MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
UKRAINIAN-AMERICAN CONCORDIA UNIVERSITY

School of Management and Business
Department of International Economic Relations, Business & Management

Bachelor's Qualification Work

Supply Chain Management: Globalization in the Age of E-business

(based on Adler Style GmbH case)

Bachelor's student of the 4th year study
Field of Study 07 – Management and Administration
Specialty 073 – Management
Educ. program – Management

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Research supervisor

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Ph.D. in Economics

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Abstract

The work is dedicated to the investigation of the supply chain management on a global scale in the context of modern environment, global turbulence, and integration of the digital technologies. The work summarizes theoretical material on the supply chain processes, examines the supply chain management on practice covering the impacting challenges, and highlights the development strategies. The author determines the impact of the supply chain disruptions on electronic business and derives methods to overcome challenges with increasing resilience. The conducted analysis indicated the possible reorganization strategies for the business operations and integration of advanced digital technologies. In order to enhance and develop business operations, the software systems enabling convenient and agile operations were considered. In general, the international supply chains were compared on global and regional levels in terms of flexibility and efficiency, and conclusions were drawn regarding the optimal strategy.

Keywords: supply chain management, electronic business, global turbulence, integration of digital technologies, and globalization.

Анотація

Робота присвячена розгляду теми управління ланцюгами постачання на глобальному рівні в контексті сучасного середовища, глобальної турбулентності та інтеграції цифрових технологій. Робота узагальнює теоретичний матеріал щодо процесів ланцюгів постачання, розглядає систему управління на практиці, та охоплює головні проблеми, виклики, та стратегії розвитку. Автор визначає вплив глобальних збоїв у ланцюгах постачання на електронний бізнес і приводить методи подолання із підвищенням стійкості. Проведений аналіз встановив стратегії реорганізації бізнес-операцій та можливості інтеграції цифрових технологій. Для вдосконалення бізнес-операцій були розглянуті сучасні технологічні інструменти які забезпечують ефективність операцій. Загалом, міжнародні ланцюги постачання порівнювалися на глобальному та регіональному рівнях с точки зору ефективності та були зроблені висновки щодо оптимальної стратегії.

Ключові слова: управління ланцюгами постачання, електронний бізнес, глобальна турбулентність, інтеграція цифрових технологій, та глобалізація.

PHEE-institute «Ukrainian-American Concordia University»

School of Management and Business
Department of International Economic Relations, Business and Management

Educational level: **bachelor degree**
Specialty: 073 "Management"
Educational Program "Management"

APPROVED
Head of Department _____
_____

TASK
FOR BACHELOR'S QUALIFICATION WORK

Yevangeliya Kristel Chelombitko
(Name, Surname)

1. Topic of the work:
Supply Chain Management: Globalization in the Age of E-Business (based on Adler Style GmbH case)

Supervisor of the work ***Natalia Chaplynska, Ph.D. in Economics***.
(surname, name, degree, academic rank)
Which approved by Order of University from **"22" September 2022 № 22-09/2022-3c**

2. Deadline for bachelor's qualification work submission "***23" April 2023***
3. Data-out to the bachelor's qualification work_
Materials from internship received during consultation with representatives of the company. Information from open resources in the Internet, official reporting of financial and economic activities of the enterprise.

4. Contents of the explanatory note (list of issues to be developed).

There are three main topics a student should develop in this work:
1. ***Theoretical and methodical bases of the supply chain management.***
2. ***Practical aspect of supply chain management on the e-commerce on the example of the company "Signa Sports United"***
3. ***Propositions of improvement for the company's development in supply chain management.***

5. List of graphic material (with exact indication of any mandatory drawings)

Graphs and figures for analysis of economical and statistical information on the company and its development, visualization of mechanism of development, etc.

6. Consultants for parts of the work

Part of the project	Surname, name, position	Signature	
		Given	Accepted
1	*Natalia Chaplynska, Ph.D. in Economics*	+	+
2	*Natalia Chaplynska, Ph.D. in Economics*	+	+
3	*Natalia Chaplynska, Ph.D. in Economics*	+	+

7. Date of issue of the assignment

Time Schedule

№	The title of the parts of the bachelor's qualification work	Deadlines	Notes
1.	I chapter	*31.12.2022*	*In time*
2.	II chapter	*20.02.2023*	*In time*
3.	III chapter	*11.04.2023*	*In time*
4.	Introduction, conclusions, summary	*23.04.2023*	*In time*
5.	Pre-defense	*27.04.2023*	*In time*

Student _____
(signature)

Supervisor _____
(signature)

Conclusions:

The Bachelor's qualification work is designed at the high level, and its content and structure fully meet the methodological requirements. The study provided a meticulous analysis of the supply chain management as an integral part of the electronic business which enables performing operations on a regional and global scale. The work contains all the necessary parts of scientific research with empirical and theoretical recommendations. The paper includes a well-developed theoretical approaches to the supply chain management and provide analysis of its development through globalization aspects in electronic business on the example of Signa Sports United company. The practical recommendations were formulated correctly and focused on the main goal and tasks of the work. In general, if successful defense, the thesis can claim to be "excellent".

Supervisor _____
(signature)

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INTRODUCTION

Supply chain management is an integral part of the business which enables performing operations on a regional and global scale. With effectively managed supply chain, a business can provide its production to the end-customer worldwide. In the modern world, it is important to understand how supply chains are being managed because businesses are highly dependent on these networks. Nowadays, international e-businesses can operate in multiple countries coordinating the majority of their operations through digital systems, but the supply chain processes are performed mainly offline. Taking the fact, that international businesses operate worldwide, they are vulnerable to uncertainties in any country of operation. Considering the extent of global turbulence today, the businesses are facing multiple uncertainties which affect their operations. Especially, this relates to international supply chains that are pressured due to border closures, container shortage, unexpected changes in transit routes, and other challenges. Therefore, it is important to gain an understanding of how global businesses can overcome multiple uncertainties or at least become more resilient. The purpose of the work is to investigate the topic of global supply chain management in depth, analyzing the relevant material to find out solutions of greater business resilience and stability.

In order to develop an understanding of the topic it is necessary to introduce main objects of research and its principles. The electronic businesses operate through a computer-mediated network, having no geographical boundaries. They are easier to set up because more processes are held via internet. Goods and services are sold online without a necessity to establish offline presence and meeting a customer. Nowadays, entrepreneurs prefer e-businesses that make it possible to have an office anywhere and opportunity to reach everywhere with flexible working hours. As long as there is an access to internet, most operations

could be handled distantly. Extending most processes online saves time, money, and place maintenance.

Global e-commerce market is constantly growing while online stores are becoming a common factor. Globalization is the cross-border trade of goods and services, information, investments, and technology. It is the integration of markets and the exchange of production all over the world. Nowadays, it is interconnected with the development of e-commerce and technological advancements which make it possible to enter the world market easily. A combination of online processes conducted through a computer network could be managed internationally. Therefore, most e-businesses aim to cross international borders as soon as possible. A store may choose to operate individually or through a marketplace with a ready customer base aware of a certain platform. With a development of online stores, purchasing items became easier and faster than ever. It takes only a few minutes to place an order and purchase it simultaneously with a card through a purchasing system. Customers are attracted by the conveniency and time-saving benefits of technological advancements which enable ordering, purchasing, and tracking their deliveries fully online. People are now having a greater choice and access to various products all over the world.

However, beyond the ease on the customer's side there is a long network managed by the electronic business which stays behind every finished good. Supply chain management (SCM) is the backbone of the e-commerce structure. It handles the entire production flow of goods, data, and finances associated with a product or service [1]. The SCM includes the procurement of raw materials, managing suppliers, manufacturers, packaging, transporting, warehousing, processing orders and delivering the final product to the end-customer. Furthermore, an e-business should consider an insurance, security system, HR, IT, and marketing employees, return and replacement, security service, and a call center.

Modern digitally based SCM include material handling and software for all involved parties in product creation, order fulfillment, and information tracking. It is used by suppliers, manufacturers, wholesalers, transportation and logistics providers, and retailers. E-businesses aim to optimize the supply chain by “smart” inventory management and automation of business processes. Development of e-commerce brought up new solutions with the use of software, technologies, video conferencing, and electronic mail which adapts supply network to modern business management. The product is being transported along from the suppliers of raw materials to the end-customer with the help of IT software and possibly blockchain technology.

Relevance of the topic. The supply chain management is crucial part of the business which ensures that the product is being delivered to the end customer. The society heavily relies on the efficient supply chains in order to obtain the demanded goods and services. Each industry aims to maintain stabilized supply chains because it directly affects business performance, financial statements, and reputation.

In the modern world, the popularity of e-businesses is rising, and more entrepreneurs tend to establish companies that provide online shopping. Internet makes the stores more accessible and convenient to the customers and more cost-effective for the businesses. As well as traditional business, an e-business is also reliable on supply chains, but it keeps its production in warehouses rather than in physical stores and use the system of online transactions. E-businesses are less dependent on the physical locations and could be easily accessible worldwide through efficient supply chain management. Eventually, it becomes a foundation of successful international trade.

Nowadays, e-businesses are going along with the increasing digitalization, because basically advanced technologies are what makes the process of online shopping possible. The businesses apply digital technologies also to various

business processes including the supply chain management to maintain operational efficiency.

The rising trend for online shopping increases the number of global e-businesses which provide their goods and services to the customers worldwide. The businesses should maintain stabilized supply chains in order to access the customers with the integration of digital technologies which enable online customer service and efficient management.

The **relevance** of this work is connected to the rapid growth of global e-businesses which tend to adapt to modern reality and uncertain environment. It is relevant to define the interconnection of international supply chain management, digitalization, and global turbulence.

Scientific elaboration of the research problem. Previously, the topic has been researched by various economists, researchers, and experts in the field such as Y. Matsui, O. Ganbold [26], N. Tien [57], M. Placek [75] have previously researched the topic of supply chain management and elaborated on the state of supply chains under uncertain conditions.

Characterizing the group of these researchers, their works were focused on the factors contributing to the supply chain disruptions, environmental uncertainty, and analysis of the relative indexes.

The written work will dive into the global issues of supply chains and propose an enhancement framework through theoretical research of the topic and its correlation with digitalization and globalization strategies. The theoretical base and gained knowledge are to be applied to the specific subject of study in order to understand how to develop resilient supply chains. This work will study the LLC “Signa Sports United” through completing an internship in private Austrian company in the same sport industry “Adler Style GmbH” that elevated the knowledge of the industry environment, economic factors, and management capabilities. Eventually, the research material, gained knowledge and experience

is to be used to make propositions for business development and enhancement through the use of digital technologies and international strategies.

In total, the work will discuss the supply chain management of a global e-business that integrates technologies into its operations, considering macroeconomic factors and global turbulence that impacts the financial and operational performance. Further, the development strategies are to be suggested in order to address global challenges and maintain efficient business operations.

The **aim** of the bachelor's work is to study and analyze the integration of the supply chain management in the modern world with technological advancements and growth of e-commerce. Furthermore, to establish the development strategies for Signa Sports United.

To achieve this aim, the following **tasks** were set:

- Develop an understanding of how the supply chain management works.
- Develop an understanding of international logistic operations of e-businesses and the role of third-party logistics services.
- Analyze the features of supply chain management on a concrete e-business, LLC "Signa Sports United".
- Analyze the impact of global turbulence and the strategies implemented by Signa Sports United.
- Conduct research on the supply chain management strategies during the global turbulence.
- Describe the development of supply chain management through the integration of digital technologies.
- Propose recommendations to enhance supply chain management in Signa Sports United.

The **research objects** are international supply chain management within the context of LLC "Signa Sports United".

The **research subject** is a set of theoretical, methodological, and practical approaches implemented in order to maintain development strategies for LLC "Signa Sports United".

The **main research methods** used in the bachelor's work include: data analysis method – involves processing the theoretical research material with the applied logical techniques and deduction, understanding the economic content; quantitative analysis – involves analytical processing of financial statements of LLC "Signa Sports United" along with individual calculations and elaboration on the company's financial performance; qualitive analysis – involves analytical models such as SWOT and PESTEL analysis; synthesis – involves combining the components of information into a structured and logical whole.

The official reports of LLC "Signa Sports United", scientific publications, journal and media articles served as an information base for writing the practical report.

The **theoretical value of obtained results** reveals the basics of international supply chain management, analyzes the integration of digital technologies, and conducts a comprehensive analysis on increasing the international supply chain resilience.

The **practical value of obtained results** is devoted to the propositions and substantiating the scientific idea in order to enhance business framework of LLC "Signa Sports United" with the instruments of international and digitalization strategies. The idea is implemented through the discussion of the main supply chain processes, the role of third-party logistics, integration of digital technologies such as blockchain, supply chain digital twins, predictive maintenance, artificial intelligence, machine learning, and more. Firstly, integrating advanced technologies can enable "Signa Sports United" more transparency and conveniency of supply chain processes, enhancing collaboration between stakeholders and their operations. Then, the international

strategies can be implemented to adjust the supply chain in order to make it more stabilized during the global turbulence.

The bachelor's qualification work consists of introduction, three chapters, conclusion, and the list of references. The three chapters outlined in the work have the following order: the concept of supply chain management, study of e-commerce LLC company "Signa Sports United", and considerations for the company's development in supply chain management. The first chapter provides necessary theoretical material about the essence of supply chain management, the role of third-party logistics, integration of digital technologies and variations of uncertainty. The second chapter provides a concept of supply chain management on the basis of LLC "Signa Sports United" with a discussion of the company's current state, financial position, impact of global turbulence, and adopted strategies. The third chapter gathers the previous information and includes research aimed to help establishing strategies of supply chain development in Signa Sports United.

CHAPTER I. THEORETICAL FUNDAMENTALS OF THE SUPPLY CHAIN MANAGEMENT

1.1. Supply Chain Management: Classification and Processes

The main components of the Supply Chain Management (SCM) in e-commerce include supply chain planning, sourcing, manufacturing, and delivering. The activities could be extended to global trade and multinational production processes [2].

Supply chain planning allows the company to balance its supply and demand, providing as much product as it requires and could be purchased by the customers. The data-driven demand plan signifies the expected number of products needed based on several factors such as trends, geographical location, customer's interest, brand awareness, etc [3]. Each resource involved in manufacturing process must be obtained in the right proportion, at the right time and place. This stage includes planning of such processes as manufacturing, distribution, procurement, resource management, and such factors as material availability and employee responsibilities. Planning is the first and essential stage that sets clear actions. An optimal metrics is used to make planning decisions on the basis of reliable data. Using a software is extremely helpful and can assist employees in the creation of a solid supply plan. As the products move throughout the chain, the software is used to keep track of sales and view the correlation with the demand. Constant updates help to balance supply and demand sides, making it possible to add timely changes. Artificial intelligence (AI) and machine learning make supply chain planning smarter. The technologies automate various processes and streamline workflows. The collection of more data can be used further to enhance performance. Supply chain software help to computerize order processing, invoicing, and shipment tracking, thereby reducing administrative

costs and saving time. In case if there are multiple fulfillment locations, software can be coordinated based on geographical location of the warehouse or the customer base.

Sourcing is the next component of SCM which includes choosing appropriate suppliers of raw materials. It encompasses selection of the supplier, purchase of goods, contract negotiation, and measurement of the long-term performance based on the set of criteria. A company is interested in maintaining cost savings and the best possible value for their goods and services. The terms of agreement are based to achieve a suitable margin that will positively affect the company's bottom line. Therefore, the goal is to find most appropriate suppliers at the lowest possible cost to gain a competitive advantage. On a national level it easier to choose where to source materials from. Businesses often prefer sourcing from China and Indonesia as it has cost-effective materials. However, there should always be a balance between the quality of the products (or raw materials) and their affordability. The central factors affecting sourcing decisions are the costs, profit margin, and competitiveness. The leading companies are looking forward to creating value but not ignoring the costs and waste reduction [4].

The sourcing in SCM includes:

- Collecting data regarding the quality of product
- Selection of suppliers and contract negotiation
- Market analysis
- Testing the product quality
- Considering outsourcing
- Constituting standards
- Implementation

Acquiring the cheapest goods and services is not the end goal of sourcing. A business considers a strategy that will make the procurement terms mutually beneficial. A business can work directly with wholesalers, manufacturers, or

distributors. It will depend on the sourcing needs and the type of required goods and services.

Outsourcing involves hiring a third party which will perform services or create goods. It can be either a partnership with a domestic supplier or a migration of operations abroad. Without outsourcing, globalization wouldn't be as prevalent as it is nowadays. It reduces operational costs and helps the company to save its financial resources, because other companies may have access to a cheaper, but good quality factors of production and technology. Globalization has led to an increase in the extent of outsourcing by organizations. Whereas, outsourcing promoted globalization by integration of different national economies into a single global economy [5]. Outsourcing increase efficiency because the business can stay focused on its strategies and core competencies. A business may partner with specialized organizations accessing a larger talent choice, rather than recruiting and training employees internally. However, in this case the business will have less control and may suffer from challenging communication.

Global sourcing is a procurement strategy which deals with international markets across geopolitical boundaries to use its benefits of skilled labor and raw materials. It provides a larger variety of resources and talents that might be inaccessible in the domestic market. The world became a large shopping mall that offers greater production capacity and opportunities to adopt new products faster.

Low-cost country sourcing (LCCS) is another method which involves sourcing goods and services from nations with low labor and production prices. It includes lower overall operating costs, minimizing capital investment, and maximizing gross margin. Common resource rich and regulated wage labor locations are China, India, Indonesia, Brazil, Bolivia, Mexico, and Eastern Europe. However, the business should consider tariffs, tax structures, and the transportation costs to make sure that outsourcing will be cost effective.

A business may choose to have a few or many suppliers, also known as single or multiple supplier strategy. Single supplier strategy is purchasing a resource from only one supplier. It is easier to track performance, gain trust and mutual benefits between the two parties. The communication with fewer suppliers lowers the workload and keeps the focus on the main. Problems may be resolved easier, and the consolidation of all requirements makes it cost-effective [6]. However, a single supplier strategy may increase the vulnerability and risks of supply process, elevating the dependency between the two parties.

Multiple supplier strategy includes several suppliers of goods. It may benefit the capacity, flexibility, and dependency, although the relationships are more complicated and require more resources to manage them. As the number of suppliers increase, so does the costs. The communication process is more complexed, and the terms of quality control may become challenging. The company usually order lower volumes when it has several suppliers and therefore result in lower bargaining power.

