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A Triple Helix Approach for the Diffusion of Blockchain Technology against Counterfeiting of Made in Italy Products in SMEs of the Marche Region

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ABSTRACT: This paper describes the opportunities that blockchain technology applied to product traceability might offer to firms of Made in Italy against counterfeiting of their products, and the challenges to the adoption of blockchain technology in these firms, especially SMEs. The focus is on the Italian Region Marche which is characterised by a prevalence of firms specialised in the Made in Italy. The paper proposes a triple helix approach to facilitate the diffusion of blockchain technology in the Marche Region and individuates policies and non-academic actors at the regional level that could help SMEs to know and adopt this innovative technology.

KEYWORDS: Anti-counterfeiting; Blockchain; Made in Italy; SMEs; Triple helix.

1. INTRODUCTION

Supply chains (SCs) are increasingly global and complex, increasing the risk of counterfeited products being sold as original [1]. Counterfeiting has become an important problem, causing damage to the firms' revenues, trademarks, and customers [2]. Anti-counterfeiting systems often rely on centralised databases to store the products' traceability information [3], [4], making it inaccessible to SC stakeholders (i.e. supply chain partners, authorities, certifiers, and customers) that cannot use such information to verify the originality of a product [5]. On the contrary, blockchain technology (BCT) enables the creation of visible and immutable databases [6] that could provide a more transparent traceability system [7], helping firms fighting against counterfeiting [8] and allowing SC stakeholders to individuate counterfeited products [9], [10], thus building customers' trust and brand loyalty [11].

Counterfeiting is a relevant problem, especially for firms of Made in Italy, which see the value of the Made in Italy brand and their revenues lowered by fake products being sold as original Made in Italy [12]. These firms could use BCT to store the traceability data about their products and make them visible to SC stakeholders to avoid frauds that hinder their brands' image [13]. In Italy, the Marche Region is characterized by a high number of small and medium-sized firms (SMEs) involved in the production of Made in Italy products [14] and could benefit from the diffusion of BCT among the firms in its territory. However, some challenges may limit the diffusion of BCT in SMEs of the Marche Region.

This research proposes a triple helix approach, which is a set of interrelationships between institutions, academia, and firms [15], as a means to facilitate the adoption of BCT in firms of Made in Italy in the Marche Region.

This paper is structured as follows. The second paragraph explains the differences between centralised and blockchain databases in their capacity to enable product transparency against counterfeiting. The third paragraph examines the opportunities stemming from using BCT against counterfeiting for firms of Made in Italy in the Marche Region and the challenges to its adoption. Finally, the paper individuates the potential benefits of a triple helix approach to foster the diffusion of BCT in the Marche Region. Conclusions and suggestions for future research are presented in the last paragraph.

2. CENTRALISED VS BLOCKCHAIN DATABASES FOR PRODUCT TRANSPARENCY AGAINST COUNTERFEITING

As Nakamoto (2008) explained, a blockchain is a distributed digital ledger of which multiple nodes store an always updated copy. Blockchains are more secure than centralised databases because there is not a single point of failure. Moreover, they allow more transparency because the data they store is time-stamped, immutable, and visible to all interested parties. For their characteristics, blockchains are ideal in situations where multiple parties do not trust each other and require that the information they share among them is easily accessible and immutable [16]. However, blockchains are not as scalable as centralised databases [17], so scalability

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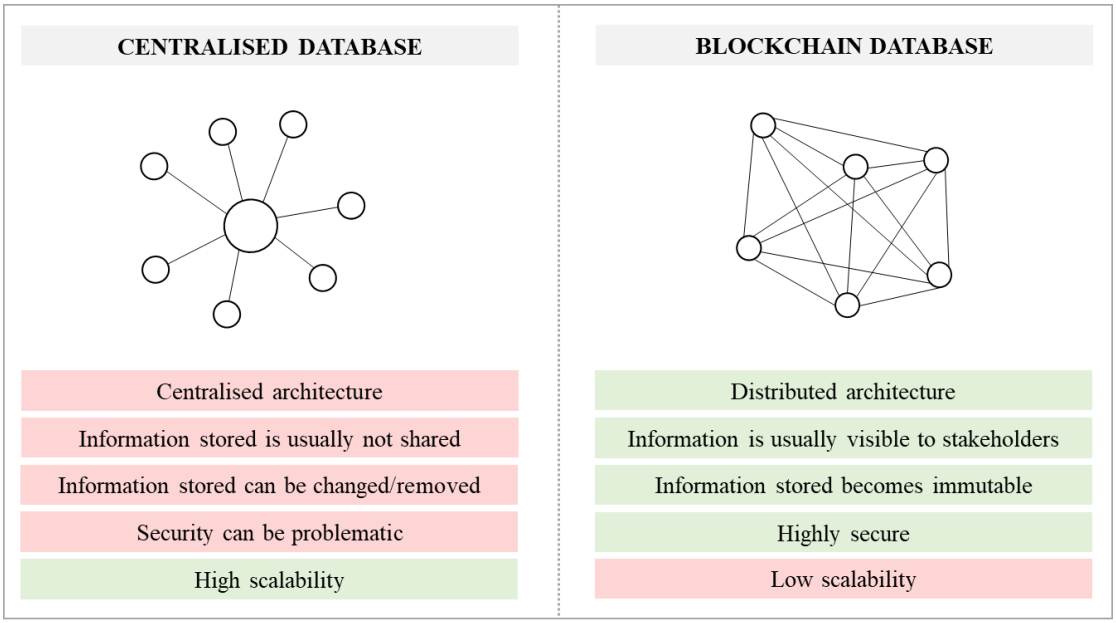
must not be a crucial requirement for parties wanting to store data on blockchains [16]. Figure 1 presents a comparison between centralised and blockchain databases.

