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ASSESSING INTEGRATED BACK AND FORTH RELATIONSHIP IN BULGARIAN CLUSTER SUPPLY CHAINS

Cluster supply chain is enterprise network with a feature of cluster and supply chain and is an important channel for enterprises close to the knowledge, resources, markets, and technologies. The research into cluster supply chains focuses on the theory of industrial clusters and plays an important role in their development and competitiveness. The aim is to study the relations along the supply chain – both back and forth, which will boost the development of clusters. The idea for the present research emerged from the conference "China and Central & Eastern Europe", International Scientific Forum in 2020, where the author presented a report on strengthening the cooperation between Bulgaria and China by building back and forth supply chain relationships.

The methods of research analysis are: method for analysing the strength of the back and forth relations along the supply chain; questionnaire method; statistical method for research of relations and dependencies. The total number of clusters included in the questionnaire are 42 and they are the main performing clusters in Bulgaria. Of the clusters under consideration, those with the highest share are the ones whose business is in the field of electrical engineering – 12% and ICT – 11.8% of the total number. Almost 5% is the share of the clusters in the field of machine building, textile and sewing industry – 4.8%, tourism and health industry – 4.5%. The Likert scale is used to assess the results from the questionnaire study. The study was conducted in the period between 2018 and 2020.

In conclusion, it can be stated that clusters in Bulgaria have not built well developed back and forth relations along the supply chain because the results from the analysis of the strength of the inner-cluster relations in terms of sales, back and forth along the supply chain illustrate low importance and insufficient development. A statistically significant relation exists between the availability of a logistics company and the general evaluation of the cluster related to the degree of development of the relations back and forth along the supply chain. The use of modern digital technologies (cloud technology, big data, multichannels, omnichannels, blockchain etc.) is not at a high level and can further be developed, which will push development back and forth along the supply chain in the clusters in Bulgaria.

This study explores and uncovers, for the first time, back and forth cluster supply chain relationship in Bulgaria. This study provides insights to clusters managers and for their strategies.

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Introduction

Supply chain management integrates suppliers, manufacturers, customers to improve the long-term performance of individual firms and partnership, integration, Information sharing, Information quality (SunHee Youn, Paul Hong, Abraham Nahm, 2008, pp. 438-456; Bowersox, Closess, Cooper, 2002; Ellram, Cooper, 1993). Successful supply chain management requires the integration of these value chain entities to create a cooperative and collaborative environment that facilitates information exchange and shared decision-making across the value chain (Berry, Hill, Klompmaker, 1999, pp. 3599-3618).

Clusters have long been a feature of economic geography, but their influence on competition has grown with the shifting nature of competition and the restructuring of how companies operate. Competition in advanced economies is increasingly driven by knowledge and skill, with low-cost labour and other resources accessed in cheaper locations. Clusters are important because they play a fundamental role in knowledge creation, innovation, the accumulation of skills, and the development of pools of employees with specialised expertise (Porter, 2007). It may be observed that industries tend to be geographically "clustered." Well known examples of clusters include the concentration of information technology firms, wineries, finance and investment banking, fashion products, or computer products. It is also very often for corporate functions to be clustered. This phenomenon was originally observed and explained by the British economist Alfred Marshall (1920) in his classic work Principles of Economics. Joining a cluster means getting a lot of advantages. A company can choose the way to be more competitive by getting bigger and bigger. However, a cluster may be an optimal balance between the complexity and bureaucracy that hamper innovation in large enterprises and the lack of scale that holds back smaller firms. In a dynamic environment, when innovation and fast market response are the keys to competitive advantage, the tacit communication and trust-building between smaller firms (and between their employees, who share culture and extensive personal contact) allow them to participate in joint learning and adoption of best practices (Rześny-Cieplińska 2016, pp. 161-172).

Cluster supply chain (CSC) is a kind of enterprise network with a feature of cluster and supply chain and is an important channel for enterprises close to the knowledge, resources, markets, and technologies. The research into cluster supply chains focuses on the theory of industrial clusters and plays an important role in their development and competitiveness. The aim is to study the relations along the supply chain – both back and forth, which will boost the development of clusters. The research began with a report presented by the author of the International Scientific Forum "China and Central & Eastern Europe", 2020, dedicated to cooperation between Bulgaria and China by building back and forth supply chain relationships.

Literature Review

The general concept of an integrated supply chain is typically illustrated by a line diagram that links participating firms into a coordinated competitive unit. Bowersox, Closess, Cooper

illustrates a generalised model adapted from the supply chain management program at Michigan State University (Bowersox, Closess, Cooper, 2002, p. 5).

Figure 1

Generalised supply chain model
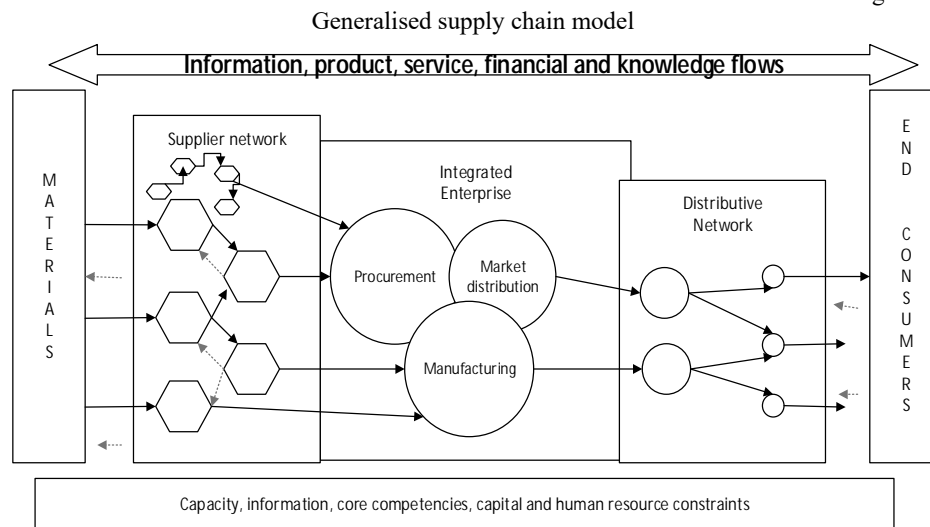
Source: Bowersox, Closess, Cooper, 2002, p. 6.

The generalised supply chain arrangement illustrated in Figure 1 logically links a firm and its distributive and supplier network to end customers. The message conveyed in the figure is that the integrated value-creation process must be managed from material procurement to end-customer product/service delivery (Bowersox, Closess, Cooper, 2002, pp. 5-6). According to Donald Waters (Donald Waters, 2003, p. 8) the simplest view of a supply chain has a single product moving through a series of organisations, each of which somehow adds value to the product. Taking one organisation's point of view, activities in front of it – moving materials inwards – are called "back"; those after the organisation – moving materials outwards – are called "forth". The "back" activities are divided into tiers of suppliers. A supplier that sends materials directly to the operations is a first-tier supplier; one that sends materials to a first-tier supplier is a second-tier supplier; one that sends materials to a second-tier supplier is a third-tier supplier, and so on back to the original sources. Customers are also divided into tiers. One that gets a product directly from the operations is a first-tier customer; one that gets a product from a first-tier customer is a second-tier customer; one that gets a product from a second-tier customer is a third-tier customer, and so on to final customers (Donald Waters, 2003, p. 8). According to the presented generalised supply chain, practically all entities are involved, which include mining companies, processing companies, wholesale and retail trade organisations, service organisations, logistics service providers and others. The supply chain will be successful, and will have a synergistic effect, if all the described participants back and forth in the supply chain take part. An interesting question is related to the integrated back and forth relationship in clusters. There is no research data to investigate

how having a logistics company in the cluster would affect the integrated supply chain back and forth. According to Dragomirov, conditions for building effective technological interaction among logistics companies and their customers have been created.

Currently, the overall level of use of various information solutions can be assessed as insufficient, which is primarily due to lower requirements by contracting authorities or they are sought by a small part of them. This means that as soon as there is a greater need for such solutions, logistics service providers are likely to implement them (Dragomirov, 2016, pp. 76-86).