Manufacturing is the next component of SCM. It involves gathering raw materials, components, or products for the final product. Afterwards, testing and quality control operations are implemented. Employees evaluate the condition of the materials before accepting them aiming to minimize errors of the product line. They are re-examining the quality of the product and ensuring that it will not be damaged during packaging or delivery. This stage is important not only for having satisfied customers, but to reduce further work within the supply chain. The customer satisfaction is related to requested quality, cost, and time frame of the delivery. Therefore, companies should work towards minimizing all possible defects and drawbacks during the stage of manufacturing.

A business should access skilled workforce including designers and engineers who will make products ready to use. The process involves coordination, collaboration and decision making for the supply chain managers to get a

demanded product [7]. Key decision in manufacturing is an appropriate pricing and the requested time frame.

Logistics is the next and one of the most crucial components of SCM. It coordinates the movement and storage of items inside the supply chain. It affects the overall quality of SCM and requires specialized assistance to get it moving. The priority for the business is to transport its products safely, timely, and effectively. For making this happen, the correct mode of transportation is chosen based on the specifics of the product, urgency, and capacity. The implementation of organized logistics is a key element in meeting customer demand and satisfaction.

The rapid growth of global trade made logistics the core of a supply chain. Global traders become more reliant on sophisticated transportation and effective management. Leading companies either work on their own or form strategic partnerships with third-party services that offer transportation and warehousing solutions. In fact, outsourcing transportation and warehousing allow the business to hold greater capacities and enter international market easier. Experienced professionals ensure that the transportation is being aligned in most convenient and practical way. As they have greater experience, they know easiest destination routes, regulations, and requirements.

Electronic businesses are highly reliable on functional SCM, expecting the inventory to be transported timely and in right proportions. Effective supply chain network can reduce operating costs and enhance financial position of the company. Manufacturers are also reliable on timely delivery because it prevents material shortages and possible shutdowns of production plants. In fact, retailers are dependent too as they don’t want to hold costly inventories for longer than necessary. Thus, a constrain in the supply chain can harm all business stakeholders and damage financial position.

In order to mitigate the risks of surplus or shortage inventory, company should calculate a safe stock. This is a buffer amount that is calculated in relation to the usual inventory levels. Having a percentage of excess stock enables a business to feel more secure in case of any supply chain disruption. To manage the costs, the company decides on the appropriate transportation mode, number of vehicles, warehouses, and parties involved. The company should constantly monitor and redesign their supply chain to have fewer warehouses and vehicles in order to minimize expenses. In addition, speeding up the dates of the delivery can allow invoicing the customers earlier and generate profits faster.

Generally, the pace of global trade benefit the economies because countries with developed supply chain infrastructure set the foundation for improvement of the standard of living and contribute to economic growth [17]. A vast railroad network, modern interstate highway system, various modern ports and airports enable the exchange of goods between companies and customers easily, timely and cost-effectively. Meaning that customers can obtain more goods and raise their standard of living in the society. The SCM ensures streamlined process of getting goods to market and ultimately to consumers, who are now able to purchase essential products at a lower cost. This positively impacts the economy and provides more job opportunities in the supply chain field. Despite the increased automation, industry still needs professionals to operate within the supply chain to manage inventory, manufacturing, transportation, and warehousing processes. Therefore, well-managed supply chain flows have obvious benefits. On the contrary, supply chain disruptions will lead to shortages of essential goods, price inflation, factory closing, bankruptcies, and negative effects on nation’s economy. Poorest nations have a common factor – inadequate or no supply chain infrastructure. This limits not only their access to vital products but also the economy growth.

1.2. Role of Third-Party Logistics in Supply Chain Management

Third-Party Logistics (3PL) allow organizations to outsource supply chain tasks such as transportation, warehousing, packaging, and order fulfilment. In uncertain market environment 3PL play a significant role in solving logistic management issues and making supply chain more agile and responsive [8]. Partnering with a 3PL can expand the customer base, increase capacity, benefit customer experience, and provide external support to run the business more efficiently.

Advantages of 3PL for a supply chain:

- Cost savings
- Access to experience and expertise
- Focus on core competencies
- Flexibility
- Scalability
- Business Growth
- Market expansion
- Customer satisfaction

Warehousing is a key element in global logistics system. Wholesalers, manufacturers, transporters – all need a storage facility that will provide a safe and secure holding of their inventory. Businesses with high levels of inventory use single or multiple facilities to store their goods and organize their stock. Certainly, a business may use a private warehouse which is leased or owned by themselves, it will give more control over inventory and transporting operations. This facility arrangement may seem more flexible and offer better security but it will require considerable investments in construction, facility management, and maintenance.

If the business is not interested in constructing a warehouse by itself, it may choose a public 3PL warehouse. It can offer inventory space, storage, managing, and distribution of products [10]. They are more convenient than private warehouses in terms of financial outlay, including maintenance, leasing, taxes, and staff training. The businesses have a wide range of services provided by specialized 3PL companies which are concentrated fully on warehousing. It does not require long-term commitments and in case of changes in demand or location, a business can easily switch to a new warehouse. In fact, a 3PL allows more flexibility and scalability for a business. It can utilize supply and distribution resources based on the current demand and business needs. When the demand is lower, no excess investments and utilized resources are spent on logistics. On the contrary, when the demand is higher the business can easily upscale.

Significantly, a 3PL has a greater network and a team of talented industry operators, who aim to build strong relationships within the logistic sector and have greater power during negotiations. Partnering helps a business to save money that would have been invested in infrastructure, warehouse space, transportation, technologies, and staff. This minimizes overhead costs and drive cost savings. It is a more practical decision for an e-business which would like to start international trade.

Outsourcing warehouse operations reduces the need to be involved in management of non-core functions. Logistics is critical but may not be the core competency of the business. Thus, it is a leeway for concentrating on main operations without deploying internal resources. It is rather hard or even impossible to combine all expertise and capacities within one business without forming strategical partnerships. A 3PL provider has the required knowledge and experience in the field which could be used advantageously. Industry operators are common with transport documentation, import and export, international compliance, economic regulations, etc. It helps businesses to access markets

where they haven’t yet established presence and saves costs for managing and storing inventory [9]. Therefore, they can enter new regions faster and easier with the know-how competencies of its partners. This in turn, fosters the global trade.

Currently, most modern warehouses are equipped with a Warehouse Management System (WMS). It is the latest technology with a software which control and administrate warehouse operations when inventory is entering the facility and is moving out. The functions include inventory tracking, picking, receiving, and putting away [11]. A WMS is significant advancement that ensures that goods are sorted and stored properly, and then are shipped and tracked accurately. A WMS is often used or integrated with other related systems such as enterprise resource planning (ERP), transportation management system (TMS), and inventory management systems.

Nowadays, companies are adapting to constantly changing environment and market scenarios in order to remain flexible. They use smart business automation that helps computerizing various processes. Business use Enterprise Resource Planning (ERP) – a software program that helps managing data and information throughout material flows, information flows, and financial flows. It enables interacting with various suppliers and partners to obtain the products at the right time and proportion. The software streamlines the path of the product that it undergoes from a supplier to a warehouse, and then to the store. The ERP and WMS are often connected, they work synchronically and share information continuously. The ERP creates master databases containing information about the new products, adds suppliers, generates invoices, and sends purchase orders. Whilst the WMS informs ERP when the goods are received at the warehouse or sent as orders. Both systems operate with the same order fields (name, address, etc.) and use unique codes that identify them [12].

The business checks the inventory levels and monitors the flow of goods in and out of the warehouse, identifying how much stock it is necessary to order.

The appropriate stock management gives the business an opportunity to meet customers demand without any delays and reduce holding expenses. There are two main types of inventory control systems: periodic and the perpetual.

The periodic inventory control system includes the count of goods at specific time intervals, usually on a monthly, quarterly, or annual basis. It is relatively easier system to manage smaller inventories and does not require any specialized technologies and equipment. However, if a business has larger inventories, it will be a durable process prone to human errors.

The perpetual inventory control system includes an accurate counting of inventory levels in the real-time. In this case, it involves a technology with barcodes and Radio Frequency Identification (RFID) tags to track items. The information is then added into a database which can be easily accessed by the warehouse staff. This system removes the necessity of manual counting and provides managers with timely information about the inventory capacity. It enables data-driven decisions regarding sales, ordering, and inventory management. This system works best for international businesses which have warehouses in multiple locations and high levels of inventory. However, it is more costly due to the integration of software control system and has its drawbacks such as scanning errors.

Business should consider keeping a safety stock in their warehouse to be able to prevent an out-of-stock situation. It will appear highly valuable in occasions of sudden demand, surges during a busy or festive holidays, and hard-to-predict situations like pandemics. According to the study of IHL Group, yearly stockouts result in $984 billion worth of loss worldwide [13]. During the pandemic, safety stock helped businesses to remain afloat while supply chains adjourned receipt of the inventory due to global restrictions [14]. It is a buffer amount during uncertainties including supplier delays, excess demand, inaccurate demand forecast, failure in orders, and financial constraints. Businesses can mitigate an

out-of-stock risk and its consequences proceeding the supply chain. A disadvantage of the safety stock is that it turns out as a business expense because holding costs usually amount to 20% of the total inventory costs. It is an excess amount of stock that must be purchased and increases the storage costs and staff hours. However, business could have more risk without keeping a safe stock. Most supply chain managers rely on software like ERP or complementary demand planning tools that help to optimize stock management. Manually, businesses use basic safety stock formula and standard deviation formula to calculate critical variables. Ultimately, by coming up with optimal levels of safety stock, businesses prevent themselves from unnecessary risks, lost sales, and customers.

Transportation is the most recognizable component of logistics which is responsible for the movement of goods along the supply chain. The transportation modes include road, rail, maritime and air transport. The appropriate mode is chosen based on product characteristics - perishable, hazardous, hard to handle, large size, fragile, etc. The next factor determining the appropriate mode is the destination point – from where the and where to the goods are to be shipped.

Road transportation is a popular mode for transporting all sorts of goods worldwide by the means of motor vehicles. A business may use commercial road freight implemented by 3PL or in-company transports organized by the enterprises themselves with the use of owned vehicles. According to the need, various motor vehicles are chosen – from vans to semitrailers including refrigerated vehicles, vacuum trucks for liquids, and hazardous goods transport. The 3PL offer full and partial truckloads considering the capacity of the products. In fact, a Full Truck Load (FTL) is the fastest and safest mode when the entire truck is booked, and it is not stopping for intermediate loadings. It travels the destination providing the full capacity space for a single business.

Road transportation a relatively cheap mode, because it doesn't require additional specific infrastructure like ports, stations, and airports. It's the most flexible and convenient method for the short and medium distances and is adaptive in terms of volumes and schedules. It has the lowest limitations and prohibitions in terms of flammable, toxic, cold, and heavy products. The service is more traceable and direct because the logistic company loads the trailer and unloads it in their warehouse without other means. As to the concerns, road transport comparatively has the highest accident rate. It also has lower capacity than ship or train, even the modern mega-trucks are still quite limited. The road transport has largest traffic restrictions especially when crossing international borders. This in turn may result in delivery delays. It is more suitable for industries that require fast and small to medium shipments directly to a warehouse, business, or customer's door. Most reliable industries on road transportation are e-commerce, retail, grocery, agriculture, and construction.

Marine transportation accounts for a vast majority of global trade, more than 90% of all goods are transported by ships. This is because they can carry the heaviest loads and greatest capacities with the cheapest possible cost. It is used for the transportation of large items shipped in bulk including metals, building supplies, agriculture, and products that cannot be accommodated by plane. Cargo ships vary in length and can carry thousands of tons of weight. Therefore, sometimes it's the only option for bulk quantities and oversized products to be carried simultaneously. It is one of the most cost effective and environmentally friendly mode due to a lower fuel cost and larger distance travelled per unit of fuel. Ships operate on a scheduled and planned route, so are more predictable. The most significant concern is time. Although, ships can carry the heaviest goods at greatest capacities they also take longest time. In case if a business works with extremely heavy goods, it may not have as much choice. On the other side,

if a business heavily relies on speedy delivery, it should rather consider another mode or plan shipments in advance.

Rail transportation is perfect for businesses that require fast, scheduled and ground freight. Commodities transported by rail transport are motor vehicles and their components, plastic, and mineral fuels. Trains can carry heavy bulk cargo over long distances with low chance of delays. It is a scheduled and predictable form of transportation that operates independently. Additionally, it has relatively low fuel consumption. However, comparatively to marine transport, it can carry lower capacities and often require multiple transfers in one shipment process. Not every area has access to railroads, so it almost always requires an additional transport, usually trucks to move products further. Considering the speed of delivery, rail is a faster mode than ship, but slower than truck or air freight. Taking into account the capacity advantage, rail is an option for businesses that has heavy bulk products but are more relied on quick delivery.

Air transportation is fastest delivery accessible across most of the world. For multinational businesses it is the most convenient solution. It has a vast scope comparatively to ship and rail, thousands of airports and landing strips worldwide. It is indeed the fastest method in most circumstances and operates on a fixed schedule. This is a major advantage that can be exploited by businesses that have perishable goods and the ones that require prompt deliveries. Planes transfer the product in secure and protective condition, it has rigorous checkpoints and little interference during the flight. However, it is certainly the most expensive mode and include checkpoints, maintenance, special handling fees for certain materials, shipping containers, etc. Businesses should consider product size, capacity limitations, along with other restrictions which are sometimes difficult to navigate. However, if the expenses are suitable and the business is highly reliable on fast deliveries it will be an ideal mode [16].

To decide on a transportation mode a business is considering the characteristics of the product, time frame, capacity, and the budget. Despite the road freight, most other ways require intermodal transportation system which includes two or more modes of transportation combined in order to deliver the product to its destination. Lastly, the terms with transportation providers are discusses to get a safe and secure delivery.

A secure packaging is required to ensure that the product arrives in a proper condition, especially when traveling across international borders. A package safeguards the product during the delivery process and contains all necessary information for the transportation provider about the customer's location. It is supposed to be practical and convenient enough, so that it will meet storage requirements and survive during the transportation. Usually, businesses propose their customers to choose the type of packaging themselves on their website. Technically, protective packaging might be made from any materials including plastic, cardboard, and metal. However, sustainable companies chase after fully recyclable ones. In fact, nowadays customers are also becoming more mindful about their purchases, so they often seek sustainable companies and prefer eco-friendly packaging. To get the most out of packaging, businesses tend to add promotional material and labeling on it. It is intended to attract potential customers and differentiate within other packages. Visibility tends to increase product awareness and excessive promotion is generated along the transportation chain. However, it may also increase the risk of theft as it may become too distinctive and catch attention of dishonorable labor or thieves.

1.3. Future of Supply Chain Management – Blockchain and Technological Advancements

A growing interest in blockchain technology emerged to the supply chain management. Primarily, blockchain is a shared ledger that records and stores transactions, tracks assets and share relevant data in a business network. Blockchain include a decentralized database that is distributed among different nodes – servers of business stakeholders. The nodes automatically check how the information is matched among the servers and has a fault tolerance. If a node is removed, the system continues to work. A centralized system is easily hacked, but a decentralized one cannot be completely hacked. Even if something happens to one of the nodes, data is kept simultaneously on different servers and is recorded. A hacker will face a scalability challenge because it is rather hard to cope with all users of a ledger at a single time. Each block of data is signed with a 'hash' – a mathematical algorithm based on the record. Each chain record is followed by other records which makes it chained together through encrypted data. Each new block in the chain makes it more secure. Therefore, the cryptographic algorithm and decentralization of the blockchain makes it almost immune from attacks. To steal an asset in a blockchain a person needs a secret code called a 'private key', but it is never shown to anyone but the owner. Unfortunately, nothing is completely impossible, and a big quantum computer can potentially break the encryption technology used in the blockchain. If a fraudster or a group of fraudsters could gather enough resources, they can attain more than 50% of a network meaning that they will get partial control over a ledger – called 51% attack. Other ways how fraudsters could gain access is phishing, routing, and sybil attacks. Phishing is a scam attempt to get user's credentials by sending emails as if they are from a legitimate source which have fake hyperlinks with fields asking about credentials. Routing attack is possible if a third-party software is introduced into work of user's provider. Even though the nodes are scattered around the world, different internet providers communicate with each other and can affect the network. To carry out a Sybil attack, fraudsters

unite and control significant number of nodes in the network. After having the access to required number of nodes, fraudsters try to disable the network by managing valid and creating non valid transactions. The harm from such attack can manifest in different ways, from cheating ratings to falsifying votes. In case a fraudster succeeds, he can conduct a 51% attack and see the flow of ongoing transactions.

Even though hacker attacks are possible, a decentralized blockchain system is perhaps one of the most secure data protection technologies currently available. Nowadays, businesses start to implement such technology in their management. In fact, a private blockchain is not vulnerable to 51% attacks, but the business should still be ready to manage risks. A strong cryptographic key management and implementation of a multi-factor authentication will help to secure the application. A business should also consider the data privacy, key management, identity access management and smart contract security.

A smart contract is a self-executing document that defines an agreement of the parties and is embedded with rules and conditions between them. It requires certain parameters needed for shaping the codes and rules for auto-execution. Supply chains became a significant use case for smart contracts engaging multiple parties. They are most useful for making payments, recording ledger entries, and altering for manual intervention. Between supply chain parties it can be used to define the cost of manufacturing products, timelines for product delivery, responsibilities of the parties, payment terms and conditions for making invoices. Smart contracts are launching automatically when specific factors are determined. In example, a supply chain manager can make a contract for an order with parameters and transfer the payment into a holding account. The sum will be deducted from the holding account automatically without human intervention. The use of smart contracts decreases the burden of managing high extent of paperwork and reduces the delays in payments and order processing. Smart

contracts are transparent for inspection as all involved parties have an access through a shared ledger [17].

A business should consider applying a blockchain technology in their supply chain management if there are many parties involved, who would like to record secure transactions, prices, location, quality, certification, and other relevant data about production. It can be more convenient for the business stakeholders to complete transactions directly without centralized intermediaries such as banks. Since transactions and other operations are performed without third parties, the costs should be reduced. Distributed ledger can facilitate faster and easier payments at a shorter time and lower fees than banks.

