

Digitalization of Supply Chain Management (Based on the Sports Industry Company Signa Sports United)

The war in Ukraine has led to a change in the supply chains around the world. In the realities of turbulent environment, managing supply chains became an essential requirement. In addition, under the influence of COVID-19, new realities of management were formed, increasing the need for the businesses to integrate digital technologies in order to withstand the turbulence. Those companies which timely shifted their management strategies will be able to experience more advantages in the future. However, digitalizing the supply chains remains a challenging issue, the resolution to which the authors are attempting to provide in this article.

The main purpose of the research is to investigate opportunities and challenges of the supply chain digitalization based on the Signa Sports United case, the European e-commerce leader in the sports industry. The article examines the main international expansion strategies in order to determine the safest option for the company to implement its business activities in other countries within the current conditions; the methods of establishing resilient and agile supply chains. The article also examines digitalization in the context of supply chain management through analysis of such processes as automation, integration of the Internet of Things, machine learning, predictive maintenance, blockchain, etc.

As a result, it was found that the topic of supply chain management coincides with the company's issue, as long as the latter experienced long-term supply chain disruptions. The company's case helped to disclose the topic in greater depth based on a concrete example. The analysis of the existing strategies in Signa Sports United in combination with the research results act as a basis for development propositions. The article also discloses methods of increasing sustainability in business operations, as long as the impact on the environment is closely related to the supply chain, and its components are the main contributors to global climate change.

Keywords: supply chain management, global turbulence, digital technologies, globalization, regionalization, sustainability

DOI 10.37659/2663-5070-2023-10-64-80

Introduction

Supply chain management (SCM) is an integral part of every business that encompasses all stages of streamlined production flow. It includes planning, sourcing, manufacturing, delivering, and returning. Without efficient and resilient supply chain, a business would not be able to manufacture a product and provide it to the end customer. There can be numerous stakeholders involved in this network, especially in a complex supply chain with multiple layers of suppliers and third parties such as third-party logistics, strategic partnerships, software vendors, and more. Therefore, supply chain acts as a backbone of a business inside any industry which allows it to provide goods and services. Nowadays, with the rising trend for globalization, the companies aim to cross international borders and the topic is highly relevant. International expansion enables accessing new markets, increasing customer base, revenues, and gaining competitive advantage. Along with that, it requires even more structured supply chains as long as managing production flow within the border of a single country is not the same as managing it on the global scale. This requires smooth communication and coordination of all stakeholders, so that the processes could be efficiently managed. Unfortunately, after international expansion, the companies are prone to global challenges to a higher extent and must consider the associated risks. The extent of global turbulence is hard to predict and constantly bring new challenges, elevating the level of uncertainty. Therefore, a reasonable strategy is to start from regionalization because it provides a safer expansion option.

The modern supply chains are integrated with advanced technologies due to the trend for globalization. The digital tools enable greater transparency, convenience, easier coordination, and cost-effective benefits. It can support business management with extra convenience and positively impact resilience of the supply chains. Although technologies solely cannot secure the business from global turbulence, they can strengthen operations and help to prepare for various uncertainties. Therefore, no modern supply chain can operate on global scale without integrating technological advancements as they are important contributors to effective international trade.

The company which became the subject of the article is the LLC "Signa Sports United" — a global e-commerce platform and European leader across sport industry. It owns more than 100 online stores and delivers the production worldwide due to strong supply chains and stakeholders across all continents. The company established its warehouses across mainland Europe and the U.S., exploits third parties in logistics and warehousing, and partners with global shipping services such as DHL and UPS. Along with that, Signa Sports United forms strategic partnerships with leading tech companies specialized in artificial intelligence (AI) and 3D modeling solutions.

Since 2020, Signa Sports United was pressured by global turbulence which reflected on the supply chain management. Even with a strong market position the company was not resilient enough to global challenges and was hardly hit by its operations. The company resulted with negative financial statements and poor business performance and is still on the stage of recovery. Signa Sports United case is extremely relevant as it can bring insights to the international trade on a concrete example.

The purpose of the article is to demonstrate the value of resilient supply chains in international trade during the global turbulence, examine the recent trends, elaborate on the most effective expansion strategy, and explain the role of digitalization within it. As the business aims to expand, there are factors necessary to consider in order to establish efficient operations that can withstand the international scale.

Literature review

In 1982, the term "supply chain management" was developed by Keith Oliver, a British logistician, and a consultant. Even though he formulated and brought attention to the term, supply chain management took shape much earlier along with the concept of assembly lines. Before 1900, the supply chains were mainly local as transportation distances were restricted to regions. Between 1900 to 1950, the supply chains began to evolve to global levels due to greater mechanization. In 1907, UPS — a multinational logistic provider was established.

Since 1950, the third industrial revolution led to the development of logistics due to techno-

logical advancements and partial automation of the production processes. The businesses could shift their operations from mechanization to digital electronics, increase communication and exploit new models of transportation. In 1969, DHL was established and revolutionized the concept of logistics. And, since 1980, the integration of supply chain management rapidly increased across industries worldwide.

The authorss and researchers such as T. Yildiz (2023) [1]. and Theodore P. Stank et al. (2015) [2]. provided great historic overview of the topic "Supply chain management" in terms of fundamental theoretical base and practical aspects. The evolution of supply chain management was described in great depth and analyzed in terms of influencing factors of its change and the development through time.

The early history of the supply chains began from antique times when armies needed to transport soldiers and supplies of military equipment. Majorly, armies used maritime logistics and implemented their strategical movements with ships. Industrial revolution and development of technologies resulted in faster transportation and longer distance movements. Therefore, more businesses could sell their goods and optimize their operations. The transportation systems also underwent evolution with further development of ships, trains, trucks, and airplanes. It created accessible and efficient supply chains opened to more industries. Furthermore, containerization accelerated the number of bulk shipments and improved business production flow [1, p. 24].

Globalization significantly influenced the development of supply chain management as it allowed the businesses to source raw materials at lower costs, exploit cheaper labor, and cross international borders to satisfy the needs of the customers at global scale. Since 2000, with the growth of free trade zones (FTZ) such as European Union (EU), Southern Common Market (MERCOSUR), North American Free Trade Agreement (NAFTA), and Association of Southeast Asian Nations (ASEAN) the global trade accelerated. In combination with the rapid growth of technologies, Internet, and convenient global communication, the businesses could easily access and compete in global markets. This influenced the development of supply and manufacturing industries with relatively cheap labor, majorly in Asia [2, p.23].

Since antiquity, industrial revolutions led to the increase of advanced technologies, transportation, and globalization. These are the crucial factors that develop supply chain management.

In 2008–2010, the Great Recession brought an understanding of benefits and downturns of global supply chains and fostered businesses to re-evaluate their networks. It was a trigger for the companies to consider shifting from globalization to regionalization because of the need of greater supervision, quality and cost balance, and limited access to processes.

Since 2011, the latest industrial revolution 4.0 started and yet continues influencing supply chain management. Nowadays, researchers provide modern analysis of supply chain management, but the general tendencies have not changed. Digitalization and development of advanced technologies is still one of the crucial components integrated in supply chain management. However, debates between on globalization vs regionalization still take place. The authorss such as N. Tien (2022) [3]., O. Ganbold, and Y. Matsui (2017) [4]. reviewed the issue of global uncertainties impacting supply chains. Since 2020, the globally operating businesses are being tested with prolonged turbulent environment affecting majority of their operations including the supply chain.