For SME the cooperation with other enterprises is often the only possibility to become part of global value chains. Forms of cooperation used are downright diverse and of different intensity, however, all forms of rather complex cooperation between businesses need one thing for their efficient and effective operation (Scheer, von Zallinger, 2007). Partnerships can lead to changes in operations. For example, the stability of a partnership might encourage suppliers to specialise in one type of product. They give such a commitment to the alliance that they reduce their product range, make these as efficiently as possible, and concentrate on giving a small number of customers a very high-quality service. They share information with customers without the threat that this will be used to get some form of trading advantage. At the same time, customers reduce their number of suppliers, as they no longer need to look around to get the best deals. Donald Waters described Japanese companies were among the first to develop strategic alliances, and at the time when Toyota had formed partnerships with its 250 suppliers, General Motors was still working separately with 4000 suppliers (Waters, 2003, p. 47).

Some factors that contribute to a successful partnership include a high level of achieved service, real cost savings, a growing amount of business, compatibility of cultures, and so on. Donald Waters and Lamber, Stock (Waters, 2003; Lambert, Stock, 2001) gave a more general list of key factors as management commitment, a contract specifying costs and responsibilities, agreed performance indicators, agreed objectives, shared culture and *joint information systems*. Lambert et al. (Lambert, Stock, 2001) summarised these as:

- *drivers*, which are the compelling reasons for forming partnerships, such as cost reduction, better customer service, or security;

- *facilitators*, which are the supportive corporate factors that encourage partnerships, such as compatibility of operations, similar management styles, common aims, and so on;

- *components*, which are the joint activities and operations used to build and sustain the relationship, such as communication channels, joint planning, shared risk and rewards, investment, and so on (Waters, 2003, p. 48).

If an organisation wants to go beyond partnerships, it has to own more of the supply chain. One common arrangement has an organisation taking a minority share in another company. This gives it some say in their operations, but it does not necessarily control them. A manufacturer, for example, might take a minority share in a wholesaler to get some influence in the way that its products are distributed. Another option is for two organisations to start a joint venture, where they both put up funds to start a third company with shared ownership. A manufacturer and supplier might together form a transport company for moving materials

between the two. The most common arrangement has one organisation simply buying other organisations in the supply chain. This increases its level of vertical integration (Waters, 2003, p. 49). By closing the loop, something bigger than an incorporation of back and forth flows is emerging. In closed-loop supply chains is also incorporated the phase of design and construction of products as well as the life cycle assessment (Mihova, 2019, pp. 411-418).

In many ways, the existence of clusters today is surprising. In the past, such agglomerations enabled communications (Sheffi, 2012). Sheffi described two major types of relationship that contribute to the success of clusters could be defined as "vertical" and "horizontal" (Sheffi, 2012). Vertical relationships are links between trading partners. Trading partner relationships are important because the lion's share of value most non-service businesses offer to their customers is obtained through the procurement of parts and services from suppliers. On the procurement side, commercial enterprises interact with a network of material and parts suppliers and an array of service providers. On the sales side, they interact with distributors, customers, and other service providers. Managing these relationships is of prime importance, especially as firm move away from vertical integrations and increasingly outsource many functions and stages of production. The horizontal relationship is between firms at the same stage of production, such as automobile manufacturing plants in Detroit, Michigan, or film studios in Hollywood, California. These firms both compete and cooperate with each other along dimensions that benefit them. Horizontal relationships also exist between functions in firms of the same or different industries. Thus, human resources, legal, procurement, finance, and supply chain management functions may collaborate across companies and industries (Sheffi, 2012).

Clusters are defined too broadly if they are aggregates such as manufacturing, services, consumer goods, or "high tech." Here, the connections among included industries are weak at best, and discussion about cluster constraints and potential bottlenecks will tend to gravitate to generalities. Conversely, equating a cluster with a single industry misses the crucial interconnections with other industries and institutions that strongly affect competitiveness. Clusters occur in many types of industries, in smaller fields, and even in some local industries such as restaurants, car dealers, and antique shops (Porter, Michael, 2000). They are present in large and small economies, in rural and urban areas, and at several geographic levels (e.g., nations, states, metropolitan regions, cities). Clusters occur in both advanced and developing economies, although clusters in advanced economies tend to be far more developed (Porter, 1998, pp. 38-63). Cluster boundaries rarely conform to standard industrial classification systems, which fail to capture many important actors in competition and linkages across industries. According to Porter, clusters were defined as geographic concentrations of interconnected companies and institutions in a particular filed. Traditional regional cluster theory has often emphasised the physical components of a cluster, identifying the density of players in a common industry as the critical factor in achieving cluster productivity and economic advantage. In an industrial cluster, the necessary components are often analogous to the supply chain of the industry, with specialised resources close at hand: knowledgeable workers, industry experienced service providers, professionals and managers, appropriate forms of financing, supportive government policies and access to appropriate transportation, distribution and ultimately customers. In a cluster of innovation, industry concentrations certainly may exist, but are not definitive. It is rather both the nature and the behaviour of the components that is distinctive (Engel, 2014, p. 10). According to Mary Jo

Waits, clusters of world-class firms in related industries are the most important economic development customers in the global economy. These clusters, rather than individual companies or simple industries, are the source of jobs, income, and export growth (Waits, 2000, pp. 35-50).

Cluster development initiatives are seen as actions aimed at accelerating the growth and competitiveness of emerging communities of enterprises within a region. These actions can be undertaken by the government (or regional authorities), the cluster enterprises and the research community.

Figure 2 illustrated the main components of a cluster of innovation. The reason clusters are relevant for innovation is that when there is a critical mass in a location of a sector or industry, the different actors can support each other, and resources can be arranged and rearranged in flexible ways. But the critical mass is not enough; the actors must be connected in various ways and there must be the mobility of resources and skills, including technological spill-overs (Ketels, Lindqvist, Sölvell, 2012, p. 38).

Figure 2

The components of a cluster of innovation
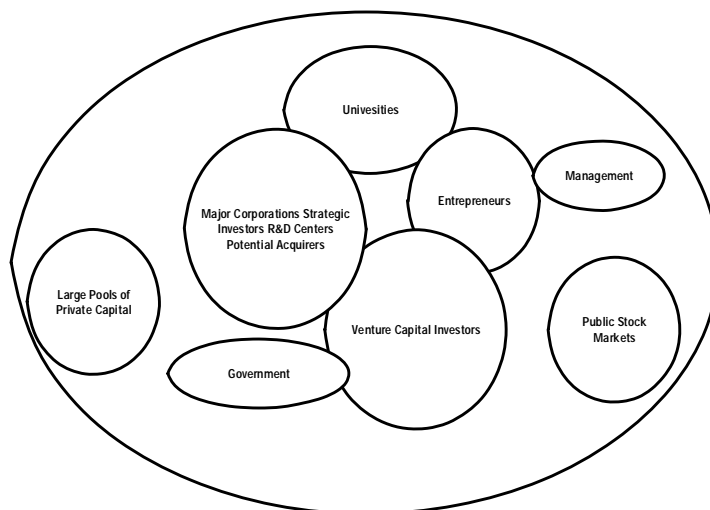
Source: Engel, 2014, p. 11.

Industrial clusters form because they yield certain advantages, as noted by many economists. Some of these advantages included trust between cluster inhabitants, tacit knowledge exchange, a collaborative environment, support for research and educational institutions, and availability of a supply base. As mentioned by Marshall in 1920, clusters attract suppliers who see advantages in locating next to their customers. Even in today's environment, the opportunities for unstructured and chance interactions with customers, the opportunities to learn where their business is heading. According to Sheffi, the opportunities to forge strong, trusting and collaborative relationships with customers are very important when firms make

location decisions. From the customers' point of view, a strong supplier base with multiple suppliers bodes well for competitive pricing and supplier innovation, which are crucial for competitiveness (Sheffi, 2012). Back integration is a form of vertical integration in which a company expands its role to fulfil tasks formerly completed by businesses up the supply chain. Complete vertical integration occurs when a company owns every stage of the production process, from raw materials to finished goods/services. Forth integration is also a type of vertical integration, which involves the purchase or control of a company's distributors. There are not enough research data on the development of integration back and forth relationship along the supply chain in the Bulgarian clusters. A well developed integrated back and forth relationship Bulgarian cluster supply chain will increase the competitiveness of the cluster itself and will accelerate the development of the enterprises participating in them, creating favourable external conditions. Velev (2007) proposed a model of the cluster approach to increase competitiveness. The model covers an analysis of the strength of the relationship in the cluster, analysing two main types of links – forth and back along the supply chain. According to Velev (2007, p. 108), once the clusters are identified, they must be evaluated and analysed. The aim is to clarify the state and importance of the cluster, to identify strengths and weaknesses, opportunities and their potential for future development. From the customer's point of view, a strong supplier base with multiple suppliers bodes well for competitive pricing and supplier innovation, which are crucial for competitiveness (Rześny-Cieplińska, 2016, pp. 161-172). Some researches show that the essence of an industrial cluster is tightly related to the supply chain. The components of a cluster of innovation are inclined toward adaptation of new technologies, creation of new markets and addressing of large, global market, illustrated by Jerome Engel (2014, p. 11) entrepreneurs, mature corporations, universities, industrial research centres, venture capital, service providers, management, government.

