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The Impact Of Clustering Indicators Based on Cluster Actors on Sustainable Local Development: An Application in Tra1 Region Provinces[1]

Sevda YAPRAKLI [2]
Omer Faruk ASLAN [3]

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Abstract

Clustering is one of the fundamental strategies contributing to Sustainable Local Development (SLD). This study aims to determine the effects of cluster indicators related to cluster actors [suppliers/producers (SUPRO), sellers/consumers (SELCON), supporting/intermediary institutions (SUPINT), and public and stakeholder support (PUBIND)] on the economic, social, and environmental indicators of SLD in the provinces of Erzurum, Erzincan, and Bayburt in the TRA1 Region, one of Turkey's underdeveloped sub-regions. For this purpose, a survey-based field study was conducted on firms belonging to activity sectors grouped according to NACE Rev.2 codes, and regression estimations were made with the obtained data. According to the regression analysis results, cluster actors of different sizes and directions have an impact on the economic, social, and environmental indicators of SLD, and the most influential cluster actor is SUPINT. Furthermore, based on the results of the multiple regression analysis, it was determined that a cluster to be established in Erzurum Province would be suitable in terms of SLD. Successful publicly funded cluster formations in the TRA1 region will contribute both to achieving social security and reducing income disparities between provinces and regions.

Key words: Clustering, NACE Rev. 2, Sustainable Local Development, Multiple Regression Analysis, TRA1 Region.

JEL Code: C31, C83, O01, R11

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[2] Prof. PhD, Atatürk University, Faculty of Economics and Administrative Sciences, Department of Economics, Türkiye, sevda1@atauni.edu.tr, http://orcid.org/0000-0002-1902-899X
[3] Lecturer PhD, Atatürk University Oltu Vocational School, Finance, Banking and Insurance Department, Türkiye, ofaruk.aslan@atauni.edu.tr, http://orcid.org/0000-0001-7415-6049

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1. Introduction

Clustering, which can be defined as the grouping of firms operating in the same field to combine their production activities in accordance with the characteristics of a specific region, is one of the fundamental policy tools for addressing local development inequalities and achieving Sustainable Local Development (SLD).

With historical roots dating back to the 1890s, clustering activities began to gain importance from the 1960s onwards as a way to close income gaps between countries/regions due to the insufficient success of traditional development policies. The process of trade and financial liberalization that emerged in almost all countries of the world in the 1980s and the technological developments of the 1990s created an intensely competitive environment. Firms forced to compete alone against strong competitors were forced to withdraw from the market. However, firms acting together and producing competing goods gained significant market shares in world markets and achieved economic gains at local, national and global levels by increasing their foreign trade revenues. With the increasing number of countries benefiting from the advantages of cooperation, clustering has become one of the fundamental local/national development tools since the 2000s (Aslan, 2023: 6).
Clustering, an important tool for addressing local/national income inequalities, enables the determination and implementation of development policies appropriate to the basic characteristics of a particular area, and contributes to the development of these areas. Countries can determine different policies depending on their resources, form different clusters, and gain a competitive advantage by producing differentiated goods. Clustering, formed by firms coming together in a specific area (regional or local scale), allows firms to increase their competitiveness by providing advantages such as reaching their consumers faster, producing higher quality goods and services, and reducing costs through the use of technology (Republic of Turkey Ministry of Industry and Technology, 2011: 5-6).

Clustering, along with the increase in the production of goods and services, allows for a decrease in average costs and an increase in productivity in the long term, i.e., the creation of economies of scale. Economies of scale can directly and indirectly affect the location, mode of operation, and the development of the geographical area in which industries are situated, depending on their proximity to resources or markets/consumers (Ocal & Ucar, 2011: 291; Undersecretariat of Foreign Trade, 2008: 22-23).

2. Cluster Actors and Sustainable Local Development (SLD)

In today's world, where national economic boundaries have almost disappeared, the ability of local firms, which are key actors in clusters, to compete with powerful international firms largely depends on both intra-cluster and external actors. According to Porter (1998), known for his work on clustering, cluster actors consist of input suppliers/producers, sellers/buyers/consumers of goods and services, supporting/intermediary institutions providing industry-specific infrastructure, skilled labor, physical and intellectual capital, and public institutions

and local stakeholders such as universities, institutes, local administrations, vocational training centers, cooperatives, non-governmental organizations, and trade associations that conduct industry-specific training and education, research, and provide physical, financial, and technical support (Porter, 1998: 78).

While each cluster has its own unique actors, in general, cooperation and specialization-based governance and competition among actors encourage firms to be efficient and effective, accelerate innovation and technical development, and increase entrepreneurial activities. This also increases economic growth, innovative activities, and competitive advantage (Solvell, 2003:18; Porter, 1998: 78). Effective/strong network connections and mutual interactions among cluster actors can create positive effects both at the industry level and at the local area level where the cluster is formed (Porter, 2000: 22-23).

On the other hand, the widespread view in the 1950s that regional economic and social problems could be solved with public policies was pushed into the background due to the energy crises and stagflation problems of the 1970s (Filiztekin, 2008: 36-37). The new policy searches that began with the globalization process in the 1980s showed that local economic development is based on local/internal characteristics, interaction and cooperation between local, national and international actors (Kargı, 2009: 24). With localization becoming a necessity of globalization, centralized governance has begun to give way to community and solution-oriented governance (Bimi, 2019: 1-2). In the 1990s, the Sustainable Local Development (SLD) Approach, which argued that local/regional development is essential for national development, came to the forefront. Since the 2000s, SLD policies have been implemented within the framework of the principle of "think globally, act locally" (Eraslan et al., 2015: 31).

SLD indicators vary depending on the area examined. Therefore, within the scope of this study, based on United Nations (UN) definitions and relevant literature, three main indicators and approximately fifty sub-indicators—economic, social, and environmental—have been considered (United Nations, 2007: 35). Accordingly, the SEC (Social, Environmental, and Cultural) approach, which is based on the necessity of leaving at least the current conditions as a legacy to future generations, accepts that economic, social, and environmental development depends on the utilization of local potential and the inclusion of local actors in the process (Kılınc, 2016: 34-35). SEC requires not only increased economic prosperity but also the resolution of problems in social areas such as education, health, community, and migration, and the mitigation/elimination of irreversible disasters such as climate change, environmental degradation, and the depletion of natural resources (Goktürk, 2006, 27-28).