Results

The topic supply chain management is enormously relevant for the companies that consider expansion strategy. A business can either choose crossing international borders within a certain region and exploit advantages of FTZs or consider large-scale globalization. This brings up a debatable question regarding a more strategical and reasonable option during constantly changing and unpredictable global conditions. In both expansion strategies, industry 4.0 is strengthening supply chain management through integration of advanced technologies. Digitalization is contributing to the increased resilience of international supply chains through automation of its main processes. Blockchain is currently the most discussed technology applied in supply chains that include a decentralized ledger accessible to all involved parties and stakeholders of the network. There are more useful technologies such as cloud computing, supply chain digital

twin, internet of things (IoT), machine learning, AI, natural language processing (NLP), predictive maintenance, and common tracing systems GPS and RFID. It is not uncommon that technologies support supply chain management because each industrial revolution fostered the development of supply chains and logistics.

Throughout the time, supply chain was often mistaken with the meaning of logistics, but it is only one component of the whole system. While logistics include physical movement of goods, the supply chain includes managing all stages of production flow. The businesses mostly tend to lower costs of logistics and warehousing what could be done through partnerships with third-party logistics (3PL). It that can save costs as it eliminates the need to purchase own transportation vehicles and establish own warehouses. The companies can rent warehouses instead and benefit from logistics expertise of the 3PL providers. The role of 3PL in modern supply chain management is huge because it saves costs and time for the business, enabling it to focus on its core competencies. Instead of transportation and maintenance expenses, the businesses can exploit international delivery services such as UPS and DHL which has its own transportation modes and partners with others to provide intermodal transportation solutions via rail, road, air, and maritime logistics. Most global supply chains include intermodal transportation with more than one transportation freight. This depends on the type of production, requested lead-time, costs, and distance.

Maritime logistics accounts to more than 90 % of global freight because it allows the greatest capacities at cheapest possible cost. Ships can transfer production in bulk capacities and types of products that cannot be delivered by any other transportation mode. Sometimes, maritime logistics are the only option for the oversized products because ships can carry tons of weight. The lead-times are predictable because maritime logistics operate within a schedule over a planned route. It appears cost effective for the businesses because ships have lower fuel cost over the longer distance. The only concern is the that the lead-times are the longest, so the businesses that have perishable goods or rely on fast deliveries would rather choose an alternative mode.

Rail is another cost-effective and predictable mode that enable transferring large quantities. The businesses which use ground transportation can transfer heavy bulk cargo by rail with shorter lead-times than ships. Most often, the production transferred through rail mode include motor vehicles, components, mineral fuels, and plastic. This mode is relatively cheap due to low consumption of fuel, and it also operates on a scheduled basis. However, the possible capacities are lower in comparison to maritime logistics and often require intermodal transportation.

Road transportation is a convenient mode as it is not connected to shipping ports, airports, and rail stations. It has the lowest prohibitions in terms of production requirements and allow transportation of flammable, perishable, cold, toxic, and hazardous goods. The business that requires short to medium distance transfers can rely on road transportation. Usually, it is one of the most traceable and secure options because once the truck is loaded it does not require intermediate unloads and will be delivered directly to the destination. A business can organize in-company transportation and purchase vehicles or delegate it to a 3PL. Although, if a business will choose to delegate logistics to a 3PL service there could be more intermediate stops. A 3PL can offer Partial Truck Loads (PTL) and Full Truck Loads (FTL). The second option will be faster and more secure, as a FTL does not require intermediate stops and additional loadings. It will provide the full capacity of the truck to a single business and deliver it to the destination point. However, the downturn of the road transportation is the highest accident rate and largest traffic restrictions in terms of crossing international borders. All in all, a vast majority of retail and e-commerce rely on road transportation as it is a convenient and flexible mode.

Air transportation is the most expensive mode with the fastest deliveries and highest number of restrictions. The businesses which have perishable goods are highly relied on air transportation mode. However, the concerns include checkpoints, special handling fees, shipping containers and maintenance. The goods must meet specific requirements of size and limited capacities, but they will be transferred under secure and protective conditions and undergo rigorous checkpoints.

Most deliveries require intermodal transportation which provide the most suitable and fast solution. In order to reduce the burden of scheduling, businesses can outsource intermodal transportation to 3PL services. Nowadays, 3PL play an important role for the businesses because it can save costs, increase scalability, and allow market expansion. A business can exploit experience and expertise of a 3PL service which has the required knowledge of international compliance, transport documentation, import and export, economic regulations, and other nuances. A 3PL provide multiple solutions in terms of distribution, transportation, and warehousing. A business can exploit warehousing capacities of a 3PL service and easily upscale production or enter new regions without a necessity to establish a warehouse.

Signa Sports United, established their own warehouses across mainland Europe and one in the U.S. in Salt Lake City, Utah. In addition to that, the company partners with Rhenus Warehouse Solutions that has one of the greatest bike capacities in Europe amounted to 215,278 square foot and has convenient distribution routes to European markets. Therefore, the businesses can combine in-company warehouses and 3PL warehousing solutions. But with a 3PL, a company can enter new regions faster and exploit warehouse capacities of its partners and then easily switch to another warehouse in case conditions changed.

Nowadays, warehouses are equipped with the Warehouse Management Systems (WMS) which helps in inventory storage through a modern software. It administrates and controls inventory movement in and out of the storage. A WMS is often connected with Enterprise Resource Planning (ERP) and Transportation Management System (TMS). In combination, the tools share data and help to optimize the stock levels. The WMS tracks how inventory is being sorted and stored inside a warehouse, while the TMS tracks inventory movement outside a warehouse, and the ERP then enables planning based on the gathered data. The automation increases the sense of security and supports the coordination of processes.

The ERP is an essential tool that supports businesses in data management through information and financial flows. The software stores information about suppliers, products, and fi-

nancial data. It enables interaction between the stakeholders regarding the production flow. It can streamline financial operations through generating invoices and inform about sent orders through interconnection with other tools. A WMS sends information to ERP when the product enters the storage and when it is sent as order. Therefore, with a combination of software systems a business can access data, check inventory levels, and order next supplies timely. The automation supports inventory management, reduces holding expenses and delivery delays.

The TMS can track complete carrier activity and inventory movement outside the warehouse. It can contain information about the transportation rates of chosen cargo freights and track the movement of the carrier. It tracks transfer of the inventory from manufacturing plants, distribution centers to the delivery to the end-customers. In addition to that, TMS can provide information to the customers, so that they can also track their parcels through the digital systems. Due to data analytics and software capabilities, a TMS can capture transportation across all modes consolidated in one platform. The software is integrated with API and EDI connections that exchange data between the involved parties. Both technologies are integrated in TMS but have different functions. While EDI exchanges data between the business stakeholders, ADI exchanges data between the software applications. As a result, the business can take multiple advantages from optimizing freight and increase customer satisfaction.

The business can integrate WMS and TMS into their supply chain themselves or exploit a software of 3PL services. Usually, a 3PL use not only WMS and TMS but integrate it with other advanced tools to drive efficiency. In this case, partnering with a 3PL becomes advantageous because transportation is their main competency. A 3PL services can help mitigate risks and supply chain disruptions through tracking relevant data and predicting disruptions before their occurrence.