A business can track the path of the inventory and record information in real time, so that all parties can control where, when, and what is being transferred. In international trade, monitoring accurate production and transportation data will appear extremely convenient and reliable. In fact, WMS data that allows business to manage the warehouse, logistics, equipment, and ordering processes can be integrated into blockchain application as well. A WMS software simplifies processes in distribution centers and helps in inventory management. Storing WMS data in a blockchain will make it resistant from reset, alteration, or deletion. Data is chained in a chronological order and cannot be edited. Only new blocks of data could be created. This ensures the reliability of information, and that no employee will make irrelevant or accident changes. The RFID sensor technology allows supply chain managers to track inventory with the use of tags and scanners which provide data that will become an automatic trigger. RFID is considered one of the fundamental parts of Internet of Things (IoT) – a technology which includes certain devices that could be added on required objects, such as vehicles or inventory. A decentralized ledger combined with the internet of things (IoT) and a GPS tracking system can empower company’s visibility of monitoring and tracing goods along the supply chain [20]. If GPS tags will be added to inventory

loads, business can trace these tags along the way at all warehouses. Employees in turn will upload the necessary data such as parameters of the products, certificates, insurance, inspection control, and delivery information into the blockchain. The history of transactions is also included into blockchain and could be accessed by all stakeholders of the business. The data is to be stored chronologically in the common space available to an unlimited number of participants who are involved in the process. All information in the blockchain will be encrypted and protected. The technology will eliminate unnecessary steps in the supply chain and provide transparency of the processes. All participants will be able to see who and how interacts with each other. Such transparency may increase trust across business network. The main advantages identified for the blockchain adoption in SCM are improved visibility, transparency, and reduced costs [21, p.3]. The main barriers to adopt blockchain massively is the lack of universal standardization of protocols, legacy systems, governmental restrictions, regulations, digitalization of legal documents, and other consensus mechanisms. Certain components of blockchain such as smart contracts require regulatory support. In case if the regulatory system does not cover them, it hinders blockchain adoption and investment in it. This acts as a barrier for global trade because some countries don't yet have legal electronic document management. To pass this challenge, specific regulations should be created for blockchain by Government and highly controlled sectors. The next disadvantage is the eliminations of jobs, because the technology reduces substantial number of works created in traditional centralized systems. Therefore, people may have resistance towards the new technology, especially those who lack understanding in modern tech sector. Widespread skepticism and lack of knowledge limits the trust towards blockchain integration. Some businesses don't yet understand what is blockchain and how it can empower management system. Initially, blockchain came from cryptocurrency and many still associate it with fraud and speculation only.

However, nowadays it can be applied not only in crypto world, but in business processes such as SCM. There is also an extent of environmental damage, due to high energy consumption. Considerable electricity usage required for implementation of blockchain techniques result in greenhouse gas emissions, pollution, noise, and other local impacts [18]. Businesses that highly value sustainability may resist adopting blockchain until the environmental impact could be lowered. However, if a business will see more advantages than disadvantages and realize the perspective to leverage supply chain capabilities it may reassure its priorities. Blockchain is a revolutionary technology that can transform supply chain management by embedding security, transparency, information sharing, fast transactions, and efficiency into the business network. Adopting such technology, a business can alter all processes from sourcing raw materials to delivering the final product. Like any technological innovation, blockchain will require time to mature and reach global market adoption over coming years. The potential of blockchain development include the shifting of trust from centralized entities to automated smart contracts, decentralization, and digitalization [19].

Natural Language Processing (NLP) is an element of AI and machine learning that has a potential for decrypting huge amounts of foreign data in streamlined manner. This can reduce or exclude the language barriers between stakeholders and decipher information simultaneously. From CSR or Sustainability & Governance perspective, NLP technology could streamline auditing and compliance which were previously unavailable due to human factor [24]. Foreign documentation, description, and negotiation will be processed faster because automation will eliminate language barriers and translate information to the required languages.

Predictive analytics and machine learning can be used in supplier selection process and relationship management. Selecting and sourcing from appropriate

suppliers will improve CSR, sustainability, and ethics. With the help of machine learning, the data sets of supplier audits, assessments, and credit scores could be gathered. Passive data could be made active and become more predictive and intelligible than ever before. The information generated by machine automation is easily accessible for human inspections. This could act as a basis for decision making to achieve best supplier scenarios.

Businesses can create chatbots for operational procurement that will analyze datasets and access necessary information. Chatbots can process an order or an invoice and communicate with suppliers. It will send them information about the product capacity and delivery dates. The reminders are usually trivial and primitive but include the main information about the task.

Machine learning can forecast inventory, demand, and supply. Intelligent algorithms analyze and process big sets of data at a faster rate than a human being. This balances the inventory levels and optimizes the delivery of goods. Machines are constantly improving and learning. They involve an endless loop of forecasting abilities which in future may fully reform the warehouse management.

AI and machine learning are already applied by businesses worldwide. The future lies within automation and machine work. Eventually, many jobs will be replaced because it will optimize efficiency. Of course, it will increase unemployment and eliminate certain labor segments, but businesses will not refuse from an option to elevate profits and bring operations on the next level. Supply chains can become faster, cheaper, and more accurate in shipping [22]. AI reduces lead time, labor, and transportation expenses. In future, if vehicles could be optimized to the extent that certain business analytics are hypothesizing, the impact on logistics will be huge. In comparison to drivers who are restricted from more than 11 hours per day without an 8-hour break, a driverless truck could possibly drive 24 hours non-stop doubling the output [23].

1.4. Reducing Uncertainty in Supply Chain Management

Uncertainty can be defined as the inability to foresee probabilities of the future events. In supply chain management it refers to the change of profitability and balance due to unexpected events that disrupt the movement of products. It can be an upstream (supply) uncertainty, downstream (demand) uncertainty, and internal (process) uncertainty. A late delivery from a supplier, unexpected order, or a breakdown in production becomes an uncertainty. A pandemic, crisis, inflation, exchange rate, and an extreme event – are external factors that can also contribute to uncertainty. It becomes a critical point when a business cannot meet the demand of the customer or predict it. In such volatile environment, deterioration in supply chain decreases productivity, influence market share and reputation. This in turn, reduces business profitability and financial health.

The COVID-19 massively disrupted supply chains all over the world, resulting in massive supply shortages due to pandemic-related restrictions. While some sectors experienced extreme demand due to relevance of production, others experienced low or no demand. In 2020, supply chains and flow of goods were simultaneously stopped. The plants in China, which supplied huge number of businesses, were closed and its production became standstill. Industries couldn't procure goods as they did before, so it brought severe financial consequences and bankruptcy for businesses that couldn't withstand the crisis. Extra damage experienced industries that relied on just-in-time deliveries. These include tech, manufacturing, automotive, and retailers.

Logistics was hit hard by the pandemic, border controls in European countries had huge traffics – the trucks could be waiting up to 15 hours. Periodically, due to the circumstances drivers were supposed to quarantine for 2 weeks resulting in a shortage of available workers. This prolonged the delivery time and resulted in severe delays.

Air freight gained a somewhat advantage from an urgent need and high demand for masks and vaccines, but it still suffered from border closures and other production shutdowns. As borders were partially closed, freight charges increased, and fewer options of transportation limited urgent deliveries. Maritime shipping was also because seaports were partially closed. European countries (especially Germany) experienced not only rising charges, but freight container shortages. This made maritime shipping not an option for most businesses.

Rail was the optimal transportation mode as it was least affected by the pandemic. It was a solution to solve many business problems. While trucks were standing in huge traffics, train transported essential goods. A train can replace about 50 lorries in terms of capacity, and it is easier to find a single driver instead of 50. It also means a single COVID-19 test to pass. There were more opportunities to transfer goods by this mode. In example, a German DB Cargo, a single wagonload, and a unique transport service in Europe allowed transporting even small capacities by rail. This came out additionally helpful. Generally, rail mode was in a winning position when the borders were closed – it requires less employees, it is relatively contact-free, and allows transferring high capacities over long distances by convenient and stable routes of Europe. Numerous advantages have proved that rail is a secure transportation mode and is more resistant to pandemic-related factors [25].

As previously mentioned, there are three main factors of supply chain uncertainty. The first one is supply uncertainty – related to material sourcing that can manifest as unavailable supply capacities, inadequate pricing, poor quality, lack of alternatives, delivery dependency, and lead time. These factors can result in postponing or even shutting down the production. Consequently, ineffective management can deteriorate customer behavior leading to excess stock and logistics expenses. Poor supplying decisions can harm the business even in a stable environment, but during extreme situations it can lead to a business closure.

Demand uncertainty is related to unpredictable changes in the customer behavior and tastes. It can be either a sudden increase or decrease in the demand for certain product. Global market is extremely competitive and offers a great variety of products. International businesses can deliver any product worldwide providing customers with unlimited choice. Businesses which cannot adapt to constant trend changes will find it hard to predict customer's demand in the long run. External factors can also affect customer uncertainty. Unpredictable events may lead to a surge in certain products. In example a demand for sanitizers and masks during the of COVID-19. However, some goods became completely irrelevant during the pandemic lockdowns and businesses that couldn't offer alternatives were ought to halt its production. [26, p.39]

Process uncertainty is related to unpredictable internal behavior within the business – labor issue, machine breakdown, high turnover, and problems with technologies. Although digitalization can benefit the business performance, new machines and advanced technologies require investments. Evidently, not all businesses are ready for additional expenses. In case of high turnover rate or labor issues it is also hard to manage operations. Employee's decision to quit the job can be influenced by issues with job satisfaction, transparency, communication, culture, and ethics. In this case, the business should concentrate on improving the internal environment to prevent uncertainties in the long run.

The best solution to cope with supply and demand uncertainty is, again, having a safety stock. The businesses will be able to meet unexpected demand and deal with supply pressures. It will have enough products to meet unforeseen demand surge and will win some time to receive new supplies. Similarly, if the business has an excess stock, it has more time to search for alternative suppliers with better terms of agreement. This will not harm company's financial health if current suppliers are delaying the material supply or have made unsuitable alterations in price or quality. Suppliers' incapability to meet business quality and delivery

requirements could be mitigated by increased coordination and transparency between the partners. Again, the blockchain technology or integration of AI could bring transparency and automation to business processes and help manage internal and external supply chain communication.

Sourcing strategies can also help with uncertainties. It is evaluated that insourcing and near sourcing are more effective than outsourcing when dealing with supply chain pressures. In example, due to COVID-19 lockdowns, those businesses which sourced goods from foreign suppliers experienced delays in deliveries. Whereas businesses that preferred in-sourcing or near-sourcing were able to manage supply chain faster due to shorter distances and lower barriers.

Insourcing refers to the allocation of tasks to an individual or a department within the organization rather than to a third-party. It enables more visibility, control and quality assurance resulting in greater flexibility. On-site evaluation can take place within the company. However, it requires more labor, costs and tine to produce the required good or service. A business uses its self-expertise and in-house logistics owning the transport, equipment, and buildings. In-sourcing can be used as a strategy to source nearer and prevent disruptions in supply chains.

Near-sourcing is another strategy to avoid uncertainties in supply management by procuring materials or moving some operations within a short distance from where the final product is sold. It enables greater control because the business can regularly visit the sites and check performance. There is less risk of misunderstandings and delays on lockdowns. This offers lower transport expenses due to the closer locations and delivery convenience. Additionally, the businesses may share the same language and culture making communication processes more common.

Fewer supplier strategy can reduce the extent of uncertainty due to a smaller number of involved parties and lower business dependency. It focuses on long-

term relationship suppliers with emphasis on conveniency and quality of the product. A business can bargain to get better prices and benefit from short transportation. The consolidation of suppliers is aimed to focus on the partners with best terms of agreement to reduce costs and improve efficiency. With fewer suppliers to manage, a business can minimize supply chain risks and be able to concentrate on core competencies [27].

Finally, supply chain uncertainty can be mitigated by smarter planning with the use of automated processes. The first step is to better understand the demand and be able to predict it. There are modern forecasting platforms which include AI technology to analyze the business data. In example a CCH Tagetik Supply Chain Planning is an advanced application that can improve forecast accuracy by connecting demand, supply, inventory, production, sales, and operation (S&OP) planning with financial data to give 360 degrees view of supply chain network [28]. Solid forecast could ease the optimization of inventory levels, considering usual demand and safety stock held for unpredictable changes. Automating business management can simplify major processes, increase visibility, support decision making, and control risks. The blockchain technology can share the information among the distributed ledger, so that all stakeholders will be able to view the processes in real time. An improved consistency allows the business to react to any sudden changes and maintain supply chain resilience. AI tools enable a business to track key performance indicator (KPI) in a systematic and autonomous way. A business can compare production performance after altering new mechanisms or new operatives. In example, if a business began using a new machine it can view how it affected the order quantity and customer satisfaction. The AI tools could gather information about the customer activity in chronological order making it easy to compare.

During the pandemic, businesses became aware that they are susceptible to uncertainties. They found out an extent of their dependency on suppliers, especially those businesses sourced from China. After the massive lockdown and experienced crisis, businesses should've assume shifting their operations closer to their borders and implementing in-sourcing or near-sourcing strategies to have more control over the processes. Businesses might consider diversifying their sourcing strategies to secure supply chains. This means that they could combine procurement from local suppliers and foreign suppliers. However, fewer suppliers can offer greater control, quality, and lower expenses.

Pandemic boosted digitalization in supply chain management because businesses discovered the convenience and efficiency of automated processes. It allows making precise forecasts based on gathered data, analyze information, track inventory and logistic processes, communicate, eliminate language barriers, generate invoices, make transactions, share information, and many more. Yet there's more to come because machines are constantly evolving and learning. Thus, it becomes impractical and meaningless to resist modern world and tools that it offers.

There are also environmental uncertainties such as climate change, greenhouse emissions, and energy consumption. This becomes another consideration for businesses – create more sustainable supply chains. Modern trend towards digitalization is controversially merging with sustainability. Although, extensive technological use may cause resource depletion and high energy consumption, the extent of damage could vary. In example electric vehicles are also considered a technology but they are much more sustainable than fuel vehicles. Its greenhouse gas emissions are lower than from an average gasoline-powered vehicles [29]. Even though blockchain is associated with high energy consumption, researchers are now finding its solutions to prevent climate crisis [30]. It could be used to track sustainability of products and monitor

pollution. In terms of business, blockchain can eliminate unnecessary steps and transportation. Potentially, blockchain can reshape the supply chain embedding sustainable activities focused on environment protection. In example, the technology can be used to detect counterfeit production and reduce resource utilization. International Business Machines Corporation (IBM) is developing green assets based on blockchain that track, measure, and reduce carbon emissions [31]. Potentially smart contracts can include carbon taxation policy that will impose to monitor emissions. The advantages of transparency, increased trust, elimination of unnecessary steps in supply chain may eventually overcome the disadvantages. Technology advancements are contributing to increased productivity of the businesses that aim to satisfy customers. Digitalization is an integral component of electronic businesses. Therefore, it is hard to resists its adoption. Electronic businesses should concentrate on technologies that can positively impact their economic system and aim to raise sustainability where it is applicable. Electric vehicles and AI tools that monitor carbon emissions can positively influence the image of a business and contribute to sustainability. A use case of sustainable blockchain adoption is the Sun Exchange – a South African renewable startup company offering to rent or purchase solar panels via internet. The customers include schools, hospitals, and businesses in Africa. Meantime, it uses blockchain to perform payments as it eliminates intermediaries and reduce energy costs by 30% [30]. This means, that blockchain technology is used favorably and in environmentally friendly practices. In fact, automation and low energy robots can be used in warehouses and significantly reduce electricity consumption. In example, AutoStore Robots use regenerative energy and returns it to the battery. They can be exploited fully on solar power systems [32]. Therefore, there are plenty options that can merge technology and sustainability in mutual benefit. Additionally, an electronic business may consider

implementing sustainable practices such as a recyclable production line or use recyclable materials for packaging.

Supply chain management is a fundamental set of operations in e-commerce which handle the entire production flow. On a global scale, it transfers the materials along the chain until the final product reaches the customer. With the rise of globalization, e-commerce became a common factor, but at the same time e-commerce is the main determinant which fosters globalization. The coincidence led to an easy access to foreign goods and services from any part of the globe. While customers take advantage of greater choice, entrepreneurs take advantage from unchallenging market entry.

In modern world, e-businesses computerize most of their processes and supply chain management is not an exclusion. An ERP system helps to plan businesses activities and create effective job scheduling, communicate with partners, and manage the flow of production. A WMS helps inventory tracking when it is being transported, and in the warehouse, where it eases the process of sorting and storing production. Both WMS and ERP systems can be integrated in the blockchain technology that will share information on a decentralized ledger among all stakeholders. Blockchain is a revolutionary technology that potentially can eliminate intervention of third parties currently present in centralized systems. Transactions could be made directly among the stakeholders without an intermediary such as banks. Blockchain can contain necessary documentation, certificates, transportation, and relevant data that will be stored chronologically in the common space. It will maintain transparency, visibility, and reduce costs. All information will be encrypted and protected in most secure data technology. Additionally, AI and machine learning can automate various business processes to support decision making, forecasting, data analyzing, invoicing, transacting, and eliminating language barriers. In fact, there are even options to combine

digitalization with sustainability, which is another major consideration of modern business. It could potentially monitor carbon emissions with the use of technologies, detect counterfeit products, and eliminate unnecessary steps in supply chain reducing excess waste. Businesses can choose to use electric vehicles rather than fuel vehicles, as they are more sustainable and produce less greenhouse gasses. Warehouses can be empowered by robot technology that generate electricity from solar panels. In other terms, businesses can introduce recyclable product lines and use recycled material for packaging.

A business may form a partnership with a 3PL service and outsource its logistics and warehousing making it easier to cross international borders. A 3PL provider is more common with import and export, transport documentation, and other regulations. Therefore, the business can concentrate on its core competencies and save capital, that otherwise would be invested in logistics and labor. Warehousing offered by third parties enables greater capacity and scalability, and again it is rather cost-effective. E-business can access a warehouse in foreign market without necessity to construct it themselves and gain additional support from experienced 3PL providers. However, outsourcing operations to foreign parties increase business dependency. Which can become unfavorable during unforeseen events. Supply chain uncertainties related to unpredictable situations in supply, demand, and internal processes. High dependency on the supplier can become a disadvantage, so the businesses might reconsider in-house or near sourcing. At least it could diversify sourcing and keep a safe stock to prevent an out-of-stock situation and prepare for unpredictable surges in demand.

Production is transported by road, rail, maritime or air freight. Businesses can use any of the modes or even intermodal transportation according to their production. However, the analysis has shown that rail is the most secure option in case of unexpected external events, such as COVID-19 pandemic.

