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## SUPPLY CHAINS IN THE CONTEXT OF THE COVID-19

### ABSTRACT

*Crown virus pandemic (COVID-19) in 2019/2020 is a new respiratory disease. More than one pandemic in recent history has affected the global economy. In addition to the fight for human health, all countries are taking action to mitigate the negative economic consequences. Within this framework, a number of measures have been taken to reduce disruption to commodity flows and Supply Chains (SC), as well as to the provision of services. The SC represents the flow of goods, services and information from raw material suppliers, manufacturers, distributors, retailers to the end-customers. There is a main problem in how the end-customer comes to the consumable product, since the SC is unable to provide its complete flow. All emergent shapes of the SCs: complete, short or reversible, undergo some transformation and adjustment to new conditions. In this paper, the authors research the changing context in which SCs take place, the limitations of particular emergent SCs shapes, and the measures and ways to adapt them in complex pandemic context. In the paper, authors, by applying scientific methods, research the SCs adjustment in the context of a pandemic as a main output of this research.*

### KEY WORDS

*supply chain; pandemic; COVID-19; limitation; adaptation;*

## 1. INTRODUCTION

SC has the focus on the flow of goods. In addition to commodity flow SC also includes the flow of services and information. SC is a dynamic phenomenon. While traditional logistics is primarily based on warehousing and transportation activities, the SC also implies the flow of information between the many SC participants. Therefore, there is a need to talk about the flow of goods and information among SC participants, namely suppliers of raw materials, transport organizations, producers or service providers, product distributors, retailers that enable the product to reach the end-customer and become a consumer. The same principles apply to services. [1]

The SC can be defined as a type of a dynamic system in which information, money and products are constantly exchanged among the chain participants. [2]

SC defined also as set of entities involved directly in the upstream and downstream of products, services, finances and information from source to customer. [3]

The SC can be considered a network of structures, distribution, transforming of procured materials into semi-products or final products for end-customer. [4]

The SC can also be described as “... a series of activities and organizations through which materials pass during their journey from initial suppliers to end-customer”. [5]

In order to respond to rapidly changing manufacturing environment and market, SC must be flexible, adaptable and reconfigurable. The potentials of changes in organization structure caused by changes in businesses must be taken into consideration during structural modelling of the SC. [6]

Consequently, Supply Chain Management (SCM) “is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders”. [7]

SCM has also inspired a new Council of Logistics Management (CLM) definition of logistics as “that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers’ requirements”. [8]

Can be concluded that the SC is a complex system of integration of many participants, such as suppliers, producers, distributors and retailers for the purpose of production and distribution of goods/services as a results of the process, in the right quantities, in the right place and at the right time, all with the aim to balance supply and demand, as one of the fundamental economic laws.

## 2. METHODS

The research question in this paper is in how the end-customer comes to the consumable product/service, since the SC is unable to provide its complete flow. All emergent shapes of the SC: complete, short or reversible, undergo some transformation and adjustment to new conditions. In this paper, the authors research the changing context in which SCs take place, the limitations of particular emergent SC shapes, and the measures and ways to adapt them in complex pandemic context. The success of adaptation depends to a large extent on the stability of the supply of goods and services globally. In researching this phenomenon, the authors approach the research of the COVID-19 context that caused the limitations of the normal unfolding of SCs, and also adjustment to new conditions.

The basic hypothesis of this research is: Even in a pandemic, SCs must not be completely interrupted because their interruption would cause unprecedented economic, social and political consequences. Despite the limitations, measures are being taken at national and global level to allow SCs to take place. The SCs show a high degree of flexibility and elasticity.

In the paper, the authors have applied general and special scientific methods of cognition. From the general scientific methods of cognition, the system theory method is applied to understanding the context and its impact on the SCs and its very complex structure.

The statistical method was applied to statistical data presentation and their interpretation.

The comparative method was applied in the research and comparison of limitations and adaptation to new conditions of different emergent shapes of the SC: complete, short or reversible.

