BLOCKPOOL

HOW DO SMES IN EUROPE DEPLOY BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGIES?

Early insight and assessment around this new technology to guide SMEs and investors.

This project has received funding from the European Union's H2020 research and innovation programme under Grant Agreement no 828888

Blockpool: “How do SMEs in Europe deploy Blockchain and Distributed Ledger Technologies? - Early insight and assessment around this new technology to guide SMEs and investors.”

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Abstract

Blockchain technology and other Distributed Ledger Technologies (BDLT) possess several unique attributes that have a potential to disrupt many industries and their respective markets. The innovative aspects of this new technology concern particularly the ability to record and share information between parties that do not necessarily trust each other, in a decentralised way. Due to the risk associated in general to innovations, start-ups and small and medium sized enterprises (SMEs) deploying BDLT solutions often struggle to obtain financing in the early stage and subsequently in the scale-up phase. However, in contrast to other innovative SMEs, blockchain companies experience further obstacles that decrease their chances for successful commercialization of the product. The early insights and examples provided in this paper were collected within the Blockpool acceleration programme. Blockpool has selected out of 109 applications from all over Europe, 25 SMEs to enhance their innovation capacity.

The intention of this paper is to show that these (intermediary) insights of Blockpool demonstrate that the acceleration concept works effectively, and to raise awareness on promising BDLT use cases and SMEs, both to motivate private investors, and to encourage other start-ups, SMEs or corporates to follow and replicate.

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1. Introduction

From a strategic European policy point of view, Blockchain together with Artificial Intelligence are the key enabling technologies in the coming years. Both are strategic technologies, that may accelerate innovation and create societal value across many different sectors. The European Commission initiated a strategy to position Europe at the forefront of these technologies a few years ago. Based on lessons learnt and market failures, where underinvestment led or still leads to the loss of key intellectual property in Europe – especially in the information and communication technology (ICT) sector – Europe strives to push public investments and to incentivise private investment.

Strategic expectations

Why are Blockchain and Distributed Ledger Technologies (BDLT)[1] considered as important? The main argument is the creation of completely new business models and ways of collaborating in the digital economy, since BDLT is expected to ensure trust through decentralisation. In other words, it provides potential alternatives to incumbent firms, improves quality and efficiency across different sectors through data integrity and traceability, and creates new dimensions by transforming ownership through tokenization of real-world assets.

Challenges for commercializing Blockchain in Europe

A general problem for innovations is to overcome the two so-called "valleys of death". The first one refers to the challenge of translating research into products and services that the market demands, of finding the right application for the technology at the right time within a given market. The second one refers to the investment required to scale these innovations at the appropriate time. To overcome these challenges, BDLT start-ups and small and medium sized enterprises (SMEs) implementing BDLT need incentives and equity investments in early stages followed by loans to scale and grow. Unfortunately, Europe is not particularly well positioned in attracting investments for scale-ups. Worse even, many start-ups leave Europe as incentives and investments in the US or China are more appealing. BDLT investments can be considered as strategic and long-term investments that are high and risky and usually lack collateral. Moreover, BDLT companies often create completely novel and untested business models that rely on a largely dispersed network of stakeholders for a proper functioning. These businesses do not align with traditional investor expectations. Investors need to be able to understand these technologies and see the initial results of the business models to be able to assess every business for its opportunity and potential return on investment. Investments are not specifically made in a technology itself, but in convincing companies and use cases. In the end, it is vital to strengthen both, the demand and the supply side. Investments are made for financial returns which arise from companies with great teams, good business models and growing markets.

[1] For consistency, the authors use the term Blockchain and Distributed Ledger Technologies (BDLT) throughout this article. However, semantically, blockchain is one type of distributed ledger, which is based on a chain of interconnected blocks. So DLT is a more generic term which also subsumes blockchain.

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The goal of this paper is to contribute to the positioning of "Europe at the forefront of Blockchain innovation and uptake"[2], by raising awareness on promising BDLT use cases and SMEs, the obstacles they face, and to provide assessment for both motivating private investments, and encouraging other start-ups, SMEs or corporates to follow and replicate.

2. Blockchain and DLT in a nutshell

2.1 Terminology

Distributed Ledger Technology (DLT)
Distributed Ledger Technologies (DLTs) can be described as networks with a decentralized and distributed organisation of data. This architecture enables automated data management without an administrative authority ("decentralised, public cash book/ ledger"). Well-known examples of DLTs are Blockchain, Tangle (e.g. IOTA) and Hashgraph.

Blockchain
Blockchain is probably the most frequently used buzzword within Financial Services Technology (FinTech). A blockchain is a DLT that can be defined as a value-exchange protocol that uses a consensus mechanism to autonomously record peer-to-peer transactions across decentralized computers (nodes) without a trusted third party.[3]

The transaction information is written in blocks that are visible to each participant or node within the network. The blockchain grows with its number of transactions and information stored. Within the network, the participants can fill different roles. So-called "miners" provide computing power to create new blocks and get an incentive for their work referring to a public blockchain. So called "smart contracts" can be used to program an application logic for the network[4]. Because each node holds identical copies of transactions in a chronological order, fraudulent activities become almost impossible due to the immense number of equivalent replications. Prospectively blockchain could contribute to a transparent way of selling and transferring digital goods or intellectual property. The most popular use case is the cryptocurrency "bitcoin"[5].

As stated in the introduction, we will use the term **BDLT** for Blockchain and other kinds of Distributed Ledger Technologies for the sake of simplification.

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[2] https://ec.europa.eu/digital-single-market/en/blockchain-technologies, retrieved on 26/10/2020.

[3] Narayanan, A.; Bonneau, J.; Felten, E.; Miller, A.; Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction.

4 Kaulartz, M.; Heckmann, J. (2016). Computer und Recht. Cologne Bd. 32, Edition 9. PP. 618-624. DOI: 10.9785/cr-2016-0923.

[5] Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf.

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BDLT principles

Participants within a BDLT network interact with each other by performing transactions. These transactions can have different purposes, e.g., transferring ownership or finding consensus. However, in order to perform transactions to achieve consensus, transactions must follow five principles.

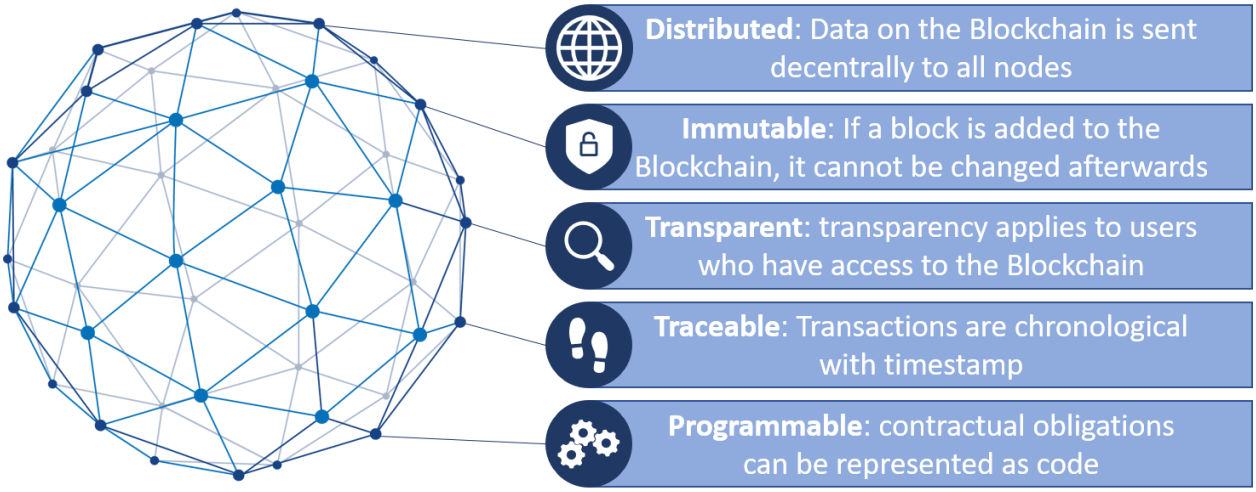

Figure 1: BDLT Characteristics. Source: Plazibat, A. (2019). PP. 47-56.[6]

BDLT frameworks

BDLT frameworks can be categorized differently. It is important to consider who has the authority to validate transactions and who has the authority to read transaction details. If everyone has the permission to read transactions on the blockchain, then the blockchain is public. If reading the blockchain is restricted, it is private. If everyone has permission to validate, a blockchain is called permission-less, otherwise permissioned. The following table serves as a simple illustration, even if further nuances are possible.

