

INFLUENCE OF LOGISTICS COMPETITIVENESS AND LOGISTICS COST ON ECONOMIC DEVELOPMENT: AN FSQCA QUALITATIVE APPROACH

Mohan Saini¹, Denisa Hrušecká²

¹ Tomas Bata University in Zlín, Faculty of Management and Economics, Department of Industrial Engineering and Information Systems, Czech Republic, ORCID: 0000-0002-4506-4425, saini@utb.cz;

² Tomas Bata University in Zlín, Faculty of Management and Economics, Department of Industrial Engineering and Information Systems, Czech Republic, ORCID: 0000-0003-1459-0040, hrušecká@utb.cz.

Abstract: Logistics is an important sector that determines a country's economic strategy while attaining higher impetus in terms of globalization and competitiveness. Infrastructure along with trade friendly government policies are the key important parameters for a competitive logistics sector. One such method to evaluate competency is the logistics performance index (LPI) by the World Bank. This index evaluates the logistics performance of the economies of the world and rank them on the basis of six parameters (customs, infrastructure, timeliness, tracking & tracing, logistics competence and international shipments). This research study illustrates the impact of logistics costs (LC) and logistics competency parameters (LPI) on the economic development. The fuzzy set qualitative comparative analysis (fsQCA) methodology is applied to identify the causal configuration relations for higher values of economic development (GDP per capita). Eight major economies across Asia (China, India, Japan, Singapore), Europe (Germany, France), the UK and the USA have been studied for the analysis. The Czech Republic and Slovenia are also included to the list of countries to have a perspective of mid-sized economies. These mid-size economies are landlocked countries (Czech Republic) and a smaller port sector (Slovenia) for logistics. The results indicate two configurations of LPI and LC that lead to higher values of GDP per capita. The major contribution to the existing literature is in identifying the influence of LPI index parameters along with LC on the economic development. The associated results illustrate that logistics competence, infrastructure and tracking & tracing of LPI index are identified as the core parameters, resulting in the higher values of GDP per capita. The results offer various insights into future area of research for evaluating new parameters such a LC to be inducted in LPI for evaluating logistics performance.

Keywords: Economic development, logistics performance index, logistics cost, fuzzy sets, fsQCA, qualitative study.

JEL Classification: O40, O57.

APA Style Citation: Saini, M., & Hrušecká, D. (2021). Influence of Logistics Competitiveness and Logistics Cost on Economic Development: An FsQCA Qualitative Approach. *E&M Economics and Management*, 24(2), 51–65. <https://doi.org/10.15240/tul/001/2021-2-004>

Introduction

Logistics has become one of the key vertical in the organization and as an important industry for an economy as a whole. It plays an important role in the economic development of a country, including various infrastructure development

to support and enhance manufacturing and other sectors. The economy has to perform efficiently in this sector for supporting a growth in all other sectors. To provide a visibility on the same, World Bank publishes index for providing visibility on the performance and scope for

improvement in logistics sectors of economies. This index is known as logistics performance index and this has been included in this study for understanding the effect on economic development of the country along with the logistics cost.

Logistics is important because it is a driver of countries and firm's competitiveness, which is fundamental to job creation and economic growth (World Bank, 2014). It is no coincidence that better performance in logistics goes along with higher incomes and development (Hofman, 2017). Ivanova et al. (2019) introduce a new approach to consequence assessment of a company's technological development where distribution channels including logistics flow management represents one of the main five components of a core business. Prior to globalization, economies used to compete within regional dynamics, however with globalization and more liberalized economies along with trade border transaction, competition started occurring between the countries across the globe, thus causing logistics a mainstream field in deciding the competitiveness amongst economies. Lampropoulos et al. (2019) emphasized the role of technological advancements, developments and innovations in economic development where intelligent logistics and smart transportation represent one of its basic pillars.

Rezaei et al. (2018) highlighted on the importance of rising demand of international freight transportation with globalisation and its significance to evaluate the importance of logistics performance. They evaluated the LPI parameters by giving weighted component to them. Bondarenko et al. (2017) identified the importance of methodical use of other means of marketing and logistics for import substitution and exploring other external markets. However, their study was limited to analyse the impact of only few aspects of supply chain on the international trade considering consumer's needs.

Hayaloğlu (2015) researched on the impact of developments in logistics sector on economic growth for 32 OECD countries. Multiple factors such as infrastructure, railways transportation road and airline transportation, were researched to identify their effect on economic growth. It was identified that relationship between development of logistics sector and economic development varies depending on the variable being considered for the evaluation. Devlin and

Yee (2005) researched on the international competitiveness along with very high logistics cost for MNA (middle east and north Africa) countries.

Akopova et al. (2017) suggested a model for intensive transport infrastructure development in Russia and EU. They also highlighted that most of the existing studies focus on only few aspects of logistics and supply chain on globalized trade. The outcome of this study will fill the research gap when considering also the impact of logistics cost along with logistics competitiveness on the economic development.

Previous studies have emphasized that the performance of logistics indicators, such as logistics infrastructure, logistics quality, and competence positively influence international trade (Bensassi et al., 2015). Our research study evaluates the influence of logistics competitive indicators in comparison with logistics cost on the economic development exploring causal relationships which have both positive and negative effects.

The paper is structured as per following details: Section I reviews the theoretical background for logistics competitiveness indicators and economic development. Section II presents the methodology including data collection, variables studied and fsQCA model along with its applicability and utility in this research. Section III explains the data analysis and its empirical results along with findings of fsQCA model on membership relation of variables in discussion followed by concluding remarks.

1. Theoretical Background

Logistics sector plays a vital role in the economic development and influence various economic sectors such as transport infrastructure, warehousing, information and communication in supply chain management. It is considered to be setting a path to becoming an important element in industry and trade development. Development in the logistics sector plays a very significant role, providing advantages in terms of logistical investments change the functioning of a company and countries. Considering this importance for logistics sector, World Bank published a comprehensive logistics performance index score in every two years rating all nations across six parameters.