Of the special scientific methods of cognition an analysis was used to research the limitations of the SCs and the ways and / or measures to adapt to new circumstances.

The deduction method was applied when deciding on the impact of the context that represents the economic environment in which emergent shapes of the SCs take place.

## 3. COVID-19 CONTEXT

Crown virus pandemic (COVID-19) in 2019/2020 is a new respiratory disease. The disease first appeared in late December 2019 in Wuhan, China's Hubei province. In January 2020, it developed into an epidemic in the People's Republic of China and spread worldwide. It was triggered by the hitherto unknown SARS-CoV-2 virus. To prevent worldwide spread, the World Health Organization (WHO) declared an international emergency on January 30, 2020, but as early as March 11, 2020, the WHO

officially declared a pandemic due to the rapid spread of the virus worldwide and high risk. Twenty days after the global pandemic is officially declared, all EU / EEA countries and more than 150 countries worldwide are affected. [9]

Countries around the world are increasingly accepting increasing security measures: including closing borders, closing airports, imposing travel restrictions, restricting movement, self-isolation or quarantine of the diseased. [10] The outbreak of COVID-19 affects all segments of society and is especially harmful to members of the most vulnerable social groups such as the elderly, chronically ill from other diseases, etc. [11] The pandemic has also raised the great dilemma of opting for a strategy to protect the lives of citizens or protect the economy from the severe economic crisis that will occur to halt production, disrupt SCs, and absent tourism trips globally. Due to the new economic situation, the COVID Global Action Platform was created to bring together the business community for collective action, protect people's lives and facilitate business continuity, and mobilize support to respond to COVID-19. [12]

At the time of writing there are 11,500,302 patients worldwide in 216 countries, 535,759 people have died. [13] The number of patients is still increasing, as is the number of deaths and it is difficult to predict the final consequences.

Based on the World Bank analysis the significant potential impact of COVID-19 is assessed on Gross Domestic Product (GDP) and trade the shock as underutilization of labour and capital, an increase in international trade costs, a drop in travel services, and a redirection of demand away from activities that require proximity between people. Global GDP is expected to decline by 2.09%, while developing countries' GDP is expected to decline by 2.49% and high-income countries by 1.84%, as presented in Table 1. The declines are 3,86% below the benchmark for the world, in an amplified pandemic scenario in which containment is assumed to take longer and which now seems more likely. [14]

Table 1 – GDP implications of various scenarios - cumulative impacts (% deviations from the benchmark)

Country/Region	Global pandemic	Amplified global pandemic
China	-3.69	-4.31
Hong Kong SAR, China	-2.31	-4.82
Canada	-1.57	-3.18
European Union	-1.85	-3.85
Japan	-2.23	-4.57
United States	-1.67	-3.40
Middle East & North Africa	-1.38	-2.95
Russian Federation	-1.94	-3.99
Developing countries	-2.49	-4.00
High-income countries	-1.84	-3.77
World Total	-2.09	-3.86

Source: [14]

The biggest GDP losses under the global pandemic scenario are expected in East Asia and Pacific (EAP) countries due to their relatively deep integration through trade and direct impact on tourism. The biggest negative shock is recorded in the output of domestic services affected by the pandemic, as well as in traded tourist services. High-income countries could see significant losses of GDP, with the estimated loss in the European Union -3.85%, Japan -4.57%, the United States -3.40% and Canada -3.18%. [15]

GDP decline in Croatia will be larger in 2020 than in 2009. According to the projections of the Government of the Republic of Croatia, GDP will fall by 9.5% in 2020, instead of the planned real growth of 2.5%. The latest EU estimates predict a 10.8% drop in Croatia's GDP in 2020, the third largest drop among EU member states. Such a significant decline is a consequence of the structure of the Croatian economy, with tourism contributing almost 20% to GDP, and this sector of the economy, due to restrictions, suffers the greatest damage on a global scale. The impact is big and there is no world economy that can handle it without consequences.

