ECONOMIC RESEARCH INSTITUTE
BULGARIAN ACADEMY OF SCIENCES

ИНСТИТУТ ЗА ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ НА БЪЛГАРСКАТА АКАДЕМИЯ НА НАУКИТЕ

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ

ECONOMIC STUDIES

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CONTENTS

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE SHADOW ECONOMY IN BULGARIA DURING THE PERIOD 2006-2019[4]

The main objective of the article is to obtain an estimate for the size and the trend of the shadow economy in Bulgaria. Based on the monetary approach, we find that the shadow economy in Bulgaria for the period 2006-2019 tends to decline as a ratio to GDP: from 31.7%, it shrinks to 21.1%. This trend could be explained by the country's accession to the European Union, as this process is associated with the harmonisation of the domestic legislation, stricter procedures, and targeted measures to curb the shadow economy by several successive governments. Despite the declining trend, the share of the shadow economy in the country remains still relatively high. This is an obstacle to its economic and social development and there is a clear need for an in-depth analysis of this phenomenon and further measures to limit it and bring it to a much lower level.
Keywords: shadow economy; monetary approach; currency-demand approach; Bulgaria
JEL: E26; E41; F15; O17; O43

Introduction

It is an indisputable fact that the shadow economy[5] exists in all countries. Practices related to this phenomenon have various manifestations and its effects are spread in different areas.

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[5] In this article shadow economy refers to economic activities that are deliberately concealed from government authorities, because they are unlawful in nature, or because they don't comply with governmental reporting requirements.

Most of these effects are generally negative for economic development, which necessitates measures to limit and prevent the shadow economy. But in order for such measures to be designed and implemented in an efficient way, the shadow economy needs to be studied in depth, which includes, among other things, estimating its size and dynamics.

Obtaining estimates of the size of the shadow economy for a country is not a trivial task. The difficulties in this area are due both to the variety of forms and shadow practices that are implemented and, on the other hand, to the simple fact that economic operators engaged in shadow practices are actively seeking to keep these activities hidden from official authorities.

In general, different approaches to obtain such estimates can be found in the economic literature, and there is no single method that is considered to be superior and hence universally accepted. Basically, the methods for estimating the shadow economy may be distinguished into two main categories – direct and indirect methods. The direct methods are based on microeconomic approaches, and they employ surveys and samples designed in a specific way to "catch" the shadow economy activities. But as Schneider & Buehn (2018) stress, the results of such methods depend on respondents' willingness to share their views and experiences honestly as regards the shadow economy, which makes them unreliable and limited as a source of information.

The indirect methods rely on macroeconomic data, identities, and models. Using them, one may obtain information about the shadow economy by observing the discrepancies between various economic, social, and other indicators over time. Some of the most popular indirect methods are based on the discrepancy between national expenditure and income statistics, the discrepancy between the official and actual labour force[6], the physical input (electricity consumption) method and, of the monetary (currency demand) method. What is common in the indirect methods mentioned is that they are built on the relationship between observable economic variables and unobservable shadow economy indicators through which the evolution of the shadow economy over time is estimated. The main strength of indirect methods for estimating the size of the shadow economy is their complex nature as based on official empirical macroeconomic data, but their results largely depend on the assumptions made.

In the present article, an attempt is made to obtain an estimate of the size and dynamics of the shadow economy in Bulgaria for the period 2006-2019 based on the so-called monetary approach. This approach, like any other valuation procedure, is based on certain assumptions. This article proposes a version of the approach in which some of the traditionally used assumptions are relaxed and others are replaced by more realistic ones. In this way, estimates are obtained for the size and dynamics of the shadow economy in Bulgaria. By doing this, we believe that our study contributes to the expansion of knowledge in an area that has not been studied systematically and for which existing research in Bulgaria is scarce.

The rest of the article is structured as follows. In Section 1. we set out the logic on which the monetary approach is based on and review the literature. We comment on the differences between the different versions of the monetary approach and justify our choice of method. In Section 2 we discuss the specification of the selected general model, provide the sources of

[6] The factors and public policies for the limitation of informal employment are discussed in Yaskal et al. (2021).

the data used and the results of the econometric estimation of eight options for the general model. Based on these eight variants, in Section 3 we estimate the size of the shadow economy in Bulgaria for the period 2006-2019. The last section presents the main conclusions of our study.

1. The Monetary Approach for Estimating the Size of the Shadow Economy – Economic Logic and Methodological Issues. A Literature Review

The different methods have their strengths and weaknesses, but still, from the so-called indirect approaches that rely on econometric models, two approaches are the most used and widespread: the monetary (or currency-demand) approach and the MIMIC (Multiple Indicators Multiple Causes) approach.[7] In this article, we opt for the former because of the sound economic logic behind it, the ease of application, as well as the availability of data.

The logic of the monetary approach is based on the fact that cash is the preferred and dominant medium of exchange used to carry out shadow transactions. Agents in the shadow economy are generally reluctant to disclose the reasons and participants in monetary transactions that take part in their illegal or simply unreported activities. Therefore, these agents pay in cash; thus, seeking to eliminate the possibility of subsequent tracking of transactions, which otherwise exists if the payments are made by bank transfer.

Because of the above, when the volume of the shadow economy increases, other things being equal, the need for cash to serve the increased shadow payments will increase. Conversely, if the shadow economy shrinks, so will the need for cash. Based on this logic, the amount of money in circulation in an economy and the changes in this amount can be used to estimate the dynamics of the shadow economy. In practice, this is done in two steps. First is the calculation of the difference between the actual amount of money in circulation and a theoretical amount obtained under the assumption that there is no shadow economy, the latter being calculated based on a proper econometric model. In this way, an estimate is obtained for the amount of money that serves the shadow transactions. In the second step, based on this amount and certain assumptions about the velocity of money, the size of the shadow economy is estimated.

The monetary approach has been applied by economists in different versions, which can be classified into four groups. The first group includes studies based on the so-called transaction method, which was proposed by Feige (1979) and further extended in Feige (1996). The method uses the identity that the total stock of money multiplied by the velocity of circulation equals the total number of transactions multiplied by the average price of these transactions. In this case, the shadow component of the economy can be calculated under the assumptions

[7] The MIMIC models are built on a structural equation modeling approach (Dybka, Kowalczuk, et al., 2019; Naghdi, et al., 2015; Klarić, 2011). However, these models face some serious limitations such as the unstable coefficients with respect to the sample size (Dell'Anno, 2003). Also, they are often the subject of criticism because of specification and identification problems (Breusch, 2005; Feige, 2016; Kirchgässner, 2016).

that the ratio of the shadow economy to the official economy is known for a base year[8], there is a reliable estimation for the velocity of money, and the ratio of transactions to official GDP. The last assumption is a serious weakness of this method since some monetary transactions have nothing to do with income generation and the amount of cash held by the public depends on many factors that can change over time.

The second group of studies applies the monetary approach making use of econometric models of the demand for cash as an absolute amount. In this case, the analysis is based on models in which the amount of money in circulation is the dependent variable, while among the explanatory variables, there is an indicator which is supposed to be a proxy for the shadow economy. Usually, this indicator is the tax rate due to the logic that high tax rates provide incentives for more shadow practices and vice versa.

In our opinion, choosing to analyse only the amount of money in circulation is a weak point for this method, because the essence of the monetary approach is to analyse the behavioural patterns with respect to payments for goods and services. Since payments could be made by both cash and bank transfers, it is important for these two possibilities to be included in the analysis, while this version of the monetary approach considers cash as the only means of payment.

Despite the abovementioned limitation of the demand for cash method, it is used for estimating the size of the shadow economy in Bulgaria by Nenovsky & Hristov (2000) and Petrov (2004), as well as for other countries (see, for example, Bowsher (1980) for the USA). Nowadays, the method is mainly used when central banks study the relation between the currency in circulation and the shadow economy, as in the case of euro area countries (Seitz, Reimers & Schneider, 2018) and tax evasion in the Czech Republic (Nchor & Konderla, 2016). Ardizzi, Petraglia, Piacenza & Turati (2011) also introduce the cash payments as a dependent variable in the money demand equation, which allows them to estimate the size of the shadow economy for 91 Italian provinces for the period 2005-2008.

In order for transferable (giro) money to be included in the models as possible means of payment, many economists suggest analysing the ratio between the currency in circulation and some monetary aggregates (most often M1 or M2). This idea is the basis for the third and fourth versions of the monetary approach. The third version is suggested by Gutmann (1977), who assumes that the currency in circulation to M1 ratio is constant over time in the absence of relative changes in the shadow economy[9]. According to Gutmann, the only reason for changes in this ratio is because people want to hide certain activities to avoid taxation and restrictions. Also, adding the assumption that the shadow economy over the period 1937-1961 was zero or negligible, Gutmann estimates the relative size of the shadow economy in the U.S.[10]

[8]Actually Feige (1979) assumed zero shadow economy for the base year in his study. Also, the assumption that the velocity of money for the official and unofficial sector of the economy is constant could be valid only if the income elasticity is unity as shown by Ahumada et al. (2006).

[9] In his original work Gutmann calls the hidden activities not "shadow economy" but "underground economy".

[10] This method is often referred to as "simple currency ratio method".

The main advantage of Gutmann's approach is the simplicity for empirical application following the strong theoretical framework and the usual availability of high-quality monetary data. There is some criticism in the literature about the equality of velocity of money in the official and unofficial sectors of the economy, which is initially assumed and the lack of econometrically testing of the hypotheses under consideration. But, of course, the main weakness of the method remains the fact that the currency in circulation to M1 ratio is considered as being dependent only on the development of the shadow economy. This assumption could be valid in the short term – other things being equal. In the medium and long term, the ratio could be influenced by factors other than the dynamics of the shadow economy. The ratio may change, but this does not necessarily mean a change in the size of the shadow economy when the economic agents in the official economy significantly change their preferences for holding cash under the impact of some permanent factors.

Nevertheless, the Gutmann's approach has been applied recently for studying the shadow economy in Romania (Davidescu, Strat, Paul, 2015), Slovakia (Palascakova, 2016), Tanzania (Epaphra, Jilenga, 2017) and Azerbaijan (Guliyev, 2019). It is worth noting that in most studies, Gutmann's approach is used as a second method for estimating the size of the shadow economy, not so much as a basic one.

The fourth and last up to now version of the monetary approach is the most used one, as stressed by Ardizzi et al. (2011) and Davidescu (2013). It can be traced back to the work of Cagan (1958) on demand for currency, further developed by Tanzi (1982, 1983). This method relies on the econometric estimation of a demand-for-currency equation using as a dependent variable a ratio between money in circulation and a monetary aggregate. But while Cagan considers as a dependent variable the currency in circulation to M1 ratio, Tanzi considers the currency in circulation to M2 ratio.

The above method has been applied to many countries since firstly Tanzi (1983) showed its applicability for the USA for the period 1930-1980. Chen & Schneider (2018) estimate the size of the shadow economy in China over 1978-2016 based on the same method. Tan, Habibullah, Kaliappan & Radam (2017) employ an extended version of the Tanzi-type model to estimate the size of the shadow economy for 80 countries from 9 regions of the world for the period 1975-2012. Hassan and Scheider (2016) combine the method and the structural equation MIMIC model to estimate the size of the Egyptian shadow economy in the 1976-2013 period. Alexandru, Ion & Catalin (2009) estimate the size and evolution of the shadow economy in Romania in 1998-2008 period employing a vector error correction model based on the same idea.

The fourth version of the monetary approach, which employs cash as a proportion of a larger monetary aggregate, has a serious advantage over the other methods. It is the fact that variables which might have an impact on the currency to M1 ratio, besides the shadow economy, can be included in the econometric model and thus, it is possible for their influence to be isolated. Given this feature, the estimation of the relationship between the amount of currency in circulation and the shadow economy is much more reliable.

However, the monetary approach is not free of criticism, of course, and Schneider and Enste (2002) provide some crucial points. They stress the absence of transactions in the shadow economy in the base year – a common assumption for these models to have a point of

reference. They also emphasise the equal velocity of money for the formal and the informal sector, as well as considering the tax burden as the only determinant (or at least the main one) of the shadow economy.

In the following analysis, we apply the last method. We reckon the solid economic background behind the currency demand approach combined with econometric analysis, as well as the wide applicability of this method for different income group countries. This gives us stable grounds to consider it as a sufficiently reliable tool for assessing the size of the shadow economy in Bulgaria. At the same time, we try to address the critical comments from the previous paragraph by relaxing some of the assumptions accepted by the cited researchers. More precisely, we don't suppose the absence of transactions in the shadow economy in a particular base year, which makes our version of the monetary method more relevant to economic reality. Moreover, we also do not consider the tax burden or any other individual indicator to be the only determinant of the shadow economy.

2. The Demand for Currency – An Econometric Model

2.1 Econometric specification

In this section, we estimate an econometric equation in order to explain the evolution over time of the currency in circulation/M1[11] ratio. This ratio is indicative for economic agents' preferences with respect to payment methods (cash or bank transfer) in a certain period. By definition, the ratio is always between zero and one and the larger it is, the more preferred is cash as means of payment. Like Cagan (1958), we choose the monetary aggregate M1 to be the denominator of the ratio instead of M2, which was the choice of Tanzi (1982 and 1983). The reason for this choice is that all financial assets which could be used as means of payment are included in M1, while in M2 some assets are included that cannot be used as means of payment given the present level of development of the Bulgarian financial system.

Under the assumption that cash is the preferred means of payment in the shadow sector, the above ratio is indicative of the relative dynamics of this sector. When shadow practices increase relative to the official activities, the demand for cash will increase relative to the payments via bank transfers and vice versa. Due to this relationship, we want to obtain a model which explains currency in circulation/M1 ratio evolution over time as a result of the influence of changes in the shadow economy. Since other factors might also have an impact on this ratio, clearly, the model should control for such possible influence, as well.

Given the above arguments, we use an econometric model based on time series data (each observation is indexed with t). The dependent variable in the model is the currency in circulation/M1 ratio, which is denoted by CY_t[12]. We believe that the evolution of this ratio is determined by the influence of four different forces. Therefore, the explanatory variables are

[11] M1 consists of currency in circulation plus overnight deposits.

[12] In some versions of the model, this dependent variable will be transformed by using the natural logarithm function.

divided into four groups, each group representing variables that have certain common aspects. As a benchmark, the econometric equation takes the following general form:

$$CY_t = a + \beta X_t + \gamma M_t + \delta L_t + \theta Z_t + u_t \quad (1)$$

The column vector $\boldsymbol{X}$ includes the first group of variables, which are macroeconomic in nature because clearly, the macroeconomic environment has an impact on the behaviour of economic agents with respect to cash balances. Possible explanatory variables from this group may include variables like inflation, unemployment, interest rates or real income per capita (see, for example, Tanzi, (1982&1983), Epaphra&Jilenga (2017)). The reasoning is straightforward. Other things being equal, higher interest rates encourage people to keep more of their money in the form of time deposits and a smaller share in cash or current accounts, in order to reduce the interest forgone when money is kept as means of payment. On the other hand, interest rates are related to inflation. Also, one might expect that a higher unemployment rate will lead to more participation of the unemployed in the shadow economy.

The second group of factors, represented by the column vector $\boldsymbol{M}$, are variables, related to the process of digitalisation and financial technology development. This process leads to the usage of credit and debit cards, POS terminal devices, ATMs, and e-wallets. As this process develops over time, economic agents will naturally hold less cash for transactional purposes (legal ones), and as a result, the CY_t ratio will respond – decreasing over time, other things being equal. In our study, we use the number of POS terminals per capita as a proxy for the development of financial technologies.

The third group of factors (column vector $\boldsymbol{L}$) includes structural variables. Here we consider indicators for the distribution of the population. In general, the older population tends to use more cash in their payments due to the lower level of trust and less knowledge of banking technologies. Also, in villages and small towns, the availability of ATMs and POS terminals is limited, which is why people there pay mainly in cash. Therefore, the population structure could have an impact on the overall demand for cash. To test for such a possible impact, we have used variables for the relative share of the population 65+ and for the relative share of the rural population.

The column vector $\boldsymbol{Z}$ includes variables that represent the incentives and disincentives of economic agents to participate in shadow practices. Here is the focus of our study based on the logic stated in Section 1 that more shadow practices will lead to larger cash holdings and vice versa. Indicators like tax rates (Cagan, 1958), share of taxes and social security contributions in GDP (Chen&Schneider 2018), government regulations (Hassan, Schneider, 2016), and tax morale (Feld, Frey, 2007) have been suggested to describe these incentives in the literature. But in our case, we use a composite indicator for economic freedom, because of several reasons.

First of all, conceptually, it is clear that shadow practices are actually a result of the lack of economic freedom in the broad sense. If a country has a higher degree of economic freedom (lower taxes, fewer social security contributions, fewer regulations, fewer trade restrictions,

etc.), there will be fewer incentives to trade or produce goods and services outside of the legal market.

Secondly, there are many cases (such as the Nordic countries) where taxes are high, but the size of the shadow economy is low or where taxes are low, but the size of the shadow economy is high. This shows that tax rates or the relative share of taxes in the gross domestic product (GDP) do not represent well enough the motivation to implement shadow practices, although these variables are used in most of the studies published in the literature.

Finally, economic freedom, in general, is a broader concept than tax morality or the rule of law or commercial freedom, which have also been proposed and used in such models in economic literature. The latter are only individual aspects of economic freedom and therefore, a composite general indicator of economic freedom can capture more comprehensively the motivation to implement shadow practices.

For our purposes, we use the composite indicator "overall score of freedom", provided by the Heritage Foundation. It is composed of 12 individual indicators which estimate different aspects of economic freedom. These indicators are grouped into four categories which are considered the pillars of economic freedom.[13] The overall score of freedom gives us a broader coverage of different *"freedoms"* in an economy, thus lowering the probability of missing variables in our model. By using the overall score of freedom, we capture the effects of the shadow economy that may be included only in a specific freedom score variable.

With α we denote the intercept of the model and with u_t the error term. The vectors $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$, $\boldsymbol{\delta}$, and $\boldsymbol{\phi}$ are row vectors with coefficients that are subject of estimation. Each of these row vectors is associated with the corresponding group of variables by vector multiplication. The model is estimated multiple times using the method of ordinary least squares (OLS) and the Newey-West heteroskedasticity and autocorrelation (HAC) consistent estimator.

According to the arguments described above, we are looking for a suitable model to explain the dynamics of the money in circulation /M1 ratio. By a suitable one, we mean a model that has good technical characteristics from an econometric point of view, as well as the signs of the estimated parameters to meet expectations, according to economic theory.

Combining different variables and different functional forms, we observed that the signs of the estimated regression coefficients remain the same, which corroborates our approach. By doing this, we arrive at eight models that are based on the same economic logic (described above). These models have approximately the same econometric features, and therefore we cannot choose one as superior. As a result, in Section 3 we evaluate the size of the shadow economy based on the estimates from these eight models, and then we take the average to arrive at our final estimate. By doing so even if some of the models overestimate or underestimate the regression coefficients, we believe that on average we derive a reasonable estimation of the true size of the shadow economy in Bulgaria. The data, the models that we use, and the estimation of the size of the shadow economy are presented in the following sections.

[13] Rule of Law, Regulatory Efficiency, Government Size, Open Markets.

2.2 Data sources and processing

This study tries to evaluate the dynamic behaviour of the shadow economy in Bulgaria and thus, the data for our variables have a time dimension. Most of the data which we were able to find is annual, but there are some variables which are reported on a monthly basis. For them, we need to obtain annual data, which refers to four variables.

The first variable is the ratio "currency in circulation/M1" (CY_t) which plays the role of the dependent variable in the estimation procedure. The source for the data is the Bulgarian National Bank's[14] (BNB) payment statistics, where these variables are reported monthly. Given this, we had two choices. First, to take the values for the end of the year (December) and use them as representatives for the whole year, which we believe would be incorrect, because of the strong seasonal effects, particularly for the month of December. The second possibility is to take the values for all twelve months, treat them as a distribution and calculate the averages. Then use these average values of the currency in circulation and M1 to calculate the ratio CY_t that we take as representative for the year t. We opt for the second approach because it is far more accurate and representative for the yearly behaviour of CY_t. Thus, the formula, used for the calculation of CY_t, is the following:

$$CY_t = \frac{Average\ currency\ in\ circulation\ during\ the\ year\ t}{Average\ M1\ during\ the\ year\ t}$$

Another two variables are calculated in the same way. $AVINFL_t$, part of the vector $\boldsymbol{X}$, is a measure of the inflation in Bulgaria during the period t. This variable was calculated by using the Harmonised Index of Consumer Prices (HICP), which is reported monthly by the National Statistics Institute in Bulgaria (NSI). To obtain yearly data, we take the average of the twelve HICP indexes for each year. Then we calculate the average yearly inflation by using the standard formula:

$$AVINFL_t = \frac{Average\ HICP_t}{Average\ HICP_{t-1}} * 100 - 100$$

With regard to interest rates, we apply a similar approach. We calculate the average annual interest rate on household deposits ($AVINTH_t$) and on deposits of non-financial institutions ($AVINTN_t$) using the interest rates by months for the respective year, which are published by the BNB:

$$AVINTN_t = \frac{1}{12}\sum_1^{12} interest\ rate\ on\ housholds'\ deposits, new\ business$$

$$AVINTN_t = \frac{1}{12}\sum_1^{12} interest\ rate\ on\ nonfinancial\ institutions' deposits, new\ business$$

Then we obtain the average interest rate on deposits of households and non-financial institutions ($AVINT_t$):

$$AVINT_t = \frac{AVINTN_t + AVINTN_t}{12}$$

[14] BNB is the Central bank of Bulgaria.

All other variables used in our model are reported annually. Data for the unemployment rate ($UNEM_t$) is provided by the NSI, the number of POS terminals per capita ($\frac{POS_t}{POP_t}$) is calculated as a ratio between the number of POS terminals, reported by BNB's payment statistics and the population available from the Demographic statics of NSI. From the Demographic statistics of NSI we also take the relative share to the total population of people 65+ ($RS65_t$) and the rural population ($RSRP_t$). As stated in Section 2.1, for the overall freedom score (OS_t), we use data, provided by the Heritage Foundation.

2.3. Estimation and results

Equation (1) is estimated eight times with different combinations of independent variables. In some of these estimations, we use different functional forms to try and evaluate how a change in the type of the equation affects the results. These are the *lin-log*, *log-log* and *log-lin* forms. Additionally, we've used the Newey-West HAC standard errors when estimating all models. The results are broadly robust to the choice of functional form. They are presented in Table 1, Appendix I, while the descriptive statistics of the used variables are presented in Table 2, Appendix I.[15]

In the top row of Table 1, numbered from 1 to 8, are the indexes of the models that we use when estimating the size of the shadow economy in Bulgaria. In the second row is the dependent variable – CY_t or its logarithmic transformation depending on the functional form. The independent variables are in the first column, denoted with their abbreviations, which were introduced in the previous section. Because the average yearly inflation can be negative during periods of deflation, we've added a constant equal to 10 to all observations when the natural logarithm function is used. This transformation won't change the variance of the data; however, it will change only the mean. We believe that this is not a problem, because, in this study, we are not interested in forecasting CY_t or evaluating the effects of the different variables on it. Our goal is to evaluate the shadow economy in Bulgaria, and therefore we are focused mainly on the impact of *O.S.* on CY_t.

The results from the econometric estimation are not surprising. The sign in front of the overall score for economic freedom (*O.S.*) remains negative in all eight equations. The negative sign indicates that as economic freedom increases, the shadow economy shrinks, and people will hold less currency in circulation relative to all means of payment because there will be less illegal transactions. The variable *O.S.* also remains statistically significant through all eight equations.

The logarithm of the variable that indicates the process of financial technology development, *POS/POP*, also remains statistically significant and with the expected negative sign. The negative sign here captures the overall effect of the process of digitalisation on the amount of currency in circulation. As this process evolves, other things being equal, people need less

[15] In Table 2 we also include results of the Jarque-Bera test for normality. The results show that the distributions of the used variables are normal.

cash, because they use more digital payment options, which decreases the ratio *C.Y.* throughout the period of our study.

The variables that capture the macroeconomic processes of inflation and unemployment are statistically significant at a 10% level for two of the eight models. In the cases when they are not significant at this level, their signs are still correct. The positive sign of the regression coefficient for the unemployment rate is expected, because the higher is unemployment the greater is the possibility that the unemployed will take shadow jobs. Also, periods of high unemployment create incentives for officially employed workers to participate in shadow practices because they may try to earn additional funds (no matter how) to protect themselves from possible future layoffs.

The negative sign for the inflation rate captures the effect of the opportunity cost of holding currency. When the inflation rate is relatively high, economic agents will try to keep as small currency holdings as possible: only up to the level of the planned transactions (legal and illegal) to minimise their opportunity costs.

We keep the macroeconomic variables in all equations, because even if they are not statistically significant, their removal can lead to a problem of missing variables, as they capture important processes in the Bulgarian economy which might influence the dependent variable *C.Y.* The *F*-statistics and the *p*-values, associated with them, indicate that the different versions of the model are better than a model with just an intercept. The variance inflation factors (VIFs) are less than five for all estimated equations. The adjusted coefficients of determination (adj. R^2) are all between 0.7 and 0.8, indicating that the different versions of the model explain between seventy and eighty percent of the total variation in the dependent variable.

It is also worth noting that interest rates and population-related structural variables were statistically insignificant for the period under study. In terms of interest rates, this is because the effect of the cost of holding cash is captured by inflation. Interest rates have a high degree of correlation with inflation and their inclusion in the model leads to multicollinearity. Also, formally speaking, the variables related to the population structure do not have a significant impact on the dependent variable. It is possible, however, for them to have some minimal influence, the effect of which was captured by one of the other more significant variables, which would be due to the relatively short time series.

3. Estimation of the Size of the Shadow Economy

In the present section, we use the regression coefficients of Section 2.3 to estimate the size of the shadow economy. We start from the understanding that cash and overnight deposits serve as payments in the official sector of the economy and shadow transactions are served only by cash.

For each of the eight models, we apply the following procedure. First, we calculate the fitted values for the money in circulation/M1 ratio ($\widehat{CY_t}$) for each year t based on the regression coefficients of the model. Next, we calculate notional values ($\widetilde{CY_t}$) which correspond to the

demand for cash as it would be if the country had maximum economic freedom. This is done by substituting in the regression equation the actual value of *O.S.* $_t$ with the number 90.[16]

With maximum economic freedom, economic agents would not be motivated to apply shadow practices. In that case, there would be no shadow transactions, or they would be negligible. According to the logic of the monetary approach, in such circumstances, economic agents would hold less cash because there would be no transactional demand for cash caused by shadow practices. Therefore, the difference between the two variables $\widehat{CY}_t - \widetilde{CY}_t$ represents the ratio between that part of the cash that serves the shadow practices (C_u) and the money supply M1, i.e.

$$\widehat{CY}_t - \widetilde{CY}_t = \frac{C_u}{M1} \tag{2}$$

Assuming equal velocity of money for the official and for the shadow sector, we can write that

$$\frac{GDP_u + GDP_o}{M1} = \frac{GDP_u}{C_u} \tag{3}$$

where:

GDP_o is official gross domestic product;

GDP_u – unofficial GDP generated by shadow economic activity.

After an elementary transformation of equation (3), we obtain that

$$\frac{C_u}{M1} = \frac{GDP_u}{GDP_o + GDP_u} \tag{4}$$

From the above equation, we derive

$$\frac{GDP_u}{GDP_o} = \frac{\frac{C_u}{M1}}{1 - \frac{C_u}{M1}} \tag{5}$$

Once we have an estimate for $\frac{C_u}{M1}$ from the econometric equations, it is possible based on (5) to estimate the ratio between the size of the GDP, created by the shadow economy and the size of the officially reported GDP. The results are shown in Table 3, where these ratios for each of the eight models discussed in Section 2.3 are shown. The last column shows the average for all models.

As can be seen from the table, the average estimate of the size of the shadow economy, as a ratio to the official GDP, has a declining trend over time. In 2006, which was the last year

[16] Most individual indicators of economic freedom are designed so that their maximum value is 100. However, this does not apply to all indicators, so we assume that there would be maximum economic freedom if the composite indicator has a value of 90. In the last year of the period under study "overall freedom score" for Bulgaria has a value of 69.0, the lowest values for the individual indicators being "judicial effectiveness" (43.6) and "government integrity" (46.8).

before the country became a member of the European Union, the size of the shadow economy was estimated at 31.7% of GDP. Each year thereafter, this number decreases compared to the previous year with only two exceptions – 2007 and 2010. In 2010 this was probably due to the global financial and economic crisis, whose effect was felt in Bulgaria in 2009.[17] At the end of the period, the size of the shadow economy shrinks to 21.1%.

Table 3

Shadow Economy to Official Economy Ratio

	1	2	3	4	5	6	7	8	Average
2006	0.305	0.247	0.251	0.278	0.358	0.299	0.300	0.496	0.317
2007	0.320	0.250	0.255	0.301	0.390	0.308	0.306	0.508	0.330
2008	0.297	0.225	0.230	0.284	0.367	0.272	0.267	0.505	0.306
2009	0.287	0.211	0.214	0.270	0.347	0.261	0.262	0.487	0.292
2010	0.343	0.257	0.261	0.308	0.400	0.312	0.313	0.546	0.343
2011	0.301	0.210	0.214	0.265	0.340	0.247	0.248	0.499	0.291
2012	0.309	0.213	0.217	0.268	0.345	0.249	0.250	0.512	0.295
2013	0.306	0.208	0.212	0.263	0.338	0.246	0.246	0.517	0.292
2014	0.288	0.193	0.196	0.252	0.323	0.233	0.233	0.496	0.277
2015	0.261	0.173	0.175	0.236	0.301	0.208	0.208	0.460	0.253
2016	0.269	0.180	0.182	0.249	0.319	0.222	0.222	0.485	0.266
2017	0.233	0.151	0.153	0.220	0.280	0.182	0.182	0.445	0.231
2018	0.223	0.144	0.146	0.215	0.273	0.173	0.173	0.446	0.224
2019	0.209	0.133	0.136	0.205	0.260	0.162	0.161	0.422	0.211

Source: Own calculations.

The applied monetary approach implicitly assumes that shadow transactions are paid only in cash. In this sense, the method is highly universal, because it covers all manifestations of the shadow economy virtually, regardless of their form, as long as the payments are in cash. Practical observations show that this is most often the case. But it is not impossible for some shadow transactions to be paid by bank transfers (when they are small) or by barter, or by cryptocurrencies, for example. If there is a significant number of such cases, this will lead to a larger size of the shadow economy, which is not reflected in larger cash holdings. In this sense, the proposed estimates might be considered as a lower limit.

The obtained results cannot be directly compared with the results of other studies for Bulgaria, based on the monetary approach, because they refer to different periods. But as a point of reference, the average annual estimate of Nenovsky & Hristov (2000) for the years 1997, 1998 and 1999 is 15.2%, 35.3% and 24.1%, respectively, while Petrov (2004) gives an average estimate for the period 1998-2002 of 10.9%[18]. Ahumada et al. (2009) derive that the size of the Bulgarian shadow economy is between 12.2% and 17.5% of its registered GDP as an average for the whole review period depending on the model specification and the definition of variables[19]. Against the benchmark of these studies, the estimates from our study present the shadow economy with a significantly higher share.

[17] In 2009, the GDP decreases by 5%.
[18] These authors apply the monetary approach based on the demand for cash method.
[19] The authors use four different models with quarterly data for the period 1998-2007.

Conclusions

In the present study, we find that the shadow economy in Bulgaria for the period 2006-2019 tends to decline as a ratio to GDP: from 31.7%, it shrinks to 21.1%. This trend might be explained by the country's accession to the European Union. The year 2006 was the last one before the country became a full member of the Union and after serious legislative and institutional changes happened. Domestic legislation is harmonised with that of the European Union, stricter procedures are required, and several successive governments make efforts and carry out targeted measures to curb the shadow economy.

Despite the declining trend, the share of the shadow economy in the country remains still relatively high. Several international studies place Bulgaria as the country with the highest share of the shadow economy of all countries in the European Union. This is an obstacle to its economic and social development and there is a clear need for an in-depth analysis of this phenomenon and further measures to limit it and bring it to a much lower level.

In the context of the model used in this article, the motivation to participate in shadow practices stems from various aspects of economic freedom. In this sense, reducing the interest of economic agents in shadow practices can be achieved through policies that have an impact on those factors that tend to reduce economic freedom. As discussed in Section 3, for the case of Bulgaria, these are primarily "judicial effectiveness" and "government integrity".

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Appendix I

Table 1

Results from the estimation of the regression model

Estimation method: OLS, Newey-West HAC standard errors, n=14, period: 2006-2019								
Dependent variable								
	1	2	3	4	5	6	7	8
	CY	CY	*ln(*CY*)*	*ln(*CY*)*	CY	CY	*ln(*CY*)*	*ln(*CY*)*
Intercept	284.93***	278.47***	10.39***	10.18***	334.11***	342.82***	11.89***	12.10***
	(83.74)	(84.28)	(1.82)	(1.82)	(62.78)	(72.09)	(1.48)	(1.69)
*ln(*POS/POP*)*	-5.10***	-5.02***	-0.13***					
	(0.96)	(1.03)	(0.03)	(0.03)	(1.56)	(1.59)	(0.04)	(0.04)
*ln(*OS*)*	-	-	-1.77**	-1.74**	-	-	-	-
	65.14**	64.05**			77.65***	77.94***	2.15***	2.15***
	(19.53)	(19.49)	(0.43)	(0.42)	(14.14)	(16.69)	(0.33)	(0.39)
UNEM	0.26	-	0.01	-	-	-	-	-
	(0.18)		(0.00)					
*ln(*UNEM*)*	-	2.16	-	0.06*	-	-	-	-
		(1.39)		(0.03)				
AVINFL	-	-	-	-	-0.23	-	-0.01*	-
					(0.13)		(0.00)	
*ln(*AVINFL+10*)*	-	-	-	-	-	-2.37	-	-0.07
						(2.25)		(0.05)
adj. R^2	0.77	0.77	0.79	0.79	0.76	0.75	0.79	0.78
F-statistic	15.12	15.14	17.52	17.61	15.08	14.12	17.01	15.94
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

*Notes: The numbers in the parentheses are the Newey-West HAC standard errors. Statistical significance indicators: *p-value < 0.10; **p-value <0.05; "***" p-value < 0.01.*

Table 2

Descriptive statistics of the used variables (2006-2019)

	CY	*AVINFL*	*UNEM*	*OS*	*PP*
Mean	38.70	2.92	8.49	65.40	0.0098
Median	39.25	2.46	8.30	64.95	0.0096
St. Deviation	4.26	3.80	2.82	2.02	0.0030
Observations	14	14	14	14	14
Jarque-Bera statistic	0.91	2.31	1.01	0.60	0.36
p-value	0.63	0.31	0.61	0.74	0.83

Source: Authors' calculations.