Signa Sports United partners with such 3PL services as DHL and UPS which are both global leaders in logistics. Both companies have latest WMS and TMS systems which allow tracking the movement of goods throughout the entire supply chain consolidated in a single portal. However, TMS alone can become limited and

integrating it with other tools can increase visibility and enable faster response to unforeseen events. The advantage of partnering with DHL is that it uses risk mitigation platform that combines multiple technological tools such as big data, machine learning and predictive analytics to predict disruptions and simplify regulatory compliance. It offers multi layered view of the supply chain and determines the interdependencies of the network [5]. The risk mitigation platform was first named "Resilience360" and then underwent rebranding to "Everstream Analytics" becoming the next phase in risk analytics solutions. The DHL is a shareholder and one of the seven investors of Everstream Analytics. In April 2023, Everstream Analytics raised a \$50 million funding [6]. The Everstream analytics was founded in 2012 with a goal to increase agility and resilience of the supply chains. In 2023, it continues to attract attention of investors due to increased importance of supply chain tech during prolonged global turbulence. In fact, the company increased its revenues at a rate of 30% from initial investment during a three-year period.

Since 2020, the supply chain resilience became one of the main priorities for the businesses due to intense macroeconomic turbulence. Since 2020, the Covid-19 outbreaks caused massive supply chain disruptions because of lockdowns and related restrictions. In 2021, the global supply chain pressure index reached its historical mean with a standard deviation of 4.3 [10]. Further, followed the ongoing war in Ukraine and leading geopolitical and macroeconomic instability. Such prolonged uncertainty is causing many threats to the international companies and encourages business transformation. In January 2023, according to Capgemini Research Institute, supply chain disruptions are considered as the main risk for the business growth reported by 89% organizations. The other risks included rising prices of raw materials and energy crisis. So, increasing supply chain resilience became a key priority for investment within 43% organizations, while 39% companies also plan to invest in technology [7]. The EU region is planning to invest more in diversification of supply chains, while Asia-Pacific (APAC) region plans to invest more in IT.

The main strategy to mitigate the risks of the supply chain deterioration and increase business

resilience is to re-shore and near-shore operations closer to the end-customers. It includes regionalization of production bases, manufacturing plants, and warehouses. Regionalization increases control over supply chains due to shorter distances and allow business to access processes easier during various uncertainties. The business can benefit from FTZ which have low or no trading barriers, lower financial charges, quotas, and other regulations. In addition to that, expanding to a market within a region can become convenient in terms of meeting the demand. In example, if an Austrian company expands to Germany, the customers will have more in common compared to the customers in Asia. The similarities in language, culture and preferences makes it easier to understand the needs of the customer within one region. Therefore, regionalization becomes a secure expansion and re-organization strategy of SCM.

However, in case if regionalization is not an option, another strategy is to diversify operations. Diversification decreases the dependency on a single geographic region. In example, if a supplier in one region becomes inaccessible, a business can access an alternative supplier from another region. It will minimize threats of uncertainties and increase business agility. In fact, it can become the best solution for the businesses to withstand global turbulence.

Signa Sports United supplies more than 600 bike brands globally to their online stores. The bike brands include such global leaders as YAMAHA and Shimano that are manufactured in Asia. In general, the range is supplied from European, Asian, and the U.S. manufactures. In addition to that, the stores launched in-house production manufactured domestically in Germany. This could act as an example of diversification strategy as long as the company have suppliers from various regions and a controllable in-house production. However, a concern is that the customers still prefer the top category bikes of well-known brands over in-house.

In 2020, Signa Sports United reported about prolonged supply chain disruptions in full-bike and e-bike category. The Covid-19 related restrictions, border closures, and factory shutdowns influenced global supply shortages. In China, the government was ought to close the whole industries. And China is one of the major global manufacturer and supplier. In terms of

the bike segment, a bike could not be constructed without one single detail, so the companies were highly reliable on timely supplies. Signa Sports United stated that the company experiences huge delays, so the orders were put on hold.

In 2020, the demand for bikes in the market was rising and experienced so called “bike boom”. It emerged from as a trend of healthcare and wellness during the Covid-19 pandemics. In Europe, the countries created the bike lanes and fostered the bike trend. In 2020, according to Conebi, Confederation of the European Bicycle industry, the unit sales of bikes and e-bikes increased by 40% units sold [8].

The net orders in Signa Sports United represented in Figure 1 express a steady increase from 2019 to 2022. It happened due to a high demand and increased customer base. In 2021, the company closed an acquisition of European sport retailer Wiggle CRC which increased their customer base and generated revenue. The acquisition contributed to the net order’s increase because of the customer pool. Initially, the organic growth was not as strong enough, so acquisitions were very beneficial.

The bike market experienced supply shortages and an extremely high demand, so the companies began to increase the prices for their production. By 2021, almost every global bike manufacturer increased prices. BA’s Market Data Service has evaluated that the average selling bike price increased by more than 40% between 2019 and 2022 [9]. The Covid-19 and Brexit are considered to have the main influence on such price increase.

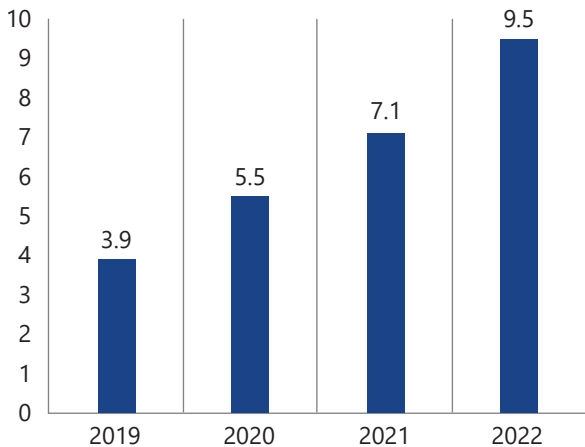


Fig. 1. Net orders in Signa Sports United (in millions)

In 2023, supply chain deterioration came to a resolution, but the bike market resulted with overstock. The manufacturers could produce bikes and businesses could receive the supplies timely. Hence, the companies finally received their supplies and could offer a great range of bikes. Now the customers can get any desired model without delays. However, the customer sentiment changed, and the demand is not meeting the level of supplies. The global turbulence influenced inflation, cost-of-living crisis, and energy crisis. In turn, rising energy costs influence high manufacturing costs, so lowering production prices is not profitable. However, the excess stock is not leaving an alternative option rather discounting activity. In 2023, the bike brands began dropping their prices and applying discounting strategy in order to reduce overstock. This becomes worldwide tendency within majority of the bike brands. The stockpiled production becomes out-of-date because the bike market launches new models each year.

In 2023, the discounts reached more than 30% across the bike brands. In example, a direct-to-consumer (D2C) brand, YT industries, offered discounts at 25%. This means that a vast majority of brands will follow a discounting strategy to stay competitive and clear out their warehouses too. Although the bike market foreseen a slowdown throughout 2023, even such bike leaders as Shimano reported that their performance resulted worser than was expected. In April 2023, Shimano reported that in Q1 of 2023, the bike sales decreased by 17% and operating income decreased by 32% in comparison to the Q1 of 2022 [11].