Many countries generated their economic growth by expanding export production. Export

performance is important especially for small economies or developing countries (Ruzekova et al., 2020). Sriyana and Afandi (2020) also highlight that trade openness has a positive impact on economic growth while studying selected Asian countries. Regarding this fact, positive logistics conditions and infrastructure should support this trade openness rate.

1.1 Logistics Performance Index, World Bank

The relation and importance of logistics sector to economic development led to the development of tool by World Bank, the Logistics Performance Index (LPI). The logistics performance index (LPI) was first introduced by the World Bank in 2007 for ranking economies on the logistics performance. This tool is used for comparing and benchmarking global economies in comparison to each other on six

parameters. Puertas et al. (2014) researched on the importance of logistics from importer and export perspective for 26 EU countries and identified that competence and tracking have gained importance in LPI parameters. The LPI is a benchmarking scale which ranks countries on six components (Tab. 1).

LPI database is published every two years and has been published for six periods till date (2007, 2010, 2012, 2014, 2016, 2018). LPI index is constructed on questionnaire-based survey in which respondents' rate eight overseas markets on six above mentioned core components of logistic performance using five-point Likert Scale (1 = very low degree, 5 = very high degree). After that, LPI index is constructed using a standard statistical technique called principal component analysis (PCA). The output of PCA is a weighted average of score presented like LPI indicator.

Tab. 1: Components of LPI

Components of LPI	Definition
Customs	The efficiency of customs and border management clearing
Infrastructure	The quality of trade and transport infrastructure
Logistics competence	The competence and quality of logistics services
Timeliness	The frequency with which shipments reach consignees within expected delivery times
Tracking & tracing	The ability to track and trace consignments
International shipments	The ease of arranging competitively priced shipments

Source: World Bank (2014)

A detailed information on the methodology of LPI is provided in reference for detailed study and understanding (Word Bank, 2014).

In order to improve logistics performance, development of infrastructure, improvement in government regulations, adoption of information technology tools and developing skilled human resources is imperative (Jhawar et al., 2017). For this, governments have to manage and understand the current logistics scenario in country and develop systems to optimize and develop through policy reformations.

1.2 Logistics Performance Index in Research Studies

Logistics performance and LPI index is researched in multiple studies across geographies to

provide insight into the logistics competitiveness in various countries such as Finland (Solakivi et al., 2009), Turkey (Ekici et al., 2016), Brazil (Faria et al., 2015) and England (Khan & Qianli, 2017).

LPI is accepted as a measure to evaluate logistics performance of an economy with respect to various trade and infrastructure policies. However, there have been few studies evaluating its influence along with the logistics cost on GDP per capita. LPI index holds a key and important role in the economic growth and competitiveness of countries. More importantly, the logistics sector is considered to be one of the main sectors in the economic development of a state. Besides measuring its economic development, focus of LPI has also been researched on the environmental sustainability (Arvis et al., 2018).

The LPI competitiveness index along with other indicators such as global competitiveness report of the World economic forum, ease of doing business are globally acknowledged and researched indicators to provide competitiveness of an economy. These indexes focus on the providing visibility of global economies on performance competitiveness, regulatory issues and its importance for growth.

A research evaluated the moderating effect of GCI (global competitive index) on the LPI (logistics performance index). The study concluded that with a higher competency on the global competitiveness index can be attained by having logistics competency in managing international shipments, tracking & tracing and timeliness (Cemberci et al., 2015). Another study concluded with the novel combination of environmental factors such as EPI (environmental performance index) and LPI (logistics performance index) to represent another aspect of ranking economies (Kim & Min, 2011). A research study by Yildirim and Mercangoz (2020) analysed the performance of logistics competency of OECD economies by adopting analytics hierarchy process (AHP) and additive ratio assessment (ARAS) grey method.

Research studies with focus on LPI score and its different components have been widely studied by the research academia. Different indexes of the World Bank regarding trade restrictions and facilitation, and related them to developing countries have been studied by the research academia (Hoekman & Nicita, 2008). They concluded through a gravity regression basis that the impact of reducing costs attached with policies will have a greater payoff than reducing tariffs.

Various factors of evaluating LPI in relation with variables such as infrastructure weighted indicators relation to global competitiveness have been researched (Erkan, 2014). They included factors global competitiveness factors such as the road quality, rail road infrastructure, port infrastructure, air transport quality and investment on research and development. A simple regression analysis was performed to identify the relationship and its signification between LPI and all of these important factors of global competitiveness. Erkan (2014) concluded that out of all the indicators only two indicators, port infrastructure and road quality have established significance results on affecting LPI.

