



## SUPPLY CHAIN FINANCE AND CHALLENGES OF MODERN SUPPLY CHAINS

Monika Bal, Kinga Pawlicka

The Poznań University of Economics and Business, Poznań, Poland

**ABSTRACT. Background:** The cognitive goal of the article is to systematize the knowledge in the field of Supply Chain Finance (SCF) in the context of the leading contemporary trends and challenges of Supply Chain Management (SCM). For the purposes of the research objective, Walmart was selected for the case study as a model implementation example. In the authors' assessment, there is a need to discuss and organize knowledge about the co-existence of SCF with modern solutions such as sustainable finance or blockchain technology. The empirical goal is to assess the sustainable supply chain finances management (SSCF) in terms of shaping the financial condition of the company and its position on the market.

**Methods:** To achieve the research objective, it was necessary to critically assess the present SCF literature and actual trends implemented in companies, which was done using case study method. The case study form was chosen due to the limited state of knowledge in a research area and the selected company is a precursor in this aspect. The research procedure consisted of: data collection, data analysis, formulating generalizations, confronting the literature, processing of generalizations and study closure.

**Results:** Conducted research helped to develop the existing theory and systematize effects and identify potential opportunities from implementing sustainable supply chain finances management based on blockchain technology. Analysis of financial data proved that benefits exceed implementation costs.

**Conclusions:** First, it was possible to develop an open-ended SCF benefit set, distinguished on the basis of varied literature. Second, implementing blockchain technology in the supply chain and drive to make it sustainable can be complementary activities. In summary, the authors formulate recommendations for other companies and indicate the direction of further research.

**Key words:** supply chain finance, blockchain, sustainable supply chain.

### INTRODUCTION

Today's supply chains are required to undergo constant change, which is caused by the management of companies searching for opportunities to gain a competitive advantage. Therefore, the importance of capital commitment awareness in the context of supply chain management has grown enormously [Chen, Cai, He, Chen, Zhao, Zou, Guo 2020]. These changes result mainly from companies following modern information technology while maintaining sustainable development. Consequently, it leads to the

entire chain integration, and in some cases restructuring and creation of global logistics networks. Therefore, there remains a high potential for optimization, which affects the company's capital structure, risk level, operating costs, profitability, and ultimately market value [Gomm 2010].

Combining SCM with leading trends: blockchain implementation and considering sustainable issues results in both improving efficiency, transparency, and traceability and significant corporate financial savings [Kouhizadeh, Saberi & Sarkis 2020]. However, the use of this combination of tools in a supply

chain strategy does not guarantee success, which is the result of many factors. The obstacle is the short presence of such a business strategy in practice and few described success stories. Therefore, the research problem of identifying the benefits of blockchain technology and sustainable finance for SCF has been addressed. To this end, the Walmart case study was analysed.

## **SYSTEMATISING KNOWLEDGE OF SCF**

More and more research is being undertaken to link logistics and supply chain management (SCM) with the business value and financial performance [e.g. Gomm 2010, Wandfluh, Hofmann & Schoensleben, 2016, Li and Chen 2019]. As H.Ch. Pfohl [2006] writes, supply chain finance (SCF) enables the rationalisation of finances by creating cooperation between manufacturers, suppliers, customers and logistics intermediaries. The optimization of financing outside the company's borders is achieved by reducing the cost of capital and accelerating cash flows [Gelsomino et al. 2016; Wuttke et al. 2016]. SCF definitions focus on rationalization through solutions implemented by financial institutions or technology with the ultimate goal of aligning financial flows with products and information flows in the supply chain (SC) [Hofmann 2003; Camerinelli 2009; Lamoureux and Evans 2011; Wuttke et al 2013]. The main areas of SCF are order cycle management, working capital management and fixed asset financing [Gomm 2010]. On the other hand, as suggest Jan H. Jansen [2016] SCF is a paradigm shift about collaboration in the SC, creating value by having better working capital management and more tight cooperation of departments or even shift in a business culture especially for small and medium-sized companies. According to the Scopus base, currently (25.05.2020) there are 1726 scientific publications in which the term SCF appears. Most of the publications are written in China (South China University of Technology), then in the United States (Michigan State University) and Great Britain (University of York).

Financial Supply Chain Management (FSCM) is based on logistic tasks linked to procurement, production as well as distribution/marketing, functionally coordinated with financial, investment and accounting tasks of the company [Pfohl 2006]. The concept is geared to shaping the risk and profit of companies, which is measured by the value for shareholders [Gomm 2010]. SCF encompasses a wide range of providers-including platforms, marketplaces, logistics companies, insurers, international development entities, private investors, and investment funds [Hawser 2020]. According to the PwC [2018] report "SCF Barometer", the most popular SCF solution in most industries and regions of the world is currently reverse factoring. The following in terms of popularity are respectively dynamic discounting, asset-based lending, and inventory finance [Hawser 2020]. SCF, popular so far mainly among large companies, is starting to be applied also in small enterprises, which may result from use of technological solutions such as blockchain improving the transparency and thus the credibility.

