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Subject review

Corporate Responsibility in the Context of Digitalization

Patricia Girrbach

Abstract: Corporate Responsibility focuses on economic performance, the protection of the natural foundations of life and social responsibility. In this context it is important to deal carefully with the limited resources available to take care of inter- and intragenerational justice by preserving the resource base. Due to the fact, that digitalization changes whole industry, a change in detail a more holistic view on responsibility is necessary. Corporate Responsibility must be enhanced to Corporate Digital Responsibility in terms of digital aspects. In this context this paper provides insights into Corporate Digital Responsibility from the perspective of blockchain usage in supply chain management.

Keywords: blockchain technology; Corporate Digital Responsibility; resource efficiency in a broader sense

1 INTRODUCTION

It is well-known that the term digitization refers to the transfer of any kind of information from a conventional old fashioned analogue kind of storage to a digital one [1, 2]. Consequently, information is nowadays available converted digitally as zeros and ones such as in the case of digital photos. Beside that the term digitization addresses also that tasks taken over by human craft in former times nowadays are carried out by computers which fulfills these tasks even more efficient than any human ever could. Hereby, digitization is the prerequisite for any kind of digitalization which can also be interpreted as automation which is based on information technologies [1, 2]. In this context new technologies enable not only a new level of production and a total transformation of processes along the entire value chain but also a new level of consumption in general. These new technologies include well-known and often used technologies such as Internet of Things, Cloud based Manufacturing, Cyber Physical Systems or also Information and Communications Technology which are essential for nowadays industry [1, 2]. Thus, these new technologies are important starting points for industry 4.0 paving the way to a new level of production initiating a new technological age which transforms production processes all over the world and whole value chains in an incremental way. In this context Corporate Digital Responsibility comes into play [1, 10]. If there is a change of whole industries, it is a necessity that companies rethink previous old fashioned organizational concepts. Therefore, this paper provides insights into Corporate Digital Responsibility from the perspective of blockchain usage in supply chain management (Fig. 1).

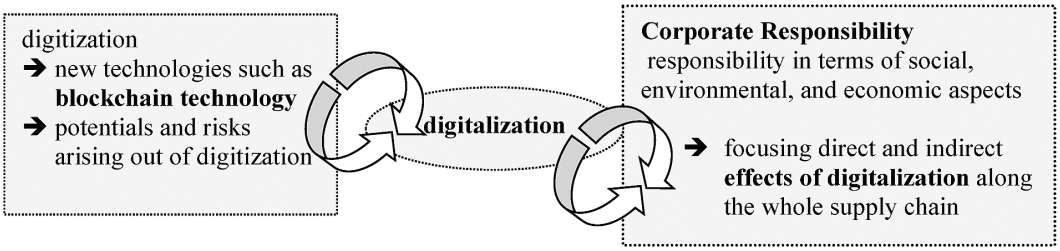

Figure 1 Corporate Responsibility in the context of digitalization (own figure)

2 CORPORATE DIGITAL RESPONSIBILITY

The term Corporate Responsibility operationalizes the company's assumption of responsibility for the effects of its decisions and activities in terms of society on the one hand as well as on the environment on the other hand [3]. Hereby, it is important to focus on sustainable development serving as vision guiding organisational behaviour in a long-term view. In this context sustainable development is a development that meets the needs of the present taking care that generations in the future will also be able to meet their own needs [1]. Therefore, Corporate Responsibility is based on the three pillars of sustainability, including in detail economy, environment, and society [1, 4]. Consequently, sustainable corporate management combines economic performance, social responsibility and finally the protection of the natural foundations of life [4]. Accordingly, it is important to take care of the limited resources available and not to live at the expense of people from other regions of the world or future generations [3]. Only then companies can promote inter- and intra-generational justice by maintaining the resource base not only for todays but also for further generations [3]. So, we can state that Corporate Responsibility as a holistic concept operationalizes the company's responsibility for the impact of its decisions and activities on society and the environment in a holistic view [3, 4]. Thus, Corporate Responsibility must be implemented in the organization processes along the entire supply chain