		Validation Who validates the transaction?	
		Permissionless	Permissioned
Access Who is allowed to read transaction details?	Public	„Everyone is allowed to read and validate.“	„Everyone is allowed to read, only authorized persons are allowed to validate.“
	Private	„Only authorized persons are allowed to read, everyone is allowed to validate.“	„Only authorized persons are allowed to read and validate.“

Figure 2: BDLT frameworks

[6] Plazibat, A. (2019). The Business Potential of Distributed Ledger Technology : Analysis and Recommendations for Action in the Financial Services Sector. (Dissertation. University of St. Gallen). PP. 47-56. https://www.e-helvetica.nb.admin.ch/api/download/urn%3Anbn%3Ach%3Abel-1412488%3ADis4912.pdf

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2.2 Underlying concepts and history of BDLT

One of the basics of BDLT is the Merkle-Tree[7] which Ralph Merkle has patented in 1979. The Merkle-Tree (or Hash-Tree) is a method for providing a digital signature for the purpose of authenticating a message.

One of the first attempts of digital money was Digicash, an electronic money corporation founded by David Chaum in 1989[8]. Digicash was using cryptographic protocols to unable banks and third parties to trace personal payments. The corporation was unable to grow successfully so it declared its bankruptcy.

In 1991, W. Scott Stornetta and Stuart Haber published the paper "How to time-stamp a digital document"[9] in which a similar data construct to Blockchain was described.

The popular cryptocurrency Bitcoin is making use of the Proof-of-Work (PoW) consensus algorithm, which was invented in 1993 by Cynthia Dwork and Moni Naor[10] in order to prevent the sending of junk mails.

Four years later, Adam Back proposed Hashcash, a mechanism which was using Proof-of-Work. Hashcash can be described as virtual postage, which should serve to make a Denial-of-Service Attack spam mails too expensive.

Finally, in 2008, a white paper was published by Satoshi Nakamoto[11], which was the most important innovation leading to Blockchain. In "Bitcoin: A peer to peer electronic cash system", a digital currency was described which claimed to solve the double-spending problem of digital currencies.

Today, BDLT has not yet reached full maturity and critical challenges remain to be solved. However, startups and SMEs can rely on major networks such as Bitcoin, Ethereum or Hyperledger from which they may choose depending on the use case.

2.3 Industry trend analysis

In this section we highlight relevant industry trends and required services for BDLT commercialization at a larger scale.

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[7] Merkle, R. C. (1988). A Digital Signature Based on a Conventional Encryption Function. Advances in Cryptology – CRYPTO '87. Lecture Notes in Computer Science No. 293. PP. 369-378.

[8] Chaum, D. (1983). Blind signatures for untraceable payments. Advances in Cryptology – Proceedings of Crypto '82 (3). PP. 199-203.

[9] Haber, S.; Stornetta, W. S. (1991). How to time-stamp a digital document. J. Cryptology 3. PP. 99-111. https://doi.org/10.1007/BF00196791.

[10] Dwork, C.; Naor, M. (1993). Pricing via Processing or Combatting Junk Mail, Advances in Cryptology – CRYPTO '92. Lecture Notes in Computer Science No. 740. PP. 139-147. DOI: 10.1007/3-540-48071-4_10.

[11] Nakamoto, S. (2009). Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf.

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BDLT and Internet of Things (IoT)[12]: Gajek and Eichmann (2019)[13] expect over 50 million devices to be connected worldwide by the end of 2020 and estimate approximately 100 million robots to be in operation between now and 2035. BDLT has the potential to connect machines and become one of the fundamental building blocks of the machine-to-machine (M2M) economy. Popular use cases include the energy sector and the mobility sector.

BDLT-as-a-Service (BaaS): BDLT-as-a-Service (BaaS) is based on Software-as-a-Service (SaaS). SaaS is a software licensing model that provides access to a software on a subscription fee model. The software is located on external (the provider's) servers rather than on internal (the user's) servers. Similarly, BaaS can mean access to cloud services of traditional players or access to a distributed ledger or BDLT infrastructure.

When implementing BDLTs, enterprises must choose between more than BDLT frameworks, including identifying the appropriate platform as well as deploying, running and maintaining a BDLT node. As the BDLT space changes rapidly, focusing on one specific platform poses the risk of technical debt. BaaS-providers tackle these challenges and offer fitting solutions. These services reduce the complexity of deploying and maintaining a node and therefore reduce the complexity of any BDLT project.

Identity Management: The management of identities is an ever increasingly important topic in this digital age. The government currently holds personal information in multiple places and is not able to share data across entities. Data breaches would result in the loss of confidential information. For example, the city of Zug has started using uPort[14] to circumvent this issue. The app gives each citizen a digital identity and eliminates the need for physical identification documents. This system benefits both the citizens as well as the administration. The citizens have more control over their data and can benefit of a faster identification system. The administration has decreased costs and can extend the services to matters such as online voting or Proof-of-Residency.

Tokenization: To trade assets digitally, assets need to be tokenized. Tokenizing an asset involves issuing a digital token on a BDLT, where that token represents an underlying tangible or intangible asset. A token is therefore a sort of a reference to an asset both tangible and intangible. For example, stocks and bonds can be tokenized in order to trade them on a BDLT. Even non-bankable assets could be tokenized such as buildings or artwork. This would enable an entirely new secondary market and would allow investors to purchase small amounts of an asset, rather than the whole thing.

Smart Contract Oracles: Smart contracts require real-world information that is not accessible on the BDLT, e.g. exchange rates of fiat currency, the price of a stock, or whether a shipment has been delivered. Smart contract oracles are trusted entities that import the necessary data

[12] IoT refers to the interconnection of devices via the internet, allowing devices to be integrated into a system in order to communicate amongst themselves or with human beings.

[13] Gajek, S.; Eichmann, K. (2019). Daten sind das neue Gold – Wenn IoT auf Blockchain trifft. Der Blockchain Factor. Norderstedt: Books on Demand. PP. 58-82.

[14] Cf. https://medium.com/uport/zug-residents-can-now-ride-e-bikes-using-their-uport-powered-zug-digital-ids-7ed31ac9d621 , retrieved 10/12/2020

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to the BDLT. The main challenge is to ensure that a particular oracle can be trusted. Smart contract oracles can become central points of failure as they could provide incorrect or manipulated information. Incentive mechanisms are implemented to overcome the possibility of manipulated data, even in a network of oracles. Comparable to the Proof-of-Stake (PoS) mechanism, oracles must stake a deposit and receive rewards for their work or lose a percentage of their stake if they misbehave.