Figure 1 A comparison between centralised and blockchain databases.



Source: *Author's elaboration based on* [16].

Firms often store traceability information about their products in their centralised databases, making such information inaccessible to stakeholders (i.e. supply chain partners, authorities, and customers) and modifiable by malicious actors [18], [19]. This way of managing data causes low transparency, information asymmetry [20], and a lack of trust among stakeholders [21]. On the contrary, blockchain technology (BCT) could provide a more transparent way to store and share products' traceability information [7], [19], [22] by making it visible and immutable [20], [23]. Since blockchains can be used to notarize and share any kind of information in a transparent way [13], firms could store on a blockchain their products' traceability data stating the provenance of raw materials, components, or ingredients [24], [25], and proving the products' originality [26] and environmental or social sustainability [19]. SC stakeholders would be allowed to individuate counterfeits by auditing immutable traceability information stored in a blockchain [9], [10], thus helping firms reduce counterfeiting of their products [8].

3. BLOCKCHAIN FOR ANTICOUNTERFEITING OF MADE IN ITALY PRODUCTS IN THE MARCHE REGION: OPPORTUNITIES AND CHALLENGES FOR SMEs

Counterfeiting of Made in Italy products is an important issue: in 2013, the value of lost sales in Italy due to counterfeiting amounted to 6.9 billion euros, corresponding to 2.7% of the total sales value [12]. Firms of Made in Italy struggle against counterfeiting, with SMEs being especially damaged because they do not have the means to monitor this threat and develop effective countermeasures [12].

In Italy, the Marche Region's economy is mostly based on clusters of SMEs (industrial districts) [14] specialised in the classic industries of Made in Italy [27]. Thus, the Marche Region would benefit from diffusing the use of BCT against counterfeiting in firms of its territory. However, these firms might have difficulties adopting BCT. First, a lack of digital knowledge inside firms could limit the adoption of BCT [28], [29]. BCT is becoming a fundamental pillar of Industry 4.0 technologies [30], and a recent survey from 2020 found that a low level of knowledge and skills in firms of the Marche Region can be the main obstacles to the adoption of these innovative technologies [31]. Enabling technologies for the correct use of BCT for SC traceability for anti-counterfeiting purposes are those allowing information sharing between SC partners. Data from the OECD shows that in Italy, in