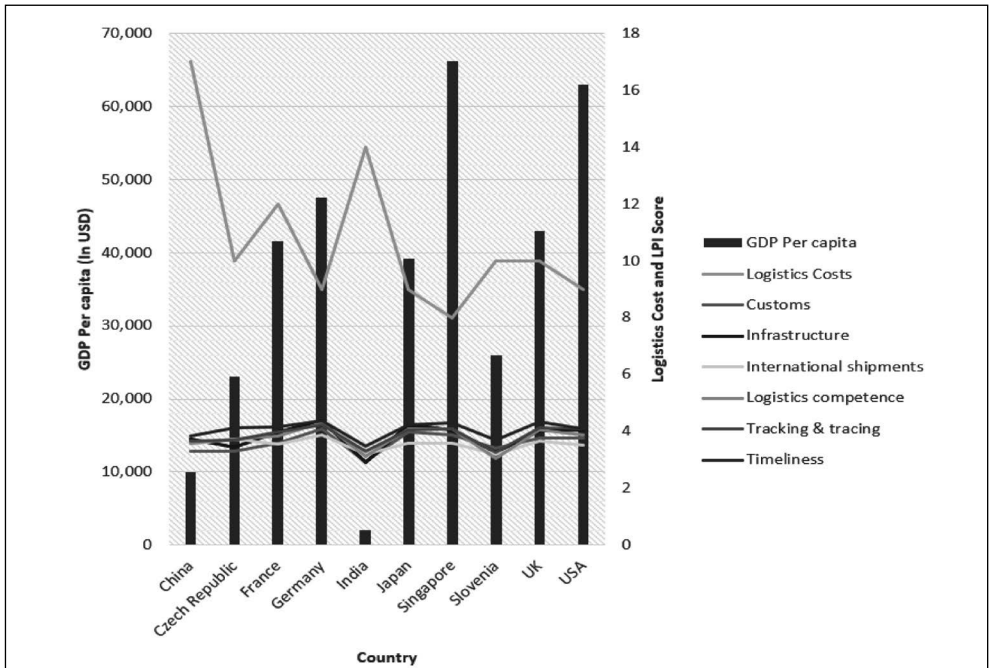
Marti et al. (2017) investigated the potential differences to be observed with the use of different income and geographical area in their studies. They proposed a data envelopment analysis (DEA) method to analyse the index of overall DEA-LPI benchmarking index. They concluded by that logistics performance is related to income and geography of the economy studied. Several other researchers (Pinheiro & Zambujal, 2012; Fernandez & Romero, 2014) have also studied the effects of other factors such as interactive influence of culture and the EODB (ease of doing business index) to identify the effect on economic development (Kalyvas & Mamatzakis, 2014).

Another study utilized hierarchical regression analysis, to evaluate the mediating impact of LPI on GCI (global competitiveness index) and GDP. The importance of GCI and GDP was identified in this study and found to be significant for developing a relationship between competitiveness and prosperity of an economy. Milenkovic et al. (2020) proved that gross domestic product has a positive impact on the price level what strengthen its importance for countries competitiveness. Another research study conducted by Marti et al. (2014) evaluated the individual components of LPI and compared it with the international trade in the emerging economies. They utilized a model of gravity to identify that all the components of LPI have significant positive relationship with international trade.

2. Research Methodology

The objective of this research study is to identify the causal membership relation between indicators of logistics competitiveness (customs, infrastructure, timeliness, tracking & tracing, logistics competence and international shipments) and logistics cost on economic development utilizing fsQCA methodology. This can evaluate the economic growth in relation to above competitive variables for major economies of the world. Secondary data is extracted from the World Bank database for major economies across Asia, Europe, the UK and the USA. GDP per capita data is in the units of US dollars, logistics cost data is represented as percentage of GDP, logistics competence data is the absolute score as computed by the LPI index. Countries are selected across the scale through non-probability judgement and theoretical sampling is considered.

Fig. 1: Comparison of GDP per capita, LC, LPI parameters



Source: own

A comparative display of GDP per capita, customs, infrastructure, timeliness, tracking & tracing, logistics competence and international shipments and logistics cost for selected economies is shown in Fig. 1.

2.1 FsQCA Analysis

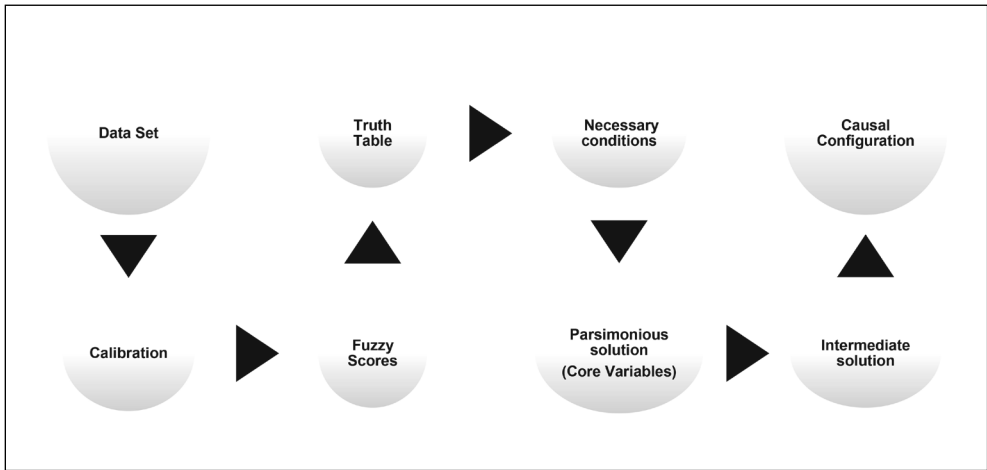
Fuzzy-set qualitative comparative analysis (fsQCA) is a research methodology developed to identify and combine causal case oriented variable qualitative analysis. This methodology adapts the creation of qualitative comparative analysis with fsQCA, developed by fuzzy-set approach using Quine-McCluskey algorithm. The fuzzy set approach is gaining attention of the research academia. The researchers utilizing this methodology across the disciplines especially management have gradually increased.

A detailed fuzzy set qualitative process in defined in Fig. 2. A calibration process is to be conducted in fsQCA technique which includes the allocation of a fuzzy set of scores to each

dependent and independent variable. These fuzzy scores are in the range of 0 to 1. This process assists in assigning a rating-based score on certain specific characteristics that highlight the extent of membership of each of the variables. Afterwards, a truth table is computed along with necessary conditions which explains the membership relation and its effect for higher or lower values of outcome variable. Such outcome variables forms a case by the combination of causal conditions and the outcome (Schneider et al., 2010). Single or multiple configurations are generated from the output of truth table and necessary conditions. These configurations are nomenclated as parsimonious, intermediate and complex configurations. Along with these configurations, conditions such as core and peripheral are also generated on the logic of Boolean algebra.