2.4 The status of the BDLT regulatory framework in Europe

But not only trends and economic demand influence the European BDLT landscape. The deployment of BDLT services also requires a clear and stable regulatory framework. It can be summarized, that the current regulation with regards to BDLT in Europe is very fragmented and still in its infancy – which certainly impacts broader adoption. As usual with new technologies, the main challenge is not to create new regulations, but to interpret how and which existing legal frameworks have to be applied to different use cases enabled by the new technology. For example, a token can be interpreted as a "property" or as the representation of a "property right". As part of the Blockpool project, Dentons Europe has been asked to provide an analysis with regards to the existing legal framework in the 27 EU Member States, complemented with an overview of the regulations for BDLT in the UK, Singapore, Hong Kong and the United States.[15]
The legal areas for the respective national analysis covered:

- Capital Markets Law
- Anti-Money-Laundering Law
- Intellectual Property Law
- Property Law and Registries
- Data Protection Law

Although the intended focus of the study was explicitly not on Capital Markets law, i.e. the regulation of banking and financial services, the main result is that the financial sector is the most developed with regards to BDLT from a legal perspective. This observation is further proved by the fact that the European Commission has recently published a first draft for a regulation on Markets in Crypto-assets (MiCA)[16], with the aim to support Europe's digital revolution, with innovative European firms in the lead, mainstreaming the benefits of digital finance to European consumers and businesses.

The study shows further the different approaches of the Member States. While some countries, e.g. Germany, France and Luxembourg are very open and observe the developments of the markets, others have very strict regulations that may sometimes hinder the uptake of innovation. As technology does not know borders, SMEs developing solutions

[15] Dentons (2020): ANALYSIS OF CURRENT EUROPEAN BLOCKCHAIN REGULATION. European Crowdfunding Network, Brussels. https://eurocrowd.org/2020/10/24/analysis-of-current-european-blockchain-regulation-october-2020/

[16] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12089-Directive-regulation-establishing-a-European-framework-for-markets-in-crypto-assets, retrieved on 10/26/2020.

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for BDLT will face the burden of different national regulations being expensive to overcome, when they want to scale – which underlines the need for common rules across Europe.

According to the study, BDLT applications are not yet regulated across Europe or within EU Member States, with exception of BDLT based banking and financial services, which are already covered by some countries under the Capital Markets law. The map below shows the extent to which the legal framework is developed in each country. Four categories of development stages can be distinguished:

1. There is an existing specific legal framework which applies to BDLT.
2. A specific legal framework is intended and planned.
3. A specific legal framework is being discussed.
4. There is neither an existing specific legal framework, nor is it planned nor discussed.

The first category (existing) describes those countries that have already covered BDLT based services affecting the Capital Markets. The second category shows countries that have plans to introduce a specific framework, plan to introduce regulations on crypto-currencies and custodian services, or plan to introduce AML Directive V. A specific legal framework is discussed when public authorities are investigating the potentials and risks of the technology, public consultations are carried out, legislative intentions exist or working groups are developing holistic policy measures.

If a specific legal framework exists, its exact nature is not considered. It has only been examined whether a specific legal framework exists.

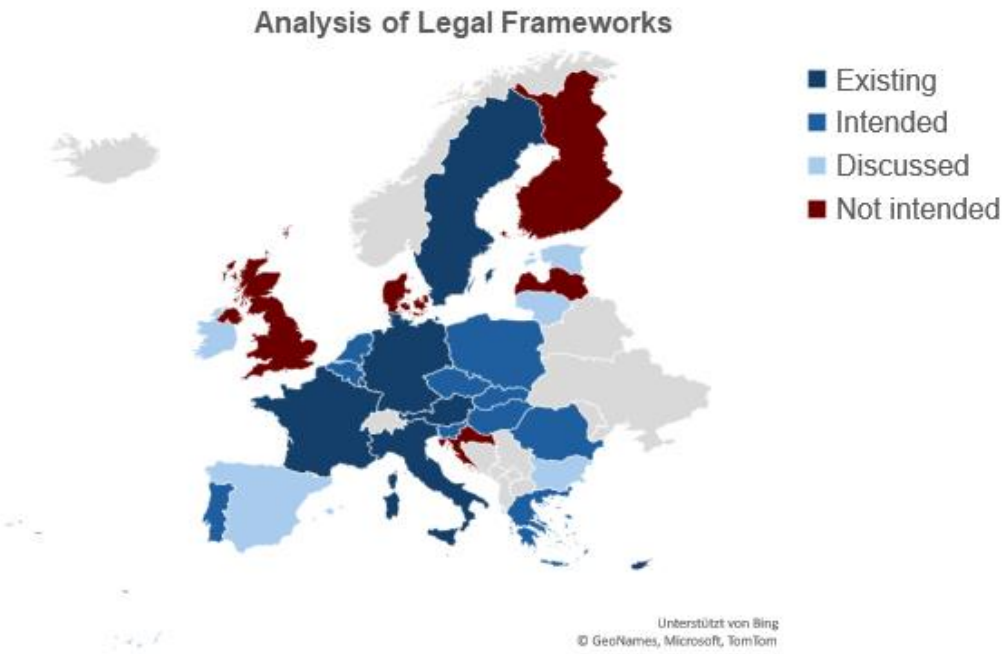

Figure 3: Legal framework for BDLT in Europe. Source: Elaborated based on Dentons (2020): ANALYSIS OF CURRENT EUROPEAN BLOCKCHAIN REGULATION. European Crowdfunding Network, Brussels [14].

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3. An Overview - BDLT-based use cases in Europe

Start-ups, SMEs and large corporates experimenting with BDLT are springing up across Europe. This section highlights that BDLT technology is evolving across different sectors and countries. Our data is based on the Blockpool accelerator programme (Blockpool.eu), co-funded by the European Commission (EC)[17]. The Blockpool accelerator is a piloting scheme motivating SMEs to test and deploy BDLTs, where 25 SMEs get the opportunity to receive 30.000 EUR financial support and to take part in a 10 month acceleration programme. Blockpool is managed by a consortium of seven partners located in six different countries[18].

By showcasing examples of how SMEs use BDLT in different sectors and gathering lessons learnt and challenges, the intended impact is threefold, namely:

1. Inspiring other SMEs to take advantage of new opportunities through BDLT.
2. Creating awareness for BDLT and especially increasing the number of intermediaries to support interested SMEs.
3. Gathering insights for shaping the right policy frameworks and reducing related risks.

The application period to the Blockpool acceleration programme was open for 3 months (from 27th November 2019 – 26th February 2020). European SMEs could apply via the accelerator website[19] and the EC participant portal[20]. The call for applications has been widely published[21] and three webinars were held to inform about the call. All partners shared the call for applications with their close networks and through their respective media channels.

In total 109 proposals were submitted to the Blockpool accelerator until 26th February 2020. Overall, proposals have been submitted from 27 different countries, while most applications came from Germany (21) and Spain (16), followed by Italy, Greece, the UK, Switzerland, France and the Netherlands[22].

[17] BLOCKPOOL is one out of three actions funded under the H2020 programme, INNOSUP-03-2018

[18] The Blockpool consortium: European Crowdfunding Network (Belgium), Frankfurt School Blockchain Center, Fraunhofer IMW (Germany), University of Nicosia (Cyprus), N-ABLE (France), Insomnia (Spain) and ERFC (Greece)

[19] https://blockpool.eu/open-call/, retrieved on 10/26/2020.

[20] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/competitive-calls, retrieved on 10/26/2020.

[21] Relevant channels used were the EC Horizon 2020 Participants Portal, the accelerator website, partners' websites, social media (Twitter, LinkedIn, Facebook, etc.), main Blockchain and DLT networks and organizations in Europe, the Enterprise Europe Network, etc

[22] The main applications were received from countries where Blockpool partners advertised the Open Call.