also affecting suppliers, partners, and customers. Therefore, a vertically and horizontally implementation is needed [5]. There are three organizational layers, Corporate Responsibility must be anchored [6]. At the normative long-term level, the principle of sustainability must be anchored as a starting point and as a vision guiding companies in such a way that they meet the needs of customers and today's society without endangering future generations to meet their own needs and choose the lifestyle they want. For this reason, sustainable strategies for production must be implemented at the strategic medium-term level. In this context sustainability strategies come into play such as consistency, sufficiency, or efficiency strategy. Starting points for fulfilling these strategies are at the operational level e.g., all measures for a more efficient supply chain management to reduce the ecological footprint or emissions and to achieve time and cost reductions. This refers directly to ecological and economic issues and indirectly to social aspects. For sustainable value creation, it is important to take a holistic view of the value chain and to look at suppliers as well as customers. The aim is to bear economic, social, and ecological responsibility for the total consequences of organizational activities along the entire supply chain. Hereby organizational responsibility goes far beyond the legal requirements for the sake of a more holistic view of responsibility [4]. This is caused in the reason that especially in the context of digitalization responsibility must be expanded. Due to that companies are responsible also for the use and consequences of new technologies arising out of digitization along the entire value chain [5, 7]. Moreover, they should use the possibilities arising out of new technologies to reach sustainable objectives since digitalization is renewing the way companies can create value. The future perspective of the digital value chain includes leaner production that meets requirements for an efficient resource-saving economy [1, 8]. Hereby, information is used on the one hand to focus and reduce material and energy flows and on the other hand to avoid rejects, material waste as well as overproduction. Consequently, processes become more efficient through digitalization as important part of Corporate Digital Responsibility (Fig. 2).

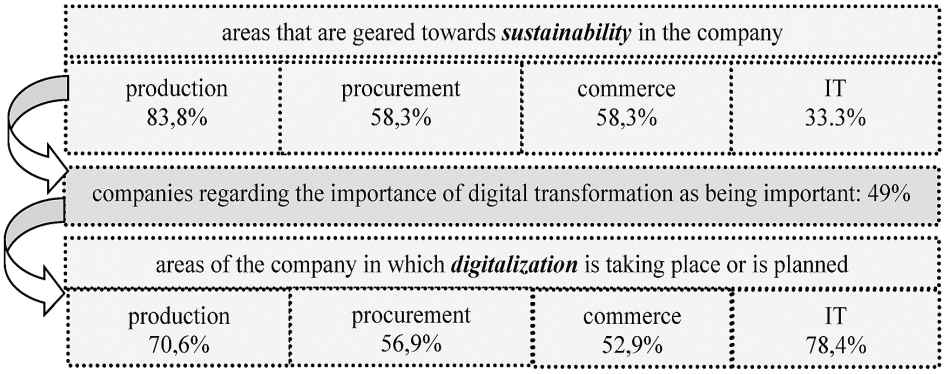

Figure 2 Responsibility and digitalization (translated based on 8)

To remain competitive, companies must take advantage of the opportunities created in the context of industry 4.0 to achieve and enhance various strategic competitive advantages [1, 9, 10]. In this regard, the future success of a company will increasingly depend on implementing digitized processes along the entire supply chain for the sake of efficiency. In this context digitalization relates to responsibility goals such as ecological, economic but also social aspects within the framework of Corporate Responsibility so efficient supply chain management is needed. Moreover, it is important not to focus only reducing costs but also mitigating risks on the other side. Digitalization enables significant improvements due to automated processes and real-time information. Moreover, digitalization permits optimized energy efficiency. Improved energy efficiency is important for sustainable management in terms of the ecological and social responsibility of companies [14]. To minimize the ecological footprint of an organization, a continuous improvement in efficiency is recommended, especially regarding energy requirements [13]. In this context companies must determine first how high the actual energy consumption in detail is and in which areas it is particularly high. This investigation serves as a starting point for improvements and specific measurements. Afterwards due to always limited organizational resources (manpower, time, money) the company must select and decide at which point in the value chain an efficiency improvement using new technologies is most promising.