To conclude, the supply chain is a backbone of e-commerce that helps a business to meet customer's demand. Evidently, modern trade is moving on a fast pace and require adapting accordingly. The COVID-19 pandemic taught businesses to become more agile in their processes and take advantage of digitalization. Nowadays, businesses became more resistant to uncertainties and should have learned how to cope with risks and unstable environment.

CHAPTER II. STUDY OF SUPPLY CHAIN MANAGEMENT ON THE E-COMMERCE LLC COMPANY “SIGNA SPORTS UNITED”

2.1 Features of supply chain management in the retail holding Signa Sports United

Following the theme of supply chain management and how it is integrated in the modern system of e-businesses, the knowledge is to be applied in a practical way with a review of the holding company Signa Sports United. A successful completion of the internship in a sport company, brough the understanding in the area of research. The knowledge is to be used in the review of an industry giant, Signa Sports United. It is an e-commerce retailer holding company based in Germany, which owns sport-related stores such as Wiggle, Fahrrad.de, Chain Reaction Cycles, Tennis Point, Addnature, and more. Overall, it unites a network of 100 digital stores, partners with more than 500 shops and over 1000 sport brands. Altogether, online platform has over 7 million active customers and over 500 million visitors per year. The company provides an opportunity of the third-party e-commerce and assists its brand-partners in marketing, data analysis, and provides advanced technologies. By acquiring new stores, the company accelerates its market growth and enlarges the sport categories [33]. Currently, it sells products in tennis, bike, outdoor, and team sports.

The main strengths of the company are innovation and technology. The AI systems and machine learning are integrated in their services. Signa Sports United forms mergers and acquisitions with leading tech companies to provide the customer’s best possible experience. In example, a strategical alliance with Motesque – a company focused on biomechanics, computer vision, and AI resulted in the launch of the first ever biomechanical AI-based virtual service

which simulates bike fittings and helps in online shopping. The scientific metrics generate a 3D avatar of the customer and propose a recommendation on the bike size [34]. The engine helps to make the most precise choice in online shopping, replacing the need to visit an offline store. Furthermore, AI-based services are used not only in the bike segment, but also in clothing. In example, Tennis Point, uses an AI service ShoeSize.me which provides shoe fittings [35]. In addition, this AI service attempts to communicate with a customer and ask the same questions as a real salesperson would do in an offline store. Consequently, this tends to engage the customers more and their shopping becomes more entertaining.

The adoption of digital innovations positively impacts the supply chain in Signa Sports United, as it reduces the rate of returns. The logistics became more optimized and sustainable because it lowered the amount of waste released into the environment and reduced transportation costs. In 2022, Signa Sports United secured $152.6 million credit line to foster growth of logistics and technology platform, as a main target for investment.

However, in January 2022, the company reported about prolonged disruptions in the supply chain management, especially in the full-bike and e-bike segment which negatively impacted their performance. Signa Sports United is considered an industry giant, but it hasn’t been immune to COVID-19 restrictions, inflation, and other global pressures. The deterioration in manufacturing and transportation led to an unmet customer demand, limited sales growth, and poor financial performance. In addition to that, one-third of customers favor e-bike category which is even more complex to produce than usual bikes, especially in critical situations. Its frames are integrated with batteries and motor has an electric fitting, so the complications during the manufacturing stage slowed down the output and sales of the production.

Usually, bikes are ordered a year in advance after the Eurobike – a trade fair held in September where new models are being presented. Companies do not stockpile huge capacities, because there are too many new models launched each year. They tend to adapt their annual production output in line with customer's demand, but even with moderate demand sometimes bikes are sold out in few months. Therefore, they are heavily relied on suppliers and manufacturers to be able to restock timely. However, when global pressures affect supply chain, it becomes extremely hard to operate efficiently in such environment and meet customer's demand timely. Furthermore, it requires additional expenses for the adjustment's costs [36].

The supply chain deterioration in the bike category refers to leading bike stores – Probikeshop, Chain Reaction Cycle, Bikester, Fahhrad.de, and Brugelmann (together they are also named "Internetstores") owned by Signa Sports United. To make an accurate investigation on the supply chain management in the company, it is necessary to analyze the supply chain in the bike stores individually. Analyzing the three leading – Bikester, Wiggle and Chain Reaction Cycles will help to understand the deterioration in the bike category and disclose the theme. The stores are giants in European bike market and were acquired by Signa Sports United to enhance its global leadership, especially in bike category. Each store has its individual website, and they are presented together on Signa Sports United platform.

The first store to analyze is Bikester – an international online bike dealer and one of the leading stores owned by Signa Sports United. It offers a wide range of products, concentrates on full-bikes, e-bikes, cycling accessories, clothing, and outdoor equipment. The main office and the warehouse are in Germany, but there are more warehouses located across mainland Europe. The production is available in Germany, Austria, Italy, Spain, England, Finland, Norway, Netherlands, Sweden, Denmark, Belgium, France, and Poland. There is a separate website for

each country, where latest bike-related products are being offered. In addition, Bikester opened its first offline store in Stockholm.

Bikester supply from around 500 bike brands and has a range of 40,000 products. The orders to a manufacturer are made two years in advance, so that the latest bike models could be arrived on time. The store tends to update other categories each month, such as sport accessories and clothing. Whereas, the last year production is usually sold with generous discounts to avoid overstock. The employees forecast the demand for bikes based on the past trends and order's history. Previously, the employees have created an algorithm which helped them forecast a rising trend in gravel bikes and they have managed to supply production earlier than their competitors. In addition, they are investigating the regional trends and specific conditions in different countries to be able to adapt the product assortment for each website.

Bikester have launched their own in-house bikes and equipment under such brands as Votec, Vermont, Serious, Fixie Inc., and Ortler. The production is designed and manufactured in Germany with all stages from planning to finishing processes held domestically. In-house brands are offering high quality bikes for all occasions and have already gained test winner awards. In terms of pricing, the company uses automatic and dynamic pricing for all production, based on changing conditions inside the market. Bikester, has an expertise in bike industry and uses this opportunity to launch creative and new designs based on the market knowledge.

Bikester has six logistic centers in Europe which facilitate fast and convenient delivery. All supply chain processes are controlled centrally, in German office [38]. It partners with physical bike stores across Europe through Service Partner Program to provide even more convenient customer service. The bikes could be shipped to the partner shops for assembly, and customers can use their service and repair technicians. In terms of transportation, they exploit such delivery

services as DHL, UPS, DPD, CargoLine, Hermes, and Koch International. The orders are supposed to be delivered within a week directly to the customer's address. However, Bikester uses separate warehouses for different types of production such as bikes, clothing, etc. This means that sometimes orders are sent in different packages and delivered on different dates, and this will be indicated in an email with all parcel information available for online tracking. The store uses an automated software which detects if the order will be separated into multi packages or sent in a single package and sends this information. Also, in case of personal dissatisfaction or product damage, the order could be returned. Transport insurance supposed to cover the losses, and the company will replace the order without extra charges. In terms of shipping costs, the small products and children bicycles under the price of €99 have a delivery cost of €4.5, products over €99 will be delivered for free, and heavy bicycles and bulk production will have a delivery cost of €29 [39].

Wiggle and Chain Rection Cycles are the next leading bike stores owned by Signa Sports United. In February 2016, Wiggle and Chain Reaction Cycles announced an upcoming merger and soon became Wiggle CRC. It was Wiggle's initiative to merge, so it bought 100% of Chain Reaction Cycles' equity. Then, Chain Reaction Cycles have closed their warehouse in Ireland and moved stock to Wiggle's warehouse – Citadel Logistics Centre in England to minimize shipping and because of the sustainability reasons. Even though the companies have merged, Chain Reaction Cycles left their own name and an individual website [40]. In 2021, Wiggle CRC was acquired by a large sport holding, Signa Sports United.

Wiggle is one of the worldwide leading online retailers of bikes, sporting, and outdoor goods, based in Portsmouth, England. In 2013, it became the sponsor of UCI, women's professional cycle team, and massively increased awareness and reputation. In 2014, Wiggle moved from the warehouse in Portsmouth to Citadel

Logistics Centre in Wolverhampton which has an area of 300,000 sqm. The warehouse is integrated with saving LED light systems and external LED flood systems around the perimeter for better safety and security. It is fully protected with the use of critical technologies including smoke detectors, CCTV, and resilient IT network. In addition, Wiggle CRC is a client of the Supply Chain Consulting Group – a leading consultancy which offer distribution network strategies, automation solutions, warehouse operations and inventory optimization. It provides an advice and assistance in all supply chain management stages and works across Europe and other continents.

Wiggle CRC ships its production to over 70 countries worldwide. In comparison to Bikester, Wiggle CRC successfully operates on different continents. All bikes are being tested by CyTech accredited technicians, who have the necessary qualification in bike industry. The bikes are assembled and then undergo a rigorous testing program. Afterwards, they are again disassembled and safely packed into custom-made packaging ready for transit. This ensures that bikes are perfectly safe and meet the required standards. Usually, it takes about three days to process an order and complete a bike inspection. Most orders are shipped from UK and could be delivered to any continent. However, orders shipped to other countries may require additional charges for custom clearances, relevant duties, and taxes.

Wiggle considers all available couriers themselves and picks the fastest option. In fact, most UK orders are shipped with EVRi Delivery – one of the largest British companies which provides a real-time information for package tracking. A customer can track the delivery on EVRi's official website or in the Wiggle CRC account. In case if the order is not suitable, it could be returned with a refund within a year from the date of purchase. However, to get a full refund the customer must pack the order safely in a sealed box meeting an outlined criteria of return policy. Then, the refund will be issued within five days. There

are also return limitations for customized items, nutritional products, damaged, or used products [41].

Although the stores have their individual warehouses, Signa Sports United have supported them with additional capacity. In June 2022, Signa Sports United formed a strategic partnership with Rhenus Warehouse Solutions – a third party logistics company with one of the greatest bike capacities in Europe. It is located in Hockenheim, Germany, and has an area of 215,278 square foot. The 3PL company has perfect distribution channels to European markets and is cost-effective for Signa Sports United [37]. It enables storing additional equipment of bike units and manage a safe stock.

Together, the bike stores of Signa Sports United are supplying from over 600 bike brands. The most popular ones are Shimano (a Japanese brand, manufactured in China), YAMAHA (Japanese brand with plants all over Asia), Orbea (Spain), Schwable (Germany), Garmin (Switzerland), Castelli (Italy), Vitus (France), Nukeproof (Northern Ireland), Endure (Scotland), Sram (USA), Prime (Austria), LifeLine (UK), Maxxis (Taiwan), and many more. Therefore, Signa Sports United is supplying the bikes from most continents. If bike brands have several manufacturing plants, it only enlarges the extent of the supply chain. Beneficially, the stores have launched in-house brands which are manufactured domestically and could be fully controlled. However, according to the top brand list, customers still prefer the famous bike brands over the in-house. The demand of the customers for the production manufactured abroad result in massive delays due to the supply disruptions.

2.2 Financial performance and statistics related to the deterioration in the supply chain management

Since 2020, the global macroeconomic turbulence affected the most companies, including the leaders in the industry. Signa Sports United have reported about prolonged disruption in its supply chain management. However along with that, the company have recently acquired Wiggle CRC and Tennis Express. Evidently, this supposed to come out as an expense for the company and should be reflected on its financial statements. The next step is to analyze the company's income statement, balance sheet, and cash flow statement to review the current financial position of Signa Sports United. Further, this will complement the full picture of how supply chain disruptions and global pressures affected the company.

The income statement of Signa Sports United is represented in the Table 2.1 with the data collected from a four-year period. It combines the financial data of company's owned stores. The income statement includes important financial indicators such as revenue, gross, profit, net income, and EBITDA. The analysis of its financial indicators will reveal the company's current financial position.

Table 2.1

Income Statement

Data expressed in millions EUR. Fiscal year Oct - Sep.

Year	**2022**	**2021**	**2020**	**2019**
Revenue	**1,062.8**	**813.7**	**644.4**	**537.1**
Revenue Growth (YoY)	30.61%	26.27%	19.98%	-
Gross Profit	**362.5**	**313.5**	**229.5**	**185.5**
Operating Income	-580	-30.3	-14.9	-32.2
Pretax Income	-565.9	-36.2	-29.4	-36.4
Net Income	**-565.7**	**-46**	**-27.5**	**-32.8**
EPS (Diluted)	-1.70	-0.20	-0.10	-2.40
Free Cash Flow Per Share	-0.70	-1.24	-0.69	-

Gross Margin	34.11%	38.53%	35.61%	34.54%
Operating Margin	-54.57%	-3.72%	-2.31%	-6.00%
Profit Margin	-53.23%	-5.65%	-4.27%	-6.11%
Free Cash Flow Margin	-22.12%	-6.55%	-4.64%	-8.73%
EBITDA	**-262.2**	**-5.9**	**3**	**-8**
EBITDA Margin	-24.67%	-0.73%	0.47%	-1.49%
Depreciation & Amortization	308.8	29.1	24.5	21
EBIT	**-571**	**-35**	**-21.5**	**-29**
EBIT Margin	-53.73%	-4.30%	-3.34%	-5.40%

References: Financials are provided by Nasdaq Data [42]. and sourced from audited reports added to Securities and exchange commission (SEC) [43].

Note: this data is compiled with the data taken from Signa Sports United financial report [44].

First important indicator in the income statement is revenue. From 2019 to 2020, the revenue growth in Signa Sports United was equal to ((644.4 – 537.1)/537.1) *100 = 19.98%. Further, the revenue growth was 26.27% in 2021, and 30.61% in 2022.

The gross profit represents the actual profit after the deduction of total costs of the goods sold (COGS). Gross profit showed a steady growth during the four-year period. From 2020 to 2021, it had the greatest growth acceleration. In 2021, it increased by €84 million (229.5+84) and was equal to €313.5 millions. Whereas in 2022, the gross profit increased by €49 million (313.5 + 49) and was equal to €362.5 million.

The net income is the actual entity’s income after deducting the operating expenses, interest expenses, and other expenses from the gross margin. Signa Sports United has a negative net income during the four-year period 2019-2022, but in 2022 the net income declined drastically down to (362.5 -163.3-779.2-21.3--9 - -26.6) = -€565.7 millions. Comparatively to 2021, when the net income was

46 million. Therefore, it declined by (46+(-565.7) -€519.7 million in one year. This was the largest decline during the period of the last four years.

EBITDA measures the company's financial condition. It is the earnings before interest, taxes, depreciation, and amortization. In 2022, the EBITDA is equal to (-565.7+-26.6+21.3+308.8) -€262.2 million with a margin of ((262.2/2,062.8) *100) = -24.67%, which is the lowest measure during the four-year period. There is a rule of 40, if an EBITDA margin is over 40%, the company has strong financial health. However, Signa Sports United has the margin of -24.67%, so there is rather poor financial health. The negative EBITDA which is equal to -€262.2 million confirms it. Comparatively, in 2021 the EBITDA margin was equal to -0.73%, so it is visible that the financial health became worser in one year.

The next financial statement is the balance sheet, represented in the Table 2.2. It includes important financial indicators such as cash, assets, liabilities, debt, and equity. The information in a balance sheet combined with an income statement will help to calculate financial ratios such as debt-to-equity ratio, current ratio, ROA, and ROE. The calculations then will help to analyze if the company can meet its short-term obligations and measure its overall profitability.

Table 2.2

Balance sheet

Data expressed in millions EUR. Fiscal year Oct - Sep.

Year	2022	2021	2020	2019
Cash & Cash Equivalents	63.1	74.7	108.9	117.9
Total Current Assets	439	316.3	297.8	299.1
Total Long-Term Assets	870.5	426.6	384.2	376

Total Assets	1,309.5	742.9	682	675.1
Total Current Liabilities	323.1	187.9	156.3	149.9
Total Long-Term Liabilities	369.1	181.6	178.6	155
Total Liabilities	692.2	369.5	334.9	304.9
Total Debt	359.6	168.1	167.1	140.1
Shareholders' Equity	617.3	373.4	322.7	344.3
Total Liabilities and Equity	1,309.5	742.9	657.6	649.2

References: Financials are provided by Nasdaq Data [42]. and sourced from audited reports added to Securities and exchange commission (SEC) [43].

Note: this data is compiled with the data taken from Signa Sports United financial report [44].

In 2022, the cash and cash equivalents were equal to €63.1 million, including a negative cash growth equal to ((63.1-74.7)/74.7) *100) = -15.53%. Comparatively in 2021, the cash growth was also negative and equal to -31.40%. The decrease means that the company has more outgoing that ingoing cash.

In 2022, Signa Sports United have increased its total assets which were equal to €1,309.5 million. They increased from €742.9 million in 2021. The difference between the two years is equal to (1309.5 – 742.9) = €566.6 million.

In fact, in 2022, the total liabilities have also increased and became equal to €692.2 million. Comparatively, in 2021 they were equal to €369.5 million.

In 2022, the total debt has increased and was equal to €359.6 million in comparison to €168.1 million in 2021. The debt growth is equal to ((359.6-168.1)/168.1) *100 = 113.92%.

Lastly in 2022, the shareholder’s equity has increased and was equal to €617.3 comparatively to €373.4 in 2021.

The Debt-to-Equity ratio (359.6/617.3) is equal to 0.58. Generally, this is a good ratio measure, which means that Signa Sports United is low risk for investors and lenders. It means that is has €0.58 of debt for €1 of assets.

The current ratio measures the ability of a company to pay its short-term obligations, usually within one year. In 2022, the company's current ratio is equal to (439/323.1) 1.36. Actually, a rate higher than 1 indicates that Signa Sports United is capable to pay short term obligations.

Therefore, both ratio indicators suggest that Signa Sports United can expect financial help from investors and lenders and can meet short term obligations.

ROA measures the profitability of the company related to its total assets. In 2022, Signa Sports United has ROA equal to (1309.5+742.9)/2 = 1026.2; -565.7/1026.2 = -0.55 or -55%. Negative ROA shows that the company is not generating the expected returns and rather experience losses.

Finally, ROE shows the relation between profits and investor returns. This measure will show how the generated earnings of the company in comparison to the cash invested. In 2022, ROE was equal to (-565.7/((617.3+373.4)/2)*100) = -114.4%. A negative ROE measure occurred because of the negative net income figure. However, according to how low it is, the shareholders are currently losing on their investments.

The Cash Flow Statement of Signa Sports United is presented in the Table 2.3. It will help to analyze the amount of cash the company has generated during a period of four years.