## **PRESENT-DAY CHALLENGES OF SUPPLY CHAIN AND SCF**

In recent years, both business and scientists' communities have been paying particular attention to the issues of ecology and sustainability. In line with this trend, keywords related to the supply chain most frequently undertaken by scientists are sustainable supply chain (own research based on Scopus for publications from 2015-2019). The relation between finance and sustainability in SC may take the form of assisting contractors in the process of implementing sustainable chain solutions that the chain leader wants to apply in own company and contractors. The challenge supply chains are facing is how to increase the efficiency of this relation [Rezende de Carvalho Ferreira et al. 2016].

The first scientific studies on SSCF (Sustainable Supply Chain Finances) have already appeared, although there is a need to analyze the methods of measuring the benefits and costs of applying this concept [Tseng et al 2019]. Financial flows along the supply chain

play a key role for sustainable development in this chain, yet both researchers and management do not seem to notice it, as the research shows [More and Basu, 2013; Basu and Nair, 2012]. However, the situation in this matter is changing dynamically. The first cases where SCF management methods have been applied are large retail chains, clothing manufacturers and consumer goods manufacturers. They are linked by a focus on consumers and pressure from them, which is one of the most important reasons for achieving sustainable development goals. By implementing the buyer's sustainability goals, the supplier gains direct discounts. The research by M. Tseng et al [2019] showed that SSCF improve the competitive advantage of companies and the most important aspects of improving results are boosting innovation, strategic competitive advantage, and financial attributes. An additional effect may be the improvement of long-term business relationships. Furthermore, to successfully apply SSCF, it is first necessary to improve the synchronization of financial decisions, learn about prices, costs and focus on product and service quality. New tools are emerging to support companies in this process [Transaction Banking 2020].

Another issue linking finances with the implementation of sustainable development objectives is so-called impact investing, i.e. investing financial resources, to create social and environmental changes (together with financial benefits) [Rezende de Carvalho Ferreira et al. 2016]. A noteworthy solution of the SSCF are green bonds, which can be issued by both the state and private sector entities. The idea is to finance a predefined target related to ecology and sustainability with emission funds [Al-Mheiri, Nobanee, 2020]. In the supply chain, this could be, for example, an investment in a closed loop, renewable energy sources or the elimination of certain materials or substances from the production process.

Another megatrend at SCM is progressing rapid digitization. The use of information systems in an integrated SC reduces its complexity and therefore the cost level. Businesses are therefore increasingly transferring their activities and processes, including the SCM process to a virtual

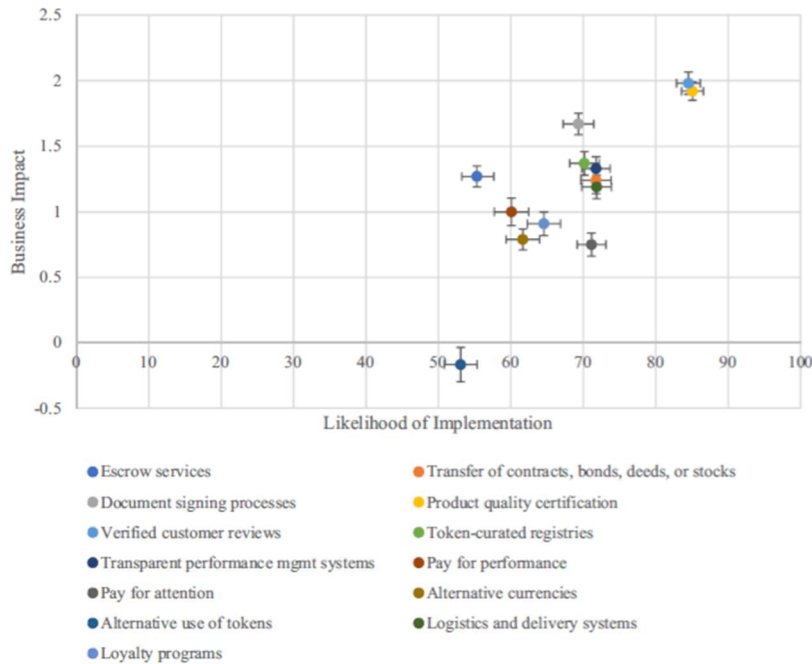
environment, which contributes to the so-called Smart Supply Chains. Their core idea is building interconnected systems integrating technologies used by all partners in the supply chain, such as IoT, Big Data, Cloud Computing, 3D printing, big data analytics [Nowicka 2018]. The latest technology, including blockchain, is also used to optimize supply chain financing.