As mentioned before Corporate Digital Responsibility is based on the concept of sustainability by assuming responsibility for economic, social, and ecological as well as digital aspects focusing on the chances for sustainable issues arising out of digitalization [1, 10]. This implies that Corporate Responsibility is expanded to Corporate Digital Responsibility in the context of digitalization. Thus, Corporate Digital Responsibility includes more comprehensive corporate responsibility in an increasingly digitalized economy and society [1, 10, 11]. In the context of digitalization organizational activities do not only focus on legal requirements but try to shape the digital world for the benefits of society and for the sake of sustainability in a more holistic and enhanced view. External effects of digital corporate activities can arise in the areas of the environment as well as labor, human rights, and other aspects such as social issues [1]. Therefore, Corporate Digital Responsibility focuses not only on social, economic, and ecological effects

of digital corporate activities along the entire supply chain but also seizes any kind of opportunities that arise for sustainable goals in the context of digitalization [10, 12] (Fig. 3). In this context sustainable goals contain any kind of value creation for companies or any stakeholder group, e.g., customers [1]. The creation of value can address economic, environmental, and social aspects. It can be sate that any technology that contributes to the well-being of people, the protection of the planet or increased profit can be considered as value-adding. Hereby, sustainability and its three dimensions serve as indicator if value is created. The social dimension focuses on people including not only employees but also external stakeholders such as customers, suppliers, or the society in general. Concerning the economic dimension new technologies should reduce costs by saving materials, time, or energy. Obviously, due to the reduction of energy and material this influences the ecological dimension in a positive way, too [1]. Advantages concerning the social dimension include improved well-being or better situations for stakeholders due to saving time or human effort. Environmental objectives focus on the protection of natural resources and the maintenance of the planet in general. This addresses the intra- and intergenerational equity. This is caused in the reason that currently climate change is one of the most pressing environmental issues. It is well known that we are using too many resources. Our ecological footprint increases. In this context the ecological footprint is a criterion for human demand for natural capital that compares on the one hand how much bio capacity is used by human activities and on the other hand how much bio capacity is available on a sustainable basis [21]. Consequently, it can be regarded as one criterion for environmental sustainability. Obviously, one important starting point for reducing our ecological debt is for example using less materials and energy in logistical processes.

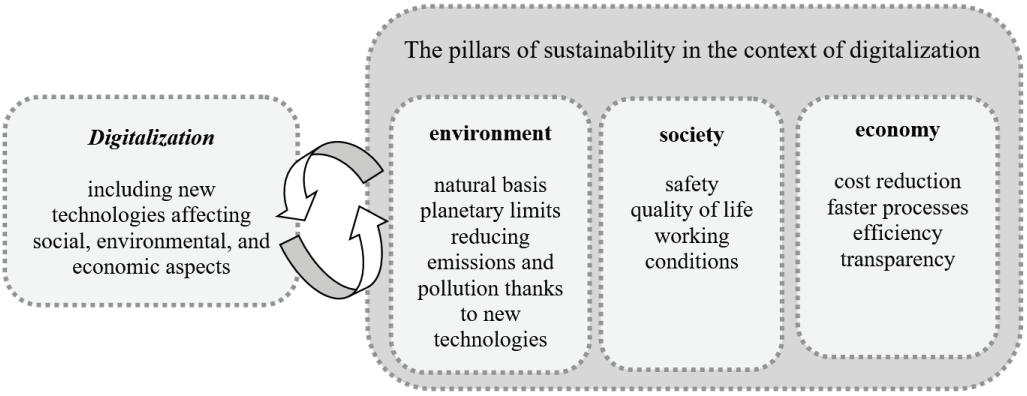

Figure 3 Responsibility in the age of digitalization (own figure based on [1])

To prove if sustainable objectives are reached the concept of resource efficiency in a broader sense is useful that can also be adapted to logistical processes [22]. Resource efficiency in the broader sense is based on the concept of resource efficiency including the number of resources contained in a product in relation to the resources required for its manufacturing or transportation and in consequence, resource efficiency can be raised by using fewer resources, e.g., in logistical processes. To concretize resource efficiency in a broader sense, resources should be differentiated. Sustainability focuses normally on resources in a more specific kind of view including only energy and material. The concept of resource efficiency in a broader sense enhances this view. In this context resources also contain e.g., time, capital, and human effort. It could be increased by a positive reducing effect on the required input factors. This refers in terms of economic aspects a reduction of time or costs, concerning environmental issues a decrease of materials, energy and waste and concerning social aspects a reduction of time or human effort (Fig. 4).