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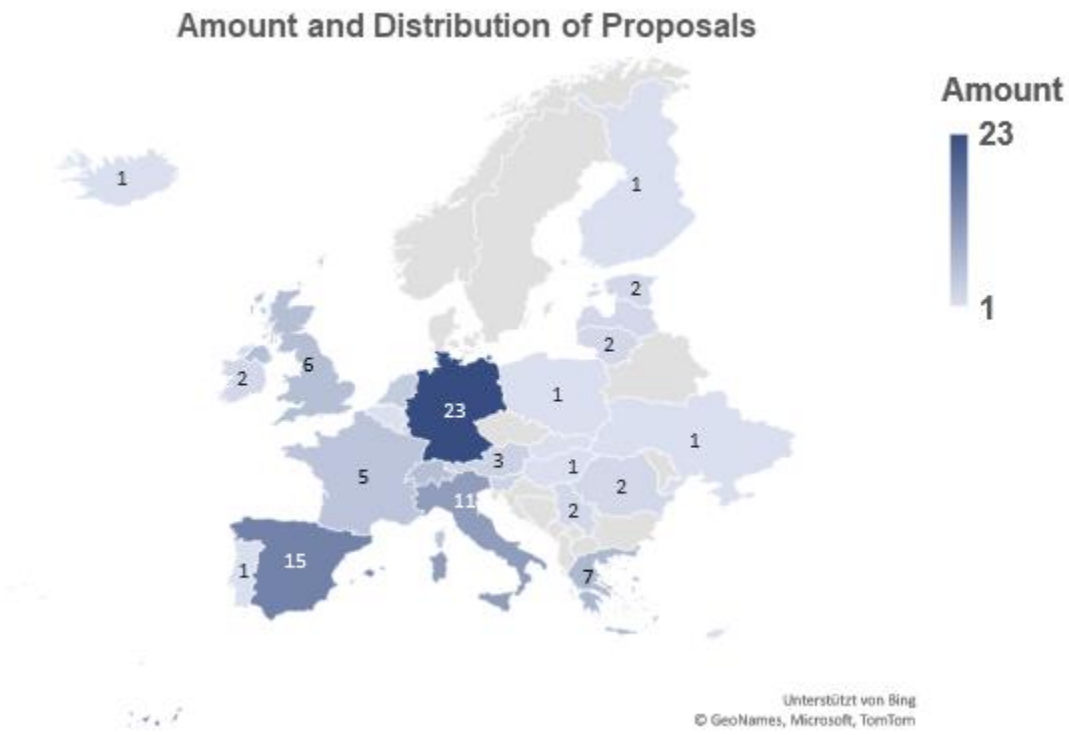

Figure 4: Country analysis of submitted proposals. Source: Blockpool (2020)

Sector Analysis: SMEs from the European Members States as well as associated countries were invited to describe their BDLT-based use case, with special emphasis on commercialization. SMEs had to submit a 10-page proposal, indicating if there are further collaboration partners, such as clients or technical service providers and referring to one of the following sectors:

- Financial & Insurance Services
- Industrial Products, Agriculture & Manufacturing
- Energy, Utilities & Raw Materials
- Healthcare
- Transport & Logistics
- Government & Smart Cities
- Retail, Consumer & Media
- Social Good

Although the uptake of BDLT seems particularly advanced in the financial sector, the Blockpool consortium was positively surprised that the distribution over the different sectors was more or less balanced, while the financial sector was, as expected, with 31% the most prominent, and healthcare the less represented with 3%[23].

[23] We should remark here that the Open Call was closed before the COVID-19 crisis.

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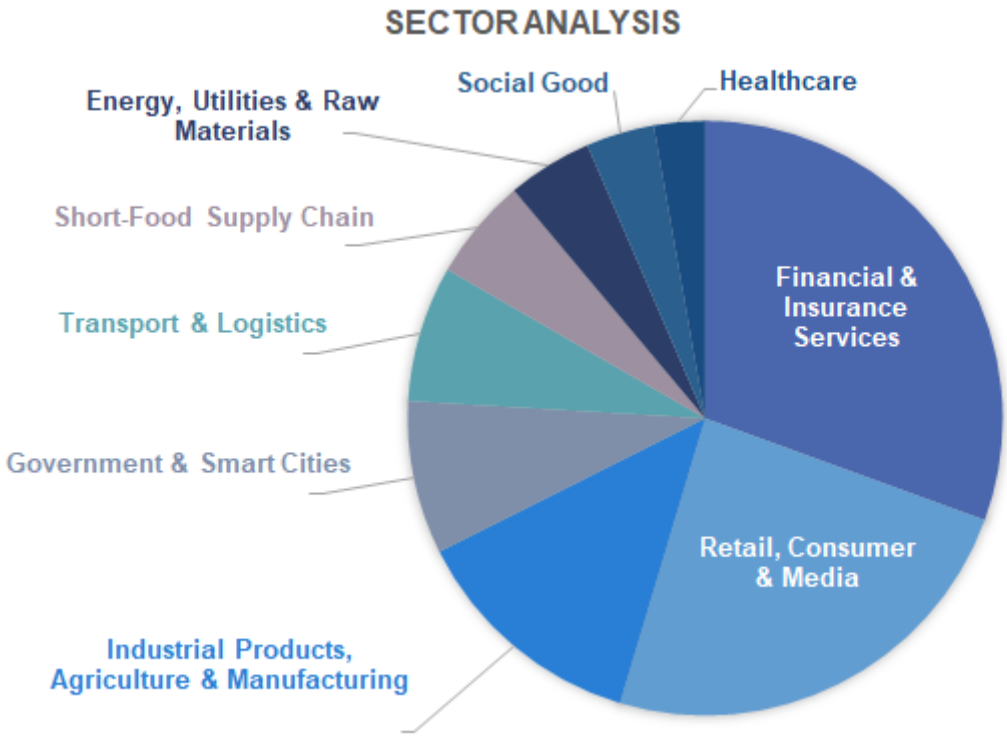

Figure 5: Sector analysis of submitted proposals. Source: Blockpool (2020)

The call for applications explicitly encouraged cross-border cooperation between SMEs and 47% of the submitted proposals involved SMEs from minimum two different countries. Gender balanced results of submissions could not be achieved, because 92% of proposals were submitted by male applicants. However, this analysis considers only the person responsible for the submission and has not analysed the teams in more detail.

Interesting insight also reveals the analysis of the different BDLT technologies deployed by the applicants. As expected, Ethereum represents the most widely used infrastructure and 43% of the applicants build their use case on this technology. This is followed by Hyperledger (13%) and Bitcoin (9%). Overall, most well-known infrastructure technologies are well represented without clear trends, showing that the BDLT landscape is quite scattered.

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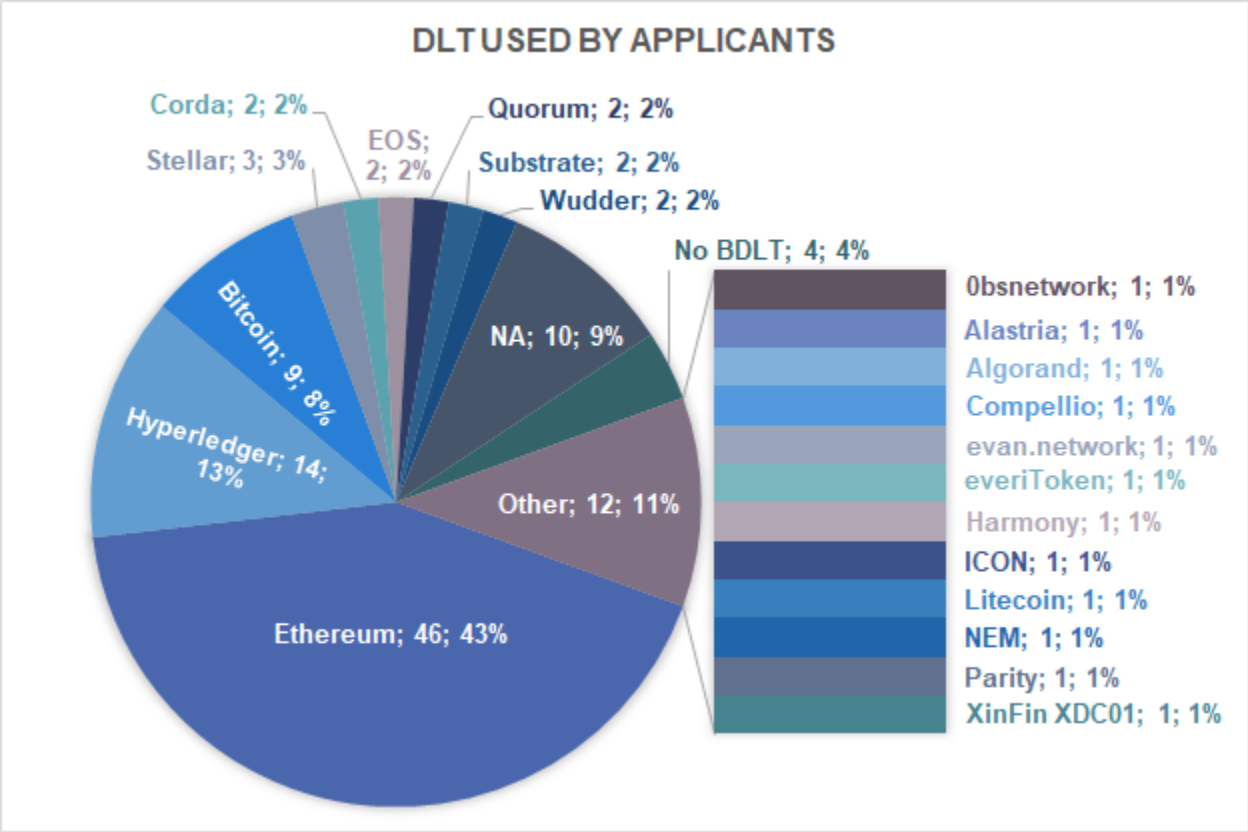