A big negative impact of amplified global pandemic expected in agriculture, natural resources, trade, manufacturing, transport and services, as presented in Table 2.

As presented in Table 2, the highest decline is expected in Traded tourist services, which is -9.26% globally. An even greater decline is expected in the United States -11.27%, Middle East & North Africa -10.03%, Russian Federation -9.62%, High-income countries -9.60%, etc. Significant decline is realized in all countries and regions and with Domestic services, too.

Table 2 – Output implications of amplified global pandemic – cumulative impacts (% deviations from the benchmark)

Country/Region	Agriculture	Natural resources	Manufacturing	Service	Domestic services	Traded tourist services	Total
China	-3.12	-1.08	-3.61	-3.67	-4.85	-4.64	-3.54
Hong Kong SAR, China	-1.29	-3.24	-1.33	-6.06	-8.46	-9.23	-5.35
Canada	-4.30	-1.10	-3.25	-3.02	-8.95	-9.16	-2.96
European Union	-3.00	-1.02	-2.89	-4.02	-9.04	-9.06	-3.65
Japan	-4.71	-2.85	-2.77	-4.62	-8.75	-8.35	-3.98
United States	-3.60	-0.21	-2.45	-3.80	-9.99	-11.27	-3.38
Middle East & North Africa	-2.76	-1.65	-2.67	-3.02	-9.11	-10.03	-2.65
Russian Federation	-3.00	-2.19	-3.73	-3.86	-8.72	-9.62	-3.58
Developing countries	-2.90	-1.42	-3.47	-3.87	-7.98	-8.63	-3.51
High-income countries	-3.49	-0.95	-2.78	-4.00	-9.20	-9.60	-3.59
World Total	-3.04	-1.29	-3.13	-3.95	-8.77	-9.26	-3.56

Source: [14]

After a decade of uninterrupted growth, the global economy came to a sudden halt because of the COVID-19 pandemic. The question now is not whether there will be a global recession but how deep it will be and how quickly countries can overcome the health crisis and pave the way for economic recovery.

The answers to these questions will be particularly important for developing economies, which are likely to be hit hardest by the crisis. These economies would have been hard pressed, in short, to mount an effective response even to a moderate global downturn. What they got instead was a simultaneous health and economic calamity without parallel in modern times.

In a nutshell, it assumes that everything goes right. Even under these assumptions, the global economy would fall into a deep recession in 2020 and output of developing economies would shrink by roughly 2%. This would not just mark the first contraction in these economies since 1960 but would also imply an astonishingly weak growth outcome relative to their average growth of 4.6% over the past sixty years.

Growth outcomes could be considerably worse if just one assumption fails to materialize. Even if three months of mitigation measures prove effective in halting the pandemic, investors and households could remain skittish or local or global SCs may not be restored. [16] The world recognized the need to close ranks across the world, not just governments and international institutions but also private creditors and businesses.

#### 4. SUPPLY CHAIN LIMITATIONS AND ADJUSTMENTS

One of the most important measures for the functioning of the economy in the context of the COVID-19 pandemic was, despite the necessary constraints, to ensure that SCs take place at the national, regional and global levels. The European Commission has issued guidelines for Member States with border migration management measures in the context of the COVID-19 epidemic. Their goal is to protect the health of citizens, ensure that they have to be treated appropriately, and ensure that basic goods and services are accessible through the running of SCs. [17]

Food supply chains are the lifeline for human existence on the planet. Whether these chains are local or international, the availability of food at the right time, right quality and right quantity is paramount. [18]

In this way, it was possible to ensure the distribution of the necessary medical equipment and materials, energy, food and other necessities of life. This prevented the shortage of essential items, inflation, the rise of crime and created the preconditions for focusing on solving the health part of the problem, as well as the assumptions for faster and easier recovery of the economy after the pandemic.