The comparison of financial and operational performance in Q1 FY2023 and Q1 in FY2022 of Signa Sports United is summarized in the Table 1. The indicators represent a YoY growth both in financial and operational performance. In 2023, the company reported about a deterioration in costumer sentiment due to geopolitical and economic pressures. In particular, it affected the bike segment and international geographies. However, despite current conditions, the company showed an increase in operational performance. The net orders result in 30% YoY growth because of the recent acquisitions and high marketing investments. The company increased its promotional activity to overcome industry overstock and drive more conversions.

Table 1. Q1 Consolidated financial summary and operational metrics in Signa Sports United (in millions)

	Q1 FY2022	Q1 FY2023	YoY Growth
Key Financials (in million EUR)			
Net Revenue	€194	€246	27%
Gross Profit	€71	€73	2.7%
Margin (%)	36.6%	29.6%	(698) bps
Operating Performance (in millions)			
LTM Active Customers	5.0	6.3	26%
Total Visits	55.2	62.2	13%
Net Orders	1.5	2.0	30%
Net AOV	€96.1	€103.7	8%

Source: Signa Sports United Q1 FY2023 Trading Update [12]

Along with that, the revenues and gross profit show an increase supported by the closed acquisitions and long-term megatrends. However, the margin decreased due to overstock and consequent discounting activities necessary to eliminate excess inventory. In 2023, the company assumes that the pressures will continue throughout the year and inventory contraction is expected to release capital of about €30–40 million. In 2023, Signa Sports United is concentrated on strategical realignment and supply chain consolidation. The focus lies towards their core markets in mainland Europe. Along with that, the company is opened to new acquisitions to continue expand its portfolio of brands.

In 2023, the global supply chains are returning to normal conditions overall. According to the Global Supply Chain Pressure Index (GSCPI) represented below (Figure 2), the standard deviation reached the new low since 2019 [13]. After the peak of historical mean in 2021 and war-related fluctuations in the beginning of 2022, the index represent the lowest standard deviation within the four-year period. It resembles that the global supply chain deterioration normalized and business can operate on pre-pandemic conditions. The suppliers and manufactures can ship without severe delays and continue production flow. Along with that, the price of containers also normalized. In 2020, the price reached almost \$18.000 due to container shortage crisis and now it decreased to pre-pandemic prices of \$1.000-\$1.500.

Although businesses overcame supply chain deterioration, the customer sentiment changed

significantly. The uncertain macroeconomic environment along with inflation, changes in customer behavior, and labor shortages, became the trends influencing business activity globally. It impacts swings in supply and demand. The warehouses are filled with inventory, industries suffer from oversupply and stagnant or low demand. The production is stuck in the shipping ports because the warehouses do not have enough capacity to hold the extents of supplied inventory. This brings another challenge for the supply chain management and a consideration for increasing its development.

Agility and resilience of supply chains are more important than ever before. Mainly, the businesses consider investing in automation and digital advancements in order to optimize their supply chains. Nowadays, one of the most effective technologies that can be integrated in supply chains is blockchain. The logistic companies including UPS already adopted blockchain in their operations. Initially, blockchain was associated with cryptocurrency but throughout the time technology became applicable in different business operations. Blockchain is a decentralized ledger that can be shared among all involved parties of the supply chain. It records and stores data in chronological order that has the most secure data protection currently available. The data inside the ledger cannot be altered, only new sets of data could be created. This increases trustworthiness and sureness of the information. The information that can be recorded in blockchain includes history of transactions,

production costs, parameters, certificates, insurance, inspection control and more. A distributed ledger can enable faster and easier transactions with lower fees than banks, so convenient and cost-effective transactions can happen without centralized intermediaries.

The blockchain also include smart contracts — self-executing automated programs. When parameters are determined, smart contracts launch autonomously. It is convenient due to the reduction of paperwork and order processing. The smart contracts can be used between stakeholders to determine responsibilities, costs of production, manufacturing, delivery time, payment, and invoicing terms. They are completely transparent and accessible to all involved parties.

The blockchain can be integrated with IoT and other software systems such as ERP and WMS. With blockchain, the company can track locations and movement of production. The information will be recorded in real time accessible to all stakeholders. To track inventory, the business can use RFID sensors which are a part of IoT. The devices are applicable to certain objects such as inventory or containers. The main advantages of blockchain include information security, real-time data recording, transparency, visibility, and lower expenses.

In 2017, UPS joined a Blockchain in Transportation Alliance (BiTa). The company views it as a potential to increase transparency between supply chain stakeholders such as shippers, vendors, brokers, consumers, and carriers. As a custom broker, the company also examines block-

chain technology in brokerage and digitalization of transactions [14].

Nowadays, the most effective digital tool which helps to foresee and respond to possible supply chain disruptions is the supply chain digital twin. It is a virtual replication of a certain process, object, or a system. Using a digital twin, a business can create a computer model of various components of its supply chain. It can include a transportation network, manufacturing plants, warehouses, and other assets. The digital twin creates an identical simulation compiled from the physical world. It is integrated with multiple technologies, visualization software and AI. With its support, a business can analyze various scenarios and prepare to address them. In example, it is possible to create a digital model of a transportation route and analyze it in terms of traffic, road conditions, weather, and vehicle capacity. By this means, a business can consider alternative routes and choose the most convenient one.

The supply chain control tower is another useful technology that helps control and analyze what is happening across the supply chain network. The control tower enables real-time visibility of the connected nodes of the supply chain. It can involve information about suppliers, manufacturing, inventory levels, transportation, as well as information about the consumer orders, supply, and demand. The tool involves a combination of technologies that can be used with a help of manpower. It can record information from each business department and show most updated data through dashboards. The tool can be integrated with analytical systems

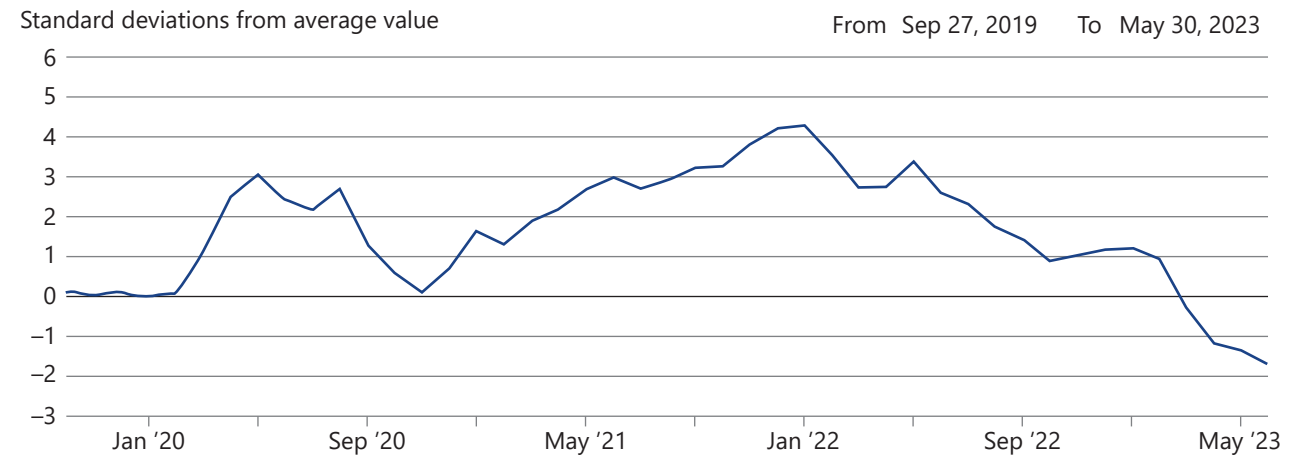


Fig. 2. Global Supply Chain Pressure Index (GSCPI)
Source: [13]