SLD is shaped according to the local potentials of each geographical area and the presence and collaborative activities of local actors such as local governments, firms, suppliers, universities, etc. Accordingly, SLD in a country can be realized in different dimensions depending on local resources (Dogan, 2016: 1799). Therefore, local-level development can contribute to national development, and both local/regional and international income inequalities can be reduced (Poroy, 2004: 5). Local-level development becomes successful through micro-scale policy applications determined in harmony by central government and local actors,

in accordance with the unique identity structure and geographical location of the local area/region (Goktürk, 2006: 28). Successful policy applications based on local potentials and actors contribute to reducing economic, social, and environmental disparities at the local level (sub-region-provinces, province-village, etc.) (Müftüoglu, 2006, 136).

When local-level development came to the forefront in the 1990s, clustering activities prioritizing local stakeholders also gained popularity (Clipa et al., 2012: 7). Positive local impacts resulting from the coordinated actions of cluster actors play a critical role in the success of local-level development policies. Because the positive/negative effects of clustering on sustainable development depend largely on increased cooperation and information sharing among local cluster actors and the consistency of economic, social, and environmental benefits with the principle of sustainability. In other words, the impact of clustering on sustainable development becomes dependent on the sustainable use of local resources, innovative solutions, and governance among actors (Eser & Kose, 2005:99; Aydemir & Soydas, 2014: 15). Key actors (suppliers/producers, etc.) are found in almost every cluster.

Suppliers/consumers, supporting/intermediary institutions, and public and stakeholder support are among the critical factors that enable cluster sustainability. Key impacts stemming from effective and efficient cluster actors (Ketels, 2003: 4; Yigit & Ardıc, 2013: 40; Andersson et al., 2004: 25) include:

- Increased trust and effective communication among actors, leading to increased information and resource sharing,
- Facilitating the achievement of common goals through effective leadership and coordination,
- Increased competitiveness through innovative approaches and R&D activities,
- Positive externalities provided by financing, training, technology, and infrastructure opportunities,
- Reduction in production costs through collaboration among expert and informed actors,
- Public policies and incentives supporting the cluster's growth and sustainability, and
- The ability to adapt quickly to changing conditions, etc. This study attempts to estimate the effects of potential clustering in Erzurum, Erzincan, and Bayburt provinces within the TRA1 Region on the economic, social, and environmental indicators of the Social and Cultural Development (SCD), based on their importance in the SCD process. To this end, the conceptual and theoretical framework is first examined, followed by a review of the relevant applied literature. The final section provides information on the research methodology, presents the findings obtained from the analyses, and offers interpretations of these findings. The study concludes with a results section containing an evaluation based on the findings and policy recommendations.

3. Literature Review

Despite its importance in the cluster success process, no applied studies examining the effects of clustering on economic, social, and environmental cluster success indicators based on indicators related to cluster actors have been found in the applied literature. In applied studies that began to increase in the early 2000s, it has been observed that economic indicators are generally used for cluster success, and competition indicators are used for clustering. The results of the literature review show that studies generally focus on identifying factors affecting cluster success and do not consider the effects of clustering on the three indicators of cluster success together. Furthermore, no studies directly related to this topic were found at the level of Turkey and the TRA1 Region. The main studies on the subject have been examined and grouped according to their findings and are presented below. Key studies on cluster success include [Breschi and Malerba (2001), Simicic (2003), Kesidou et al. (2009), Choi (2010), Elola et al. (2012), Yu et al. [2013), Cirer-Costa (2014), Doleroux et al. (2016), Stojčić et al. (2019) and Lowitzsch et al. (2020)] have determined that clusters located in developed countries/regions and formed/created in accordance with local characteristics generally have high success levels. Accordingly, clusters in developed countries/regions are relatively more successful than clusters in less developed countries/regions in terms of stakeholder relations, autonomous local administrations, material and institutional infrastructure, equity and investment level, qualified workforce-expertise, demand conditions, competitiveness, etc.

Fan and Scott (2003), Nel et al. (2003), Mcrae-Williams (2004), Mabuza (2006), Portnov (2006), Bramwell et al. In significant studies on the economic impacts of clusters by Kim et al. (2008), Kim and Zhang (2008), Koutsouris (2009), Taylor and Miller (2010), Zheng (2010), Tien (2010), Yu et al. (2011), Middleton (2011), Choe and Roberts (2011), Garanti and Zvirbule (2013), Chuluunbaatar et al. (2014), Giacomin (2017), Bevilacqua et al. (2019), Derlukiewicz et al. (2020) and Petach et al. (2021), it has been determined that the effects of clusters on macroeconomic indicators such as productivity, competitiveness, innovation, production technology, employment, openness, etc., vary according to the sectoral characteristics of the clusters. These studies have shown that the positive effects of successful clusters on local economies are due to: It has been indicated that clusters emerge thanks to factors such as cooperation and networking among cluster actors, similar product production among firms, increased spatial agglomeration, entrepreneurial potential, public support, effective institutional structure, and governance.

In the fundamental studies conducted by Portnov (2006), Bramwell et al. (2008), Zheng (2010), Lombardo and Falcano (2011), Chuluunbaatar et al. (2014), Zheng and Zhao (2017), Derlukiewicz et al. (2020), and Guo et al. (2021), it has been determined that the effects of clusters on sustainable development and social indicators vary depending on factors such as the spatio-temporal dimension, the level of development of the geographical area, local characteristics, and demand conditions. According to the findings of these studies, clusters have varying degrees of impact on social indicators such as inward/outward migration, socio-cultural development, entrepreneurial activities, social capital and effectiveness, human capital, and crime rates. Major studies focusing on the impacts of clusters on the

local environment and their transition to a green economy [Cunha and Cunha (2005), Deutze and Gibbs (2008), Davies (2013), Sjøtun and Njøs (2019), Kyllingstad and Rypestøl (2019), Derlukiewicz et al. (2020), and Zhang et al. (2021)] have found that clusters have both positive and negative impacts on the environment. These studies suggest that tourism, functional agriculture, and eco-industrial clusters are more environmentally conscious due to their activities, that carbon emissions are related to spatial clustering, and that net emission performance increases with economic clustering. However, clustering in industry and some service sectors can also lead to negative impacts such as overuse of resources, increased waste, environmental pollution, and destruction of natural areas.