#### 4.1 Complete Supply Chain

Complete Supply Chain (CSC) is a SC that has all the components, from raw materials and raw material suppliers, through production, storage, distribution, retail, to the end-customer. The modern approach of SC does not finish there, but implies feedback and material flow (waste) through selective collection, recycling, and return of recycled waste as raw material to a new production cycle, as presented on Fig. 1. “Waste is no more disposed of uncontrolled in the environment but is recycled. Part of waste that can no longer be recycled is disposed of permanently in a non-hazardous manner, in accordance with the regulations.” [19]

In the context of COVID-19, CSC is under difficult conditions due to a number of limitations that have taken effect in almost all countries of the world. Limitations covered all stages of the CSC and manifested themselves in various forms through: difficult raw material procurement, difficult production, stockpiling and lack of storage space, difficult distribution, difficult retail, difficult waste management.

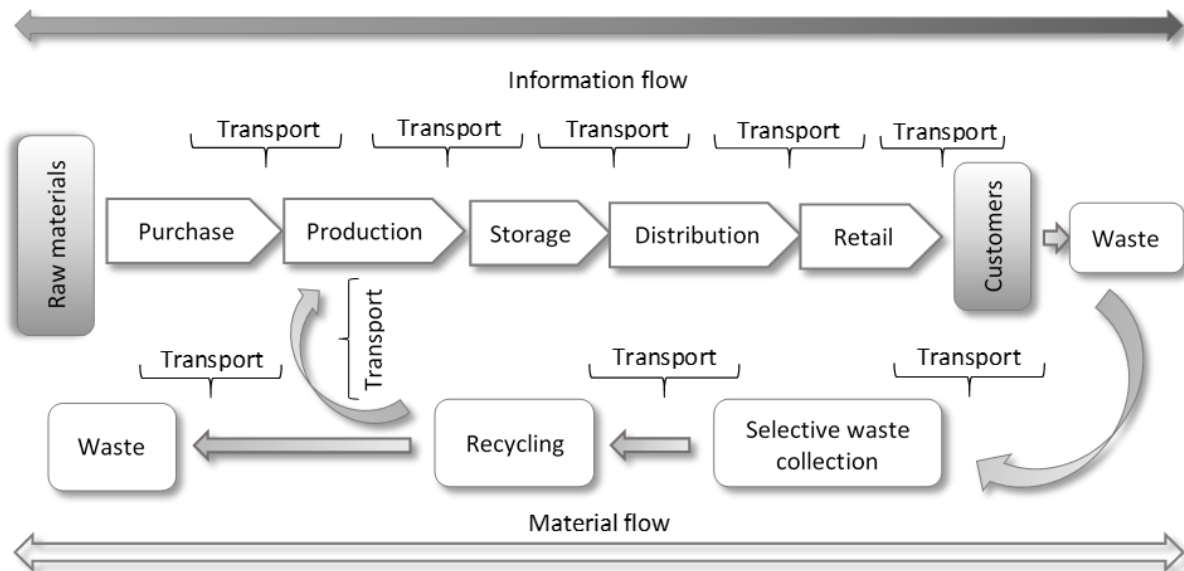


Figure 1 – Complete Supply Chain as a modern approach

Source: [1]

CSC can be discontinued at any time, at any stage of its development, and most often in retail, as one of the first measures in many countries was the closure of shopping malls. No matter what stage of the CSC unfolds, the CSC does not work. The limitations of CSC developments that have occurred globally as a result of COVID-19, as well as the response to these limitations through adjustments, are shown in Table 3.