In terms of digitalization the author enhances the well-known concept of resource efficiency in a broader sense to resource efficiency 4.0 for pointing out chances as well as risks raising out of digitalization due to new technologies. Moreover, the concept is enhanced to further input and output factors which become relevant in the context of digitalization such as increased trust through documented transparency in terms of social (e.g., the protection of privacy, working conditions) and environmental (e.g., ecological footprint) aspects of a product or service. In terms of the output this contributes to the sustainability-orientation of products and services as important value-adding element for customers. Hereby, resource efficiency 4.0 doesn´t aim bringing out exact figures because this is impossible since various direct and indirect influences and interdependencies exist in the process of manufacturing. Rather resource efficiency 4.0 aims to deliver an awareness of the impact of new technologies in terms of further aspects using resource efficiency as a well-established basis term that companies are used to handle. This is important since many companies are often not aware of the fact that they can influence not only environmental aspects, but also further social aspects such as the privacy or safety (better working conditions) of people by using new technologies. Therefore, companies should pay attention to all advantages of new technologies by focusing further input factors, including not only saving time, capital, emissions, or materials, but also the option of averting exploitation of people and environment due to more transparency along the entire manufacturing process (Fig. 4).

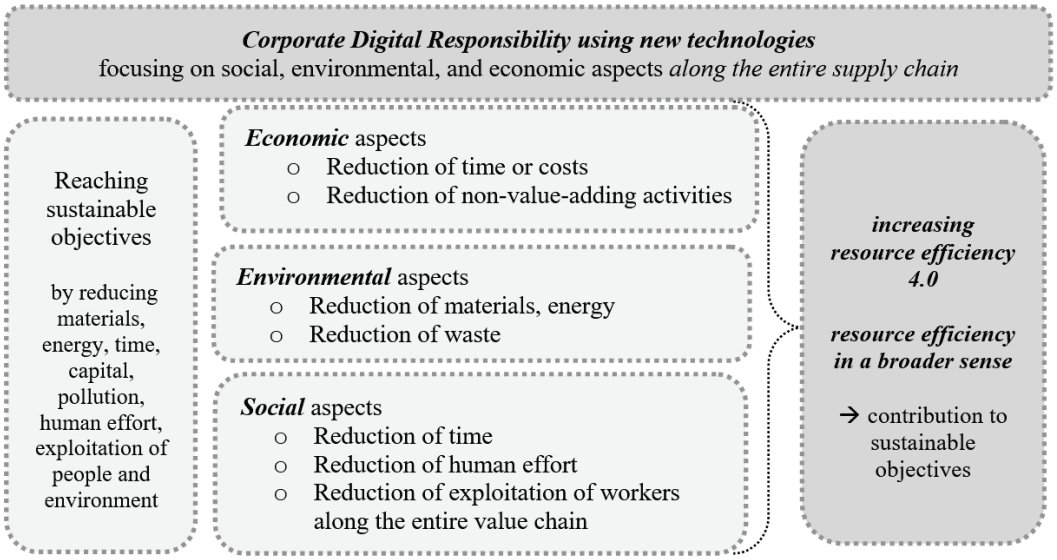

Figure 4 Reaching sustainable objectives by increasing resource efficiency 4.0 (own figure)

Therefore, based on the concept of resource efficiency 4.0 Corporate Digital Responsibility can contribute to sustainable objectives using digitalization [1, 8, 13]. In this context especially logistic processes offer a high potential for increasing resource efficiency along the entire supply chain focusing on ecological, economic, and social aspects. Figure 4 shows possible advantages arising out of new technologies. In the following it will be shown that blockchain technology has the potential to optimize not only energy management processes in almost all stages of the value chain but also to contribute to economic, environmental, and social objectives based on a sustainable supply chain management.