According to Wojciech Piotrowicz and Richard Cuthbertson, the changes at the clusters supply chains management are driven by new technologies, such as smart mobile devices (smartphones and tablets) and related software (apps, mobile payments, e-valets, e-coupons, digital flyers, location-based services). There are changes in the IT provision, reduced cost, and access to technology (big data and cloud computing), which allow for personalisation and price optimisation. There are also new in-store technologies available (virtual screens and aisles, virtual mirrors-fitting rooms, digital signage, intelligent self-service kiosks, vending machines and dynamic menus), as well as QR codes, in addition to mobile devices brought to the shop by customers. Studies of Wojciech Piotrowicz and Richard Cuthbertson focused on the impact of technology in three areas: 1) multi-channel and in-store retailing and development of new business models; 2) mobile technologies; 3) customer experience and supplier relationships. Supply chain investments are perceived as a key issue in channel integration. When the retailer is considered a hub for retail activities, the supply chain design should reflect this. Issues such as product availability, returns, delivery options, backflows, and inventory management across channels should be addressed. Because online and traditional channels are often managed separately, integration of both physical and information flows is required. However, different options may also be considered, such as "showrooming," in which products are just viewed and "experienced" in-store and then delivered directly to the customer. The mix of traditional and online options will be the most likely solution: for smaller items, the "click and collect" option (buy online, collect in-store),

and the "showroom," supported by interactive screens, for items that need space for storage and exhibition. All such options should be supported by redesigned end-to-end distribution and delivery systems; there should also be an integration of marketing and supply chain management to ensure product availability across channels and a pull-order system from the product manufacturers (Piotrowicz, Cuthbertson, 2014).
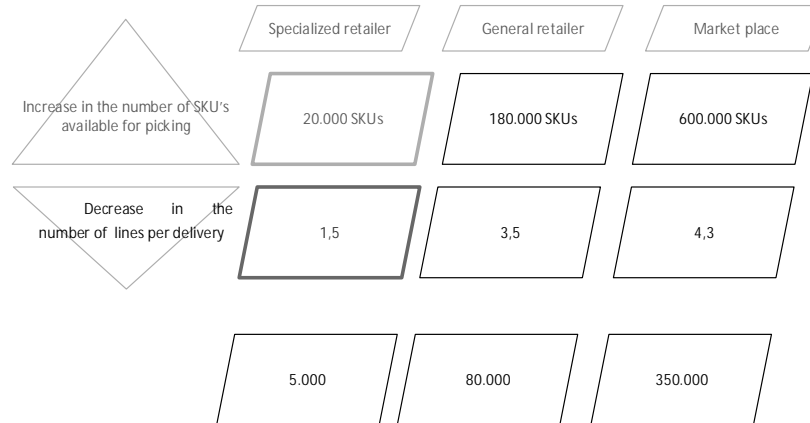
A number of studies have shown the relationship between information technology and the supply chain in trade and manufacturing organisations. According to Dragomirov, modern e-commerce platforms are more than a software solution for the presentation of the company products in the webspace. Now they have real potential for their transformation into small-sized ERP systems, which are not limited just to the organisation. They are open to the supply chain members and to online integration with their information systems which is a prerequisite for developing basic SCM practices in the supply chain and achieving better competitiveness of supply chain members. This evolution stage of the e-commerce platforms is a signal for the appearance of alternatives for flexible SCM software solutions (Dragomirov, 2020), pp. 250-261). However, there is a lack of in-depth research on the relationship between digital technologies and development integrated back and forth Bulgarian supply chain cluster organisations.

It is important to carry out research together with cluster members to determine which services are already available in the market and which must be developed and offered by cluster management (subsidiarity). Existing products and services should simply be integrated into the cluster's range of products and services, with special conditions negotiated with the providers for cluster members (demand bundling). The cluster managers should try to consolidate the various services in an integrated "cluster service system" for which the cluster management office acts as a sort of "one-stop-shop" (Scheer, Zallinger, 2007, p. 34). Figure 3 illustrates the increase in the average number of stock-keeping units (SKUs), the decrease in the average number of line items per delivery, and the increasing number of sales orders per channel a traditional retailer should be prepared to expect when engaging in e-commerce (Kourimsky, Berk, 2014).

Making the received goods available for immediate sale is a key challenge for retailers switching to having the distribution centre ship goods directly to the end customer. In most distribution centres, the stock is sorted before being put away, so that it can be easily found and grouped for picking (Kourimsky, Berk, 2014). It is therefore important to look at the relationship back and forth in cluster supply chains. There aren't studies that analyse the integrated relationship back and forth in Bulgarian cluster supply chains. According to Binghua He, cluster supply chain (CSC) is a special kind of enterprise network with a double feature of cluster and supply chain and is an important channel for enterprises close to the knowledge, resources, markets, and technologies. Cluster supply chain (Figure 4) has a special network structure and network relational, which are different from general cluster and supply chain. In a particular industry cluster region, all kinds of enterprises and non-enterprise organisations around the core enterprises are connected to form local integration of supply chain through "trust and commitment" informal or formal contract (He, 2016, pp. 751-762).
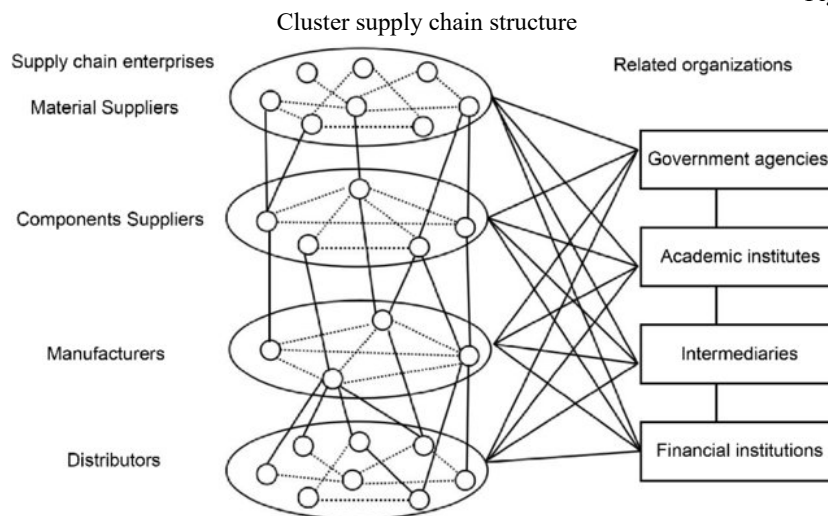
Figure 3

Fundamental effects of e-commerce engagement on a traditional retailer's supply chain

	Specialized retailer	General retailer	Market place
Increase in the number of SKU's available for picking	20.000 SKUs	180.000 SKUs	600.000 SKUs
Decrease in the number of lines per delivery	1,5	3,5	4,3
	5.000	80.000	350.000

Source: Kourimsky, van den Berk, 2014.

Figure 4

Cluster supply chain structure

Source: He, 2016, pp. 751-762.

The majority of authors studied agree that the aim of supply chain management (SCM) is to boost company competitiveness and profitability, both along the entire supply chain and for the end consumer. The integration of the processes in the supply chain and the reorganisational initiatives should aim to increase the total efficiency and effectiveness of the supply chain in the clusters. Since the supply chain encompasses all stages from supplying resources to selling the ready product to the end consumer, the analogy used is that of a flow,

where organisations, positioned close to the source of resources, are defined as being at the beginning of the supply chain or the upper end of the flow. And the opposite – those organisations that are close to the end-user are organisations that are at the end of the supply chain or in the lower part of the flow.