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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TRADE RELATIONS BETWEEN VIETNAM AND BULGARIA: PERFORMANCE AND ITS DETERMINANTS[3]

The article uses trade data from various sources (UNCTAD, RIVA, General Statistics Office of Vietnam; Ministry of Trade and Industry of Vietnam) to evaluate the trade relationship between Vietnam and Bulgaria in the period 2010-2020. In the assessment, the backward linkage is also analysed to quantify the value-added contribution of Vietnam and Bulgaria in the two countries' exports to the world. The article also analyses a number of important factors affecting the two countries' trade relations, such as cooperation framework, trade characteristics of the two countries (RCA, TC, ES indices), and trade costs. Finally, on the basis of findings from the analysis of the current situation as well as the new context of the implementation of the EVFTA, the article points out the prospects as well as some implications for strengthening the two countries' trade relations in the coming period.
Keywords: Vietnam; Bulgaria; trade relations; performance; determinants; EVFTA
JEL: F15; F13

1. Introduction

Vietnam and Bulgaria are two transition economies that have both achieved remarkable successes in economic development and international trade. An important economic transformation has been undergone in Bulgaria over the past three decades to change the country from a highly centralised, planned economy to an open, market-based, upper-middle-income economy. After decades of exceptionally high economic growth and improved living standards, some legacy issues from that early period, the global financial crisis of 2008, and the pandemic-induced crisis in 2020 pushed the country into a hard time with Poverty and income inequality remain among the highest in the EU.[4] Papers that investigated Bulgarian international trade spent much effort on its status in the post-EU-accession period (Shivarov, 2014; Levkov, 2017; Kalinkova, 2021), and its trade structures (Čiburienė, 2006); Shivarov, 2014; Kacarski et el., 2017; Chobanov, 2019). Bilateral trade between Bulgaria and other

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[4] https://www.worldbank.org/en/country/bulgaria/overview#1.

partners reviewed significantly converged in trade relations with EU partners (Čiburienė, 2006; Shivarov, 2014; Kacarski et al., 2017; Levkov, 2017; Kalinkova, 2021), in which some pictured main characteristics of Bulgarian foreign trade (Shivarov, 2014; Levkov, 2017; Kalinkova, 2021) and put forward challenges for Bulgarian trade prosperity (Shivarov, 2014; Chobanov, 2019).

Vietnam is one of the top twenty economies with the most prominent trade scale globally, with import and export turnover exceeding 668 billion USD and a growth rate of 19% in 2021 (Ngoc An, 2022). There are many studies on Vietnamese trade (Grumiller et al., 2018; Tröster et al., 2019; Tu and Giang, 2018; Nguyen el al., 2020; Athukorala, Kien, 2020; Chaudhary, Khoi, 2019). The study focuses on analysing the characteristics of Vietnam's trade (Tu, Giang, 2018; Nguyen, et al., 2020; Chaudhary, Khoi, 2019; Athukorala, Kien, 2020) and the factors affecting Vietnam's trade performance (Grumiller, et al., 2018; Tröster, et al., 2019; Nguyen, el al., 2020). The absence of studies that examine and evaluate the potential for bilateral trade between Vietnam and its trading partners is a prominent feature among studies on Vietnamese trade.

To partially compensate for this research gap and realise the need to analyse bilateral trade characteristics as a basis for assessing trade potential between the two countries, the authors have conducted a study on investigating the bilateral trade performance between Vietnam and Bulgaria and its determinants. The paper is divided into four parts to realise the above research objective. The paper begins with the research background in the first part. Then, the second part analyses the current bilateral trade situation between Vietnam and Bulgaria. The determinants that affect bilateral trade between the two countries are presented in the next part. The last piece of the paper is to conclude and assess the prospects for bilateral trade relations between the two countries.

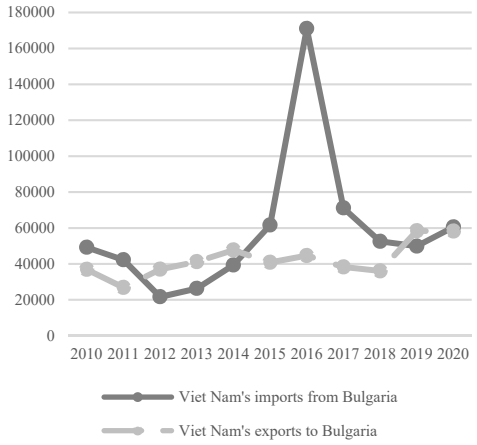
2. Bilateral Trade between Bulgaria and Vietnam: Performance for the Period of 2010-2021

The trade turnover between Vietnam and Bulgaria witnessed impressive growth by 10% per year in recent years. In the first ten months of 2021, despite the complicated development of the epidemic, total exports and imports between the two countries have reached over 200 million USD. Bilateral trade between the two countries has evolved throughout 2010-2020, although the asymmetry in export and import growth figures under Vietnam and Bulgaria's perspectives existed. Trade turnover of Vietnam to Bulagia in 2020 was more considerable 1.4 times than the figure in 2010. Vietnamese export to Bulgaria increased by 1.6 times, while Vietnamese imports from Bulgaria increased by 1.2 times. From Bulgaria's perspective, export volume to the Vietnamese market grew 1.6 times after 11 years. Import volume from Vietnam sharply escalated by 2.1 times for the same period.

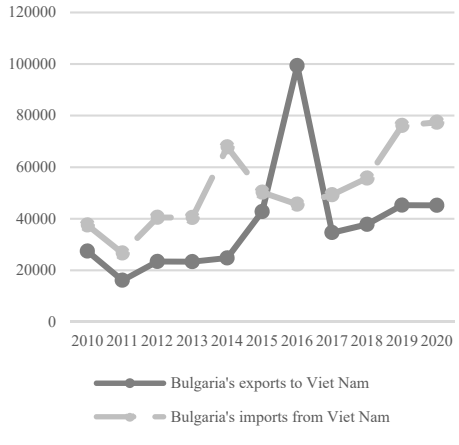
Figure 1

Bilateral trade between Vietnam and Bulgaria from 2010 to 2020

a. Vietnam's imports from and exports to Bulgaria



b. Bulgaria's imports from and exports to Vietnam



Source: https://unctadstat.unctad.org.

In 2020, the total export of Vietnam to Bulgaria reached 58.2 billion USD, in which 13 commodities had a turnover larger than one billion USD. Shares of the top five major exporting commodities were 12.6%; 11.75%; 11.6%; 11.4%; 6.5% for, respectively, HS 39 (Plastics and articles thereof); HS 40 (Rubber and articles thereof); HS 87 (Vehicles other than railway or tramway rolling stock, and parts and accessories thereof); HS 94 (Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; ...); HS 55 (Man-made staple fibres). On the other hand, the total import of Vietnam from Bulgaria was 60.5 billion USD, with 11 commodities getting imported turnovers over one billion USD. Five merchandise goods occupied the largest share in the total import were HS 30 (Pharmaceutical products); HS 74 (Copper and articles thereof); HS 28 (Inorganic chemicals; organic or inorganic compounds of precious metals, rare-earth metals, ...); HS 26 (Ores, slag and ash); HS 84 (Machinery, mechanical appliances, nuclear reactors, boilers; parts thereof) with shares of, respectively, 22.5%; 15%; 13.1%; 10.1%; and 4.7%.

Top major commodities in Bulgarian export to and import from Vietnam mainly overlapped ones in Vietnamese export to and import from Bulgarian but the case of HS 09 (Coffee, tea, maté and spices). Vietnamese reported an export of HS 09 to Bulgaria at nearly 3 billion USD in 2020. According to the data reported from Bulgaria, the import volume of the same commodity was surprisingly high at over 15 billion USD in 2020. Based on Guo (2010), the bilateral trade discrepancy index between Vietnam and Bulgaria for HS 09 commodities was 0.75, meaning that Vietnam was under-reporting exports to Bulgaria and Bulgaria was over-reporting imports from Vietnam. The asymmetry in bilateral trade data reported by Vietnam and Bulgaria may originate from differences in valuations of imports and exports (CIF-FOB

differences), differences in attribution of trade partners, differences in recording re-exports, and other sources of discrepancies (Javorsek, 2016).

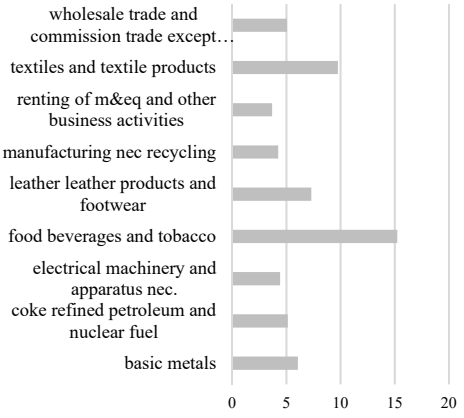
In trade structure by partners, Vietnam modestly made up to 0.1% of total Bulgarian imports and 0.2% of Bulgarian exports. Leading suppliers for Bulgaria came from EU countries. Germany was the largest exporter to Bulgaria, accounting for 12.13% of total imports of the country, followed by Italy, Romania and Turkey at around 7% of Bulgaria's import turnovers in 2020. EU countries still continuingly were key destinations of Bulgaria's export flows. The share of Bulgaria's exports targeted to Germany, Romania, Italy, Greece, and Turkey in 2020 were respectively 16.1%; 9.1%; 6.9%; 6.7%; 6.4%. Asia-European trans-continent trade of Bulgaria significantly converged on China from 2010 to 2020. Vietnam's partner-related trade story has the same regional characteristic as the case of Bulgaria's one. Essential trade partners of Vietnam geographically concentrated on East Asian countries like ASEAN, China, Japan, and South Korea. The U.S. and EU are key trade partners, too, but are vital destinations for Vietnamese exports. Bulgaria accounted for only an insignificant share, 0.02%, in Vietnamese exports and imports.

Under trade in value-added perspective, Vietnam's backward linkage to Bulgaria reached a value of $20.79 million, equivalent to 0.06% of the total export of Bulgaria in 2017. Vietnamese exports are embedded in Bulgaria's exporting sectors: food beverages and tobacco (15.24%), textiles and textile products (9.76%), leather products and footwear (7.3%), primary metals (6.07%), coke refined petroleum and nuclear fuel (5.14%). On the other hand of the scale, Bulgaria's value-added account for 0.018% of Vietnam's exports to the World in 2017. Food beverages and tobacco, computer electronic and optical equipment, textiles and textile products, leather products and footwear, manufacturing new recycling were the top five Vietnamese exporting sectors that used inputs from Bulgaria with the respective share of 24.85%, 12.43%, 12.37%, 9.22%, 6.52%.

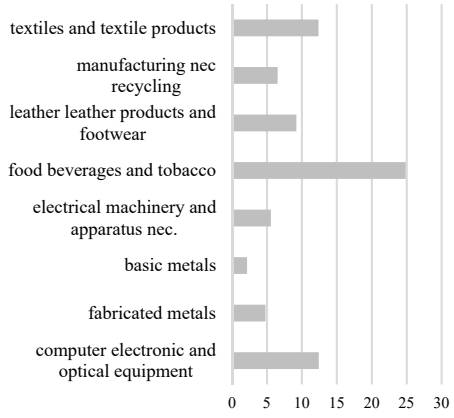
Figure 2

Backward linkages between Vietnam and Bulgaria by sector in 2017 (%)

a. Vietnam's value-added Bulgaria's exports to World by sectors



b. Bulgaria's value-added in Vietnam's exports to World by sectors



Source: https://riva.negotiatetrade.org

According to the RIVA database in 2017, 73.2% of inputs came from domestic suppliers in total Vietnamese exports to Bulgaria. The rest came from foreigners, mainly ROW (6.3%), China (6.1%), South Korea (2%), Japan (1.8%) and the US (1.5%). In addition to 79.6% local contents,Bulgaria's imported inputs in exports of all sectors to Vietnam came from ROW (4.6%), Spain (1.9%), Germany (1.6%), Romania (0.84%) and Greece (0.78%).

3. Determinants

3.1. Cooperation framework

Since the official establishment of the bilateral diplomatic relation between Bulgaria and Vietnam on February 8th, 1950, the two countries have signed several economic agreements. In 1993, the Agreement on Trade and Economic Cooperation between the Republic of Bulgaria and the Government of the Socialist Republic of Vietnam was signed in Hanoi. The Contracting Parties accord to each other the most-favoured-nation treatment in the field of trade, including the transport of goods for export and import, customs regulations, tariffs and additional costs related to the import and export of goods between the two countries. In 1996, Hanoi continuing witness the signing of the Agreement on Mutual Promotion and the Protection of Investments and Double Taxation Avoidance between the two countries. Although those agreements created a favourable environment for bilateral trade and investment, they lasted only six years (the former agreement) or ten years (for the two later agreements). Therefore Vietnamese and Bulgarian trading firms did not enjoy preferential tariffs over other trade partners who had free trade agreements with the two countries.

EVFTA, which has characteristics of a new generation free trade agreement, was expected to open a new brighter chapter for bilateral trade growth between the two countries. Regarding commitments to open markets for merchandise goods, the EU has eliminated import tax on about 85.6% of Vietnam's export tax lines to the EU as soon as the agreement comes into effect. By 2027, the number of import tax lines eliminated by the EU will reach 99.2%, equivalent to 99.7% of Vietnam's export turnover. About 0.3% of Vietnam's remaining export turnover will be subject to a tariff quota by the EU with an import tax rate within the quota of 0%. The EVFTA market access commitment is the highest commitment Vietnam has ever enjoyed among FTAs it has engaged, especially when the EU is one of Vietnam's key export markets.

On the contrary, Vietnam also committed to eliminating tariffs according to the milestones immediately after the agreement entered into force, seven years and ten years after the agreement entered into force, respectively, 48.5%; 91.8%; and 98.3% of tax liens. Vietnam will eliminate about 1.7% of the remaining import tax lines according to the schedule or apply tariff quotas according to WTO commitments. Under EVFTA, Vietnam and the EU have also agreed to implement several non-tariff trade management measures to facilitate trade, such as customs procedures, SPS, TBT, and improve transparency in the legal environment. At the same time, the two sides have committed that electronic transactions will be exempt from import tax and continue to maintain dialogue on management issues related to e-commerce.

The EVFTA requires wholly obtained for most Vietnamese exporting agricultural products. For other cases of acceptance of rules of origin, the EVFTA requires a code conversion rule, often accompanied by a requirement for a limit on the proportion of non-originating raw materials (between 20% and 60%). For industrial products (except textiles), standard rules of origin (ROO) applied are a requirement in local value content (LVC) used in production; change in tariff heading (CTH); and specific processing of production.

Table 1

ROO for some HS codes under EVFTA

HS	ROO
Plastic (HS 39)	CTH or LVC 50%
Rubber (HS 40)	CTH or LVC 70% (with some exceptions of used car tires; refillable car tires)
Transportation means (HS 87)	• LVC 45% for cars and auto components • CTH or LVC 50% for motorcycles and motorcycle components
Wood and wood products (HS 44 và 94)	• CTH or LVC 70% • Some raw wood products: Rules of specific processing of production

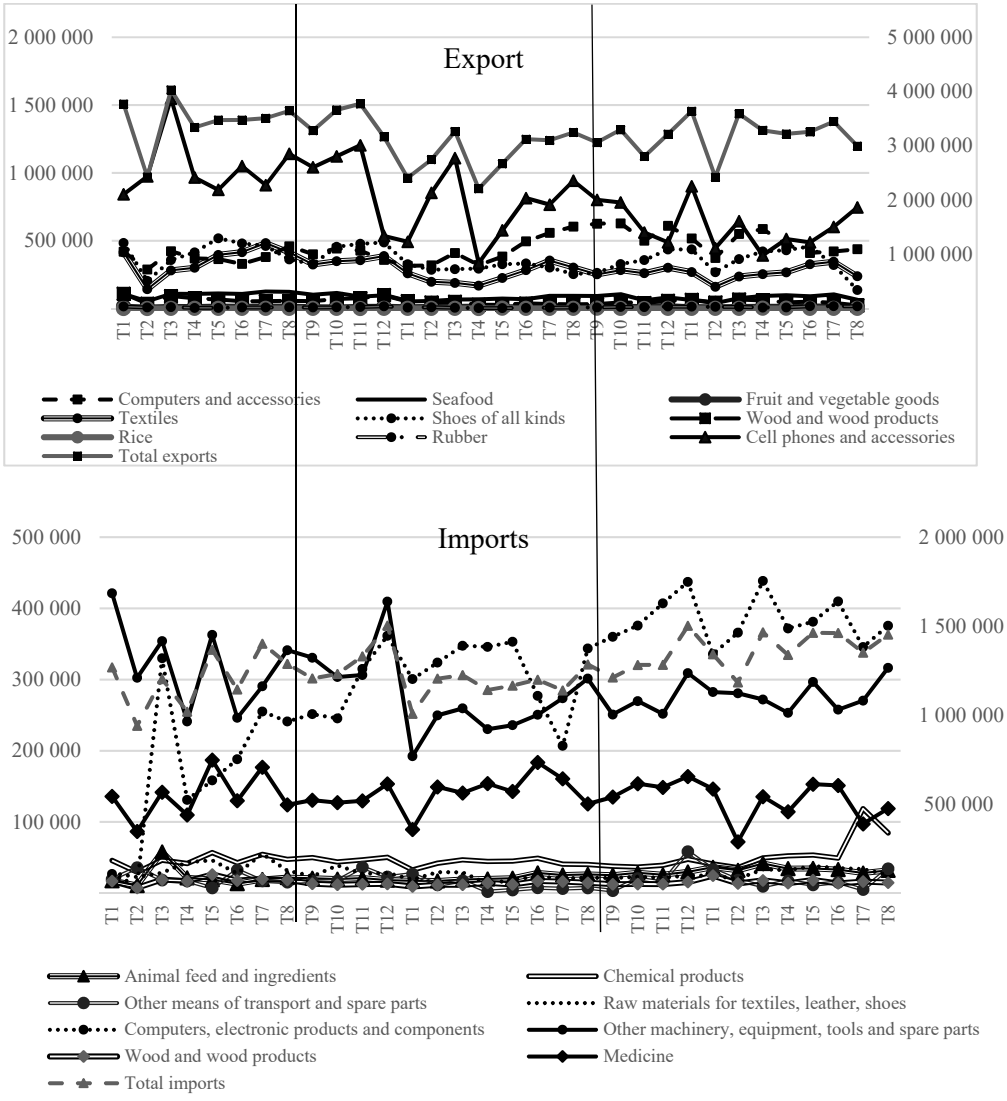
Source: Ministry of Trade and Industry, Vietnam (2019).

From the analysis of backward linkages between the two countries taken in the previous part, we can essentially be free of anxiety about the lack of qualification to EVFTA'ss ROO when Vietnamese products are exported to Bulgaria. Vietnam's imports embedded in its total sector exports to Bulgaria generally owned local value content of 73.2%, higher than most of the requirements in industrial products" local value content in ROO under EVFTA.

The EVFTA created highly favourable conditions to promote Vietnam's essential products to the EU market and created a premise for diversifying export markets. From the time EVFTA officially took effect, bilateral trade between Vietnam and the EU in the first eight months of 2021 reached approximately $37 billion, up 14.9% over the same period in 2020 when the Agreement did not come into force. Eight-month export turnover reached nearly $26 billion, up 14%, and imports from the EU into Vietnam reached $11.1 billion, up more than 18.05% over the same period in 2020. Export of iron and steel products in the first eight months of 2021 had a turnover of approximately 1.1 billion USD, gaining a growth of up to 990% over the same period in 2020. In the first eight months of 2021, Vietnam's products with export turnover of over 1 billion USD to the EU, such as computers and components; other machinery, equipment, tools and spare parts; textiles, garments; and shoes of all kinds, had immediately taken advantage of the tariff incentives of the EVFTA Agreement with the growth rate of 11%; 55%; 6%; and 17% over the same period respectively. In addition, Vietnam's agricultural and forestry products exported to the EU market have recorded strong growth since the agreement came into effect. Export turnover in the first eight months of 2021 to the EU market of pepper, seafood, vegetables, wood and wood products, rice, tea, and rubber grew by 57%; 10%; 6%; 29%; 21%; 68%; and 127% over the same period in 2020. The commitments to 100% import tax exemption and reduction immediately when the EVFTA comes into effect have brought price advantages to Vietnam's exports in general and vital exporting products in particular.

Figure 3

Import and export turnover of Vietnam to the EU by month in the period of 2019-2021



Source: General Statistics Office, Vietnam.

Since the EVFTA took effect until June 4th, 2021, 180,551 sets of C/O form EUR.1 have been issued by authorised agencies and organisations, with a turnover equivalent to more than 6.6 billion USD to 27 EU countries, in which mainly exports of footwear, textiles, fishery products, electronic goods etc. Exporters have self-certified 4,845 shipments valued

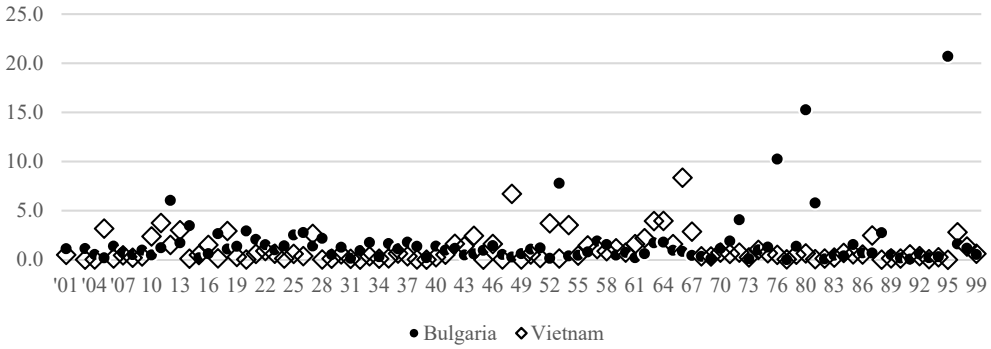
at more than 14.91 million USD to the EU to enjoy preferential tariffs under EVFTA (Ngân An, 2021). Besides the growth in the value of two-way trade between Vietnam and the EU, Vietnam's attracting investment from the EU has also achieved very encouraging results. Commitments to transparency in governance have helped improve the investment trade environment and facilitate investment flows from the EU. Accumulated to June 2021, Vietnam recorded 2,221 projects (an increase of 142 projects over the same period in 2020) from 26/27 EU countries, corresponding to a total registered investment capital of 22,216 billion USD (up 449 million USD over the same period in 2020). Total FDI into Vietnam invested by EU companies accounted for 5.58% of total registered investment capital and 6.57% of projects (Ngân An, 2021).

3.2. Trade characteristics

The paper uses three trade indicators to illustrate the trade characteristics of Bulgaria and Vietnam: Revealed Comparative Advantages index (RCA), Trade Complementarity Index (TC), and Export Specialization Index (ES). The first index helps assess the two countries' export potential. In contrast, the second one can provide helpful information on prospects for intraregional trade in that it shows how well the structures of a country's imports and exports match. The last but not most undersized index, ES, provides product information on revealed specialisation in the export sector of the two countries.

Figure 4

RCA of Vietnam and Bulgaria in 2020



Source: Authors' calculation.

The RCA index of country *i* for product *j* is attained by the product's share in the country's exports concerning its share in world trade. A country that owns an RCA score under unity in any product does not have a comparative advantage. On the contrary, an RCA score that exceeds unity signals a product's revealed comparative advantage. According to the illustration from Figure 4, Bulgarian and Vietnamese RCA scores overlap in several products. 38/97 HS codes have gaps in the RCA scores of less than 0.5 points, of which about 20 HS codes are precisely at the same value. More than half of the total HS codes, 52/97, of the two countries differ less than one point. Fortunately, those products have low RCA scores and are not the two countries' major exporting products. The top ten HS codes occupying the

most significant RCA scores in Vietnam and Bulgaria are presented in Table 2. Footwear, textile, and food products lead in RCA score on the Vietnam side, while agricultural, metal, and weapon products are RCA leaders on the Bulgaria side. The differences in RCA scores of crucial export products of the two countries prove trade potentials between them.

Table 2

RCA for selected HS codes of Vietnam and Bulgaria in 2020

HS	Product details	RCA	HS	Product details	RCA
24	Tobacco and manufactured tobacco substitutes	2.8	16	Preparations of meat, of fish or crustaceans, molluscs or other aquatic invertebrates	2.9
18	Cocoa and cocoa preparations	2.9	11	Products of the milling industry; malt; starches; inulin; wheat gluten	3.0
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal ...	3.5	'03	Fish and crustaceans, molluscs and other aquatic invertebrates	3.2
70	Glass and glassware	4.1	52	Cotton	3.5
79	Zinc and articles thereof	5.8	50	Silk	3.7
10	Cereals	6.0	’09	Coffee, tea, maté and spices	3.7
51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric	7.8	61	Articles of apparel and clothing accessories, knitted or crocheted	3.9
74	Copper and articles thereof	10.2	62	Articles of apparel and clothing accessories, not knitted or crocheted	4.0
78	Lead and articles thereof	15.3	46	Manufactures of straw, of esparto or other plaiting materials; basketware and wickerwork	6.7
93	Arms and ammunition; parts and accessories thereof	20.7	64	Footwear, gaiters and the like; parts of such articles	8.3

Source: Authors’ calculation.

General TC formula between two countries is defined as

$$TC_{ij} = 100*(1 - sum*(|m_{ik} - x_{ij}| / 2))$$

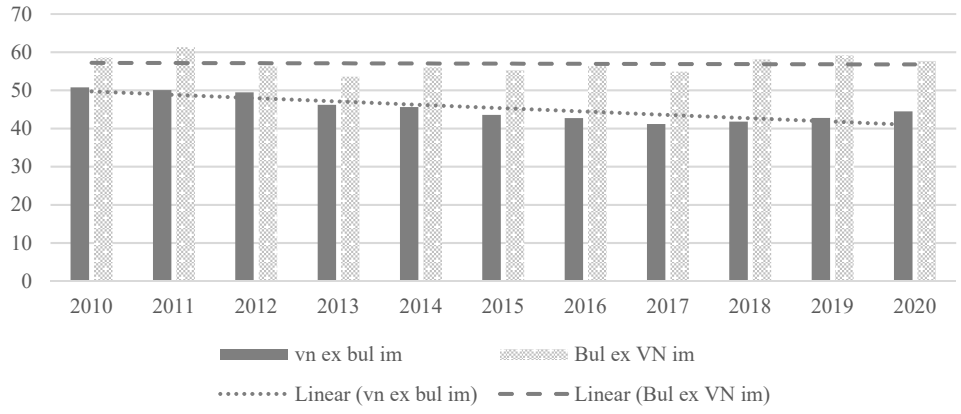
with x_{ij} is the share of good i in global exports of country j and m_{ik} is the share of good i in all imports of country k. A zero turnover of one country’s export or its bilateral partner’s import defines a zero TC value. In contrast, the total match between the import and export shares of the two countries leads to the maximum TC score of 100. Applying this index for bilateral trade between Vietnam and Bulgaria between 2010 and 2020 showed how to match Vietnamese and Bulgarian trade structures. With the TC performance scores between Bulgarian exports and Vietnamese imports fluctuating from 50 to 60, the two countries’ trade structures complement each other. Conversely, the TC index for Vietnamese exports and Bulgarian imports stood in the range from 40 to 50 simultaneously, illustrating the average level of matching between Vietnamese exports and Bulgarian imports.

ES is calculated as the ratio of the share of a product in a country’s total exports to the percentage of this product in imports to specific markets or partners. ES is also used to investigate the two countries’ evident trade characteristics. The ES score below a unity means a comparative disadvantage, while an ES value above a unity illustrates specialisation in this market. Unlike the case of RCA, ESI for Vietnam and Bulgaria in 2020 did not attain the

approximate value in the majority of HS, implying heterogeneous comparative advantages of the two countries regarding export specialisation in the other country's market.

Figure 4

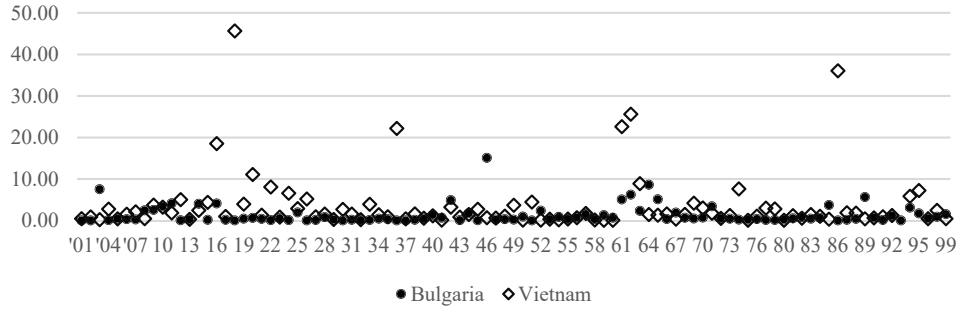
TC index for bilateral trade between Vietnam and Bulgaria in 2010-2020



Source: Authors' calculation.

Figure 5

ESI for Vietnam and Bulgaria in 2020



Source: Authors' calculation.

Bulgaria specialized in exporting HS 18; HS 86; HS 36; HS 62; and HS 61 to Vietnam market with impressively high ESI index of 45.6; 36; 22.2; 19.4; and 17.5 respectively. On the other hand, Vietnam had outstanding advantages in exporting HS 46; HS 64; HS 03; HS 89; HSS 65 to the Bulgarian market when these items' ESI was 14.4; 8.6; 7.2; 5.6; and 5.1, respectively.

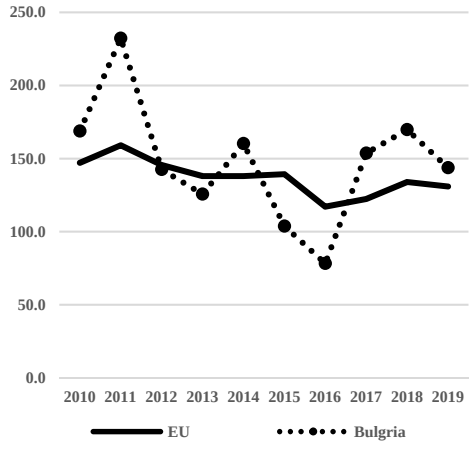
3.3. Trade costs

The cost of non-tariff trade between Bulgaria and Vietnam in 2010-2019 is still higher than the average level of non-tariff costs between Vietnam and France, Germany and the UK. Goods traded between Vietnam and Bulgaria incur a non-tariff cost equivalent to 169% of the value of goods in 2010, then reduced to 144% in 2019. In cross-border exchanges with France, Germany, UK, and Vietnamese goods incur a lower cost than in the exchange with Bulgaria, at 147.2% of the value of goods in 2010 and 130.9% in 2019. However, it is good news that the rate of reduction in the cost of bilateral non-tariff trade between Vietnam and Bulgaria in the period 2010-2019 was faster than the average rate of reduction in the cost of non-tariff trade between Vietnam and Bulgaria. Three partners in the same period, 14.8% and 11.1%, respectively. Due to the lack of data, we use the average non-tariff trade costs with Germany, France, and the UK to proxy the cost of non-tariff trade between a Southeast Asian country and other countries. European countries and implications for Bulgaria. The bilateral non-tariff trade costs between Vietnam and Europeans are also lower than the bilateral non-tariff trade costs between other ASEAN countries such as Indonesia, Malaysia, the Philippines, Singapore, and Thailand. In 2019, the non-tax cost of goods exported from Vietnam, Indonesia, Malaysia, the Philippines, Singapore, and Thailand to Bulgaria was 130.9%, respectively; 387%; 200%; 195.2%; 142.7%. Moreover, Vietnam also recorded a significant reduction in non-tariff trade costs in 2010-2019, 11.1% compared to the reality in contrast to Malaysia, the Philippines, Singapore and Thailand with high trade costs. tax increases in the same period at 20%, 5%, 20%, 1% respectively.

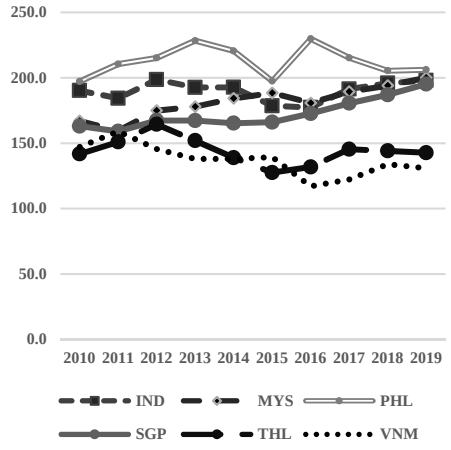
Figure 6

Equivalent non-tariff trade costs of selected countries in 2020-2019

a. Non-tariff trade costs between Vietnam and Bulgaria and the EU



b. Non-tariff trade costs between Bulgaria and selected ASEAN member states



Source: Authors' calculation.

Bulgaria's trade regulations align with the EU's common market access issues for Vietnamese firms. Bulgaria's imported goods are declared to customs by commercial documents or other relevant documents. As of January 2011, the European Commission's safety and security regulations for Advance Cargo Declaration are mandatory for all goods exported to, arriving at or moving through the EU. Products imported into the Bulgarian market are subject to value-added tax (VAT). Goods shipped to the Bulgarian market must also comply with EU standard weight regulations such as directive 80/232/EC on the permissible deviations of the minimum weight, the capacity of the container, and volume. Imported goods in the EU and Bulgaria are encouraged to achieve green label under an environmental labelling law in 1992, revised in 2000. Although obtaining a green label is optional and quite expensive as businesses can pay up to 1,300 Euros for registration, 25,000 Euros/year to buy the right to use the green label (small and medium-sized businesses get a 25% off) but the green label can be an effective marketing tool, as the demand for green and clean products is increasing in Europe in general and Bulgaria in particular.

In the case of food products, all food-related information must be accurate and in Bulgarian. Bulgaria follows all the common EU standards on the Phytosanitary Regulations standards for goods and services. Notably, products tested and certified abroad may be subject to testing and re-certification according to EU regulations. The EU may have a different approach to protecting consumer health, safety, and the environment. In recent years, EU standards have been developed under a New Approach applied in all 27 EU member states to ensure the free movement of goods between member states.

At the same time, Vietnam trading businesses also need to pay attention to the standard conformity assessment system. The European Product Law gives manufacturers several options concerning conformity assessment, depending on the degree of danger in using the product. These options can be self-certification, type inspection, production quality control system, and comprehensive quality assurance system. Enterprises can access the list of conformity assessment bodies of member countries at the following online address of the European Commission: http://Europa.eu.int/comm/enterprise/nando-is /home/index.cfm. Businesses are allowed to participate in voluntary conformity assessment programs to speed up the certification process of the final product. In addition, enterprises exporting to the Hungarian market also need a certificate of safety for users (CE). Although the CE marking is used primarily for inspection purposes, consumers may consider it a quality certification mark.

Although Vietnam's exports must meet many different standards to access the Bulgarian market, the country has shown its efforts to reduce the risk of non-tariff measures becoming non-tariff barriers by implementing trade facilitation measures. According to the UN global survey on Digital and sustainable trade facilitation, Bulgaria's trade facilitation performance score has increased from 60.22% in 2015 to 86.02% in 2021, while Vietnam has improved its implementation status from 48.39% in 2015 to 61.29% in 2021. Significantly, measures such as publication of existing import-export regulations on the internet; advance publication/notification of new trade-related rules before their implementation; advance ruling tariff on classification and origin of imported goods have been fully implemented by Bulgaria and partly implemented by Vietnam have somewhat helped exporters and importers of the two countries reduce fixed and variable costs regarding market information.

4. Prospects for Trade Relations between the Two Countries in the Coming Time

From the analysis of the current situation and factors affecting the bilateral trade of Vietnam and Bulgaria, some prospects for trade relations between the two countries in the coming time can be drawn. Firstly, the characteristics of the trade structure of Vietnam and Bulgaria show the potential for growth in bilateral trade between the two countries. Products with export strengths of Vietnam and Bulgaria also do not overlap. Moreover, the export structure of Vietnam and the import of Bulgaria and the structure of Vietnam's import and export of Bulgaria are complementary. Secondly, the EVFTA has brought many opportunities for bilateral trade and investment between Vietnam and Bulgaria. Most of the tariff barriers are removed as soon as the agreement comes into force, which will directly impact increasing bilateral trade flows between the two countries. Besides, the import and export goods of Vietnam and Bulgaria will also benefit indirectly from implementing the agreement. The Vietnamese government has carried out various mandatory institutional measures following its commitments to the EVFTA. Ministry of Industry and Trade has cut 680/1216 business conditions under the State management of the Ministry of Industry and Trade since 2020, of which 205 business conditions were cut in the period 2019/2020. As a result, fixed and variable trade costs related to import and export procedures will undoubtedly continue to be reduced.