Blockchain is a decentralized and dispersed database in the open source model and a peer-to-peer (P2P) network, with no central computers and no centralized data storage. It is used, among others, to book transactions encoded in the form of cryptographic algorithms [Nakamoto 2009]. It enables secure exchange of monetary value and information leading to new cooperation between the SC entities [Chen, Cai, He, Chen, Zhao, Zou, Guo 2020] along the entire supply chain in both its physical (buyer-supplier or supplier-customer) and support (carrier-supplier or financial institution-buyer) tiers [Carter, Rogers, and Choi 2015]. Blockchain-based applications can also replace nonvalue adding intermediaries (e.g., call centers, e-commerce platforms). C. Durach et al. [2020] demonstrated in their research that there is a variety of implementation areas for blockchain in SC in terms of implementation probability and business impact. The results of their research are presented in Figure 1.

Inefficiencies in the processing of internal and external financial settlements in the supply chain are, in addition to low awareness, a major obstacle to the implementation of SCF. Despite the progressive computerization of processes in supply chains, the processing of financial transactions in most corporations remains in the traditional paper form [More and Bass 2013], leading to delays in payments, higher DSO (Days Sales Outstanding) and, as a result, increased demand for working capital. For many companies operating on minimum margins, even small delays can have a serious impact on their liquidity. Moreover, the flow of goods along SC is often not transparent enough. The development of blockchain technology can respond to these challenges [More and Bass 2013] by providing tamper-proof history of production, handling, maintenance, as well as digital ownership and

packaging information, leading to increased transparency in the chain and intensified integration [Ghode et al. 2020]. In traditional business-to-business flows there is a high risk of falsification or distortion of e.g.

information, documents, or cash. On the contrary, blockchain guarantees fairness and allows for secure authentication of logistics and spread of information in the network.



Source: Durach et. al, 2020

Fig. 1. Best blockchain application areas in SC transactions: Means of expected likelihood of implementation and impact on business



Source: Chen, Cai, He, Chen, Zhao, Zou, Guo 2020

Fig. 2. Role coordination in a blockchain-based platform for supply chain financing (BCautoSCF)

Research of J. Kim and S. Shin [2019] has shown that the characteristics of blockchain technology (information transparency, information invariability and smart contracts) have a significant positive impact on the development of partnerships in supply chain, which translates into company performance. First examples of implementation show that blockchain in SCF is a great opportunity for small and micro enterprises with a short credit history. Blockchain-based supply chain management platform for the Chinese market was launched in 2019 by DBS Bank to fill the gap in financing for logistics providers by increasing their creditworthiness. Using blockchain technology, it takes a few seconds to verify supplier transactions and 24 hours to receive financing [Hawser 2020].

The SCF concept was initially rapidly spreading in business, as the topic of scientific analysis it gained popularity later. It seems that the same is true for the combination of SCF with the trends discussed in this paper. The use of blockchain in SC is a new but fast-growing research area. According to Scopus (as of 22.07.2020), there are 915 publications with phrases: supply chain and blockchain, but:

- 70 for combination: supply chain + finances + blockchain
- 74: sustainable + supply chain + blockchain
- and only 3 with combination: sustainable + supply chain + blockchain + finance.

The most modern supply chains currently using SCF are characterized by the simultaneous application of modern technologies such as APIs and blockchain, the implementation of philosophy of greening supply chain and the consideration of the interests, including financial, of end-chain small companies. This is evidenced by the results of the Annual Awards for World's Best Supply Chain Finance Providers 2020 published by Global Finance [Hawser 2020]. Technology solutions such as distributed ledger technologies and application programming interfaces (APIs) increase the ability of banks to reach small entities at the end of the chain, usually ignored by commercial trade finance banks. Banks such as Paribas' GNP effectively compete among SCF

solutions providers offering sustainable finance solutions.

## **SUSTAINABLE SUPPLY CHAIN FINANCE AND BLOCKCHAIN TECHNOLOGY - THE WALMART CASE STUDY**

The company famous for optimizing the supply chain through innovation is the American supermarket chain Walmart Inc. founded in 1962 by S. Walton [www.walmart.com]. In 2019, Walmart began working on the application of blockchain technology to SCM. In the same year, he also started a sustainable supply chain finance project [Dimitrov 2019]. Being one of the world's largest retailers, Walmart owes its success to effective and efficient supply chain management. The store chain has been a precursor of partnerships with suppliers, treating them more like partners than competitors. As one of the first companies, over 10 years ago, it implemented RFID to track pallets with goods in every link of the supply chain. This venture has become a benchmark for other retail chains. Walmart contributed to the roll-out of the Electronic Scoreboard (RetailLink), which could be used by suppliers and carriers to measure their progress towards offering the highest quality customer service.

It is also characteristic of the Walmart chain to ensure that the supply chain is sustainable, which was manifested in the systematic implementation since 2005 a set of practices leading to greening supply chain, as shown in Table 1. These objectives are mostly still being pursued by Walmart, although some have been slightly modified or their role has increased.

Walmart's Sustainability Index Program (currently THESIS - The Sustainability Insight System) is a global database of product sustainability, created in cooperation with a scientific consortium. Ultimately, all products available for sale at Walmart [Quinn 2009] are to be included. Index collects and analyzes in one place information from various stages of product movement from sourcing

materials to after-sales service. It helps to identify social and environmental hotspots - places in the chain that require action, and then presents potential solutions to diagnosed problems by category. Detailed ratings as well

as the ranking position in various categories are visible to suppliers. All this encourages commitment to continuous improvement of products to make them more sustainable [Walmart Inc. 2018].