The fuzzy set qualitative comparative analyses (fsQCA) is the qualitative methodology approach adopted in this research paper for the data analysis. This approach contributes in

Fig. 2: FsQCA analysis



Source: own

identifying the associated causal relationship between LPI index parameters and logistics cost on the economic development. Research scholars from the various fields especially management and economics have emphasized on the critical relation of such causal configurational analysis for research purpose (Fiss, 2011).

The fsQCA is a technique which can be utilized for identifying relationships for smaller set of samples. This assists in identifying the inter dependability of one or more variable in arriving at a specific outcome. As per Kraus et al. (2018), this methodology is widely used by researchers in management and this technique is gaining the attention for identifying the outcome relationships for qualitative purpose. Thus, fsQCA contribution for identifying the outcome are of key importance in theoretical selection of interest and its causes on the outcomes. It identifies the specifics paths of generated configurations that lead to the specific outcome (Park et al., 2017).

There cannot be only one suitable configuration that determines the outcomes, Misangyi et al. (2016) suggested that presence or absence of the associated outcomes in due to the conjunction of various associated input variables. They highlighted that outcome results always have interdependence of multiple causal conditions rather a single cause.

The fuzzy sets represent an asymmetric modelling technique that associated the fuzzy score sets and logics to develop causal configuration relationships. Such a modelling comprises of complex theories which have many advantages in creating relationship between two or more independent variable. Statistical correlation and beta coefficients many not be sufficient in such an approach. Fuzzy set methodology is best adopted to study such a complexity. FsQCA computes outcome conditions that lead to higher to lower values of dependent variable. Collinearity challenges may also be the cause of percentage accuracy in the cases of high correlation between two variables (Olya & Altinay, 2016). As per the research by Wu et al. (2014), it was concluded that no one single simple condition can be the cause of an outcome of interest. Several associated indicators act in combination to each other and cause an outcome of the interest. Regression analysis is not sufficing to establish a relationship between an independent variable in smaller subsets (Liu et al., 2015).

As suggested by Woodside and Zhang (2013), an outcome is dependent on combination of various algorithms in asymmetric approaches. In an asymmetric approach, independent variable values are sufficient in predicting the occurrence of dependent variable but that do not necessarily lead to the

occurrence of dependent variable. Whereas, in a symmetric relations values of independent variables are sufficient for predicting the outcome of dependent variable and vice versa. The main objective of fsQCA is allowing for outcome and predictor variable to be on a fuzzy scale rather a dichotomous scale. They provide patterns of elements that lead to a specific outcome rather than just identifying correlation between dependant and independent variables (Kourouthanassis et al., 2017).

2.2 Research Data Variables and Data Analysis Process

The logistics competitiveness indexes of LPI such as customs, infrastructure, timeliness, tracking & tracing, logistics competence and international shipments along with logistics cost data collected through secondary database of World Bank. The fsQCA study aims to evaluate the configuration that determine the extent to which the higher values of GDP per capita is related to all the input indicators.

FsQCA is a widely studied qualitative analysis process, and involves multiple steps

for the data analysis process. A detailed summary of data analysis process is illustrated in the Fig. 3.

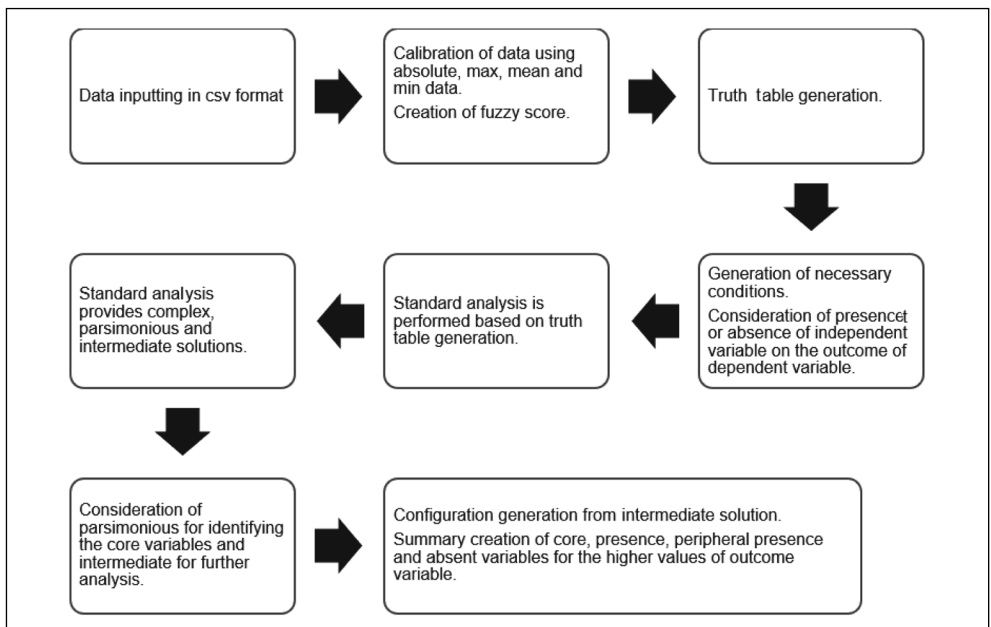
3. Research Results

The fsQCA 3.0 software was used to analyse the presence or absence of the logistics competitiveness variables, logistics cost and its membership relationship with the economic development of ten selected economies.