Table 3 – Limitations and adjustments of CSC in context of COVID-19

Limitations	Adjustments
Difficult procurement of raw materials	
reduced demand  reduced number of workers	new distribution channels (web sales, delivery, dedicated production)  worker protection measures
Difficult production	
difficult procurement of raw materials reduced number of workers production ban conversion of production reduced number of workers	decrease in production worker protection measures gradual liberalization dedicated production worker protection measures
Large inventory and lack of storage space	
difficult distribution lack of storage space rising storage costs	agreed procedures production reduction, alternative warehouses reduced deliveries
Difficult distribution	
closed state borders strict sanitary controls at the border ban on traffic of trucks, aircraft, etc. self-isolation for drivers reduced number of drivers due to illness	interstate agreement unified simplified procedure convoys of trucks across the country with escorts simplification of self-isolation or abolition new drivers, higher pay, lower fuel costs
Difficult retail	
retail does not work, no buyers are coming limited number of customers  increased quantity and value of purchase limited working hours	new distribution channels (e-sales) adjustment of working hours, customer protection measures  stock insurance, customer information better organization, gradual liberalization
Waste management	
difficult selective collection of waste difficult transportation difficult recycling difficult manipulation difficult care reduced number of workers due to illness	better organization reduction of transport frequency better organization better organization better organization worker protection measures

Source: Authors.

The adjustments are a response to the necessary limitations that had to be introduced to reduce the risk of uncontrolled spread of the infection. The adjustments aim to allow the CSC to unfold as much as possible under the circumstances so that life can also take place in the context of COVID-19.

## 4.2 Short Supply Chain

Short Supply Chain (SHSC) is a product of the efforts of small businesses, especially family farms, to remain competitive in the market. SHSC is actually an innovation of CSC. There is no clear and simple definition of "local food products" or "short supply chains" that could be applied to a variety of production, processing, distribution and distribution systems associated with local food production systems in the EU Member States. More important than a single definition is that these terms are interpreted in accordance with the area and context in which they are developed.

The definition of SHSC can also be derived from SC definitions. Accepting this approach may be defined as a flow of goods, services and information from the supplier, through the transporter, the manufacturer, the distributor, the retailer to the end-customer, whereby the manufacturer independently carries out the transport and distribution, very often storage, too, of the product to the end-customer and at the distribution and delivery stage sales realizes immediate contact with the customer (Fig. 2). In the EU, SHSC is mainly used in the production of agricultural food products on small and medium-sized farms. The main goal is logistic costs optimization. [1]

Today, it is essential that organizations move towards sustainability. Manufacturing organizations, willingly or not, must be committed to sustainable thinking of the environment because there are drivers in the environment which forces them to adhere to sustainability standards. [20]

This concept is applied in many EU countries, very successfully. About 46,000 or a third of the total number of Austrian small agriculture companies deals with direct sales. Their 11,000 direct sales outstrip more than half of their annual income. Fruit, wine, pork meat and eggs are the most commonly used for SHSCs. They are less used for placement and distribution of milk and meat products from dairy and livestock farms. 5% of the money spent in Spain for food was spent on products from the SHSCs. There are more and more SHSCs in Italy. In 2009, 63,000 producers were included, an increase of 4.7% over 2008, with a total value of EUR 3 billion, an increase of 11%. Of this, 40% refers to the wine sector and 20% to fruits and vegetables. [21]