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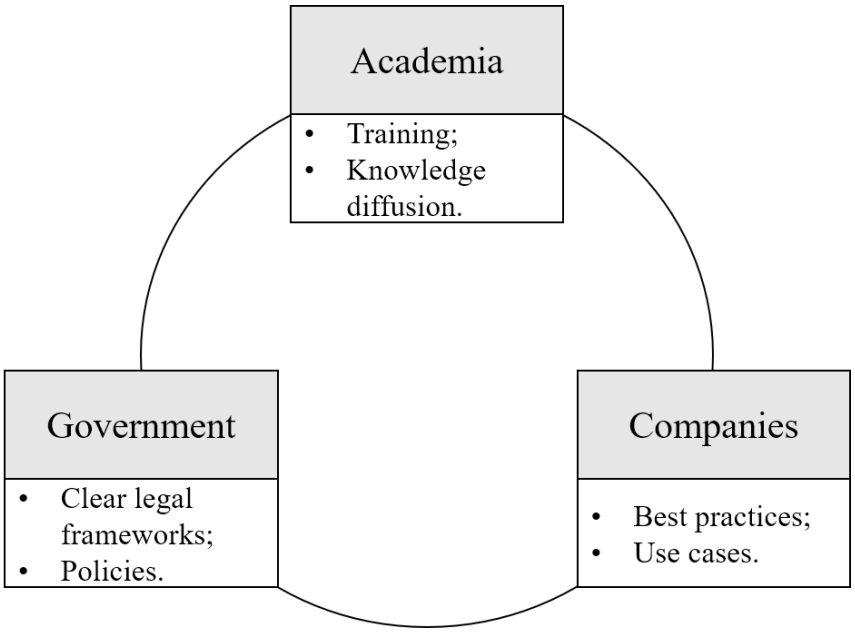
2017, only 10.1% of small-sized and 18% of medium-sized firms were sharing data digitally with SC partners.[1] Secondly, firms that are already digitalized will need to understand how to properly integrate BCT with their internal business software [32]. Third, poor access to digital infrastructure could be detrimental to the adoption of BCT, especially if firms need to store big quantities of data in little time in a blockchain [33]: in 2021, only 37.2% of Italian small-sized and 49% of medium-sized firms had access to an internet connection faster than 100 Mbit/s,[2] which is the threshold over which firms can build digital capacity [34].

4. A TRIPLE HELIX APPROACH TO FACILITATE THE DIFFUSION OF BLOCKCHAIN TECHNOLOGY IN THE MARCHE REGION

The concept of the triple helix explains how collaboration between government, academia, and firms can foster innovation and economic development [15]. In the context of the Marche Region, each of these three actors could contribute to facilitating the adoption of BCT in firms of Made in Italy (Figure 2).

Figure 2. A triple helix approach for the diffusion of BCT in the Marche Region.



Source: *Authors' elaboration.*

The first helix to consider is that of academia, including universities and research centres. A survey from 2017 by [35] on firms in the Marche Region approaching Industry 4.0 technologies found that less than 4 out of 10 firms had a relationship with universities. Nevertheless, universities could help firms in their technological transformation, also by training skilled managerial figures, as managerial quality and worker skills have a strong effect on the rate of diffusion of digital technologies [36]. In the specific case of BCT, academia could provide technical, economic, and legal knowledge on BCT to firms. All the four universities in the Marche Region have been involved in understanding and diffusing the potentialities of BCT.[3]

As for the helix of firms, it is necessary to understand the contribution that BCT adopters and developers might have in the Marche Region. Since research on blockchain suffers from a lack of empirical data [37], [38] and benchmarking between blockchain

[1] OECD Dataset: ICT Access and Usage by Businesses, https://stats.oecd.org/Index.aspx?DataSetCode=ICT_BUS#
[2] *Ibidem.*
[3] The result was gathered by searching for the keyword "blockchain" in the websites of the four universities of the Marche Region: Università degli Studi di Camerino, Università degli Studi di Macerata, Università degli Studi di Urbino Carlo Bo, Università Politecnica delle Marche.

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solutions [39], firms using or selling BCT-related services are use cases providing valuable sources of practical knowledge for researchers and governments to learn from and individuate best practices on the use of BCT. At the same time, BCT adopters and developers in the Marche Region would benefit from collaborating with researchers to understand the technical, organizational, and legal limitations of their technologies and adjust their solutions to the existing frameworks. Both BCT adopters and developers must be actively involved in the diffusion of BCT in the regional territory because their contribution is crucial for developing innovative solutions that answer the needs of firms of different sizes and sectors.

Finally, national and regional governments would use the insights received from academia and firms to create laws and policies on BCT for the economic development of the territory. Given the lack of clear legal frameworks on BCT, governments should focus on providing clarity on what kinds of blockchain solutions firms can use and how [40]. However, governments at all territorial levels are still exploring the applications of BCT. At the European level, the European Commission developed a "Blockchain Strategy"[4] to explore the potentialities of BCT. At the national level, the Italian Parliament just provided a definition of Distributed Ledger Technology,[5] and in 2019 the Italian ministry for economic development (MiSE) partnered with IBM to develop a case study to gather empirical data on the use of BCT for traceability of the "Made in Italy" in the textile sector in Italy [41]. In the Marche Region, the Regional Council stated that the Region promotes the use of a multifunctional IT platform based on blockchain technology to facilitate access to information regarding the origin, nature, composition, and quality of regional products.[6]