Figure 6: Used BDLT analysis of submitted proposals. Source: Blockpool (2020)

In the following sections, we will focus on the 25 SMEs selected for the acceleration programme and map the applications to previously identified trends or challenges.
The big picture of this analysis will show that most start-ups and SMEs deploying BDLT across Europe are facing similar systemic obstacles. The Blockpool accelerator was limited to select only the 25 best ranked SMEs[24], which are presented in more detail in the next section.

4. How do SMEs in Europe deploy Blockchain and Distributed Ledger Technologies?

The following table provides an overview of the 25 selected SMEs for the acceleration programme and their different application areas. The use cases are presented in a short and easy to understand way. The selected SMEs are only labelled by their project name. A full description of the respective company and more details can be found on the Blockpool website[25]. The overall goal of the Blockpool acceleration programme, is to support the SMEs in commercializing their BDLT based products and services, thus a requirement for the application was to already have a prototype, which will achieve commercial maturity during the acceleration programme:

[24] All proposals have been assessed individually and independently by 3 experts. Based on the ranking of the evaluations, the 25 highest scored SMEs were selected.
[25] https://blockpool.eu/25-selected-smes/, retrieved on 10/26/2020.

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Project Acronym	Country	Sector	Blockchain used
MORFIN	**Luxembourg**	**Financial & Insurance Services**	**Bitcoin**
Morfin is a token issuing platform for micro economies, offering a gamification layer on top of the financial layer. Use cases include employee engagement and rewards, family financial management and education or customer engagement and rewards. External integrations include public BDLT, video games and time management systems. Each micro economy has an issuer, a pool of consumers and an optional pool of partners. The issuer can create tokens, tasks, and rewards. The issuer distributes the currency to the consumers and redeems it against money or rewards. The consumers can earn, receive, send, or spend tokens. The partners can sell goods or services for tokens to the consumers and redeem the tokens for money from the issuer.			
SYGNAL	**Germany**	**Financial & Insurance Services**	**Ethereum**
The SYGNAL project aims to connect quantitative research firms and institutional investors via BDLT by creating a new distribution channel for investment intelligence, by directly connecting institutional investors to quantitative research, and by opening the investment management industry to greater innovation. The aim is to increase transparency and build an audit trail for investment intelligence and thus, to satisfy European regulatory requirements by making investment intelligence available in real-time to all qualified investors.			
BlockFacts Oracles	**UK**	**Financial & Insurance Services**	**Ethereum**
BlockFacts is a financial data API and analytics provider for digital assets, making data accessible to BDLT developers and technologies. Thus, BlockFacts integrates financial data from own and other sources onto the respective BDLTs. The goal is to develop a BDLT data oracle for multiple BDLT (Corda, Ethereum, etc.). This oracle can connect any BDLT with off-chain data.			

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NCDLT	**Lithuania**	**Financial & Insurance Services**	**R3 Corda**
With NCDLT SME exporters can upload relevant trade documents to be able to finance their account receivables from global funding sources. It is a BDLT-based trade documents verification network allowing financiers to review endorsed documents by the local auditors and notaries with the consent of the importers. NCDLT connects SME exporters to global capital market investors eliminating cross-border account receivables for the SMEs exporters and providing low risk asset class to banks and investors across the world.			
FCA	**Germany**	**Financial & Insurance Services**	**Other**
FCA offers digital asset custody and asset-servicing solutions for professional and institutional investors. FCA keeps digital assets accessible while cryptographically. FCA enables the full range of financial services for digital assets in one platform to maximize returns. FCA is granted a preliminary crypto-asset custody license approval as qualified custodian (§ 64y Para. 1 KWG) and will be supervised by the German Federal Financial Supervisory Authority (BaFin).			
AstraKode	**Italy**	**Financial & Insurance Services**	**Hyperledger**
AstraKodes mission is to facilitate enterprise software development by making it faster, easier, and more accessible by commercializing a low-code development and life-cycle management platform, specialized on BDLT technology. Low low-code development platforms, next to reducing the amount of traditional hand coding, facilitate both greater participation in the development process, and the reconversion of resources with obsolete skills. Using a low-code platform to build BDLT applications will allow companies to reduce costs, time, effort, and risk associated with building production-ready Blockchain applications.			
Motoblockchain	**Spain**	**Transport & Logistics**	**Ethereum**
Motoblockchain is a digital identity platform for motorcycles and riders. With Motoblockchain, owners can store all the information related to their motorcycle's life: owner's history, mileage in time, invoices and money invested in modifications, accessories, improvements, revisions, as well as all the photos of the related components. Every user can decide the level of privacy of each document, with whom to share it and finally create trust towards a buyer. The digital identity created is inherited to the new owner after the motorcycle sale.			

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TELEBLOCK	**Spain**	**Transport & Logistics**	**Other**
The company designs and manufactures an autonomous and multipurpose platform, specially designed for agroforestry applications, capable of operating in complex orography and high inclination. With a high mobility and reduced volume, it allows the coupling of a great number of tools for the integral management of the crop. The aim of TELEBLOCK is the secure registration of vehicle and machinery events using BDLT technology. To this end, the vehicle will share its operating data with a BDLT-based system that will make immutably available relevant data to allowed parties involved in vehicle maintenance and operation.			
IMCCP	**Latvia**	**Transport & Logistics**	**Ethereum**
IMCCP aims to make the food cold chain more secure, transparent, and trusted. It provides a solution that protects the brand image and reputation of the involved parties and helps to boost consumer trust and confidence. It helps to prevent the major health risks from food spoilage that are caused by cold chain temperature breaches during the delivery of perishable food products. The platform utilizes purpose-built IoT sensors that enable real-time monitoring and alerts, as well as transparent delivery information to end-consumers.			
LOADER	**Greece**	**Transport & Logistics**	**Quorum**
LOADER is a charging station management app for electric vehicles in cooperation with a company that installs charging stations in Greece. The app will be used to manage multiple charging stations and to bring security to financial transactions, protect users and vehicle data privacy. Loader’s premise is to be a flexible open platform (GPL3 license) that allows additions from the developer community. Loader's objective is to offer transparency for charging data that is meaningful to the end user (availability and charge cost), while protecting user’s privacy.			
AirCargo E2E	**Finland**	**Transport & Logistics**	**Hyperledger**
AirCargo E2E establishes a BDLT network for air cargo logistics chain to assure end-to-end compliance of goods (salmon, medical, etc.). It provides solid data for the EU-, local tax-, customs authorities and all the actors in the logistic chain, to have a total immutable view on each export item status (size, temperature, location etc).			