Kamasak et al. (2008) and Iyem et al. In their studies at the sub-regional and provincial levels for Turkey, they determined that potential clusters could have positive effects such as increased added value, increased competitiveness, decreased unemployment, and increased investment and exports. Studies examining the impact of clustering on rural/regional economic development [Gozek and Emeksiz (2012), Kırankabes and Arık (2014), Gokdeniz (2015) and Irhan (2016)] determined that successful sectoral clusters, suitable for characteristics such as local resources, climate, location, and ecological structure, would contribute to local development. These studies emphasized that clusters established with guiding public aid, such as increasing the level of connectivity of local stakeholders and supporting innovative activities, and which can be transferred to the private sector, can make their local areas more attractive.

Table 1 presents a summary of applied studies examining cluster success and the effects of clustering on key indicators of clustering.

Table 1. Economic, Social and Environmental Impacts of Clustering: Key Studies

Researcher(s)	Scope/Period	Method	Research Finding
Breschi/Malerba-2001	Scandinavian Countries and 5 Countries/2001	Case Study	Successful ICT clusters have positive effects.
Fan/Scott-2003	China and East Asian Countries/2000	Field Research	Clusters that create added value are successful.
Simicic-2003	North Shore City - 51 Companies/2003	Field Research	Production of substitute goods and cooperation among actors increase cluster success.
Nel and et. all.-2003	South Africa - Coal Mining/1981-2000	Field Research, Regression	The closure of the coal cluster negatively affected production and employment.
Mcrae Williams-2004	Australia Victoria - Wine - Tourism/2005	Field Research	Clustering that is appropriate to local characteristics contributes to local development.

Cunha/Cunha-2005	Tourism Sector/2005	Statistical Analysis	High-income tourism clusters cause less harm to the environment.
Portnov-2006	Canada/1991-1996	Field Research, Descriptive Analysis	The attractiveness of the geographical and industrial area is effective in cluster success.
Mabuza-2006	Birmingham - Media Industry/2006	Field Research	Clustering contributes to the local economy.
Kim/Zhang-2008	China/Qingdao - 150 Sectors/2008	Field Research (Case Study)	There should be clustering in high-tech industries.
Kamasak and et. all.-2008	Kahramanmaras - Textile/2002-2007	Statistical Analysis, Field Research	Clustering will contribute to sectoral and provincial development.
Bramwell and et. all.-2008	Canada Waterloo - Information Technology/2003-2004	Field Research, Interview	Clusters impact the local economy.
Deutz/Gibbs-2008	Selected Clusters in the USA and EU/2008	Field Research (Interview)	Eco-tourism clusters are environmentally conscious.
Kesidou and et. all.-2009	Uruguay Montevideo - Software/2009	Field Research	Clusters that follow innovations and are collaborative are highly successful.
Koutsouris-2009	Greece/Tourism Cluster/2009	Case Study	Clustering develops the village and tourism sector.
Taylor/Miller-2010	Maine, Mississippi/2010	Field Research	Local clusters are more stable and resilient than export clusters.
Choi-2010	South Korea - 475 Sector/2010	Field Research	Local autonomy is important for cluster success.
Zheng-2010	Shanghai-212 Sector/2010	Field Research	Public clusters are more successful than spontaneously formed clusters.
Tien-2010	Taiwan Museum Clusters/2006-2007	Field Research, Regression	Clusters increase sectoral and local income and employment.
Yu and et. all.-2011	China-Transportation Infrastructure/1978-2008	Time Series Analysis	There is a relationship between clustering and growth.

Choe/Roberts-2011	4 Developing Countries-Sectoral Clusters/1980-2007	Field Research	Clusters have an impact on competition.
Lombardo/Falcano-2011	Italy Level 3 Region/1995-2009	Panel Data Analysis	Cluster performance and spatial characteristics affect the economy and crime rates.
Middleton-2011	Woodford-3 Sectors/2002-2010	Statistical Analysis	Publicly supported clusters have a positive impact on the local economy.
Elola vd.-2012	Four Basque Clusters/2008	Field Research	Clusters can contribute to local development.
Gozek/Emeksiz-2012	Mersin, Izmir, K.Maras-4 Companies/2012	Field Research, SWOT Analysis	Clusters operating with insufficient capacity or being idle increase costs.
Davies-2013	Ireland-59 Clean Technology Clusters/2011	Field Research	Efficient use of institutional resources is important for the transition to a green economy.
Yu and et. all.-2013	China/2012	Field Research	Modern agricultural clusters will be successful.
Garanti/Zvirbule-2013	Regional Clusters/2013	Field Research	The economic impact of clusters varies according to their geographical location.
Chuluunbaatar and et. all.-2014	Mongolia-Circus Industry/2013	Field Research	Clustering affects social capital, sector, and regional development.
Cirer-Costa-2014	Mallorca Island-Tourism/1900-1936	Descriptive Analysis, Z Series Analysis	If the cluster is successful, it positively impacts the local economy.
Kırankabes/Arık-2014	TR 26 Sub-Region-Manufacturing Industry/2008-2011	Correlation Analysis	There is a positive relationship between clustering, openness to the outside world, and development level.
Gokdeniz-2015	Ayvalık-Tourism Cluster/2015	SWOT Analysis	Stakeholder collaboration reduces local economic and environmental problems.
Irhan-2016	Istanbul - Knitwear Sector/2015	Field Research,	The positive sectoral impacts within the