which help to determine the causes of current events and foresee future ones. The tool analytics compile what-if scenarios, based on which a business can prepare strategies to address specific situations. One of the main benefits of the tool is that it informs each of the connected department how in particular it would be affected. In example, a company has a timeline to produce a certain product and the control tower alerts that suppliers will delay the delivery of materials. Consequently, the tool will show the predicted impact on revenues and operational levels. The what-if scenario can include a strategy to source materials from alternative suppliers. It will also represent gains and losses from each scenario. Eventually, the tool will send relevant information among the involved departments. The control tower records the updated feedback about material shortages, shipment delays, inventory levels, production status, and transportation stages. It can compare supplier orders with actual deliveries, alert with potential problems and propose solutions. Therefore, a control tower enables identification of the upcoming challenges and helps to prepare for them.

In manufacturing plants, a business can integrate predictive maintenance which include machine learning and tracking sensors. It helps to determine the current state of the machinery and foresee a breakdown through detection of various faults. The technology analyzes the machine's

condition in real-time. Therefore, a business can ensure vehicles are working safely and fix them before an actual failure. The technology helps to maintain a stable production flow, saving costs and time. In case of a machinery breakdown, a business would have to stop production flow, it will become more costly and time-consuming than with the use of predictive maintenance.

Therefore, digitalization is progressing and becomes the main driver of competitiveness and innovation. Organizations can automate various processes, transforming their business models. The technologies can now predict, analyze, and generate information. In supply chain management, the technologies enable to foresee and evaluate possible scenarios based on which a business can maintain strategies. It simplifies and automates routine processes providing valuable insights. Integrating digital tools such as supply chain digital twin, control tower, and predictive maintenance enable to identify trends and patterns in data autonomously. Then, the managers can interpret these patterns and focus on strategic realignment.

Figure 3 represents research results of Capgemini Research Institute. It shows the percentage of planned investments in supply chain technologies. In average, 40% of organizations plan to increase investments in technologies and only 26% plan to decrease. Therefore, it can be considered a rather sufficient area for investment.

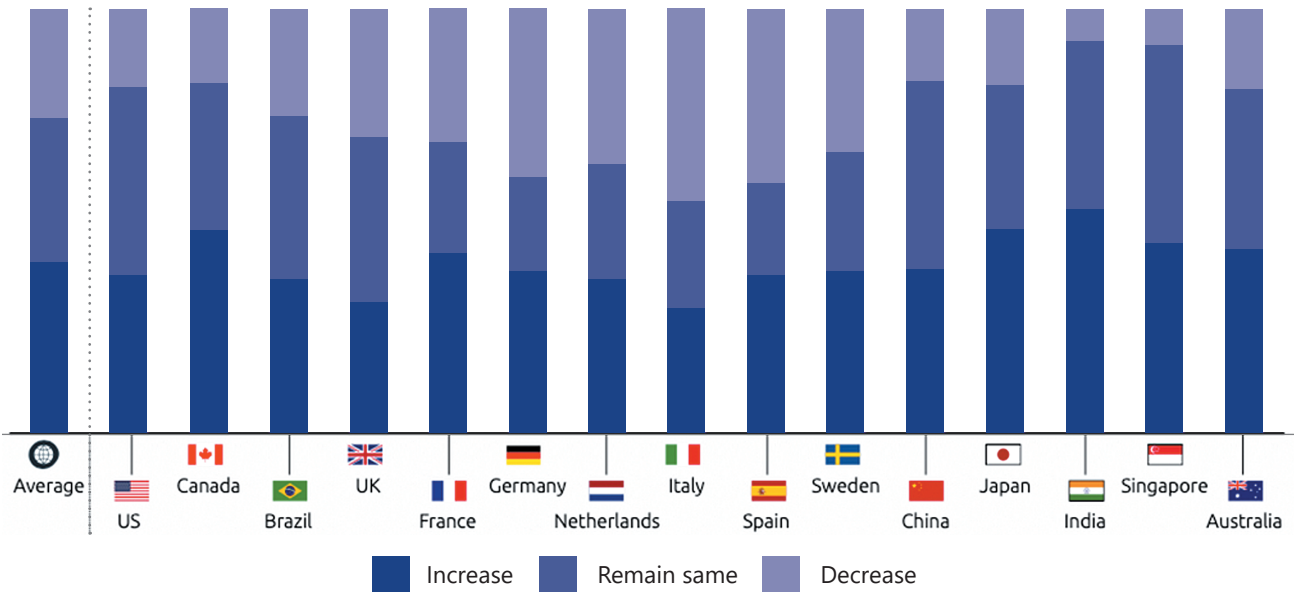


Fig. 3. Percentage of executives stating how investments in supply-chain technology will change in the next 12–18 months (N = 2.000 respondents from unique organizations)

Source: [7, p. 24]

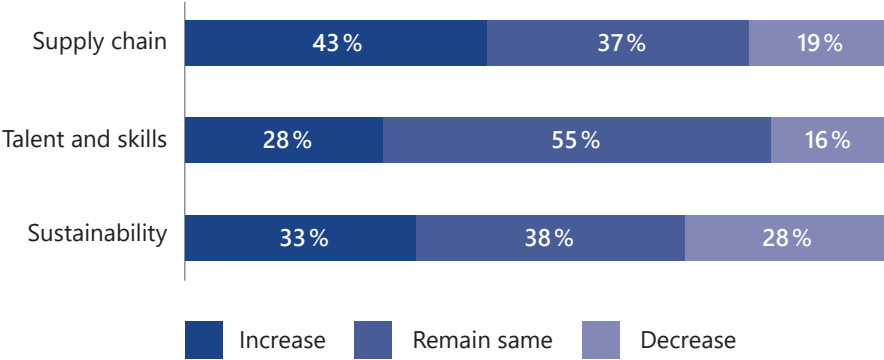
The environmental impact and sustainability is another key topic within SCM. In 2021, 37 % of greenhouse gas emissions came from transportation [15]. However, transportation is merely related to one component of the whole supply chain. In turn, the whole supply chain accounts to more than 90 % of greenhouse emissions [16]. It influences climate change and causes global warming. Along with that, the supply chain can often impact toxic waste, pollution, deforestation, and other environmental damages. This makes sustainability a highly relevant issue. However, it is considered a rather expensive investment by many organizations. A Capgemini recent report showed that only 33 % of organizations plan to increase investments in sustainability, 38 % plan to remain the same, and 28 % plan to decrease [7]. The difference between the planned increase and decrease in investments comes out insufficient. In Figure 4, it is visible that the main priority remains optimization of the supply chain with a planned 43 % increase of investments. Optimization of SCM mainly includes regionalization, alterations in sourcing methods, and integration of technologies, and sustainability is not prioritized.