3 THE CONTRIBUTION OF BLOCKCHAIN TO RESOURCE EFFICIENCY 4.0

Sustainable-oriented companies taking responsibility for ecological and social issues are challenged to create transparency and traceability for the end customer along the entire supply chain [16]. This is caused in the reason that transparency and resulting trust are the basis of economic cooperation in all stages of the entire value chain. In this context on the one side companies and retailers must trust suppliers delivering the guaranteed quality produced in accordance with specific quality standards in terms of working conditions or environmental issues and on the other side consumers must trust that the promised quality in terms of sustainable aspects have been adhered to at all processes and stages of the value chain. Hereby, Corporate Responsibility requires a credible proof of ethically correct economic activity in terms of materials or production methods based on transparency due to permanent available detailed documentation along the entire process [16]. In this context blockchain technology (BC) comes into play which creates trust by a complete and non-changeable history of transactions [16, 17, 19]. Normally there is a need to check the authenticity of a document, a banknote, a contract or a product by banks, notaries, or lawyers. There are also numerous wholesalers, retailers, and online shops along the supply chain as well as the mentioned authentication instances increasing the final price for customers. Moreover, inefficient transportation processes cause emissions and pollution along the whole supply chain. Beside those aspects deliveries are often too late or the security in terms of data exchange or transparency in terms of the delivery is not given. Furthermore, there is no guarantee that products and services have been produced in a socially acceptable and environmentally friendly manner as promised.

In this context blockchain offers many chances in terms of sustainable goals such as economic, social, and environmental aspects since blockchain technology creates a totally new quality of any kind of transactions [17, 19]. In simplified terms, blockchains can be described as distributed databases organized by the participants in the network [15, 16, 17]. First, every transaction (e.g., loading of goods), is generated by a sender, and digitally signed. This transaction is distributed to the participants (so-called nodes). The nodes of the network check the validity of the transaction and try to find a consensus. Relevant consensus models are Proof of Work, Proof of Stake and Proof of Authority (authentication nodes). Verified transactions are stored in a block using hash functions which represents transactions uniquely [16, 17]. A block contains the transaction data such as time stamp, digital fingerprint, and data from the previous blocks. This coding is secure against manipulation. Blocks are linked to the existing blocks by chaining, so that a chain is created. Since blockchain uses distributed ledger technology thus data is stored on each node [15, 16, 17]. Changes to the database are not possible due to the large number of copies. This makes blockchain a secure booking system for any form of digital property rights that no longer needs a central authority (e.g., notary or bank) caused in the reason that every raw material, and process step, as well as every transport and transaction can be stored in a tamper-proof manner [16]. This ensures transparency along the entire value chain for all stakeholders (partners, customers, and suppliers). Hereby smart contracts

as part of the blockchain technology carry out transactions automatically as soon as a transaction has taken place (e.g., receipt of money due to the payment of a customer) [15, 16, 17]. Consequently, blockchain creates transparency and trust with increased security against fraudulent manipulation.

The following practical example shows how well the blockchain technology works regarding sustainable goals increasing resource efficiency in a broader sense. IBM and Maersk (shipping company) started a pilot project whereby containers were shipped to Hamburg from abroad replacing all necessary papers by blockchain [18]. According to Maersk, at least 200 or more individual operations must be issued per container in former times. That means that without blockchain at least 30 office workers are employed, and hundreds of documents must be printed for each container. Concerning transportation often inefficient processes take place due to the reason of inefficient route planning or traffic jam. In that context IBM and MAERSK aim to increase efficiency in terms of processes, materials (paperless processes), and transportation using blockchain taking over the role of the digital delivery note in the supply chain available for all participants. Inventory control, warehouse processing, and object tracking based on RFID-chips is possible in real-time.

Thanks to location data, smart contracts introduce following activities autonomously, e.g., when the required goods reach the port, the container is automatically unloaded and afterwards loaded onto the truck [15, 16, 17]. Based on new technologies (embedded systems, internet of things), vehicles are advancing into self-communicating units taking on driving tasks or automatically adapting routes (e.g., based on traffic jam information). In this context helpful methods such as predictive analytics are used optimizing route planning for all vehicles. Hereby, blockchain enables complete transparency and permanent documentation of all transactions along the entire supply chain [15, 16, 17].

This practical example shows, that due to blockchain all necessary papers have been replaced by blockchain technology [18]. This leads on the one hand to paperless digitized documents (better data handling), automated contract execution possible due to smart contracts and on the other hand to faster and error-free processes) [15, 16, 17]. Decentralized authentication saves a lot of time and money while increasing security against fraudulent manipulation. There are low contract, enforcement and monitoring costs compared to regular contracts. Increased transparency is achieved through real-time information relating to goods and participating actors. Thanks to blockchain MAERSK deliveries are safer, cheaper, faster, and eco-friendly since materials (paper) as well as emissions (transport) can be reduced through digitalized, optimized processes. Moreover, it contributes to social aspect of sustainability since transactions are safer for everyone involved. Additionally, the service quality for customer increases (Fig. 5).