		Descriptive Analysis	cluster are quite high.
Doleroux and et. all.-2016	Québec - Maritime /2001-2011	Time Series Analysis	The production volumes of firms within and outside the cluster differ.
Giacomin-2017	Southeast Asia/Costa-Rica/1900-2000	Field Research, Comparison	Clustering increases the local influence of multinational firms.
Zheng/Zhao-2017	China - Industrial Clusters/2017	Correlation Analysis	The level of clustering affects entrepreneurship and sectoral production.
Iyem and et. all.-2018	Aydın, Denizli/2018	Three-Star Analysis	The manufacturing industry sector has high clustering potential.
Bevilacqua and et. all.-2019	France - Local Clusters/2019	Field Research	Local clusters are effective in smart specialization and production.
Stojčić and et. all.-2019	Slovenia/Croatia/2008-2016	T-test, Statistical Analysis	In both countries, clusters have positive economic impacts.
Kyllingstad/Rypestøl-2019	Norway, Adger Processing Industry/2014, 2017	Case Study	Cluster actors need to work together for sustainability/green economy.
Sjøtun/Njøs-2019	Norway, 3 Clusters/2018	Comparative Analysis	Clusters have different approaches to the green economy.
Derlukiewicz and et. all.-2020	Selected Clusters in the EU/2019	Literature and Report Review	Public clusters affect sustainable development.
Lowitzsch and et. all.-2020	18 Countries Renewable Energy Clusters/2019	Field Research	Governance and heterogeneity affect the number and success of clusters.
Zhang and et. all.-2021	China Wuhang/2001-2015	Panel Data Analysis	Effective clusters improve environmental quality.
Petach and et. all.-2021	USA - Banking Sector/2005-2016	Time Series Analysis	Bank concentration positively impacts local development.
Guo and et. all.-2021	China/21 National Park Clusters/2021	Panel Data Analysis	Park clusters affect sustainable development.

Source: Prepared by the author(s).

As can be seen in the table, applied studies have mostly focused on the economic impacts of clustering. Based on the findings of these studies, it can be said that there is a consensus that existing or potential clusters affect/may affect local economies and contribute/may contribute to reducing local development inequalities to varying degrees. However, it is observed that these studies differ in terms of clustering and SLD indicators, local and sectoral characteristics, analysis methods, etc., and have not been able to reach a clear conclusion regarding the direction and magnitude of the economic, social, and environmental impacts of clustering.

This study differs from studies in the literature in terms of sample, research period, actor-based clustering indicators, the three basic indicators of SLD, and the analysis of survey data using econometric (regression) methods. This research, which is the first of its kind for the provinces of the TRA1 Region and offers policy recommendations, is expected to contribute to the national literature and guide future studies.

4. Methodology

The provinces of the TRA1 Region are below the Turkish average in terms of economic, social, and environmental indicators of the Social and Cultural Heritage (SCH). Erzurum is in the best position at the provincial level, followed by Erzincan and Bayburt. Despite lagging behind in terms of clustering level, the provinces of the TRA1 Region have significant clustering potential, especially in the service sector. The TRA1 Region, which has the potential to be an attractive center for local investment opportunities, lacks the clustering activities that would allow it to best utilize this advantage. However, considering local physical and human characteristics, the successful implementation of clustering activities based on public-private partnerships in sectors with clustering potential is extremely important for reducing local income inequalities and ensuring SCH (Aslan, 2023: 141-143, 160). Therefore, this study attempts to determine the effects of clustering indicators on SCH indicators at the cluster actor level. For this purpose, a survey-based field study was conducted on firms operating under the NACE Rev.2 code in the provinces of Erzurum, Erzincan, and Bayburt in the TRA1 Region, and the primary data obtained were evaluated using statistical and econometric analysis methods. Based on the findings of the analyses, local policy recommendations were made, and efforts were made to contribute to the development of the provinces.

Determining the Research Sample

In the provinces of the TRA1 Region, one of Turkey's less developed regions, there is clustering potential among firms operating under the NACE Rev. 2 code, and the most suitable sector for clustering is the service sector (Aslan, 2023: 157, 160). Therefore, this research includes firms registered with chambers of commerce and industry under the Social Security Institution (SGK) and possessing clustering potential (SGK, 2022). In the TRA1 Region, there are a total of 11,396

firms with clustering potential: 7,441 in Erzurum Province, 2,995 in Erzincan Province, and 960 in Bayburt Province (Aslan, 2023: 166-167).

Simple random sampling, where each firm in the population has an equal chance of being included in the sample, was used for sample selection. The minimum sample size selected from the population of 11,396 firms was calculated for each province with a 95% confidence level and a 5% margin of error. Accordingly, the sample includes a total of 981 firms: 365 for Erzurum, 341 for Erzincan, and 275 for Bayburt. Considering the possibility of erroneous responses and evaluations, 387, 377, and 364 questionnaires were prepared for Erzurum, Erzincan, and Bayburt respectively (a total of 1128) (Aslan, 2023: 167-168). Before administering the questionnaire to firm officials in the sample, it was administered to 25 firms to determine if there were any issues regarding the clarity of the statements in the questionnaire. A structured interview technique was used to collect data, and face-to-face interviews were conducted with firm officials.

Research Methodology

To determine the effects of clustering indicators related to cluster actors in the provinces of the TRA1 Region on the economic, social and environmental indicators of the SYK, the traditional estimation equation was used.

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \ldots + \beta_k T_i + \varepsilon_t \quad (1)$$

In equation (1), Yt represents the dependent variable, X, Z and T represent the independent variables, i represents the province, β represents the coefficients and ε represents the error term. In the study, the following estimation equations were created based on equation (1).

$$\boldsymbol{SLD = \beta_0 + \beta_1 SUPRO + \beta_2 SELCON + \beta_3 SUPINT + \beta_4 PUBIND + \varepsilon t} \quad (2)$$

$$\boldsymbol{SLD_S = \beta_0 + \beta_1 SUPRO + \beta_2 SELCON + \beta_3 SUPINT + \beta_4 PUBIND + \varepsilon t} \quad (3)$$

$$\boldsymbol{SLD_E = \beta_0 + \beta_1 SUPRO + \beta_2 SELCON + \beta_3 SUPINT + \beta_4 PUBIND + \varepsilon t} \quad (4)$$

$$\boldsymbol{SLD_{ESE} = \beta_0 + \beta_1 SUPRO + \beta_2 SELCON + \beta_3 SUPINT + \beta_4 PUBIND + \varepsilon t} \quad (5)$$

In the equations above, SLD represents the economic, social, and environmental indicators of SLD respectively, SLD_{ESE} represents SLD in the context of the arithmetic mean of the three sub-indicators, SUPRO represents clustering indicators related to cluster actors such as supplier/producer, SELCON represents seller/supplier, SUPINT represents supporting/intermediary institutions, and PUBIND represents public and stakeholder support.