Table 1. Walmart's 8 practices for sustainable supply chain

Practice	Short description	Financial aspect
Identifying goals, metrics, and new technologies	Sustainability of all core suppliers and providers of all private-label products were evaluated by Walmart's assessment called "15 questions" Initiating the creation of the Sustainability Consortium - a collective of manufacturers, retailers, NGOs, and universities	With better information company can rationalize its supply chain and reduce costs. Scorecard is including also financial performance
Certifying environmentally sustainable products	Certifying products by outside organization results in verification of environmental performance, increased transparency, and better visibility of the entire chain	Growing trust in supply chain has positive impact on finances
Providing network partner assistance to suppliers	Consulting, trainings, and assistance for suppliers to achieve desired results	Win-win: short payback period, significantly lower costs for suppliers, achieving goals for Walmart
Committing to larger volumes of environmentally sustainable products	Making long-term quantity commitments to drive suppliers toward more sustainable practices	Building partnership and motivating sustainable investments keeping low cost
Cutting out the middleman	Buying directly there, where Walmart is selling raw product (e.g. apples but not cotton)	Buying directly from farmers increases both their and Walmart's income
Restructuring the buyer role	Facilitating more effective supplier relationship management by team-based approach that allows individuals to specialize in one narrow area and staff rotation (between roles)	Higher efficiency of purchasing process
Consolidating direct suppliers	Shifting power within the relationship from Walmart to the supplier may encourage him to invest in sustainability	Long-run profitability for the supply chain as a whole
Licensing environmental innovations	Proactive role of Walmart in promoting the spread of good ideas e.g. bringing best suppliers together in non-competitive working groups	Through licensing, suppliers can generate additional revenue streams and realize a quicker payback on their investments

Source: own work [Plambeck and Denend 2011]

A leading example of the SSCF is the network's partnership with the UK bank HSBC in China to promote greater sustainability in the SC by linking the funding rate to supplier sustainability references compared to the Walmart Sustainability Index [Hawser 2020]. The joint work resulted in the development of the WSIP/THESIS index and Project Gigaton [www.business.hsbc.com]. The supply chain financing program aims to promote sustainability by adjusting financial rates between supplier and enterprise. Under the program, suppliers who take sustainability initiatives and demonstrate progress in achieving their targets will have access to preferential funding rates from HSBC. Financial support can take a variety of forms, from standard green loans to innovative projects that fund suppliers to develop tools to reduce the negative environmental impact of their activities. Walmart's second initiative is the Project Gigaton launched in 2017 to reduce one billion tons of greenhouse gases by 2030.

To achieve this goal, working with suppliers is crucial, as the entire life cycle of a product is analyzed to assess its environmental impact. All suppliers are invited to cooperate regardless of the products they offer or their current level of pro-sustainable activity, and their targets are set individually. To meet the program goal, Walmart also makes its own investments in renewable energy, including solar power generation in California and the purchase of wind power for stores in Texas [Quinn 2009].

According to N. Blyth, Global Head of Trade and Receivables Finance in HSBC [www.business.hsbc.com]: "Embedding sustainability in global supply chains is not only beneficial for the environment and society, but also for companies' bottom lines. As the world's leading international bank, HSBC is actively building new partnerships and frameworks to help deliver a more sustainable future for all." Walmart's

management board is of a similar opinion, believing that focusing on sustainability throughout the supply chain stimulates innovation and generates added value for the company. Investing in sustainability can not only lead to higher productivity and cost reductions for suppliers, but also stimulate the development of employee creativity and high-tech activities [www.walmartsustainabilityhub.com].

Described above path of development chosen by the company's management has led to the implementation of another technological novelty - blockchain in the supply chain, despite this technology is currently unavailable for most companies and constitutes a huge challenge in logistics.

According to the VeChain platform, VET [www.vechain.org] Walmart China in June 2019 began work on a project to supervise the transport and food supply process throughout the supply chain via blockchain. For this purpose, the Walmart China Blockchain Traceability Platform [www.cointelegraph.com] was established, managed as a joint venture by Walmart China, VeChain, PricewaterhouseCoopers (PwC), cattle company Inner Mongolia Kerchin, and the China Chain-Store & Franchise Association. Initially, the blockchain-controlled supply chain is going to cover 23 product lines, then another 100 products from various categories will be included.

K. Feng, Chief Operating Officer of VeChain reported [www.prnewswire.com]: "It is expected that the Walmart China's traceability system will see traceable fresh meat account for 50% of the total sales of packaged fresh meat, traceable vegetables will account for 40% of the total sales of packaged vegetables, traceable seafood will account for 12.5% of the total sales of seafood by the end of 2020." Such an approach is evidence of gradual development of the project and testing the functioning of the supply chain based on new technology, which allows for constant correction of errors and deviations from the intended purpose.