Some policies and non-academic actors of the regional territory can be individuated to promote the diffusion of BCT in firms of the Marche Region. As for the policies, an important role could be played by the regional Smart Specialisation Strategy (S3)[7], which aims to invest European community resources in enabling innovative technologies in the existing territorial resources and production capacities to build comparative advantages and sustainable growth in the long term. A further opportunity for the diffusion of BCT comes from Digital Innovation Hubs (DIHs),[8] which are part of the European Commission's strategy to help firms improve their processes, products, and services through digital technologies. DIHs support firms by acting as knowledge brokers and connecting them with external public and private actors, such as universities, research centres, service providers, and corporations [42]. The Marche Region territory has four operational DIHs, none of which deal specifically with BCT.[9] Finally, the i-Labs platform on I4.0 technologies could be beneficial for testing novel solutions supporting collaboration between different stakeholders. The mission of i-Labs is of promoting synergistic, effective, and stable collaboration between the academic and business world, favouring the contamination and sharing of knowledge, especially among SMEs.[10]

5. CONCLUSIONS

Firms of Made in Italy, especially SMEs, are struggling against counterfeiting of their products. Current anti-counterfeiting systems are inadequate because firms usually store their products' traceability information on centralised databases, which are not accessible to SC stakeholders, that have no means to verify if a product is original. BCT would allow firms of Made in Italy to share their products' traceability information with all SC stakeholders in a transparent way and assure them that the traceability information is tamper-proof. By using BCT, firms could provide SC stakeholders with evidence that their products are original, thus increasing their trust and reducing losses in revenue caused by counterfeiting.

[4] European Commission Blockchain Strategy, https://digital-strategy.ec.europa.eu/en/policies/blockchain-strategy#:~:text=At%20a%20high%20level%2C%20the,be%20sustainable%20and%20energy%2Defficient
[5] Art. 8-ter DL 135/2018, "Tecnologie basate su registri distribuiti e smart contract", https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2019-02-12&atto.codiceRedazionale=19A00934&elenco30giorni=true
[6] Consiglio regionale delle Marche, Art. 1 law 36/2020, https://www.consiglio.marche.it/banche_dati_e_documentazione/leggi/dettaglio.php?idl=2174
[7] Smart Specialisation Strategy platform, https://s3platform.jrc.ec.europa.eu/home
[8] Digital Innovation Hubs (DIHs) in Europe, https://ec.europa.eu/digital-single-market/en/digital-innovation-hubs-dihs-europe
[9] Smart Specialisation Platform, https://s3platform.jrc.ec.europa.eu/digital-innovation-hubs-tool. At the time of writing, the database was last updated on the 10th of May of 2020.
[10] i-Labs, https://www.i-labs.it/it/smart-and-digital-solutions

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The Marche Region is characterised by a strong presence of firms of Made in Italy that would benefit from adopting BCT against counterfeiting. However, some challenges could limit the diffusion of this innovative technology, like a lack of digital knowledge inside firms, problems with the integration of BCT with other existing software, and poor access to digital infrastructure.

To facilitate the diffusion of BCT, a triple helix approach connecting academia (universities and research centres), firms, and governments might be beneficial. Universities are knowledge diffusers that could help firms in their technological transformation by providing knowledge on BCT and on enabling technologies such as those related to the digital sharing of data between SC partners. Firms need to be involved in the development of BCT, as they are a source of empirical data for researchers and governments to understand which are the best practices for BCT and how to foster its adoption in the Marche Region. Governments should provide firms with clear legal frameworks on BCT and access to a faster internet connection. Finally, in the context of the triple helix in the Marche Region, the diffusion of BCT may benefit from the regional Smart Specialisation Strategy (S3), from Digital Innovation Hubs (DIHs) connecting firms with external public and private actors, such as universities, research centres, service providers, and corporations to facilitate the adoption of BCT, and, lastly, from the i-Labs collaborative platform on I4.0 technologies that could establish a stable collaboration between the academic and business world, favouring the contamination and sharing of knowledge, especially towards SMEs.

It may be also beneficial to encourage collaboration between the academia of the Marche Region and research centres and universities of other regions and countries that are already experienced in BCT for SMEs. Similarly, the regional government should collaborate with other governments at all territorial levels to learn the benefits achieved and the challenges encountered by policymakers regarding policies on BCT. Further, firms of the Marche Region could be included in international clusters to share knowledge with firms that already adopted BCT and participate in BCT-related projects with them.

The suggestions presented in this paper call for more empirical insights. The second step of this research will be sending a questionnaire to firms in the Marche Region to assess their level of awareness and knowledge on BCT. Using a bottom-up approach, the research will try to understand what firms think is needed to increase the diffusion of BCT in the Marche Region.

As for suggestions for future research, a comparative perspective on the development of BCT among different firms, regions, and countries, is needed to analyse the best practices in terms of BCT solutions and related policies.

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