By accepting the entire concept of the supply chain, the participants in it represent all companies and organisations with which a given company collaborates directly or indirectly with through its suppliers and clients from the point of production of the raw materials to the point of product consumption. It can be pointed out that the structure of the supply chain is the network of participants and the relations among them. The key processes are those that involve the manufacture of certain products and add value for the consumer. The management components include the managerial changes through which these processes are integrated and managed in the supply chain. It is important that the participants along the back and forth supply chain be identified. The interrelations in the cluster characterise the degree, to which the companies in its composition collaborate in terms of their trade relations. The supply chain network structure will have a different look depending on who is the focal company in the cluster. Both back and forth integrations are vertical integration strategies to gain better control of the value chain, reduce dependence on the suppliers and increase business competitiveness. Therefore, having a logistics company as a member of the cluster could improve the back and forth relationship in the cluster. All industries, both in industry and in the service sector, need to participate in inter-company cooperation back and forth supply chain (Velikova, 2012, p. 18). There is a research in the field of logistics in the energy sector in Bulgaria, which examines issues related to compressed natural gas (CNG) physical distribution management to daughter CNG refuelling stations (Stefanov, 2018, p. 17), but the existence of cluster forms of interaction between participants in the energy supply chain have not been studied. There is still a serious shortage of primary data on the establishment and functioning of the supply chain in clusters in Bulgaria, on the strength of back and forth relationship for the cluster, as well as on the impact of their influencing environmental factors and more efficient use of innovation potential at national and international level.

In well-industrialised countries, as well as in developing ones, the efficient operation of clusters can be seen. Companies forming clusters can help business entities, small and medium-sized enterprises, in particular, improve their competitive edge. Regardless of an industrial sector or branch in which they operate, companies grouped in clusters have better opportunities for development, identification of production niches, access to export markets and recruitment policy than they have while operating alone (Rześny-Cieplińska, 2016, pp. 161-172).

The geographic scope of a cluster refers to the territorial extent of the firms, customers, suppliers, support services, and institutions that are embedded in the ongoing relationships and interdependent activities that characterise the cluster. The geographic span of a cluster can range from a small area within a city to areas encompassing much of a nation (Enright, Sun Hung Kai, 2000, pp. 1-21).

Methodology

The object of this research is the Bulgarian clusters, which, according to data provided by the Bulgarian Small and Medium-sized Enterprises Promotion Agency (BSMEPA), amount to 300 cluster organisations in total, the majority of which are organised in non-for-profit organisations under the Bulgarian legislation. According to research conducted by Slavova, Bankova and Ivanov, the span of cluster structures is limited – the majority of clusters (approximately 50% of those studied) have a limited number of members – between 11 and 20 and they are mostly representatives of business; just 23 clusters have as their members universities, scientific organisations, schools; and only 9 clusters have municipalities, NGOs and other organisations in their structure. The number of cluster members and their structure show that the clusters under consideration are not developed in terms of the width of the cluster structures. The management of the cluster initiatives does not differ – the clusters have a standard managerial structure [General Meeting and Board of Directors]. The goals that cluster state on their websites are numerous and can be classified into four segments, most commonly stated: (1) enhancing the competitiveness of members/industry; (2) training and qualification of employees; (3) expansion of market positions, including internationalisation; (4) promoting innovation (products, technology, technology); (5) cooperation between cluster members (Slavova, Bankova, Ivanov, 2018, pp. 14-28).

The methods of research analysis are:

- Method for analysing the strength of the back and forth relations along the supply chain;

- Questionnaire method;

- Statistical method for research of relations and dependencies.

The total number of clusters included in the questionnaire are 42 and they are the main performing Bulgarian clusters. Of the clusters under consideration, those with the highest share are the ones whose business is in the field of electrical engineering – 12% and ICT – 11.8% of the total number. Almost 5% is the share of the clusters in the field of machine building, textile and sewing industry – 4.8%, tourism and health industry – 4.5%. The Likert scale is used to assess the results from the questionnaire study. The study was conducted in the period between 2018 and 2020.

Working hypotheses

H1 – Bulgarian clusters have well developed back and forth relations along the supply chain.

H2 – There is a relation between the availability of logistics companies as cluster members and the development of the back and forth relations along the supply chain.

H3 – There is a relation between the use of modern digital technologies (cloud, big data, multi-channels, omni-channels, blockchains etc.) and the development of back and forth relations along the supply chain in the cluster organisations.

To prove Hypothesis 1 an Indicator for gauging the strength of the back and forth relations in the clusters, including the two indices, will be used: (Velev, 2007, p. 134).

1. Analysis of the strength of the inner-cluster relations related to sales along the supply chain

$$I_s = \frac{\sum_{i=c}^{r} \sum_{j=c}^{r} x_{ij}}{S_c + \cdots + S_r} 100,$$

   Where:

   I_s is intensity of sales within the cluster as a percentage of the sales of all industries in the cluster to other industries;

   c – the leading cluster industry;

   r – total number of industries in the cluster;

   x_{ij} – volume of production expressed as a value which the i sector (i=c-r) provides to the j sector (j=c-r). The element of the matrix of the balance of intersector relations.

   $S_c + \cdots + S_r$ – the sum of sales of all industries in the cluster to other industries (to industries in the cluster and to industries outside the cluster).

2. Analysis of the strength of the inner-cluster relations related to purchases, i.e. back supply chain

$$I_p = \frac{\sum_{i=c}^{r} \sum_{j=c}^{r} x_{ij}}{P_c + \cdots + P_r} 100,$$

   Where:

   I_p is intensity of purchases in the cluster as a percentage of production purchases in all industries in the cluster (%)

   c – the leading cluster industry;

   r – total number of industries in the cluster;

   x_{ij} – volume of production expressed as a value, which the i sector (i=c-r) provides to the j sector (j=c-r). The element of the matrix of the balance of intersector relations.

   $P_c + \cdots + P_r$ – the sum of purchases for production in all industries in the cluster from other industries (from industries in the cluster and from industries outside the cluster)

3. Analysis of the strength of inner cluster relations in the back supply chain

$$I_{\text{вр}} = \frac{\sum_{i=1}^{q} \sum_{j=c}^{r} x_{ij} + \sum_{j=c}^{r} CT_j + \sum_{j=c}^{r} IM_j}{P_c + \cdots + P_r} 100,$$

   Where:

   $I_{\text{вр}}$ is intensity of external purchases – total (%)

4. Analysis of the strength of intercluster relations forth along the supply chain.

$$I_{B3} = \frac{\sum_{i=c}^{r} \sum_{j=1}^{q} x_{ij} + \sum_{i=c}^{r} K_i + \sum_{i=c}^{r} C_i + \sum_{i=c}^{r} E_i}{S_c^o + \cdots + S_r^o} 100,$$

Where:

I_{B3} is intensity of external purchases total %.

5. Analysis of the strength of the uncommercial relations between the enterprises and their associates in the cluster. The following fields will be evaluated under Mladen Velev's methodology:

№	Fields of analysis
1.	Analysis of the cooperation relations in conducting joint activities by enterprises in the cluster
2.	Analysis of the intensity of informal contacts
3.	Analysis of the trust between the participants in the cluster

To prove the second hypothesis a Chi-squared test will be used to study the dependence between the availability of logistics organisation in the cluster and the general evaluation of the cluster in terms of the development of the back and forth relations along the supply chain**.**

To prove the third hypothesis, we will use the Indicator "use of contemporary digital technologies when managing the supply chain", which includes the following fields:

| №	Fields of analysis
1.	Extent at which cloud technologies are used in the supply chain
2.	Extent at which big data is used along the supply chain
3.	Extent at which multi- and omni-channels are used along the supply chain
4.	Extent at which blockchain is used along the supply chain

Results of research

According to research conducted in Bulgaria, there are 300 registered clusters. Sofia is the main centre of clusterisation, with nearly 150 clusters. A number of cluster organisations are created in Plovdiv, Varna, Burgas and Russe. The Bulgarian clusters are not saturated since they include a small number of companies with a relatively small sales volume and the companies have a different level of specialisation and their members rely on common infrastructure and development strategies.

The companies in the clusters are mostly family-owned businesses with 100% equity capital. This guarantees independence and gives them the possibility to make quick changes and make flexible decisions, but along with that, this is a restrictive factor in terms of easy access to external financing and fast growth. The members of the cluster organisations are companies with similar, interrelated or complementary activities and specialisation. From the point of view of business sustainability, there are also well-established companies with extensive market experience. The total number of people employed in the clusters averages 1000 for the country. The cluster members are predominantly medium-sized and small companies with over 80% of the employed people working in the middle-sized companies.

According to a study by S*ala, Maticiuc, Munteanu* (Sala, Maticiuc, Munteanu, 2016, pp. 10-17)*,* Looking at the score obtained by each country, we can see that cluster development in the western countries of Europe is seen more pregnant than in the east part of the continent. In the same time, we can say that state of cluster development in the developed countries is significantly better than in the developing ones. Figure 5 illustrated the score for state of cluster development. The top positions are occupied by 13 of the 15 European Union states that joined the European Union by 2004. Malta is the state which is intercalated in the rankings, displacing Spain, while Greece is occupying the last position of the ranking. The top-ranking is occupied by Italy, Germany and the Netherlands.