3.1 FsQCA Descriptive Analysis and Data Calibration

The data in this research analysis comprises of effect of logistics performance index parameters such as customs, logistics competence, international shipments, timelessness, tracing & tracking and logistics cost on economic development of ten major economies of Asia, Europe, the UK and the USA. Tab. 2 shows descriptive statistics of dependent and independent variables along with calibration scores while adopting the method figures of maximum, mean and minimum in the last column of the Tab. 3. As per Fiss (2011), the

Fig. 3: FsQCA data analysis process



Source: own

Tab. 2: Descriptive statistics

	Mean	Std. dev.	Min	Max	N	Calibration
GDP per capita	36,174.2	20,992.4	2,005.9	66,188.8	10	(66,188.8; 36,174.2; 2,005.9)
Logistics costs	10.80	2.78	8.00	17.00	10	(17; 10.8; 8)
Customs	3.61	0.36	2.96	4.09	10	(4.09; 3.607; 2.96)
Infrastructure	3.81	0.47	2.91	4.37	10	(4.37; 3.814; 2.91)
Intl. shipments	3.55	0.21	3.19	3.86	10	(3.86; 3.545; 3.19)
Logistics competence	3.78	0.42	3.05	4.31	10	(4.31; 3.775; 3.05)
Tracking & tracing	3.85	0.35	3.27	4.24	10	(4.24; 3.851; 3.27)
Timeliness	4.07	0.30	3.50	4.39	10	(4.39; 4.069; 3.5)

Source: own

values of the dependent and independent variables are to be calibrated and transformed into fuzzy scores.

Truth table is generated after the calculation of fuzzy scores for further analysis of necessary conditions (Curado et al., 2016). These fuzzy scores range from 0 to 1, and every figure in the score correspond to the membership degree of the variables. This research paper considered the full membership (presence) at the maximum value, mean in case of partial membership and

minimum for the absent membership to calibrate the data into fuzzy scores. For the identification of fuzzy scores, a prefix fz is used for variables. Tab. 3 illustrates the fuzzy scores computed by the fsQCA for the respective economies.

One of the most important benefit of adopting this technique is the ability to analyse on smaller sample sets. The output is generated in the form of configurations which are either present or absent along with a consistency and coverage score. Those cluster of configurations reflects

Tab. 3: Fuzzy scores computed from the fsQCA 3.0

Country	fzGDP	fzLC	fzCust	fzInfra	fzIntl	fzLogcomp	fzTT	fzTM
China	0.09	0.95	0.19	0.45	0.49	0.32	0.31	0.19
Czech Republic	0.24	0.3	0.19	0.24	0.88	0.44	0.31	0.57
France	0.63	0.64	0.48	0.73	0.51	0.59	0.76	0.77
Germany	0.76	0.13	0.95	0.95	0.95	0.95	0.94	0.96
India	0.05	0.82	0.05	0.05	0.06	0.06	0.05	0.05
Japan	0.57	0.13	0.92	0.91	0.61	0.85	0.87	0.9
Singapore	0.95	0.05	0.85	0.79	0.58	0.86	0.87	0.9
Slovenia	0.29	0.3	0.3	0.14	0.05	0.05	0.05	0.13
UK	0.67	0.3	0.73	0.76	0.77	0.82	0.87	0.9
USA	0.94	0.13	0.75	0.78	0.43	0.63	0.87	0.57

Source: own

Note: fz = fuzzy score;
 fzGDP = fuzzy score GDP per capita;
 fzLC = fuzzy score logistics cost;
 fzCust = fuzzy score customs;
 fzInfra = fuzzy score infrastructure;

fzIntl = fuzzy score international shipments;
 fzLogcomp = fuzzy score logistics competence;
 fzTT = fuzzy score tracking & tracing;
 fzTM = fuzzy score timeliness.

the level to which an independent variable or a cluster of independent variables influence the higher or lower values of dependent variables.

Various other analysis techniques like correlation and regression represent the general tendencies, however fsQCA examines and illustrates the presence of associated factors that affect the outcome variable. This methodology examines the inter relationship of a group of elements of a sample set.

The main objective of this research paper is to evaluate and compare the set of mutually related configurations that confirms the higher values of GDP per capita. Tab. 4 depicts the influence of individual competitive variables presence or absence (~) on the higher GDP per capita. Consistency and coverage scores are detailed for each independent variable. Multiple studies in the management research have considered a consistency value of more than 0.9 as necessary and few have also considered 0.8 as to be almost necessary (Schneider et al., 2010). Higher values of presence of customs, infrastructure and tracking & tracing results

in higher values of GDP per capita however lower values of logistics cost results in higher GDP per capita. The prime importance of such an analysis is to derive, if a single condition is always necessary to identify the presence and absence for higher values of outcome. The score ranges from 0.28 to 0.92 for the consistence of causal factors, signifying their presence or absence. There are three present conditions for which consistency is higher than 0.90 and one for absence.

Tab. 5 illustrates the outcome of two configuration which represents the effects to fzGDP (higher values of GDP) in the intermediate solution. This research has established two set of configurations that results in higher values of economic development (GDP per capita). Analysis of necessary conditions is crucial for identifying the outcome of fzGDP. Tab. 5 shows that all the conditions of logistics competitive are not necessary conditions for higher values of GDP per capita. A detailed analysis of these configurations along with intermediate analysis shows, that in first configuration

Tab. 4: Necessary conditions results

Outcome variable: fzGDP		
	Consistency	Coverage
fzLC	0.393064	0.544000
~fzLC	0.926782*	0.769600
fzCust	0.905588*	0.868762
~fzCust	0.383430	0.433551
fzInfra	0.909441*	0.813793
~fzInfra	0.337187	0.416667
fzIntl	0.761079	0.741088
~fzIntl	0.520231	0.578158
fzLogcomp	0.868979	0.809695
~fzLogcom	0.379576	0.444695
fzTT	0.924856*	0.813559
~fz TT	0.287091	0.363415
fzTM	0.888247	0.776094
~fzTM	0.321773	0.411330

Source: own

Note: ~ indicates absence of condition;
* meets 0.90 consistency benchmark for usually necessary conditions.

condition fzInfra, fzTT and fzLogcomp, fzCust, fzTM have contribution to the higher values of outcome variable fzGDP and the variable fzLC is exactly the opposite in contributing for higher values of GDP. fzTM and fzCust are the partial (●) present conditions, whereas International shipment is displaying no contribution (x) to first configuration. The parsimonious solution represents the conditions fzInfra, fzTT and fzLogcomp which are the core configuration solutions (●).