Nevertheless, the governments tend to increase sustainability regulations of supply chain emissions. In November 2022, the EU Council passed a new standard, a Corporate Sustainability Reporting Directive (CSRD). According to the new legislation, large companies ought to publish sustainability reports on environmental and social impacts [17]. The CSRD information is supposed to help investors, policymakers, customers, and other stakeholders to evaluate the non-financial performance. The CSRD is an

extended version of Non-Financial Reporting Directive (NFRD). The modern framework has a greater scope of reporting requirements and encompass more companies, including SMEs.

In November 2022, the White House proposed a plan to protect the supply chain from climate-related risks. It includes Federal Supplier Climate Risks and Resilience Rule which requires organizations to report on their greenhouse gas emissions and climate-related financial risks [18]. The organizations ought to set targets connected to the reduction of greenhouse gas emissions. In March 2022, the Securities and Exchange Commission (SEC) also proposed a rule for public companies to disclose the climate-related information in financial statements [19]. The pending rules require disclosing the information about greenhouse gas emissions, electricity consumption, and more.

The importance of sustainable development is growing. It is confirmed by the increasing governmental regulations towards climate-related risks. The businesses are supposed to reduce their environmental impact through reconsideration of business models. As long as the majority of emissions are coming from supply chains, businesses can identify sustainability issues along each of its component. To lower the extent of emissions, a business should reduce waste, consider using sustainable materials, and increase energy efficiency. Along with that, logistics is a crucial component. Transportation-related emissions should be lowered in order to achieve more sustainable supply chains. A business can optimize transportation network by reducing extra miles and fuel consumption. Firstly, if the supply chains will become regional or lo-



■ Fig. 4. Percentage of executives stating their organization’s investment plan in the next 12–18 months (N = 2.000 respondents from unique organizations)
Source: [7, p.22]

cal it will decrease the distances. Secondly, with the use of digital tools such as, previously mentioned digital twin, a business can consider most convenient and short routes. Hence, investing in automation will help improving transportation routes and decrease extra miles. Along with that, businesses can invest in energy-efficient equipment such as electric vehicles and solar panels. In example, a business can consider establishing manufacturing plants and warehouses that run on solar power.

In Europe, a smooth energy transition has been disturbed with the war in Ukraine and the following energy crisis. However, Europe plans to increase solar-photovoltaic (PV) electricity in order to address the challenges. In 2022, the EU announced the target to increase solar-PV capacity from 224 GW to 750 GWDC by 2030 [20].

The sustainable approaches applicable to components of the supply chain are summarized and explained in Table 2. The main priority is to reduce energy consumption through integration of renewable energy sources and technologies that optimize operations. The business can consider stakeholders that are interested in sustainability and reduction of environmental impact. Promoting sustainable policies within a business and its parties is essential in order to become more environmentally and socially responsible. As a result, it will benefit reputation of the company and increase its customer pool. Nowadays, when the importance of sustainability is widely recognized, the customers are more likely to purchase from the businesses that are committed to responsible consumption of natural resources.

Table 2. The components of the supply chain

Sustainable Supply Chain Management	Explanation
Sustainable procurement	Choosing the right suppliers that show their dedication to sustainability. Ideally, it helps to begin a circular supply chain where the resources can enter a loop with continuable usage. The suppliers who have better control over their resources will reduce waste, energy, and environmental impact of the business.
Sustainable product development	Developing and promoting products that are eco-friendly and have low environmental impact. A business can use recycled materials or develop products that can be recycled and repurposed. Furthermore, the company can use recyclable packaging.
Sustainable manufacturing	Switching to renewable sources of energy such as solar, air, and hydro power will decrease carbon footprint during the manufacturing stage. A business can consider energy-saving technologies such as LED lighting and HVAC systems. The LED lighting can consume less energy but provide the same amount of light. The HVAC system provides heating, ventilation, and air conditioning consuming less energy during operation. The system is automated and controls the temperature throughout the day and optimize the consumption of the required energy.
Sustainable warehousing	The warehouses can also install LED lighting and HVAC systems in order to optimize energy consumption. In addition, a business can use motion-sensing lights. It will detect moving objects and will turn on and off the lights automatically. The predictive maintenance integrated in the machines will help to detect various malfunctions and improve warehouse sustainability. The use of recyclable packaging and plastic containers will help to reduce waste. A business can reuse the material within the warehouse to minimize the environmental impact. Lastly, a business can set up warehouses closer to the end-customers to decrease transportation.
Sustainable logistics	Optimization of transportation network can be analyzed through technologies such as supply chain digital twin. The main priority is to decrease the unnecessary transportation and reduce fuel consumption. Re-shoring and near-shoring operations can decrease distances as long as supply chain will become more local or regional. If possible, a business can consider sustainable transportation alternatives such as electric vehicles.

Source: compiled by the authors with the use of [1, 21, 22]

In order to examine the competencies of Signa Sports United within the context of researched topics, a SWOT analysis has been made. It is expressed in Table 3 and determines strengths, weaknesses, opportunities, and threats of the organization. As a result of the SWOT analysis, it is visible that Signa Sports United has more strengths and opportunities than weaknesses and threats. The company has a high market share in Europe and is currently focused on its core-markets with strong competitive positions. In 2022, the company published their latest presentation which stated a plan to refocus international partnerships and change positioning in core markets. Signa planned to pause expansion of international logistics and localize international markets. This will help to overcome the weakness of supply chain constraints and prevent further disruptions. The company planned to improve order economics which means optimizing the quantities purchased and minimizing inventory costs, as well as more efficient stock management. This will help to overcome the issue with inventory levels and reduce current overstock. The company is interested in focusing on lean operation management which involves doing more with less and allows to gain more cost benefits. The strategic alliances with tech

companies and integration of advanced technologies are among main strength which opens more opportunities for development. As to the other opportunities, the company can facilitate cross-brand promotion and enlarge their brand portfolio. Acquisition of new strong brands will strengthen their market position, generate revenue, and increase customer pool. This can refer to the EU and the U.S. regions where the company established its presence. Along with that, Signa Sports United can develop its sustainable product lifecycle and consider environmental impact. The latest presentation included a plan to increase sustainability practices. In 2021, the company published their first Environmental, Social and Governance (ESG) report. It showed the company's commitment to measure carbon footprint, existent targets, and corresponding actions to reduce greenhouse gas emissions. Since 2019, the company became a ClimatePartner and considered to be climate neutral for the fourth year. In 2023, Signa Sports United plans to publish their second ESG report which will disclose their new targets and achievements. Signa Sports United mentioned that it would like to focus on lean management. It involves a strategy to reduce any waste of time, effort and costs that does not create value. Lean manage-

Table 3. SWOT Analysis of Signa Sports United

STRENGTHS	WEAKNESSES
A leading tech platform in Europe. High market share. Integrates advanced technologies. The stock is listed on NYSE. Extended to the U.S. market. Forms strategic partnerships and M&A. Sustainable achievements in logistics such as climate compensated shipping and use of electric vehicles. ClimatePartner Climate neutral company Alliances with digital companies. High net orders and customer activity.	Supply chain constraints. Inventory levels and overstock (full-bike and e-bike segment especially) Small market share in the U.S. Negative profitability. Increase of long-term and short-term debt.
OPPORTUNITIES	THREATS
Increasing community awareness in the U.S. through M&A and marketing investments. Cross-brand promotion. Foreign investments. Verticalization by increasing portfolio of brands through M&A. Integration of more advanced technologies within supply chain processes. Improvement of sustainable product lifecycle. Encouraging recycling.	Deterioration in customer sentiment and operational environment. Rising inflation and economic instability. Debt default. Cost-of-living crisis. Increased prices for logistics.