The first work on the decentralized database was started in 2016 with IBM, which resulted

in the creation of Distributed Ledger Technology (DLT), now to be synchronized with blockchain. DLT is a distributed database with registers replicated and shared between distributed geographical units. Since then, Walmart has been involved in several DLT-related patents, including the identification of the product withdrawn from the market, the tracking of meat products, the surveillance of supply drones, and the patenting of intelligent supply in the United States [www.cointelegraph.com].

Currently blockchain is also used by Walmart Canada. According to the company, all external freight forwarders are already using the platform, which has contributed to the security of supply chain operations. Walmart Canada has established a partnership with DLT Labs, resulting in a project called DL Asset Track. This is a new system that uses blockchain to track delivery, verify transactions, and automate payment and reconciliation between the company and suppliers to more than 400 stores in Canada. According to DLT Labs, the system has the advantage of being simple and intuitive to use, requiring only a web portal or mobile application. The project aims to increase the company's distribution efficiency by managing, integrating, and synchronizing all supply chain and logistics data in real time, linking data between Walmart Canada, shipping companies and suppliers.

According to J. Bayliss, Senior Vice President of Logistics and Supply Chain at the company [www.risnews.com]: "carrier partners move over 500,000 loads of inventory nationally, which creates an extraordinary volume of transaction data. This new dynamic and interactive blockchain technology platform is creating complete transparency between Walmart Canada and all of our carrier partners. Blockchain is enabling a material advance in our smart transportation network, with expedited payments, extensive cost savings and other benefits among our supply chain. Moreover, this degree of improved efficiency represents a powerful platform for us to continue to reduce our environmental footprint and continue our leadership in environmental sustainability." The use of blockchain technology will contribute to increase

efficiency of the supply chain, which will result in cost reductions.

To verify that statement, we analyzed financial indicators from last 5 years, when the changes described above were carried out (Table 2.). Total revenues and total assets have been growing gradually since 2016, which may indicate the growing business activity. However, profitability (Net Margin, EBITDA, ROE, ROA) and liquidity (Quick ratio, Current ratio) have only been increasing since 2019

when the work on the implementation of blockchain technology began and the commitment to supply chain finance sustainability increased (project plans were already in place since 2016). Data from last 2 quarters of 2020 show continuation of growing trend. However, data from the next 5 years after implementation will be needed to clearly identify the impact of discussed changes on financial results.

Table 2. Walmart's financial measures

	2020	2019	2018	2017	2016
<b>1</b> Total revenues*	523.964	514.405	500.343	485.873	482.13
<b>2</b> Operating income*	20.57	21.96	20.44	22.76	24.11
<b>3</b> Total assets*	236.50	219.295	204.522	198.825	199.581
<b>4</b> Net Profit Margin	3.05%	1.30%	1.97%	2.81%	3.05%
<b>5</b> EBITDA*	31.56	32.64	30.97	32.84	33.56
<b>6</b> Return on Asset	6.29%	3.11%	4.84%	6.80%	7.31%
<b>7</b> Return on Equity	19.08%	8.57%	12.53%	17.17%	17.90%
<b>8</b> Current ratio	0.79	0.80	0.76	0.86	0.93
<b>9</b> Quick ratio	0.22	0.23	0.20	0.22	0.24

Source: own work based on data from: <https://www.macrotrends.net/stocks/stock-comparison> [access 15.10.2020]

## DISCUSSION

The SCF is now entering a new phase from a poorly researched innovation to a complete, mature, and increasingly widespread concept in SCM. Not only large industry leaders (although those still dominate, according to PwC research), but more and more small suppliers, even without a credit history, participate in SCF programs [Hawser 2018]. These changes force the search for innovative solutions within the SCF, and these focus primarily on technological innovations and the consideration of the sustainable aspect. As the future of SSCF, the blockchain technology is indicated, which will facilitate the configuration of mechanisms dedicated to the SSCF, open the way for more effective, sustainable and secure supply chain financing solutions and, consequently, contribute to their diffusion [Al-Mheiri, Nobanee, 2020].

The literature review shows that there are many articles on SCF and FSCM, while there are far fewer scientific publications on

comprehensive supply chain finance management in the face of new logistics challenges, including technological innovation and environmental protection. However, as in the times of the financial crisis of a decade ago, there is a strong interest in this issue of business environment, as evidenced by the growing number of entities offering such services.

After analyzing Walmart's case study, it appears that implementing blockchain technology in the supply chain and sustainability are complementary activities. From Figure 1 we see that areas of blockchain implementation in the Walmart network such as verification of supplier information and SCF support are areas that generate big business impact. It can therefore be assumed that they bring measurable benefits to the company that exceed costs. The authors have defined such costs and the potential benefits, dividing them into the short and long term effects (Table 3.).