Table 2.3

Cash Flow Statement

Data expressed in millions EUR. Fiscal year Oct - Sep

Year	**2022**	**2021**	**2020**	**2019**
Net Income	-565.7	-46	-27.5	-32.8
Operating Cash Flow	-190.5	-30.4	-4.2	-22.1
Investing Cash Flow	-238.1	-31.6	-28.1	-29.1
Financing Cash Flow	422.8	17.1	19.8	142.9

Net Cash Flow	-7.7	-44.8	0	91.7
Free Cash Flow	-235.1	-53.3	-29.9	-46.9
Free Cash Flow Margin	-22.12%	-6.55%	-4.64%	-8.73%
Free Cash Flow Per Share	-0.70	-1.24	-0.69	-

References: Financials are provided by Nasdaq Data [42]. and sourced from audited reports added to Securities and exchange commission (SEC) [43].

Note: this data is compiled with the data taken from Signa Sports United financial report [44, p.18].

Primarily, it is visible that most important indicators in the cash flow statement have negative figures.

In 2022, the negative operating cash flow from -€30.4 million increased to -€190.5 million (a difference of -€160.1). This empathizes that Signa Sports United has more outgoing than ingoing cash.

In 2022, the negative investing cash flow was equal to -€238.1 million, making a (-238.1 – -31.6) -€206.5 million difference from 2021.

Lastly, in 2022, the financing cash flow is positive and is equal to €422.8 million, an increase in (422.8-17.1) €405.7 million from 2021. Signa Sports United is a public company, so the financing cash flow could come from issued stock on the NYSE.

After analyzing the main financial statements of Signa Sports United, the consolidated financial summary is provided in the Table 2.4. includes the main data from the previous financial statements, along with quarterly measures and indicators of operating performance such as platform total visits, active customers, net orders, and net AOV. It will help to conclude the financial analysis of the company and make it complete with a use of additional measures.

Table 2.4

Q4 FY21 and FY22 Consolidated Financial Summary

Key financials expressed in millions EUR	**Q4 FY21**	**Q4 FY22**	**YoY Growth**	**FY21**	**FY22**	**YoY Growth**
Net revenue	**€234**	**€300**	**28.2%**	**€814**	**€1,063**	**30.6%**
Gross Profit % Margin	€88	€95	8.0%	€313.5	€362.5	15.6%
Adj. EBITDA	**€0**	**(€29)**	**NM**	**€30**	**(€66)**	**NM**
% Margin	0.1%	(9.6%)	NM	3.6%	(6.3%)	NM
Operating Performance (In millions)						
LTM Active Customers	**4.8**	**6.7**	**39%**	**4.8**	**6.7**	**39%**
Total Visits	72.8	79.2	9%	262.9	319.7	22%
Net Orders	2.1	2.5	21%	6.8	9.5	40%
Net AOV	€95.6	€102.1	7%	€102.1	€101.8	(0%)

Signa Sports United Financial Reports Q4 FY2022 and FY2022 results [44].

Note: This table may be compiled with data taken from sources [42]., [43]..

The consolidated financial summary in the Table 2.4 shows significant measures from FQ and FY of 2021 and 2022, comparing the key financial indicators and operational performance between the two years. Summarizing the change in significant financial measures, the company states that the decrease in the gross margin is related to the discounts which were supposed to help reducing the overstock inventory and drive customer demand. Regarding the net loss, which is equal to -€565.7 million, it is related to the goodwill impairment and extra charges related to public listing in the NYSE. In addition to that, the supply chain deterioration is highly affecting the customer sentiment contributing to lower overall measures. In turn, the decrease in EBITDA is impacted by the gross profit levels and inflationary pressures which increase the costs in challenging operational environment.

The Fig. 2.1 and 2.2 visualize the company's revenue growth and the net loss. In 2022, Signa Sports United had a revenue of €1,063 million (Fig.2.1) and the

net loss of -€565,7 million (Fig 2.2). The revenue growth is mainly dedicated to the closed acquisitions. However, the net loss represents a more realistic company's profitability measure, after subtracting the total expenses. The company shared that the goodwill impairment was at an expense of €244 million and public listing charges on the NYSE was at an expense of €122 million. Along with additional expenses the company resulted with an extremely high net loss. Therefore, even if there initially was an increase in company's revenue, the expenses came out considerably higher resulting in negative net loss [50, p.9].

Revenue in LLC "Signa Sports United" (*in millions EUR).*

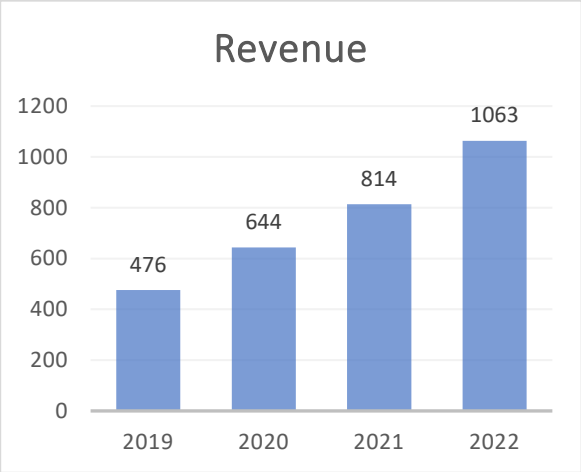

Fig. 2.1

Net Loss in LLC "Signa Sports United" (*in millions EUR).*

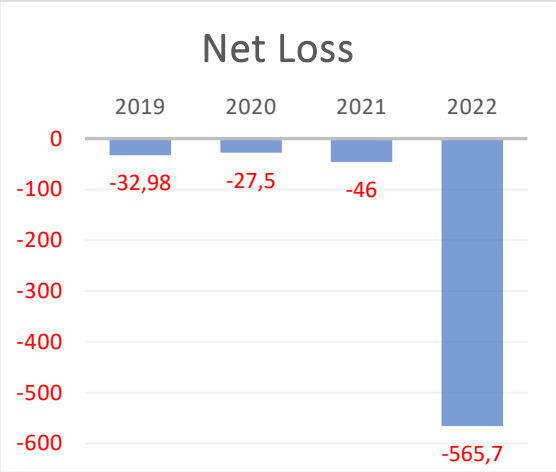

Fig. 2.2

In 2022, in terms of operational performance, there is a 39% YoY growth in active customers which is equal to 6.7 million. The main contribution of such

growth is related to the acquisitions of Wiggle CRC and Tennis Express, combined with marketing that drove conversions. Investment in marketing was a wise decision because organic traffic wasn't as efficient as before because of the customer sentiment. In 2022, there is an increase in total visits equal to 319.7 million with a 22% YoY growth. The net orders have also increased and are equal to 9.5 million with a 40% YoY growth. Whereas, the Net AOV have stayed almost the same as in FY2021, but it has increased at a rate of 7% quarterly comparing the FQ2021 and FQ2022.

In the official annual report FY2022, Signa Sports United reports that it has experienced an unexpected decline in the customer sentiment due to pressures in operational environment and inflation. The deterioration in supply chains have matched with the war in Ukraine. Together, the macroeconomic trends have significantly increased the customer cost-of-living, resulting in the change of customer behavior. All of this resulted in an overstock market and sufficiently impacted the company's profitability. Mostly, it impacted the bike segment and the operations in international territories. The unexpected issues slowed down the planned expansion of its bike business in the U.S. market. In addition to that, supply chain constraints affected the bike segment in its core Germany and UK markets.

In 2022, the challenging macroeconomic environment have impacted the profitability, sales, and cash generation. The company expects that inflation and deterioration in customer sentiment will continue in 2023, and market overstock in sports industry, especially the bike category, will continue even in 2024. Beneficially, the company have closed Wiggle CRC and Tennis Express acquisitions which helped them drive revenue growth. Without acquisitions the financial statements could have been worser, as well as the company's operational performance. To be able to retain profit growth and achieve the

required financial flexibility, Signa Sports United formed an agreement with its lending group [45, p.3].

2.3 The impact of macroeconomic turbulence and the adoption of strategies in Signa Sports United

In 2023, the global economies continue to suffer from uncertainties such as geopolitical instability, rising inflation, falling financial markets, rising interest rates, supply chain bottlenecks, cost-of-living crisis, energy supply crisis, food supply crisis, and more. These external factors are affecting human individuals, societies, and business organizations.

A period of 2020-2022 brough ongoing challenges for businesses worldwide. In 2020, the COVID-19 pandemic disrupted the business operations, workforce, sales, and the supply chains. The second quarter of 2020 had the greatest decline in output and working hours since World War 2 [46]. The manufacturing plants were shut down, production was stopped, and most employees were ought to work from home. However, not all industries were adaptable to such conditions.

Signa Sports United was highly reliable on their suppliers. However, pandemic-related restrictions included the border closures, so there were massive delays in supply. In China, the Government have closed the entire industries and the production was put on stop. As to the bike segment, without one single detail the whole construction of the bike doesn’t work. Hence, as Signa Sports United was heavily reliable on supplies, it had to delay the orders. The company was no longer able to get the required amounts on time. In addition to that, Stephan Zoll, the CEO of Signa Sports United, have stated that German and UK markets, which are the core markets for the company, have experienced the most supply shortages [47].

Ironically, there was a rising trend for bikes during COVID-19 lockdown. As long as people were ought to stay home, many of them began thinking about a

healthy lifestyle. The bikes could also replace public transport, which evoked a lot of anxiety during the pandemics. Therefore, many countries, especially in Europe, rushed to make the bike lanes to encourage a healthy trend. In fact, this rising demand for bikes in 2020 was called “the bike boom” [59]. While the supply chains were a global problem, the demand for bikes in the market was almost exploding.

Signa Sports United reported about a high demand for bikes but stated that it was especially hard to get spare parts and rare products. Also, the last year models were not as easily sold as before, so the company had to set high discounts. While many companies stopped supplying new bikes, Signa Sports United on the contrary began scaling up. It expected an enormous rise in demand and supplied the products which were ordered in advance. Usually, the company makes an order 12-18 months in advance, so even with a decline in production output, it has managed to get an earlier planned stock. In example, in 2020, Bikester reported that their assortment was limited in color and some models were unavailable, but still there was a range of products to choose from. In addition to that, it has adjusted their assortment specifically for each country’s website in order to optimize temporarily limited stock. In addition, the launch of in-house brands was strategically beneficial in such conditions because it decreased the dependency for international suppliers [48]. However, customers still preferred more popular bike brands like Shimano, which is manufactured in Asia and was extremely hard-to-get. Indeed, the Financial Times have even reported about the supply chain problem in the global bicycle market due to the inability of Shimano’s bike parts being delivered [49]. Therefore, the lead time for the transportation of new orders have sufficiently increased. However, Signa Sports United was in a beneficial position, still being able to meet the rising bike demand with a range of available products.

The increase in the net orders in Signa Sports United is shown in the Fig. 2.3 which demonstrates the growth of the net orders during a four-year period. Importantly, the net orders are calculated after the cancelation and full returns. It is visible that by each year the number of net orders is steadily increasing, proving the phenomenon of the "bike boom". In 2022, the company's net orders were equal to 9,5 million, which show a 4 million growth since 2020 (5,5 million). While many industries during the pandemics struggled from the decline in demand, the demand for bikes was enormously high. In fact, the highest demand was for the e-bikes. Currently, they are becoming more affordable and may outpace the standard models in the next few years. However, the number of net orders might have been even greater if not the global supply pressures.

Net orders in Signa Sports United (in million)

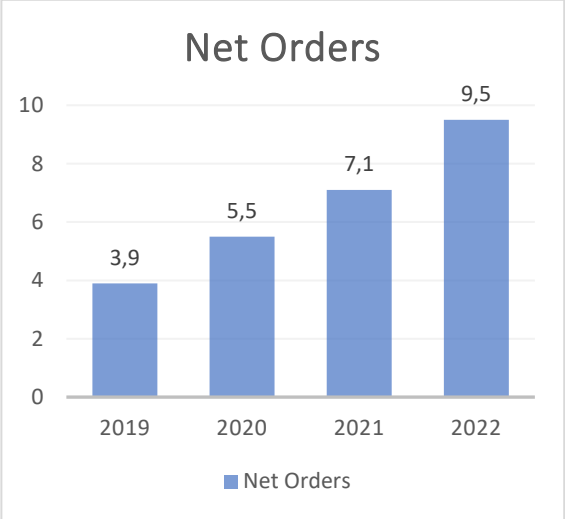

Fig 2.3

To continue the impact of global pressures, the Fig. 2.4 represent the Global Supply Chain Pressure Index (GSCPI) for the period from the beginning of 2017 to the beginning of 2023. From 2020, it is statistically visible that the index shows an accelerated growth representing massive supply chain disruptions occurring all over the world. During 2020, the index fluctuates and by the end of the year it

declines. However, few months was not enough time for the companies to recover. The constant closures of ports due to COVID-19 outbreaks and high shipping costs, especially from Asia to Europe and the U.S., were a great concern during the year.

Since the beginning of 2021, the index showed a steady growth again. In fact, in the end of 2021, the GSCPI reached its peak above the historical mean with a standard deviation of 4.3 [51]. In 2021, the COVID-19 cases began to rise again with all following restrictions. In addition to that, extreme weather conditions such as hurricane Ida, affecting the temporarily plant closures, and Suez Canal blockage, contributed to the global supply chain disruptions during the year.

Since the beginning of 2022, the index showed a steady decline meaning that the problem of global supply chain disruptions was partly resolved, and businesses experienced less frustration on the supply side. In fact, in October 2022, the GCPI Index reached its minimum level during the period of the two years. By the end of 2022, the factors which mostly contributed to the GSCPI fluctuation was Asia outbound air freight costs and Korean delivery times.

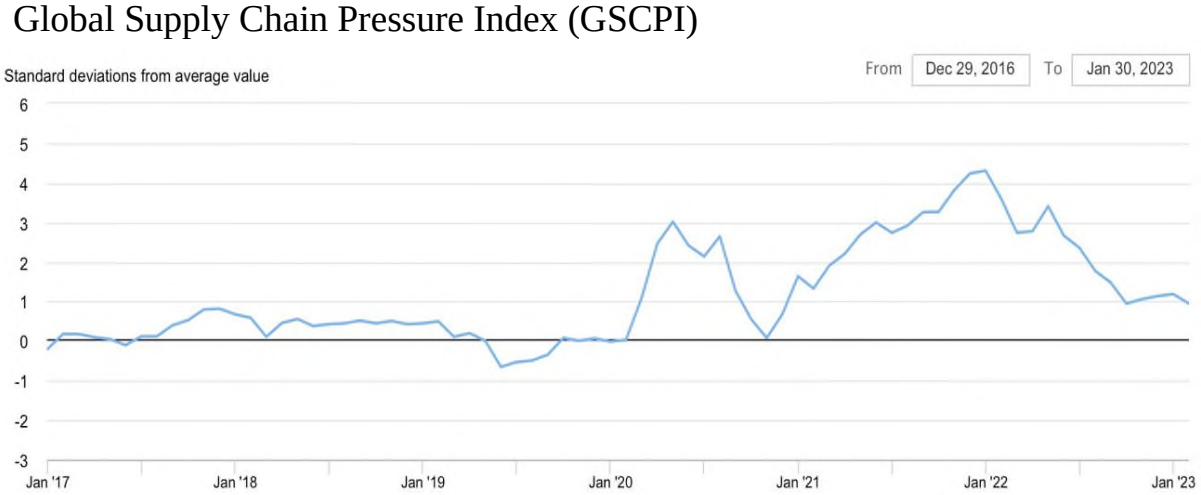

Fig. 2.4. standard deviation of the GSCPI [52].

When global pressures began to affect the company's performance, Signa Sports United have postponed some of its projects. The company halted the initiative to expand its operations across the U.S. market. The ongoing outbreaks of COVID during 2020-2021 period have significantly increased the prices of raw materials and reduced the production output. Due to the high dependence on components, the company requires timely supplies. However, the international transportation restrictions affected the global supply chains. The closures of shipping ports and airports along with safety regulations impacted the worldwide increase of shipping costs and time of the delivery. In 2020, all bike manufacturers were unprepared to meet such substantial increase in demand. The lockdowns have impacted their production output and it was considered lower than normal output levels. Therefore, the companies were lacking 2020 and 2021 bike models, resulting in a substantial production shortage. To get all variations of colors, sizes, and specific items was almost impossible. Shimano, one of the most popular supplied brands of Signa Sports United, have reported that European bike assemblers are in surge in orders, but the U.S. retailers are already out of stock. In fact, the Shimano plants in Singapore and Malaysia were strictly forced to close during lockdowns [53]. If some bike models required compulsory parts, the component shortage resulted in the inability to assemble bikes and make them ready for sale. Although the demand for bikes in the industry was never as immense, the Governments, especially in Europe and Asia, were highly regulating the closures of manufacturing plants.

Shortly after the beginning of the pandemic, there was another global issue – scarce availability and high cost of shipping containers. It was additionally impacting the supply delays. The Fraunhofer Center for Maritime Logistics and Services (CML), a port organization, came up with a conclusion that container shortage occurred because of the turnaround time of containers from Europe to Asia. Before the containers were shipped back to Asia, they spent more than 50

days in the European, U.S., and U.A.E. ports. In contrast, the container spent only 5 days maximum in the Asian port. The container companies were taking an advantage from this situation and increased the price for the container at 9 times from 2019 to 2021. If in 2019, the container price was $1,000, in 2021 it was $9,000 [54]. For Signa Sports United, it meant that even if the bike was assembled and sent as an order, it may have been delayed to a customer because it haven't been unloaded or haven't even reached the container stage due to their shortage. Therefore, a customer may have been waiting for about two months for the delivery of an order. In March 2022, 60% of container shipments were still delaying, meaning that the container shortage remained.