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EKLESIA	**France**	**Government & Smart Cities**	**Ethereum**
EKLESIA develops a fully functional decentralized voting solution. This solution will be used to implement local governance in an eco-neighbourhood, based on the concepts of direct and liquid democracy. This eco-neighbourhood will provide the citizens with a toolbox for governance, including this decentralized voting solution.			
BC-NFC-Smart Cities	**Austria**	**Government & Smart Cities**	**Other**
Blockchain and NFC technology guarantee complete transparency of all services in Smart Cities. The city administration, public institutions, companies and residents are brought to a common platform in order to make as many services as possible usable for residents and the administration. Each relevant object is made uniquely identifiable by labelling it with an NFC transponder. Each of these transponders has the crypto function and can thus sign a transaction for the BDLT.			
WeSmart	**France**	**Energy, Utilities & Raw Materials**	**Alastria**
WeSmart proposes a software for the operational management of local renewable energy communities, i.e., a group of individuals or companies deciding to jointly produce, store, or consume local renewable energy. To ensure transparency and trust among the members of the microgrid and to avoid a third-party arbitrage in the microgrid, WeSmart adds a BDLT layer to its existing platform, allowing a decentralized adoption of the rules of the community, monitoring the local energy flows (log of the energy exchanges) based on which accounting and settlement is operated.			
AAA CO2	**Switzerland**	**Energy, Utilities & Raw Materials**	**Other**
The E-Generators developed by AAA generate highly profitable CO2-neutral electricity from industrial waste heat and steam. So far, CO2 Certificates are not measurable. All E-Generators are equipped with appropriate sensors and chips and transmit these data, e.g., steam input quantity and current output power constantly. Technical data for trend monitoring of the components and performance data are also equipped with corresponding sensors and chips. By issuing digital tokenized securities, AAA Efficiency AG can raise capital from investors, the rights associated to this token are comparable to classic profit participation rights.			

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GREENNOVATION	**Spain**	**Energy, Utilities & Raw Materials**	**Stellar**
GREENNOVATION is a platform that empowers consumers to participate in a decentralized energy and CO2 market by valorizing their energy surpluses and CO2 savings through BDLT. A monitoring system sends data to the blockchain based platform. After receiving this information, the platform converts and certifies the emissions and the equivalent quantity of CO2 that was not emitted due to the implementation of renewable energies. This amount of CO2 will be turned into digital tokens, allowing companies and institutions to spend it in regulated and secondary markets.			
FISHING VESSEL DETECTION	**Belgium**	**Industrial Products, Agriculture & Manufacturing**	**Hyperledger**
Illegal, unreported and unregulated fishing is a significant problem that affects marine ecosystems and that currently is insufficiently monitored through a multitude of technical systems. By combining available data sources, which contain a vast amount of information using BDLT technology, it is possible to capture near real-time exchange of information. This may include publicly available and protected information such as port inspection, enabling government agencies to have oversight of fisheries operations and efficiently deploy marine patrols and Port State Measures. In doing so countries can prove that they have the capabilities to track fishing vessels, a catch certification scheme and as a result enter the European market.			
BTPM	**Slovenia**	**Industrial Products, Agriculture & Manufacturing**	**Ethereum**
BTPM is designed for companies developing and producing customer-specific bearing solutions for highly dynamic movements, precise positioning, and complex environmental conditions. This is a complex process with strong internal development and external partners involved. It is important to establish an environment where all the development and manufacturing activities are tracked in time order and where every dataset is uniquely represented and transparently shared via the network. That kind of environment will bring trust to all the participants so that everybody is certain that data once is written could not be changed anytime in the future.			

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RAAYREWallet	Germany	Retail, Consumer & Media	Ethereum
RAAYRE, is a token wallet which helps property managers to incentivise desired behaviours of tenants, such as submitting on-time payments, saving energy, reporting damages, and reporting dangerous behaviour in the neighbourhood. The general concept is modelled on airlines' frequent flier programmes and intends to achieve customer loyalty. Instead of traditional reward points, tenants will receive ERC-20 tokens issued by the property owner, which can be exchanged for a discount on the monthly rent.			
STAXE	**Spain**	**Retail, Consumer & Media**	**NA**
Staxe is a BDLT solution designed for the cultural and creative industries, tokenizing live events such as concerts, conferences or festivals to create an innovative financing channel for organizers to finance events and to delegate risk. Staxe's core purpose is to enable access to resources and funds to the highly illiquid market of live events to support European cultural infrastructure.			
EECF-P	**Italy**	**Social Good**	**Bitcoin**
EECF-P certifies the energy and environmental impact of products and services and provides citizens with transparent information (green marketing) and concrete incentives towards adopting sustainable purchasing habits (gamification mechanism). Companies receive support to evaluate and reduce energy usage and ecological impact (in terms of greenhouse gas emissions) of their products and services. Using a mobile application, citizens will have the opportunity to view unaltered and certified information on energy consumption, emissions and the history of products on the market: demonstrating their purchase, they will receive a quantity of eco-token proportional to the emissions avoided thanks to the savings measures implemented by the manufacturing company. Thereafter, the accumulated eco-tokens can be used in the form of prizes and discounts.			
DATARELLA-TD	**Germany**	**Social Good**	**Ethereum**
Traceable Donations (TD) leverages the advantages of BDLT to bring efficiency, transparency, and trust into donations by introducing an ERC20 based token. Donors will be granted full transparency on how their donations are spent. Moreover, it will be possible to earn tokens by promoting projects. The tokens can also be used as a reserve value upon which, new community tokens can be created, which then can be exchanged.			

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LORENA	**Spain**	**Social Good**	**NA**
By using BDLT LORENA will help public administrations, non-profit organisations, private companies and individuals to securely create, deliver and manage verifiable credentials. In practice, citizens can save their verifiable credentials issued by other actors (public authorities, universities, organisations, etc.) in wallets under their full control. These digital credentials contain information generated by different authorities related to the individual citizen.			
THX	**NL**	**Social Good**	**Ethereum**
THX is designed to give incentives to members in online communities. Smart contracts and an API allow easy deployment within existing apps with no additional infrastructure. Potential partners include SMEs and non-profits organisations which manage large communities of customers. The company is developing a commercial integration between THX and Open Social community software.			

5. BDLT uptake by SMEs - Trends

The previous section provided an overview of the 25 selected SMEs for the acceleration programme. As mentioned in chapter 3, in total 109 proposals were submitted to Blockpool in 2019. We now showcase some trends we identified from those proposals:

In general, two main trends could be identified, namely a BDLT specific trend as well as a global trend. Both trends are discussed in the following sections.

Tokenization, as already identified in chapter 2.3., received most attention, with real estate being the prime use case. Tokenization was, however, proposed for a range of uses, such as tokenizing receivables from farmers to trade on a secondary market or CO2 certificates for energy. Cybersecurity was a close second with respect to the number of applications received. Most applications related to cybersecurity also had a component of identity management. Identity management as well as Blockchain-as-a-Service were present in several applications.

The global, non-BDLT specific trend clearly felt in the evaluation concerned green and environmental impact. A big part of the overall applications distributed over all sectors related to the environment and limiting the environmental impact humans have on the planet. Concepts that could reduce the CO2 production through solar panels and measure its benefit was a popular topic of choice. Automating processes in the agricultural sector also received a high number of applications. Food traceability and security – i.e. determining exactly where the food comes from – was a hot topic during this round of applications as well. Based on the number of applications related to environmental issues BDLT is being devised to not only

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tackle efficiency issues in the financial sector but to help solve large-scale environmental problems.