Table 3. Achieved and potential benefits and costs of implementing blockchain technology and SSCF in Walmart's SC

Short-term benefits (already achieved)	Strategic benefits (achieved over 5 years after blockchain implementation)	Main costs and obstacles
Increase trust & transparency to Walmart's end consumer	Minimize fraudulent products that either harm consumers and/or result in PR damage	Transparency is not always desirable – requires partner relations which is not always the most effective (according to transactional cost theory)
Direct insight into inventory and supply chain inefficiencies. Digitize essential certificates and documents to optimize information management, certify provenance, and ensure authenticity	Reducing negative environmental impact by: - reduction of unnecessary transport - ability to prove product is safe during a foodborne outbreak - the cost of human health and life	Time and resources used after incorporating blockchain into existing system for employees training program and implementation plan
fast identification of potential problems in the supply chain related to the circulation of information, goods and finance that can be quickly resolved	Build a more sustainable food system by detecting food fraud, increase safety, reduce spoilage & waste with analytics	Cost of implementation of new systems: reconstruction of the company's infrastructure and business processes can disrupt the operation of the entire enterprise or take human resources from other projects within the organization
automation of financial operations maintaining an appropriate level of transaction verification, secure management of distributed databases	Increased monetization from specific segments by validated organic beef vs. non-organic OR wild vs. farmed salmon	Some suppliers may not be able to adapt to a blockchain-based environment due to some shortages
Increase in revenue, decrease in costs: 89%, Enhancing traceability 81%, 79% Enhancing transparency (Source: report Insolar)	Create a global view of the provenance across Walmart's supply chain	
Gain halo effect from new tech potential	Prepare roadmap for future solutions	
Improve shelf-life management and waste of expired products	achieving added value through a combination of blockchain and SSCF resulting from preferential financing rates for green activities	
	increased transparency in the chain and intensified integration between suppliers as well as banks and financial institutions leading to higher performance of all chain due to motivated suppliers	

Source: Own elaboration based on <https://academy.binance.com/pl/articles/blockchain-use-cases-supply-chain> [access 15.10.2020].

The effectiveness of including sustainability and blockchain implementation into the SCF and the achievement of long-term goals, with regard to financing, may be a subject of the future research. Increasing the SC efficiency, together with the security of operations, can contribute to the reduction of activities that do not generate value for the company, thus minimizing the negative impact of its activities on the environment. The existence of an interface between supply chain finances, blockchain technology and concept of sustainable supply chain may be further investigated.

## SUMMARY

The systematization of knowledge in the field of supply chain finance allowed to critically assess information in this area and to identify the most important theories and aspects related to finance in logistics. As a result, it was possible to analyze case study

of Walmart and establishing cooperation with the British bank HSBC.

There is a considerable amount of English-language literature on sustainable supply chain finance, associated with the trend of "green logistics", but there was a lack of analysis and methods for measuring the benefits and costs of this concept.

On this basis, the following recommendations for enterprises were formulated regarding the current financial management of the supply chain:

1. Blockchain can be used to effectively shape sustainable supply chains. This technology enables, above all, the safe implementation of logistics processes by excluding disruptions in the flow of information throughout the supply chain.
2. Blockchain is an opportunity especially for complex chains with large disproportions in the bargaining power of entities where suppliers are small and micro businesses.

3. The future of the SCF may be the use of methods such as equity crowdfunding and venture capital in investments related to ecology and sustainability, e.g. the so-called impact investing.
4. Financial operations in global supply chains will force an increase in the SC transparency and fastening the process of chain integration, as well as support by specialized banking institutions.

Therefore, future research for SCF and sustainable finance should undertake methods of assessing supply chain financing measurement, and related indicators should be dynamically adjusted, quantified and calculated based on the development of different regions and different industries and related policies.

## ACKNOWLEDGMENTS AND FUNDING SOURCE DECLARATION

Institute of International Business and Economics statutory fund.