Third, Vietnam needs to continue promoting and strengthening trade relations with Bulgaria. Bulgaria is a member of more than 40 trade agreements with 80 countries worldwide, including the EU-Vietnam Free Trade Agreement (EVFTA). It also has a seaport which correctly serves import and export activities. Therefore, Bulgaria can become a distribution centre for goods with other countries, the bridge for Vietnamese enterprises to enter the large EU market. Successfully exporting merchandise goods into the Bulgarian market means successful EU market penetration. Furthermore, Bulgaria is also one of the suppliers to the EU market so that Vietnamese intermediate goods can enter the EU value chain through the Bulgarian market.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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INNOVATIVE NATURE OF SOCIAL ENTREPRENEURSHIP AT THE PRESENT STAGE[6]

The paper reveals that social entrepreneurship as a type of activity aimed at solving certain problems of society, first emerged in the former Soviet Union in the form of enterprises in the society of the blind; and, accordingly, in Ukraine, which at that time was part of the Soviet Union. These events took place more than fifty years earlier than in the United Kingdom, which is now considered the founding father of social enterprises. The conditions in which the first social enterprises were created and functioned, the influence of public administration and regulations on this process are shown, and it is shown how social enterprises created on the basis of humanism became an instrument of coercion by the state and thus lost their essence. The example of Costa Rica (first place in the world in the Happy Planet Index) and Norway (second place in the world in terms of Prosperity) shows that methods of supporting social entrepreneurship can range from full-fledged institutional support at all levels to almost complete lack of influence and control by the state. The existing classifications, features and concepts of social enterprises were analysed, mistakes made in the past were taken into account, and in particular, the need for non-discrimination was emphasised. And on this basis, the authors proposed to identify four features that are mandatory and relevant to each social enterprise. It is emphasised that none of the components of the "Triple Bottom Line" can be defined as the most important because they are all equally important. It is shown that a social enterprise is not identical to a charitable organisation. It has been established that a classic enterprise may have the characteristics of a social enterprise, but a social enterprise obligatory must have these characteristics in order to fulfil its mission. It has been shown that the same organisations can be sources of funding or social entrepreneurs, depending on what services it provides in specific conditions. The instruments of state support of social entrepreneurship in Ukraine are considered and it is shown that they are insufficient. The labour market and the number of people with disabilities in Ukraine are analysed, the existence of problems with the employment of people with special needs is shown and the need

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to strengthen state aegis and provision of regulatory and legal support for social entrepreneurship in Ukraine is emphasised. The obtained results are planned to be used in further research, which will relate to the opportunities for social entrepreneurship in the field of environmental services.
Keywords: social entrepreneurship; humanism; innovation; social values; environment; people with special needs
JEL: L26; L31; M29

Introduction

Today the development of the social business as one of the important indicators of the level of socio-economic development of the state is becoming increasingly important. With the emergence of new economic and social relations in Ukraine, the emergence of enterprises focused on improving society, indicates a departure from motivation only to make a profit to the motivation to make a profit with a simultaneous overall positive impact on society. For our country, social entrepreneurship, in its current sense, as well as entrepreneurship in general, are relatively new activities. Accordingly, the period from which the class of Ukrainian entrepreneurs began to form is very small – three decades (since 1991). Compared to other developed countries, this is a very short time. As for social entrepreneurship in its current sense, it has existed in Ukraine for an even shorter period of time, although attempts to organise such activities have appeared much earlier. The term "social entrepreneurship" came into scientific circulation only in the mid-2000s. Despite such a short period of existence, social business has every chance to become one of the important tools to solve many problems in the social sphere and help increase the effectiveness of public policy in this area.

Methodology

In the process of research, the authors successfully used the following methods: theoretical – used to select a set of sources appropriate for study according to the research topic, these include: scientific articles in domestic and foreign publications: Lunkina (2019); Arapetyan (2008); Spreckley (1987); Elkington (2004), etc.), archival collections of legal documents – Resolution of the Council (1944), publications in international information and analytical publications – Kraaijenbrink (2019), monographs – Svinchuk (2017), manuals for entrepreneurs in in the field of social entrepreneurship – Doluda (2017), analytical reports – Social entrepreneurship in Ukraine (2020), Ukrainian legislation – Laws of Ukraine, resolutions of the Cabinet of Ministers of Ukraine, codes, etc., Internet sources –State Statistics Service of Ukraine (State Statistics Service, 2021), State Employment Service of Ukraine, Ukrainian Society blind, Institute on Employment and Disability, etc.; general philosophical analysis (dialectical method, in particular, the principle of historicism, was necessary in studying the relationship between the formation of social entrepreneurship and historical events in the world; the principle of objectivity was used to abstract from the provisions that are considered true and opportunities to form an objective view of events, decisions and results of their implementation, for a comprehensive coverage of the research topic used a systematic method; highlighting the most important and necessary aspects of the study of social entrepreneurship was ensured through the use of the principle of

comprehensiveness; determinism was used to determine the relationship and conditionality of events. The formulation of the author's classifications and conclusions is based on legal methods (formally logical), as well as sociological methods (statistical and expert assessments).

Theoretical Basis of the Study

Since social entrepreneurship (SE) is a type of activity, the existence of which is desirable and even necessary for each country, its state, problems and prospects for development are constantly in the field of study of many scientists. The research of foreign experience is important for the formation of an understanding of the phenomenon of social entrepreneurship, and it was studied by Lunkina and Ivanenko (2019).

The first attempt to determine the net profits of social entrepreneurship in Ukraine was made by Arapetyan and Arkhipchuk (2008).

Spear and Bidet (2003) explored the role of social enterprise in European labour markets.

Mokiy and Datsko (2014) explored the possibilities of strengthening the economic security of depressed areas through the development of social entrepreneurship.

Horyn and Bulavynets (2021) considered the use of social entrepreneurship as one of the tools to diversify the financing of the state social policy. Theoretical and applied aspects of public-state partnership are revealed in the works of Bodelan (2014).

Golubyak (2017) expanded this direction, highlighting the main prerequisites for the formation of social entrepreneurship as a combination of public and private sectors and the role of the state in ensuring the political and legal status of social entrepreneurship.

Kamenko and Vyhovska-Kamenko (2021) stressed that the emergence of social entrepreneurship is the response of society as a whole to the social needs that are formed in it over time. Some problems and prospects for the development of social entrepreneurship are considered by Kyfyak and Malysh (2020).

At the same time, there are some gaps in research, which is explained by the specifics of the functioning of social entrepreneurship in the world, including Ukraine, because it is believed that it is currently undergoing a stage of formation and formation. In particular, it is necessary to clarify in historical retrospect the circumstances of the emergence and formation of the SE. As several definitions, features and classifications of social entrepreneurship have been proposed to date, but none of them has become generally accepted, it is necessary to try to determine the main features of social entrepreneurship and its features.

Results

Homeland of the first social enterprises is considered to be the United Kingdom, where this idea emerged in the late 1970s as a commercial, organisational model alternative to private

business, cooperatives and state-owned enterprises. It was then that F. Spreckley proposed to use the term "social enterprise" (Spreckley, 1987, p. 3).

However, the statement about the social enterprises and Great Britain is not entirely correct, because the fact is that the first social enterprises emerged much earlier, in the Soviet Union and in Ukraine, which was part of it. On April 6, 1925, with the participation of representatives from Ukraine, the first congress of the All-Russian Society of the Blind (hereinafter – VTS) was held, at which a number of decisions were made to expand opportunities for the blind and visually impaired. In particular, in order to create opportunities for the blind to acquire literacy, Braille study groups were established; the Life of the Blind magazine was founded (1924); the Electric Motor Association of the Blind (1925) began to operate, uniting a number of artisanal and semi-artisanal workshops for the blind (a factory was later launched on its basis (1929), where the disabled worked); the first artel of cooperation of invalids under the name "Mineral" was created (1927) and much more.

The Ukrainian Society of the Blind (USB) was registered in 1933, although the activities to create artels and small enterprises, which employed people with visual impairments, had begun earlier. A great achievement is that in 1934 the world's first magazine for blind children "Yunyy pioneer" ("Young Pioneer") (since 1996 – "Shkolyaryk" ("Schoolboy")), began to be published in Ukraine. It should be noted that the children's magazine in Braille, "Seedlings Braille Books for Children" in the United States, began to print only in 1984, i.e. fifty years later than in Ukraine.

In 1935, almost 80 production workshops operated under the auspices of the USB, and their number continued to increase. Most of the enterprises for the disabled that emerged in those days operate in Ukraine and other post-Soviet states, and today the only difference is the status – today they are public organisations.

At the same time, it should be recognised that all the activities of the Soviet government to establish and support the SE are discredited by further policies of discrimination against people with disabilities. This refers to the government's decisions on the isolation of disabled people by keeping them in specialised institutions and limiting the circle of communication, the lack of devices that would give disabled people the opportunity to move freely (lifts ramps, elevators, handrails, equipped common areas, etc.). In addition, on January 20, 1943, the Council of People's Commissars of the USSR adopted Resolution N 73 "On Measures for the Employment of Invalids of the Patriotic War" (Resolution of the Council, 1944). According to this document, if a disabled person was unable to find employment for two months, the state stopped paying him a pension. Resolution N 73 was later repealed. At present, there are no signs of coercion or discrimination in the SE, but the state's concern for people with disabilities in Ukraine is low.

Although the SE originated in the early twentieth century, its humanistic component began to manifest itself somewhat later. Since the end of the twentieth century, when the support of social entrepreneurship began at the state level, most of these enterprises are constantly changing their behaviour in the market. These changes are caused by competition for various forms of support (state aid, program funding, benefits, charitable contributions, donations, volunteer work, etc.). This situation, in turn, provokes the constant gradual movement of non-

profit organisations belonging to the social sphere, towards a more commercialised form and vice versa.

For a better understanding of the actual spectrum of social enterprises, it is advisable to consider the proposed G. Dees classification scheme and signs of transition from a fully non-commercial social enterprise to a commercial and vice versa (see Table 1).

Table 1

The Social Enterprise Spectrum

		Purely Philanthropic <——————————> Purely Commercial		
Motives. Methods, and Goals		Appeal to goodwill Mission-driven Social value	Mixed motives Mission and market-driven Social and economic value	Appeal to self-interest Market-driven Economic value
Key stakeholders	Beneficiaries	Pay nothing	Subsidised rates, or mix of full payers and those who pay nothing	Market-rate prices
	Capital	Donations and grants	Below-market capital, or mix of donations and market-rate capital	Market-rate capital
	Workforces	Volunteers	Below-market wages, or mix of volunteers and fully-paid staff	Market-rate compensation
	Suppliers	Make in-kind donations	Special discounts, or mix of in-kind and full-price donations	Market-rate prices

Sources: Dees, 1998.

It is sometimes suggested that the main difference between traditional and social entrepreneurship is that the SE is created solely to solve social problems. In our opinion, this approach is not correct enough, as the lack of profitability is a distinctive feature of non-profit organisations such as the International Committee of the Red Cross, the National Endowment for Democracy, the Eurasia Foundation and many others. Note that in this study, we consider a social enterprise, i.e. an organisation that has a positive impact on the development of society, but has all the hallmarks of an enterprise, so charities and charitable foundations are not taken into account. From this point of view, the above spectrum of social enterprises requires some adjustment.

Social enterprises can be classified based on the level of integration between social programs and business activities (Alter, 2007):

1. Embedded Social Enterprises – Social programs and business activities are one and the same. Non-profits create Embedded Social Enterprises expressly for programmatic purposes. The enterprise activities are “embedded” within the organisation’s operations and social programs, and are central to its mission. Social programs are self-financed through enterprise activities and thus, the embedded social enterprise also functions as a sustainable program strategy.
2. Integrated Social Enterprises – Social programs overlap with business activities, often sharing costs and assets. Organisations create integrated social enterprises as a funding mechanism to support the non-profit’s operations and mission activities.

3. External Social Enterprises – Social programs are distinct from business activities. Non-profits create external social enterprises to fund their social services and/or operating costs. The enterprise's activities are "external" to the organisation's operations, but support its social programs through supplementary financing. External social enterprises generally do not benefit from leveraging, cost-sharing or program synergies, therefore, to serve their purpose, they must be profitable.

It is quite difficult to unambiguously describe "social entrepreneurship" because different countries have their own understanding of what can be considered this type of activity, methods or even the expediency of its support. For example, in Costa Rica, which ranks first in the Happy Planet Index (among 140 countries), the Institute of Social Security (Caja Costarricense de Seguro Social) has been established. The government has issued a decree recognising the SE as a national interest, established a Committee on Social Innovation, determines the "index of social progress" on many indicators, develops programs to increase it, and so on.

When considering social entrepreneurship, it is important to distinguish it from entrepreneurship in its classical sense. In the current legislation of Ukraine, there is no definition of SE, and the first definition of entrepreneurship appeared in 1991. The Resolution of the Verkhovna Rada of Ukraine "On Entrepreneurship" states that it is "…direct independent, systematic, at your own risk activities for production, implementation work, provision of services for profit, which is carried out by individuals and legal entities registered as business entities in the manner prescribed by law" (Resolution of the Verkhovna, 1991).

Article 42 of the Commercial Code of Ukraine stipulates that entrepreneurship is an independent, proactive, systematic, at their own risk economic activity carried out by business entities (entrepreneurs) in order to achieve economic and social results and profit (Commercial Code, 2003). In this definition, in contrast to the previous one, the concept of "entrepreneurship" is significantly expanded and already contains a social component. In 2015, a draft profile law was developed, however, after consideration by the Committees of the Verkhovna Rada of Ukraine, it was declared corrupt and revoked. The bill was re-included in the agenda in 2019 and once again rejected due to numerous shortcomings.

However, in Norway, which ranks second in the world in terms of welfare, there is no separate government policy aimed at supporting the SE, while some companies in this area are provided with little material support. It is believed that such enterprises should be able to prove their viability first at the level of business incubators, accelerators, technology parks, etc.

In domestic practice, when it comes to social business and entrepreneurship, the emphasis is on active social position, constant dialogue with the public and participation in solving the most painful social problems, rather than the activities of enterprises created on the initiative of public organisations. Although such enterprises are the most stable and independent of crises, in addition, they make a great contribution to the economy of their countries (Bodelan, 2014, p. 7).

In 1994, J. Elkington developed the Concept of Social Entrepreneurship (now called the "Triple Bottom Line (TBL)"), which defines the basic principles of this activity (Elkington, 1997, p. 70):

- trade and financial independence, viable;
- creation of social values;
- activities that involve environmental responsibility.

The essence of "Triple Bottom Line" is that the SE meets its destination only if there is a benefit for (Kraaijenbrink, 2019):

- people: the positive and negative impact an organisation has on its most important stakeholders. These include employees, families, customers, suppliers, communities, and any other person influencing or being affected by the organisation.
- planet: the positive and negative impact an organisation has on its natural environment. This includes reducing its carbon footprint, usage of natural resources, toxic materials and so on, but also the active removal of waste, reforestation and restoration of natural harm done.
- profit: the positive and negative impact an organisation has on the local, national and international economy. This includes creating employment, generating innovation, paying taxes, wealth creation and any other economic impact an organisation has.

At the same time, in our opinion, none of these benefits can take precedence over others or be ignored.

Scientists distinguish two groups of characteristics of social enterprises (Lunkina, Ivanenko, 2019, p. 143):

a) the main:

- priority of social goal:
- reinvestment of profits in the development of social enterprise:
- transparent activities and periodic public reporting;

b) secondary:

- financial independence;
- democratic (collective governance);
- scale;
- introduction of innovations.

We believe that this list should be simplified and supplemented, as there are three features inherent in any SE, in addition, the analysis of the experience of organising social enterprises in Soviet times, operating in full compliance with the law, shows the need to add a fourth

feature. Taking into account the comments, the social enterprise must meet the following criteria:

- activities for profit;
- social orientation;
- legality;
- respect for human rights and non-discrimination.

The SE is distinguished by its ability to work in areas with underdeveloped private markets, which forces it to develop in limited conditions. While most entrepreneurs operate under conditions of resource scarcity, social entrepreneurs face a specific set of challenges because they purposely locate their activities in areas where markets function poorly. Thus, while commercial entrepreneurs seek markets with sufficient carrying capacity to support growth, social entrepreneurs actually seek markets characterised by a paucity of resources (Domenico, Haugh, Tracey, 2010, p. 683).

Thus, factors of the development of social entrepreneurship in the world practice are the shortcomings and failures of the market and the state; different levels of social protection in national economic models; differentiation of incomes of social groups; growth of social needs (Suprun, 2012, p. 454). Mission – the essence of the existence of the SE is to solve the problems caused by these factors. Based on the mission of the enterprise or organisation, the general directions of activity are formed, the purpose of creation, features of functioning, main tasks, expected results and their evaluation for a certain territory, community, business environment, local community, etc. are determined.

Current trends in the accumulation and distribution of wealth while changing market approaches to social change create the preconditions for the formation of three main waves of social innovation, these include (Reis, 1999, p. 8):

Social Entrepreneurship – Social entrepreneurs create social value through innovation and leveraging financial resources for social, economic, and community development.

Business and Social Responsibility – Pressures from an active and vocal civil society, along with enlightened corporate leadership, are motivating many businesses to reconsider how they can be responsible for their business and the communities in which they work and serve their customers.

Philanthropy as Social Venture Capital – As government devolves, non-profits adapt to more entrepreneurial models, and as business reinvigorates its role in social development, philanthropy is also incorporating new approaches for social investment and the creation of social capital.

Consideration of the main features of both classical and social business is carried out according to the following criteria: purpose of activities, sources of funding, content of activities, distribution and use of profits. According to the first criterion, the purpose of social business is to solve social problems and make a profit. The sources of financial income for social business are participants' funds, income from their own activities, grants and microfinance, charitable contributions, grants from government agencies, funds received

under corporate social responsibility programs, bank loans. According to the third criterion – the main content of the activity – the social enterprise focuses on the production of goods and/or services and the implementation of social projects.

Regarding the main social results of activities, they are goods and services and solutions to social and environmental problems at the local or regional level, assistance to socially vulnerable groups (Svynchuk, Kornetskyy, Honcharova et al., 2017. p. 20-21). In general, there is reason to believe that social and traditional businesses have a lot in common, except for one feature: traditional business may contain elements of social, but social must contain them, ie meet the stated goal and be socially effective. It is also worth noting that microcredit, as a source of funding, can also be a form of SE, as such institutions can provide banking services to the unemployed and other vulnerable groups.

Based on the main mission of the activity, the most promising for development in our country are the following types of social enterprises (Horyn, Bulavynets, 2021, p. 32):

- "employment": an enterprise whose main task is to employ a certain category of the population - people who cannot create competition in the labour market and need help (women who have experienced domestic violence; homeless; internally displaced persons; drug addicts, etc.);
- "financing of services": the goal is to direct the profit (in full or in part) to the implementation of social initiatives (support for people with disabilities, ensuring the activities of institutions for the homeless, etc.).

Some researchers believe that most social enterprises in Ukraine are established in large cities, and their activities are carried out either locally or nationally, the purpose of their activities is mostly employment or livelihood support (Kyfyak, Malysh, 2020, p. 278). However, social business in Ukraine is not limited to large cities, it more or less covers almost all aspects of society.

Funding for starting and developing social businesses can be attracted in several ways (Table 2). First of all, you should pay attention to those sources that do not need to be returned.

Table 2

Sources of financing of social business

No need to refund	Need a refund
o fundraising through crowdfunding platforms	o credits
o social investments from citizens or legal entities in order to create public good	o investing in promising business ideas (business incubators, venture funds, business angels, etc.) in order to obtain certain benefits
o conducting marketing campaigns for the sale of products for the development of social enterprise	
o grant funds for the implementation of projects for the establishment of social enterprises	

Sources: developed by the authors on the basis of Doluda, Nazaruk, Kirsanova (2017, p. 18-21).

Based on the direction and low profitability of social business, as well as the above sources of funding, it is logical that the maximum support comes from NGOs, charitable foundations, international development programs, etc.

A significant place among the stakeholders of the SE is occupied by local governments, which in the framework of programs to support small and medium-sized businesses can provide (Social entrepreneurship, 2020, p. 19):

- reimbursement of interest rates on business loans;
- provision of "marketing vouchers" – reimbursement of 50% of the payment for participation in city-state and international exhibitions;
- work of business support centres, and consulting centres for both beginners and existing businesses;
- public purchasing and social orders;
- provision of premises for rent to public organisations at preferential rates.

SE both directly and indirectly contributes to the solution of urgent problems of certain territories, which is done by creating jobs, solving the most acute social, cultural and economic problems. Accordingly, by reducing the amount of social benefits for unemployment, assistance to vulnerable groups, counteracting negative migration trends, ensuring reinvestment of taxes and fees, etc., significantly improves the socio-economic condition of the territories (Mokiy, Datsko, 2014, pp. 164-165). Therefore, comprehensive support for social entrepreneurship by the state is logical and appropriate.

Tax legislation in Ukraine encourages companies to involve people with disabilities in their activities, and provides tax benefits for this. Such a tool of state regulation is good, but insufficient, because meeting the needs of the community requires a focus of business on the social mission, and not only on the involvement of people with disabilities in the work of the company. One form of protection for disadvantaged and low-income communities is societies that provide jobs for such people (Arapetyan, Arkhypchuk, 2008, p. 6). The problem is that the creation of such jobs depends solely on the desire of the employer, and he currently does not have enough motivation, because it requires some effort and sometimes creates inconvenience (special workplace, individual work schedule, etc.). Given the fact that in Ukraine, as of 01.01.2021 there are 2.703 million people with special needs (State Statistics, 2021), and the number of registered unemployed – 1.804 million (State Employment, 2021), the chance for a disabled person to get a job is very small. The average disability pension in 2021 was UAH 2,641/month, which forces people with disabilities to look for additional income to survive.

Within the social entrepreneurship, one finds a multitude of occasions for integration and employment. The organisation of this system can be defined as private and autonomous, having, among other missions, to reach social and economic aims of common interest, to limit the monopolising strategies, single or private the profits and work for the local collectivities or for groups of persons coming from the civil society and having common interests. They are often managed jointly by all concerned actors, mainly paid workers, voluntary workers and users. With the right support, the social entrepreneurship can contribute in a more efficient way to the enlargement of the labour market and the creation

of new possibilities for low qualified workers or with their abilities reduced so that they can use their skills and be fully active in their professional life (Bidet, Spear, 2003).

The Yang-Tan Institute for Employment and Disability at Cornell University (USA) compared the dynamics of changes in the employment rate among people of working age, taking into account the presence of disability over the past ten years. It was found that during the study period, the employment of persons without special needs increased from 74.5% to 79.4%, while for the disabled from 35.7% to 37.3% (Employment Rate, 2018). No such study has been conducted in Ukraine, but we assume that the situation is not better. In such circumstances, the SE becomes one of the best solutions to ensure the employment of people with disabilities, especially given that the methods of state influence on the employment of these people are quite limited. In general, these methods take two forms:

1) coercion – the current penalties for non-compliance with the quota for the number of disabled people employed at the enterprise, in accordance with the Law of Ukraine "On Fundamentals of Social Protection of Persons with Disabilities in Ukraine" (Law of Ukraine, 1991);
2) incentives and assistance – tax benefits for enterprises that employ persons with disabilities in accordance with the of Ukraine (Tax Code, 2010).

An audit conducted by the Accounting Chamber of Ukraine showed that enterprises and organisations that receive state support to provide employment for people with disabilities, most of the profits are directed to production needs (71% or 1.5 billion UAH). And very little money (6% or UAH 12.5 million) is spent on social needs and job creation for people with disabilities. In total, such enterprises and organisations received over UAH 2.1 billion in profits, tax benefits and financial assistance from the Social Protection Fund for Disabled People in 2017-2019 (Chamber of Accounts, 2020).

Currently, the main problem with the employment of people with disabilities in Ukraine is that the employer creates such jobs of his own volition; he does not have sufficient motivation to do so. Creating a working environment for a person with a disability requires some effort on the part of the employer, and this is associated with many inconveniences (workplace arrangements, individual work schedules, etc.). Among the most effective ways to interest the entrepreneur are to legalise the status of a social enterprise and strengthen control over compliance with current legislation in this area (proper use by the employer of all benefits and preferences provided by the state to solve social problems).

Conclusions

Historically, the first social enterprises did not appear in the 1970s in Great Britain, but in 1925 in the USSR and Ukraine, which was then part of it. The idea of Soviet-style social entrepreneurship was discredited by coercion and discrimination.

None of the components of the concept of the "Triple Bottom Line" can be singled out as more important, because failure to comply with one of the indicators will distort the essence of social entrepreneurship. The statement that a social enterprise should be non-profit

contradicts the legal definition of "enterprise". All social enterprises have four characteristics: profit-making activities, social orientation, legality, and the absence of coercion and discrimination.

The main activities of social entrepreneurship are determined on the basis of its mission, it also determines the purpose of creation, operation, main tasks, expected results and their evaluation for a certain territory, community, business environment, local community, etc.

There is a lot in common between social and traditional enterprise, the difference is that traditional business can have a social focus or contain its elements, but for a social enterprise, the presence of such a focus is mandatory.

It is very difficult for people with disabilities to compete in the labour market, especially given the large number of registered unemployed in Ukraine. Despite the system of penalties established by current legislation, employers do not have sufficient motivation to employ people with special needs and try to avoid this. We offer several ways to solve this problem and ensure compliance with the law by companies interested in state support: first, it is necessary to strengthen control over the use of funds received by entrepreneurs from the state budget and which should be used to provide disabled people with jobs; secondly, to establish a provision according to which funds that were used improperly must be returned to the budget. For example, if instead of going to social needs, they were spent on business expansion.

Social enterprises can largely solve the problem of employment of people with special needs. It should also be borne in mind that there are companies that, depending on the circumstances, may change the nature of their activities. This, in particular, is about microcredit, because in the case when the organisation provides funds for the development of the SE – it is financing, and in the case when the organisation itself provides banking services to vulnerable groups, it operates as a social enterprise and in such conditions could apply for benefits. However, to date, the legal status of the SE has not been properly formalised and therefore remains uncertain.

The above confirms that there is an urgent need in Ukraine to develop and adopt a profile law on social enterprises and social entrepreneurship. In order to avoid ambiguity, all provisions of such a legal act must be clearly spelt out so that acts of corruption and falsification are impossible. The next step, after the adoption of this law, should be the development of a strategy for the development of social enterprises at the national and local levels.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE RELATIVE NATURE OF SUCCESS AND FAILURE – FUNCTION OF TIME AND CONTEXT
What can we learn from the History of three large-scale projects?[3]

In this paper, we study three long-term projects, with a life cycle of several centuries, where the environment and the economic conditions change: as well as the borders and the political regimes of the countries, the behaviours and the aspirations of men, the daily life and the perception of the world. For these large projects, their life cycle, including the classic stages of beginning, maturity and completion, the end may be far away... but sometimes it already gives an idea of the outcome of the project. To show the relativity of their success and failure, we have chosen to evoke three large projects of the same nature: whose failure or success can be appreciated nowadays. We will first study, respecting the chronology, the oldest waterway, the Canal du Midi, the most important large project of the 17th century (1667-1682), which was a success as long as it enjoyed a natural monopoly. We will then evoke the Suez Canal, which was a success, and which remains so (1859-1869). Finally, we will study the Panama Canal, which was a resounding failure under the French government (1881-1903), but which later became an undisputed success when completed by the Americans (1904-1914). Many factors have modified the destiny of these great projects, and we will try to analyze them. For these three projects, we have used archives and testimonies somewhat forgotten in time, which raises our second objective – to inform and communicate the existence of these resources because their volume requires much more effort than ours.
Keywords: Large project financing; Controversial markets; Natural monopoly; Large project risks; Man-made waterways
JEL: N60; N61; N63; N65; N65; N70; N71; N73; N75; N77; O18

1. Introduction

"Nicaragua has awarded a Chinese company a 100-year concession to build an alternative to the Panama Canal, in a step that looks set to have profound geopolitical ramifications.

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[2] *Dr. Jean-Guy Degos +, Emeritus Professor, Bordeaux University.*
[3] This paper should be cited as: *Atanasov, P., Degos, J.-G. (2022). The Relative Nature of Success and Failure – Function of Time and Context. – Economic Studies (Ikonomicheski Izsledvania), 31(5), pp. 46-70.*

The president of the country's national assembly, Rene Nuñez, announced the $40bn (£26bn) project, which will reinforce Beijing's growing influence on global trade and weaken US dominance over the key shipping route between the Pacific and Atlantic oceans."[4]

Can we build, today, such a large-scale projects that our ancestors have built before? What can we learn from History?

When we talk about great projects, since ancient times, we think of architectural projects, such as the Hanging Gardens of Babylon, the pyramids of Egypt, the Great Wall of China, the cathedrals, or more recent projects, such as the first trip to the Moon. But all these projects, which are great projects, don't have the same nature: some are one-time projects with a single objective, and as soon as this objective is reached, we can say that the project is a success, as the first steps of Neil Armstrong on the Moon (Apollo 11 Mission, 21.07.1969). Other projects are not one-time projects and they must necessarily be long-term: and over a period of several centuries, where everything changes, countries, people, borders, behaviours, daily life, it is difficult to have a permanent success. For long-term projects, there seems to be a life cycle, with a beginning, a maturity generating success and an end. Sometimes the end is still a long way off, but sometimes it has already taken effect. Large projects with a certain lifespan are not always permanently successful, but they are not always unsuccessful either. To show the relativity of the success and failure of projects, we have chosen to focus on three large projects of the same nature: the drilling of three canals, projects that have been going on for a long time and whose failure or success can nowadays be appreciated. We will first study, respecting the chronology, the oldest waterway – the Canal du Midi. The project was the most important major project of the 17th century, which was a success as long as it enjoyed a natural monopoly and which became a failure when another monopoly, that of the railroad, appeared. We will then discuss the Suez Canal, which was, despite vicissitudes and difficulties, a success, and remains so, but we will study it before its nationalization by the government of Lieutenant Colonel Gamal Abdel Nasser. Finally, we will study the Panama Canal, which was an abysmal failure under French governance, and which later became a very profitable project when the Americans took over. We are thus in the presence of a project with mixed success – the Canal du Midi; a project with undeniable success – the Suez Canal; and a third project that was a failure for the French management – the Panama Canal. In each case, we will try to analyze the favourable and unfavourable factors that modified the destiny of these great projects, and we will try to draw lessons from them.

2. Methodology

Our research represents a historical investigation and analysis of documents, books and articles that describe the genesis, the establishment and the completion of the three projects.

[4] Nicaragua gives Chinese firm contract to build alternative to Panama Canal – The Guardian, 06.06.2013.

2.1. The canal du Midi

Our primary source, concerning the *Canal du Midi*, was the documents registered in the "Archives du Canal du Midi", supervised by the Inland Waterways of France in Toulouse (France). Archives are classified in a systematic way and represent 3 series of documents, divided into bundles and grouped by themes: 906 bundles in 26 themes. Thus the "Construction of the canal" (as a separate topic) gathers the first 62 bundles. There is also the correspondence between Paul Riquet and Jean-Baptiste Colbert[5], who deals exclusively with the technical elements of the project. The second series of archives concerns the accounting of the origins of the channel. It contains the folders from 910 to 1197 (according to some documents of Mr Borel from 28.05.1664 to 14.04.1665), from the year 1665, prior to the construction of the canal, until the end of 1684.

The third series of archives, concerning the accounting and the statistics, records the accounting of the accelerated navigation of the canal. The service was active until the development of the railroad (1830-1848). The third series consists of 40 boxes of unclassified records. Inside each box are preserved the monthly and annual summary schedules as well as the revenue and, often, the river freight bills justifying the income and indicating the nature of the transported products. We used the official documents registered in the archives of the channel, such as the act *"Edict du Roy, pour la construction d'un canal de communication des Deux Mers, Océane et Méditerranée, pour le bien du commerce"* (1667, Printing House Rellier, Toulouse), the act *"Procès-verbal du bornage du Canal de Languedoc"* (1784, Printing House Jean Martel, Montpellier) as well as the detailed invetory *"Recueil des lois, décrets, ordonnances, décisions et arrêtés relatifs aux actions du Canal du Midi, au profit des héritiers de Riquet de Caraman"* (1852, Printing House Le Normant, Paris). We also used some secondary sources, such as the work of General Antoine-François Andréossy *"Histoire du Canal du Midi connu précédemment sous le nom de Canal du Languedoc"* (Andreossy, 1799).

2.2. The Panama Canal

We used, as primary sources, the documents registered, since 1993, in the National Archives of the world of decentralized work in Roubaix. The documents, of the Companie Universelle du Canal de Panama, appear under the topic 7AQ. Hereby we present the information that was used in the research:

- 7AQ2: Debt issuance's conditions in 1880, 1882, 1883, 1884, 1886, 1887, 1888; General Assembly of the Companie Universelle du canal interocéanique; reports of the Board of Directors;
- 7AQ3: AQ11: Newsletters of the company, 9 volumes;
- 7AQ12: Judgment ordering the liquidation of the Companie Universelle du canal interocéanique;

[5] Jean-Baptiste Colbert is an exceptional person who occupies an important place in the History of France. At this period he is General inspector of finances then Secretary of State of the house of the king and Secretary of State to the navy.

- 7AQ14: Act relating to the liquidation of the Companie Universelle du canal inter-océanique (01.07.1893) appointing Mr Lemarquis as executor and Mr. Gautron, as co-executor;
- 7AQ17: Lawsuit of Panama;
- 7AQ46: Historical Record on the case of Panama, articles, judgments, legal consultations, etc.

These archives were amputated from many technical issues, a consequence of the transfer of the French concession to the Americans (16.04.1904). The archives of the Companie Universelle du canal interocéanique and its liquidation were given by Mr. Lemarquis (in charge of the liquidation from the 04.07.893, and executive director of Société Générale in 1950), to the National Archives on 03.10.1950. Mr. Lemarquis had committed himself, preserving these archives for about twenty years.

We also used some secondary sources such as: P. Bunau-Varilla: *Panama: creation, destruction, resurrection (Bunau-Varilla, 1892)* or: L.N.B. Wyse: *Panama Interoceanic Canal: Colombia Mission 1890, 1891* – a General Report about the plan and the project profile (Wyse, 1891).

2.3. The Suez Canal

Research has also been conducted at the Center of the World of Work Archives, located in Roubaix. The Centre is custodian of the archives of the Compagnie Universelle du Canal Maritime de Suez (property of the Association of Friends of Ferdinand de Lesseps). An authorization of consultation of the Archives was obtained from its President. The countable and financial data were extracted from the original annual reports presented to the shareholders during the period of construction of the canal.

2.4. Currency estimation

A significant component in a historical research represents the actualization of the currency: the archives are sometimes written in pounds, *sols*, public funds of money (deniers) and sometimes in francs. The official birth of the franc goes back to 1360, by an ordinance of 05.12.1360 by John II the Good. This franc, representing a small amount of money (of fine gold), is called franc d'or. Later, the Decree concerning the weights and measures, known as the Law of 18 Germinal, Year III (07.04.1795), gives birth to the new franc d'or (the Republican logic which abolished the old physical measures to replace by the meter, litre or gram). Its adoption precedes by little the bankruptcy of the paper money (System of Law). The franc is then a devaluated currency, but it replaces the pound (1 franc = 1 pound) without currency manipulation. The franc will become a strong currency with the law of the "germinal franc" of the 7 germinal year XI (23.03.1803), which defines its value by reference to money and gold. Thus to interpret the monetary tables of the archives, where there are pounds and francs, it is necessary to consider the "approximate" parity between the two.