Figure 5

Score for the state of cluster development in European Union Countries in 2019
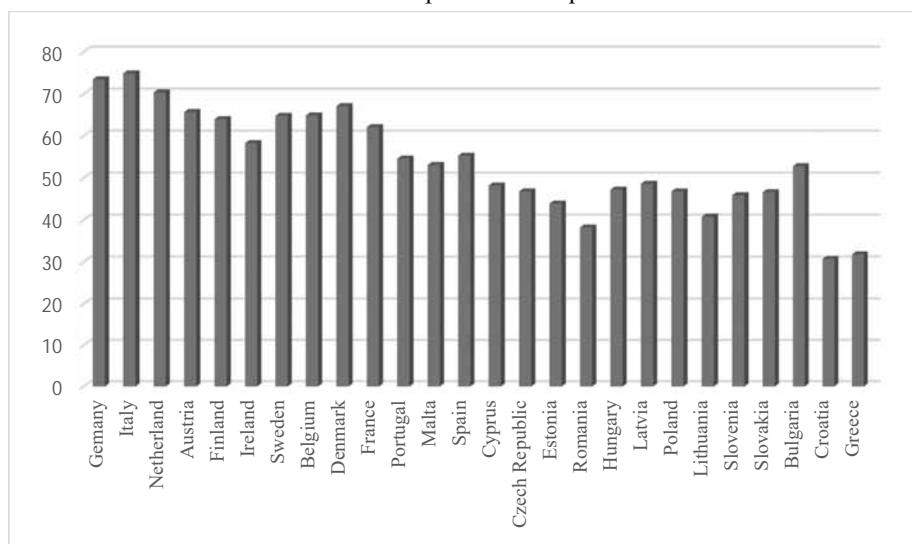
According to the methodology of EAPSMEB (Executive Agency for Promotion of Small and Medium Enterprises in Bulgaria), Bulgarian clusters are classified according to the stage of development, which is illustrated in Figure 6.

There are four developed Bulgaria clusters in the following sectors: machine building, furniture production, extractive industry, electrical engineering and telecommunications. There are 21 developing clusters in total and there are 18 clusters, that are at an initial stage. There are nonclassified clusters in the categorisation, which amount to 15% or 12 clusters and it should be pointed out that there are not logistics clusters.

The cluster approach is based on the requirement for geographically located chains of independent organisations, but this principle is not widely advocated in Bulgarian organisations. The methodology for cluster categorisation includes a system for assessing the potential of the sub-sectors of the Bulgarian economy, which contains the five factors, illustrated in Figure 7.

Figure 6

Categorisation of Bulgarian clusters by stage of development
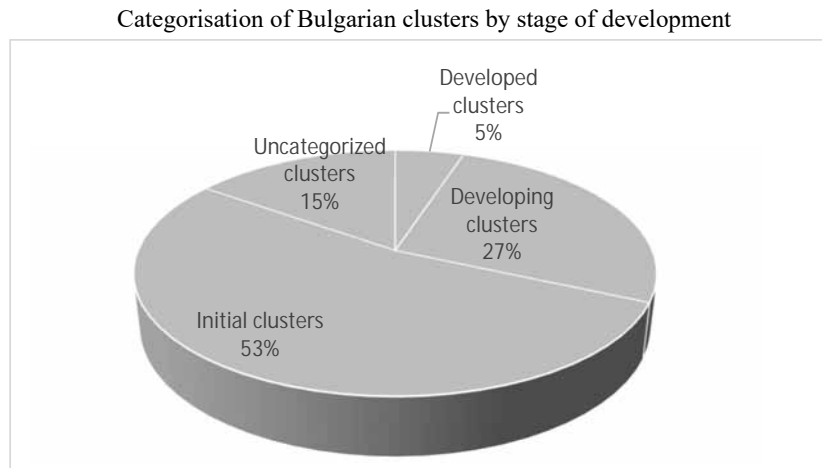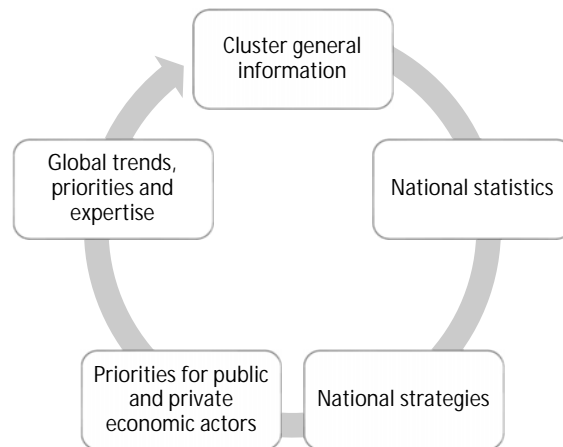

Figure 7

Factors for assessing the potential of the sub-sectors in the Bulgarian economy

Based on these criteria, the most promising subsectors in Bulgaria are fruit and vegetable processing; ICT; textile articles; wine-making; General engineering; energy; tourism; woodworking and furniture, auto parts; high technologies; Transport and Logistics. The transport and logistics sectors are included in this classification, but there are only *two logistics clusters in Bulgaria*. Cluster organisations, on the other hand, Automotive-bw (Germany), Bayern Innovativ (Germany), Clúster de la Indústria d'Automoció de Catalunya (Spain), Galician Automotive Cluster (Spain), European Automotive Strategy Network (The Netherlands), Automotive Cluster Bulgaria Association (Bulgaria), Pôle Véhicle du Futur

(France), Serbian Car Cluster (Serbia) and Silesia Automotive & Advanced Manufacturing (Poland) are teaming up with the European Automobile Cluster Network (EACN) to set goals that aim to be awarded the Smart Specialization Award as a European Strategic Cluster Partnership (ESCP) and building and/or increasing trust between partners and their members. The clusters listed include more than 1,400 members – companies and research institutes, of which more than half are small and medium-sized enterprises (SMEs). In total, EACN member clusters have over 300,000 employees. The partners will concentrate their joint efforts on Industry 4.0 – Factory of the Future – Industrial Modernization.

In the automotive industry, technical necessity, political sensitivities and market variation have kept final vehicle assembly, and by extension, much of parts production, close to end markets. Powerful lead firms and industry associations, largescale employment and relatively high rates of unionisation, and the iconic status of motor vehicles in the minds of consumers (and policy-makers) in many countries increase the political clout of the automotive industry. As a result, regional and national production structures remain surprisingly strong and coherent in comparison to another volume good producing industries where global sourcing of parts and materials is the norm and worldwide demand for finished goods can be met from a handful of giant production clusters. As a result, political pressures go a long way toward explaining patterns of direct investment in the automotive industry (Sturgeon, Biesebroeck, Gereffi, 2008, pp. 297-321).

The main priorities of cluster goals in Bulgaria are first and foremost related to modernisation, growth and optimisation of the supply chain, followed by growth and investment (Figure 8).

Figure 8

Radar chart of cluster efforts over the next years
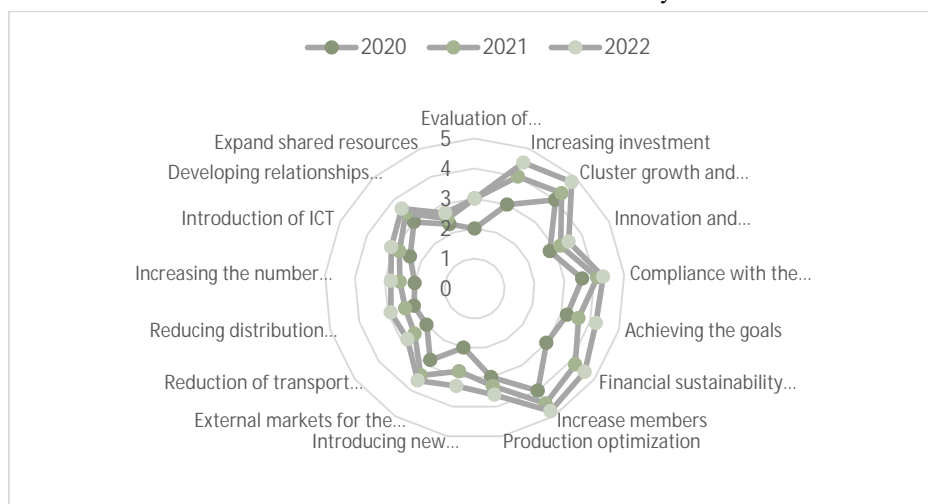
The set goals are implemented through appropriate projects that companies bring within the cluster, as well as projects with producers from other countries, such as long-term

cooperation in the production of equipment, parts and finished products, servicing and after-sales services with local partners and joint appearance on third markets, expanding cooperation on new products and new partners in other countries and testing capabilities to enter neighbouring markets.