In 2022, the greatest challenge for global supply chains became the ongoing war in Ukraine. As a result, the war fostered global inflation, increased prices for fuel, energy, food, and other necessary commodities. The increased prices for petrol and diesel are making road transportation more expensive. The U.S. department of energy reported that the price for petrol have increased by 49%, while price for diesel increased by 55% [55]. In Spain, the logistics' companies even made strikes because of the high fuel prices. However, the increased expense on logistics isn't the only issue. The companies also suffer from increased prices for raw materials. Such rapid price inflation forces the companies to consider cheaper materials and methods of logistics, because the situation leads to the increase in price for any goods. Along with the road transportation, the war has disrupted other forms – maritime shipping, air freight, and rail transportation. The airspace and landing restrictions resulted in numerous cancellations of airlines and impacted the cargo freight. Ukraine have closed airspace for civil flights, and the Russian airspace is banned for the EU countries, so the airlines are avoiding the routes which include either country's airspace. The airlines had to change its usual routes, and especially it affected the routes from Asia to Europe and contrariwise. The rail freight which transported goods through China-

Europe corridor also went through Ukraine. During the past 2 years, Ukraine attempted to accelerate traffic volumes through its territory, and more international companies began to trust this route. In 2021, the transit through Ukraine was equal to 2% of westbound traffic volumes on the New Silk Road [56]. However, the Russian invasion damaged Ukrainian transport infrastructure, disrupting international logistics and making it dangerous and impossible for previously used transit flows. Therefore, the companies had to change their transportation routes. In terms of the maritime logistics, the war also cut off many important routes. The Azov Sea and Black Sea ports in Ukraine were temporarily closed due to the danger of missile attacks. For the companies, maritime routes through Ukraine also became impassible.

According to the International Chamber of Shipping (ICS), together Ukrainian and Russian seafarers amounted to 14.5% of global shipping workforce [57, p.637]. Hence, the war becomes another challenge for the global maritime workforce, because EU fleets heavily relied to them. Without substantial number of workers, the maritime shipping lacks not only containers, but qualified employees. The challenging environment combining with disrupted supply chains and container shortage impacts the delivery of the bikes of European companies, including Signa Sports United. The uncertainty reaches manufacturing and delivering processes. The high-end bicycle brands, such as Shimano, reports that the challenge to assemble bikes timely will continue in 2023. Several bike parts may take from 6 months to 2 years of lead time, in comparison to the usual lead time of 2-3 months. This occurs because several parts are extremely short in supply globally. Therefore, the companies will struggle from the lead time of new orders.

As a result of the war in Ukraine, the European countries were highly affected in terms of food and energy markets. The rising prices for energy, food, and commodities are intensifying the cost-of-living crisis, leading to the complete

deterioration in the customer sentiment. Stephan Zoll, CEO of Signa Sports United, have reported that bike segment was highly affected by the customer's behavior due to the inflationary pressures and war in Ukraine [47].

The main strategy of Signa Sports United during global pressures is to focus on its core markets – Germany, UK, and mainland Europe. If previously, the company wanted to expand its market in U.S. and Asia, after the increased global uncertainty it might rather choose countries where it has an established awareness and strong market position. In Europe, the company is already a market leader in the sports industry, so it has more confidence during turbulent times. In addition to that, Signa Sports United considers expanding its consolidation opportunities by acquiring and merging with more successful companies.

Concretizing, Signa Sports United focused plan for 2023-2024 includes three main components:

- Focusing on the core markets
- Adapting commercial and operating models
- Delivering transaction synergies

Firstly, by focusing on the core markets Signa Sports United wants to put on pause its international logistics expansion. The company will not yet expand the territories where it currently operates and delivers its production. It wants to phase down its international partnerships or refocus them. In addition, it plans to optimize the pricing and service levels for contribution. As a result, it aims to increase the gross profit margin and keep overhead costs in control, including marketing expenses.

Secondly, by adapting commercial and operating models the company wants to make its stock management more efficiently organized. It wants to enhance the order economics to be able to purchase the necessary quantities and meet the demand of the customer. In addition to that, the company plans to optimize the

cost base by adjusting the values, so that the values added on top of the production costs will be more cost-efficient. If the costs for the supply and manufacturing increased, then the costs for the production might also increase for the better profitability. Also, the company may optimize its discounting prices for the last-year models which reduce overstock of last-year production. It also wants to reduce the complexity of its common operating procedures, what can be done by integrating IT and machine learning. As a result, these actions are aimed to reduce overhead costs and increase stock turn.

Lastly, by delivering transaction synergies, Signa Sports United means that it's stores could cross-sell own brands and contribute to revenue synergy. Again, this involves mergers and acquisitions that will generate more revenue than a single entity would do by operating separately. The cost synergies are also planned to be implemented in the procurement strategy by optimizing the commercial terms of supplying. In addition to that, the company plans to increase efficiency from consolidating logistics footprint and technology. This means that it will optimize logistic processes in order to reduce shipments and achieve lower transportation rates. Taking the fact that the company often ships one order in multiple parcels, it may combine the parcels into a single one by gathering the stock into a single warehouse. This will also positively impact sustainability and lower the company's carbon footprint. Also, Signa Sports United plans to consider more advanced technologies in order to generate more efficiency from its operational processes. It wants to introduce an approach of lean operations which is a minimalist strategy aimed to reduce the time spent on the non-value-added tasks. As a result, it plans to increase revenue, gross profit margin, and reduce expenses.

Signa Sports United reports that the impact of the planned changes can reduce its sales, especially in the international markets. However, the sales generated from the core markets could beneficially contribute to overall company's

financial performance. It expects a gross market contraction in the first half of FY2023 and its recovery in the second half of FY2023. It is related to the maintenance of targeted inventory levels in the bike market. In FY2024, the lean operation approach is planned to result in the cost benefits. From FY2024, the transaction synergies are also planned to bring results after the IT innovations and IT re-platforming of Signa Sports United. The FY2024 cost benefits also relate to the logistic consolidation and procurement strategy. However, the focus on the optimization of inventory levels is expected to release capital of about €30-€40 million. But even if it will lower the company's revenue levels at first, it will come out beneficial in the long term. Such capital commitments will improve financial flexibility and allow the execution of strategic realignment of operations.

The company plans to make advantage of such global megatrends as sports digitalization, shift from offline to online, e-mobility, green transport, and healthy lifestyle. By acquiring more sport's retailers, the company aims to subscale regional competition. It wants verticalize and grow in terms of portfolio of brands and target smaller brands with strong intellectual property in its category. Moreover, the company plans to enable the brands to operate in D2C (direct to customer) form [58, p.22].

The SWOT analysis in Table 2.5 can help in defining whether the execution of strategic realignment is possible in a short-term period. It visualizes the main company's strengths, weaknesses, opportunities, and threats. Firstly, there are more strengths and opportunities than weaknesses and threats, on which the company may ground. It has a high market share and significance in European market meaning that its regional position is rather stabilized. Their strategic partnerships should help in cross-selling brands and marketing to promote production across core-markets. The formed agreement with lending group ensures financial assistance to achieve the predetermined plan. The weaknesses

are more relatable to the effect of global issues and U.S. operations. The company haven't yet gained the same success in the U.S. market, but it already established a warehouse there and issued stock, so the first steps were made. In the future, the company may have an opportunity to receive foreign investments and form M&A with U.S. stores to increase their market share in new region. The considered threats are mostly external economic and social factors that can hamper their strategy execution. Unfortunately, the company cannot influence the external factors. The only solution is to increase business resilience and exploit current strengths and opportunities.

Table 2.5

SWOT ANALYSIS – Signa Sports United

STRENGTHS	**WEAKNESSES**
• The brand is a leading tech platform and bike company in Europe. • High market share • Use of advanced technologies. • Stock listed on NYSE. • Presence in the U.S. market. • Strategic partnerships. • Effective M&A. • Sustainability achievements and sustainable logistics such as climate compensated shipping and use of electric vehicles. • Marketing instruments inside the platform. • Marketing alliances with digital companies. • Formed agreement with lending group.	• Supply chain constraints. • Overstock. • Small market share in U.S. • Negative profitability. • Increase of long-term and short-term debt.

• Steadily increasing net orders.	
OPPORTUNITIES	**THREATS**
• Strong advertising campaigns in U.S. to increase community awareness. • Cross-brand promotion as long as it partners with various brands inside the industry. • Foreign investments. • M&A of U.S. bike leaders.	• Deterioration in customer sentiment and operational environment. • Rising inflation and economic instability. • Debt default. • Cost-of-living crisis. • Increased prices for logistics.

Table. 2.5. Source: compiled by author.

Further, to define the company's opportunities and threats inside the European market, the Table 2.6 represent PESTEL analysis. It helps to recognize the macroenvironmental factors that Signa Sports United is facing. Particularly is shows the political, economic, social, technological, environmental, and legal factors.

Firstly, EU has a free trading area which enables easier trade with limited or no barriers. This is highly convenient as it provides more transparent and predictable trading environment. The economic factors are not as positive because the geopolitical tensions impacted inflation, rising interest rates, and fuel prices. The company may have to consider cheaper methods of supplying and transportation to reduce overhead costs. Consequently, the social factors are coming from economic instability and result in changing customer sentiment and behavioral habits. The cost-of-living crisis lowers the demand for production and may impact future net orders. Therefore, the company may have to consider lowering their prices closer to the pre-pandemic levels. Otherwise, the overstock market may not eliminate excess production. The technological factors with increased automation, technologies, and blockchain are rather relatable. As long as the company integrates technological advancements, the rising trend is highly

applicable and could be exploited beneficially. In fact, environmental factors are also positive for Signa Sports United. Green consumption, movement towards sustainability, reduction of ecological damage, and recycling correlates with the value of the company. Furthermore, bike riding is considered green and sustainable transportation mode that is pollution free. Lastly, legal factors are less relatable to the company. However, health and safety legislation can correlate with bike riding as long as it promotes wellness and ensures health of the employees. Therefore, PESTEL analysis represented rather optimistic forecast for the company's development in the EU. If it will adapt to the economic and social environment, the other factors will enforce the implementation of strategic plan.

Table 2.6

PESTEL analysis – Signa Sports United

Political	Economic	Social	Technological	Environmental	Legal
• Free trade area in EU. • Political stability.	• Rising inflation. • Increasing interest rates. • Increasing fuel prices. • Economic instability after invasion in Ukraine.	• Changing customer behavior. • Cost-of-living crisis lower the demand for multiple products. • Changing consumption, travel, and behavioral habits.	• Rise of cryptocurrencies (also economic factor) and blockchain technologies. • Increased automatization.	• Recycle policies. • Green consumption. • Movement towards sustainability. • Reducing ecological damage and waste.	• Health and safety legislation. • anti-discrimination laws.

Table 2.6. Source: compiled by author.

Summarizing the chapter, Signa Sports United is a global online retailer which owns sport-related stores. The stores are operating internationally through an online platform with 7 million active customers. The company adopts AI, machine learning, and robotics across its operations to optimize efficiency. Therefore, innovation and technology are across its main strengths. The company's core markets are across mainland Europe, but it also operates in the U.S. and recently became a public company listed in the NYSE.

In 2022, Signa Sports United reported about prolong disruptions in the supply chain in full-bike and e-bike segment. The stores make an order from the manufacturer two years in advance. Together, they supply from more than 600 brands with manufacturing plants in Europe, U.S., and Asia. The bike category stores have warehouses in most European countries, and in the U.S. Multiple warehouses enable the company to deliver production internationally at a faster pace. In 2022, Signa Sports United provided its bike stores with additional capacity and formed a strategic partnership with a 3PL service, Rhenus Warehouse Solutions. Often, the stores keep the production separately, meaning that a single order could be sent in multiple parcels from different warehouses. In terms of logistics, Signa Sports United partner with delivery services such as DHL, UPS, DPD, CargoLine, Hermes, Koch International, and EVri Delivery.

The financial statements of Signa Sports United signify that the company has an increased revenue growth due to an acquisition of Wiggle CRC and Tennis Express. However, high expenses resulted in an increased net loss which is rather a more realistic measure of profitability. The company states that it was highly affected by COVID-19 pandemic restrictions, war in Ukraine, and following global pressures. The external factors have contributed to the financial health of the company and mostly hit their bike segment. In addition to that, in 2022, the expenses increased due to the public listing in NYSE and high marketing investments, because organic growth wasn't as efficient as before.

Eventually, in terms of operational performance, the company showed decent growth. The net orders, active customers and platform visits resulted in an accelerated YoY growth. Ironically, this is related to the COVID-19 lockdown which resulted in a “bike boom” and increased the global demand for bikes and a healthy lifestyle trend. The increased demand for bikes reflected on the growth of net orders. However, COVID-19 restrictions have negatively impacted the global supply chains. The closure of manufacturing plants resulted in low production output and closures of borders caused the delays in supplies and order deliveries.

The company mentioned that it was extremely hard to get rare products and spare details. But ordering production in advance helped to receive earlier planned production.

During 2020-2021, Signa Sports United was suffering from pandemic related restrictions and experienced high dependence on its suppliers. All bike manufacturers and suppliers were not prepared to meet such demand in such tough conditions. The components could not be delivered timely, and the bikes could not be assembled and shipped to the customers. Everything was followed with huge delays. The GSCPI expressed the global supply chain pressures affecting all international companies, including Signa Sports United.

The container shortage issue followed the pandemic pressures. Even when the manufacturing plants have opened and suppliers could ship production, the delays continued because of the limited container amounts globally. The turnaround period of containers was almost two months, so the production continued to arrive with huge delays.

Since 2022, the war in Ukraine became the new challenge for Signa Sports United. It impacted the increase in price of fuel, making logistics more expensive. Along with that, transportation routes from Asia to Europe through Ukraine became impassible for all forms of logistics – road freight, rail freight, air freight,

and maritime. Moreover, the war contributed to the rising inflation and increased prices for commodities and raw materials. This intensified the cost-of-living crisis and impacted the customer's behavior.

To combat global pressures, Signa Sports United plans to focus on its core markets, and put on pause its expansion strategies. The company has a strong market position across mainland Europe, so it will increase awareness and cross-sell own brands. This requires refocusing international partnerships and may include formation of new mergers and acquisitions in Europe.

Secondly, the company plans to reorganize its stock and supply the necessary quantities to meet the demand of the customers. This will follow with cost optimization of stock because the prices for raw materials and manufacturing have increased. The costs for logistics will also be optimized by the reduced number of shipments, what could possibly be done by combining the stock in a single warehouse.

Lastly, the company plans to integrate more advanced technologies and re-organize its online platform. It has even secured $152.6 million credit line to foster growth of logistics and IT platform. Even though that the planned realignments could lower the revenue, Signa Sports United ensures that they will beneficially impact the company in the long term.

CHAPTER III. CONSIDERATIONS FOR THE COMPANY'S DEVELOPMENT IN SUPPLY CHAIN MANAGEMENT

3.1 Recommendations for building international supply chain management strategies during the globally turbulent environment

The theoretical part of the supply chain management in the first chapter was followed by the practical investigation on the international company Signa Sports United. During the second chapter, it became evident that the decrease of the company's financial indicators was related to global supply chain crisis, started in 2020. The COVID-19 pandemic acted as the greatest catalyst of the crisis, and then followed by the container crisis, and Russian invasion in Ukraine. In the beginning of 2023, the global turbulence isn't yet coming to a resolution, and its consequences are highly impacting economic environment. The managers of global supply chains are ought to find new transporting routes avoiding both Ukrainian and Russian transit zones, while the logistic prices are continuously rising, as well as the manufacturing costs. Together the factors increase the costs for products in almost all categories. Signa Sports United decided to minimize risks by no longer expanding its current territories, and rather focusing on the core markets. The strategy is expected to minimize the potential revenues but should increase the actual profit due to stable positioning in the established markets of mainland Europe.

The third chapter will contain research of the most effective strategies for supply chain management during the crisis. It is important to analyze how the world is addressing the challenge of supply chain disruptions and depict effective solutions for Signa Sports United development. The company is already moving towards the right direction and focuses on the core markets. However, there are certainly more strategies and approaches the company can consider in order to

improve their current position. Based on the research, it will become evident which approaches Signa Sports United can take into consideration. The relevant propositions are to be made to elaborate on the company's development.

The entrepreneurs haven't yet recovered from COVID-19 consequences when the new problems have emerged. The war in Ukraine disrupted food and energy markets leading to a change in customer's behavior. The rising inflation is triggering the cost-of-living crisis all over the world. Therefore, while people suffer from high production prices and relatively low incomes many goods became irrelevant. In addition to that, supply chains continue to take longer lead times than expected due to the necessity to adapt to current environment. Logistics prices are rising in terms of all modes – air, rail, road, and maritime freight. The petroleum shortages and its increasing prices also contributing to the supply chain challenges. The companies ought to increase the prices of their products due to material and transportation costs. Long-distance transportation becomes less efficient and takes durable lead times. Therefore, regionalization can become a better option, rather than full-scale globalization.

A fully global company operate all over the world in all major economies, despite the distance, difference in culture, languages, norms, regulations, laws, and preferences. Whereas multinational companies which favor regionalization operate in the neighboring countries with similar cultures, languages, laws, regulations, etc. During the massive supply chain disruptions, the companies that follow regionalization expansion strategy will have an advantageous position because there will be shorter distance and easier terms of business establishment. Expanding regionally is more secure and predictable because raising awareness in a country with customers of similar culture is easier than to those of totally different. In example, if a German company will expand its operations to Austria, the customers of both countries share the same language and have many cultural similarities. However, if a German company expands its operations to China, it

will need a rigorous preparation because customers will have other needs based on their culture and country specifics.

Another reason for regionalization is free trading zones (FTZ) and trading blocs. A free trading area includes several countries which signed an agreement allowing them to have little or no international trade barriers. It reduces the behind-the-border barriers and eases the flow of goods and services between the countries. The FTZ optimizes supply chains by streamlined logistics with lower financial charges, quotas, and prohibitions. It maintains significant cost savings through lower merchandise processing fees (MPFs), tariffs, taxes, and custom duties. A number of regional agreements were formed to increase business growth with a greater freedom of trade. They include European Union (EU), North American Free Trade Agreement (NAFTA), Association of South Asian Nations (ASEAN), and South American trading block – MERCOSUR [60]. The FTZ facilitates international supply chains enabling the companies to procure and manufacture products with lower expenses, leading to lower consumer goods prices.