Source: compiled by the authors with the use of [12, 23, 24]

ment has two pillars — to provide the customer value and to improve business operations continuously. It is based on four principles — value, value stream, flow, pull, and perfection. The idea is to define what value means for the customers and meet it. The value stream includes the necessary steps leading to the provision of the valuable end-product. Then, the value stream is optimized and put on flow. Basically, it is the supply chain that runs smoothly in which each stakeholder provides efficient input. The pull of customers is then satisfied with the product at the time when it is needed. In fact, the goal of the pull principle is to limit inventory and ensure that the products are manufactured only when needed and at the right quantity. Finally, the perfection principle is to promote the idea of continuous improvement within the organization. It should be embedded in its culture and business philosophy.

As a result, lean management can sufficiently improve operations of Signa Sports United. Reducing unnecessary steps and focusing on value creation will ensure that the company sets right priorities and achieves its targets faster. As to the idea of limiting inventory, after market overstock the industries might consider alterations in their procurement strategies. Initially, lean management proposed just-in-time manufacturing strategy when the products are created only when they are needed and ordered. However, since 2020, when the world faced global supply chain disruptions, the companies have been talking about the end of just-in-time due to supply shortages and considered holding more inventory instead [25]. In 2023, when industries faced overstock, just-in-time was revived or at least concerned again. The companies can either look toward just-in-time or optimize their inventory management. Although if a company such as Signa Sports United procure from Asia, just-in-time might not be an option due to long lead times. However, in terms of local manufacturing and domestic production it can become more reasonable. At least, just-in-time strategy can be implemented with new models of production during the current market overstock situation. In respect that the supply shortages can easily shift to market overstock under highly uncertain environment, the long-term solution would be to predict the market demand and to rather keep a safe stock just-in-case. In the long-term, a buffer

amount can minimize risks and save companies during the supply shortages, but it should be optimized to the hard-to-get and rare products, as long as those that have no regional substitutes.

Conclusions

Establishing a resilient network is essential in order to provide goods and services to the customers. As business expands to international markets, its supply chain become prone to global factors. The expansion could include either globalization or regionalization strategies. First option is riskier, whereas the second is more secure as it is within one region. The priority is to increase the supply chain resilience and agility. Otherwise, a business would likely to suffer from unpreparedness even if it is a global leader.

Signa Sports United has multiple stakeholders worldwide and a complex supply chain. However, since 2020, the company have been suffering from global supply chain disruptions and then ended with an overstock. The company resulted with poor financial statements and business performance. Eventually, it had to reconsider its SCM in order to combat external factors.

Since antiquity, industrial revolutions contributed to the development of SCM. Advanced technologies and transport fostered global trade due to greater opportunities. Nowadays, a business can integrate multiple technologies in its SCM, and it is still one of the main methods to strengthen it. The software is embedded in planning, sourcing, manufacturing, and transporting operations. It allows gathering real-time information about the inventory and increase traceability, security, and minimize expenses. The warehousing and distribution are now accompanied with modern software systems which optimize each stage. The 3PL services deploy more technologies in logistics, such as Everstream Analytics platform which offers a multi layered view of the supply chain. The 3PL play a major role in international expansion because they offer their expertise and allow exploitation of warehouses, while the businesses can stay focused on their core competencies, save time and costs.

In 2023, the supply chain resilience became a key priority within organizations, especially in the EU region. The main method to mitigate the disruptions is to regionalize or diversify supply

chains through re-shoring or near-shoring. It will increase control over the supply chain due to shorter distances and advantages of FTZ. The diversification will decrease dependency onto single region or market. In example, Signa Sports United procures brands from various regions and launches in-house brands. This might have contributed to the ability to fulfill the orders during the past three years.

The resulted overstock and changed customer sentiment requires additional alterations of SCM. Automation helps to gather data and increase business alternatives. In example, by recording real-time data in blockchain technology, business stakeholders can access data timely and respond to the changes faster. A business can use supply chain digital twin and control tower technologies to prepare for various scenarios. To maintain stable production flow, it can also use predictive maintenance. It will improve manufacturing process and ensure that the company is aware of any faults inside machinery. Currently, the technologies are among one of the main areas for investments, especially across APAC region.

Another relatable topic disclosed sustainability as long as the majority of emissions are caused by supply chain processes. The governments globally tend to increase regulations which encourage companies to report their sustainable commitments. The organizations are meant to employ more activities that reduce environmental impact. This can be done through reduction of waste and emissions during the supply chain processes. The businesses might consider renewable resources, recyclable materials, and increasing energy efficiency. This can be supported with increased automation and investment in energy-saving equipment.

Signa Sports United is a ClimatePartner and a climate neutral company which is environmentally responsible. It plans to increase sustainability within its business units in future, but its main focus is on lean operations, improvement of inventory management, consolidation of logistics, and optimization of the supply chain. Lean management can help to optimize the SCM as it aims to reduce unnecessary costs, effort, and time. It perfectly matches with the disclosed themes such as regionalization, digitalization, and sustainability practices as long as they are also directed on optimization of SCM. Each of

the themes tend to increase efficiency, reduce costs, and increase supply chain resilience. Therefore, existing plans of the company along with the disclosed strategies could strengthen their operations and help to withstand uncertain environment.

References:

1. Yildiz, T. (2023). Logistics and supply chain management: Fundamentals and strategies. ResearchGate. https://www.researchgate.net/publication/369302425_Logistics_and_Supply_Chain_Management_Fundamentals_and_Strategies
2. Stank, T. P., Autry, C. W., Daugherty, P. J., & Closs, D. J. (2015). Reimagining the 10 megatrends that will revolutionize supply chain logistics. *Transportation Journal*, 54(1), 7–32. <https://doi.org/10.5325/transportationj.54.1.0007>
3. Ho, & Tien, N. H. (2022). Russia-Ukraine war and risks to global supply chains. ResearchGate. https://www.researchgate.net/publication/361701652_Russia-Ukraine_war_and_risks_to_global_supply_chains
4. Ganbold, O., & Matsui, Y. (2017). Impact of environmental uncertainty on supply chain integration empirical evidence. *The Journal of Japanese Operations Management and Strategy*, 7(1), 37–56. https://doi.org/10.20586/joms.7.1_37
5. DHL Supply Chain. (n.d.). Four ways to increase the value of your TMS. <https://www.dhl.com/global-en/home/our-divisions/supply-chain/thought-leadership/articles/four-ways-to-increase-value-of-tms.html>
6. Wiggers, K. (2023, April 4). Everstream, which applies big data to supply chain management, raises \$50M. TechCrunch. <https://techcrunch.com/2023/04/04/everstream-which-applies-big-data-to-supply-chain-management-raises-50m/>
7. Capgemini. (2023, January 13). Where are organizations investing in 2023? Supply chains and tech are top of the list [Press release]. Capgemini. <https://www.capgemini.com/news/press-releases/where-are-organizations-investing-in-2023br-supply-chains-and-tech-are-top-of-the-list/>
8. CONEBI. (2021, July 12). European bicycle industry booming. <https://www.conebi.eu/european-bicycle-industry-booming/#:~:text=Latest%20data%20reveals%20that%20sales,during%20the%20course%20of%202020>
9. Witts, J. (2023). Bike prices will fall in 2023 due to excess stock, but not across the board. BikeRadar. <https://www.bikeradar.com/features/long-reads/2023-bike-prices/#:~:text=The%20BA%27s%20Market%20Data%20Service,cent%20between%202019%20and%202022>