This research, for which an ethics committee report was obtained with decision number 118 of the Atatürk University Social and Human Sciences Ethics Committee meeting dated 14.04.2023 and numbered E.88656144-000-2300125119, used primary data obtained from field research conducted on firms registered with chambers of commerce and industry within the scope of SGK and operating according to the NACE Rev 2 code. For the dependent and independent variables in Equations (2), (3), (4), and (5), the participants' answers to the questions were used, and the averages of the values related to the answers were used.

Using primary data, the equations in question were subjected to multiple regression analysis, and separate estimates were made for the provinces of the

TRA1 Region (Erzurum, Erzincan, and Bayburt). For multiple linear regression analyses, the relationship between variables must be linear, and there should be no problems of autocorrelation or multicollinearity. In this study, the Durbin-Watson (DW) value was used to evaluate autocorrelation, and the Variance Increment Factor (VIF) value was used to evaluate multicollinearity. A DW value between 1 and 2.5 indicates the absence of autocorrelation; a VIF value less than 10 indicates the absence of multicollinearity (Garson, 2012: 50; Hair et al., 2014: 200). SPSS Statistics 20 software was used for the analysis of the survey data.

To collect data, the relevant literature was utilized, and an 87-question survey form consisting of four sections was prepared. The survey utilized a pre-prepared closed-ended question technique and a 5-point Likert scale [(1) Definitely No, (2) No, (3) Undecided, (4) Yes, and (5) Definitely Yes]. The first section of the survey form consists of 14 questions containing demographic/descriptive information about company officials and companies. The second section includes 9 questions measuring participants' opinions on clustering [level of knowledge about clustering, factors hindering clustering, costs and level of financing, public support]. Due to page limitations, the analysis results based on the data obtained from the first and second sections of the survey are not presented here. The third section of the survey consists of 28 questions for clustering indicators related to cluster actors such as suppliers and producers, vendors and consumers, supporting and intermediary institutions/organizations, and public and stakeholder support. The fourth section contains 36 questions aimed at determining the economic, social, and environmental indicators of clustering. The dependent and independent variables to be used in the regression analyses were determined using the data obtained from the last two sections.

Results of the Analyses

Before estimating equations (2), (3), (4), and (5) in the study, analyses were performed on the survey questions that determined the dependent and independent variables. For this purpose, reliability and validity tests were used, and it was investigated whether the survey questions were suitable for determining the variables. The Cronbach Alpha (α) reliability criterion, one of the internal consistency estimation methods, was used for the reliability of the scale. A Cronbach-α coefficient of $0.61 < \alpha < 0.80$ indicates that the scale has a moderate level of reliability, and a coefficient of $0.81 < \alpha < 1.00$ indicates that the scale has a high level of reliability. The accuracy, i.e., the validity, of the survey questions in measuring the dependent and independent variables is tested with exploratory factor analysis.

The suitability of the data for factor analysis was tested using the Kaiser Meyer Olkin (KMO) coefficient and the Bartlett Sphericity test. A KMO value above 0.50 indicates that the data are suitable for factor analysis. A statistically significant ($p<0.05$) Bartlett Sphericity value indicates that the survey data exhibit a normal distribution (Yasar, 2014: 66; Deniz and Tutgun-Unal, 2019: 1037-1038).

The reliability and validity test results for the survey data are presented in Table 2.

Table 2. Clustering and SLD Indicators: Reliability and Validity Test Results

SLD Indicators	Cronbach-α	Kaiser-Meyer-Olkin (KMO)	Bartlett's Test of Sphericity	
			χ^2 Value	p Value
Economic Indicators (9 Questions)	0.888	0.958	20001.546	0.000
Social Indicators (11 Questions)	0.891	0.974	27457.463	0.000
Environmental Indicators (16 Questions)	0.890	0.971	41083.850	0.000
All SLD indicators (36 Questions)	0.996	0.990	99242.420	0.000
Clustering Indicators				
Suppliers and Producers (7 Questions)	0.653	0.651	1805.816	0.000
Sellers and Consumers (7 Questions)	0.673	0.655	2995.748	0.000
Supporting and Intermediary Institutions (7 Questions)	0.688	0.697	3046.320	0.000
Public and Stakeholder Support (7 Questions)	0.687	0.696	3125.227	0.000
All clustering indicators related to cluster actors (28 Questions)	0.833	0.892	19728.455	0.000

Source: Authors' calculations

According to the table, the Cronbach-α coefficients for the questions in the survey are above 0.50 for both clustering and SLD indicators. Accordingly, there is consistency between the sub-indicators that constitute the main indicators, and the values of the variables are reliable. The results of the KMO and Bartlett Sphericity tests show that the KMO and $\chi 2$ values are (> 0.50) and ($p < 0.05$), respectively. These indicate that the data are valid/suitable for factor analysis and have a normal distribution. Within the scope of exploratory factor analysis, data with factor loadings greater than 0.50 and total explained variance values above 50% were considered acceptable variables.

Findings Obtained from Equation Estimations

Equations (2), (3), (4) and (5) were estimated for Erzurum, Erzincan and Bayburt, and the findings are presented below.

Estimation Results of Equation No. (2)

The results for equation (2), estimated separately for each province, are given in Tables 3, 4 and 5.

Table 3. Findings Regarding Erzurum Province

	Coefficient	t-statistics	p	VIF
Static	-0.240	2.747	0.006	-
SUPRO	-0.089	-1.694	0.169	1.071
SELCON	0.009	0.194	0.847	1.081
SUPINT	**0.312**	**5.718**	**0.000***	1.439

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PUBIND	0.015	0.289	0.773	1.291

R^2	F sta. (p)	Standard Error	Durbin Watson (DW)
0.413	20.630 (0.000)	1.153	1.6887

*: Indicates statistical significance at the 1% significance level.
Source: Authors' calculations

According to Table 3, equation (2) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 41.3%. The DW value (1 < 1.69 < 2.5) indicates no autocorrelation and the VIF values (< 10) indicate no multicollinearity problem.