Regionalization might be the most constructive and effective resolution to lower the impact of global supply chain crisis. Nowadays, the trend of manufacturing the product on one end of the world and selling at another declines [61]. For the companies that are highly dependent on other countries – reshoring might become a right strategy. Returning the manufacturing to the country where the company is located will decrease the supply chain lead time and overall dependency. However, it could be wise not to concentrate everything in one geography and consider nearshoring as well. International companies can reorganize manufacturing to smaller blocks in regional economies. The main idea of the regionalization strategy is to organize supply chain processes closer to where the products are going to be sold. When a business runs its operations closer to the end customer, it gains more control over the supply chain. The

relationships with suppliers are better as they become more local and reachable. The supply chain gains more visibility and distance becomes less challenging. Since 2020, global companies faced numerous challenges, so it was a matter of time for the trend to begin moving towards regionalizing. So, reshoring or nearshoring becomes an attempt to save money and reduce lead time. However, it is takes time to reorganize company's operations and includes additional expenses. There is also a problem arising because in reality the regions are not the same, and yet several types of production are being concentrated mostly in one region. In example, most of raw materials for electronics are manufactured in China, and semiconductors in U.S. Taking this into account, there might be a lack of alternatives for certain types of production rather than leaving suppliers on another part of the world. After all, diversification becomes the most optimal strategy. Having multiple suppliers domestically, regionally, and globally will reduce risk. Of course, the focus lies towards closer regions, but the production native to other regions is best to be left offshored.

A single company cannot stop global challenges, but certainly can minimize risks for itself. Regionalization basically helps to mitigate the challenges of disrupted supply chains in terms of distance, barriers, lead time, transportation, and production costs. However, considering the fact that some raw materials might not have a regional substitute, the companies should keep a safe stock. Having excess production in a warehouse can minimize of threat supply chain disruption. Particularly a safe stock should include most rare or hard-to-get products and raw materials. During the times when companies don't know exactly when the inventory is arriving, it is critical to have a buffer amount to meet the demand of the customers.

However, the companies should also consider other factors such as changing customer behavior. High inflation and rising cost-of-living crisis is threatening the previous demands. In terms of the bike industry, cycling has always been

considered a relatively costly sport. In 2023, according to the Bicycle Association it is stated that the average-sold bike price has risen by 26% since 2019 [62]. The prices were rising already before 2019, so not all the blame lies on the past four years. However, the pandemic triggered the price levels to increase at a faster rate due to booming demand and relatively low supply. The component prices for bike details increased as well, making the premium models to cost over €10,000.

In Europe, the UK cycling market has suffered not only from inflation, but from the Brexit. In fact, currently Brexit is considered the greatest catalyst of rising bike prices in UK. The inflation has weakened the pound sterling making the import more costly, and Brexit increased the transportation costs and customs. Eventually, multiple aspects contributed to the final pricing including manufacturing, raw materials, exchange rates, delivery charges, and duty customs. In 2022, the mentioned factors led to a 10% price increase for several bike models in UK [63]. However, the bike prices were predicted to go lower in 2023 due to the bike overstock.

After the peak of supply chain challenge in 2021, the e-commerce retailers in bike segment started ordering more bikes due to extremely high demand and poor supply. By the end of 2022, global supply chain deterioration began to normalize, and the orders were fulfilled both on the supplier and retailer sides. In 2023, bike market faced a problem – huge overstock bike models. If base models stay demanded, the models closer to premium are being stockpiled. In addition to oversupply, economic turbulence contributes to a fall in spending. The bike retailers may have overestimated the market demand and resulted with excess production. Consequently, this impacted high discounts for 2022 and even 2023 models, to reduce overstock. The companies were having massive back orders from customers. In fact, the orders went back along to the supply chain too. Stores left with surplus were cancelling their orders sending them back to initial suppliers [64].

Shimano is a global leader in bike components and one of the top brands supplied by Signa Sports United. In February 2023, Shimano published their expectation of a 21% YoY decrease in sales. In comparison, the company had a 16.6% YoY growth in 2022. However, the 2023 forecast doesn't look promising at all. Shimano avoided listing oversupply as a cause and mentioned instead political and economic factors as the main causes of predicted decline. Regionally speaking, Shimano considers European market because of the energy and resource prices, as well as the supply chain constraints, and the U.S. market because of the high inflation and interest rates. As for China market, the country overall is threatened by the stagnation of economic activity after the last spread of COVID-19. Together, global turbulence has led to an oversaturated market with a downward forecast. In 2023, the prices are already lowering to almost pre-pandemic levels due to discounting activity. According to the market analysts, the decision to increase bike prices of low-to-medium category was rather questionable because this range is most sensitive to any changes. Since the beginning of 2023, the low-to-medium category bikes was more static than high-end category. Unfortunately, 2023 will be a tough year for bike retailers in terms of decision making and strategies [65].

The global environment is changing at a very fast pace, but the overall tendency in the bike market for 2023 is comprehensible. International bike retailers cannot influence the political and economic factors and ought to adapt to the modern turbulence. The increased costs for manufacturing and transportation elevated prices for production, but the customer sentiment came out negative. Therefore, the companies placed discounting strategy to reduce overstock production and return the customer activity. However, such strategy is supposed to damage their financial performance and couldn't last forever. In fact, discounting strategy is understandable only to reduce the surplus production. After managing the inventory levels, the companies should consider other less

damaging strategies. As already mentioned, reorganizing company's international trade from global to regional can be quite effective in the long run. However, such transition will take time and additional expenses. In fact, companies still may have to leave several operations offshored if there are no regional substitutes. As a result, the companies may have to consider other, short-term strategies, to stay afloat. These may include choosing the cheapest mode of transportation, manufacturing, search of regional substitutes, raising in-house production, integration of technology, and inventory planning.

3.2. The development of the supply chain management through integration of digital technologies

The companies can increase the supply chain resilience and agility of the supply chain management by integrating digital technologies into its business operations. The emergence of internet of things (IoT), big data analytics, cloud computing, blockchain, and machine learning can make the supply chain more interconnected and transparent. By incorporating digital technologies, the companies can optimize their planning, sourcing, warehousing, and transporting operations. Digitalization cannot directly reduce the risks of supply chain deterioration, but it can make the company stronger and help it withstand the global turbulence. The companies may either choose to make small investment and digitalize only several processes or invest heavily and maintain a full-scale digital transformation.

The supply chain resilience increases the firm's capability to respond to supply chain disruptions though forecasting and contingency planning. Extending the use of digital technologies helps optimizing operational levels and maintaining greater resilience. Digital supply chain platforms enable the participants to

communicate with each other and share necessary information timely. Digital platforms allow capturing and storing numerous datasets where the stakeholders can upload relevant information and others can access it. The modern technologies can identify the inventory movement along the supply chain capturing the transportation route and warehousing points. Tracking the complete transportation channel of a certain product corresponds to the supply chain traceability that impact resilience. In case of any unexpected event, the company can view the location of the product and communicate with the suppliers or drivers promptly. The technologies such as radio frequency identification (RFID) and Global Positioning Systems (GPS) can help in maintaining supply chain traceability. The use of RFID has multiple purposes including inventory tracking, asset management, customer service and loss control. It highly improves the visibility of product throughout the transportation process and inside a warehouse or retail store. Whereas GPS are more often used to track the transportation vehicles and access their location in real-time. Generally, the digital technologies can be integrated through the whole supply chain starting from raw material supply to the final stages of product delivery. It does not eliminate the event, but it allows the company to respond faster.

The digital technologies positively influence supply chain agility making the company more adaptable to market shifts and changing customer behavior. The companies integrate technologies to enhance internal data handling and elevate their decision-making processes. Before responding to the external factors, the company should be able to coordinate the internal exchange of information and data management. Especially, it relates to the e-commerce companies where most operations are handled online. A business should be prepared to manage unexpected competition, changing customer behavior, and interorganizational relationships. There should be an accessible and accurate transfer of information and communication between all involved parties. Technologies such as

blockchain can provide a safe information transfer for geographically distributed stakeholders and elevate the global or regional e-commerce. Blockchain can assist in procurement, logistics, tracing, monitoring, and trade financing. It keeps the information in chronological order and share it among all supply chain participants timely. Easy access to reliable up-to-date information enables the firm to foresee an upstream supply and downstream demand and react to any market shifts. Furthermore, it will minimize the total costs of the company's responsiveness and time.

Integrating digital technologies into business operations require significant amount of information by connecting various stakeholders and processes within an organization. The digital platforms can act as a medium of information connected and shared among the participants. It maintains more effective interaction promoting both – external information exchange and internal information handling. Tracing and monitoring company's activities along with the inventory movement eliminates the informational disparity and inequality between the participants, and reduce unpredictability of downstream markets. Without elevating supply chain traceability, companies may receive inaccurate information and signals that will decrease resilience. However, with the integration of traceability technologies the company can revolutionize their supply chain eliminating inefficiencies and drawbacks. The company could react faster being more adaptable to changing environment and uncertain events such as supply chain deterioration. In fact, collaborating with prompt exchange of information is crucial during any unforeseen disruptions. Even though external factors such as pandemics, geopolitical challenges, war, and crisis stay unmanageable for a firm, it can increase resilience and agility through digital technologies. They enable better data processing to analyze supply chain disruptions and lead to more efficient responses. Assuming, a firm can exploit

more advantages if it will integrate multiple digital technologies in its operations, rather than a single one [66, p.46].

Responding to the global turbulence, the companies may implement three leading digital strategies: supply chain digital twins, predictive maintenance, and tracking. The supply chain digital twin is a computer model and a digital replication of a certain object, process, or a system. It can represent different components and operations of the supply chain including transportation networks, warehouses, and production facilities. The digital twin uses the data from the physical world and create an identical digital simulation which can be used to analyze performance of the operations. It can help in detecting a potential challenge and enable a company to prevent or address the issue in the physical world. In addition to that, it can help to reconsider the current business operations to maximize efficiency, optimize transportation routes and generate cost savings. In example, a company can create a virtual model of a transportation network and analyze different routes in order to come up with the most convenient. The transportation routes could be analyzed according to the traffic patterns, vehicle capacity, weather, and road conditions. A company can simulate various supply chain network designs and depict the most suitable according to their inventory level, production capacity, and customer demand patterns. Finally, digital twin can also be used to virtualize the production process and analyze various scenarios. Considering the internal data in combination with the technology tool, the company can maintain a solid plan and production strategy.

Predictive maintenance is the next tool which can be used in supply chain optimization. It involves machine learning technologies and sensors that track and analyze the performance of various machines and operational processes. The tool helps foreseeing when a machine is likely to have a breakdown, so that the company can prevent it. This makes the business operations more resilient because the company can ensure that their machines and robotics are working

safely and efficiently. Predictive maintenance enables diagnosing real-time data of vehicle condition and performance. In the long run, it may reduce repairing costs because it foresees the faults and defects in key components timely before they result in failure. However, one of the main advantages of the tool is that it ensures safety and stability of business operations [67].

Tracking enhances the business traceability and allow accessing real time information with the use of internet and relevant technologies. Apart RFID and GPS, which were mentioned previously, a company can also track social media, news, and other sources to analyze industry updates. It can indicate the potential disruption in the supply chain due to new regulations, shifts in demand, or relevant industry changes. In fact, social media can be used to respond to the customer's questions about the delays explaining the issue of supply chain deterioration. Communicating with customers will reduce misunderstanding and increase awareness of the challenge. Therefore, the organizations could tell the truth about global supply chain constraints as long as the customers may not know the real situation and blame the company for their unmet expectations. Rather than making optimistic guesses, a company can explain in a polite manner that they don't know a specific date of inventory restock and keep in touch both with the suppliers and the customers. The customer service can suggest offering substitutes which are available in stock and are easier to supply or manufacture. The company could win in case their proposition is accepted, and the customers could be satisfied. For the business which began producing in-house production it is essential to increase awareness and communicate with their audience. During the ongoing uncertainty many businesses will have to reorganize their operations regionally and change the actual range of products. Therefore, increased connection and communication with customers will come out extremely supportive [68].

Returning to the transportation technologies, a company can track their shipments across land, rail, air, and sea all over the globe. The RFID technology is often integrated with location intelligence system which increase the visibility of the supply chain network with the use of GPS information. The systems are combining location information from internal organizational datasets, IoT services, and external objects including rail, ground, air, and ship carriers. The advanced tracking systems enhance not only the traceability of inventory location but generate understanding of the product condition. Modern sensors are added on the packaging, container, or an object and enable detecting its temperature, damage, and spoilage signals. The company's managers can receive real-time information remotely from those sensors tracking if the necessary parameters are met. Therefore, in case a problem arises, a company can manage the supply chain immediately.

Another technology with almost unlimited applications is blockchain. It could be highly relevant for e-businesses because of the transparent record of transactions between suppliers, manufacturers, and distributors in a decentralized ledger across the computer network. There are numerous reasons to integrate the blockchain technology. It majorly increases transparency and security resulting in more trust between participants of the supply chain. Blockchain can be used for inventory management to track and optimize the stock levels and quality control to ensure removal of defective products. It enables checking product authenticity through the tamper-proof records with the information about product origin and its movement along the supply chain. Furthermore, the transparent records of data could be used to check the compliance and regulatory requirements reducing the risks associated with non-compliance and penalties. The data recorded in the blockchain is verified and immutable meaning that the history of operations and transactions inside the ledger are unalterable. This guarantees full and indisputable history of company's activities. In addition to

that, other digital technologies can be used in conjunction with blockchain. The company can create smart contracts which are completely digital, simply a self-executing program, stored inside the blockchain. It is a digital agreement between the parties which runs automatically when the predetermined conditions are met. Smart contracts eliminate the middleman making the transactions more cost-effective and the companies are not reliable on a single entity such as bank. The transactions are irreversible and completely trackable which again leads to greater transparency. Nowadays, global companies start to integrate blockchain technology starting with one or two stages of supply chain. Companies such as Ikea, Walmart, Home Depot, and luxury brand LVMH use blockchain technology. In example, Walmart uses blockchain to track the supplies and origin of food products in their stores [69].

Lastly, cloud computing is another technology used in supply chain management to connect suppliers, manufacturers, and customers. It is used for data storage, development tools, fraud detection, networking, big data analytics, backups, and archiving. Cloud computing can provide processing capacities to IoT, machine learning, and data analytics. In contrast to blockchain technology, the data in cloud is mutable and centralized. Cloud computing uses a single server resource for data processing which can be accessed by multiple users around the world through internet. In fact, blockchain technology can be integrated into cloud computing. The two can work together to provide better data security and backup solutions. There are common cloud computing services such as Amazon Web Services (AWS), Oracle, Google Cloud Platform, Alibaba Cloud, Microsoft Azure, and more. In fact, AWS and Oracle already integrated blockchain into cloud computing.

Summing up, digital technologies are already reorganizing the modern supply chain with the use of AI, machine learning, IoT, blockchain, and cloud computing. They offer innovative approaches for managing business operations

and enable the companies to receive real-time information. The advantages generated through digitalization create a range of opportunities to foresee events and respond to micro and macro environment turbulence mitigating the potential risks. Established digitalized supply chains enhance collaboration, information exchange, risk management, visibility, and control. In addition to that, it increases the business resilience and agility enabling to withstand global turbulence.

3.3. Supply chain analysis and the development propositions for Signa Sport United

In 2023, Signa Sports United continues suffering from prolonged supply chain disruption in combination with economic and geopolitical instability. The company is a leading e-commerce and tech platform in European region, which is considered to be their core market. Subsequently, after becoming a leader in Europe, it started establishing presence in the U.S. market. In 2021, Signa Sports United went public and was listed in the NYSE. Afterwards, in 2022, the company set a warehouse in Salt Lake City, Utah, and launched their operations in North America. However, the global instability challenged their operations, and the company mentioned the strategical decision to focus on their core markets in mainland Europe to recover and elevate profits.

Although Signa Sports United planned to concentrate on their core market, it had launched operations in the U.S. market. Throughout 2022, the information regarding their U.S. operations and plans was limited. Indeed, the company holds a leading position only in European region and haven’t yet gained even similar success in the U.S. market. Therefore, there was no certainty whether the company planned to shut down their operations in North America, put them on pause, or slowly continue expanding. Though, in March 2023, Signa Sports

United bike division have announced an opening of new corporate office in North America, Park City, Utah. This means Signa Sports United renewed its focus and continue expanding to North America. The company stated that their new office in Utah will handle North American bike operations and enhance service to its growing customer and dealer base in the new region. In addition to that, the office is meant to support their warehouse and bike distribution center in Utah. The new facility is responsible for sales, marketing, customer service, and other operations in North America. It is planned to become a center of collaboration that elevate their global resources and provide new solutions to customers and partners. Furthermore, it is now responsible for the distribution of Vitus and Nukeproof bikes which are manufactured in Europe [71].

In March 2023, the company posted their latest fiscal quarter report which stated current challenges of an overstock market and depressed customer sentiment in the bike category. In 2023, after global prolonged supply chain pressures, the orders finally arrived, and market resulted with an oversupply. Subsequently, economic environment shattered the customer's demand and purchasing activity. The corresponding economic pressures are majorly related to rising inflation and consequences of ongoing war in Ukraine. Therefore, the company resulted with more stock and less demand. Nonetheless, due to the last-year acquisitions, Signa Sports United managed to increase their customers base and resulted in active customers YoY growth of +26%, net revenue +27% YoY growth, and €73 million gross profit in Q1 FY2023 [72]. Hence, this represents a positive tendency meaning that the company's initiatives are correct. In addition to that, their planned strategy to focus on the core markets remains, so the company might form new mergers and acquisitions of European leaders like Wiggle CRC and Tennis Express in the nearest future.

Generally, Signa Sports United is implementing the correct strategies, but it could consider more development opportunities in order to enhance its

operations. After researching the possible solutions of supply chain optimization during the global turbulence, it became evident that the most effective strategies are related to regionalization and integration of digital technology. Taking the fact that Signa Sports United recently extended their operations to U.S. and continue to supply popular bike brands from Asia, America, and Europe – it has stakeholders globally. Therefore, the development opportunities could be related to minimization of supply chain expenses and maximization of its efficiency. The first could be done by lowering the supply, manufacturing, transportation, and production prices. Whilst the efficiency could be elevated through integration of digital technology. In fact, the company is already a leading digital tech platform in Europe, meaning that it should be looking towards other digitalization opportunities.

The procurement of bikes from global suppliers appears extremely costly in combination with higher manufacturing and logistic costs. In 2022, when the demand for bikes suddenly increased, the costs also increased. Despite the recent inflationary pressures, the bike prices began rising two years in advance. The fig. 3.1 represents the estimated price for Shimano bikes due to inflation and the actual end-price. It is visible that inflation wouldn't elevate the prices as much as the companies elevated them due to the enormous demand. Of course, when the demand exceeds the supply the product prices tend to rise. Especially, it corresponds to the market leaders such as Shimano. It is one of the top-ordered bike brands in Signa Sports United which is manufactured in Asia. The price for Shimano 105 model after inflation was estimated at £733, but eventually the price became more than £1600 in 2022.