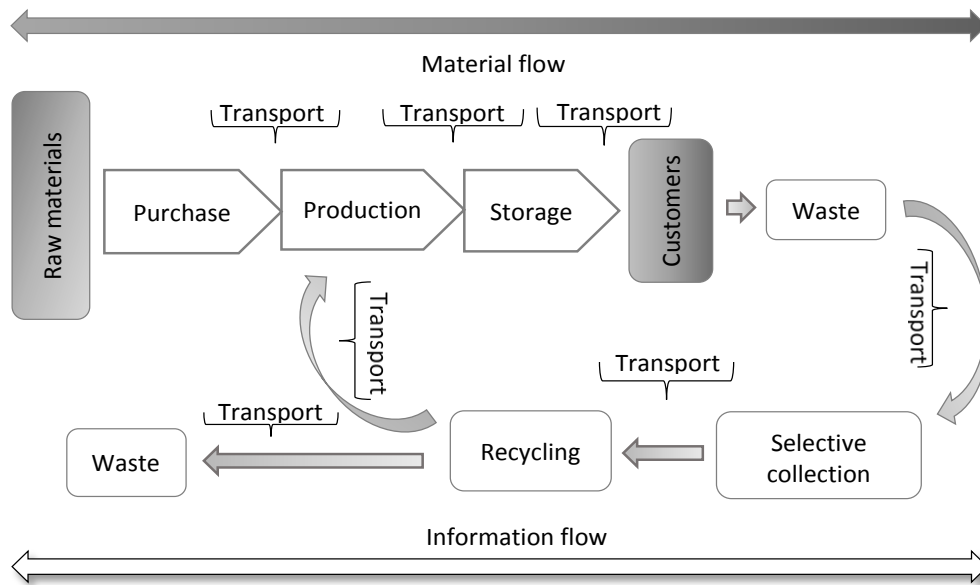


Figure 2 – Short Supply Chain as a modern approach

Source: [1]

Micro, small and medium-sized enterprises and private sector production can play a significant role in the work and development of Clusters and can accelerate economic activities and contribute to the development of the local economy.

In the case of SHSC, there were a number of limitations in the context of COVID-19, as shown in Table 4. They are characteristic of all stages of the SHSC. SHSC is most often interrupted in the distribution stage due to closure, such as green markets, or shopping malls. The problem with small farmers is that agricultural products mature in a very short period of time when they need to be marketed or fail.

In the case of SHSC, it can be talked about in the service sector as well, not just in the producing sector. This example also covers services provided by providers to users such as construction services, postal delivery services, various artisanal maintenance services performed in households by users, etc.

Table 4 – Limitations and adjustments of SHSC in context of COVID-19

Limitations	Adjustments
Difficult procurement of raw materials	
reduced demand reduced number of workers	new distribution channels (web sales, delivery, dedicated production) worker protection measures
Difficult production	
difficult procurement of raw materials shortage of workers production ban conversion of production reduced number of workers	decrease in production worker protection measures, additional stimulation gradual liberalization dedicated production worker protection measures
Large inventory and lack of storage space	
difficult distribution lack of storage space limited durability of the product rising storage costs	agreed procedures production reduction, alternative warehouses new distribution channels (web sales, delivery) reduced deliveries
Difficult distribution	
restriction of movement in a certain area strict sanitary controls the manufacturer also distributes limit number of customers	movement passes unified procedure better organization new distribution channels (e-sales, delivery, individual customer approach)
Waste management	
difficult selective collection of waste difficult transportation difficult recycling difficult manipulation difficult care reduced number of workers due to illness	better organization reduction of transport frequency better organization better organization better organization worker protection measures
Difficult to provide services	
reduced demand reduced number of workers services ban restriction of movement in a certain area strict sanitary controls	diversification of services (emergency services) worker protection measures gradual liberalization movement passes unified procedure

Source: Authors.

However, flexibility and focus on the end-customer as fundamental features of SHSC resulted in adjustments as shown in Table 4. Some of the innovations are: reorientation to dedicated production to combat COVID-19, new distribution channels such as web sales, changed procedures in coordination with government bodies, etc. The basic task of the adjustments measure is to ensure that the SHSC unfolds in the context of COVID-19 and continue the unfolding of the SHSC to meet the needs of end-customer, to continue its economic activities, and to ensure the survival of producers and service providers in the market.

### 4.3 Reversible Supply Chain

The Reversible Supply Chain (RVSC) stems from the later shortening of the SHSC. This is due to the fact that there is insufficient labour force to harvest fruits and vegetables that matures in the short term and needs to be put to the end-customer in a time that guarantees high quality. In these circumstances, producers do not deliver the products themselves to customers as with the SHSC but the customers come to the producer and on the spot pick up the products (Fig. 3). In this way the products are of high quality to the customer, and the producer optimizes their logistics costs and remains competitive. [1]