In second configuration obtained, almost all the conditions are essential for the higher values of economic development (GDP per capita) with the exclusion of fzCust which is absent (∅) in the second configuration. Upon intercomparing the two configurations, fzInfra, fzTm, fzTT, fzLogcomp are key conditions that results in the higher values of economic development (GDP per capita) with fzLC, fzCust, fzIntl displaying an inverse relation in two of the configurations. FzTT, fzInfra and fzLogcomp are also the core solutions present in the parsimonious solution.

It is significant to be observed that all the parameters of LPI are not the core parameters which influence the higher values of GDP per capita. LC has a considerable inverse effect on overall economic development of a country may

be included in the list of indexes to evaluate the logistics performance. In sum, economies should focus on improving infrastructure along with tracking & tracing systems to perform on logistics competency part of the economic development. The condition of LC for the inverse relations depicts that LC plays a pivotal role in affecting economic development of a country. Better systems along with partial conditions such as customs, timeliness and international shipments need to be sustained at adequate points for higher values of GDP. Previous researches have focussed on evaluating and establishing the relationship between LPI and the factors such as environmental index, infrastructure weighted index, the mediator effect of LPI on economic development with other index such as global competitiveness index, income and geographical areas and aspects of sustainability. This research has contributed to the literature by considering logistics costs as one of the parameters for identifying the causal combination. LC as a percentage of GDP is one of the important measure of logistics efficiency. Rantasila and Ojala (2015) researched on the national level logistics costs overview and categorized logistics cost into three identifiable metrics such as absolute

Tab. 5: Intermediate solution results

Causal configuration	1	2
fzLC	∅	●
fzCust	●	∅
fzInfra	●	●
fzTm	●	●
fzTT	●	●
fzLogcomp	●	●
fzIntl	x	●
Raw coverage	0.782274	0.292871
Unique coverage	0.535645	0.046243
Consistency	0.906250	0.938272
Overall solution coverage	0.828516	
Overall solution consistency	0.892116	

Source: own

Note: ● indicates the presence of a condition; ∅ indicates the absence of a condition; a big symbol (●/∅) indicates core conditions; a small symbol (●/∅) indicates peripheral conditions; x indicates no contribution to configuration.

costs, as a percentage of sales or turnover, and as a percentage of GDP. This research paper utilized the macroeconomic perspectives of logistics cost and utilized the method of novel fuzzy qualitative analysis, fsQCA to perform the causal analysis for evaluating the influence of logistics competitiveness by utilizing LPI and LC on the economic development. The outcome has also highlighted about restructuring the parameters of LPI and include parameters such as LC to provide a more holistic perspective of logistics performance of an economy.

Conclusions

The findings of this study identified the influence of logistics competitiveness and logistics cost on the economic development. LPI is a globally acknowledged scale for monitoring the logistics performance of 160 countries and is published on every two-year basis. Countries are ranked on the basis of performance across six parameters which are customs, logistics competence, infrastructure, international shipments, timeliness and tracking & tracing. Influence of each of these variables on GDP per capita along with logistics cost is evaluated in this paper. This study considered the major economies of the world located across Asia, Europe, the UK and the USA. (China, India, Japan, Singapore, France, Germany, Slovenia, the Czech Republic, the UK and the USA).

Multiple complex theories suggested that one single condition is not the cause of a specific outcome. Several indicators in combination and association cause an outcome of occurrence. FsQCA test causal relations for both positive and negative outcome of interests and methods in evaluations are asymmetric.

The results obtained from fsQCA analysis identified that out of all the parameters of logistics performance index logistics competence, infrastructure and tracking & tracing owns a higher consistency in predicting higher values of economic development. Competitive parameters like customs, timeliness and international shipments forms partial part of configurations for causal relationship. Two configurations detailed in Tab. 5 represents the detailed presence and absence of configuration for the higher values of economic development (GDP per capita).

The main objective of this research paper is to understand the causal relationship between the economic development with the

logistics competitiveness indicators and the logistics cost. The research study establishes important configuration of core parameters such as infrastructure and tracking & tracing which links to the most important requirement for a competitive supply chain network. Efficient customs rules along with technology-oriented tracking tools and infrastructure enable faster movement for goods production and consumption.

It is also identified that with lower values of logistics costs, there is a high GDP per capita growth projection. It is also suggested that possible growth in such a configuration is a sign that with reduction in logistics cost, cost of goods may lower down thus making prices to drop and hence passing the benefits to consumers with lesser cost. The results have major implications on the research study as logistics cost which is a critical component and is not covered in logistics performance index, presents conclusive results on the causal configurations. This study marks a novel way to expand the indicators utilized for computing logistics performance index in which cost should be included as an important part.

Limitation of this study is the specific consideration of economies of Asia and Europe; thereby it is required to replicate and study these results to other countries of these continents. This study also needs to be evaluated over years and identify the changes in causal relationship. The outcome has displayed the solutions that link to achieving higher GDP with LC and LPI index parameters. The findings should be replicated with other variables of economic development for identifying the causal relationship.

Future research study will focus on comparing the results with other tools of statistics and relating the results for the identifying the influence of these indexes along with few more variables such as ease of doing business, global competitive index on the economic development of a country.