As can be seen from the estimation results in the table, the effect of the clustering indicator in the form of SUPINT on the economic indicator of SLD in Erzurum is positive and statistically significant. The coefficient value of the SUPINT variable, which is significant at the 1% significance level, is 0.312. Accordingly, a one-unit increase in the clustering indicator in the form of supporting and intermediary institutions increases the economic indicator of SLD by 0.3 units. SUPINT is the only clustering indicator affecting the economic indicator of SLD in Erzurum.

Table 4. Findings Regarding Erzincan Province

	Coefficient	t-statistics	p	VIF
Static	2.151	1.977	0.049	-------
SUPRO	0.048	0.889	0.375	1.129
SELCON	**0.128**	**2.358**	**0.019***	1.135
SUPINT	0.014	0.257	0.798	1.091
PUBIND	-0.037	-0.658	0.511	1.205

R^2	F sta. (p)	Standard Error	Durbin Watson (DW)
0.592	29.559 (0.000)	1.357	1.947

*: Indicates statistical significance at the 5% significance level.
Source: Authors' calculations

According to the VIF and DW values in the table, there is no multicollinearity or autocorrelation problem. The R^2 value indicates that the model has an explanatory power of 59%, and the F statistic (p) value shows that the equation is significant as a whole. According to the estimation results, the SELCON variable has an effect on the economic indicator of SLD in Erzincan Province. The coefficient value of the SELCON variable, which is statistically significant at the 5% significance level, is 0.128. Accordingly, a one-unit increase in the clustering indicator in the form of sellers and consumers increases the economic indicator of SLD by 0.13 units. According to this result, the improvement in the seller/consumer variable in Erzincan Province positively affects the economic indicator of SLD.

Table 5. Findings Regarding Bayburt Province

	Coefficient	t-statistics	p	VIF
Static	-0.185	1.639	0.102	----------
SUPRO	0.054	0.977	0.329	1.222
SELCON	0.000	-0.003	0.997	1.386
SUPINT	0.099	1.803	0.072	1.212

PUBIND	**-0.121**	**-2.384**	**0.018****	1.038
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.417	26.984 (0.000)	1.508	2.015	

*: Indicates statistical significance at the 5% significance level.
Source: Authors' calculations

When the VIF and DW values in the table are examined, it is seen that there is no multicollinearity or autocorrelation problem, and the entire equation is explained at the 42% level and is significant at the 1% significance level.

As seen in Table 5, there is no statistically significant variable other than the PUBIND variable. The effect of the PUBIND variable on the economic indicator of SLD is negative, and the coefficient value is (-0.121). Accordingly, a one-unit increase in the clustering indicator in the form of public and stakeholder support reduces the economic indicator of LD by 0.12 units. The finding shows that the supports are insufficient or that the existing supports are still in the investment phase requiring costs.

Estimation Results of Equation No. (3)

The results for equation (3), estimated separately for each province, are as shown in Tables 6, 7 and 8.

Table 6. Findings Regarding Erzurum Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	0.171	3.109	0.002	----
SUPRO	-0.090	-1.706	0.157	1.071
SELCON	-0.004	-0.091	0.927	1.081
SUPINT	**0.313**	**5.689**	**0.000***	1.439
PUBIND	0.023	0.435	0.664	1.291
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.401	19.153 (0.000)	1.146	2.682	

*: Indicates statistical significance at the 1% significance level.
Source: Authors' calculations

Examining the VIF and DW values in the table, it is seen that there is no multicollinearity or autocorrelation problem and that the entire model explains 40%. The Durbin-Watson (DW) value was found to be 2.682. This indicates the presence of autocorrelation. According to the estimation results, the clustering indicator that affects the social indicator of SLD in Erzurum Province is SUPINT. A one-unit increase in the SUPINT variable increases the social indicator of SLD by 0.31 units.

Table 7. Findings Regarding Erzincan Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	2.12	1.999	0.046	-----
SUPRO	0.053	0.980	0.328	1.129
SELCON	0.104	1.700	0.158	1.135
SUPINT	0.029	0.547	0.585	1.091

PUNIND	-0.033	-0.586	0.558	1.205
R^2	**F ist. (p)**	**Standart Hata**	**Durbin Watson (DW)**	
0.525	24.997 (0.000)	1.365	1.937	

Source: Authors' calculations

According to Table 7, equation (3) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 53%. The DW value (1 < 1.94 < 2.5) indicates no autocorrelation and the VIF values (< 10) indicate no multicollinearity problem.

According to the estimation results, no clustering indicator has a significant effect on the social indicator of SLD in Erzincan Province. Based on this finding, it can be said that the variables in the province are not ready for a potential clustering initiative and that providing training to the relevant sector representatives by their chambers and professional organizations before moving to such a policy would help to achieve more successful results.

Table 8. Findings Regarding Bayburt Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	-0.23	-1.653	0.099	----
SUPRO	0.064	1.176	0.240	1.222
SELCON	**0.124**	**2.465**	**0.014***	1.038
SUPINT	0.106	1.639	0.153	1.212
PUBIND	-0.016	-0.270	0.787	1.386
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.517	25.943 (0.000)	1.515	2.011	

*: Indicates statistical significance at the 5% significance level.
Source: Authors' calculations

According to Table 8, equation (3) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 51.7%. The DW value (1 < 2.011 < 2.5) indicates that there is no autocorrelation and the VIF values (< 10) indicate that there is no multicollinearity problem.

According to the estimation results, there is no significant effect of any indicator other than the clustering indicator in the form of SELCON on the social indicator of SLD in Bayburt Province. The coefficient value of the SELCON variable, which is significant at the 5% significance level, is 0.124. Accordingly, a one-unit increase in the clustering indicator related to the cluster actors in the form of sellers and consumers increases the social indicator of SLD by 0.13 units.

Estimation Results of Equation No. (4)

The results for equation (4), estimated separately for each province, are given in Tables 9, 10 and 11.