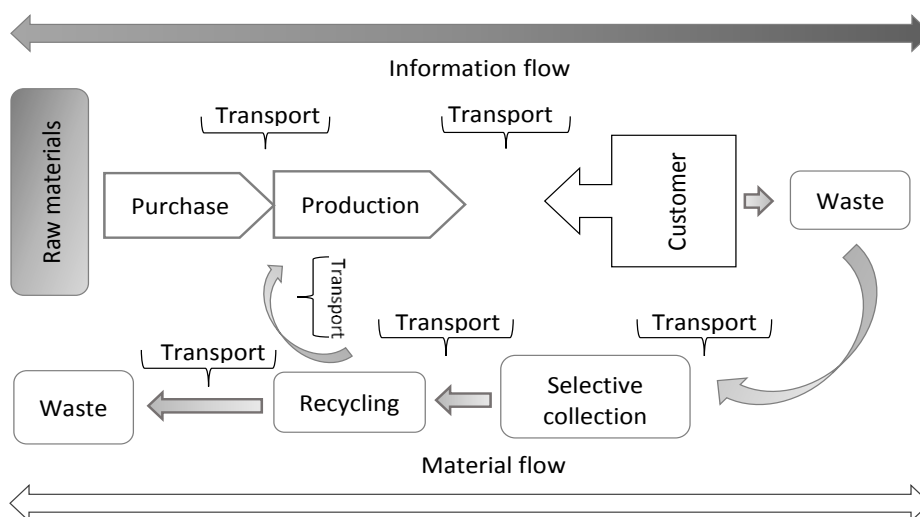


Figure 3 – Reversible Supply Chain as a modern approach  
Source: [1]

As with the previous two emergent SC shapes, in the context of COVID-19, constraints also occurred in the unfolding of RVSCs, as shown in Table 5. The limitations are of such a nature that they prevent the RVSC from proceeding as it was before COVID-19. Due to limitations on movement and prohibition of gathering people, it is not possible for customers to come to the producer and harvest or pick up agricultural products or take another product, pay for it and leave it, and subsequently consume it.

Table 5 – Limitations and adjustments of RVSC in context of COVID-19

Limitations	Adjustments
Difficult procurement of raw materials	
reduced demand reduced number of workers	new distribution channels worker protection measures
Difficult production	
difficult procurement of raw materials shortage of workers production ban conversion of production reduced number of workers	decrease in production worker protection measures, additional stimulation gradual liberalization dedicated production worker protection measures
Difficult distribution	
restriction of movement in a certain area difficult distribution greater quantity of products in a short time limited durability of the product demand reduction, limited number of customers strict sanitary control	movement passes agreed procedures temporary convenient warehouses new distribution, customer arrival to producer, drive-in, reduced deliveries, individual approach to the customer a unified procedure
Waste management	
difficult selective collection of waste difficult transportation difficult recycling difficult manipulation difficult care reduced number of workers due to illness	better organization reduction of transport frequency better organization better organization better organization worker protection measures
Difficult to provide services	
reduced demand reduced number of workers services ban  restriction of movement in a certain area strict sanitary controls	diversification of services (necessary services) worker protection measures new distribution channels (e-school, e-lectures, tv school, e-animation of children, e-citizens), gradual liberalization movement passes unified procedure

Source: Authors.

When it comes to manufacturers, many forms of adjustments have been developed, which has enabled end-customers to consume their products. Designing adjustments has also led to certain innovations through the establishment of uniform procedures and individual approach to the customer in order to understand his needs and product requirements as much as possible.

The experiences of some countries, such as Canada, United States, Europe and UK are useful. „An element of food distribution that is undergoing significant change during the COVID-19 pandemic is the expansion of online grocery deliveries. Prior to the pandemic, the Canadian grocery sector had been slower than its counterparts in Europe and the United States to offer online grocery delivery services. Click and collect services, wherein a customer places an online food order for collection at a retail store, have been on the increase, particularly in major urban centers, but home delivery services are considerably less common. Online grocery delivery models encompass two main categories: dedicated online-only services, for example, Ocado in the UK as well as Amazon, and existing grocery retailers with an online delivery option“. [22]

This also applies to services such as services which require close contact (hairdressers, pedicurers, masseurs, etc.). It is the same with the consumption of hotel and other tourist services where customers come to the service provider to consume the service.