3. The "Canal du Midi"[6] and the "Garonne Lateral Canal" (1667-1682) – A Great Project with Mitigated Success

The construction of the Canal du Midi, later complemented by the Canal Latéral à la Garonne, challenged common sense and measure. The construction, archaic but the object of a titanic effort, was a success thanks to the tenacity of its designer, Pierre-Paul Riquet.

3.1. Pierre-Paul Riquet, and the foundations of the Canal du Midi.

Pierre-Paul Riquet was born in Béziers, probably on 29.06.1609[7], and studied brilliantly at the Jesuit college of his native city, especially in mathematics and physical sciences. At the age of 19, he married Catherine de Milhau, a wealthy heiress who brought him financial stability and political support. He inherited a large fortune from his father in 1630 and with the support of his godfather, he was able to buy a position as a farmer of the gabelles and in 1651 became a sub-farmer for Languedoc. For 20 years, he preserved and increased his fortune thanks to the gabelles farm (the function was very profitable because the tax collector guaranteed the tax on his personal property). Occasionally, he was a supplier of ammunitions to the army of Catalonia, in Cerdanya and Roussillon. As sub-farmer general of the gabelles of Languedoc, he was still without fief and noble titles. In 1652, he acquired the ruined donjon of Monrepos (later renamed Bonrepos) and negotiated with the Consuls of Toulouse for full ownership of the fief, on the condition that he restore it to a state of defence and protect the neighbouring population in case of a threat. Purchase after purchase, he enriched and extended his domain with several hundred hectares of farmland. Bonrepos was the operational base, the logistical support point for Riquet in the construction of the canal. The water features of his property could help him in the realistic modelling of the canal, and he had a study room built in a dungeon at the corner of the castle. By the end of the 1650s, he was a wealthy man who enjoyed the support of the Archbishop of Toulouse, Charles-François d'Anglure de Bourlemont. Making effective use of his protections, he became Fermier général des gabelles du Languedoc. With the support of the Archbishop of Toulouse, on 15.11.1662, he wrote to Colbert[8], the King's Minister of Finance, about *"a canal that could be built in this province of Languedoc for the communication of the two seas, the Ocean and the Mediterranean"*, which was the real starting point for the construction of the Royal Canal of Languedoc, ordered to be built by King Louis XIV in 1666.[9] The digging of the canal began in 1667 and lasted 15 years, but despite his efforts and sometimes superhuman performance, Riquet experienced financial difficulties, insurmountable technical problems

[6] "The concern over architectural aesthetics and landscapes, which led its designer, Pierre-Paul Riquet, not only to succeeding in a technical achievement, but also to creating a work of art." UNESCO.
[7] His birth certificate has never been found in Béziers, nor his marriage certificate; his date of birth appears only on his death certificate.
[8] The correspondence with Colbert, which is important, appears in bundles 20-26 for the years 1662 to 1673, bundle 27 for the years 1674 and 1679. There are also letters from Colbert to the Marquis de Seignelay (liasse 28), letters from Riquet between 1667 and 1679 (liasse 29, letters from 1662 to 1673 (liasse 30), liasse 31: Letters addressed to Riquet, liasse 32: Letters addressed to Colbert between 1667 and 1672, liasse 33: Letters addressed to Colbert between 1664 and 1666.
[9] Edict of Saint-Germain-en-Laye, October 1666.

and all kinds of setbacks. On 01.10.1680, when he died, the canal was not finished. The canal was completed in 1681 and inaugurated on 24.05.1681 by Mr. Henri d'Aguesseau[10], the king's intendant in Languedoc. It took him 3 years to write the official report, which was published on 13.07.1684 (Canal Archives, liasse 14, pièce 07a).

3.2. Construction of the Royal Channel of Languedoc

The Canal du Midi, which necessity was felt since the earliest times, was constructed in the 17th century under the reign of Louis XIV. It shortens the distances between the Atlantic Ocean and the Mediterranean Sea by approximately 5,000 kilometres. The channel was built to facilitate the trade between the North and the South of Europe, allowed to circumvent the Iberian Peninsula and avoid crossing the Strait of Gibraltar, which was costly and dangerous in those times. There was a political purpose also: the rivalry between France and Spain. The Channel allowed so to avoid paying high taxes which are imposed by Spain during the passage of the Strait of Gibraltar. Technically, it is a junction canal with a sharing reach, which connects the lateral canal to the Garonne to the Mediterranean Sea. The channel culminates in 189 m at the beginning of Naurouze, his complete length is 257 km by counting the Pond of Thau (251 km without the pond). The Channel includes 65 sluice gates, among which several are numerous and represent 104 locks.

Table 1

Receipts, expenses, and net incomes of the Canal du Midi of France, in francs, during 106 years, from 1686 till 1791 (after 1791, the paper money was put into circulation and calculations became uncertain)

Series by 10 on 10 years	Receipts	Expenses	Net income by series	Average Net Income by series
1686-1695	1 812 749,90	906 502,81	902 247,09	90 224,70
1696-1705	3 323 591,38	1 124 484,96	2 199 106,42	219 910,64
1706-1715	4 951 950,50	1 853 943,94	3 078 006,56	307 800,65
1716-1725	4 004 570,61	1 494 180,95	2 510 389,66	251 038,96
1726-1735	4 017 991,61	1 795 970,83	2 222 020,78	222 202,07
1736-1745	4 156 966,27	1 928 875,87	2 228 090,40	222 809,04
1746-1755	6 280 274,20	3 016 004,88	3 264 269,32	326 426,93
1756-1765	6 697 109,67	2 614 479,71	4 082 629,96	408 262,99
1766-1775	7 623 986,22	3 879 540,29	3 744 445,93	374 444,59
1776-1785	9 881 346,56	4 385 884,65	5 495 461,91	549 546,19
Last 6 years				
1786-1791	4 724 545, 07	2 670 571,92	2 053 973,15	342 328,85
Total 106 years	57 455 081,99	25 670 440,81	31 784 641,18	31 784 641,18

Sources : Andreossy, 1799, p. 292.

Riquet had competent collaborators, such as François Andreossy, a meticulous cartographer who studied the Italian channels in 1660s, in particular the locks and the plans of works

[10] The intendant of Languedoc Henri D'Aguesseau, father of the chancellor and Keeper of the Seals Henri François d'Aguesseau, will take 3 years to write the report, published on 13.07.1684 (Archives du canal, liasse 14, pièce 07a).

attributed to Leonardo Da Vinci (multiple locks, hydraulic lifts, elliptic forms, etc.). Andreossy was the leveller, cartographer and planner of the canal. The work of his grandson, General Andreossy, includes unpublished information, such as the progressive table of revenues and expenditures and the net product of the Canal du Midi (Andreossy, 1799, p. 292).

3.3. Financial management of the project

According to several estimations the building of the channel would cost between 17 and 20 million pounds (or francs). The personal contribution of Pierres-Pauls Riquet is about 20 to 25% of the total amount. According to the assessments of A. Maistre (1979, pp. 92-93), confirmed by the archives of the channel (bundles 44-51), we have more details about the funding of the channel:

The adjudication of the construction of the canal was made in two lots, the construction from Toulouse to Trèbes, on the one hand, and the construction from Trèbes to the Etang de Thau on the other hand. The total amount of the project would be as follows:

1. Financing performed by the Royal Treasury: £ 8,484,050
2. Funding provided by the States of Languedoc: £ 8,070,202

Total paid by the government: £ 16,554,252

3. Personnel participation of Pierre-Paul Riquet: £ 4,022,592

Total cost price of the channel is: £ 20,576,844

Some transactions that have been double-counted must be subtracted:

- the auction on the encashment of the gabelles due by Riquet and assigned to the construction of the canal: £ 1,000,000;
- Sums coming from the revocation of Edicts: £ 1,983,333;
- second auction on gabelle's collecting: £ 442,483

A total of: £ 3,425,816

The total price of the Canal du Midi would be £ 20,586,844 - £ 3,425,816 = £ 17,161,028.

The total project has been funded as follows:

Funding section Toulouse-Trèbes: £ 3,630,000

To finance this first part, Riquet asked to be granted (Maistre, 1979, pp. 81-82.) by:

- the subrogation and the use of the farms and salt tax in the Languedoc-Roussillon Region for 10 years in the same way as the current tenants, Mr Langlois and Mr Belleguise. The amount of £ 1,000,000 will be paid by Mr Riquet in 8 years by 8 equal payments;
- the sale of "*regrats*" (salt sold at retail): £ 530,000;

- the discount of 5 sols for each allocated bushel[11]: £ 600,000;
- the sale of *septain*[12] rights: £ 100,000;
- the purchase of the fief of the first part of the project: £ 150,000;
- the channel toll: £ 50,000.

The total amount of £2,430,000 was insufficient but became official in the royal Edict of 1666. For the remaining £1,200,000, the king created offices to collect taille in Languedoc, a sum payable in eight years and eight equal payments. The use of the creation of offices, generators of cash, to replace a failing banking system, which was very understandable at the time, is reminiscent of current problems, where, in the subprime crisis, constraining banking management has been replaced by additional deregulation – when the bank creates problems, other techniques are substituted. In November 1666, the king created the offices of auditors of the accounts of the administrations, consuls and collectors of ordinary and extraordinary taxes in all the towns and parishes of Languedoc. It is expected that the sale of these offices will yield a profit of £150,000. The financing of the first enterprise having been carried out, it was necessary to study the second enterprise, whose financing was more uncertain:

Financing of the section Trèbes – Etang de Thau: 5 832 000 £

- the subrogation of the farms on iron mines, repurchases and expenses of various services, financed by the States of Languedoc: 2 400 000 £;
- payment from city hall of Montauban (called "La generalité de Montauban")[13]: 600 000 £;

[11] *Minot* – a measure unit, the *Minot*, has eleven inches nine lines of height, on a foot two inches eight lines in diameter. The *minot* is used to measure dried things, like grains, cereals, or earth. It contains three bushels. Four bushels is equal to a *setier*. But since the Romans and their *sextarius*, the setiers are different, depending on the regions and products. The *setier of Toulouse* is equivalent to 32 bushels, or 93.3 liters, but there are setiers of 156 liters.

[12] *Septain* – rights on a territory, dependent on a city (or area).

[13] *La Généralité de Montauban* is an administrative district of Guyenne created in 1635 and extended over two provinces – Rouergue and Quercy. Recettes générales, commonly known as généralités (French pronunciation: [ʒeneʁalite]), were the administrative divisions of France under the Ancien Régime and are often considered to prefigure the current préfectures. At the time of the French Revolution, there were thirty-six généralités.

Among the multiple divisions utilised for various purposes by the kings' administrators, généralités emerged gradually from 14th to 16th centuries. Initially fiscal, their role steadily increased to become by the late 17th century – under the authority of an intendant (reporting to the Controller-General of Finances) – the very framework of royal administration and centralisation.

Before 14th century, oversight of the collection of royal taxes fell generally to the baillis and sénéchaux in their circumscriptions. Reforms in 14th and 15th centuries saw France's royal financial administration run by two financial boards which worked in a collegial manner: the four généraux des finances (also called général conseiller or receveur général) oversaw the collection of taxes (taille, aides, gabelle, etc.) and the four trésoriers de France (treasurers) oversaw revenues from royal lands (the domaine royal)…] *Wikipedia.*

- payment from the cities of Foix, Nébouzan, Bigorre: 90 000 £;
- the remaining funds were advanced by King Louis XIV.

Construction of the harbour of Sète (This): 1,080,000 £

A third investment made by Riquet was the construction of the harbour of Cette, now named Sète. He obtained this contract from the royal authorities for £1,080,000, partly funded by the maintenance fees paid by the city (£33,000 for ten years, i.e. £330,000). Riquet obtained in perpétua the fishing rights of the harbour of Sète and those of the canal to be built on the Etang de Thau. The difference was to be funded by the revenue from the gabelles.

The construction of the canal was a complex operation, but its financing was not simple either. Global monetary management, forward planning and immoderate recourse to borrowing were the key words for the financing of this project.

3.4. The end of a natural monopoly and the beginning of another

"The arrival of the railway in the area killed the waterway transport of the river" (Minovez, 1999. The Canal Latéral à la Garonne, an extension of the Canal du Midi, was obsolete almost before it was put into service, a project for a Pyrenees Canal was never built, nor was that for a large capacity maritime canal, likely to link Bordeaux to Narbonne and allow large commercial ships and warships to pass from the Atlantic to the Mediterranean. One of the central strengths of the river navigation was the strong demand and trade of the city of Toulouse, but Toulouse itself had the claim to become an important railroad junction in the center of a dense network, and the city ended up preferring the railroad, after much struggle and procrastination. The railroad has for him its novelty, its modernity, and its adaptation to the industrial techniques of the 19th and 20th centuries. Its characteristics make it a natural monopoly and even a double natural monopoly{Numa, 2009 #116). A natural monopoly exists in a sector of activity when the availability of economies of scale favours a single company capable of ensuring the supply and services of an entire market. The Compagnie du Canal du Midi had obtained ownership of the Canal after the decree of March 10th, 1810, which allowed it to lease it to the Compagnie du Chemin de fer du Midi, which also owned the Canal latéral à la Garonne. The lease was for a period of 40 years and was subject to strict conditions such as the obligation to pay off debts existing at the time of the lease, and to administer and pay for the improvement of the waterway. The Compagnie du chemin de fer du Midi worked to divert customers from the canal to rail. After many ups and downs, the State decided to buy back the canal. On October 26th, 1897, a bill was adopted by the Chamber of Deputies, and then by the Senate, and the law of repurchase, voted on November 27th, 1897, was promulgated on December 3rd, 1897.[14] The State took possession of the canal in 1898, but the arbitration commission charged with calculating the compensation to be paid to the owners submitted its conclusions on February 1st, 1901, two and a half years later. It awarded the Compagnie du Canal du Midi a 3 % annuity of 750,000 francs, with an effective date of July 1st, 1898, without giving the reasons or details of its decision. We can think that

[14] In the Journal Officiel of 03.12.1897, where the law of 27.11.1897 appears, pp. 6766-6768, the two conventions of 03.11.1896 are annexed to the law.

the commission settled for making a simple arithmetical average between the claims of the Compagnie du Midi, which wished to obtain an annuity of 1,500,000 francs and the State, wished to pay nothing. It is specified that all the accounts "pending or reserved between the State and the Company will be definitively settled, without any addition or reduction being made for any reason whatsoever". For the two canals, the Canal du Midi and the Canal Latéral à la Garonne, the State also assumed responsibility for personnel and maintenance, which, after deduction of state revenues, represented an additional annual expense of 1 million francs. Since 1956, the Canal du Midi has been conceded, according to the General Code of the property of public persons, to the public office of the Voies Navigables de France. But its boundaries are those fixed by the original fief granted to Pierre-Paul Riquet in 1666 and then fixed by the official reports of 1772. The French State is the owner of the *Canal des deux mers* and took effective delivery of it on 01.07.1898, but since its purchase, the *Canal des deux mers* (Canal du Midi and Canal latéral à la Garonne) is only a shadow of its former self. The rail and road have confined it to a tourist role. It was classified in 1996 as a world heritage site by UNESCO, being the second channel, classified (in 1996) as a World Heritage of Humanity by UNESCO. The other one is the Canadian Rideau Canal.

4. The Suez Canal before Its Nationalization (1859-1869) – A Successful Major Project

There is little in common between the South of France – mountainous, with rugged to irregular hydrography, with a watershed and a temperate climate; and desert Egypt, where sand dominates, or even equatorial Panama – a realm of rain, wind, and storms (most of the year). Robert Courau (1932) and André Siegfried (1941) have analyzed accurately the two major projects of Suez and Panama and we recall in the next two sections some aspects of the construction and life of these two canals and their influence on the evolution of the world maritime routes.

The Suez Canal has a length of 161 km, 193 if we consider the diversion channels in the Red Sea and the Mediterranean Sea. Its original dimensions, a width of 54 meters and a depth of 8 meters, were modified many times to remain today with a width of 170 meters, but it is doubled for 67 km and its depth is 20 meters. It connects the city of Port Said located on the Mediterranean Sea and near Lake Manzala, to the city of Suez, north of the Red Sea. On its road several salt lakes – the Small Amer lake, the large Amer Lake and the Lake Timsah punctuate its road. The canal is lined with a railway and a road tunnel under the canal was built in 1981. The site of the canal is thus a privileged set of communication routes. Completed in 1869 under the direction of Ferdinand de Lesseps, we can go from Europe to Asia without going around the Cape of Good Hope.

4.1. Ferdinand de Lesseps and the Suez Canal concession

The foundation of modern Egypt was established by Mehemet Ali (1769-1849), who created a real State. Despite his attempts, Mehemet Ali was not able to free Egypt from the tutelage

of the Sublime Porte[15] – the traditional suzerain supported by Russia. But he nevertheless laid the foundations of a modern nation by engaging European experts, by launching a policy of reform of the administration and the army, and by developing a policy of large public projects (Siegfried, 1941). He was aware of the strategic location of Egypt for France and England, concerning the trade with India and the Far East. Mehemet Ali was a friend of Ferdinand de Lesseps' father and when the latter arrived in Egypt in 1831, the viceroy entrusted him with part of the education of his 13th son, Mohammed-Saïd. On the death of the sovereign, Abbas I Hilmi became pasha in his turn, but was assassinated by two slaves on 13.07.1854, Mohammed-Saïd, his uncle, succeeded him. Grateful to his former mentor, on 30.11.1854, he signed a firman[16] granting the concession of the construction of the future canal to Lesseps. This firman, unilaterally modified six months later, complicated Lesseps' relations with the British Foreign Office for many years. But with this beginning of official recognition, Lesseps began the second part of his life. He was born in Versailles on 19.11.1805, into a Scottish family who had long been established in Bearn and the Basque Country. After studying law, he chose, like his father and brother, the consular career, which took him to Lisbon, Tunis, Alexandria and Barcelona. In spite of an exemplary career and a remarkable record of service, his tense relations with General Oudinot in Italy earned him a reprimand from the Conseil d'Etat and the first part of his career ended in 1849. Reflecting the work of the engineer Lepère on the possibility of a canal, and those of Savary on the establishment of a trading company in the East, his great idea took shape (Jeanne, 1941). Upon learning, in 1854, of the death of Abbas Pasha and the accession of Mohammed Said, Lesseps immediately congratulated Mohammed Said, who officially invited him to Egypt. There, on November 15th, he presented his project to create a company to build and manage the canal. The sovereign accepted it and announced, ten days later, in front of the general consuls and the viceroy of Egypt, that he had decided to open the Suez Isthmus and to entrust the project to an international capital company, established by Ferdinand de Lesseps (Siegfried, 1941). Only the British General Consul does not approve the project. The concession became effective on November 30th. Its duration was 99 years and at the end of the concession, the canal became the property of Egypt. To ensure the logistics of the construction site and to manage the finances, Ferdinand de Lesseps created the Compagnie Universelle du Canal Maritime de Suez.

4.2. Construction and opening of the Canal de Suez

The granted concession was challenged by the United Kingdom, which throughout the works engaged, directly or indirectly through Turkish or Egyptian or even French intermediaries, in a war of attrition on many fronts.

[15] Egypt was under the dependence of the Sultan of the Ottoman Empire, and it was governed by a Viceroy. The Sublime Porte was the gate of honor of the Topkapi Palace, the Vizirat of Constantinople, the seat of government of the Sultan, Master of the Empire. The Sublime Porte was the diplomatic term used in Europe in the foreign ministries to refer to Turkey or Constantinople, depending on the context. It is in 1936 that the Turkish name of Istanbul will be definitively imposed.

[16] A firman (decree in Persian) is a royal text promulgated by a sovereign of an Islamic country (Turkey, Iran, Mughal Empire).

- *Establishment of the company:* The first step is the creation of the Universal Company of the Canal de Suez. It was created in 1858 after the three official firmans concerning the Concession of 1854, 1855 and 1856. The capital of 200 million francs is divided into 400,000 shares of 500 francs par value (Statutes, Article 6): there were subscribed 207,111 shares by French investors (51.77% of the capita), 177,642 shares by the Viceroy of Egypt (44.41%), and 15,247 shares for foreigner investors. Only 10 Egyptians bought shares. According to the Statutes (Article 7), the securities are denominated in German, Italian, Turkish, English, and French. The company is run by a board of Directors (32 members), where the directors are appointed for eight years. A Management Committee of four members is headed by a President. Each Administrator must own 100 shares. The president is assisted by three vice-presidents. General Assemblies may only deliberate if a quorum of 1/20 of the share capital is present. Article 51 of the Statutes, skillfully drafted, states that 25 shares have 1 vote and that a shareholder cannot have more than 10 votes: thus, the Viceroy of Egypt, with 177,642 shares, had only 10 votes and when he gave its participation to England, they had only 10 votes. This limitation was common in the customs of the time. The distribution of profits, under section 63, was as follows:
    - 15% for the Egyptian Government;
    - 10% for the founders;
    - 3% for directors;
    - 2% in a pension fund;
    - 70% for the shares, depreciated or not.

The Viceroy's 177,642 shares were paid by *sanal tanab* – Egyptian Treasury bonds (Convention of August 6th, 1860).

- *Cost estimation:* The original budget was 200 million francs[17]. But the budget has been exceeded and the expenditures in 1869, at the end of the construction, were 432 million francs. The company was saved from bankruptcy only by the willingness of a couple of investors who subscribed to a large amount of bonds. In 1929, the total cost had increased further to exceed one billion francs, but the franc had weakened considerably, and this amount is equivalent to 570 million euros today[18]. The financing of such an amount was provided, a half, from the initial capital and loans, and the other half from the future profits. In the early years, the construction of the canal employed, according to the firman of 1854, 25 000 fellahs, paid 3 or 4 dollars per day, food included. England, supported by the Egyptian Foreign Minister Nubar Pacha and the Duke of Morny, managed to overturn the clause of compulsory labour, and the works could continue, after the arbitration of

[17] To have an idea of the current (2021) equivalent, we can use the following methods: 1 franc 1860 = 15,23 francs 1999 and 1 franc 1999 = 0,20 Euro 2021 – a conversion coefficient of 1 franc 1860 = 15,23*0,20 = 3,046 Euro 2021. We can also use a parity based on gold: the 0,2902 gram of gold of a germinal franc (5 g. of silver to the title of 9/10 of end, law of the 17 germinal year XI, April 7, 1803) worth 14,44 Euro today (July 2021).

[18] Using the Franc-Euro converter of the French National Institute of Statistics (INSEE) updated in March 2013.

Napoleon III, with only 12 000 Egyptians paid more than before, and a lot of foreigners, often with a troubled past, such as some escaped Austrian criminals.

- *Capital and various contributions:* The subscribed 400,000 shares paid the 30% required by Article 12 of the Statutes, which is 150 francs per share, plus 150 francs the following year. The company committed to not make the 3rd call before 1861. The shares received a statutory interest rate of 5% per year on the amount paid up, until the construction of the canal. The results of 1871, 1872 and 1873, insufficient to pay the dividends, were compensated by consolidation bonds. In the end, they were paid as well as all the subsequent dividends. From 1891, the dividends exceeded 20% of the capital. The share price, 500 francs par value, experienced mixed fortunes – down to below 200 francs between 1866 and 1872, but exceeding 1000 francs in May 1880, and 1250 francs in December 1880 just before the crisis of 1929, the title worth 26 500 francs, or about 80 719 of our current Euro (2021).
- *Subscribed bonds:* the initial capital of 200 million francs equalled the first investment, which, we have seen, was far exceeded. It was, therefore necessary to issue 423 million bonds and 34 million consolidation bonds with 8% of interest (a total of 457 million francs equivalent to 1,39 billion Euros today). For the loan management, Ferdinand de Lesseps decided to not use a bank, refusing the deal from the Rothschild and Fould's bank. He considered that the bank commissions were exaggerated and decided to ask the public directly, mainly in France. For that, Ferdinand de Lesseps rented a place in Paris – place de Vendome, for the modest sum of 12,000 francs.
- *Inauguration and opening of the canal*: the Empress Eugenie inaugurated the canal on 17.11.1869 – the Emperor Napoleon III, suffering, could not travel. There was an opportunity for the Viceroy of Egypt to show that his country was a modern, worthy to be compared with the great European nation states, and he treated royally the hundreds of guests. They mobilized the entire Egyptian population to clean up the area around the canal (rat hunting, cleaning houses) to honour the procession of 77 ships taking part in the official opening of the canal. A religious ceremony involving Muslim and Catholic faiths gave the signal for departure. The Eagle–the French Imperial ship with Empress Eugenie on board, and the Greif – the ship of the Austrian Emperor Franz Joseph led the procession. According to the journalists, the inauguration banquet of the ceremony would have cost two million francs. This event should not make us forget that about one and a half million Egyptians took part in the canal's construction and that about 125,000 died, mainly from cholera.

4.3. The International life of the Suez Canal

- *England takes the financial control of canal*: The expensive lifestyle of the Viceroy of Egypt led him into debt and he was forced to give the right to use his shares for a period of 25 years to Crédit Foncier de France.[19] The French government did not understand the

[19] Article 63 of the statutes of the Company stipulated that 15% of the profits would be paid to the Egyptian government. The Viceroy sold this participation to the Crédit Foncier de France in 1880, for

interest of such an investment, and it was Disraeli, head of the English government, who reacted in the right way: the viceroy had given an option to France for 92 million francs, equivalent to 4 million pounds sterling. With the authorization of Queen Victoria, who committed the guarantee of England, the Rothschild bank advanced the funds. The French bankers and the government did not object. This was not a bad thing, since France and England became co-owners of the canal, with France having a majority on the board of directors and England being the principal shareholder, whereas a canal owned exclusively by France would have raised many diplomatic problems in a region located on the road to the English Indies, where English ships carried more than 50% of the traffic. But the precaution of Lesseps, who had locked the governance of the canal company, with article 51 of the statutes, which specified that a single shareholder could not have more than 10 votes, was also required for England. The years 1869-1876 were difficult for the shareholders of the canal company, who were deprived of dividends, and for the Egyptians, who had to develop their country and suffered from the effects of the international economic situation, in particular the fluctuations in the price of cotton, during and after the American Civil War. The financial difficulties forced both the English and the French to create a condominium. But the stronger will of the English allowed them, with the agreement of the French and the Turks, to take over Egypt in 1882 and to consolidate their position in 1916 with the Sykes-Picot agreements approved by the Russians and the Italians, which divided the Middle East between France and England, but gave France control over Lebanese Syria (present-day Lebanon), Cilicia (Anatolia in present-day Turkey) and Syria, and left the United Kingdom to control Palestine and Egypt – and therefore the Suez Canal.

- *Science and Technology to the rescue of the canal*: The canal began to make substantial profits when steam navigation replaced sail navigation: the Red Sea and the canal are areas of light winds, unlike the Atlantic or the Indian Ocean. It was not until the number of steamships (only 5% in 1859 when work began) increased and their speed exceeded 20 knots per hour, and their coal consumption became lower, that transport by modern ships was preferred to transport by sailing ships – slower but less expensive. From that moment on, the canal was able to establish its superiority over routes such as Liverpool-Bombay (6,223 miles via Suez instead of 10,680 miles via Cape Town, a saving of 42 per cent), or Liverpool-Yokohama (14,436 miles via Cape Town and 11,113 miles via Suez, a saving of 24 per cent). An adjustment of the rates increased the superiority of Suez on the long routes (Siegfried, 1940, pp. 82-86). In 1888, the Treaty of Constantinople gave the Suez Canal international status, which has not always been respected.

- *International Incidents and World War I*: A first serious incident, called the Aqaba incident, took place between the Turkish Empire and Britain, concerning the Hijaz railway project planned by the Ottoman Empire. The United Kingdom considered this project to be a threat to Egypt and the Suez Canal and threatened the Ottomans with war. The Ottomans, fearing a naval battle at their disadvantage, gave up the project after the crisis. Almost 10 years later, the Suez Canal was caught up in the First World War: on

22 million gold francs for a period of 25 years. The CFF entrusted the management of this fortune to one of its subsidiaries, the Société civile pour le recouvrement des 15% du Gouvernement égyptien.

28.01.1915, the 4th Turkish army of Djemal Pasha attacked the British army stationed in Egypt, in order to take control of the Suez Canal. The United Kingdom, under the command of Major General Maxwell, inflicted heavy losses on the Turkish army, which withdrew to its initial positions on February 3rd. A few days later, England and its allies launched the Dardanelles offensive, both land and sea, to seize Constantinople.

After the First World War, the canal continued to flourish: 486 crossings were recorded in 1870, but 6,635 in 1937 (Siegfried, 1941, p. 91). The most dramatic events were the nationalization of the canal in 1956 and the Six-Day War in 1967. Today, despite these terrible crises, the canal is still a geostrategic gateway of the greatest importance: 14% of the world's maritime traffic passes through it, i.e. about 20,000 ships per year. The Universal Company of the Suez Canal became a financial company, the Suez Financial Company, founded with the indemnities received after the nationalization of the canal in 1956 and developed thanks to the judicious purchase of non-operating assets acquired with the retained profits. It later merged with Société Lyonnaise des eaux et de l'éclairage (SLEE), founded in 1880, to form the Suez group, which merged with Gaz de France in 2008. The GDF Suez group is the world's second-largest energy group and the world's largest service company. The company was deprived of the canal, which has been managed since 1957 by the Suez Canal Authority, responsible for its governance and operation, and remains the world's largest canal. The second is the Panama Canal, which we will discuss in more detail below.

5. A Great Project that Failed: The Panama Canal in the French Version (1881-1903)

The Panama Canal is about 77 kilometres long. Between Columbus Bay (Aspinwall), located on the Atlantic Ocean, and Panama Bay, on the Pacific Ocean, it crosses a mountain, the Culebra, which rises to 98 meters above sea level. Making a trench in this mountain was the major difficulty in the construction of the canal, and one of the reasons for the failure of the Panama Canal Inter-Oceanic Company. The depth of the trench finally built was 55 meters and its length was 13 kilometres. Ferdinand de Lesseps wanted to build, as in Suez, a level canal, but to reduce the volume of excavations, the engineers who succeeded him preferred a canal with locks, and they considerably reduced the volume of materials to be evacuated. There are two series of locks on the Pacific side (Pedro Miguel Locks, Miraflores Locks), separating a central lake located 26 meters above sea level in Gatún. On the opposite side, there are three series of locks on the Atlantic side (Gatún Locks). Let's pass over the numerous failed projects to mention the one of the French Geographical Society, which sent to Panama Lucien Napoleon Bonaparte Wyse and a team of engineers (Wyse, 1886; Wyse, 1891), several of whom did not return. The real destiny of the Panama Canal was cast.

5.1. The difficult creation of the Universal Company of the Panama Inter-oceanic Canal.

Bonaparte Wyse[20], commissioned by the Geographical Society of Paris, made a precise topographical survey with his team[21] and prepared a project including tunnels and locks[22]. An initial discussion opposed him to Ferdinand de Lesseps, who was convinced of the superiority of the level canal. Wyse ended his mission by making an agreement with the Panama Rail Road, holder of the concession of the railroad since 1848, and with the Colombian government[23] for the concession of the inter-oceanic canal (Wyse, 1886; Wyse, 1891). Once these preliminary projects were completed, Wyse handed them over to Lesseps, who decided to prepare an International Congress for the study of the inter-oceanic canal, which was held in Paris in May 1879. Two preliminary projects were selected out of the 50 presented: a project in Nicaragua, with a long route and a cost of 770 million gold francs, and a project in Panama, with a route five times shorter but valued at more than one billion gold francs. Lesseps chose the second project, which required a very deep trench. The congress estimated the construction time at 12 years. The planned length of the canal was 74 kilometres, its depth 8 meters and its width 22 meters. The estimated cost of the project was 1.174 billion francs:

- 612 million for the work,
- 153 million – unforeseen expenses,
- 130 million – maintenance costs,
- 38 million – administrative and bank charges,
- 241 million – loan interests.

The Congress endorsed Ferdinand de Lesseps (Courau, 1932) and gave him a blank check. In June 1879, Lesseps quickly provided the two million francs needed to pay the Colombian government for the concession and to cover the initial set-up costs. On 05.07.1879, he bought the concession from Bonaparte Wyse, his studies, plans and contracts with the Panama Rail Road on behalf of the future company. On August 6th and 7th, 1879, the first issue of shares for 400 million was offered to the public, but it was almost entirely unsubscribed (30 million subscribed). F. de Lesseps then opted for communication: he gave conferences in France, North America, England, Belgium and Holland. During these conferences, subventions and bribes, modestly described as "largesse", were paid to the press and banks. "In October 1880, the canal company finally received the benefit of Ferdinand de Lesseps' efforts. The second share issue was a success[24]: the 300 million gold francs, or 1.5 billion paper francs, requested

[20] Lucien Napoleon Bonaparte Wyse was the great grandson of Lucien Bonaparte. He was a great entomologist, of Irish nationality, a lieutenant of ship. He reached his maturity as an entomologist in the 20th century.
[21] Of the eight engineers in his team, three will die in Panama.
[22] There was a choice between a lock tunnel, requiring less earthwork, and a level tunnel, requiring the digging of a deep trench. The second one was more expensive.
[23] On 18.05.1878, when the concession was granted, the Republic of Panama did not yet exist, and Colombia had the jurisdiction over the isthmus. French National Archives 7AQ 1.
[24] Syndicated agreement for the subscription of shares, archive 7 AQ 2.

were largely subscribed. The issue was doubled (600 million gold francs), but there was already a bad habit of paying the press, banks and people likely to make difficulties. The Compagnie universelle du canal interocéanique took over the assets of the Société civile du canal interocéanique du Darien, founded at the instigation of Louis Napoléon Bonaparte and managed by L. N. B. Wyse (Wyse, 1886; Wyse, 1891).

5.2. The surprises and difficulties of a mismanaged reality

What is the difference between a lock canal and a level canal?

A level canal is a canal that will connect two water basins that have a similar water level – example: the Corinth Canal (1882-1893).

A lock canal is a canal that must play with important differences in level, both in the water basins and in the terrain to be crossed – for example: the Canal du Midi, and the Panama Canal (in the second stage).

In the case of the Panama Canal, we have an important difference in tides between the Pacific Ocean (where the tidal differences are between 5 and 6 meters on the east coast) and the Atlantic Ocean (where the tidal differences on the west coast are between 0.5 and 1 meter). But surprisingly, Ferdinand de Lesseps initially decided to go for a level canal, which was strongly disapproved by the engineers involved in the project at the time, including a certain Gustave Eiffel.

The studies of 1880 and 1882 estimated that between 75 and 120 million cubic meters of excavation would be required for a level canal. The canal with locks would have saved 40 million cubic meters.

By the end of 1888, the canal company had cleared 55 million cubic meters. Another 30 million cubic meters would have been needed. Of the 55 million cubic meters used by the French, the Americans used 23 million and still extracted 259 million cubic meters, four times more than the Suez Canal. The Americans lowered the bottom of the canal to 12 meters, instead of the 8 meters initially planned. The least we can say is that the preliminary studies were conducted with little care. It is important to underline also that at the time of these large projects, and in general, managers considered that the efficient management of companies and projects should be based on 3 pillars: production, finance and marketing. In fact, the first project management guidelines appeared in the 1990's[25] when they tried to generalize decades of experience in project management. In the case of the Lesseps version of the Panama Canal, each of the three pillars had significant flaws:

[25] One of the first books recognized as a Project Management framework is Linn Stuckenbbruck's work with members of the Southern California Chapter of PMI: The Implementation of Project Management: The Professional's Hanbook – Addison-Wesley Publishing Company, 1981.