6. Obstacles hindering BDLT uptake by SMEs

As other young innovative companies, BDLT SMEs often struggle to obtain financing in the early stage and subsequently in the scale-up phase. However, in contrast to other innovative SMEs, BDLT companies experience additional obstacles that decrease their chances for successful commercialization of the product.

As mentioned in the introduction, BDLT technology is not yet commercialized on a larger scale and several challenges have to be addressed. In the frame of the Blockpool project, the following obstacles were identified based on a questionnaire[26] and expert interviews[27].

Overall, the results of both the questionnaire and the interviews were rather similar. The main obstacles identified by the respondents were:

- Lack of technology and application awareness
- Lack of infrastructure
- Negative Reputation
- Regulation
- Technology
- Resource availability

The **lack of technology and application awareness** was identified as one of the most common issues in the uptake of BDLT. In most organisations, big and small, senior executives do not appear to have sufficient understanding of the potential of BDLT nor access to use cases that could be applied to their companies. As a result, neither large nor small companies do invest sufficiently into the new technologies.

Not only the lack of awareness but also the **lack of infrastructure** was mentioned as a detriment of BDLT adoption. As it often happens, implementing BDLT-based solutions requires adjustment of IT systems within the company and thus additional costs. Furthermore, BDLT implementation would require training for the employees. This makes the uptake of blockchain technologies overall, but especially in the SME sector quite challenging. The survey showed that especially the manufacturing industry seems to not be prepared to implement BDLT.

[26] The survey was answered by 49 participants in total, of which 30 participants were companies and 19 were sole traders.

[27] The interviews were set up as semi-structured interviews with a duration of 30-60 minutes. The sample of interviewees consisted of four BDLT SMEs, four corporations and one independent BDLT expert with a background in academic research.

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Negative reputation of BDLT in general appears to be hampering the uptake. The survey showed that not only the executive management, but stakeholders in general, were found to be a limiting factor. For example, respondents reported widespread prejudice against BDLT, linking the technology to the of laundering money and financing of illegal activities.

Regulation has also been mentioned as key factor hindering the adoption of BDLT technologies, according to the respondents. Since the technology and its regulation are still evolving, companies need to adjust their businesses each time new regulation is published. Companies would benefit from guidance on the impact of regulation on technologies, according to the respondents. For example, it was mentioned that guidance on how GDPR impacts BDLT technologies, could improve the uptake. Understanding the impact of commercial law, GDPR, trademarks and copyrights is considered a crucial step. It was suggested that regulation should go hand in hand with sandboxing tools to foster innovation. Otherwise, there is an emerging risk that investors will only support the use cases that are easily understood and ground-breaking innovation of complex systems will happen outside of the EU.

The most prominent reason limiting the uptake of BDLT technology appears to be the **technology** itself. The current lack of scalability and the large memory requirements for Proof-of-Work concepts were mentioned as the main hurdles. The respondents identified several additional challenges, such as developing global systems and application-oriented use cases. Apart from the software, the hardware was also said being not ready for mass adoption, constrained by limited computing power. On top, a general lack of technical standardization, especially when it comes to interoperability, was also mentioned.

The experts identified **the availability of resources** for financing and building a strong network as another challenge preventing the uptake of BDLT. This extends to both, the availability of skilled workers familiar with BDLT technologies and investment into the BDLT industry. Very few private investors, Business Angels and Venture Capitalists in Europe are specialized or have extensive experience within the BDLT industry.

The interviews not only identified the current challenges but also offered **possible solutions**. The BDLT industry faces the challenge of attracting end users to its technology. Respondents proposed to improve the usability and simplicity of BDLT solutions, for example of the user-interface. Also, the survey identified the transfer of value and assets, improved transparency, efficiency and factoring (i.e. resale of receivables) as instances where smart contracts can add value.

7. Risk assessment

The following section attempts to assess the risk probability of the respective obstacles into high, medium and low risks and provides potential mitigation strategies.

Technology and Infrastructure– high risk

The survey showed that technology was the main risk hindering the uptake of BDLT technologies. Key issues identified were the interoperability and scalability of the technology,

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the maturity of it as well as the fact that networks could not handle a large-scale adoption at this point in time.

Mitigation strategy: The issue of scalability and maturity can be addressed through more innovation. The Proof-of-Work consensus is the one used in the Bitcoin network and was hence the first one to be deployed in the cryptocurrency industry. Since then new consensus mechanisms have been developed, that are considerably more efficient and scalable. Innovation will continue to identify shortcomings and address them, so fostering innovation is a prime tool to improve and develop this young technology.

The inability of the current network to support a large-scale adoption can only be addressed over time via investments into the infrastructure. This not only applies to spending on improving existing internet connections, it also applies to large corporations that still rely on legacy systems. These companies need to be willing to invest into their own infrastructure. For this to happen the companies and executives first need to understand the long-term benefits of using BDLT, which can only be achieved through awareness raising and education.

Regulation – high risk

The regulatory and legal framework was identified as a large issue in both the expert interviews and the survey. As outlined in section 2.4, the regulation is still developing and very few countries in the EU have set concrete rules to guide the BDLT industry. Switzerland, Lichtenstein, and Germany are front-runners in this respect, but other regional laws or an EU-wide framework does not currently exist[28].

Mitigation strategy: In order to address this issue policy makers must come together at an EU level and set a common set of guidelines. The difficulty in this task is to strike the right balance between regulation and guidelines to ensure that companies have clarity, but enough freedom to drive innovation forward. A positive observation in this respect is the very quick reaction of the EC towards encouraging harmonised regulation, as it happened in the field of crypto-assets with the MiCA proposal[29].

Reputation and lack of knowledge – medium risk

It was highlighted that decision makers do not have sufficient knowledge of BDLT to favour their implementation. Instead, the technology still suffers from a bad reputation. Additionally, few experts exist, which dampens recruiting and thus makes it more difficult to hire the right talent for new projects.

Mitigation strategy: The knowledge gap can only be bridged by continued education and awareness creation. Universities are gradually incorporating BDLT topics into their syllabus

[28] Dentons (2020): ANALYSIS OF CURRENT EUROPEAN BLOCKCHAIN REGULATION. European Crowdfunding Network, Brussels. https://eurocrowd.org/2020/10/24/analysis-of-current-european-blockchain-regulation-october-2020/

[29] On 24 September 2020, the European Commission (EC) adopted an expansive new Digital Finance Package including a comprehensive new legislative proposal on crypto-assets, called Markets in Crypto-assets (MiCA), that was developed to help streamline distributed ledger technology (DLT) and virtual asset regulation in the European Union (EU) whilst protecting users and investors.

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and entirely new degrees and/or professional certificates are being created. Whilst these initiatives commended, the change will be gradual. In order to facilitate faster uptake of the technologies training efforts need to be increased and buy-in from large corporations need to be secured.

Resource availability – medium risk
As outlined in the introduction, Europe faces compared to other economies, an investment gap. The reasons are diverse and range from cultural aspects, fragmentation of financial markets and a lack of sufficient risk-bearing capacity. Especially disruptive technologies, such as BDLT, face substantial challenges when seeking the finance to scale up. So far, investors do not have the right technical expertise to assess the market prospects.

Mitigation strategy: In order to close the investment gap, the European Commission has developed a Blockchain investment fund that provides equity investments in highly innovative start-ups and SMEs[30]. Further, it is expected to see greater adoption and venture capital investment in BDLT, as more and more BDLT based financial services apps are built and BDLT becomes more widely accepted.

8. SWOT strategies and recommendations

Based on the analysis of industry trends and main implementation risks, this section summarizes the specific strengths and weaknesses of BDLT. Following the analysis of identified strengths, weaknesses, opportunities and threats (SWOT), we suggest strategies and recommendations to create the right framework conditions for BDLT uptake by SMEs and increase of private investments in this new technology. These recommendations are mainly targeted to policy makers, who can trigger respective measures withing policy, funding or other framework programmes.