Table 9. Findings Regarding Erzurum Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	0.293	3.492	0.001	---------

SUPRO	**-0.096**	**-2.015**	**0.045****	1.071
SELCON	-0.013	-0.264	0.792	1.081
SUPINT	**0.333**	**6.036**	**0.000***	1.439
PUBIND	0.020	0.376	0.707	1.291
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.593	18.223 (0.000)	1.166	1.711	

* and **: Indicates statistical significance at the 1% and 5% significance levels, respectively.

Source: Authors' calculations

According to Table 9, equation (4) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 59.3%. The DW value (1 < 1,71 < 2.5) indicates no autocorrelation and the VIF values (< 10) indicate no multicollinearity problem.

According to the estimation results for Erzurum Province, the clustering indicators SUPRO and SUPINT are significant at the 5% and 1% significance levels on the environmental indicator of SLD in Erzurum Province. A one-unit increase in the SUPRO and SUPINT variables has a negative (-0.10) and positive (0.33) effect, respectively, on the environmental indicator of SLD. According to this result, improvements at the supplier and producer level may lead to more successful results.

Table 10. Findings Regarding Erzincan Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	2.242	2.133	0.034	----------
SUPRO	0.049	0.908	0.365	1.129
SELCON	0.103	1.785	0.160	1.135
SUPINT	0.029	0.547	0.585	1.091
PUBIND	-0.041	-0.724	0.469	1.205
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.424	18.840 (0.000)	1.360	1.921	

Source: Authors' calculations

Examination of the VIF and DW values in the table reveals no multicollinearity or autocorrelation problems, and the model as a whole explains 42% of the data. In Erzincan Province, clustering indicators do not have a statistically significant effect on the environmental indicator of the SLF (Student Loan and Facility). This finding supports the opinions expressed by participants in face-to-face interviews in the province, who stated that they were not receptive to the merger and that their reluctance to join the partnership stemmed from previous problems.

Table 11. Findings Regarding Bayburt Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static	-0.231	1.772	0.077	----------
SUPRO	0.064	1.175	0.241	1.222
SELCON	-0.014	-0.241	0.810	1.386
SUPINT	0.094	1.730	0.084	1.212

PUBIND	**-0.130**	**-2.590**	**0.010***	1.038
R^2	**F sta. (p)**	**Standard Error**		**Durbin Watson (DW)**
0.512	10.250 (0.000)	1.509		2.054

*: Indicates statistical significance at the 5% significance level.
Source: Authors' calculations

According to the VIF and DW values in Table 11, there is no multicollinearity or autocorrelation problem. The R^2value shows that the model has an explanatory power at the 51% level and the equation is significant (F stat.(p) = 0.000). As seen in the table, the clustering indicator in the form of PUBIND has a significant effect on the environmental indicator of SLD in Bayburt Province at the 5% significance level. Accordingly, a one-unit increase in the clustering indicator in the form of public and stakeholder support reduces the environmental indicator of SLD by (-0.13) units.

Estimation Results of Equation No. (5)

To estimate Equation (5), participant responses regarding the economic, social and environmental indicators of SLD were taken into account, and data on the SLD variable was obtained by taking the arithmetic mean of the means for each indicator. The results for Equation (5), estimated separately for each province, are presented in Tables 12, 13 and 14.

Table 12. Findings Regarding Erzurum Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static		3.215	0.001	
SUPRO	-0.093	-1.766	0.150	1.071
SELCON	-0.005	-0.099	0.921	1.081
SUPINT	**0.324**	**5.896**	**0.000***	1.439
PUBIND	0.019	0.375	0.708	1.291
R^2	**F sta. (p)**	**Standard Error**		**Durbin Watson (DW)**
0.402	19.342 (0.000)	1.148		1.694

*: Indicates statistical significance at the 1% significance level.
Source: Authors' calculations

According to Table 12, equation (5) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 40.2%. The DW value (1 < 1.69 < 2.5) indicates autocorrelation and the VIF values (< 10) indicate that there is no multicollinearity problem. According to the table, the clustering indicator in the form of SUBINT positively affects SLD at the 1% significance level and the coefficient value is 0.32.

Table 13. Findings Regarding Erzincan Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static		2.061	0.040	
SUPRO	0.051	0.929	0.354	1.129
SELCON	**0.110**	**2.015**	**0.045***	1.135
SUBINT	0.025	0.476	0.634	1.091

PUBIND	-0.038	-0.668	0.505	1.205
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.526	19.964 (0.000)	1.355	1.935	

*: Indicates statistical significance at the 5% significance level.
Source: Authors' calculations

Table 13 shows that there is no multicollinearity or autocorrelation problem according to the VIF and DW values. According to the R^2 value, the equation has an explanatory power of 53%.

According to the estimation results, there is no indicator other than the clustering indicator in the form of SELCON that has a significant effect on SLD in Erzincan Province. The coefficient value of the SELCON variable, which is significant at the 5% significance level, is 0.11. Accordingly, a one-unit increase in the clustering indicator related to the cluster actors in the form of sellers and consumers increases SLD by 0.113 units.

Table 14. Findings Regarding Bayburt Province

	Coefficient	**t-statistics**	**p**	**VIF**
Static		1.706	0.089	
SUPRO	0.062	1.129	0.260	1.222
SELCON	-0.011	-0.191	0.849	1.386
SUPINT	0.099	1.817	0.070	1.212
PUBIND	**-0.126**	**-2.507**	**0.013***	1.038
R^2	**F sta. (p)**	**Standard Error**	**Durbin Watson (DW)**	
0.523	20.000 (0.000)	1.506	2.069	

*: Indicates statistical significance at 5% significance levels.
Source: Authors' calculations

According to Table 14, equation (5) is significant at the 1% significance level (F stat.(p) = 0.000) and the explanatory power of the equation is 52.3%. The DW value ($1 < 2.07 < 2.5$) indicates no autocorrelation and the VIF values (< 10) indicate no multicollinearity problem.