5.2.1. The Production pillar

First, the lack of preliminary studies: Lesseps distrusted engineers, such as Gustave Eiffel or Philippe Bunau-Varilla, who had always preferred the option of a canal with locks, and he listened to the bad advice of men who were incompetent, devious and duplicitous (Degos, 2011). The lack of prior studies on volumes and costs was then aggravated by the neglect of time calculations. In the Panama project, there was no precise conceptualization of the project, no real preparation of the construction site (study of the times, study of the ranges of operation, coordination of the excavation works, transfer of the cuttings, consolidation of the riverbanks) – no scientific approach. The great authors of the organization, F. W. Taylor, H. Fayol, E. Mayo, will come later. As the preliminary studies and the setting up of the construction site were not thought out, there was no way to control the cost and time variances. It was the same thing at Suez, but Suez is a dated, traditional project, not a modern industrial project. The Panama project is anchored in the present of modern industry and its three imperatives of resources, costs and deadlines. What the engineers of the English railway succeeded at the beginning of the 19th century, the engineers of Panama, a few years later, were unable to reproduce (Cermoise, 1886). Those in charge of the canal company did not use all the civil and industrial engineering science that was available in their time, even if they were of excellent level, as the American engineers who took over from them recognized between 1904 and 1914.

5.2.2. Financial pillar

The range of financial and stock market resources available to Lesseps was small and rudimentary: shares, founder's shares, or bonds. These limited funds were badly used. The property titles and the founder's shares were distributed too generously, the debt securities were granted with too generous conditions, even if they were not scandalous, compared to the financial market of the time, a market which was far from being efficient and ensuring optimal choices.

5.2.3. Marketing and communication pillar

Lesseps had a very personal conception of marketing: trips offered to Panama, large receptions, large parties, banquets, financial gifts, checks to politicians, to journalists.[26] The sums paid to journalists and politicians (who sometimes wore both hats, like Clémenceau) were very opaque and could be described as advertising expenses, but also as an attempt at corruption. Ferdinand de Lesseps, obsessed with the canal, thought that the end justified the means.

[26] Ferdinand de Lesseps paid a lot of money to the press, a practice that was common at the time and to which Émile Zola testifies in his novel *L'Argent*.

5.2.4. The unexpected conditions

- *Yellow fever:* about 27,500 people died[27] on the two construction sites, French and American, of the Panama Canal between 1882 and 1914, from yellow fever without anyone really knowing what this epidemic was. It was only at the beginning of the 20th century that the Americans, successors of the French, solved this major and unforeseen problem, which did not exist in Suez. The Yellow fever every day brought its share of corpses[28] and gave the survivors a sense of precariousness that encouraged them to live their life in excess: gambling, drugs and prostitution. The labour force of the canal, which was available, attracted the dregs of humanity who saw a unique opportunity to make a fortune on the cheap. It was not easy to reconcile hard work and corrupting leisure.
- *The geographical conditions:* the climate in Panama is characterized by seven months of torrential rains and five months of drought. The option had been taken to orient the canal north-south (vertically in relation to the two poles), whereas the Atlantic-Pacific relations are of the east-west type (horizontally in relation to the two poles). Each year, it was necessary to preserve the work of the previous year and to divert the Chagres River, to avoid flooding. On the Atlantic coast, it rains six times more in Panama than in France, four times more on the Pacific side.

5.3. From the financial distress to the financial crash

The greatest industrial works of the last two centuries could only be achieved because their funding was rationally conceived and properly secured. The Suez Canal, the relocation of the Abu Simbel temple above a dam, the Apollo projects, are examples of this. The Panama Canal, on the other hand, is a combination of poor judgment, ignorance of the reality of the terrain and financial errors.

1880-1885: The period of normal funding[29]

An initial capital of 300 million francs was projected, and the costs represented 7.5% of the total, or 22.5 million, of which 9 million were for the financial syndicate's commissions. The amount of these expenses is not exorbitant for the time. The investment syndicate had a particularly comfortable position: the syndicate did not give any underwriting guarantee. It undertook to facilitate the emission and it paid 4 francs per share (for 10 000 shares is 40 000 francs). If the issue succeeded, the syndicate was reimbursed for its stake and received in addition 20 francs per share, in total 240 000 (net amount 200 000). If the issue failed, the syndicate lost 40,000 francs. More than a subscription with a firm commitment, it was an

[27] 21,900 workers died between 1882 and 1888, with some days having 40 deaths, but under American leadership there were another 5,600 deaths between 1904 and 1914, or about 27,500 in total. The Americans had finally solved the problem of yellow fever, but malaria, tuberculosis, cholera, diphtheria, and bubonic plague continued to take their toll. By way of comparison, the construction of the Palace of Versailles caused more than 100,000 deaths.
[28] Robert Coureau (1932, p. 149) notes that 27 engineers from the Ecole Centrale arrived in 1885 and 1886, and that 11 had already died in 1887.
[29] National Archives: Ref. 7 AQ 2.

option. The financial syndicates of the time were not really involved in the operations they were supposed to coordinate. As the National Archives file 7 AQ 2 shows, from 1882 to 1884 there were 935 million bonds issued (1880, 1882, 1883, 1884), plus 720 million in 1888. The first bonds had a nominal value of 500 francs and an interest rate of 3%; from 1884 the interest rate increased to 4%, with the addition of a substantial premium of 167 francs, resulting in an issue price of 333 francs and a redemption price of 500 francs. In 1883, the issue of 300 million bonds yielded only 171 million francs net.

1885 – 1887: The period of the first difficulties

In May 1885, Lesseps resigned himself to issuing loans in batches, after the third quarter of the capital had been called. The crisis began at the end of 1887. The Company had already obtained a total of 935 million, of which 225 million in shares and 710 million in bonds, representing a liability funding divided into 1/4 of equity capital and 3/4 of foreign capital. And in the 3/4 of foreign capital, there are not many assets in return. Financed by private funds not guaranteed by the state, the equity was insufficient. The canal, like the railroads, should have been financed with 10% equity in a liability guaranteed by the state, but the Panama Canal, far from France, did not have the same economic appeal at the time as a railway company that was a factor of economic progress and military security.

1887-1888: The period of the deep crisis leading up to the crash

From 1880 to 1888, cashless, the company increased the number bond issues but with varying success. A billion francs of shares and bonds were on the market, fully saturated. The latest call for funds was November 1888, which was the last chance: it would have taken 400 000 obligations for the company to survive (which concerns 350,000 savers). Lesseps gets government support to extend the three-month maturities of the debt, but the Chamber of Deputies, in December 15th, 1888, rejected the government's proposal by 256 votes against 181. In December 1888, Lesseps called Panama to stop the work. He knew he has lost, and he lost everything. There will still be a slight reprieve, because of the nearly two years' period before the company entered in liquidation, and before the scandal broke (Siegfried, 1941).

5.4. The questionable but inevitable fall of the Lesseps' project

On 05.02.1889, the court of the Seine pronounced the dissolution of the Universal Interoceanic Canal Company.[30] Ferdinand de Lesseps was a victim of his own negligence, of his ignorance of the Central American hard realities, but also of the financial world, which had reserved the advantages of Panama emissions[31] and of the unscrupulously greedy deputies. The government was reluctant to bring to light the Canal case. The nationalists – represented by Paul Deroulede, the Socialists – by Georges Laguerre, and the Royalists – by Baron Mackau, were divided between them, but they had a common interest to burst the

[30] Judgment of 04.02.1889, Archives 7 AQ 12.

[31] In the financial syndicate there were 9 banks with sometimes exorbitant demands: The Comptoir d'escompte, the Société générale de crédit industriel et commercial, the Société des dépôts et des comptes courants, the Société générale, the Banque de Paris et des Pays bas, the Crédit lyonnais, the Société financière de Paris and finally the Banque d'escompte de Paris.

scandal. The difficulties of the company were often used by those politicians to fight against their opponents. The government had tried to cover the scandal in June 1890 (attacked by Provost de Launay MP), in March 1891 (attack by Gauthier de Clagny MP), and in June 1891, just days before the canal company is stripped of its concession. The government, under the pressure of the deputies, accepts only to open an investigation. Gauthier de Clagny returned in charge, asking where are 718 million from 1500 million, for which the company cannot justify the spending. He was relayed by Mr. Delahaye (MP) denouncing many of his colleagues (the "chéquards"), who ended up by getting a commission of inquiry, the Committee of 33. The Committee established that Mr. Reinach, main corruptor of the Parliament, received 9,879,145 francs (testimony of councilor Prinet) and that he has distributed 4,390,475 francs in various checks (testimony of Mr. Thierrée – a banker). The government itself has received 300,000 francs (testimony of Georges Laguerre). From September to November 1882, journalists tried to finish the company.[32] To appease the spirits, on 17.12.1892, Charles de Lesseps, Fontanes and Cottu – administrators of the company, are incarcerated. Councilor Prinet, who was in charge of investigating the case, submitted his final report to the General Attorney in June 1892, aware of the relative weakness of his arguments. The French period of the canal ended up with several trials, a main trial for fraud, cancelled for F. de Lesseps because of procedural weaknesses[33], and an accessory trial for corruption. In the Panama cases and trials, Ferdinand de Lesseps and his son failed miserably, but above all, the political morals of the French Republic and its justice system failed.

In 1894 the polytechnic engineer Philippe Bunau-Varilla, created the new Panama Canal Company, which cannot survive, and Bunau-Varilla (1892) sold, on 10.11.1903, the rights for the exploitation and the construction of the Panama Canal to the United States. The engineers of the US Army, under the leadership of the Chief Engineer Colonel George Washington Goethals, have developed a new project involving the construction of three sets of locks and the creation of an artificial lake – the Lake Gatun. After more than ten additional years of work and an additional budget of 2 billion gold francs spent to buy the French company, to build military defenses, to widen and to deepen the waterway, the canal was finally completed and inaugurated on 15.08.1914 – the first day of the First World War. The ship Ancon inaugurated the crossing. The Canal remained under US administration until

[32] In particular Edouard Drumont in his newspaper La libre parole. Drumont had already published the anti-Semitic pamphlet "La France juive" in 1886; the Boulangist newspaper La cocarde accompanied La libre parole in its demolition. By linking La France juive, the Jews and the Panama scandal, Drumont was heavily responsible for the development of anti-Semitism in France, culminating in the Dreyfus Affair in 1895. Archives 7 AQ 15 and 7 AQ 16 present the report made on behalf of the commission of inquiry and the testimony given before the commission.

[33] Ferdinand de Lesseps never went to prison. According to article 479 of the Code of Criminal Investigation, which was specifically referred to in the law of 20.04.1810, concerning the grand officers of the Legion of Honor, he should have been summoned directly, the only way to interrupt the statute of limitations which had been running since 1888. However, the act of the Public Prosecutor, who had proceeded with a simple indictment, did not interrupt the statute of limitations, and at the time of the judgment, all of the facts charged were time-barred, and the defendants were released on 16.06.1893.

1979, when it was reassigned to Panama (Treaties Omar Torrijos[34] – Jimmy Carter). The Panama Canal (14,000 ships, or 5% of the world trade[35]), currently managed by the Panama Canal Authority is planning to exceed the Suez Canal, its direct competitor, for the transit of container ships and liquefied natural gas. Work almost as important as that of its construction, required the pouring of 4 million cubic meters of concrete, new locks of 4,200 tons can accommodate Post-Panamax ships of 420 meters long[36].

6. Conclusion

The three canals we have just studied have several points in common: despite their respectable age and the ups and downs of their life curve, they still exist and for two of them, are doing better than simply surviving. Their life curve, all things being equal, includes an initial launch phase, at the time of the feasibility study, financing and construction, then a more or less chaotic take-off phase, a maturity phase and a decline phase. The first canal, the Canal du Midi, has undoubtedly a new life which is devoted to the green tourism.[37] As for the other two canals, Suez and Panama, they have not yet experienced their phase of decline, and they are adapting, sometimes with considerable effort, to the new situation of international trade and maritime navigation, which requires increasingly large tonnages to be transported. Transport volumes are now considerable and ships, whether tankers, ore carriers or container ships, are very large. A new approach to global transport logistics has emerged and is developing. At one point or another in their life cycle, the three channels mentioned above have had the advantage of a natural monopoly, and they have also benefited from the fact that this natural monopoly could not be challenged. But sometimes, the conditions of competition have changed and the authorities responsible for managing them have had to draw the consequences, but this has not always been possible: Suez took advantage of the emergence of steamers to turn what might have been a problematic nature of sailing ships and wind into an advantage, but its administrators had no influence on this technological evolution. In the same way, the technology of oil and gas pipelines, or of the construction of hyper-tankers, was a factor to be considered, not a parameter to be modified. But nothing is

[34] Omar Torrijos was the father of Martin Torrijos, Panama's recent president from 2004 to 2009, who once again re-launched the work to modernize the canal.
[35] Reuters.
[36] The main constraint – and the main weakness – of canals is their gauge: the old French canals had a modest gauge, and in the 19th century Freyssinet tried to increase it. Then, the European canals had a larger gauge, but still insufficient to compete effectively with other transport means. The Suez Canal can only accept Suezmax ships and the Panama Canal can only accept Panamax or post-Panamax ships. The largest ships built by mankind, the VLCC Very Large Crude Carriers, which can carry 150,000 tons, and the ULCC Ultra Large Crude Carriers, which can carry 300,000 tons, cannot pass through the Suez Canal, the Panama Canal or, a fortiori, any other European canal. These huge vessels can only transit the Cape of Good Hope and Cape Horn, and their competitors can only be oil pipelines, on certain continents, but not on the major oceans.
[37] According to a survey conducted in 2019 by Voies Navigables de France (VNF) – the national operator of inland waterway activities in France – inland waterway tourism in France generates an annual turnover of 1.4 billion euros with 15.6 million passenger-days and more than 6,100 employees working in the industry. More than 20% of this turnover comes from the Canal du Midi.

definitely won or lost. The Panamanian government has decided to considerably increase the capacity of the Panama Canal and to equip it with the most modern electronic equipment. The Egyptian Suez Canal Authority has approved a system that allows large oil tankers to be emptied at the entrance to the canal, to transit the oil through a pipeline parallel to the canal, and to reload oil tankers at the exit. All these technical solutions extend the "maturity" phase of the product life curve. The Canal du Midi has lost its advantage over the railroad, but perhaps it will find a new life in a context where ecology and sustainable development will take priority over unbridled energy consumption. Insofar as their traffic and turnover allow them to do so, the canals still have a role to play. The Suez Canal allows 20,000 ships to transit each year, i.e. 14%[38] of the world traffic; the Panama Canal is currently more modest, since it receives only around 14,000 ships and 9% of the world traffic[39], but its ambition is, with the improvements made in 2014, to overtake Suez one day, which may be possible depending not only on economic contingencies, but also on political and religious ones: the Middle East is much more unstable than Central America, which is now closely monitored by the United States, and this may be an obstacle to international traffic. On the other hand, Asian countries, led by China, have made the Panama Canal a privileged strategic issue to increase their market share in America. We must not forget that the main world maritime route passes through the major ports of Western Asia, crosses the Pacific Ocean, passes through North America, crosses the Panama Canal, then the Atlantic Ocean, and passes through Europe and the Mediterranean, thanks to the Suez Canal reaches the Indian Ocean and the loop closes on Eastern Asia, its starting point.

It should not be forgotten either that large projects, like small ones, are sensitive to traditional economic conditions: they depend on demand, their funding method, their prices, and their costs, absolute but above all relative to the competitiveness of other projects, and to technological developments. Like all human enterprises, even if they are driven by extraordinary feelings, they are subject to the common constraints of prices, costs, distances, and delays. The management that governs them must be neither frightened nor shy but must show imagination and creativity.

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ANNEX[40]

Technical and economical comparison between the Suez Canal and the Panama Canal

	Suez		Panama	
Work Kick-off	1858		1881	
Opening	1869		1914	
Actual Status	Active		Active	
Authority	Egypte		Panama	
Type	Sea-level canal		Lock canal	
	1870	2020	1914	2020
Overall length km	164 km	193,3 km	74 km	80 km
Width	61/91 m	313 m	33 m	33 m
Water depth	8 m	24 m	8 m	14 m
Max Draft of Ship	22 feet	66 feet	40 feet	50 feet
Max tonnage (DWT)	5 000	240 000	52000	240000
Transit time (hours)	40 hours	12-16 hours	no information	8-9 hours
Last year (2020):				
- Turnover (billion USD)		5,61		3,44
- N° Vessels		18 829		13 469
- N° tonnage (000)		1 170 000		475 200
Average tall per vessel (approximately)	$	300 000		255 000
Average cost per ton	$	4,79		7,25
Initial Cost	432 M Golden Francs		639 M USD*	
Actualisez (2021) cost	8,6 B USD		19,3 B USD	

* The initial cost does not consider the additional work to increase the capacity of the channels. Thus, according to Maurer and Yu (Maurer, Yu, 2008), the cost assigned to the construction of the Panama Canal is 287 M USD on the French side (equivalent to 9.17 billion USD in 2021 according to the GDP Deflator) and 352 M USD (equivalent to 10.13 B USD in 2021). For example, the expenses for the military fortifications (23 M USD in 1914) are not considered.

[40] All economic and technical information is retrieved from the websites of the Authorities that govern the two channels: historical data and financial statements. To cross-check this information, we have verified some data, when possible, in other information resources such as the Encyclopedia Britannica but also Lloyd's records and the US Congressional Library.

Year (* 366 days)	Suez				Panama			
	N° (Vessel)		Net Ton (1000)		N° (Vessel)		Net Ton (1000)	
	Total	Daily Avg.	Total	Daily Avg.	Total	Daily Avg.	Total	Daily Avg.
2010	17 993	49,30	846 389	2 318,87	14 250	39,04	300 800	824
2011	17 799	48,76	928 880	2 544,88	14 684	40,23	322 100	882
2012*	17 224	47,06	928 472	2 536,81	14 544	39,74	333 700	912
2013	16 596	45,47	915 468	2 508,13	13 660	37,42	320 600	878
2014	17 148	46,98	962 747	2 637,66	13 481	36,93	326 800	895
2015	17 483	47,90	998 652	2 736,03	13 874	38,01	341 000	934
2016*	16 833	45,99	974 185	2 661,71	13 114	35,83	330 000	902
2017	17 550	48,08	1 041 576	2 853,63	13 548	37,12	403 800	1 106
2018	18 174	49,79	1 139 630	3 122,27	13 795	37,79	442 100	1 211
2019	18 880	51,73	1 207 087	3 307,09	13 785	37,77	469 600	1 287

ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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TESTING FOR STRUCTURAL BREAKS IN THE GROWTH OF THE SERVICES SECTOR IN INDIA: A REASSESSMENT[2]

There has been an ongoing debate amongst economists about whether or not the economic reforms of the early 1990s induced a spurt in the growth of the Services sector in India. The focus of this paper is thus to analytically re-examine the nature and magnitude of the structural breaks in the growth of the share of the Services sector in the gross domestic product over 1950-1951 to 2013-2014 with an intention to further probe this issue. The results of this exercise show that the structural break in the growth of the share of the Services sector in gross domestic product occurred in the early 1980s, much before the economic reforms set in, coinciding with the hypothesis that the early 80s marked the structural break in India's economic growth. The increases in per capita incomes over 30 years since independence seemed to have led to the structural break in this sector in the early 1980s, plausibly because the demand for services is highly income elastic. There is no denying though that economic reforms in the 1990s helped in maintaining and propagating the growth of the Services sector triggered in the early 1980s. The sub-period analysis has also hinted at the slowdown in the growth of the Services sector, which could have serious economic implications in coming times.
Keywords: Services sector; Structural Breaks; Gross Domestic Product; Indian Economy; Dummy Variable Technique
JEL: C1; C22; H00; F63

1. Introduction

The Indian growth experience has defined most existent growth theories. It is well established in economic literature (Fisher, Colin Clark, Kuznets and others) that as an economy develops, the share of the primary sector in national income and employment declines leading to the rapid development of the manufacturing sector (Bhattacharya, Mittra Arup, 1989) in the second stage of development. And then, as per capita incomes further rise that is in the third stage of growth, the leading role in the economy is taken over by the Services sector. In India also, the Services sector has emerged as the largest and fastest-growing sector in recent years. Today, it is hailed as the engine of economic growth by many. It has reached the third stage

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(only in terms of G.D.P. share[3]), but by frog leaping the second stage; unlike the experience of other developed nations where there was a natural transition from industrialisation to services economy (Datta, Madhusudan, 1989). This peculiarity of having a large share of the Services sector in G.D.P. at relatively low levels of per capita incomes makes India's growth story very intriguing. Over the recent years, therefore this phenomenon has invoked the interest of many researchers in India as it does not corroborate with traditional growth theories. There has been an ongoing debate regarding the role of liberalisation in bringing about this spurt in the growth of the Indian economy (Wallack, 2003; Rodrick, Subramanian, 2004; Sinha, Tejani, 2000; DeLong, 2001) and also whether it would be sustainable in the long run. Many economists are of the view that economic reforms adopted in the early 1990s were the chief drivers of this spurt in growth, but others have debated that period around the early 1980s marked the break in the growth of India's G.D.P. Since the Services is the largest sector, contributing to G.D.P., so same arguments hold for Services sector growth also. In conventional wisdom, it is agreed upon that the economic reforms induced a spurt in the growth of the Services sector, but some economists have also pointed out that there may be multiple breaks in the growth of the services sector since independence (R.O.Y. Choudhury, Purba, 2016). In the light of the above debate, a reassessment or, to say, a re-examination of the timing of the break in the growth of the share of the Services sector becomes imperative. Examining the performance of the Services sector over the last six decades would throw direct light on the performance of the Indian economy and its prospects, thus the rationale for undertaking this study.

Most of the existing studies have explored the breaks in the growth of G.D.P. originating in the Services sector. But in this study, the structural breaks in the growth of the share Services sector in G.D.P. have been studied.[4] The relative growth of any sector is reflected in its share in gross domestic product. The contribution of any sector to the national income is a strong indicator of its performance over time (D'Souza, Errol, 2000). The change in percent share of a sector in gross domestic product occurs because of the difference in the rate of growth of output originating in that sector and the rate of growth of output originating in the rest of the economy, that is, all the other sectors taken together (Dutt, Lee, 1993). It follows quite logically that if a sector has a higher rate of growth of output compared to the output in the rest of the economy, then its share in G.D.P. will increase over time; if it has a lower rate of growth of output compared to a rate of growth of output of all the other sectors combined then its share in gross domestic product share will decline, and if it has the same rate of growth of output as the rate of growth of output in the rest of the economy than its share in G.D.P. will remain constant (Kuznets) (Gujarati, 1995). The changes in the relative share of the Services sector in G.D.P. thus would capture the true picture underlying the growth of this sector.

So this paper attempts to analyse the growth trends and test for structural breaks in the share of the Services sector in a G.D.P. over the sixty-three-year period from 1950-1951 to 2013-2014 period as the data at 2004-2005 constant prices is only available for this period

[3] The share of the Services sector in employment is lagging behind and does not correspond with its share in G.D.P.

[4] A relative measure of a phenomenon is any time a better measure compared to studying any absolute measurement of the same thing.

(Kuznets, Simon, 1961). The availability of data at the same base year till 2020-2021 does pose a limitation to this study. Due to the changes in the methodology and definitions of some subsectors of the Services sector for which concordance is not available so splicing of data was also not used as it would unnecessarily distort the results. Since the paper is based on the share of the Services sector in G.D.P. and not on the Services sector G.D.P. in absolute terms, therefore the results remain meaningful full as the changes in the G.D.P. originating in any sector do not get reflected immediately in its share in G.D.P. The change in G.D.P. share happens slowly over a period of time. Also sixty-four-year period is a sufficiently long time to capture the trends and breaks in trend.

The main objective of this paper is to analytically describe the nature and magnitude of trends in the share of the Services sector in G.D.P. and then test for the structural breakpoints in these trends using intercept and slope dummies. The dummy variable technique is, chosen over the unit root testing of structural breaks because, in the case of Services sector growth in India, there are sufficient plausible breakpoints that can identify a priori. Therefore, the dummy variable technique was considered to be more suitable as blindly trying for the breakpoints was not required. For testing structural breaks, five major watersheds or breakpoints were broadly identified in the evolution of the Indian economy and polity over this period of six decades.

To begin with, the theme is introduced in section one. Then the trends in the share of the Services sector and other major sectors in G.D.P. from 1950-1951 to 2013-2014 are examined in section two (Nagraj, 1991). After that, we take up the question of stability and break in the trends in these shares over these 64 years in section three and explore the breaks at five important points in the evolution of the Indian economy over this period of six decades. In section four, an attempt was made to locate the singular most important breakpoint in the share of the Services sector using multiple dummies and probe the issue of whether economic reforms were responsible for turning around the growth of this sector as claimed by many researchers (Panagariya, 2004). Lastly, the conclusion is summed up in section five.

2. Changes in The Share of Services and Other Sectors in Gross Domestic Product: 1950-1951 To 2013-2014

To begin with, a simple comparison of the percent share of the three sectors in the gross domestic product at constant prices (at 2004-2005 prices) over the 1950-1951 to 2013-2014 period gives a bird's eye view of the changes in the structure of Indian economy. The Services, Secondary and Primary sectors are defined in this study on the lines used by C.S.O.[5]

[5] For ready reference these definitions are as follows: SERVICES SECTOR: It includes the following seven sub-sectors: (i) Trade, Hotels and Restaurants; (ii) Railways; (iii) Transport, Storage and Communication other than Railways; (iv) Banking and Insurance; (v) Financing, Real Estate and Business Services other than Banking and Insurance; (vi) Public Administration and Defence; (vii) Community, Social and Personal Services other than Public Administration and Defence. SECONDARY SECTOR: It includes: (i) Manufacturing (registered and unregistered); (ii) Electricity, Gas and Water Supply; (iii) Construction. PRIMARY SECTOR: It includes: (i) Agriculture and Livestock; (ii) Forestry and Logging; (iii) Fishing; (iv) Mining and quarrying.

The summary information on the percent share in G.D.P. of the Services sector and other two sectors at different points of time over the 1950-1951 to 2013-2014 period is presented in Table 1.

Table 1

Sectoral Shares in G.D.P. at factor cost at 2004-2005 Prices

Period (Average for triennium ending)	Percent Shares in G.D.P.		
	Services Sector	Secondary Sector	Primary Sector
1952-53	29.6	14.4	53.6
1962-63	30.9	18.6	48.4
1972-73	34.2	21.9	42.4
1982-83	38.1	23.1	38.1
1987-88	40.3	23.1	35.7
1992-93	43.5	23.8	32.5
2003-04	51.9	24.4	23.9
2013-14	59.9	24.2	15.9

Source: G.O.I., C.S.O., National Income Accounts Statistics (Revised Series), 2018.

This table reveals that the sectoral composition of gross domestic product has undergone a major change since independence. The percent share of the Services sector shows a steady increase from 29.6 percent in the early 1950s to 43.5 percent in the early 1990s to almost 60 percent in 2013-2014. It has doubled in this period of 64 years. Similarly, the share of the Secondary sector in G.D.P. has also grown from 14.4 percent to 24.2 percent over the same period. Table 1 also reveals that the share of the Primary sector in gross domestic product registered a considerable decline; from as high as 53.6 percent in the early 1950s to just about 24.2 percent in 2013-2014. It can be concluded from this information that the percent share of the Primary sector has steadily declined, on the other hand, the shares of the Services sector and the Secondary sector show a steady increase. It is seen from the table that the Services sector emerged as the largest sector of the Indian economy in terms of G.D.P. share somewhere in the mid-'80s. Out of these three sectors of the economy (primary, secondary and services), the Services sector is probably the most diversified internally. The Services sector is an agglomeration of a large number of very heterogeneous sub-sectors; all of which have the common feature of producing one or the other service.

The emergence of this sector as the largest sector in terms of G.D.P. bypassing the industrial sector is a peculiar feature of the Indian growth story and from the above data, it seems to have occurred somewhere in the early eighties and not the early nineties. But this is only a hunch that needed to be corroborated with statistical testing thus prompting us to establish the trend and rigorously test for a structural break in the growth of the share of the Services sector in G.D.P. This has been taken up in the next two sections one by one, respectively.

Statistical Procedure to Analyse Trend

For statistical analysis of the trend in the share of the Services sector in G.D.P., a simple linear model or semi-log trend model or more complex non-linear models can be employed. The visual inspection of graphs (not included here due to paucity of space) on the growth of percentage share of the Services sector in G.D.P. suggested that the use of linear or semi-log

formulation may be a good approximation to the behaviour shown by the underlying data in most cases. The non-linearity's observed in the graphs were taken care of with the help of slope dummy variables. To begin with, we have estimated the semi-log trend models to discern the nature of trend in the share of Services sector in a G.D.P. over the 1950-1951 to 2013-2014 period. The semi-log trend model was preferred over the simple linear model because the coefficient of time variable in such a model not only reveals the nature of the underlying trend in the dependent variable but can also be directly used to calculate the percent per year growth or decline rates. These growth/decline rates have also been computed and have been used in the discussion. Moreover, the simple linear trend model is handicapped by the fact that the values of the dependent variable (percent share of Services sector in a G.D.P.) being constrained between 0 and 100 percent do not fulfil the O.L.S. assumption of normality. But the dependent variable is more likely to fulfil the classical regression assumption of the normal or near-normal distribution when converted into a log form.

For ready reference, it may be mentioned that we have estimated the following trend equation from the time series data about 1950-51 to 2013-14 period at 2004-2005 constant prices.

$$log\ Y = a + b\ T + e$$

where:

Y is percent share of a sector in G.D.P.;

T – Time variable (1950-51 to 2013-14), taking values 1 to 64.

This equation was estimated with the standard ordinary least squares method. The sign, size and statistical significance of the regression coefficient of time variable in this model indicates the nature and magnitude of trend or change in the share of the Services sector in a G.D.P. over time. The growth/decline rate has been computed in the case of each sector of the Services sector with the help of the regression coefficient of time variable in the above semi-log model, using the following formula.

$$Growth/Decline\ rate = [Antilog\ (Regression\ coefficient\ of\ Time) - 1]\ X\ 100$$

The growth/decline rates, so computed are percent per year compound growth/decline rates.

Trends in the Share of Services and Other Sectors in Gross Domestic Product

The results of our regression analysis of trends in the share of the main sectors in a G.D.P. are presented in table 2. From the results given in this table, it may be seen that the regression coefficient of the time variable has a positive sign and is significant at a 1 percent level in the case of the Services sector. It is thus clear that the share of the Services sector in a G.D.P. has been growing over these 64 years at the highest rate of 1.2 percent per year. Similarly, the regression coefficient of the time variable is also positive and significant at a 1 percent level in the case of the Secondary sector indicating thereby that the share of the Secondary sector in a gross domestic product has also been growing over this period. In the case of the Primary sector, the regression coefficient of the time variable is significant at a 1 percent level and has the expected negative sign; thus, a decline in the share of the Primary sector in G.D.P. is indicated.

Table 2

Trends In The Share Of Services And Other Sectors In Gross Domestic Product: 1950-1951 to 2013-2014

Eq. No.	Dependent Variable G.D.P. (log form)	Estimated Coefficients			Growth Rate (Percent per year)
		R. Square	Intercept	Coefficient of time variable	
1.	Services Sector	0.99	3.24 (401.7)	0.012 (53.52)a	1.2
2.	Secondary Sector	0.76	2.82 (136.1)	0.008a (14.28)	0.8
3.	Primary Sector	0.92	4.13 (170.6)	-0.018a (-27.54)	-1.8

Notes:
1. Figures in parenthesis are t-values.
2. a indicates significance at a 1% level for a two-tailed test.
3. Growth Rate= [antilog (slope coefficient of time)-1] x 100

It can be seen that the Services sector is the fastest sector whereas agriculture‘s share in the G.D.P. is steadily declining. But these trends give us the overall picture of 64 years, when and how this sector took over the sectors is a valid question that follows these findings. Hence in the next section, we have taken up the issue of a structural break in the trends in the share of Services sector with the view to address the debate on whether or not the economic reforms led to the spurt in the growth of the services sector by re-assessing the breakpoints using multiple dummies. Since the same kind of growth has not been seen in the employment share of the Services sector, this exercise of re-examining the structural breaks would contribute to the understanding of the issues plaguing Services sector growth.

3. Testing for Stability and Break in Trend

In this section, the focus is to test for the stability and break in trend or is to say in other words, to re-examine the structural breaks in the share of the Services sector in G.D.P. This would be done by identifying watershed points in the growth path of the economy and then using multiple dummies to test for structural breaks around these selected points. The rationale for the econometric technique used and the chosen watershed points are explained below:

(1) Econometric Procedure to Test Break-In Trend: The overtime stability of trend coefficients during these 64 years and the nature and magnitude of possible structural breaks in the trend can be tested broadly in three ways, namely Chow test, Dummy variable technique and Unit root tests. The first two methods are alternate but almost equivalent statistical procedures, with the latter having some clear advantages. The Chow test is a classical method to test for structural change. This test by splitting the sample into two sub-periods tests for the stability of regression coefficients to establish the structural change. But this technique does not give us the nature and magnitude of the change and also leads to a substantial loss in the degrees of freedom (Quandt, Richard, 1960). The dummy variable technique using intercept and slope dummies, on the other hand though equivalent but is much superior to the Chow test. It not only tests for

structural change but also gives the magnitude and direction of this change with negligible loss in degrees of freedom. Of course, in both these methods researcher needs to have some a priori knowledge of plausible breakpoints (Bai, Jushan, Pierre Perron, 1998). Alternative to these two methods is the Bai & Perron unit root test for structural change, which endogenously determines the breaking point (using dummies) with no a priori knowledge. But testing for structural breakpoint blindly without any a priori information would qualify for the same critique as data mining. Also, endogenous estimation of break dates is sensitive to the length of partition in the Bai Perron test (Wallack, Jessica, 2003). Since, in the case of Services sector growth, there are sufficient plausible breakpoints that can identify a priori therefore, the dummy variable technique was thought to be the appropriate technique for the problem that we intend to explore. So in this section, we shall explore whether or not the trend in the share of the Services sector in G.D.P. over the 1950-51 to 2013-14 period remained stable or if there were significant breaks in trend within this period using intercept and slope dummies. Employing this dummy variable procedure, we have analysed to find out whether or not the nature and magnitude of the trend in growth in the share of the Services sector in G.D.P. have changed (Rodrik, Dani, Arvind Subramanian, 2004). The procedure is to use intercept and slope dummy variables to test for the significance of the break-in trend in the two sub-periods. This can be done by estimating a single time trend regression equation for the entire period by including intercept and slope dummy variables at the breaking point as follows:

$$log\ Y = a_o + a_1\ D + b_o\ T + b_1\ DT + e$$

where:

Y is percent share of each sector in gross domestic product

T – time variable (taking values 1 to 64)

D – the dummy variable that takes values 0 for each year in the first sub-period and value 1 for each year in the second sub-period.

D.T. – the slope dummy that is generated by multiplying the intercept dummy variable with the time variable.

The above regression equation combines the separate regressions for the two periods, which can be computed from this equation. In this model a_1 is the differential intercept coefficient which indicates how different is the intercept in the second period from the first period; similarly, b_1 is the differential slope coefficient which gives the difference in the slope coefficients of the two periods (Sinha, Ajit, Shirin Tejani, 2004). The sign, size and statistical significance of the differential intercept and slope coefficients will indicate whether or not and in what ways growth has differed in the two sub-periods. Both differential intercept, as well as differential slope coefficient and also R-square values, are used to select and pinpoint the time point (year) in which a break in trend may have occurred. But for estimating the nature and magnitude of change in trend and growth rate, only the differential slope coefficient is the relevant statistic (DeLong, Bradford, 2001). Also, the growth/decline rate has been computed in the case of each sub-period of the Services sector with the help of the regression coefficient of time as described in section I.