Acknowledgement: *The authors are thankful to the Internal Grant Agency of FaME TBU in Zlin No. IGA/FaME/2021/002 for the financial support to carry out this research.*

References

Akopova, E., Przhedetskaya, N., Taranov, P., & Roshchina, L. (2017). Marketing mechanisms for the development of transport infrastructure of Russia and the EU. *European Research Studies Journal*, 20(1), 188–197. Retrieved August 20, 2020, from <https://www.um.edu.mt/library/oar/handle/123456789/28976>

Arvis, J. F., Ojala, L., Wiederer, C., Shepherd, B., Raj, A., Dairabayeva, K., & Kiiski, T. (2018). *Connecting to Compete 2018: Trade Logistics in the Global Economy* (Report). Washington, DC: World Bank. Retrieved August 18, 2020, from <https://openknowledge.worldbank.org/handle/10986/29971>

Bensassi, S., Márquez-Ramos, L., Martínez-Zaroso, I., & Suárez-Burquet, C. (2015). Relationship between logistics infrastructure and trade: Evidence from Spanish regional exports. *Transportation Research Part A: Policy and Practice*, 72, 47–61. <https://doi.org/10.1016/j.tra.2014.11.007>

Bondarenko, V., Parkhomenko, T., Erokhina, T., & Guzenko, N. (2017). Marketing and Logistic Instrumentarium of Activation of Inter-Country Cooperation of Russia and Solving the Issue of Import Substitution. *European Research Studies Journal*, 20(1), 105–116. <https://doi.org/10.35808/ersj/600>

Çemberci, M., Civelek, M. E., & Canbolat, N. (2015). The Moderator Effect of Global Competitiveness Index on Dimensions of Logistics Performance Index. *Procedia – Social and Behavioral Sciences*, 195, 1514–1524. <https://doi.org/10.1016/j.sbspro.2015.06.453>

Civelek, M. E., Uca, N., & Çemberci, M. (2015). The Mediator Effect of Logistics Performance Index on the Relation between Global Competitiveness Index and Gross Domestic Product. *European Scientific Journal*, 11(13), 368–375. <https://doi.org/10.5281/zenodo.1452336>

Curado, C., Henriques, P. L., Oliveira, M., & Matos, P. V. (2016). A fuzzy-set analysis of hard and soft sciences publication performance. *Journal of Business Research*, 69(11), 5348–5353. <https://doi.org/10.1016/j.jbusres.2016.04.136>

Devlin, J., & Yee, P. (2005). Trade Logistics in Developing Countries: The Case of the Middle East and North Africa. *World Economy*, 28(3), 435–456. <https://doi.org/10.1111/j.1467-9701.2005.00620.x>

Ekici, Ş. Ö., Kabak, Ö., & Ülengin, F. (2016). Linking to compete: Logistics and

global competitiveness interaction. *Transport Policy*, 48, 117–128. <https://doi.org/10.1016/j.tranpol.2016.01.015>

Erkan, B. (2014). The Importance and Determinants of Logistics Performance of Selected Countries. *Journal of Emerging Issues in Economics, Finance and Banking*, 3(6), 1237–1254.

Faria, R. N. D., Souza, C. S. D., & Vieira, J. G. V. (2015). Evaluation of logistic performance indexes of Brazil in the international trade. *RAM. Revista de Administração Mackenzie*, 16(1), 213–235. <https://doi.org/10.1590/1678-69712015/administracao.v16n1p213-235>

Fernández-Serrano, J., & Romero, I. (2014). About the interactive influence of culture and regulatory barriers on entrepreneurial activity. *International Entrepreneurship and Management Journal*, 10(4), 781–802. <https://doi.org/10.1007/s11365-014-0296-5>

Fiss, P. C. (2011). Building Better Causal Theories: A Fuzzy Set Approach to Typologies in Organization Research. *Academy of Management Journal*, 54(2), 393–420. <https://doi.org/10.5465/amj.2011.60263120>

Hayaloğlu, P. (2015). The Impact of Developments in the Logistics Sector on Economic Growth: The Case of OECD Countries. *International Journal of Economics and Financial Issues*, 5(2), 523–530. <https://doi.org/10.15604/ejss.2017.05.01.002>

Hoekman, B., & Nicita, A. (2008). *Trade Policy, Trade Costs, And Developing Country Trade* (Policy Research Working Paper No. 4797). Washington, DC: World Bank. <https://doi.org/10.1596/1813-9450-4797>

Hofman, B. (2017). *Performance and Prospects of Global Logistics*. Keynote speech at the CaiNiao Global Smart Logistics Conference 2017. Retrieved August 20, 2020, from www.worldbank.org/en/news/speech/2017/05/22/performance-and-prospects-of-global-logistics

Ivanova, A. S., Holionko, N. G., Tverdushka, T. B., Olejarz, T., & Yakymchuk, A. Y. (2019). The Strategic Management in Terms of an Enterprise’s Technological Development. *Journal of Competitiveness*, 11(4), 40–56. <https://doi.org/10.7441/joc.2019.04.03>

Jhavar, A., Garg, S. K., & Khera, S. N. (2017). Improving logistics performance through investments and policy intervention: a causal loop model. *International Journal of Productivity and Quality Management*, 20(3), 363–391. <https://doi.org/10.1504/IJPMQ.2017.10003289>