## REFERENCES

- Al-Mheiri W., Nobanee H., 2020. Green Bonds: A Mini-Review, *SSRN Electronic Journal*, February  
<http://doi.org/10.2139/ssrn.3538790>.
- Camerinelli E., 2009. Supply chain finance, *J. Payments Strategy & Syst*, 3 (2), 114–128.
- Carter C.R., Rogers D.S., Choi T.Y., 2015. Toward the Theory of the Supply Chain. *Journal of Supply Chain Management* 51(2):89–97,  
<http://doi.org/10.1108/09600030810882816>
- Chen J., Cai T., He W., Chen L., Zhao G., Zou W., Guo L., 2020. A Blockchain-Driven Supply Chain Finance Application for Auto Retail Industry. *Entropy*, 22(1), 95,  
<http://doi.org/10.3390/e22010095>.
- Dimitrov, B., 2019. How Walmart And Others Are Riding a Blockchain Wave to Supply Chain Paradise, *Forbes*, [www.forbes.com](http://www.forbes.com), dostę: 24.05.2020.
- Durach C., Blesik T., Düring M., Bick M., 2020. Blockchain Applications in Supply Chain Transactions. *Journal of Business Logistics*, 1–18,  
<http://doi.org/10.1111/jbl.12238>.
- Frohlich M.T., Westbrook R., 2001. Arcs of integration: An international study of supply chain strategies, *Journal of Operations Management*, 19, 2, 185-200,  
[http://doi.org/10.1016/S0272-6963\(00\)00055-3](http://doi.org/10.1016/S0272-6963(00)00055-3).
- Gelsomino L.M., Mangiaracina R., Perego A., Tumino A., 2016. Supply chain finance: a literature review, *International Journal of Physical Distribution & Logistics Management*, 46, 4, 348-366.
- Ghose D., Yadav V., Jain R., Soni G., 2020. Adoption of blockchain in supply chain: an analysis of influencing factors. *Journal of Enterprise Information Management*,  
<http://doi.org/10.1108/JEIM-07-2019-0186>.
- Gomm M. L., 2010. Supply chain finance: applying finance theory to supply chain management to enhance finance in supply chains, *International Journal of Logistics: Research and Applications*, 13(2), 133-142,  
<http://doi.org/10.1080/13675560903555167>
- Hawser A., 2020. New Leaders of Supply Chain Finance. *Global Finance*, 34, 2, 34-36.
- Hofmann E., 2003. The flow of financial resources in the supply chain: creating shareholder value through collaborative cash management, In: ELA, ed. Eight ELA doctorate workshop. Brussels: ELA.
- Hofmann E., Sertori Y., 2020. Financial Spillover Effects in Supply Chains: Do Customers and Suppliers Really Benefit? *Logistics* 2020, 4(1), 6,  
<http://doi.org/10.3390/logistics4010006>.
- Jansen J. H., 2016. Supply Chain Finance "Is SCF ready to be applied in SMEs?", *Vestnik*, December 2016.
- Kim J.-S., Shin N., 2019. The Impact of Blockchain Technology Application on Supply Chain Partnership and Performance, *Sustainability*, 11(21), 6181,  
<http://doi.org/10.3390/su11216181>.

- Kouhizadeh M., Saberi S., Sarkis J., 2020. Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers, *International Journal of Production Economics*, 231, 107831, <http://doi.org/10.1016/j.ijpe.2020.107831>.
- Lamoureux J., Evans T.A., 2011. Supply Chain Finance: A New Means to Support the Competitiveness and Resilience of Global Value Chains, Available at SSRN 2179944, <http://doi.org/10.2139/ssrn.2179944>.
- Lee H. L., So K.C., Tang C.S., 2000. Value of information sharing in a two-level supply chain, *Management Science*, 46, 5, 626-643, <http://doi.org/10.1287/mnsc.46.5.626.12047>
- Li S., Chen X., 2019. The role of supply chain finance in third-party logistics industry: a case study from China, *International Journal of Logistics Research and Applications*, 22(2), 154-171, <http://doi.org/10.1080/13675567.2018.1502745>.
- More D., Basu P., 2013. Challenges of Supply Chain Finance: A Detailed Study and a Hierarchical Model Based on the Experiences of an Indian Firm, *Business Process Management Journal*, 19, 624-647, <http://doi.org/10.1108/BPMJ-09-2012-0093>.
- Nakamoto S., 2009. A peer-to-peer electronic cash system. Bitcoin. URL: <https://bitcoin.org/bitcoin>.
- Nowicka K., 2018. Supply Chain Management in era of Smart Industry. *Gospodarka Materiałowa i Logistyka*, 3, 6-8.
- Transaction Banking, 2020. How to drive sustainability with supply chain financing. Open Insights by Nordea, <https://insights.nordea.com/en/sustainable-finance/how-to-drive-sustainability-with-supply-chain-financing/> [15.04.2020].
- Pfaff D., Skiera B., Weiss J., 2004. Financial supply chain management. Bonn: Galileo Press.
- Pfohl H. Ch., 2006. Finansowe aspekty łańcucha dostaw: zorientowanie na koszt i wartość w logistyce [Financial Supply Chain: Cost and Value Orientation in Logistics], W: T. Janiak (red.), *Najlepsze praktyki w logistyce*. Polski Kongres Logistyczny "Logistics" [Best Practices in Logistics. Polish Logistics Congress], Instytut Logistyki i Magazynowania, Poznań.
- Plambeck E. L., Denend L., 2011. The greening of Walmart's supply chain—revisited, *Supply chain management review*, 15(5).
- Quinn, B., 2009. Walmart's Sustainable Supply Chain. *Green Connection*. September, p. 24.
- Rezende de Carvalho Ferreira C.M., Amorim Sobreiro V., Kimura H., Luiz de Moraes Barboza F., 2016. A systematic review of literature about finance and sustainability, *Journal of Sustainable Finance & Investment*, 6(2), 112-147, <http://doi.org/10.1080/20430795.2016.1177438>.
- Tseng M.-L., Lim M. K., Wu K.-J., 2019. Improving the benefits and costs on sustainable supply chain finance under uncertainty. *International Journal of Production Economics*, 218, 308–321, <http://doi.org/10.1016/j.ijpe.2019.06.017>.
- Wandfluh M., Hofmann E., Schoensleben P., 2016. Financing buyer–supplier dyads: an empirical analysis on financial collaboration in the supply chain. *International Journal of Logistics Research and Applications*, 19(3), 200-217, <http://doi.org/10.1080/13675567.2015.1065803>.
- Wuttke D.A., Blome C., Foerstl K., Henke M., 2013. Managing the Innovation Adoption of Supply Chain Finance—Empirical Evidence From six European Case Studies, *Journal of Business Logistics* 34 (2), 148–166, <http://doi.org/10.1111/jbl.12016>.
- Wuttke D.A., Blome C., Heese H.S., Protopappa-Sieke M., 2016. Supply chain finance: Optimal introduction and adoption decisions. *International Journal of Production Economics*, 178, 72-81, <http://doi.org/10.1016/j.ijpe.2016.05.003>.
- Website: Walmart Inc., [www.walmart.com](http://www.walmart.com), access: 24.05.2020.
- Website: VeChain VET, [www.vechain.org](http://www.vechain.org), access: 24.05.2020.