„The modern supply chain network has complex structure and dynamic environment. It is very important to evaluate the network robustness, which represents its ability to maintain function and connectedness once some nodes or edges are lost. A resilient supply chain network is able to maintain the delivery of supplies in response to demands under unexpected disruptions.“ [23]

Numerous innovations have also been noted in this area. One of the very pronounced phenomena is „The phenomenon of supply chain elasticity (SCE)“, that is, the transformation of RVSP into SHSC, such as in education, sport training and kindergartens. Prior to the advent of COVID-19, services of all levels of education and childcare were provided in the form of RVSP, as trainees and children (users) came to educational institutions and kindergartens, ie to providers, to consume the service. Due to limitations on movement and the ban on gathering more people, providers (schools, colleges, educational institutions) continued to provide services, but as SHSCs, they also provided distance education services as e-education or education through nationally concessioned TV channels. In the case of kindergarten children, it was about animating children through e-playrooms and the like. In the same way, athletes in many branches of sports have trained. In these examples, it is significant that delivery took place through communication infrastructure such as the Internet, transmitters, receivers, etc. Thus, in the cases of education, sports and animation of kindergarten children, the RVSC experienced a transformation into the SHSC due to limitations and only as such continued to take place.

The results of this research confirm the basic hypothesis that even in a pandemic, SCs must not be completely interrupted because their interruption would cause unprecedented economic, social and political consequences. Despite the limitations, measures are being taken at national and global level to allow SCs to take place. The SCs show a high degree of flexibility and elasticity.

The producer and the end-customer are involved, because the environmental problem is not an individual problem, but every individual (the producer, the end-customer) has the responsibility for environmental protection and should make a contribution within the system that operates in a particular area. [20]

## 5. CONCLUSION

SC is one of the foundations of any economy and its contribution to economy is crucial. SHSC is the result of the need and effort of small producers, primarily agricultural food products and others, to be competitive on the market with large sales chains. In order to improve their competitiveness, they have to fill several conditions, including the association and implementation of the SHSC strategy. The

RVSC stems from the later shortening of the SHSC. This is due to the fact that there is insufficient labour force to harvest fruits and vegetables that matures in the short term and needs to be put to the end-customer in a time that guarantees high quality. In the context of COVID-19, all three emergent shapes of the SC have been confronted with a number of limitations aimed at stopping the COVID-19 pandemic and preserving human lives. At some point, these limitations completely halted the development of SCs, which diminished the effectiveness of the fight against pandemics, and at the same time threatened the powerful collapse of economies both nationally and globally. Completely stopping SCs was unacceptable to all market participants and threatened shortages, panic, rising crime, inflation and other side effects. Various adjustments have therefore been made to enable SCs to take place, to combat the pandemic and to ensure that the economy operates at a reduced intensity. Designing customizations has also resulted in innovative solutions such as designing new distribution channels and a stronger focus on end-customers. One of the results of these innovations is the phenomenon of transformation of RVSC in to the SHSC in the provision of services at all levels of education, sport training as well as in the animation of kindergarten children. This transformation showed the elasticity and adjustment of the SCs to a particular complex situation, and therefore the authors called „The phenomenon of supply chain elasticity (SCE)“.

The problem researched in this paper is the changing context in which SCs take place, the limitations of particular emergent SC shapes, and the measures and ways to adapt them in complex pandemic context. The success of adaptation depends to a large extent on the stability of the supply of goods and services globally.

The result of the research presented in this paper is the SCs adjustment ability to the context such as COVID-19, based on the principles of quality, sustainable development, process and costs optimization, life cycle approach, social responsibility, circular economy, for the benefit of mankind.

Further research will be directed toward new models of adjustment of SCs as context changes. The development of such models is essential for risks management, that is, managing future crises, both nationally and globally.

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