- Kalyvas, A. N., & Mamatzakis, E. (2014). Does business regulation matter for banks in the European Union? *Journal of International Financial Markets, Institutions and Money*, 32, 278–324. <https://doi.org/10.1016/j.intfin.2014.06.007>
- Khan, S. A. R., & Qianli, D. (2017). Does national scale economic and environmental indicators spur logistics performance? Evidence from UK. *Environmental Science and Pollution Research*, 24(34), 26692–26705. <https://doi.org/10.1007/s11356-017-0222-9>
- Kim, I., & Min, H. (2011). Measuring supply chain efficiency from a green perspective. *Management Research Review*, 34(11), 1169–1189. <https://doi.org/10.1108/01409171111178738>
- Kourouthanassis, P. E., Mikalef, P., Pappas, I. O., & Kostagiolas, P. (2017). Explaining travellers online information satisfaction: A complexity theory approach on information needs, barriers, sources and personal characteristics. *Information & Management*, 54(6), 814–824. <https://doi.org/10.1016/j.im.2017.03.004>
- Kraus, S., Ribeiro-Soriano, D., & Schüssler, M. (2018). Fuzzy-set qualitative comparative analysis (fsQCA) in entrepreneurship and innovation research – the rise of a method. *International Entrepreneurship and Management Journal*, 14(1), 15–33. <https://doi.org/10.1007/s11365-017-0461-8>
- Lampropoulos, G., Siakas, K., & Anastasiadis, T. (2019). Internet of Things in the Context of Industry 4.0: An Overview. *International Journal of Entrepreneurial Knowledge*, 7(1), 4–19. <https://doi.org/10.2478/ijek-2019-0001>
- Liu, Y., Mezei, J., Kostakos, V., & Li, H. (2017). Applying configurational analysis to IS behavioural research: a methodological alternative for modelling combinatorial complexities. *Information Systems Journal*, 27(1), 59–89. <https://doi.org/10.1111/isj.12094>
- Martí, L., Martín, J. C., & Puertas, R. (2017). A Dea-Logistics Performance Index. *Journal of Applied Economics*, 20(1), 169–192. [https://doi.org/10.1016/S1514-0326\(17\)30008-9](https://doi.org/10.1016/S1514-0326(17)30008-9)
- Martí, L., Puertas, R., & García, L. (2014). The importance of the Logistics Performance Index in international trade. *Applied Economics*, 46(24), 2982–2992. <https://doi.org/10.1080/00036846.2014.916394>
- Milenković, N., Kalaš, B., Mirović, V., & Andrašić, J. (2020). The impact of macroeconomic determinants and tax form on inflation in selected Balkan countries. *Serbian Journal of Management*, 15(1), 7–18. <https://doi.org/10.5937/sjm15-16685>
- Misangyi, V. F., Greckhamer, T., Furnari, S., Fiss, P. C., Crilly, D., & Aguilera, R. (2017). Embracing Causal Complexity: The Emergence of a Neo-Configurational Perspective. *Journal of Management*, 43(1), 255–282. <https://doi.org/10.1177/0149206316679252>
- Olya, H. G. T., & Altınay, L. (2016). Asymmetric modeling of intention to purchase tourism weather insurance and loyalty. *Journal of Business Research*, 69(8), 2791–2800. <https://doi.org/10.1016/j.jbusres.2015.11.015>
- Park, Y., El Sawy, O. A., & Fiss, P. C. (2017). The Role of Business Intelligence and Communication Technologies in Organizational Agility: A Configurational Approach. *Journal of the Association for Information Systems*, 18(9), 648–686. <https://doi.org/10.17705/1jais.00467>
- Pinheiro-Alves, R., & Zambujal-Oliveira, J. (2012). The Ease of Doing Business Index as a tool for investment location decisions. *Economics Letters*, 117(1), 66–70. <https://doi.org/10.1016/j.econlet.2012.04.026>
- Puertas, R., Martí, L., & García, L. (2014). Logistics performance and export competitiveness: European experience. *Empirica*, 41(3), 467–480. <https://doi.org/10.1007/s10663-013-9241-z>
- Rantasila, K., & Ojala, L. (2015). National-level logistics costs: An overview of extant research. *International Journal of Logistics Research and Applications*, 18(4), 313–324. <https://doi.org/10.1080/13675567.2015.1016413>
- Rezaei, J., van Roekel, W. S., & Tavasszy, L. (2018). Measuring the relative importance of the logistics performance index indicators using Best Worst Method. *Transport Policy*, 68, 158–169. <https://doi.org/10.1016/j.tranpol.2018.05.007>
- Ruzekova, V., Kittova, Z., & Steinhauser, D. (2020). Export Performance as a Measurement of Competitiveness. *Journal of Competitiveness*, 12(1), 145–160. <https://doi.org/10.7441/joc.2020.01.09>
- Sriyana, J., & Afandi, A. (2020). Asymmetric Effects of Trade Openness on Economic Growth in Selected ASEAN Countries. *E&M Economics and Management*, 23(2), 66–82. <https://doi.org/10.15240/tul/001/2020-2-005>
- Schneider, M. R., Schulze-Bentrop, C., & Paunescu, M. (2010). Mapping the institutional capital of high-tech firms: A fuzzy-set analysis of capitalist variety and export performance.

Journal of International Business Studies, 41(2), 246–266. <https://doi.org/10.1057/jibs.2009.36>

Solakivi, T., Ojala, L., Töyli, J., Hälinen, H.-M., Lorentz, H., Rantasila, K., & Naula, T. (2009). *Finland State of Logistics 2009* (Report). Helsinki: Ministry of Transport and Communications Finland. Retrieved August 18, 2020, from http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/78270/Julkaisuja_21-2009.pdf?sequence=1&isAllowed=y

Woodside, A., & Zhang, M. (2013). Cultural Diversity and Marketing Transactions: Are Market Integration, Large Community Size, and World Religions Necessary for Fairness in Ephemeral Exchanges? *Psychology and Marketing*, 30(3), 263–276. <https://doi.org/10.1002/mar.20603>

Wu, P.-L., Yeh, S.-S., Huan, T. C., & Woodside, A. G. (2014). Applying complexity theory to deepen service dominant logic: Configurational analysis of customer experience-and-outcome assessments of professional services for personal transformations. *Journal of Business Research*, 67(8), 1647–1670. <https://doi.org/10.1016/j.jbusres.2014.03.012>

WorldBank. (2014). *The LPI Methodology*. Retrieved August 17, 2020, from <https://wb-lpi-media.s3.amazonaws.com/LPI%20Methodology.pdf>

Yildirim, B. F., & Mercangoz, B. A. (2020). Evaluating the logistics performance of OECD countries by using fuzzy AHP and ARAS-G. *Eurasian Economic Review*, 10(1), 27–45. <https://doi.org/10.1007/s40822-019-00131-3>