(2) Watershed points and their rationale: This period of 64 years is not only quite long but is also dotted with several major events in the economy and polity of India. To mention only the more important: the first phase of planning virtually came to an end in the mid-sixties with the declaration of plan holiday for three years; Green Revolution occurring in the mid-sixties completely transformed the Agricultural sector; internally motivated liberalisation of the economy started in the early 1980s and structural adjustment programme and globalisation started in the early 1990s and the maturing of economic reforms by mid-2010s. These changes in the structure of the economy may have significantly affected the nature and size of trends in the share of the Services sector in G.D.P. On this basis, five major watersheds or breakpoints were identified in the evolution of the Indian economy and polity. Based on these 5 watersheds, the entire period of 64 years was divided into two sub-periods in each case and we shall try to find out whether or not / where and when a structural change has happened. The sub-periods and their significance and rationale are briefly described in Chart 1. The reasons for selecting each of the watersheds have been explained in detail below, where regression results of each watershed point are being reported.

Chart 1

Sub-Periods of 1950-1951 to 2013-2014 and Their Rationale

Sr. No.	Sub-Period Sets	Rationale / Importance
1.	Ist Sub-period : 1950-1951 to 1966-1967 IInd Sub-period : 1967-1968 to 2013-2014	Building of key industries completed, virtual derailment of plans – Plan a holiday. Beginning of the Green Revolution
2.	Ist Sub-period : 1950-1951 to 1970-1971 IInd Sub-period : 1971-1972 to 2013-2014	Beginning of Garibi Hatao & IRDP etc. programmes, Nationalisation of banks. A restart of Five Year Plans.
3.	Ist Sub-period : 1950-1951 to 1980-1981 IInd Sub-period : 1981-1982 to 2013-2014	Maturing of Green Revolution. First big loan with conditionality's from I.M.F. Internally motivated liberalisation begins.
4.	Ist Sub-period : 1950-1951 to 1995-1996 IInd Sub-period : 1995-1996 to 2013-2014	New Economic Policy and World Bank / I.M.F. directed structural adjustment programme and joining W.T.O., globalisation/second phase of economic reforms sets in.
5.	Ist Sub-period : 1950-1951 to 2005-2006 IInd Sub-period : 2006-2007 to 2013-2014	Maturing of Economic Reforms and liberalisation / 15 years after the first phase of economic reforms

Taking each of these five watersheds and using the methodology, we have tried to find out whether or not the nature and magnitude of trends in the share of the Services sector and its sub-sectors in gross domestic product changed midway over this span of 64years (1950-1951 to 2013-2014) using C.S.O. data at 2004-2005 prices. To begin with, the break-in trend for all sets of five sub-periods as displayed in chart 1 was analysed. For selecting the time point (year) in which a break in trend may have occurred, dummies for three to four years above and below the selected watershed points were tried and the sizes of differential slope coefficients and their t-values and also the R-squares were compared for each these and employing a procedure frequently used in such exercises, the year or years in which these coefficients reached the highest values were deemed to be the year (years) in which the break-in trend occurred. It is only then that a particular breakpoint /watershed year was selected.

The results for the selected breakpoints are displayed collectively in Table 3. But have been discussed separately for each sub-period (other results have not been reported to save space).

First Set of Sub-Periods

Sub-period I: 1950-1951 to 1966-1967

Sub-period II: 1967-1968 to 2013-2014

Several factors suggest that 1966-1967 may be a probable breakpoint in the trend pattern. Firstly, by 1966-1967 the initial phase of the building of key and basic industries had been almost completed. Further, the third five-year plan had been completed by March 1966 and after that, there was a virtual derailment of plans and the government declared a planned holiday for 3 years, (1966-1967 to 1968-1969) and only annual plans were in operation. Another reason for selecting 1966-1967 as the breaking point was that this coincides with the beginning of the Green Revolution, which completely transformed Indian agriculture. Moreover, the well-known slowdown in industrial development also started in the mid-1960s. So in the mid-sixties, a break in trend is expected. After trying various dummies around the mid-sixties, 1966-67 was selected as the first watershed point. Thus keeping in mind the economic significance of these events, it will be analysed whether there has been any significant change in the nature and magnitude of trends in the post-1966-67 period compared to the previous period.

To test for break-in, a trend in the intercept and slope dummy variables model described earlier has been estimated for the Services sector. These results reveal that in the case of the Services sector, the differential slope coefficient has a positive sign and is significant even at one percent level. This suggests that the nature and magnitude of the time trend in the gross domestic product share of the Services sector did experience any significant break after 1967-1968. Till the mid-60s the Services sector was growing at the rate of 0.9 percent, but after that, it has been growing at the rate of 1.4 percent. Growth in the second sub-period is much higher than in the first, but it could be argued this may be simply due to statistical reasons that are more number of years in the second sub-period.

Table 3

The Shares Of Services Sector In G.D.P. In The 5 Subperiods

Eq. No.	SUB PERIODS	Estimated Regression Coefficients				Growth Rate
		R-Square	Slope Coefficient of time variable b_o	Differential Slope Coefficient for II Period b_1	Slope Coefficient for the II Period $b_o + b_1$	
1.	(i)1950-51 to 1966-67 (ii)1967-68 to 2013-14	0.96	0.009 (8.23)	0.005a (4.07)	0.014	(i) 0.9 (ii) 1.4
2.	(i)1950-51 to 1970-71 (ii)1971-72 to 2013-14	0.97	0.008 (11.36)	0.005a (6.79)	0.013	(i) 0.8 (ii) 1.3
3.	(i)1950-51 to 1980-81 (ii)1981-82 to 2013-14	0.99	0.009 (23.2)	0.006a (10.64)	0.015	(i) 0.9 (ii) 1.5
4.	(i)1950-51 to 1995-96 (ii)1996-97 to 2013-14	0.97	0.01 (39.9)	0.005a (4.51)	0.015	(i) 1.0 (ii) 1.5
5.	(i)1950-51 to 2005-06 (ii)2006-07 to 2013-14	0.94	0.01 (46.9)	0.005 (0.89)	0.01	(i) 1.0 (ii) 1.0

Notes:
1. Figures in parenthesis are t-values and in square bracket are Z values.
2. a indicates significance at a 1% level for a two-tailed test.
3. Form of equation estimated log y = a + bt + e
4. Growth Rate = [antilog (slope coefficient of time) – 1] x 100.

Second Set of Sub Periods

Sub-period I: 1950-51 to 1970-71

Sub-period II: 1971-72 to 2013-14

The analysis for a break in the trend for the second set of sub-periods, i.e. 1950-1951 to 1970-1971 (Ist period) and 1971-1972 to 1999-2000 (IInd period), is discussed now. The break of time trend at 1970-71 is also likely on account of many factors. The five-year plans were again put on rails, after a holiday of three years, at the beginning of the second period. Indira Gandhi launched her famous economic welfare programmes like 'Garibi Hatao' at the beginning of the second period. Another major political and economic event that almost coincides with this break is the nationalisation of 14 banks in 1969. Furthermore, by the early 1970s, dependence on food imports was much-reduced thanks to the Green Revolution. So a break in trend can be expected in the early 70s. After trying various dummies around the early 70s, 1970-1971 was selected as the second watershed point. Given the above-stated events, the break-in trend in the share of the Services sector in gross domestic product and other sectors may have occurred around this year, i.e. 1970-1971. These results clearly show that the differential slope coefficient is significant at a 1 percent level in the case of the share of the Services sector in gross domestic product. This suggests that there was a significant break in trend in the share of Services sector in the gross domestic product after 1970-1971. Since the differential slope coefficient has a positive sign, this means in the second period the share of the Services sector has been increasing at a higher rate compared to the pre-1971-1972 period. The growth rate of the Services sector share in the gross domestic product was 1.3 percent in the second period, i.e. after 1970-1971 as compared to 0.8 percent in the first period, i.e. before 1971-1972. Growth in the second sub-period is much higher than in the first, but still, the second sub-period is much larger.

Third Set of Sub-Periods

Sub-period I: 1950-51 to 1980-81

Sub-period II: 1981-82 to 2013-14

The early 1980s saw some significant changes in the economic and political scenario of the country. Indira Gandhi again came to power effectively at the beginning of this period. By this time, the Green Revolution had also substantially matured and India had become self-sufficient in food. An upturn in industrial production also started in the early 1980s. When the sixth five-year plan was launched, India was facing a severe balance of payments difficulties. So in 1981, India entered into an arrangement with I.M.F. for a loan of five billion dollars which had its attached conditionality's that set the process of liberalisation of the Indian economy rolling, albeit at a slow pace. All these factors may have led to a change in the economic dynamism of the economy and as a consequence, the pattern of growth of various sectors may also have been affected. So in the early 1980s again a break in trend is expected. After trying various dummies, 1980-1981 was selected as the third watershed point. Testing for a break in trend between these two sub-periods is also important because the two sub-periods are statistically of the same size. The estimated regression coefficients with the

growth/decline rates are presented in Table 3. A look at these results reveals that slope coefficients are statistically significant at 1 percent level, in the case of the share of the Services sector in gross domestic product. The positive sign of the differential slope coefficient and its statistical significance at the one percent level suggests that the share of the Services sector in gross domestic product increased at a faster rate (1.5 percent) in the second period (1980-1981 onwards) compared to the earlier period (0.9 percent). Here both the sub-periods are balanced in terms of the number of years, so we can conclude with some confidence that the growth in the second sub-period is much higher than the first. It seems the early 1980s was an important breakpoint both statistically and economically but needs to be explored further.

Fourth Set of Sub-Periods

Sub-period I: 1950-51 to 1995-96

Sub-period II: 1996-97 to 2013-14

Coming down to more recent years, the break in trend since the early 1990s was examined. The rationale for taking 1990-91 as the breakpoint year is that this year coincides with the introduction of the Structural Adjustment Programme (SAP) and the beginning of the new era of liberalisation and globalisation of the Indian economy. As a result of the new reforms, the whole dynamics of the Indian economy seems to have undergone a change from a mixed economy to a more open and liberalised market economy, integrated more closely with the global markets. Such paradigm shifts and basic change in the character of the economy is likely to affect various sectors differently. Furthermore, the beginning of the information technology (a sub-sector of the Services sector) revolution also almost coincides with the beginning of this period. So the early 1990s are a clear watershed in the Indian economy when a break-in trend in the shares of different sectors is likely to have occurred. After trying various dummies around this period was selected as the fourth watershed point. The results are presented in Table 3.

It may be seen from these results that in the case of the Services sector, the differential slope coefficient is significant at 1 percent level; indicating a break in trend in the share of the Services sector in the gross domestic product after 1995-1996. The positive sign of the differential slope coefficient suggests that the share of the Services sector was growing at a higher rate (1.5 percent per year) in the post-1995-1996 period compared to the earlier period when the growth rate was 1.0 percent per year. So liberalisation and globalisation of the Indian economy after 1990-1991 seems to have speeded up the growth of the share of the Services sector in gross domestic product. Cleary growth in the second sub-period is much higher than the first even though the second sub-period has a much lesser number of years. The so early 1980s up to mid-nineties are important watershed points indicating robust growth in the Services sector.

Fifth Set of Sub-Periods

Sub-period I: 1950-51 to 2005-06

Sub-period II: 2006-07 to 2013-14

The economic reforms had sufficiently matured by the mid-2010s, 15 years after the first phase of initiation. So it was expected another break in the growth-share of the Services sector could have occurred after the complete implementation of the economic reforms and with the overall G.D.P. growing robustly. Again after trying various dummies 2004-2005 was selected as the fifth breakpoint. The results are presented in Table 3. It may be seen from these results that in the case of the Services sector, the differential slope coefficient is non-significant; indicating that there was no break in trend in the share of the Services sector in the gross domestic product after 2005-2006. It continued to grow steadily at 1 per cent per year in both the periods. Cleary growth in the two sub-periods is the same. This result seems to hint at a slowdown in the services sector growth but would still be a premature but important conclusion that warrants more research.

So from the above discussion, it can be seen that there are multiple structural breaks in the growth of the share of the Services sector and this needs to be explored further as to which is the most important one or whether all of them are equally important. This exercise is undertaken in the next section. We do get some clues from the sub-period growth rates that somewhere between the early 1980s and mid-1990s the spurt seems to have happened. The results in this section are also suggestive of a slowdown in the services sector growth after the initial spurt and call for further investigation with more data because if actually, Services sector growth is tapering off, then it would be a matter of serious concern to policymakers in coming years.

4. When Did the Break in Trends Occur?

If the differential slope and intercept coefficients were statistically significant only in one of the above five exercises, then no further work would have been needed and one could straight away declare that year to be the break year. But the significant differential coefficients are observed at five of these breakpoints. So the results of these previous five exercises have to be compared and evaluated to select the year (or period) when the break-in trend in the share of the Services sector in the gross domestic product may have occurred. Ideally, one should do such dummy slope variables exercise for each of the years separately for the entire 64-year period and then decide in which year the break in trend may have occurred. But such a mechanical exercise was not needed in the present case because the significant events in this 64-year current history of the Indian economy are well known and indicate the possible years in which a break in trend is likely to have occurred. So the trend breaks were tested only for these plausible five-time points. For selecting the time point (year) in which a break in trend may have occurred, as stated above, the sizes of differential slope coefficients and their t-values and also the R-squares were compared for these five breakpoints. Employing a procedure frequently used in such exercises, the year or years in which these coefficients reached the highest values were deemed to be the year (years) in which the break-in trend

occurred. In the case of the share of the Services sector in G.D.P., the break-in trend seems to have occurred after 1980-1981. The size and t-values of differential coefficients attain the highest values (out of the five break points considered here) at this breakpoint; the R-square is also the highest at this breakpoint. The maximum difference in the growth rates in the two sub-periods of 0.6 percent points seen in equation 3 is also suggestive of 1980-1981 as the actual breakpoint and also the two Subperiods are all most of the same size in years.

Though, to be doubly sure, another econometric exercise was conducted.

We estimated regression by taking dummy variables (intercept and slope) for two breakpoints at a time in pairs using the following equations:

$$log\ Y = a_o + b_o\ T + a_1\ D_1 + b_1\ D_1T + a_2\ D_2 + b_2\ D_2\ T + e$$

where:

Y is percent share of each sector in gross domestic product

T – time variable (taking values 1 to 64)

D_1 – 0 for 1950-51 to 1980-81; 1 for 1981-82 to 2013-14

D_1T – the slope dummy that is generated by multiplying the intercept dummy variable with the time variable.

D_2 – the dummy variable that takes values 0 for each year in the first sub-period and value 1 for each year in the second sub-period for all the other sub-periods, each of the other four subsets taken one at a time.

D_2T – the slope dummy that is generated by multiplying the intercept dummy variable with the time variable.

Table 4

Locating The Breakpoint In The Shares Of Services Sector In G.D.P.

Eq. No.	SUB PERIODS	Estimated Regression Coefficients			
		Differential Slope Coefficient of dummy for each period	Differential Slope Coefficient for the early 1980s	Slope Coefficient for Time Variable	R-Square
1.	(i)1950-51 to 1966-67 (ii)1967-68 to 2013-14	0.000 (-1.35)	0.006 (3.04)[a]	0.009 (9.33)[a]	0.99
2.	(i)1950-51 to 1970-71 (ii)1971-72 to 2013-14	0.002 (0.051)	0.008 (2.70)[a]	0.008 (12.16)[a]	0.99
3.	(i)1950-51 to 1995-96 (ii)1996-97 to 2013-14	0.01 (0.96)	0.005 (13.42)[a]	0.009 (22.96)[a]	0.99
4.	(i)1950-51 to 2005-06 (ii)2006-07 to 2013-14	0.002 (0.539)	0.006 (9.00)a	0.009 (19.03)[a]	0.99

Notes:
1. Figures in parenthesis are t-values and in square bracket are Z values.
2. a indicates significance at a 1% level for a two-tailed test.
3. No. of observations = 64.

So along with the early 1980s, all the other breakpoints were used one by one as control variables. In this model, b_1 is the differential slope coefficient which gives the difference in

the slope coefficients of the post the early 80s from the base category of whichever breakpoint is earlier years and b_2 is the differential slope coefficients, which give the difference in the slope coefficients of the other sub-periods from the above-stated base category. The equations exhibiting significant results are displayed in Table 4. This exercise was done for all the other combinations also, but only the results for the early 1980s dummy exhibited significant differential coefficients. The non-significant results for other combinations of breakpoints are not reported here to save space. It can be seen from the results that the slope coefficient for the early 1980s dummy is significant in all the equations.

When the early 1980s dummy was introduced along with another break point the differential slope coefficient of the early 1980s was significant at one percent level in all the four equations, whereas the differential slope coefficients became insignificant for all other sub-periods indicating that the actual break in the growth of Services Sector had taken place in early 1980s, thus reconfirming our results. So it can be confidently concluded with that the trend in the share of Services sector in gross domestic product experienced a significant break after 1980-1981; the share of this sector started growing at a significantly higher rate from the beginning of 1980s that is at the eve of economic reforms and not due to economic reforms. It is possibly this impact that spills over to other breakpoints, that is why they exhibit significant results when taken individually. From this exercise thus, we were able to locate a singular breakpoint in the early 80s from a set of multiple breaks. The structural break in a share of the Services sector in gross domestic product occurred in the early 1980s, much before the economic reforms set in. Thus validating and coinciding with the hypothesis that the early eighties marked the structural break in India's economic growth. The increases in per capita incomes over 30 years since independence seem to have led to the structural break in this sector in the early 1980s plausibly because the demand for services is highly income elasticity in the long run.

5. Conclusion

Summing up, it can have concluded from this analysis that the share of the Services sector in G.D.P. grew at the fastest rate compared to the other two sectors in the 64 years under consideration. The study has shown that given the post-independence process of growth of the Indian economy, multiple plausible structural breaks were seen in the share of the Services sector, but an actual break occurred in the early 1980s. All other breakpoints probably capture the spillover from the spurt in the growth in the early 1980s when individual breakpoints are considered. The plausible reason seems to be that since it is well established in the literature that the Services sector growth is positively linked to per capita growth, so by the early 1980s, 30 years after independence, the Indian economy had matured and the per capita incomes had substantially increased. The economy was growing at a high rate of 7.2%, leading to a spurt in the Services sector growth since demand for services is highly income elastic in the long run. But the above conclusions, when seen in the light of the sub-period growth rate results (of section 3), it can be said that there is no denying that economic reforms have helped in maintaining and propagating the growth of the Services sector triggered in the early 1980s. Both the factors, the high rate of economic growth combined with the first big I.M.F. loan in the early 1980s (which could be said to be a precursor to

liberalisation), acted as catalysts for the structural shift and plausibly explained the spurt in the Services sector growth in early ’80s. Of course, giving economic reforms their due, this spurt would not have been probably sustainable had economic reforms not followed.

The sub-period analysis also hints at another very important change that may be unfolding which is the slowing down in the growth of the Services sector after the mid-2000s, which could have serious economic implications in coming times. The results are strongly suggestive of a slowdown in the growth of the Services sector somewhere in the 2000s, especially when a major global recession happened in 2008. Though it would be a little premature to say this, it asks for rigorous econometric analysis with additional data and should be taken cognisance by policymakers, especially since the contribution of this sector in employment has still not matched up to its share in G.D.P. and even today we grapple with jobless growth and pandemic has further done unforeseen damage.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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STRATEGIC ENTREPRENEURSHIP AS A MAIN FACTOR FOR THE DEVELOPMENT OF ECONOMIC ZONES IN BULGARIA[2]

Although the field of strategic entrepreneurship in business organisations is well-established, it is relatively understudied in government organisations and NGOs. It is even more understudied as regards economic zones. The main goal of this article is to prove the leading role of strategic entrepreneurship in developing economic zones. In view of achieving this goal, the article presents the main types of economic zones and the factors for developing their competitiveness. Three main stakeholder organisations related to the economic zones are set forth, considering their characteristic Entrepreneurship-Strategic Management Interface – ESMI. A theoretical framework of strategic entrepreneurship in economic zones is proposed, and qualitative research is carried out by considering two case studies in Bulgaria. These two cases differ in ownership (public and private), goals, strategies, and management. The research results show the importance of strategic entrepreneurship as a factor for the development of economic zones in Bulgaria. This significance is manifested in both surveyed organisations.
Keywords: economic zones; entrepreneurship; strategic management; strategic entrepreneurship; total entrepreneurship
JEL: L21; L31; L12

1. Introduction

Establishing strategic entrepreneurship as a research field began in the late twentieth and early twenty-first centuries. It was born due to the unification of the two independent research fields: strategic management based on administrative management approaches and entrepreneurship as a manifestation of individual qualities of the entrepreneur (leader) and

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[2] I would like to express my deep gratitude to Prof. Kiril Todorov who provoked me with this interesting and complex topic. As one of the founders of entrepreneurship in Bulgaria he made me believe that the entrepreneurship as a philosophy, a way of thinking and behavior is important for all kinds of organizations, society and our personal development. Thanks to the conferences, organized by Prof. Kiril Todorov, I had the opportunity to meet and communicate with exceptional people like prof. David Smallbone and prof. Prof. Ken O`Neill.
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organisational culture (De Wit and Mayer, 2010). They manifest themselves as independent scientific and applied fields through the historical development of entrepreneurship and strategic management. In its classic version, entrepreneurship is accepted as being typical for start-up companies, and the entrepreneur is the company's founder who takes the risk to receive profit (Cantillon, 2010). Today entrepreneurship is perceived as a thriving organisational culture and behaviour model, typical for corporations (Kuratko, 2007) and non-business organisations (Badelt, 2003; Windrum and Koch, 2008). On the other hand, strategic management emerges as inherent in large national and multinational companies (Ansoff, 1965). Nowadays, it is typical for all kinds of organisations. The strategic management approaches, principles, and methods have been transferred to SMEs (Todorov, Smallbone, 2014), public organisations (Bryson and George, 2020), and NGOs (Steiss, 2003). Their interaction is observed in contemporary literature dedicated to strategic management and entrepreneurship. The conditions of a dynamically changing environment determine the need to combine the advantages of the methodological nature of strategic management and the entrepreneurial model of behaviour (Covin and Lumpkin, 2001). The integration of the strategic management advantages (oriented towards creating competitive advantages) and the entrepreneurial model of behaviour (oriented towards the search for new opportunities) leads to the formation of two additional research fields – strategic entrepreneurship and strategic leadership (Hitt et al., 2002; Hitt, 2011; Mazzei, 2018). Numerous studies, publications, and methodological guidelines are related to economic zones (UNIDO, 2019; OECD, 2017; World Bank, 2008). Their classification, roles, and significance for the economic development of regions and countries, stakeholders, stages of development have been considered (OECD, 2017; World Bank, 2008; Tudor et al., 2007; Martin et al., 1996; Carnall, 2007). Attention has been focused on strategic and operational management issues (UNIDO, 2019), developing entrepreneurial and innovation ecosystems (Mason and Brown, 2014; Granstrand and Holgersson, 2020). Although strategic entrepreneurship studies in business organisations are well established in the scientific and research field (Hitt et al., 2002; Hitt et al., 2017; Meyer and Heppard (eds.), 2000; Meyer et al., 2002; Michael et al., 2002), it remains relatively limited in public institutions and NGOs (Klein at al., 2013; Patzelt and Shepherd, 2009; Luke,2005). The limitation in studies of strategic entrepreneurship in economic zones is even more significant. Considering the understanding that economic zones emerge due to the entrepreneurial model of behaviour and strategic management of a business or state and local governments, this article sets forth the importance of strategic entrepreneurship (SE) as a factor for their development.

This publication aims to confirm the importance of strategic entrepreneurship as a factor in the development of economic zones. A review of publications featuring the various evolutionary forms of economic zones, their essence, features, and factors for development is aimed at achieving the primary goal (UNIDO, 2013, 2015; World Bank, 2008).

The thesis set forth in the article has proved that strategic entrepreneurship is a significant factor in the economic zone's sustainable development. The starting point of the chosen methodology of the research is the understanding that strategic entrepreneurship has a vital role in creating value for individuals, organisations, and society (Hitt et al., 2012).

The methodology chosen here includes four main steps. *First step* – the individual types of economic zones and the diverse groups of interest related thereof have been derived within

the frameworks of the literature review. There are three prominent organisations (stakeholders) that deliver value through EZs: economic zones as managed organisations, government (public authorities – national government, regional, municipality, city), resident firms (companies in industrial zones) (UNIDO, 2015; World Bank, 2008; ESCAP, 2019; Tudor et al., 2007; Martin et al., 1996; Tudor et al., 2007). *Second step* – the theoretical background of strategic entrepreneurship has been presented as a basis of its interpretation in the context of EZs development. The two main domains (research fields) of strategic entrepreneurship (Murphy et al., 2005; Kuratko, 2007; Drori and Landau, 2011; Lentsch, 2019) and strategic management (De Wit and Mayer, 2010; De Wit, 2017; Todorov and Smallbone, 2014) – have been reviewed, showing their intersections. On this basis, the need to introduce the concept of ESMI (Entrepreneurship and Strategic Management Interface) has been set forth, extrapolating its applicability in economic zones (Meyer et al., 2002). Third step – this diversity of stakeholder organisations necessitates the adoption of a broader interpretation of strategic entrepreneurship. It has been proceeded to the development of a *theoretical framework* justifying the applicability of strategic entrepreneurship and its importance for the development of EZs on the basis of the literature review. Its focus is on the ESMI in business organisations and public authorities, institutions, and non-government organisations. The emphasis is on the characteristics of strategic entrepreneurship in economic zones' government bodies. *Fourth* – conducting an empirical study. The scope of the empirical study includes two case studies of organisations managing the majority of economic zones in Bulgaria. The first one is "Trakia Economic Zone – TIZ". It is the result of a public-private initiative. TIZ extends to the territory of the Plovdiv region. The second one is the National Company Industrial Zones EAD, established by the Ministry of Economy. The company designs and manages economic zones all over the country. The two zones under survey differ, in regard their origin, management, geographical characteristics, and way of development. This determines a different manifestation of strategic entrepreneurship in the cooperation.

The intricate character of the problem under consideration does not allow the application of the factor analysis for the establishment of the "strategic entrepreneurship-development of the economic analysis" direct connection by using correlation and regression analysis. Therefore and due to the lack of a recognised methodology for studying the defined research field, the use of the case-study method has been preferred. Despite the fact that this method does not allow the hypothesis to be tested by using the statistical tools, the results of the study have confirmed the significance of strategic entrepreneurship as a factor in the development of economic zones.

2. Literature Review

2.1. Types of economic zones

There are five types of economic (industrial) zones (EZ): Industrial Park, Special Economic Zone, Eco-Industrial Park, Technology Park, and Innovation District (UNIDO, 2015). These types represent the evolutionary forms of economic zones studied in their sequence of development (Table 1).

Table 1

Types of economic zones

Industrial Park (IP)	IP is *the simplest form of an economic zone.* The IPs is a tract of land which is subdivided into separate plots. They are separated according to a comprehensive plan with infrastructure provision (electricity, communication, water, roads), transport, and public utilities. (UNIDO, 2015)
Special economic zones (SEZs)	SEZ in "geographically limited area, usually physically secured (fenced-in); single management or administration; eligibility for benefits based upon physical location within the zone; separate customs area (duty-free benefits) and streamlined procedures. (World Bank, 2008)
Eco-Industrial Park (EIP)	*The development of EIP* lies in two important concepts: sustainability and industrial ecology. EIP is defined as a community of businesses (manufacturing and service) businesses whose goal is to enhance environmental and economic performance (UNIDO, 2015).
Technology Park (TP)	*Technology Park (TP), or High-Tech Parks (HTPs) Science Park(SP),* is a specific form of industrial zones. Its principal designation is to help to increase the wealth of its community. The TP's management body has to build the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.
Innovation District (ID)	IDs are urban technology parks. In short, they are defined as "areas of innovation," which goal is to create an innovative and environment attractive for entrepreneurs, talented people, knowledge-based businesses, and risk investments (UNIDO, 2015; Wagner et al 2017; Wagner et al 2019; Katz and Wagne, 2014; ESCAP, 2019).

Source: adapted from UNIDO, 2015.

2.2. Stakeholders in EZs

The EZ can be a private initiative, or initiated by the government, regional and local authorities, or a public-private partnership. The establishment and development of industrial zones have many technical, economic, social, institutional, and policy aspects (UNIDO, 2015, 2019). The various groups of interest determine the creation of favourable conditions for the development of economic zones: government/policymakers, implementing agency/staffs (economic zone government body and staff), investors, resident firms, employees, business associations/chamber of commerce, service providers customers of resident firms, development partners (external) / international organisations, civil society (UNIDO, 2019). There are three stakeholder organisations examined here: national, regional, and local authorities; companies in EZ (resident firms); and EZ government body. The institutional framework of the management of the industrial zones may take one of the following forms: private, public, or public-private partnership (PPP). There are four roles within the economic zones: regulator, developer, operator, owner/sponsor from the point of view of the services provided (UNIDO, 2019).

2.2. Theoretical background of strategic entrepreneurship in EZ

Campbell et al. (2002) summarise five strategic schools depending on the "sources" used for strategic decision-making. Mintzberg et al. (1998) offer a broader view by identifying ten "schools of thought". Recognised schools have been divided into prescribing (formalised), informal and configuration schools. The complex nature of strategic entrepreneurship requires achieving unity between prescribed and informal schools of thought (De Wit and Mayer, 2010; De Wit, 2017; Hitt et al., 2011). The examined schools give grounds for forming strategic and entrepreneurial domains, constituting strategic entrepreneurship in the EU.

2.2.1. Strategic domain of SE

Once having been considered typical for big companies and corporation business organisations, strategic management has been promoted successfully in SMEs (Todorov, Smallbone, 2014). Many principles, approaches, and strategic management methods have been applied to public institutions (Bryson and George, 2020; Ongaro and Ferlie, 2015) and NGOs (Steiss, 2003). The main goal is to create public value for society and guarantee sustainable development (Moore, 1995), so linking strategic management, leadership, and performance is necessary (Poister et al., 2010). Key issues that may necessitate a transformation (strategic change) are the dynamically changing environment, competition intensity, digitalisation, ongoing innovation and rapid change (Johnson et al., 2011). This dynamic environment needs an intersection between prescriptive and informal approaches (De Wit, Mayer, 2010; De Wit, 2017).

2.2.2. Entrepreneurial domain of SE

The entrepreneurial school of thought evolved over three periods: prehistoric bases (up to the 1970s), economic bases (up to the 1980s), multidisciplinary (at the end of the twentieth century) (Murphy et al., 2005). During the third period, entrepreneurship expanded from start-ups and SMEs to be applied in big companies as corporate entrepreneurship (Kuratko, 2007), non-business organisations (Badelt, 2003) and public institutions (Windrum and Koch, 2008). Chandra's research (Chandra, 2018) confirms the multidisciplinary nature of entrepreneurship, identifying 46 topics in the entrepreneurship domain, including business/corporate, social (Peris-Ortize et al.(Eds.), 2017; Martin and Osberg, 2007), institutional (Drori and Landau, 2011; Windrum and Koch, 2008), and political entrepreneurship (Lentsch, 2019; Silander and Silander, 2016). The complexity of economic zones implies the perception of the multidisciplinary nature of entrepreneurship. This importance is verified by the understanding of a strong connection between entrepreneurship, innovation, and economic growth (Drucker, 2009).

2.2.3. Entrepreneurship-Strategic Management Interface (ESMI)

The dynamically changing environment determines the need to combine the benefits of strategic management's methodological nature and the advantages of the entrepreneurial model of behaviour characterised by the continuous search for opportunities, innovation, risk-taking, and proactivity and independence (Mazzei, 2018; Hitt et al., 2017). The integration of strategic management's advantages (oriented towards creating competitive advantages) and the entrepreneurial model of behaviour (oriented towards searching for new opportunities) leads to the increasing importance of strategic entrepreneurship (SE) and strategic leadership. (Hitt et al., 2011; Covin and Lumpkin, 2001; Hitt et al., 2002; Hitt et al., 2001)

Meyer et al. (2002), Michael et al. (2002) suggest the need for a more integrative approach to study and research in both these fields. SE integrates entrepreneurship and strategic management knowledge; entrepreneurial action is taken with a strategic perspective (Kuratko and Audretsch, 2009). Meyer et al. (2002) consider the term intersection as more appropriate than integration. Integration means "to unite or blend" entrepreneurship and SE "into one whole". The intersection is a more detailed view of "cooperation". The intersection grows to an interface and concept called "Entrepreneurship-Strategic Management Interface – ESMI" (Meyer et al., 2002). The ESMI underlines the collaboration of strategic management and entrepreneurship. This intersection can be defined as a fruitful partnership through which these independent domains "intersect" to create a new scientific and research field called strategic entrepreneurship (SE). In the current situation, it is interpreted in terms of its role in the EZs development.

3. The Theoretical Framework of Strategic Entrepreneurship in EZs and Its Role in Their Development

3.1. Strategic entrepreneurship in EZs management

Based on the specifics of strategic entrepreneurship in business organisations, we can derive the two main domains (business strategists and entrepreneurship) within the EZs. Given its applicability in the three main interest groups, emphasis is placed on the SE of EZ's management body.

3.1.1. Strategic domain in EZs

The strategic domain is applicable to the three types of stakeholder organisations in EZs. The methodological toolkit of strategic management inherent in business and non-business organisations is extrapolated to economic zones. The decision-making process in EZs and their development is impossible without a meaningful strategic management process based on the configuration school of thought. EZ's management body should assess its strategic position, define strategic decisions and ensure their implementation. Some essential ideas of strategic and entrepreneurial domains lie at the core of strategic entrepreneurship in EZs examined here: Ansoff's strategic business sphere concept and product-market specialisation

(Ansoff, 1965); Porter's competitive advantage, competitiveness, and value-added chain, Porter's diamond (Porter, 1985, 1990); business model concept (Gassmann et al., 2014).

3.1.2. Entrepreneurial domain in EZs

Entrepreneurship, entrepreneurial opportunities, innovation, and risk in the EZs have to be considered in business, corporate, political, social, and institutional entrepreneurship applied by different stakeholder organisations in economic zones. The variety of stakeholders necessitates a more comprehensive definition of entrepreneurship in EZs. Entrepreneurs (business, social, institutional, political) are opportunity-driven and ready-to-take-risks who manage any official organisation (economic zone, public authorities, and institutions). Entrepreneurship (business, social, institutional, political) is a process by which stakeholders identify and pursue entrepreneurial opportunities without the immediate constraint of the resources they currently control. Opportunities and innovations (business, social, institutional, political) are also perceived in a broader sense of the values they bring about: economic, market, social benefits, institution efficiency, attracting investments, and enhance entrepreneurship within EZ. The intensification of entrepreneurship and innovations in economic zones needs entrepreneurial (Mason and Brown, 2014) and innovative ecosystems (Granstrand and Holgersson, 2020).

3.1.3. ESMI in EZs

Being the main domains of SE, strategic management and entrepreneurship are spread in all kinds of organisations. So the importance of SE refers to all types of organisations – business organisations, state-owned enterprises (Luke, 2005), public organisations and NGOs (Klein et al., 2013; Luke and Verreynne, 2006), universities, and the academic field (Patzelt and Shepherd, 2009). In the case of EZs, SE is prescribed for the three main kinds of stakeholder organisations (*public authorities, resident companies, and EZ's government body)*). Strategic and entrepreneurial domains are presented for each group. Pursuing their goals, all three main stakeholders contribute to the development of industrial zones and their competitiveness. When deriving ESMI in EZs, the goals of these groups are taken into account; the strategic and entrepreneurial domains characteristic of them are determined (Table 2).