10. Akinci, O., Beningo, G., Clark, H., Cross-bermingham, W., & Nourbash, E. (2023, January 6). Global supply chain pressure index: The China factor. Liberty Street Economics. <https://libertystreeteconomics.newyorkfed.org/2023/01/global-supply-chain-pressure-index-the-china-factor/>
11. Pal, A. (2023, April 27). Shimanos first quarter sales worse than expected despite already lowered projections. road.cc. <https://road.cc/content/news/shimanos-first-quarter-sales-not-forecast-300887>
12. Signa Sports United. (2023, March 16). SIGNA Sports United Q1 FY23 trading update [News release]. https://s28.q4cdn.com/222973702/files/doc_news/SIGNA-Sports-United-Q1-FY23-Trading-Update-2023.pdf
13. Federal Reserve Bank of New York. (n.d.). Global supply chain pressure index (GSCPI) [Data set]. <https://www.newyorkfed.org/research/policy/gscpi#/interactive>
14. Henderson, J. (2020, May 17). UPS joins alliance to create blockchain standards for logistics. Supply Chain Magazine. <https://supplychaindigital.com/technology/ups-joins-alliance-create-blockchain-standards-logistics>
15. Transport — Topics. (n.d.). IEA. <https://www.iea.org/topics/transport>
16. EPA Center for Corporate Climate Leadersip. (2023, January 17). Supply chain guidance. US EPA. <https://www.epa.gov/climateleadership/supply-chain-guidance#:~:text=Organizations%27%20supply%20chains%20often%20account,account%20their%20overall%20climate%20impacts>
17. Impakter Limited. (2023). Navigating the EU Corporate sustainability reporting directive. Impakter. [https://impakter.com/what-is-the-eu-corporate-sustainability-reporting-directive/#:~:text=The%20Corporate%20Sustainability%20Reporting%20Directive%20\(CSRD\)%20is%20an%20EU%20ESG,like%20financial%20accounting%20and%20reporting](https://impakter.com/what-is-the-eu-corporate-sustainability-reporting-directive/#:~:text=The%20Corporate%20Sustainability%20Reporting%20Directive%20(CSRD)%20is%20an%20EU%20ESG,like%20financial%20accounting%20and%20reporting)
18. House, W. (2022). What they are saying: Business and climate leaders applaud President Biden's proposed plan to protect federal supply chain from climate-related risks. The White House. <https://www.whitehouse.gov/ceq/news-updates/2022/11/17/what-they-are-saying-business-and-climate-leaders-applaud-president-bidens-proposed-plan-to-protect-federal-supply-chain-from-climate-related-risks/>
19. U.S. Securities and Exchange Commission. (2022, March 21). SEC proposes rules to enhance and standardize climate-related disclosures for investors [Press release]. SEC.gov. <https://www.sec.gov/news/press-release/2022-46>
20. Bettoli, A., Naucclér, T., Nyheim, T., Schlosser, A., & Staudt, C. (2022, December 13). Building a competitive solar-PV supply chain in Europe [Report]. McKinsey & Company. <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/building-a-competitive-solar-pv-supply-chain-in-europe>
21. Sustainability Victoria. (n.d.). Choose the right LED lighting. Sustainability Victoria. <https://www.sustainability.vic.gov.au/energy-efficiency-and-reducing-emissions/save-energy-in-the-home/lighting/choose-the-right-led-lighting#:~:text=LEDs%20use%20much%20less%20energy,efficient%20forms%20of%20lighting%20do>
22. Mecalux. (2021, November 9). 8 best practices for a sustainable warehouse. Mecalux.com. <https://www.mecalux.com/blog/sustainable-warehouse#:~:text=A%20sustainable%20warehouse%20is%20a,of%20waste%20and%20energy%20consumption>
23. Signa Sports United. (2023, February 7). FY22 earnings presentation [Investor presentation]. https://s28.q4cdn.com/222973702/files/doc_financials/2022/q4/SSU-Q4-FY22-Earnings_Presentation-FINAL_07Feb23.pdf
24. Signa Sports United. (2022, June). ESG report 2021. https://s28.q4cdn.com/222973702/files/doc_downloads/2022/09/RZ_SSU_ESG_EN_RGB_220914.pdf
25. Shih, W. (2022, January 30). From just-in-time to just-in-case: Is excess and obsolete next? Forbes. <https://www.forbes.com/sites/willyshih/2022/01/30/from-just-in-time-to-just-in-case-is-excess-and-obsolete-next/?sh=3574eef54daf>

Чаплинська Н. М., Челомбітко Є. К.

Діджиталізація управління ланцюгом поставок (за матеріалами компанії зі спортивної індустрії "Signa Sports United")

Війна в Україні призвела до зміни ланцюгів поставок в усьому світі. Управління глобальними ланцюгами поставок в реаліях турбулентного середовища стало надзвичайно актуальною вимогою часу. Крім того, під впливом COVID-19 були сформовані нові вимоги до організації сучасного бізнесу, що переважно міг вижити тільки із застосуванням діджитал технологій. Ті компанії, що вчасно перейшли на нові рейки побудови бізнесу, зможуть отримати надприбутки в майбутньому. Однак проведення діджиталізації ланцюгів поставок все ще залишається складним питанням, відповідь на яке намагаються надати автори в даній статті.

Основна мета дослідження полягає у дослідженні можливостей та проблем діджиталізації ланцюгів поставок на прикладі компанії "Signa Sports United", світового лідера електронної комерції у спортивній індустрії. У статті розглянуто основні стратегії експансії компанією міжнародного ринку з метою визначення найбільш безпечного варіанту реалізації діяльності в інших країнах в сучасних умовах; методи створення стійких та гнучких ланцюгів поставок. Також у статті досліджується діджиталізація в контексті управління ланцюгами поставок за рахунок аналізу таких процесів, як автоматизація, організація інтернету речей, проведення машинного навчання, предиктивного обслуговування, блокчейну, тощо.

В результаті виявлено, що тема управління глобальними ланцюгами поставок збігається з проблемою компанії, оскільки остання пережила тривалі перебої в ланцюгах поставок. Кейс компанії допоміг глибше розкрити тему на конкретному прикладі. Аналіз існуючих стратегій "Signa Sports United" у поєднанні з результатами дослідження став основою для пропозицій щодо розвитку. Також в статті розглянуто методи підвищення сталості в бізнес-операціях, оскільки вплив на навколишнє середовище тісно пов'язаний з ланцюгом поставок, і його складові є основними чинниками глобальної зміни клімату.

Ключові слова: управління ланцюгами поставок, глобальна турбулентність, цифрові технології, глобалізація, регіоналізація, сталість