Website: [www.cointelegraph.com](http://www.cointelegraph.com), access: 24.05.2020.

Website: [www.business.hsbc.com](http://www.business.hsbc.com), access: 24.05.2020.

Website: [www.prnewswire.com](http://www.prnewswire.com), access: 24.05.2020.

Website: [www.walmartsustainabilityhub.com](http://www.walmartsustainabilityhub.com), access: 6.07.2020.

Website: [www.risnews.com](http://www.risnews.com), access: 24.05.2020.

Website: [www.macrotrends.net/stocks/stock-comparison](http://www.macrotrends.net/stocks/stock-comparison), access 15.10.2020

## FINANSOWANIE ŁACUCHA DOSTAW ORAZ WYZWANIA WSPÓŁCZESNYCH ŁAŃCUCHÓW DOSTAW

**STRESZCZENIE. Wstęp:** W ocenie autorek istnieje potrzeba zwrócenia uwagi oraz uporządkowania wiedzy w zakresie współlistnienia zarządzania finansami łańcucha dostaw z nowoczesnymi rozwiązaniami, takimi jak zrównoważone finanse, czy technologia blockchain.

**Metody:** W ramach realizacji celu konieczna była krytyczna ocena obecnego dorobku literatury z zakresu SCF oraz aktualnych trendów wdrażanych w przedsiębiorstwach. Do osiągnięcia celu badawczego posłużono się studium przypadku przedsiębiorstwa Walmart, które pozwoli rozwinąć istniejącą teorię i dokładniej wyjaśnić kwestię osiągniętych korzyści z wykorzystania technologii blockchain i zrównoważonych finansów do zarządzania łańcuchem dostaw. Posłużenie się studium przypadku jest uzasadnione ze względu na niewielki stan wiedzy w danym obszarze badań, a wybrana firma jest w tym aspekcie prekursorem. Procedura badawcza składała się z: gromadzenia danych, analizy danych, sformułowania uogólnień, konfrontacji z literaturą, opracowania uogólnień i zamknięcia badania.

**Cel:** Celem poznawczym artykułu jest usystematyzowanie wiedzy z zakresu Supply Chain Finance (SCF) w kontekście wiodących współczesnych trendów i wyzwań Supply Chain Management (SCM). Celem empirycznym jest analiza potencjalnych korzyści dla przedsiębiorstw z zarządzania zrównoważonym rozwojem finansów łańcucha dostaw.

**Wnioski:** Po pierwsze, możliwe było opracowanie zespołu korzyści służących do zarządzania finansami łańcucha dostaw. Zbiór ten wyróżniono na podstawie zróżnicowanej literatury i nie ma on charakteru zamkniętego. Po drugie, wdrożenie technologii blockchain w łańcuchu dostaw i dążenie do jego zrównoważenia mogą być działaniami komplementarnymi. Podsumowując przeprowadzone rozważania, autorki formułują rekomendacje dla innych przedsiębiorstw i wskazują na kierunek dalszych badań.

**Słowa kluczowe:** finanse łańcucha dostaw, blockchain, zrównoważony łańcuch dostaw

---

Monika Bal ORCID ID: <https://orcid.org/0000-0003-3997-5377>

The Poznań University of Economics and Business  
Institute of International Business and Economics  
Department of Logistics  
Al. Niepodległości 10, 61-875 Poznań, **Poland**  
e-mail: [Monika.Bal@ue.poznan.pl](mailto:Monika.Bal@ue.poznan.pl)

Kinga Pawlicka ORCID ID: <https://orcid.org/0000-0002-8634-5282>

The Poznań University of Economics and Business  
Institute of International Business and Economics  
Department of Logistics  
Al. Niepodległości 10, 61-875 Poznań, **Poland**  
e-mail: [kinga.pawlicka@ue.poznan.pl](mailto:kinga.pawlicka@ue.poznan.pl)