The cluster supply chain is built by groups of market participants at different levels, government institutions and other organisations of related and supporting sectors on whose joint efforts the development of the cluster and the sector as a whole depends. The retailers are the last unit in the supply chain before the end consumers. Although some companies (for example, big European chains) set up their own distribution networks (to establish their own brands on the market) as part of their strategy for vertical integration, they manage to keep the focus on the production activities. The smaller market participants actively perform distribution and communication activities, typical of the upper levels of the supply chain aiming to receive a market share. According to Velev (2007), the indicator of the intensity of the forth internal relations along the supply chain characterises the degree of importance of the cluster, reflecting the market of manufacturing production of the companies in the cluster. The indicator of sales intensity inside the cluster reflects the progress made in the clusters in Bulgaria and strengthening the relations between the organisations in the cluster.

The main indicator used to determine the strength of the trade relations along the back supply chain is the intensity of the internal purchases, which show the relative share of purchases of the cluster from organisations inside the cluster from the total volume of its purchases needed for manufacture. This indicator illustrates a low degree of development of the trade relations related to purchases in the clusters under consideration.

The main indicator of the strength of the cluster external relations in terms of the purchases (along the back supply chain) shows the relative share of purchases in the cluster by external industries from the entire volume of purchases needed for production. The study uses the formula for regional clusters since it does not include national clusters. The importance of the indicator is higher than 50%, which shows that the external deliveries have a higher value than the deliveries from the industries inside the cluster. The quality of the products or services and consequently their competitiveness on the market depend largely on the quality of the work of its suppliers. The low-quality products or services purchased by suppliers result in either unjustified expenses or losses for the company or to the dissatisfaction of the end consumers with the products delivered by the company. Both the former and the latter affect adversely the company's performance. Therefore, it is important that clusters have reliable relations back along the supply chain, which is capable of delivering products or services which correspond to the agreed characteristics – price, place and terms of delivery, availability of documents proving products/services compliance.

The key indicator used to analyse the strength of the cluster internal relations in terms of sales, i.e. forth along the supply chain shows the relative share of the cluster outbound sales, including to other sectors, for end consumption and export, from the total sales volume (i.e. of the total value of the products manufactured in the cluster). The results from the analysis show that external sales have a larger share of the sales in the cluster. This indicator discloses the relations of the cluster with external consumers as a supplier. Indicator, used to gauge the

strength of the relations in the cluster, the following indicators are included illustrate in Table 1.

Table 1

Indicator, used to gauge the strength of the relations in the cluster (%)

Indicator, used to gauge the strength of the relations in the cluster, the following indicators are included	Mean for the clusters studied for 2019	Mean for the clusters studied for 2018	Mean for the clusters studied for 2017
Analysis of the strength of the relations in the cluster in terms of sales, forth along the supply chain	38	35	30
Analysis of the strength of the relations in the clusters in terms of purchases, i.e. back along the supply chain	45	43	38
Analysis of the strength of the relations between clusters forth along the supply chain	62	65	68
Analysis of the strength of the relations between clusters back along the supply chain	72	67	64

The competitiveness of cluster partnerships is determined to a great extent by product specialisation, on the one hand, and on the other – by the organisation of the cluster network of members and partners, by the quality of the interrelations between them and by their recognisability on the international markets. The analysis of the strength of the non-commercial relations between enterprises and their associates in the cluster underlie the building up of a synergy effect and embody the high potential for speeding up innovative processes. Three research areas in non-commercial relations are included. The first area is ***an analysis of the cooperation relations related to conducting joint activities of the enterprises in the cluster***, which, the analysis shows, lack cooperation in terms of the joint activity for gathering information and informing each other, joint research and development, joint production and joint activity focused on improving infrastructure. The low degree of cooperation stands out in the field of joint activities of the enterprises in the cluster related to joint educational activities, joint purchases and joint marketing activities (Figure 9).

Figure 9

The links of cooperation on the implementation of joint activities of enterprises in clusters
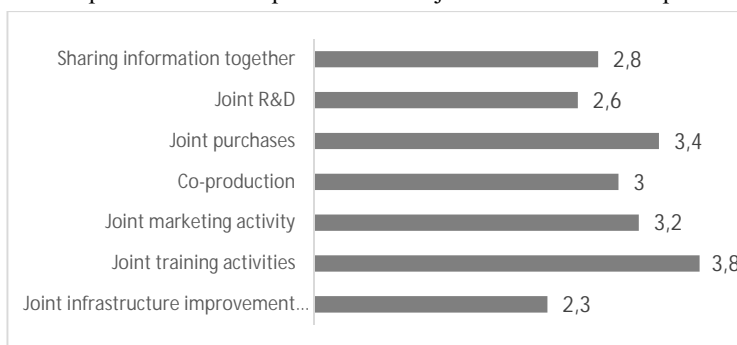
The communication mix elements most actively used are personal sales in the stores, trade fairs, open door days and demonstrations in the production workshops, direct marketing, as well as word-of-mouth communication. A common communication means among all cluster members are brochures and catalogues (common for the cluster and individual for the members) and the trade stalls where they present their capacity and production. The websites of individual companies do not contain comprehensive and regularly updated information, navigation and visualisation of the individual components – they are static without active online stores and different foreign language versions.

Clusters in Bulgaria develop public relations mainly through interviews in local and national media and organising events, but these activities are still quite limited. The messages are rather sporadic, not constant, which does not facilitate the creation of a sustainable position and trust in the mind of the target groups of clients and partners. Some of the most actively implemented activities are the participation of the cluster members, jointly and individually, in various conferences, seminars and trainings. No investments are made in the supply chains as well as in broadening the relations between the cluster members. The more widely represented trend in the supply chain partnerships are the ***vertical partnerships***. The vertically integrated clusters include companies connected through sellers-buyers relations within the supply chain. A number of international studies point out that partnerships in the supply chain are related to sharing information aimed at improving and increasing the existing production capacity. A key competitive advantage can be the joint planning of production, but it is not actually implemented, as shown in Figure 10.

Figure 10

Areas of cooperation between cluster members
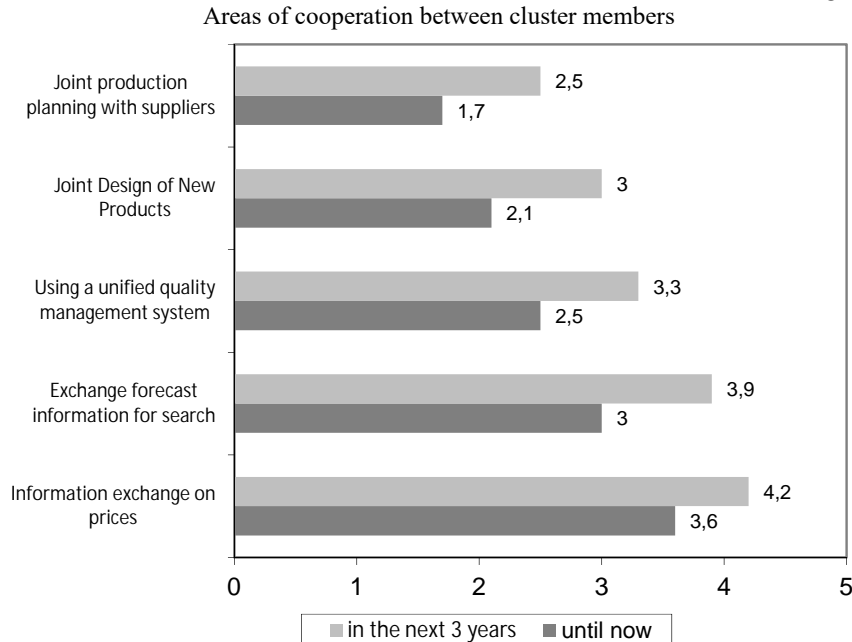
Producers exchange information with the suppliers about the inventory but they still ignore the transfer of information to them about future promotions and programmes aimed at improving customer service. Producers do not share information with suppliers about sales, plans about development and growth and do not undertake activities related to planning joint activities.