Concerning the blockchain technology in general participants are in direct contact and have direct access to digitized documents [15, 16, 17]. Results are, intermediaries are left out, transaction costs fall, and processes become more efficient. Blockchain ensures security since it enables detailed access control. In addition, it is tamper-proof thanks to cryptography. The decentralized structure enables permanent data storage in the entire network for the sake of data backup. The blockchain technology contributes to sustainable objectives in several ways: Automatous processes along the whole supply chain containing digitalized documents are established [15, 16, 17]. The supply chain is logistically optimized (e.g., automatic determination of the best route using real-time data). Besides that, transactions with suppliers, partners and customers are simplified, improved, and automated. Processes are faster, cheaper, error-free, optimized with increased service quality and security (benefits for partners and customers). Stakeholders save time and money. In terms of ecological goals, blockchain reduces the ecological footprint through optimized transport, reduced emissions, and paperless processes. The following figure shows some of the positive effects of the blockchain technology on sustainable objectives (Fig. 5).

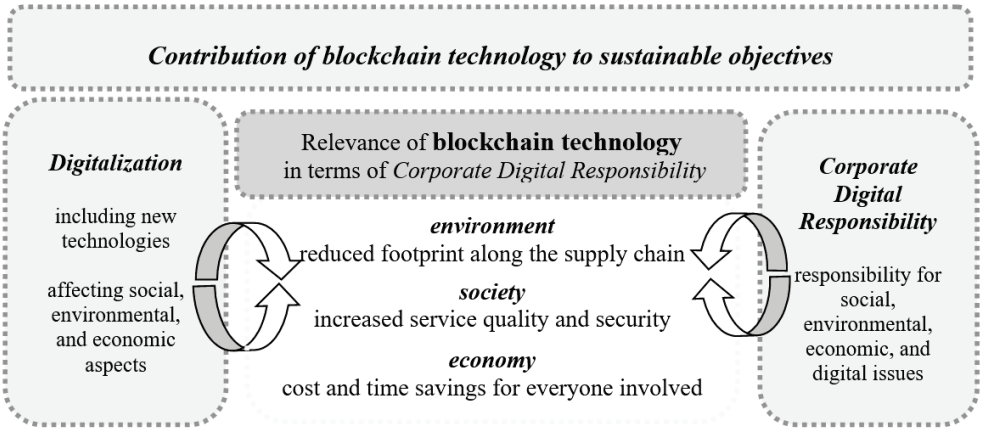

Figure 5 Blockchain and its positive effects on sustainable objective (own figure)

Another important advantage concerning social issues is that participants are in direct contact and have direct access to digitized documents and party-specific information is possible [16]. In this context blockchain technology enables manufacturers to oblige their suppliers to document production steps with images and text. Customers can then,

for example, call up the entire value creation of a particular product on a product detail view. Thus, companies can offer their customers more transparency by making the entire value chain and the ecological footprint visible in online stores. Especially in terms of sustainable aspects it is important that the composition of products or the production process (e.g., working conditions) can be retrieved from the blockchain. Customers who value sustainable production thus gain more security through traceability. Consequently, blockchain creates transparency and trust due to increased security against fraudulent manipulation by creating a complete and non-changeable history of transactions [16, 17]. In summary, blockchain enables cost and time savings for everyone involved (economy) as well as a reduction in the ecological footprint (ecology). Moreover, it enhances service quality, creates trust and transparency concerning working conditions and can consequently reduce the exploitation of workers (social) along the entire supply chain [16]. So, Corporate Digital Responsibility can make a significant contribution enhancing resource efficiency 4,0 using new technologies such as blockchain [1, 2, 20] (Fig. 6 and 7).