The illustrated SWOT analysis does not claim to be complete and is to be interpreted in relation to the various approaches of BDLT. As the individual technological approaches differ, sometimes considerably, the statements must be put into perspective.

[30] https://ec.europa.eu/digital-single-market/en/news/eu-artificial-intelligence-and-blockchain-investment-fund-invest-100-million-euros-startups

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	Technology factors	Environmental factors	
Strengths	■ Transparency and traceability of data ■ Data integrity through cryptography ■ Data quality through immediate owner control and real-time information ■ Reliability through decentralization ■ Direct (P2P) interaction without intermediary ■ Pseudonymization/anonymization of network participants ■ Programmability	■ Reduction of bureaucratic hurdles ■ Time and cost savings for European SMEs through increased efficiency in process automation as well as process monitoring (process optimization) ■ Cross-border value creation processes (new forms of collaboration and organization; cross-company KYC approach, etc.) ■ Secure and digital transferability of non-digital assets trough tokenization ■ European leadership in a potentially disruptive technology approach	Opportunities
Weaknesses	■ High energy demand ■ Constantly growing data volume ■ Lack of processing speed and scalability ■ Lack of technological maturity ■ Lack of international standards ■ Lack of integration with legacy systems ■ Partly missing interoperability between BDLTs ■ Uncertainties regarding data protection (e.g. right to be forgotten)	■ High complexity and partly high energy demand decreases the uptake of BDLT and could lead to a rejection in society ■ Technological maturity for a wide range of applications will never be reached ■ Lack of standards and numerous frameworks lead to Europe-wide isolated solutions ■ Regulatory uncertainties lead to adoption barriers for European SMEs ■ High development and implementation costs of BDLT equalize efficiency increases (short term)	Threats

Figure 7: SWOT analysis for BDLT

SO strategy

SO strategies are used to create opportunities by leveraging the strengths of BDLT. They offer ways and means of driving BDLT innovations forward in Europe. In the medium to long term there is the possibility of technological leadership in a potential key technology.

This includes in particular the increased use or testing of so-called **smart contracts**. These are digital, rule-based protocols that check and document transaction results in a distributed ledger and can independently execute transactions if predefined conditions are met[31]. In business practice, this could automate certain processes and execute contractual consequences in real time. By minimizing the interaction between the contract parties without an intermediary, it also leads to savings in effort and costs.[32]

However, the opportunities presented here should not hide the existing weaknesses of smart contracts such as e.g. the dependence on the executing system or errors in the programme code.

[31] Wright, A.; De Filippi, P. (2015). Decentralized Blockchain Technology and the rise of Lex Cryptographia. P. 11; Lauslathi, K.; Mattila, J.; Sepällä, T. (2017). Smart Contracts – How will Blockchain Technology Affect Contractual Practices. ESLA Reports No. 68. P. 11.

[32] Schlatt, V.; Schweizer, A.; Urbach, N.; Fridgen, G. (2016). Blockchain: Grundlagen, Anwendungen und Potenziale. PP. 23-25.

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ST Strategy

ST strategies are primarily intended to minimize risks such as isolated solutions across Europe and high development and implementation costs. For this reason, the European Commission may consider to continue focussing on **promoting BDLT adoption** within the Member States and, if necessary, expanding it to a larger extent. EU funding for BDLT can help European SMEs to implement pilot projects and to automate and optimise their processes in the long term. Furthermore, completely **new collaboration formats** enabled through BDLT (e.g. so-called Decentralized Autonomous Organisations), should be further explored.

In addition to BDLT funding priorities, it is necessary **to increase the political discourse** on relevant topics, e.g. support the development of standards to enable technical interoperability and compatibility. **Long-term monitoring of the funded BDLT projects** ensures progress. Ideally, the project results will be digitally mapped and made available for the **exchange of knowledge between (inter)national working groups**.

It is also important to demand and promote the knowledge transfer to the wider society. The knowledge gap can only be bridged by continued **education and advertising of the technology** as mentioned above. Public discourses, such as the debate about the increased energy requirements of BDLT, can thus be put into perspective.

WO strategy

Appropriate WO strategies take advantage of the opportunities to overcome the technology weaknesses of BDLT. Special emphasis in support programmes should refer to evaluation together with test and user groups. **Usability and user centered-design of BDLT applications are** particularly necessary to ensure the best possible acceptance. Such continuous involvement of practitioners allows streamlining EU funding priorities in the field of BDLT.

The European Commission should continue encouraging **own pilot projects or prototype developments**. In this way, the Commission's technological competence is expanded, legacy systems are replaced where possible and positive signals are sent out to European SMEs with regard to BDLT adaptation.

WT strategy

WT strategies aim primarily to avoid risks by minimizing technological weaknesses. In order to prevent Europe-wide isolated solutions or adaptation obstacles, it is recommended to **collect and evaluate comprehensive examples of best practice regarding use cases and regulatory frameworks** of EU member states, as e.g. the Blockpool project has covered with the above mentioned regulatory study[33]. A uniform regulatory framework within the EU is required to foster BDLT activities. In practice, an SME providing a BDLT-based financial service and scaling it up across Europe would need to obtain 27 different licences. This is not only time

[33] Dentons (2020): ANALYSIS OF CURRENT EUROPEAN BLOCKCHAIN REGULATION. European Crowdfunding Network, Brussels. https://eurocrowd.org/2020/10/24/analysis-of-current-european-blockchain-regulation-october-2020/

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consuming, but is cost intense and risks slowing down innovation.[34] A potential solution is to find a harmonised regulatory approach, as recently suggested by the European Commission with the Proposal for a regulation on Markets in Crypto-assets (MiCA)[35], to ensure that companies have clarity, but enough freedom to drive innovation forward.

9. Conclusion

BDLT-based use cases are envisaged to change current digital services we use through the internet, towards more transparency, trust and decentralization. Therefore, BDLT have a high innovation potential both for the European industry as well as for citizens, as new business models will evolve.

In order to achieve the ambitious goals set as quotation at the beginning of this paper, the European Commission encourages cooperation and reinforces investments[36] in this field, in order to better understand how the European SME landscape takes up this new technology and to understand legal and regulatory bottlenecks, focus research and shape policy frameworks.

Until May 2021 the Blockpool project will work closely with 25 selected SMEs and pilot potential solutions for addressing the most critical challenges identified above. Best practices use cases and success stories will help to support the understanding both from the demand and supply side. In addition, targeted investment and technical assistance to SMEs, will help to mitigate the high risks related to the technology itself. Besides working with the selected SMEs, the Blockpool project is dedicated to educating the wider public on BDLT via a freely available MOOC and recorded webinar series.

At the end of the Blockpool project, a comprehensive set of policy recommendations and lessons learnt from the 25 selected SMEs will be published.

To support the uptake of BDLT, consumers need to be aware of and understand the connected benefits and advantages, but also be educated on potential risks associated with the implementation of innovative technologies. But not only the demand side needs to be educated, also the supply side requires user-friendly and commercial tools and solutions to adopt the new technology to existing business processes.

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[34] Franczyk, B.; Zwanzger, M.; Bilski, N.; Römer, I.; Zimniak, M.; Ackermann, E.; Rockel, J.; Fiedler, H. (2019). Branchenübergreifende juristische, technische sowie ökonomisch-soziale Analyse von Smart Contracts im Kontext der Sharing Economy und Evaluation von Chancen, Risiken und Gestaltungsaspekten des Verbraucherschutzes unter Einsatz der Blockchain-Technologie in Deutschland und im europäischen Rechtsraum. PP. 61-64.

[35] European Commission (2020): Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on Markets in Crypto-assets, and amending Directive (EU) 2019/1937, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020PC0593

[36] List of EU funded projects in the field of BDLT: https://ec.europa.eu/digital-single-market/en/news/eu-funded-projects-blockchain-technology, retrieved on 26/10/2020.

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