Figure 3.1. Shimano – price due to inflation vs actual price

Source: https://road.cc/content/feature/rising-cost-cycling-crisis-298419 [73].

During the two-year period 2020-2022, the bike market experienced a period of rapid demand growth combined with supply problems. This enabled the companies to set extremely high prices. The orders were massive, but the companies had limited stock and suffered from supply and delivery issues. The orders were delayed with uncertain lead-time both for the retailers and for the end-customers. However, in 2023, the market faced an opposite situation. There is now more supply than demand, the prices are extremely high, and there is an overstock in the bike market. The pressure is confirmed by Signa Sports United which currently attempts to clear its overstock. Consequently, the bike prices are predicted to decrease again. Several analysts even foresee the prices to go below the prices before pandemics.

In order to reduce the excess stock, Signa Sports United can implement a discounting strategy to lower their costs and potentially attract more customers. Currently, the discounting activity is used by most bike retailers because the problem is the same inside the industry. After managing overstock, Signa Sports

United may consider reorganize their suppliers. Of course, there might be no substitutes for leading bike brands such as Shimano or others top ranked brands. Customers can demand a specific brand because of its global reputation and recognition. However, as long as the company supply from over 600 brands, less popular brands could be reconsidered. Furthermore, the company launched their in-house brands which are manufactured majorly in Germany. As the European leader, Signa Sports United should have an extent of influence in the market to promote their in-house production regionally. Therefore, in the future their own brands can substitute other ones supplied and manufactured abroad. Investing in promotion of their in-house brands can become a first step towards regionalization. However, as long as the company already extended their operations in U.S., complete regionalization isn't an option. Although, it may consider near-shoring and manage the production range according to each region. The U.S. facilities could supply and promote more American brands and European facilities can supply and promote more European and in-house brands.

Another strategy to manage stock effectively is to become more innovative and future oriented, focusing on the production that is expected to be more demanded. Analysts consider that in future e-bikes will become more popular than regular bikes. In fact, Signa Sports United also mentioned that e-bikes contributed to the majority of their net orders. Figure 3.2 represent the bike sales projection in Europe made by the industry analysts which show that the sales of regular bikes are predicted to decrease, while the sales of e-bikes are predicted to increase till the end of 2030.

Unit sales projection for regular bikes and e-bikes – Europe

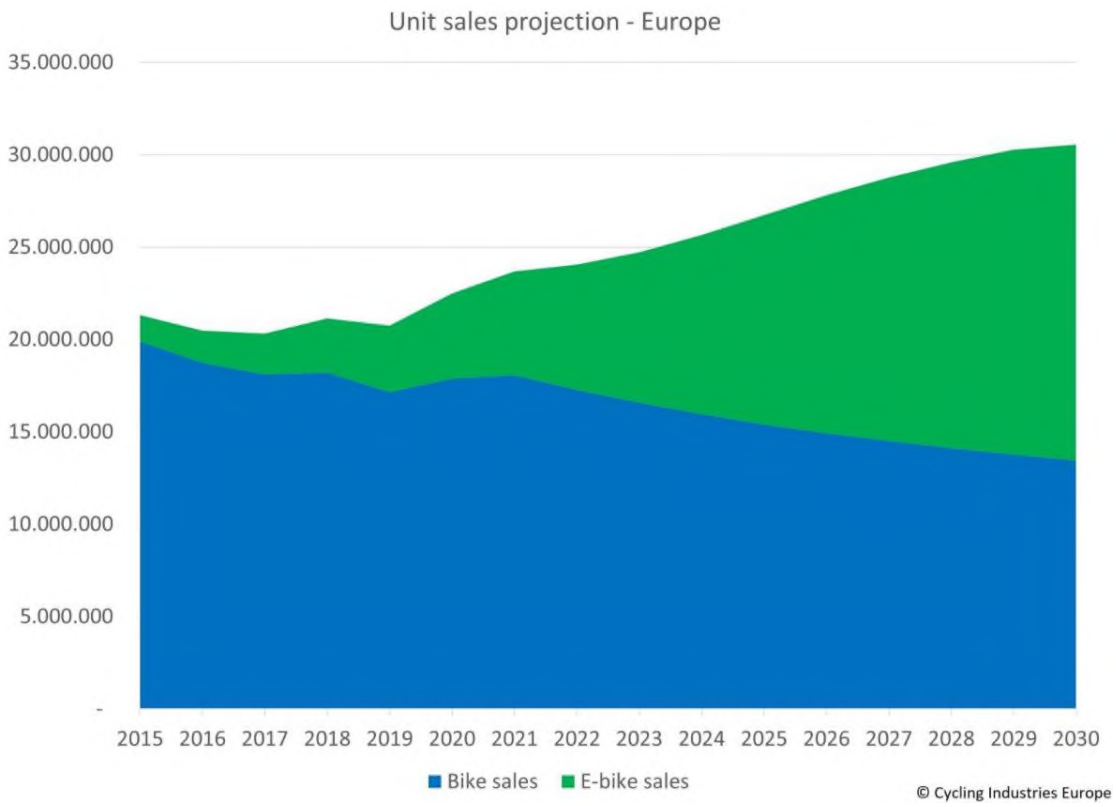

Fig 3.2 Unit sales projection in Europe

Source: https://cyclingindustry.news/annual-bike-sales-to-run-at-more-than-double-new-car-registrations-by-2030/ [74].

Another contributing factor to the projected growth of e-bikes is environmental sustainability because sometimes e-bikes become a convenient alternative transportation mode. Especially, the tendency is popular across European and North American regions, exactly where Signa Sports United have established its presence. Hence, by these means, the company may consider shifting to a larger range of e-bikes. Furthermore, the popularity of e-bikes is significantly driven by the technology advancements, one of the company's main strengths and the field of investment.

After optimizing the product range, Signa Sports United should consider developing their supply chain network. Previously, it was considered cost-effective to offshore business operations abroad where the labor is relatively cheap procuring from Asia. However, during the past two years, the shipping

costs skyrocketed and procurement from Asia became not as competitive as before. During the three-year period between 2019 and 2022, the shipping costs of a container from China to EU increased from $2,000 to more than $15,000 [75]. Consequently, the bike companies began massively reshoring and nearshoring their possible operations.

Although since spring 2022 maritime logistic costs fell to almost pre-pandemic levels, the past years should have taught the companies that the environment is prone to sudden changes and global uncertainty causes multiple challenges. It became evident that reshoring and nearshoring is much more secure and far-sighted strategy. In case regionalization is not an option, diversification becomes the most optimal strategy for Signa Sports United. Supplying brands from various countries, including those within the same region of operation, increases the chance of more resilient supply chain network. In addition, when the company manufactures production itself, it gains more control over operations and could better withstand uncertainty.

The next important consideration is choosing the most efficient transportation mode. In 2022, after the beginning of war in Ukraine, global logistics were disrupted due to the necessity of changing transportation routes. This corresponded to all transportation modes – rail, road, air, and maritime. In 2022, maritime became the most competitive transportation mode during the invasion in Ukraine. In turn, the rail freight shipments through Northern Corridor dropped in volume at 34% [76]. As for Signa Sports United, maritime logistics from China to EU is an ideal transportation mode which enables shipping bulk volume of bikes. Whereas rail and road freight could be used within a certain region – inside EU and U.S. In terms of cost, rail transportation is considered to be the cheapest and can transfer more volume than trucks. The company’s partner, Rhenus Warehouse Solutions, also offers intermodal transportation combining rail, road, air, and maritime logistics. This certainly has its advantages as long as intermodal

transportation can be cost-effective by reducing fuel costs and sustainable by reducing carbon footprint.

In terms of customer delivery, Signa Sports United uses such services as DHL, UPS, DPD, CargoLine, Hermes, and Koch International. The orders are supposed to be delivered within a week directly to the customer's address. However, combined orders are shipped from different warehouses, so the information about delivery time about each order is sent to the customers individually. In 2017, UPS delivery service joined the Blockchain in Transportation Alliance (BiTA) and integrated blockchain technologies into its deliveries. The supply chain analysts named UPS a "United Problem Solver" because it managed to cope with supply chain disruption better than most services [77]. It applies a visibility tool which updates necessary information about the product throughout the shipment. Nowadays, professional delivery services began integrating various technologies into its operations including warehousing solutions, transportation solutions, and management services. Therefore, Signa Sports United may consider implementing more innovative approaches to their supply chain management too.

The integration of digital technologies makes the supply chain more resilient and agile during global turbulence. Signa Sports United may consider integrating blockchain or cloud computing into their management in order to visualize the activities of multiple stakeholders. Increased collaboration and traceability will develop the company's planning and forecasting activities and stabilize the supply chain. By this means, the company can become more confident in terms of the delivery lead-time and monitor any disruptions. Blockchain technology can provide a chronological image of the history of operations based on which the company can make future corrections. In fact, the data could be accessed by all stakeholders maintaining mutual benefit. Each stakeholder can view which strategies were effective and which could be reconsidered based on the outcomes.

In addition, the immutable data system increases the accuracy and fairness of the technology use.

Signa Sports United already integrated AI, machine learning, RFID sensors, and GPS tracking system. Further, it can integrate supply chain digital twins in order to test their new strategies. The company can test new transportation routes or modes in a simulated virtual reality. This can help maintaining strong alternative transportation options in case of a possible supply chain disruption in future.

The company can integrate predictive maintenance which is a highly efficient technology responsible for detecting various faults and defects of a machine inside manufacturing plants. This can become a strategical investment as long as the company launched their in-house production manufactured internally. The technology can prevent breakdowns of their machines enabling secure and stable manufacturing operations. It reduces the risk that their production will be stopped due to machine failure. In addition to that, it can become cost-effective in the long run, because detecting the parts prone to breakdown and repairing them timely requires less expenses than fixing the whole machine after a total breakdown or purchasing a new one.

The changing environment is shaping the customer sentiment and during the time of high uncertainty, customer sentiment undergo fluctuations. Signa Sports United should combat these fluctuations which impact the demand and purchasing activity. Firstly, the company should analyze its customers and communicate with them through internet, media articles, and social media. An ongoing feedback system will provide and understanding of the changing customer behavior and its main reasons. In turn, the AI applications can help with gathering data in real-time about the customers. The company can also increase awareness about the challenges it is going through and what actions are taken in order to overcome them. This can create a greater connection between the

company and its customers. Another option is to engage customers through interactive surveys or social events that helps understanding the customer's vision and identify their expectations. Lastly, the company should not neglect innovativeness and keep up with the changing trends. Being future-oriented can increase competitiveness and differentiation within the industry.

Summing up the third chapter, global turbulence pressured the operations of international companies. At first supply chains were disrupted because of the COVID-19 restrictions, and then due to the combination of economic and geopolitical factors. The companies haven't yet recovered from the consequences of previous challenges when new ones have emerged. Together, it contributes to highly uncertain environment in which companies must adapt.

Multinational companies found that expanding regionally is more secure option, than globally. It is easier to extend a business in a country with similar culture, language, and customer preferences. Especially, if there is a free trading zone with little or no trade barriers. By this means, companies tend to reshoring or nearshoring their operations to no longer be reliable on the countries in another region. In case if regionalization isn't possible, differentiation strategy is therefore optimal.

Inside the bike industry, the companies faced multiple challenges. In 2020, during the bike boom, the demand was enormous while the supply was challenging. This contributed to the increased costs for the bike production. In 2023, the bike supplies have normalized and the retailers' received their orders. However, due to economic downturns the demand decreased, and the market was left with overstock. The companies ought to decrease their prices in order to reduce stockpiled inventory. In a highly unpredictable environment, the companies tend to maintain more resilient and agile supply chain network. Apart from regionalization, this could be done through integration of digital technologies. Numerous variants are now applicable to supply chain management

including AI, machine learning, tracking, RFID sensors, GPS systems, supply chain digital twins, predictive maintenance, blockchain, cloud computing, and more. These technologies can reorganize supply chain making it more traceable, efficient, and stabilized.

The proposition for Signa Sports United includes continuing to differentiate its operations in order to lower their reliability on foreign stakeholders. Reshoring or nearshoring possible operations can increase control over the supply chain. In addition, the company should concentrate on promoting their in-house production to optimize their stock, and possibly reducing the number of brands supplied. Taking into account overstock situation, discounting strategy can reduce inventory levels. In the long-term, the company can become more future oriented and consider production that already gains enormous success. E-bikes are predicted to substitute regular bikes. Therefore, the company can consider supplying more e-bike models and regular bikes only of top-demanded brands. This should lead to stock optimization and increase competitiveness. The company should concern changing customer sentiment and combat such fluctuations. The customer base and feedback should be analyzed through relatable surveys and special events. This can engage customers and the communication enables better understanding of their needs. Lastly, the supply chain digital twin can enable the company to maintain the most convenient transportation route and find alternatives in case of changes in external environment. Then, the blockchain technology can enhance collaboration and transparency within stakeholders and can combine data collected from most of technologies and record it in a chronological order.

CONCLUSIONS

After investigating the international supply chain management, the integration of digital technologies, and the impact of global turbulence, the relevancy of the topic became evident. The role of supply chain management is determined as a backbone of all business operations. Without a resilient network, a business will not be able to deliver production to the customer. The aim of this work was to study and analyze the integration of the supply chain management in the modern world with technological advancements and growth of e-commerce. The tasks were to develop an understanding of how the supply chain management works, develop an understanding of international logistics operations of e-businesses and the role of third-party logistics services, analyze the features of supply chain management on a concrete e-business LLC “Signa Sports United”, analyze the impact of global turbulence and the strategies implemented by Signa Sports United, conduct research on the supply chain management strategies during the global turbulence, describe the development of supply chain management through integration of digital technologies, and propose recommendations to enhance the supply chain management in Signa Sports United. After completing the work, it is possible to state that the aim was fulfilled through accomplishment of tasks.

The first chapter encompassed the theoretical material describing the principles of supply chain management. In order to understand how the supply chain management works, the processes such as planning, sourcing, manufacturing, and delivering were explained. The planning is the primary stage which is often integrated with AI technology and analytical tools to allow better data gathering. Sourcing comprises of choosing appropriate suppliers of raw materials and can have such strategies as outsourcing, low-cost country sourcing, as well as single and multiple supplier strategy. Manufacturing gathers the raw

materials into the final product, and logistics includes coordination of inventory movement and its storage.

The international logistic operations of e-business are implemented either by establishing own warehouse and purchasing or leasing trucks, or by forming a partnership with a 3PL service which will offer transportation and warehousing solutions. Partnering with a 3PL can become more convenient in terms of the financial outlay, maintenance, leasing, taxes, and staff. This is because the 3PL hire specialists with required knowledge who are common with transportation documents, import, export, international compliance, and other regulations better than anyone. The modern warehouses are now integrated with WMS, which ensures proper inventory storage, and is often linked with other digital technologies which enable planning and tracking inventory transportation. The business or the 3PL chooses the most suitable transportation mode based on the product characteristics. Usually, logistics require intermodal transportation that will combine modes for greater conveniency.

The second chapter of the work analyzed the features of supply chain management in Signa Sports United, the company's current state, financial position, impact of global turbulence, and the strategies implemented. In terms of supply chain management features, the company has a wide range of bikes supplied from more than 600 brands globally. In addition to that, the company recently launched their in-house bike brands, manufactured domestically in Germany. It has own warehouses across mainland Europe and the U.S., and partners with 3PL, Rhenus Warehouse Solutions. It has one of the greatest bike capacities in Europe and convenient distribution channels. The company's production is shipped worldwide.

Speaking of the company's current state, it experienced supply chain disruptions for more than two years followed by war in Ukraine, and leading consequences. Unfortunately, it was reflected on the financial statements

decreasing the net income. The company has growing revenues due to closed acquisitions of Wiggle CRC and Tennis Express, but the net loss is more realistic profitability measure. The goodwill impairment, and charges from public listings contributed to the net loss, as well as the supply chain disruptions and global turbulence. Based on the conducted financial analysis, Signa Sports United has poor financial indicators. Nevertheless, the company showed decent operational performance. After the closed acquisitions, the company gained an access to more customers and elevated the number of platform visits, active customers, and net orders.

The strategies implemented by Signa Sports United to combat global turbulence were related to an increased focus on the core markets in Europe. The company exploited its strong market position to cross-sell own brands. This requires refocusing international partnerships and can lead to the formation of new mergers and acquisitions in Europe.

The third chapter focused on research of international supply chain strategies during the globally turbulent environment, the supply chain development through integration of digital technologies, and propositions for Signa Sports United. After conducting research on the supply chain strategies during the global turbulence, it was derived that regionalization or diversification strategies can play an important role in stabilizing the business. This can be done through reshoring or nearshoring possible operations and bringing them closer to the end-customer. Main advantage of regionalization includes FTZ, lower barriers, and similar customer preferences. However, sometimes it is hard to substitute global suppliers, so diversification comes out as another option to decrease dependency onto single country.

The development of supply chain can be done through integration of digital technologies. They enhance operational transparency, traceability, collaboration, and efficiency. The automation of various business processes can support

decision making, forecasting, data analyzing, invoicing, transacting, and eliminate language barriers. Multiple technologies can be integrated into blockchain technology that will keep records of all sets of data. It will ensure secure data protection and decentralized access to international stakeholders. The companies can use blockchain to perform transactions, recording operational data, increasing collaboration, and transparency. For the supply chain participants, it could be used to define the costs, delivery timelines, track inventory location, and more.

A recommendation to enhance supply chain management in Signa Sports United is to regionalize operations in order to increase control over the processes. The company should invest in promotion of in-house brands and decrease dependency on the global suppliers. Further, considering integration of digital technologies such as blockchain, it can enable convenient and transparent collaboration with stakeholders. It will record data uploaded by each participant enabling to track the processes in real time. This is especially convenient in modern fast-paced, changing environment. Also, the supply chain digital twins can be used to simulate transportation networks and develop alternative routes to prepare for unforeseen changes.

To conclude, the theoretical data, practical review of Signa Sports United, and extensive research, allowed in-depth analysis bringing the understanding of the topic. It became evident that international supply chain management is crucial part of every business which involves multiple processes and stakeholders. Globalizing operations can become challenging due to changing environment, different country conditions and responses. The research derived an understanding that regionalization occurs to be more safe option of expansion due to closer borders. The distance of globalization becomes a concern when unforeseen events take place. Meaning that the businesses highly reliable onto

single suppliers over long distance will experience more challenges than those who regionalize or diversify its operations.

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