The first stakeholder group includes public authorities at the national, regional, and local levels. Their main goals refer to a given territory's sustainable (institutional, social, and economic) development (of country, region, municipality) (Farole and Akinci (Eds.), 2011; Zeng, 2010; UNCTAD, 2019). The implementation of such goals is related to achieving national/regional competitiveness (strategic domain). The public institutions are modernised and transformed through innovations that change the nature of value creation and service delivery by public authorities, but potentially in their organisation's nature (Feller et al., 2011; Mulgan and Albury, 2003). The characteristics of strategic management, entrepreneurship and innovations in the public sector are perceived in the EC's institutional, social and political entrepreneurial context. If we refer to EZs, the public authorities' role consists of creating a favourable competitive environment for EZ's development. Porter's diamond determines competitive development at the national and regional level, with three

factor-driven, efficiency-driven levels. They are featured in 12 pillars, followed by the Global competitive index.

Table 2

ESMI – Entrepreneurship and Strategic Management Interface (Stakeholder Organization in Industrial Zones, their general goal and strategic entrepreneurial domains ESME in EZs)

	Strategic entrepreneurship domains (ESME) in EZs	
Main goals of organizations stakeholders	**Strategic domain EZs**	**Entrepreneurial domain in EZs**
I. National, regional and local authorities GDP growth GDP per capita Low unemployment Gini index Competitiveness Sustainable development	**National/*regional* competitiveness (12 pillars):** 1.Porter's diamond of competitiveness - Factor-driven - Efficiency-driven - Innovation driven 2.Global Competitive Index (World Economic Forum) - Institutions - Infrastructure - Macroeconomic environment - Health and primary education - Higher education and training - Goods market efficiency - Labor market efficiency - Financial market development - Technological readiness - Market size - Business sophistication - Innovation *3.*Doing business index (World bank)	**Entrepreneurship of public authorities** Political Intuitional Social Academic
II. Companies in EZ ROI Revenue Profitability Market share Sustainable development Competitiveness	***Company competitiveness*** 1.Product-market strategies - Strategic business sphere - Concentration - Diversification 2. Competitive business strategies (Porter) - Key resources - Key competences - Dynamic capabilities - Competitive advantages 3.Business model and value-added chain	**Entrepreneurship in business organization** Business Corporate Social Academic Institutional
III. EZ government body Number of target companies Increases of territory Value of investments Employment Sustainable development of EZ Competitiveness of EZ	***EZ's competitiveness:*** 1.EZ's Services – target companies strategies - Specialization (concentration) - Diversification - Services 3.EZ Competitive advantages and competitive strategy 4.12 pillars of national and regional competitiveness (Porter's Diamond, Global Competitive Index)	**Entrepreneurship of EZ's management body** Business Political Institutional Social Academic

Source: own systematisation.

The second group includes companies that operate within EZs. At the core of SE's acceptance is the understanding that it is crucial for the sustainable development of SMEs, big companies and corporations, operating within the IZ from the industrial, agricultural, and service sectors. SE challenges large, established firms to become more entrepreneurial and challenges smaller entrepreneurial ventures to become more strategic (Hitt et al., 2012). They

show the importance of the strategic domain, through which the business model is determined, a competitive strategy is developed, and competitive advantage is provided (Porter, 1985). Product-market growth strategies are defined (Ansoff, 1965).

There are several domains of intersection between entrepreneurship and strategic management (Hitt et al. 2001): 1) innovations; 2) networks; 3) internationalisation; 4) organisational learning; 5) top management teams and governance; 6) growth. According to the sources and types of innovations and the extent of the transformation and the new configuration can vary widely: organisational rejuvenation, sustained regeneration, strategic renewal, domain redefinition (Covin and Miles, 1999).

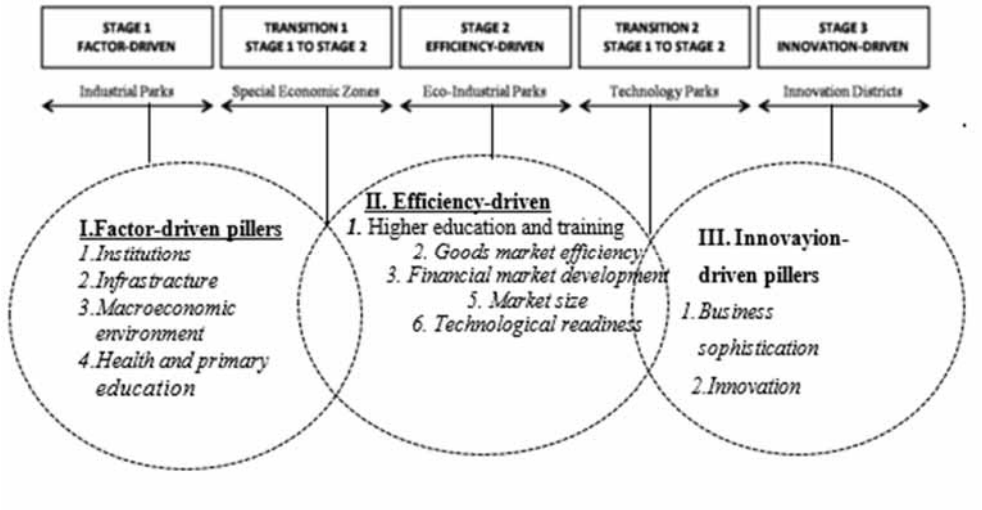
The third stakeholder group is EZ's government body. The role of SE in this group is to create a competitive environment within EZ's boundaries and ensure sustainable development. Understanding the EZ's nature and its role in bringing about EZ's sustainable competitive development through incremental and radical change by continuously seeking new opportunities and innovations is at the core of fulfilling this role. The strategic domain of SE includes two complementary perspectives. The first perspective brings EZ closer to the strategic domain of companies – it refers to EZ as a managed organisation. In this case, target companies are selected in terms of their sectoral affiliation, internationalisation and export orientation. The competitive approach is defined according to the costs target companies pay and the variety and quality of offered services. This perspective shows the importance of business, political and institutional entrepreneurship. The second perspective considers the EZ in the context of regional and national competitiveness. Porter's diamond, Global Competitive Index, and Doing business Index can be used to determine the competitiveness of EZ. As a result, EZ's competitive conditions could be even better than those at the national and regional levels. For this reason, economic zones attract more investment, and the pace of development of the region is catching up with those at the national level and other areas in the country. It is essential to consider the trinity: competitiveness of the economic zone – competitiveness of companies operating within its boundaries – the competitiveness of the region/country).

3.2. Stages of development of economic zones

The five types of economic zones represent the evolutionary stages of development of the economic zone. The first stage is IP, and the last one is ID (UNIDO, 2015). EZ's competitiveness is based on Porter's concept of national competitiveness (Porter, 1990). This concept summarises four determinants of national advantages: factor conditions, demand conditions, related and supporting industries, firm strategy, structure, and rivalry. Based on these determinants, Porter (1990) suggests four stages of national competitive development: factor-driven, investment-driven, innovation-driven, and wealth-driven. These determinants and stages of competitive development apply to EZs (UNIDO, 2015) (Figure 1).

Figure 1

Stages of development of economic zones and main pillars



Source: UNIDO, 2015, p. 16.

Stage 1: The emergence of Industry Park is associated with the first stage of competitive development, which defines them as factor-driven. The IP can be with or without built-up (advance) factories and standard facilities. Wyman, 2018; King Sturge, 2002 identify differences between industrial parks' core functions in developed countries where warehouses and distribution facilities are the most common tenants and the developing economies where manufacturing activities dominate. Among the main drivers of factor-driven EZs are institutions, infrastructure, macroeconomic environment, health and primary education

Transition 1: The transition from stage one to stage two is realised through the development of a Special Economic Zone. SEZ is a geographically limited area, usually physically secured (fenced-in); single management or administration; eligibility for benefits based upon physical location within the zone; separate customs area (duty-free benefits) and streamlined procedures (World Bank, 2008). The terminology used across countries varies wildly but also includes the most common terms. (OECD, 2017) SEZ is a generic term including Free Trade Zones (FTZs), Export Processing Zones (EPZs), Enterprise Zones, and Freeports (FPs). The SEZ is a designated estate where trade laws related to tariffs, quotas, or duties differ from those in the other parts of the country (UNIDO, 2015). Another SEZ classification largely correlates to the economic development stages that are typically seen across the globe: special manufacturing zones, special service zones, sector-specific zones, and transnational or extraterritorial zones (Wyman, 2018).

Stage 2: Eco-Industrial Park represents the next evolutionary stage of the competitive development of EZ. It is efficiency-driven. Participants collaborate to manage ecological and reuse issues (energy, water, materials) to achieve this common goal. This business

community seeks to achieve a total effect more significant than the sum of the individual benefits which each company would realise for itself (Tudor et al., 2007; Martin et al., 1996). The benefits are related to: low-carbon, green, or circular zones; promotion of industrial symbiosis and green technologies; delivering resource efficiency; improvement of the social, economic, and environmental performance of EIP's resident firms and as a result of their competitive advantage; promoting climate-resilient industries, green value chains, inclusive and sustainable business practices and socially responsible relations with regional communities (UNCTAD, 2019). Higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness and market size are the rivers of efficiency.

Transition 2: The last third stage is related to the passage through Technology parks. The TP enhance the knowledge and technology development in universities, R&D centres, innovative companies, and new markets in this connection. TP stimulate the innovation and growth of innovation-based companies through incubators and spin-offs. They also provide other value-added services and high-quality space and facilities (UNIDO, 2019; IASP, 2020; EIB, 2010; Jones et al., 1985; Petree et al., 2000). Some specific principles are prescribed (Wasim, 2014), and management guidelines (EIB, 2010) are needed to guarantee the sustainable development of technology parks and create value for park tenants (Albahari et al., 2019).

Stage 3: The third stage is the development of innovation-driven districts (UNIDO, 2015; Porter, 1990). IDs' management must develop an appropriate infrastructure, institutions, scientific, technological, educational, and social organisations and value-added services(Drucker at al., 2019; Wagner at al., 2017; Wagner, at al., 2019). Urban areas are more suitable for fostering innovations than suburban technology parks. Based on the 22@ Barcelona's model, IDs can be defined as "top-down urban innovation ecosystems" (ESCAP, 2019). They are designed around: urban planning, productive, collaborative, and creative, all coordinated under strong leadership, with the ultimate objectives of accelerating the process of innovation and of strengthening the locations' competitiveness (Morisson, 2014; Belussi and Sedita, 2019). IDs establishment and development result from the intentional clustering and cooperation of businesses, institutions, ideas, and people (Sharma, 2012). The forces driving innovation include business sophistication and innovations.

3.3. The role of strategic entrepreneurship in economic zones development

The ideas at the core of SE in business organisations are perceived in EZs' governance. EZ's business model (Wei et al., 2012; Trapp, 2014), Ansoff's matrix adaptation, Porter's competitive model, and Porter's Diamond are the basis for determining the degree of change in the functioning of the economic zone. Ansoff's strategic business sphere concept and product-market specialisation take a new shape (Ansoff, 1965). Instead of product-market growth strategies, a matrix of the services offered by EZ and target companies EZ's type and EZ's services – target companies matrix is considered in the modified version of the Ansoff matrix. There are four basic development options based on Ansoff's matrix. The interpretation of Porter's competitiveness development (Porter, 1990) and companies' competitiveness (Porter, 1985). Its determination is based on the scale: added value by EZ's

services – costs paid by resident companies and competitive development stages (Porter, 1990). All sources and types of innovation leading to incremental and radical changes (Drucker, 2009; McCraw, 2007; Trott, 2017) are examined in the context of business, social, institutional, and political-strategic entrepreneurship (Table3).

Table 3

The strategic domain of the economic zone's government body

1. EZ's business model	*- Who are the target companies?* Identify the target companies (investors) that EZs seek to attract. This includes the question of their sectoral specialization, the size of the companies, the origin of the capital, the degree of internationalization of the business, the export orientation. The number and structure of the target companies are determined in accordance with the available territory and PESTEL prerequisites. *- What values EZ deliver to the target companies?* Competitive business environment. Fostering innovation. Support entrepreneurship. -Where? Answers the question of where geographically the geographical area is located. *How EZ delevers its services(Value-adde chain)?* Infrastructure, superstructure, and facilities management; Administrative services and Specialized industrial support infrastructure; Business development and innovation management; Social service management; Performance management and monitoring. *Why EZ deliver its services?* Regional and national development. Improve competitiveness within the zone. Develop one or more specific sectors. Attract investment and technology. Promote environmental safeguards. Community development.
2. EZ's Ansoff's matrix (services-target clients)	*- Current companies - current services: EZ improves existing services for existing companies.* *- Current companies - new services: The EU offers new services for existing companies.* *- New companies - current services: EZ attracts new companies with the profile of existing ones by offering them existing services (in the current or new geographical area).* *- New companies - new services (diversification): the company offers new services for a new type of companies.*
3. EZ's competitive advantage	*- Cost leadership: IZ creates conditions that lead to the lowest possible costs for companies that attract and stay in the area. This is especially important for EZs, which are at the stage of factor-driven competitive development.* *- Differentiation: IZ offers conditions that lead to opportunities for creation/transition to efficiency-driven competitive development. A greater degree of differentiation is required for innovation-driven competitive development.* *- Niche strategy (cost leadership)* *Niche strategy (Differentiation)*
4. EZ's Porter's competitive stage of development and competitive index pillars	*- Factor-driven: Institutions; Infrastructure; Macroeconomic environment; Health and primary education* *- Efficiency-driven: Higher education and training; Goods market efficiency; Financial market development; Market size; Technological readiness;* *-Innovation-driven: Business sophistication; Innovation*

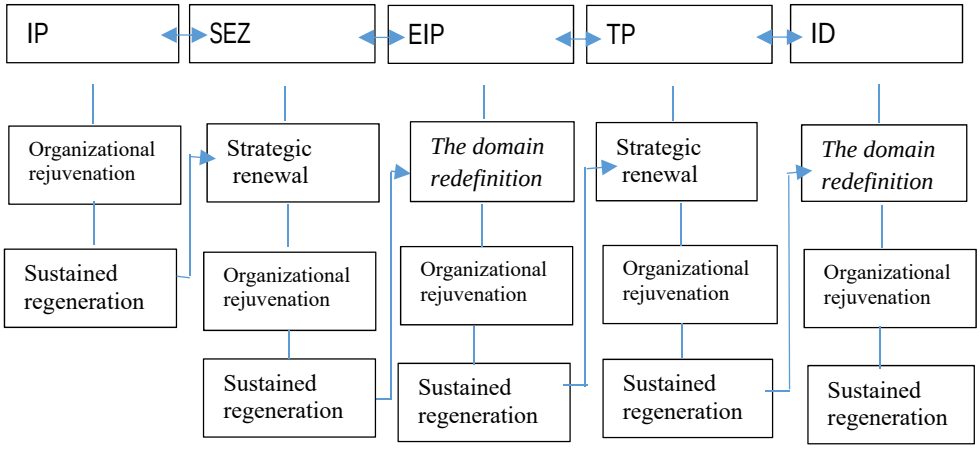
Source: own systematisation.

Innovations were prescribed by Schumpeter (McCraw, 2007) and their seven sources were proffered by Drucker (2009) and ideas were prescribed by the configuration school of thoughts. These innovations can happen anywhere and everywhere – major (radical) and minor (incremental) changes of all types: product, process organisational, management, production, commercial/marketing, and service innovations (Trott, 2017). Here, the main types have been synthesised – product (services delivered to companies in EZs), processes (value-added chain of EZs), and EZ's business model innovation of EZ. According to the innovations' sources and types, the extent of the transformation and the new configuration in EZs development can vary widely. These transformations (change) can be within the current stage of development of EZs or the transition to the next stage (Cawsey and Deszca, 2014).

SE affects every kind of EZ's competitive development and has great importance for the transformation from one stage to another. Depending on the extent of ongoing changes, a greater or lesser degree of transformation occurs – SE manifests its importance for competitive development within the individual stage and when the transition from one stage to another is accomplished. The changes are most significant when moving to the next stage of development (Figure 2).

Figure 2

Types (stages) of competitive development of economic zones and the extent of change



Source: own work.

It is important for the SE to examine the entrepreneurial and strategic domains that shape up its economic zones' ESMI model. Depending on the extent of changes, a greater or lesser degree of alteration and new configuration occur. Changes and transformations can be initiated and implemented from top to bottom (by the economic zone's governing body), from bottom to top (from), or in interaction zones (Zeng, 2010). The momentum of change can also come from outside the zone. Specific changes can be made by the companies themselves, which operate within the zone's boundaries, others by the zone's governing body or local and national authorities. Changes in all cases require interaction between all these groups and the manifestation of strategic entrepreneurship, expressed through the concept of ESMI. Of particular interest are the ESME of EZs as regards the topic chosen. According to

the type and the extent of change in EZs, there are four types of transformations in EZ (Covin and Miles, 1999): organisational rejuvenation EZ, sustained regeneration in EZ, strategic renewal in EZ, domain redefinition in EZ.

Organisational rejuvenation of EZ: the emphasis of change (innovation) is on choosing a set of variables related to the EZ's operations. The EZ stays in the current stage of competitive development. The aim is to maintain a low-cost structure for EZ's operations and those of its business inhabitants. EZ can improve its competitiveness within the current development stage without changes in its services package and target companies' scope. Organisational renewal can lead to fundamental redesign (business process reengineering) to readjust the EZ value-added chain elements. The innovations aim to change EZ's internal process by changing the cost structure in EZs and the quality of services and interaction with existing companies. Therefore, the aim is to improve the efficiency and effectiveness of the existing Value-added chain without changing the chosen competitive approach to the development of EZ.

*Sustained regeneration. C*ontinuous regeneration occurs within a specific stage of EZ competitive development. At its core is a constant search for new entrepreneurial opportunities by introducing new services to the existing resident firms and attracting new companies with the same profiles. The aim is to "exploit" the applied competitive strategy within the current specialisation of EZ. In addition to the change in the internal process of EZ, the change of cost structure in EZs and the quality of services of existing companies, new services are offered, and the goal is to attract new companies, to fully use the chosen competitive approach, expanding the range of companies and services provided.

Strategic renewal. In this case, there is a focus of the EZ inward. It examines EZs reviewing and redefining their relationships with existing and new target companies, institutions, and other stakeholders. This renewal reflects the changes in strategic approach and EZ's practices when necessary. Strategic renewal is present when there is a fundamental competitive repositioning. Strategic renewal appears in the second stage of strategic development and the second transition stage. This change is less risky than a redefinition of the EZ domain. One of the risks is the emergence of a conflict between the changes made and the routine activities. (Tuncdogan et al., 2019) EZ Model Reconstruction is the ultimate form of renewal. It reconfigures its model to improve the operational efficiency of EZ. The EZ's business model reconstruction includes strategic elements, such as outsourcing, which rely on external contractors for activities previously provided by EZ or to insource other operations (Kuratko and Audetsch, 2009; Trapp, 2014; Wei at al., 2012).

The domain redefinition is associated with moving to the next evolutionary stage of competitive development. The EZ changes its specialisation, starts delivering new services to new target companies, or changes the profile of existing ones. This change can be based on the emergence of new knowledge, new resources, or a new approach to combining them. This change is the riskiest for EZs development, and it is essential to assess whether the EZ manages this change itself or complies with the imposed requirements. It examines whether there are opportunities for creating new services or for changing its specialisation. In this case, a total transformation of EZ and a new configuration is required. EZ changes its service-companies specialisation, competitive approach, and value-added chain (Carnall, 2007; Morris et al., 2010).

4. Research Methodology of the Empirical Study

4.1. Argumentation for the choice of qualitative research

The deductive approach has been used in the research. It has been proceeded to a qualitative study of two cases that are fully representative of the development of economic zones in Bulgaria on the basis of the literature research review and the derived theoretical framework of strategic entrepreneurship as a factor for the development of economic zones. These two cases differ in their ownership (one is public, and the other one is private), goals, development strategies, and management. The complexity of strategic entrepreneurship determines the choice of qualitative research to prove its role as a factor in developing EZs.The research has explored the advantages of the case study as it is widely used to study the management, functioning, and development of economic areas. There are quantitative studies that prove that the development of economic zones leads to the development of regions and entire countries. However, there is actually a lack of quantitative research on the applicability of strategic entrepreneurship and its impact on EZ development. This circumstance has given additional grounds for choosing quality research. Methods of gathering information include studying information from secondary sources such as the official websites of the two organisations, presentations, participation in conferences, publications in the media, and interviews with management.

4.2. The measures of development of EZs

Porter's theory for national competitiveness is at the core of determining the extent of economic zones' development. Its perception presupposes the study of the development of EZ carried out through Porter's diamond. On this basis, the competitive development of EZs can be defined as factor-driven, efficiency-driven, or innovation-driven (Figure 1). EZs development, like the nation's prosperity, as defined by Porter (1990), is determined by its economy's productivity. The value of goods and services measures the productivity of EZ's human capital, material, and non-material resources. Productivity is the prime determinant of a standard of living achieved by employees in the long run, measured by per capita income in an EZ host region. The level of productivity, in turn, sets the level of prosperity that a (regional) economy can reach.

The productivity level also determines the return rates obtained by investments in an industrial zone and the level of GDP growth rates. In other words, a more competitive EZ is likely to grow faster over time. Porter's theory has been used to develop indexes for determining national competitiveness: *The Global Competitive Index* of the World Economic Forum. The European Commission uses its index called the European Regional Competitiveness Index (RCI). The World Bank's Doing Business Index is the third most popular one. These indexes are applicable for defining EZs and regional competitive development. Based on the inclusive and sustainable industrial development (ISID) principles, there are four main indicator categories for development: economic performance indicators, social performance indicators, environmental performance indicators, technological and innovation indicators (UNIDO, 2013). Based on the logic of Porter's theory for national competitiveness and target indices, the following specific indicators that

measure the economic zone's development have been derived when considering the two case studies: the size of the territory and its expansion, area occupation, retention of existing companies, attracting new ones, number of investments and employees. Another evidence is the development of the infrastructure, institutional changes, GDP growth in the region, GDP per capita increase, unemployment decrease, and net migration. The transition from one stage is the final manifestation of EZs development. Its precursors are the incoming companies with higher competitiveness (technological level, added value, and market potential).

5. Main Findings and Recommendations

On the basis of the qualitative study, it has been established that ESMI occurs in both cases. Both cases, the Trakia Economic Zone (TEZ) and the "Industrial zones" National company, prove the importance of strategic and entrepreneurial domains.

5.1. The first case – Trakia Economic Zone (TEZ)

With more than 20 years of experience, *Trakia Economic Zone (TEZ)* was established officially in 2013. TEZ is the result of a successful collaboration between a private holding based in Plovdiv, its partners from Italy and Israel, one of the most important industrial companies in Bulgaria – KCM 2000 AD and local authorities. TEZ combines the six industrial zones – Maritsa, Rakovski, Kouklen, Plovdiv Industrial Park, Innovation Park, and Agrocenter Kaloyanovo.

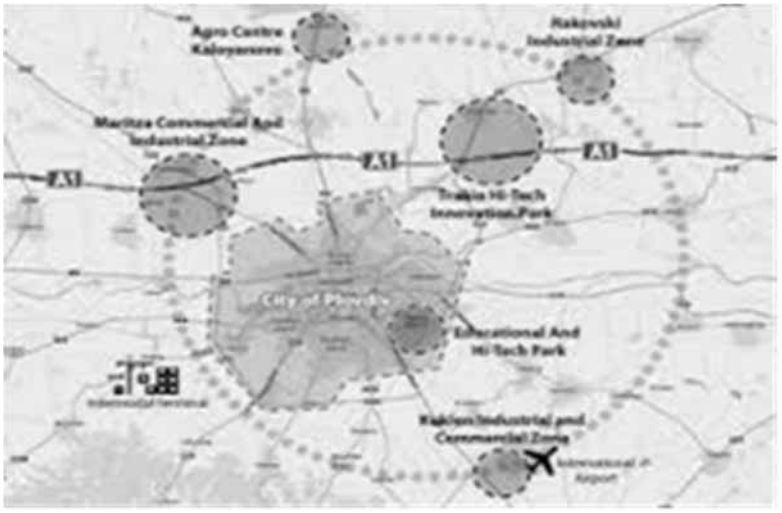
5.1.1. The strategic domain of TEZ

Trakia Economic Zone is what is known as an EZ linked to a specific city, aiming to maximise the benefits for investors from choosing a specific location by providing a range of services. The total area of TEZ is 10,7 mln. m², of which 4 mln. m² (37%) are occupied. All of them are concentrated in the Plovdiv district (Figure 3).

TEZ's service-target companies portfolio: the target companies include companies from different sectors of the economy. Since the first zone launch in 1996, over 180 companies have been attracted from different industries: Engineering, Electronics, Foor, Logistics Chemistry, Textile, Food, Energy Equipment, Machinery, Chemistry, Automotive, Metals, Logistics, and ICT. Many investors are among world leaders in their industry – Liebherr, Ferrero, Socotab, Kaufland, Schnider Electric, TNT, DB SCHENKER, Osram, Telus, Modis. *Main services* delivered to resident firms include: design, rent, and sale of properties, legal services, EU funding, bank funding, build to suit, full investment management, and one-stop-shop. *Geographical coverage:* mainly in Plovdiv municipality. Nowadays, TEZ is expanding its know-how to Stara Zagora, Haskovo, and Bourgas.

Figure 3

Trakia Economic Zones and its seven zones operating in the Plovdiv district



Source: https://tez.bg/bg/zoni/.

5.1.2. The entrepreneurial domain of TEZ

Political and institutional entrepreneurship: the development of the Trakia Economic Zone in 2014 united the Plovdiv Municipality, another eight local municipalities, and several associations. TEZ has efficiently coordinated and cooperated with local and state governments, educational institutions, associations, and business communities thanks to its model. TEZ was granted the "First region for priority support from the State in Bulgaria" and its sustainable development program became a part of the Innovation plan of Plovdiv Region 2017-2020.

Academic entrepreneurship: TIZ has established the Education-industrial board and Trakia EDU – Vocational training centre to cover the companies' needs in Trakia Economic Zone for training and retraining their existing and new employees. The EDU provides laboratory space, develops trainers' skills, and organises the training courses according to employers' needs.

Social entrepreneurship: construction of kindergartens and social housing, medical centres, involvement of all social communities, and promotion of social entrepreneurship.

5.1.3. Measures for EZ development

The territory of the zone amounts to 10.7 million m^2, of which 4 million m^2 are occupied (37%). TIZ's investments since its inception amount to more than €2 billion. More than 30,000 new jobs have also been created. TEZ is the largest and most sustainable industrial area in Bulgaria and in Southeast Europe. The development of TEZ in 2014 united the

Plovdiv Municipality, another eight local municipalities, and several associations. A strategy to transform TEZ into an eco-industrial park by achieving carbon neutrality has been adopted. Two projects have been launched: CoSuReM – Concept for sustainable resource management – circular economy in TEZ and Typhaboard – a study of the use and production of innovative building materials. Through its competitive development, TIZ is ahead of the country's competitive development. The Bulgarian economy ranks 49th out of 137 countries according to the Global Competitive Index (2018). Thanks to the achievements of Trakia Economic Zone, the city of Plovdiv has ranked amongst the top three in the category "FDI Strategy" in the "European cities of the future 2018/2019 (Top 10 Small European Cities of the Future 2018/2019)" ranking published by the Financial Times. TIZ is expanding geographically. There is an agreement for cooperation between the Thrace Economic Zone and the Municipality of Bourgas, Stara Zagora, and Haskovo to develop economic zones on the territories of the respective municipalities. The best sign that the economic zone is the place for a successful business is that the companies within the zone grow and continue to invest.

5.2. The second case – National Company Industrial Zones PLC

National Company Industrial Zones PLC was established in 2009. It is a 100% state-owned holding company. Seven zones have already been opened: in Sofia, Bourgas, Vidin, Rousse, Svilengrad, Stara Zagora, and Varna. Four of the projects are under development – in Kardzhali, Karlovo, Telish, and Souvorov. Industrial zones are established as a stock company with National Company Industrial Zones and municipalities as a shareholder. They also sign memorandums of cooperation for the development of industrial zones (Figure 4).

5.2.1. Strategic domain

National Company Industrial Zones Ltd. uses the approach of industrial zones to implement nationally significant policies in attracting significant investors for the specific region. It is the Bulgarian government's instrument for the implementation of the national industrial policy. The company manages 12 industrial zones across the country with a total area of more than 8,000,000 square meters. In the general case, the municipality provides the land on which it intends to develop the industrial zone, and the state company provides the funds for building the necessary infrastructure.

NZ's service- target companies portfolio: Since 2009, over 30 companies have been attracted to Bozhourishte (Sofia) zone, mainly in Industry, High Tech, Warehousing, and Logistics. Among the investors are JYSK, BHTC – Behr Hella Termocontrol, Multivac, Loulis, Inovas, Speedy. Thirty-five contracts have been signed between companies and the economic zone in Bourgas.

Figure 4

The economic zones under the control of National Company Industrial Zones

Source: http://nciz.bg/.

Main services to businesses: development of industrial zones, offering plots and warehouses for sale or rent, encouraging investments in different industries, and creating favourable investment conditions.

Geographical coverage: Seven operating industrial parks: Industrial Park Sofia-Bozhourishte, Industrial & Logistics Park – Bourgas, Free Zone Ruse, Industrial Zone Svilengrad, Industrial Park Vidin, Southern Industrial Zone – Varna, Industrial Zone Zagora. Five zones are under construction: Industrial Park Karlovo, Industrial Park Pleven – Telish, Industrial Park Souvorovo – Varna West, Industrial Zone Kardzhali, and High-tech production park – Simitli.

5.2.2. Entrepreneurial domain

Political and institutional entrepreneurship: When implementing projects in state-owned industrial zones, investors can rely on predictability and competitive conditions, partnership, and assistance throughout the investment process. *Academic entrepreneurship:* The Fast Tracking Success project's launch aims at accelerating the professional development of young staff at universities and vocational high schools through permanent employment and internships in foreign companies in industrial areas.

5.2.3. Measures for EZ development

350,000 m^2 have been occupied out of the total of 7,400,000 m^2. Investments attracted in the managed zone amount to more than 0.5 bln. Euros. More than 2,000 new jobs have been created.

5.3. Summaries and recommendations

There is a manifestation of the strategic and entrepreneurial domains of ESMI in both examined economic zones, which confirms the study's main hypothesis. Both companies have four components of their business model.

- *First*, there are target companies with the desired characteristics, such as sectoral specialisation, degree of internationalisation, size, and technological development. Their profile varies from factor-driven to efficiency-driven. Refocusing on high-tech and innovative companies producing high added value has been observed.
- *Second*, the services delivered to the target companies have been defined. They vary widely. Those that the target companies need at the initial stage are particularly highly developed.
- *Third*, the geographical coverage of the two EZ's activities, performing the role of developer, operator, owner/sponsor has been determined. The data available is an evidence that the National Company Industrial Zones has national coverage. TIZ focuses its activities on the territory of Plovdiv Municipality and Plovdiv district. It is now expanding to three other municipalities.
- *Fourth,* through the offered portfolio of services, the two companies are positioned as reliable developers, operators, and owners among the companies operating within their boundaries. Attracting investors, their retention and development within the zones show that the proposed conditions are at the required level of competitiveness.

Strategic entrepreneurship is at the core of the development of the two considered zones. SE guarantees the continuous development of economic zones within the various stages of competitive development (EZ organisational rejuvenation, sustained regeneration). SE carries out the transformation (EZ strategic renewal) and moves to the next development stage (EZ domain redefinition). In both cases, more competitive development conditions are created than competitiveness at the national level. Currently, the two zones are being transformed from a factor-driven to an efficiency-driven stage of competitive development. There are initiatives to create innovation-driven conditions to attract high-tech and innovative companies. Appropriate conditions should be developed thereof. Strategic and entrepreneurial domains of ESMI are needed for their development. The development of a strategic development plan and a guide for ESMI-oriented management would accelerate the development of the zones within the two companies and may spread to other economic zones in the country. An entrepreneurial model of behaviour is also needed for this purpose.

6. Conclusions

This argues for the role of SE in the emergence and development of economic zones. Based on the understanding that entrepreneurship adds value to individuals, organisations, and society (Hitt et al., 2012), it is reasonable to accept its importance as a primary factor for developing economic zones. Political and business entrepreneurship is at the core of the emergence of EZs. In the subsequent development, all other entrepreneurship forms find their

place. Within a specific stage, entrepreneurship's role is to seek opportunities and innovations that maximise the effect of the economic zone's specialisation. The development of economic zones includes searching for new opportunities and innovation, leading to a change of specialisation and moving from one stage of development to another. The variety of stakeholders necessitates a more comprehensive definition of the entrepreneurship domain in EZ. The complex nature of economic zones implies the manifestation of entrepreneurship in all its forms, applicable by the organisations interested in EZ activities. Entrepreneurship, entrepreneurial opportunities, innovation, and the risk in the Economic zone is to be considered in business, corporate, political, social, and institutional entrepreneurship applied by different organisations in economic zones.

The methodological toolkit of strategic management inherent in business and non-business organisations is applicable in managing economic zones. The decision-making process in EZs and development is impossible without a meaningful strategic management process based on the configuration school of thought. EZ's management body should assess its strategic position, define strategic decisions and guarantee their implementation.

The ideas underlying the core of EZ in business organisations are perceived in EZs. Ansoff's strategic business sphere concept and product-market specialisation (1965) take a new shape: EZ's type and EZ's services – target companies matrix. The interpretation of Porter's competitive advantage and competitiveness concepts also needs modification. Its determination is based on the scale: added value by EZ's services – costs paid by resident companies and competitive development stages. All sources and types of innovation leading to incremental and radical changes are examined in the context of business, social, institutional, and political-strategic entrepreneurship.

SE affects every kind of EZ's competitive development and has great importance for transformation from one stage to another. A greater or lesser degree of transformation occurs depending on the degree of ongoing changes. The changes are most significant when moving to the next stage of development. SE manifests its importance for competitive development within the individual stage and in the transition from one stage to another. The role of EZ within a specific stage consists of improving the competitive environment for resident companies. The importance of SE is supposed to examine the entrepreneurial and strategic domains, which form its economic zones' ESMI model.

The two case studies examined here do not feature statistically significant results. Even though they confirm the thesis defended in this article. The study of the topic will be expanded by suggesting a theoretical model of strategic entrepreneurship and examining its role in developing economic zones in Bulgaria and around the world.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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DEA IN PERFORMANCE MEASUREMENT OF TWO-STAGE PROCESSES: COMPARATIVE OVERVIEW OF THE LITERATURE[3]

Standard non-parametric Data Envelopment Analysis (DEA) introduced by Charnes, Cooper, Rhodes (1978) does not provide adequate detail to identify the specific sources of inefficiency embedded in the activities on the level of production sub-processes of an enterprise, without considering the internal structure of the business. One of the DEA applications is to evaluate the efficiency of two-stage processes, where all outputs of the first stage are intermediate measures, which are considered as inputs of the second stage. In recent years, there has been an exponential growth in the number of publications related to theory and applications of efficiency measurement for two-stage systems. These models assess both the overall efficiency score of the whole process and each of the individual sub-processes. Results from the analysis give an approach to the significant more detailed information that would otherwise remain hidden in the ,,black box" of efficiency analysis. Opening the black box of efficiency analysis offers managers to monitor and measure the efficiency of their production sub-processes. The management is able to early detection of the inefficiencies in the production process.
The aim of the paper is twofold. The first task is to survey and classify the Two-stage DEA models and present the applications of these models across the literature. The second aim is to offer important support to future researchers, providing a ,,new" knowledge base regarding network DEA methods and encourage researchers to collect data suitable for this type of network analysis.
The objective of the work is to review the network DEA literature, because the number of studies which seek to measure the efficiency and productivity of decision-making units with internal structures has increased in the last years dramatically. This paper aims to support future researchers on this topic.
Keywords: Data Envelopment Analysis; Efficiency; Intermediate product; Internal structures; Two-stage process; Two-stage NDEA
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1. Introduction

Data Envelopment Analysis (DEA) is a non-parametric technique for evaluating the efficiency of organisations in terms of inputs and outputs. DEA is a mathematical programming technique originally developed by operations research workers studying business firms and not-for-profit organisations to identify best-practice efficiency frontiers and to measure shortfalls from the frontiers. The basic goal of DEA models is to evaluate on a comparative basis the efficiency of homogeneous decision-making units (DMUs), which use inputs for their activities and transform them into desirable or undesirable outputs. The beginnings of the ideas leading to the current form of this non-parametric method can be found in the study of Farell (1957), which was significantly followed by the work of Charnes et al. (1978) and Banker et al. (1984). Authors formulated exactly radial DEA models under the assumption of constant returns to scale (CCR model), or taking into account the variability of returns to scale (BCC model). The pioneers in the formulation and application of non-radial DEA models are the studies of Charnes et al. (1985) and Tone (2001). These models pertain to single level situations, in which the production process consists of single stages for each member of a given set of Decision Making Units (DMUs).