Currently, the sector can be described as exhibiting insufficient levels of cooperation, communication and coordination along the entire supply chain – nowadays, key sub-sectors perform in isolation and to a great extent chaotically. The weak relations between the different units along the supply chain and the limited coordination result in the fact that producers depend mostly on import materials, are not in a position to sign collective contracts for larger orders of raw materials and vice versa – to produce collectively large output in shorter periods of time. Transportation costs are generally high due to the fact that raw materials are imported in small quantities. Generally, the geographic proximity between the companies within the individual clusters and the intensification of the cooperation between them provide an opportunity for overcoming such limitations. Since individual small and medium-sized companies could not encompass the entire range of activities, they should adopt strategies to cooperate both vertically and horizontally in order to fulfil larger orders from abroad, to keep wider and more inclusive inventory, to reduce costs related to the supply of materials, to conduct joint advertising activity and maintain a joint partnership network.

Vertical production relations between small firms facilitate production relations between firms. Where production processes can be vertically disassembled, an inter-firm division of labour based on process and product specialisation, can have positive consequences for economies of scale and scope. Specialisation reduces the capital constraints faced by individual enterprises by distributing capital costs across small firms within the chain. Vertical subcontracting and a specialised division of labour was observed in varying degrees in most of the small firm clusters (Nadvi, Schmitz, 1993).

Intense competition is an important hallmark of horizontal inter-firm relations within small firm clusters. Intense horizontal competition within the cluster does not, necessarily, preclude horizontal cooperation. Such cooperation can take place in pre-competitive areas such as the provision of infrastructure or training between potentially competing producers and can also arise where firms share large or critical production orders by pooling production capacity. This practice, frequently termed as "capacity contracting", is often viewed as part of a survival or coping strategy. It reflects an organisational response on the part of small firms faced with severe capital constraints and market uncertainty which limit their ability to expand capacity.

The second field of analysis of the strength of the non-commercial relations between the enterprises and their partners in the cluster is an ***analysis of the intensity of the informal contacts***. These contacts between the people in the cluster are the most difficult to evaluate but are of great interest because they can distribute the unencrypted knowledge that is of great importance to innovations. The intensity of the informal contacts depends on the proximity of the companies, the availability and activity of organisations that are common for the clusters and factors related to the place of residence, social environment, the way spare time is spent, personal preferences (Velev, 2007).

The results from the analysis show that there are no contacts between those working in other companies in the cluster, or such contacts are extremely rare and sporadic. These contacts can become a fact when there are family relations between those working in different companies in the cluster.

The third area of analysis of the strength of the non-commercial relations between the enterprises and their partners in the cluster is an ***analysis of the trust between cluster participants***, shown in Figure 11. It is trust that underlies the building of clusters as unified economic bodies and this is the basis for strengthening the cooperation between individual organisations and individuals.

Figure 11

Analysing trust between cluster participants
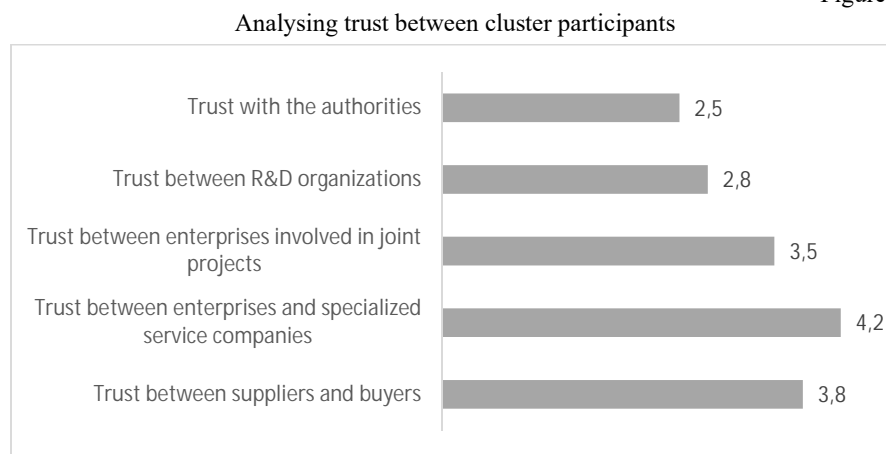
The analysis results show that the strength of the internal relations in the clusters under consideration is underdeveloped, both the back and forth ones along the supply chain. The conclusions based on the analysis do not support hypothesis 1, i.e. the clusters in Bulgaria have not developed back and forth relations along the supply chain according to the ***indicator for gauging the strength of the relations in the clusters***. An interesting fact to be pointed out is that only 11% of the studied clusters feature logistics companies (Third Party Logistics Provider – 3PL) as part of the cluster member companies. Logistics companies present a wide variety from the point of view of the services provided – from companies providing several packaged services to companies providing the entire range of services needed to manage and deliver the logistic services to the clients – for example, management of delivery and/or management of distribution. A special type of a third party in logistics is the so-called Lead Logistics Provider (LLP). These are companies, that provide one point of contact for the clients coordinating the activity of several 3PL providing comprehensive solutions to their clients. These logistics providers are the most appropriate members of the cluster organisations, as well as the so-called supply chain integrators (Fourth Party Logistics provider – 4PL). The fourth partner in logistics is an integrator that incorporates resources, capabilities and technologies of its own organisation with the ones of other organisations in order to design, build and maintain comprehensive solutions for the supply chain. It is

common for the fourth party companies in logistics to be highly competent in the field of supply chain management combined with an appropriate software solution. All this can justify the need for such an organisation as part of the clusters for the development of the back and forth relations along the supply chain. The results show that this hypothesis should be accepted since there is a statistically significant relation between the existence of a logistics company and the general evaluation of the cluster in terms of the degree of development of the forth and back relations along the supply chain. This conclusion is justified by the level of significance of Chi-Square Pearson, which is 0.00346. Cramer's coefficient is 0.45802. What is more, the two conditions needed for the implementation of Chi-Square, in this case, are met.

A small number of the companies in the clusters under consideration have built their own distribution network. Those that make an exception are the companies manufacturing their own trademarks. They depend on a limited number of concept stores, operating under their own brand, which, however, do not invest sufficiently in promoting merchandising, customer service and advertising. Online trade is not developed at all, or it is underdeveloped in the clusters in Bulgaria. Companies do not promote actively online stores where they can offer their production to both domestic and foreign markets. Apart from being distribution channels, concept and online stores could perform communication function to promote products. The cluster does not feature a functioning distribution network of retailers which can meet the cluster standards (for location, range of products, trade mark, service standard, type of customer base etc.) and to show interest in orders of different trademarks.

The Indicator *use of modern digital technologies in supply chain management* is used to prove the third hypothesis with several fields of analysis described in Figure 12.

Figure 12

Degree of use of modern digital technologies in supply chain management
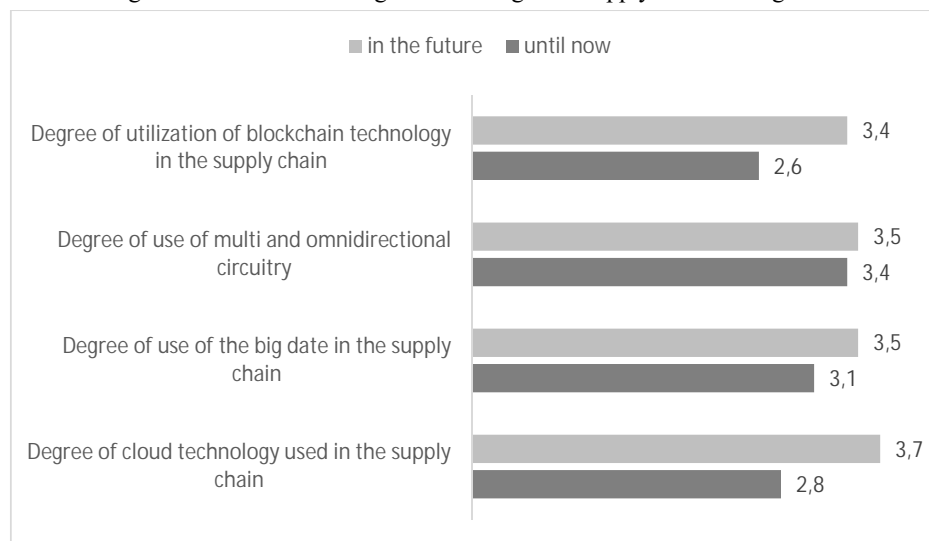
The mean value of the use of modern digital technologies is approximately 3 for the indicator, which includes four fields. The multi-channel and omni-channel supply chains are not widely spread in the clusters in Bulgaria. The introduction of multi-channels will do away with the inconsistencies and will create a common system for better customer service. This means that the existing systems will have to be integrated in order to guarantee flawless fulfilment of orders. 3PL companies are not members of the cluster, but they could integrate the long supply chains and become an integral part of the cluster.