According to the estimation results, the PUBIND clustering indicator in Bayburt province has a negative effect on SLD at the 5% significance level. A one-unit increase in the PUBIND variable reduces SLD by (-0.13) units. The negative effect seems consistent with the opinions of the participants in the province that they have difficulty receiving financial support from institutions and organizations such as KUDAKA due to their distance from Bayburt. When the estimation results for Equations (2), (3), (4) and (5) are evaluated in general, it is seen that a cluster to be established in the provinces of the TRA1 Region has a positive effect on SLD in terms of cluster actors such as SUPINT and SELCON. SUPRO and PUBIND indicators, on the other hand, have negative effects. The general finding obtained in this study, "Clustering has both positive and negative effects on SLD", is consistent with the findings of Breschi and Malerba (2001), Nel et al. (2003), Cunha and Cunha (2005), Mabuza (2006), Kamasak et al. (2008), Koutsouris (2009), Tien (2010), Lombardo and Falcano (2011), Elola et al. (2012), Gokdeniz (2015), Zheng and Zhao (2017), Kyllingstad and Rypestøl (2019), Zhang et al. This is consistent

with the research results of Bramwell et al. (2008), Lombardo and Falcano (2011), Garanti/Zvirbule (2013), Chuluunbaatar et al. (2014), Zheng and Zhao (2017), Bevilacqua et al. (2019), Sjøtun/Njøs (2019), and Guo et al. (2021), who obtained positive and negative effects, respectively.

Based on the results of multiple regression analysis, the study aimed to determine which province in the TRA1 Region would be suitable for clustering in terms of SLD (Social, Economic and Environmental) indicators. For this purpose, the statistically significant coefficient values of the clustering indicators were compared. It was accepted that forming a cluster in the province with the clustering indicators and coefficient values that most affect SLD and its economic, social and environmental indicators would provide optimum benefit to the SLD of the TRA1 Region. Table 15 presents the results of the comparison of the coefficient values of the clustering indicators at the provincial level.

Table 15. Province Selection for Possible Clustering.

Economic	**Erzurum**	**Erzincan**	**Bayburt**
SUPRO	-		-
SELCON	-	0.128	-
SUPINT	0.312	-	-
PUBIND	-	-	-0.121
Result	***SUPINT***	***SELCON***	***PUBIND***
Social	**Erzurum**	**Erzincan**	**Bayburt**
SUPRO	-	-	-
SELCON	-	-	0.124
SUPINT	0.313	-	-
PUBIND	-	-	-
Result	***SUPINT***	-	***SELCON***
Environmental	**Erzurum**	**Erzincan**	**Bayburt**
SUPRO	-0.096	-	-
SELCON	-	-	-
SUPINT	0.333	-	-
PUBIND	-	-	-0.130
Result	***SUPRO/ SUPINT***	-	***PUBIND***
SLD	**Erzurum**	**Erzincan**	**Bayburt**
SUPRO	-	-	-
SELCON	-	0.110	-
SUPINT	0.324	-	-
PUBIND	-	-	-0.126
Result	***SUPINT***	***SELCON***	***PUBIND***

Source: Authors' calculations

As shown in Table 15, in terms of the positive effects of clustering indicators on the SLD and its economic, social, and environmental indicators, the SUPINT variable stands out in Erzurum, while the SELCON variable stands out in Erzincan. In Bayburt, the PUBIND variable is statistically significant but has a negative sign. In terms of positive impact and coefficient values, the most effective clustering indicator is SUPINT, and Erzurum is the province with the best effect of the clustering indicator on SLD. This is followed by the SELCON variable and Erzincan. Accordingly, it can be said that clustering in Erzurum will provide

optimum benefit to the SLD of the TRA1 Region. In Bayburt, however, clustering can be said to be unsuitable due to the negative effect of the PUBIND variable. Based on comparative results derived from coefficient values obtained from regression analyses, it can be said that a cluster to be established in Erzurum Province could contribute to the Social Security Institution (SSI) of both other provinces and the TRA1 Region, and the added value created in this way could reduce income inequalities between provinces and regions. For this to happen, it is extremely important that cluster actors become effective and efficient, that initiatives towards clustering activities are supported by central and local governments, that all cluster actors are directly involved in the system at every stage from policy formulation to finalization, and that they receive awareness training on clustering.

5. Conclusions

This study aimed to determine the effects of cluster indicators such as suppliers/producers (SUPRO), sellers/consumers (SELCON), supporting/intermediary institutions (SUPINT), and public and stakeholder support (KAPAYDES) on the economic, social, and environmental indicators of the SLD in the provinces of Erzurum, Erzincan, and Bayburt in the TRA1 Region. For this purpose, a survey-based field study was conducted on firms operating under the NACE Rev.2 code, and the primary data obtained were evaluated using multiple regression analyses.

To determine the variables in the estimation equations, Cronbach α, Kaiser-Meyer-Olkin (KMO), and Bartlett sphericity tests were first used to investigate whether the questions in the survey form were suitable for determining the variables. Then, the averages of the responses of the survey participants were taken to determine the data for the dependent and independent variables. According to the regression analysis results, cluster actors, with varying sizes and directions, have an impact on the economic, social, and environmental indicators of the SLD, and the most influential cluster actor is SUPINT. Furthermore, based on the results of the multiple regression analysis, it has been determined that a cluster to be established in Erzurum Province would be suitable in terms of the SLD.

Based on the analysis results, it is possible to say that successful publicly supported clusters established in Erzurum Province can contribute to the SLD of both other provinces and the TRA1 Region. The ability of a cluster established in Erzurum to positively impact the SLD depends on factors such as: developing communication networks between local and global actors, maintaining local information flow, increasing local entrepreneurial activities, establishing innovative R&D departments, ensuring access to innovation services, establishing a high-tech industry, and producing goods and services that meet global demand. For this, public support and public-private sector collaboration become crucial. In this context, intra-cluster interaction and learning networks, institutional and material infrastructure investments, product and market diversification, umbrella

organizations representing actors, high-level institutionalization, and lobbying activities can contribute to both cluster success and the SLD of the local economy. Furthermore, providing selective and supervised clustering support to firms that can be effective in areas such as entrepreneurship, infrastructure, investment and operation, human resources, physical capital, R&D and design centers, e-export, virtual fairs and multi-stores, waste management, etc., will increase the contribution of the established clusters to the SLD.

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