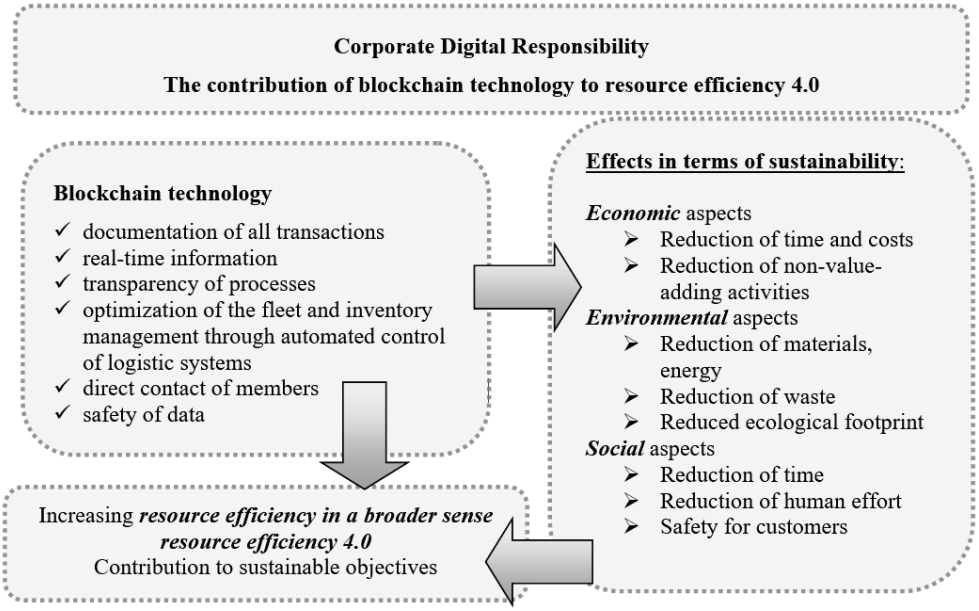

Figure 6 Relevance of blockchain technology in terms of Resource efficiency 4.0 [own figure]

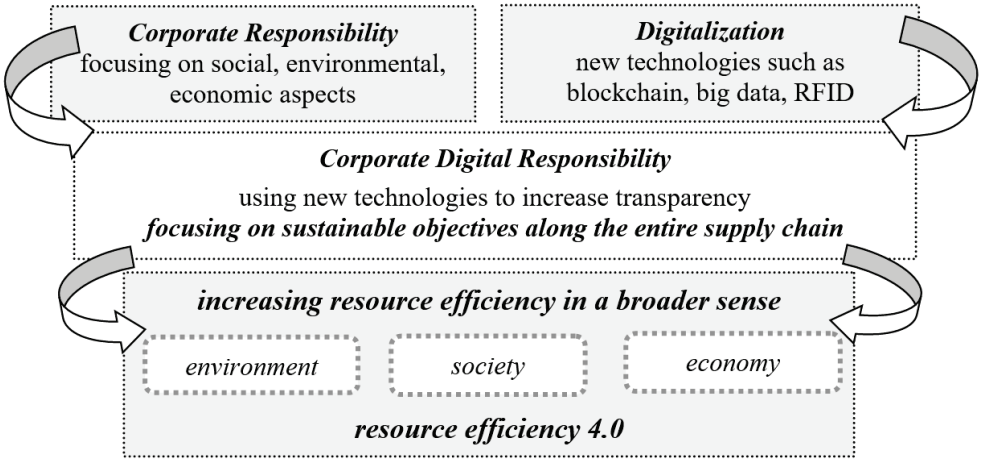

Figure 7 Corporate Digital Responsibility as a starting point for enhancing resource efficiency 4.0 [own figure]

4 CONCLUSION

This paper provides insights into Corporate Digital Responsibility from the perspective of blockchain usage in supply chain management using the concept of resource efficiency in a broader sense, in detail resource efficiency 4.0 as starting point. Regarding Corporate Digital Responsibility, digitalization, especially blockchain, offers social as well as ecological and economic potential benefits that companies should take advantage of. Only then can responsibility-oriented companies meet their responsibility regarding ecological, economic, and social aspects in the digital age, e.g., by offering customers more security, protection, and cost savings regarding goods received, but also by reducing the organizational ecological footprint along the entire supply chain. Therefore, the blockchain technology

fulfills current requirements for contemporary sustainable corporate management and process control along the entire supply chain as part of Supply Chain Management 4.0 [16]. This is caused in the reason that blockchain technology creates a new quality of transactions contributing to the concept of resource efficiency 4.0 in a significant way.

Notice

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Author's contacts:

Patricia Girrbach, Professor Doctor
FOM, Fachhochschule für Ökonomie and Management,
Rotebühlstraße 121, 70178 Stuttgart, Germany
Tel.: (+49) 800 1959595
p.girrbach@gmx.de