Relatively low usage of information systems and technologies in the Bulgarian enterprises is found in other researches and they mention that this problem will be resolved by the implementation of basic solutions in the beginning and more advances in the future (Dragomirov, 2014, p. 169). Digitalisation and implementation of information technologies along the cluster supply chain will contribute to the forth and back development of the supply chain in the cluster. The digitalisation along the supply chain will lead to shortening the chain through the incorporation of units within the cluster.

The creation of an online-based network used to manage the supply chain will result in better awareness and resource allocation, will save time and allow companies to focus on their core activity. According to expert evaluations, the implemented SCM cluster system facilitates: the reduction of costs of material and their storage in the organisations in the cluster by 5 – 35%. The conclusions based on the study show that modern digital technologies (cloud technology, big data, multichannels, omnichannels, blockchain etc.) are not actively used in the management of the supply chain in the clusters under consideration in Bulgaria. To justify the relation between the use of modern digital technologies (cloud technology, big data, multichannels, omnichannels, blockchain etc.) and the forth and back development along the supply chain in the clusters in Bulgaria Chi-Square Pearson is used, which is 0,00359. The results show that this hypothesis should be accepted since a statistically significant relation exists.

The conclusions based on the analysis show that it is necessary to broaden the strength of the inner-cluster relations related to sales, forth along the supply chain and to be directed towards the joint collection of information and mutual informing, joint research and development, joint production and joint activities to improve infrastructure. The joint production planning can be the key competitive advantage. To broaden the relations, conditions should be created to include more suppliers of materials in the clusters, as well as the possibility to sign collective contracts for larger orders for raw materials, when these are imported. Emphasis should be placed on the development of informal contacts in the cluster organisations, primarily on the trust between the cluster participants. The successful management of the cluster chains depends on the existence of a logistics company, that should coordinate the logistics processes both forth and back along the supply chain and they could integrate the long supply chains and become an integral part of the cluster.

Conclusion

In conclusion, it can be stated that clusters in Bulgaria have not built well developed forth and back relations along the supply chain because the results from the analysis of the strength

of the inner-cluster relations in terms of sales, forth and back along the supply chain illustrate low importance and insufficient development. A statistically significant relation exists between the availability of a logistics company and the general evaluation of the cluster related to the degree of development of the relations forth and back along the supply chain. The use of modern digital technologies (cloud technology, big data, multi-channels, omni-channels, blockchain etc.) is not at a high level and can further be developed, which will push development back and forth along the supply chain in the clusters in Bulgaria.

Possibilities to improve the supply chain management can be seen in the creation of successful partnerships between cluster participants, which are fully integrated electronically and are capable of satisfying the clients' needs. The partnerships formed in the supply chain are related to the development of relations back and forth along the supply chain. The development possibilities are based on building common strategies along the horizontal axis for providing jointly a broader and deeper product range through common channels for production realisation, including breaking into foreign markets. Such a form of cooperation can be conducted in clusters, which specialise in the production of similar products and complement each other and can develop common sales channels.

Attracting more members manufacturing products at different levels along the supply chain would guarantee greater independence, fast order completion, flexibility and competitiveness of all companies in the cluster. Apart from attracting new members, this effect could be achieved to a great extent if the existing members of the cluster share their partnerships networks along the entire supply chain: from finding the needed raw materials, processed materials, to the production of a wide variety of goods. Companies, which specialise in supporting and finishing activities could participate in the partnership network.

Attracting logistics companies in the cluster organisations would result in higher efficiency of the logistic processes. By 3PL and 4Pl cooperation, the relations in the cluster will be developed and improved by improving the service and providing faster and better communication between the companies. The cluster organisation will benefit from using 3Pl and 4Pl solutions, working together by reducing the price and providing improved services and processes which aim at guaranteeing clients' maximum satisfaction with the entire process along the supply chain.

References

Berry, W. L., Hill, T., Klompmaker, J. E. (1999). Aligning marketing and manufacturing strategies with the market. – International Journal of Production Research, pp. 3599-3618.

Bowersox, Closess, Cooper. (2002). Supply chain Logistics management. First Edition. ed. McGraw-Hill-Higher Education.

Dragomirov, N. (2020). E-Commerce Platforms and Supply Chain Management – Functionalities Study, pp. 250-261.

Dragomirov, N. (2016). Interaction between logistics service providers and Bulgarian processing and trading companies. – Economic alternatives, Vol. 1, pp.76-86.

Dragomirov, N. (2014). Information systems in logistics. Sofia: Publishing complex – Unwe.

Ellram, L., Cooper, M. (1993). The Relationship Between Supply Chain Management and Keiretsu. – The International Journal of Logistics Management, 4.

Engel, J. (2014). Global Clusters of innovation – Enterpreneurial Engines of Economic Growth around the World. Edward Elgar Publishing Limited.

Enright, M., Sun Hung Kai. (2000). Survey on the characterisation of regional clusters. pp. 1-21.

He, B. H. (2016). The Features and Evolution of Cluster Supply Chain Network. – Open Journal of Business and Management, 4, pp. 751-762.

Ketels, C., Lindqvist, G., Sölvell, O. (2012). Strengthening Clusters and Competitiveness in Europe, The Cluster Observatory. ed. The Cluster Observatory.

Kourimsky, H., Berk, M. (2014). The Impact of Omni-Channel Commerce on Supply Chains, Intelligence Ntt Data Business Solution. ed.

Lambert. D., Stock, J. (2001). Strategic Logistics Management. Mc-Grow-Hill International Edition.

Waits, Mary Jo. (2000). The Added Value of the Industry Cluster Approach to Economic Analysis, Strategy Development, and Service Delivery. – Economic Development Quarterly, Vol. 14, pp. 35-50.

Mihova, L. (2019). Literature Review on Closed-loop Supply Chains and Reverse Logistics in the Context of Sustainable Development Goals. 15th International Conference of ASECU.

Nadvi, K., Schmitz, H. (1993). Industrial clusters in less developed countries: review of experiences and research agenda. Institute of Development Studies University of Sussex.

Porter, M. (1998). The microeconomic foundations of economic development [parts I and II]. – In: The global competitiveness report 1998, pp. 38-63.

Porter, M. (2007). Clusters and Economic Policy: Aligning Public Policy with the New Economics of Competition.

Porter, M. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. – Economic Development Quarterly, Vol. 14.

Rześny-Cieplińska, J. (2016). A Case Study On The Potential Benefits Of Consolidation Within Transport Logistics Aand Freight Forwarding Clusters In The Pomeranian Region. – Journal of Media Critiques, Vol. 2, pp. 161-172.

Sala, D., Maticiuc, M., Munteanu, V. (2016). Clusters influence on competitiveness. Evidences from European Union countries, Challenges of Modern Management. Bucharest, Romania.

Sheffi, Y. (2012). Logistics clusters. London: The MIT Press.

Slavova, I., Bankova, J., Ivanov, Hr. (2018). Clusters and clusters initiatives in Bulgaria: development and challenges. – Economic and social alternatives, 4, pp. 14-28.

Stefanov, M. (2018). Features of Compressed Natural Gas Physical Distribution: A Bulgarian Case Study. – Logistics, 2, p. 17.

SunHee Youn, Paul Hong. (2008). Supply chain partnerships and supply chain integration: the mediating role of information quality and sharing. – Logistics Systems and Management, pp. 437-456.

Scheer, G., Zallinger, L. (2007). Cluster Management – A Practical Guide. Deutsche Gesellschaft für.

Sturgeon, T., Biesebroeck, J., Gereffi, G. (2008). Value chains, networks and clusters: reframing the global automotive industry. – Journal of Economic Geography, 8, pp. 297-321.

Velev, M. (2007). Clusters approach to increase competitiveness. Sofia: Softtreid.

Velikova, E. (2012). Strategic alliances in tourism. Sofia: Avangard Prima.

Waters, D. (2003). Logistics An Introduction to Supply Chain Management. Palgrave MacMillan.

Wojciech, P., Cuthbertson, R. (2014). Introduction to the Special Issue Information Technology in Retail: Toward Omnichannel Retailing. – International Journal of Electronic Commerce.