The production process can have multiple stages, and therefore measuring the efficiency of every single stage separately would be necessary and useful to diagnose and improve the overall efficiency of the production activities. The first idea that the production systems consist of a finite set of sub-technologies (also referred as sub-activities, sub-processes, sub-systems) was mentioned in the work by Shephard, Färe (1975). In recent years, an application and theory of Network Data Envelopment Analysis (NDEA) has received more attention in the DEA literature. Many authors provide literature reviews on the empirical surveys in the field of NDEA efficiency analysis, the most relevant NDEA techniques, approaches, methodological development, application fields and development trends. Cook, Seiford (2009) provided a literature review of the various DEA models and presented the multilevel models with the concept of sub-technologies inside the process of efficiency analysis. Halkos et al. (2014) presented different Two-stage DEA approaches and defined four categories with their mathematical formulations and applications, namely independent, connected, relational and game-theoretic Two-stage DEA models.

Emrouznejad, Yang (2018) made a survey and analysis of the first 40 years of DEA literature (1978-2016). Authors investigated the top 5 most popular research keywords in 2015 and 2016 investigated in journal DEA – related articles with the second place for research keywords: Network DEA, Two-stage DEA and efficiency Decomposition. Zhou et al. (2021) suggested future research DEA application directions in using the NDEA models, which take into account the inner operational mechanism of the sub-systems in each DMU under evaluation. Xu et al. (2020) mentioned the Network DEA method as a new concept of extended DEA in the field of the DEA method, which can show more detailed efficiency in the production process. Daraio et al. (2020) made a systematical review of empirical surveys that have been written in the field of efficiency and productivity analysis using frontier estimation methodologies and identified the term networks as one of the most attractive terms extracted from the departing bibliography list by their systematic review of the empirical surveys. Lampe and Hilgers (2015) focused on the DEA and Stochastic Frontier Analysis

(SFA) papers and identified three main research topics from Network DEA models, namely Relational Network Model (Kao, 2009 and Kao, Hwang, 2008), Multi-Activity Network DEA (Yu, Lin, 2008) and Slacks Based Network DEA (Avkiran, 2009, Tone, Tsutsui, 2009). Zhou, Xu (2020) summarised the research studies of the Fuzzy Data Envelopment Analysis (FDEA) research and developed the FDEA model to integrate the fuzzy sets with different DEAs, such as the network DEA and two-stage DEA.

Färe, Whittaker (1995) and Färe, Grossskopf (1996) first proposed an input-oriented Two-stage NDEA model to study the relative efficiency of dairy production processes. In another study, Färe, Grossskopf (2000) presented a NDEA model for assessing Swedish Institute for Health Economics. This concept became the basis for the further studies and research in this area. However, many more complex cases have been studied during the literature where the business system is separated into more processes, either with series or parallel structure, or some mix of these. These structures are called in the literature network structures, and the DEA techniques developed to measure efficiency in such systems is referred as network DEA (Kao, 2014). Network DEA has been widely used for efficiency in various industrial and commercial sectors. The application field of Two-stage DEA models is miscellaneous. Luo (2003), Chen, Zhu (2004), Avkiran (2009), (2015), Kao, Liu (2014), Wang et al. (2014), Wanke, Barros (2014) Kwon, Lee (2015), Zha et al. (2016), Wanke et al. (2017), An et al. (2018), Ding et al. (2019), Halsaf et al. (2020), Henriques et al. (2020) proposed applications of Two-stage DEA to banking sector. Yang (2006), Chen et al. (2009) created a Two-stage DEA model allowing for applications to the life and health insurance companies. Zhu (2011), Gramani (2012), Lu et al. (2012), Lozano et al. (2013), Tavassoli et al. (2014) proposed applications of Two-stage DEA to airline performance. Färe, Whittaker (1995) Majiwa et al. (2018) developed a NDEA approach allowing for applications to agriculture. Chiu, Lin (2018), Yin et al. (2020) presented a performance evaluation with NDEA model in tourist hotels. Eco-efficiency analysis with Two-stage NDEA approach became a hot research topic in the studies Chu et al. (2015), Chen et al. (2018), Mirmozaffari (2018). Yang et al. (2008), Tsolas (2011), Lozano et al. (2013), Wang et al. (2014), Wu et al. (2016), Chen et al. (2018) provided an approach for analysing the reuse of undesirable intermediate outputs in a Two-stage production process with an application in different sectors. Liang et al. (2011), Kao, Lin (2012), Lee, Worthington (2016), Golshani et al. (2019) applicate NDEA to measure the quality of the university research services.

The overall efficiency of Two-stage DEA models can be evaluated with the decomposition approach presented by Kao, Hwang (2008), Chen et al. (2009), Wang, Chin (2010), Zhu (2011), Gramani (2012), Chu et al. (2015), Despotis (2016a), Chen et al. (2016), and game-theoretical approach proposed by Chen et al. (2006), Liang et al. (2008), Izadikhah et al. (2018).

We emphasise that the goal of our paper is to present a systematic survey of the literature on using the NDEA in Two-stage processes, because the number of studies on this topic is quite large, as depicted by Emrouznejad, Yang (2018) and Zhu (2020). The listing of NDEA related publications and articles is the most complete source of references for this topic and its applications in measuring the efficiency of Two-stage processes, productivity or performance with internal structures.

The article is organised as follows. Following the introduction, the series and parallel structure and types of Two-stage processes are described in Section 2. Section 3 proposed an NDEA literature review, which applied Two-stage static approaches to measure the performance of DMUs. Section 4 outlines conclusions and discusses the possibilities for further research in this area.

2. Basic Structures and Types in Network Systems

A common feature among the several models is that the efficiency evaluation of the DMU depends on the efficiency values of its sub-processes, thereby increasing the discrimination power of DEA methodology with respect to the black-box approach (Castelli et al., 2010). We classify the contributions of DEA literature assessing DMUs, whose internal structure is known.

Network models use different structures. In the development of NDEA were used different models with two or multiple stages (static models) or extend it to time-dependent processes (dynamic models). NDEA approach is constructed under Constant Returns to Scale (CRS) or Variable Returns to Scale (VRS) and can be input-, output- or non-oriented. In this section, we describe the structures and types of models, including intermediate flows between the sub-processes in the production process.

2.1. Two basic structures in NDEA

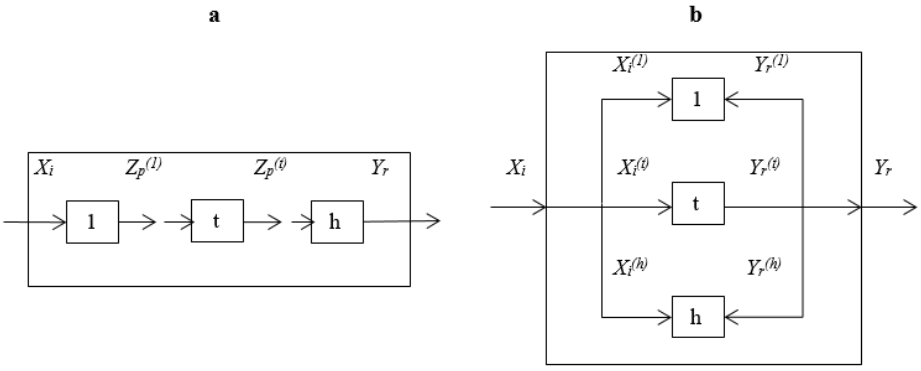
Barlow, Proschan (1975) assert that parallel and serial structures are two basic structures of a system, but a more complex network system can be represented by a parallel system with serial sub-processes or a serial system with parallel sub-processes. For each of these structures, system (in)-efficiency can be broken down into (in)-efficiency of individual processes (Kao, 2009). The serial network model contains DMU with two or with multiple sub-processes, linked by an intermediate product. The authors divide the serial structure into a simple and extended one depending on the possibility of exogenous inputs into sub-processes and on the possibility to produce final outputs in each sub-process (Kao, 2014). In this section, we study the difference between series and parallel structure. In NDEA study, authors often use the combination of both of them, e.g. study Javan, Malkhalifeh (2016), Ma et al. (2017).

The Series system of h sub-processes with the structure of *DMU j* is shown in Figure 1a. X_{ij} and Y_{rj} represent the inputs and outputs of the network system. Stage 1 consumes all the inputs $X_{ij,\ i=1,\ldots,j,}$ supplied from outside to produce the intermediate products $Z_{pj}^{(t)}$ $p=1,\ldots,q$ from process t, $t=1,\ldots,h-1$. The intermediate product from process t is output from sub-process t and also an input for sub-process $t+1$. This series structure can be used in static or dynamic models, including time period. The number of intermediate products can be different for each sub-process. Series system of sub-processes in static understanding is described in studies Luo (2003), Kao, Hwang (2008), Liang et al. (2011), Amirteimoori et al. (2016), Despotis et al. (2016a), Izadikhah et al. (2018), Tsolas (2020).

Another basic structure in network systems is parallel (see application for parallel production system in study Kao, Lin, 2012). Figure 1b shows the structure of the general parallel systems, where the sub-processes are operating independently (Halkos, et al., 2014). Kao, Hwang (2010) emphasise that parallel structures are a special case of serial structures without intermediate measures. Each stage consumes the inputs $X_{ij}^{(t)}$, i=1,...,m to produce the outputs $Y_{rj}^{(t)}$, r=1,...,s for *DMU j*. The sum of inputs for all the sub-processes is equal to the input of the whole network system of *DMU*, as: $\sum_{t=1}^{h} X_{ij}^{(t)} = X_{ij}$. The same also applies to outputs, $\sum_{t=1}^{h} Y_{rj}^{(t)} = Y_{rj}$. The series system considers of *h* sub-processes and a parallel structure is composed of *h* sub-processes.

Figure 1

a Series systems, b Parallel systems



Source: Edited by Kao, 2009.

2.2. Types of NDEA models

The main types of NDEA models are discussed in the research papers from Färe, Whittaker (1995), Färe, Grosskopf (1996, 1997, 2000), Färe et al. (2007) and presented and applied in the studies mentioned in Table 1. Figure 2 shows the Two-stage processes in static and dynamic understanding and with shared input to sub-processes. The presented study focuses on the static Two-stage NDEA model, but for a full understanding, all types of NDEA models are presented.

Static network model

Cook et al. (2010a) detected that the most commonly used static model is the Two-Stage Network DEA Model (NDEA model). Kao (2014) divides Two-stage static DEA models into

basic and general. The difference between the general model and the basic model consist in the possibility of exogenous inputs $X_i^{(2)}$ to the second sub-process and the possibility of producing the final outputs $Y_r^{(1)}$ in the first stage (Figure 2a). Halkos et al. (2014) refer to the static NDEA model as a model, where the sub-technologies are connected by the intermediate product, and where exogenous inputs can enter to the process in each sub-activity. Also, final output can be produced in each sub-process.

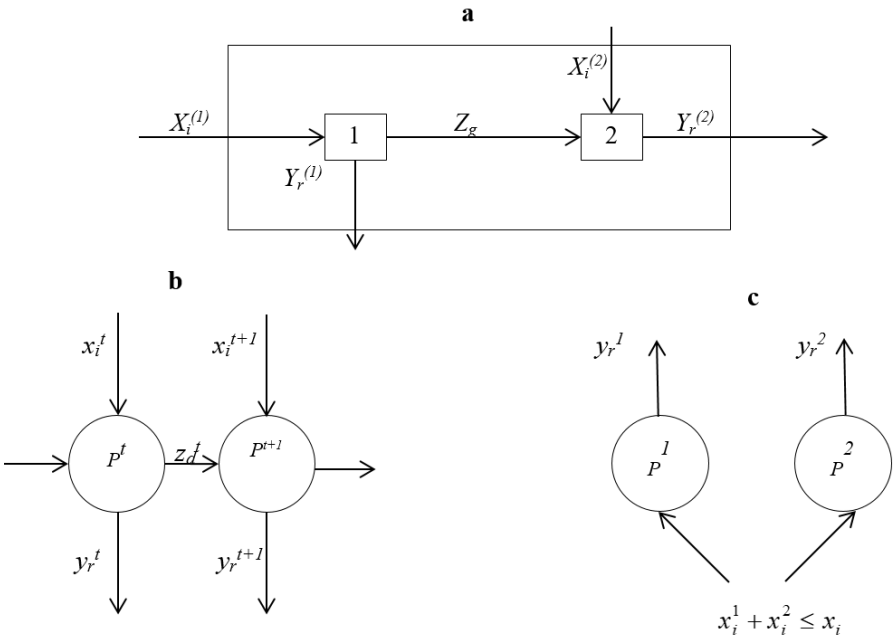
Dynamic network model

A dynamic model has introduced the dynamic aspect of the production process. Intermediate product acts as an output in the first time period and enters to the production process the next period of time. Färe, Grosskopf (2000) considered the same production process in two successive periods with period-specific inputs and outputs. In addition, some of the outputs in the first period are used as inputs in the second. By representing the production processes as nodes or subunits, these time-intermediate products are the intermediate flows of a (dynamic) network (Castelli et al., 2010). Figure 2b shows a model constructed in two-time periods *t* and *t + 1*. Two sub-processes are P^t and P^{t+1}. Sub-technology produces as final output and as intermediate at time t, and represents exogenous inputs to the process. Sub-process P^t produces $y_r^t\left(r=1,...,s^t\right)$ as final output and $z_d^t\left(d=1,..,D^t\right)$ as an intermediate product at time *t*. Inputs $x_i^t\left(i=1,...,m^t\right)$ and $x_i^{t+1}\left(i=1,...,m^{t+1}\right)$ are exogenous inputs to the process.

Technology adoption model

Figure 2c illustrates a simple version of the distribution of resources among two sub-processes, where the flow of one production process does not follow the results of the second process (parallel structure). Research studies (see also Chen et al., 2010) also called this model a Shared resources model. Inputs x_i are divided between two sub-processes P^1 and P^2. Input x_i^1 is the input for sub-process P^1 and x_i^2 is the input for sub-process P^2. The sum of individual inputs must not exceed the total inputs, ie. $x_i \geq x_i^1 + x_i^2$. These two sub-processes produce final outputs y_r^1 and y_r^2.

Figure 2
a Static Two-stage model, b Dynamic model, c Technology adoption model



Source: Edited by Färe, Grosskopf (2000).

3. Literature Overview of the Literature and Classification of Two-Stage Static DEA Approaches

An important area of development in the non-parametric DEA methodology in the last years has been devoted to applications wherein DMUs represent Two-stage or multi-stage processes (sub-processes). The current paper presents an overview of journal articles dealing with DMUs with Two-stage static sub-processes (Table 1). Empirical studies primarily deal with the creation of an innovative NDEA model and apply it to illustrative numerical examples. Cook et al. (2010a) reviewed the various existing DEA models for measuring efficiency in the mentioned Two-stage network structures or processes. Authors classify these DEA models into four categories: standard DEA approach (e.g. studies Seiford, Zhu, 1999; Sexton, Lewis, 2003); efficiency decomposition approach (e.g. studies Chen, et al., 2009, (2016; Wang, Chin, 2010; Zhu, 2011; Chu, et al., 2015; Despotis, et al., 2016a); network-DEA approach (e.g. studies Färe, Whittaker, 1995; Chen, Zhu, 2004); and game-theoretic approach (e.g. studies Chen, et al., 2006; Liang, et al., 2008; Izadikhah, et al., 2018).

Fukyama, Mirdehghan (2012) presented that the assumption of proportional changes in inputs and outputs were not correct in some cases and it was advisable to use a non-radial measure of efficiency. Tone, Tsutsui (2009) proposed a network slacks-based DEA model

(called NSBM), that could deal with intermediate products formally. NSBM can be input-, output- or non-oriented (see also Tone, Tsutsui, 2010). Using this model of the divisional efficiencies along with the overall efficiency of DMUs can be evaluated. Their study has been the basic framework of NSBM and was extended in many other research papers, like Avkiran, McCrystal (2012), Lozano et al. (2013), Tavassoli et al. (2014), Chiu, Lin (2018), Golshani et al. (2019). Two-stage processes usually have undesirable intermediate outputs, which are normally considered to be unrecoverable final outputs. In the literature overview, we have found papers Yang et al. (2008), Tsolas (2011), Chen et al. (2015), Wang et al. (2014), Wu et al. (2016) and Chen et al. (2018) that discusses the undesirable intermediate outputs in Two-stage structure.

Fuzzy DEA approach for parallel series was proposed in the study by Kao, Lin (2012) and for series structure in the study by Yang, Liu (2012). NDEA models, which allow for any orientation or scale assumption, were described in the study by Sexton, Lewis (2003). Input-oriented Two-stage DEA model was used in the study by Lu et al. (2012), Tsolas (2020) and the un-oriented Two-stage model in the study by Lewis et al. (2013).

In the Two-stage process, authors developed additive models. Research papers by Chen et al. (2009), Cook et al. (2010b) introduce an additive decomposition approach to the Two-stage network studied by Kao, Hwang (2008) and use DMU-specific weights to reflect the „sizes" of the stages within a DMU. This additive approach can be applied under CRS and VRS assumptions. Additive models for Two-stage processes with flexible intermediate measures and shared inputs, which measure the efficiency of not only the overall process, but also the individual sub-processes are extended in studies Lu et al. (2012), Wang et al. (2014), Amirteimoori et al. (2016), Ding et al. (2019), Guo et al. (2020).

The relational approach to measuring the efficiency of Two-stage processes assumes a mathematical relationship between overall efficiency and individual efficiency of sub-processes. The study by Kao (2009) builds a relational NDEA model, taking into account the interrelationship of the processes within the system, to measure the efficiency of the system and those processes at the same time. By introducing dummy processes, the original network system can be transformed into a series system, where each stage in the series is from a parallel structure. This study extended the paper by Kao, Hwang (2008), where the relational NDEA model for the series structure was introduced. Many other authors Liu, Wang (2009), Kao, Hwang (2010), Lozano (2011), Sun et al. (2013) and An et al. (2018) provided more alternative ways for measuring the performance of the Two-stage process using relational NDEA model.

Some research papers by Chen, Zhu (2004) show that using the concept of cooperative game theory, or centralised control, for a Two-stage process can be viewed as the one, where the stages jointly determine a set of optimal weights on the intermediate factors to maximise their efficiency scores. The centralised approach generated efficiency decomposition for the two individual stages. The centralised model was developed in the study by Liang et al. (2008) and extended with shared inputs and outputs (see Li et al. (2016), Ding et al. (2019)), and applied to banks Wanke, Barros (2014), airlines Zhu (2011) and university research services Lee, Worthington (2016).

This paper is a literature overview of static Two-stage NDEA models and proposes a classification and bibliographic collection of the static Two-stage publications shown in Table 1. The analysis comprised of the 76 NDEA research articles published from 1995 to 2021 (a large number of citations on the Web of Science). The second column shows the non-parametric approaches to measuring the network efficiency and classifies the articles by the used NDEA methods. The third column shows the application fields of NDEA methodology including the Banking sector, Insurance companies, High-tech industries, Airlines, Universities and others. The fourth column contains Two-stages (two sub-processes), that make up the whole production process of DMU. N/A means, that the research study was theoretical or the application was an only illustrative example. The last column shows the type of research paper: Theoretical (T), Theoretical and Practical (T/P) and Practical (P). If the paper was only Theoretical (T), it is indicated in parentheses, what was innovative and developing NDEA methodology in the presented paper.

Table 1

Comparative overview of static Two-stage NDEA approach

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
Amirteimoori et al. (2016)	Additive models for Two-stage NDEA	Numerical example	N/A	T (proposed additive NDEA model in series processes with shared resources)
An et al. (2016)	Internal resource waste in Two-stage NDEA model	Numerical example	N/A	T (developed Two-stage model considering a degree of centralisation)
An et al. (2018)	Relational DEA model for a Two-stage system	Commercial banks	Production/profitability	T/P
Avkiran, McCrystal (2012)	NSBM: Sensitivity Analysis of NDEA	Illustrative example: Retail Bank Branch	Division of tellers/Division of bankers	T (first systematic investigation of the sensitivity of NDEA)
Chen et al. (2006)	Supply Chain DEA Game model	Numerical example (Enterprises)	Supplier/ Manufacturer	T (developed two efficiency functions for supplier and manufacturer and proposed a bargaining model)
Chen et al. (2009)	Additive Two-Stage NDEA (additive efficiency decomposition approach)	Non-life insurance companies	Premium acquisition/ Profit generation	T/P
Chen et al. (2010)	DEA frontier for Two-stage processes	Numerical example (Non-life insurance companies)	Premium acquisition/ Profit generation	T (developed approach for determining the frontier projections for Two-stage processes)
Chen et al. (2012)	Two-stage NDEA model to evaluate sustainable product design performances „sustainable design efficiency”	Automotive industry	Product design/ Environmental impact	T/P

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
Chen et al. (2016)	Two- stage DEA model with slacks-based measures	Numerical example	N/A	T (proposed SBM-based approach to extend the work of Tone, Tsutsui (2009) and derive the efficiency decomposition and frontier projection)
Chen et al. (2018)	Two-stage NDEA model with undesirable intermediate measure	Environmental evaluation (regional industrial water system)	Economic development/ Environmental protection	T/P
Chen et al. (2020)	Shared Inputs Two-Stage Network DEA developed by Castelli et al. (2010)	High-tech industries	Technological development/Technological conversion	T/P
Chen, Zhu (2004)	Centralized Two-stage DEA efficiency model	Impact of IT on Enterprises	IT investment/ Firm performance	T/P
Chiu, Lin (2018)	Two-stage NSBM model developed by Tone, Tsutsui (2009)	Tourist hotels	Service Production stage/Service Operation stage	P
Chu et al. (2015)	Two-stage NDEA approach with equitable efficiency decomposition	Eco-efficiency analysis (provincial-level regions)	Production system/ Pollution control system	T/P
Despotis et al. (2016a)	Two-stage series NDEA: composition vs decomposition approach	Illustrative application	N/A	T (developed a novel approach to assess the individual and the overall efficiencies in Two-stage NDEA)
Despotis et al. (2016b)	Two-stage NDEA model (Weak-link approach)	Numerical example	N/A	T (developed the weak-link approach in simple and general two-stage processes)
Ding et al. (2019)	Additive Two-Stage model with fixed cost allocation	Banking sector	Productivity /Profitability	T/P
Färe, Whittaker (1995)	Static and dynamic NDEA approach	Dairy farms	Crops production/Livestock production	T/P
Galagedera et al. (2016)	Two-stage NDEA model modelling leakage	Mutual funds families	Operational Management Process/Portfolio Management Process	T/P
Golshani et al. (2019)	Two-stage NDEA with intermediate measures	Illustrative application (Chinese universities)	N/A	T (proposed super efficiency of network NSBM model)
Gramani (2012)	Two-stage NDEA model (Efficiency Decomposition Approach)	Airlines	Operational performance/ Financial Performance	P
Guo et al. (2020)	Two-stage additive network DEA	Illustrated examples	N/A	T (frontier projection and divisional efficiency)

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
Guo, Zhu (2017)	Two-stage non-cooperative NDEA model	-	-	T (developed non-cooperative model with a shared resource and general non-cooperative model)
Hafsal et al. (2020)	Two-stage DEA (developed by Kao, Hwang (2008)) General Two-stage DEA (developed by Kao (2017))	Banks	Divisional/System efficiency	P
Henriques et al. (2020)	Two-stage DEA	Banks	Literature review	T (Controversies and future directions in Two-stage NDEA approach)
Izadikhah et al. (2018)	Two-stage series model with freely distributed initial inputs and shared intermediate outputs	Numerical example for banks	Profitability/Marketability	T (proposed Two-stage model built on the concept of Stackelberg leader-follower game model)
Javan, Malkhalifeh (2016)	Two-stage NDEA with interval data	Numerical example	N/A	T (proposed DEA models for measuring the efficiency of series and parallel systems with interval data)
Jiang et al. (2021)	The uncertain two-stage network DEA models	Numerical example	N/A	T (expands the application of DEA models by establishing the uncertain two-stage NDEA)
Kao (2009)	Relational network DEA model	Non-life insurance companies	Premium acquisition/ Profit generation	T/P
Kao, Hwang (2008)	Two-stage NDEA relational model considering series relationship of two sub-processes	Non-life insurance companies	Premium acquisition/ Profit generation	T/P
Kao, Hwang (2010)	Relational NDEA model	Impact of IT on Enterprises (Banking industry)	IT investment/ Firm performance	T/P
Kao, Lin (2012)	Fuzzy NDEA approach for parallel production systems	Departments on University	Teaching/ Research	T/P
Kottas et al. (2020)	Variable intermediate measures Slacks-Based Measure (VSBM) Two-Stage network DEA approach (developed by Chen et al. (2016)	Turbofan aero-engines	Specific Fuel Consumption/Take-off specific thrust	P
Kwon, Lee (2015)	DEA-neural Two-stage network approach	Banking sector	Production process/ Profit Earning Process	T/P

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
Lee, Worthington (2016)	Centralised NDEA model base on Liang et al. (2008)	University research services	Research/ Grant Applications	P
Lewis et al. (2013)	Un-oriented Two-stage NDEA model using the classical radial objective	Major League Baseball	Front office/ On-field	T/P
Lewis, Sexton (2004)	NDEA model for two and multiple stages	Major League Baseball	Front office/ On-field	T/P
Li et al. (2016)	Two-stage NDEA model with shared inputs and outputs among the stages	Numerical example	N/A	T (extended the centralised model to measure the efficiency with shared inputs and outputs)
Li et al. (2018)	Non-cooperative Two-stage NDEA approach	Illustrative application	N/A	T (identify the leader stage of a two-stage DEA)
Li et al. (2021)	Two-stage fixed-sum DEA approach	Countries performance in the winter Olympic Games	Non-specific	T/P
Liang et al. (2008)	Two-stage NDEA centralised model using the game theory concept	Numerical example (three data sets)	N/A	T (developed Non-cooperative and Centralised model for Two-stage processes)
Liang et al. (2011)	Two-stage series NDEA model with feedback variables	Universities	Teaching/ Research	T/P
Lim, Zhu (2016)	Two-stage NDEA model (frontier projection and duality)	Numerical example	N/A	T (developed formulas to calculate the frontier projections and divisional efficiency)
Liu et al. (2015)	Two-stage NDEA model with undesirable inputs, intermediates and outputs	Numerical illustrations (Banking sector)	N/A	T (developed Two-stage model with undesirable input-intermediate-outputs)
Liu, Lu (2012)	Two-stage NDEA model (ranking function based on network method)	Numerical illustrations (Research & Development)	Technology development/ Technology Diffusion	T/P
Liu, Wang (2009)	Relational two-stage NDEA approach developed by Kao, Hwang (2008)	Manufacturing firms	Production acquisition / Profit earning	P
Löthgren, Tambour (1999)	Two-stage NDEA model	Pharmacies	Production / Consumption	T/P
Lozano (2011)	Relational NDEA model (Technical and Cost Efficiency NDEA model)	Numerical illustrations (Manufacturing firms)	Production acquisition / Profit earning	T (proposed simple technical and cost efficiency NDEA models, each sub-process can have its

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
				own Returns to Scale assumption)
Lozano et al. (2013)	Two-stage NDEA approach with undesirable outputs	Airlines	Production Process/ Sales Process	T/P
Lozano, Khezri (2021)	Proposed smallest improvement NDEA approach	Illustrated example	N/A	T (Proposed improvement NDEA approach for cooperative, non-cooperative scenarios)
Lu et al. (2012)	Additive Two-stage NDEA model developed by Chen et al. (2009), Cook et al. (2010b)	Airlines	Production / Marketing	P
Luo (2003)	Two-stage series NDEA model	Banking sector	Profitability/ Marketability	P
Ma et al. (2017)	Hybrid Two-stage DEA with additional inputs	Illustrative application	N/A	T (Two-stage model with parallel-series hybrid system with additional inputs)
Majiwa et al. (2018)	Two-stage NDEA model	Rice processing industry	Drying/Milling	P
Mirmozaffari (2019)	Two-stage NDEA model	Eco-efficiency analysis (Cement companies)	Production stage/pollution Control Stage	P
Nemati et al. (2020)	Two-stage DEA model (developed by Ma (2015))	Refinery industries	Production/Sale	T/P
Seiford, Zhu (1999)	Two-stage NDEA model	Banking sector	Profitability/ Marketability	P
Sexton, Lewis (2003)	Two-stage NDEA model, which allows for any orientation or scale assumption	Major League Baseball	Front office/ On-field	T/P
Sun et al. (2013)	Relational Two-stage NDEA model with VRS	Numerical illustrations (Banking sector)	Productivity /Profitability	T (developed Two-stage NDEA model with Variable Returns to Scale by abandon this assumption)
Tavana et al. (2016)	Two-stage DEA model in supply chains	Numerical example	N/A	T (proposed Generalized Two-stage model measuring performance in three-level supply chains with VRS and CRS)
Tavassoli et al. (2014)	NSBM with shared inputs to measure technical efficiency and service effectiveness	Airlines	Production Process/ Service Process	T/P
Tsolas (2011)	Two-stage NDEA model including undesirable outputs	Banking sector	Profitability/ Market Value Generation	P

Author (s)	Applied techniques	Application field	Two Sub-processes	Type
Tsolas (2020)	Two-stage series DEA method	Mutual fund performance evaluation	Operational management/ Performance management	P (input-oriented BCC model developed by Banker et al. 1984)
Wang , Chin (2010)	Two-stage NDEA model, which compared decomposition models and the weighted harmonic one	Numerical illustrations	N/A	T (proposed alternative DEA model for Two-stage process, focused on Weighted harmonic mean model and Generalised Two-stage DEA model)
Wang et al. (2014)	Additive Two-stage NDEA model under VRS with undesirable output	Banking sector	Deposit producing/ Profit Earning	P
Wang et al. (2016)	Two-stage innovation efficiency model: a non-radial DEA approach	Energy enterprises	Research and development/Marketing	T/P
Wang et al. (2020)	Two-stage network DEA approach	High-tech industries	R&D stage/ The commercialisation stage	T/P
Wanke, Barros (2014)	Centralised Two-stage NDEA efficiency model	Banking sector	Cost efficiency/ Productive efficiency	P
Wu et al. (2016)	Shared flow Two-stage DEA model with undesirable outputs	Industrial production	Production/Waste disposal	T/P
Yang (2006)	Two-stage NDEA model	Insurance Industry	Production/ Investment	P
Yang et al. (2008)	Two-stage NDEA model including undesirable outputs	Agricultural Sector	Production/ Abatement	T/P
Yang et al. (2011)	Supply chain Two-stage CRS DEA model	Banking sector	Production/ Performance	T/P
Yin et al. (2020)	Two-stage network approach base on bi-objective model	Hotel performance	Hotel operations/Hotel marketing	T/P
Yu et al. (2016)	Fixed cost allocation based on Two-stage NDEA	Numerical example	N/A	T (proposed a novel Two-stage DEA based model for allocating fixed cost to DMUs)
Zhu (2011)	Centralised Two-stage NDEA efficiency model (efficiency decomposition for two individual stages)	Airlines	Operational Performance/ Financial Performance	T/P
Zhu et al. (2019)	Two-stage NDEA with fixed cost allocation	Numerical example	N/A	T (developed the model, that add and allocate fixed cost as an additional input in each stage)

Source: Own resourcing.

4. Conclusions and Future Research Directions

Since the seminal paper of Färe, Whittaker (1995) in Network DEA, there has been a dramatically growth in the number of NDEA articles in the last years. The presented study provides a literature overview of the Two-stage NDEA models, structures and types for measuring the efficiency in DMUs, taking into account their internal structures. A comparative overview of the research papers, the most used methodological approaches, the application field and the sub-processes of Two-stage production process are shown in Table 1. It has been shown that the NDEA model has more discriminate power than the standard DEA model. While the standard DEA model deems most of the DMUs efficient, the NDEA model is able to evaluate the performance with respect to its internal structure (sub-processes).

The authors see the limitation of measuring the efficiency with the NDEA method in the data set, which is needed for this type of non-parametric analysis. We would like to point out to collect the data from DMUs with internal structures.

This study should be an incentive to collect this type of data and extend, and improve the NDEA methodology. In our future research, we will focus on applying the NDEA methodology to agricultural enterprises with sub-processes (complex structures are made from crop and livestock production). We will show how to measure the efficiency and productivity of agricultural enterprises with a complex internal structure on the level of sub-technologies (NDEA methodology), as well as on the level of the whole production system (standard DEA methodology).

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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BUSINESS INNOVATION ACTIVITY AND THE FOURTH INDUSTRIAL REVOLUTION IN RUSSIA[5]

The research is devoted to a comparison of the level of Russian companies' innovation activity for the period 2011-2020. The authors propose the Index of Innovative Activity based on the integrated indicator calculation, which combines a range of factors reflecting different aspects of business innovation activities. The generalised principal component approach, which was the basis of this study, didn't neglect any residual dispersion of source data and allowed us don't give any subjective weights to the factors. Based on the study results, the authors try to identify the reasons for the growth or decline in innovative activity in the specified period. The research illustrates that the role of barriers to innovation is gradually decreasing, and factors that promote innovations are becoming more important. Our study lays the foundation for the regular calculation of the index to assess the trends.
Keywords: Industry 4.0; innovations; technological development; principal component analysis (PCA)
JEL: C38; L21; O14; O31

1. Introduction

It has been ten years since Germany announced at the 2011 Hannover Messe its project to transition to the fourth industrial revolution. The German project was based on the computerisation of national production. But since then, the term Industry 4.0 has been used

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much more broadly, encompassing many innovations, including smart manufacturing, the Internet of Things, big data, artificial intelligence, nanotechnology, 3D printing in industry and medicine, quantum computing, robotics, and unmanned aerial vehicles, blockchain, cryptocurrencies. The World Bank called such technologies "disruptive" because they create opportunities for radical change and the risks associated with these opportunities (World Bank, 2021).

The introduction of new technologies does not automatically mean a transition to the best. Research on the relationship between scientific and technological development and its results for society was carried out in the late 1980s. Lvov D. S. and Glazyev S. Yu introduced the concept of a technological order into scientific circulation. It is also necessary to highlight the works of Deaton A., Krugman P., Ford M., Pikketi T., Bodrunov S.B. et al. (Deaton, 2016; Krugman, 2011; Ford, 2015; Piketti, 2014; Bodrunov, 2018). Studies by the expert of the World Economic Forum and its founder and President K. Schwab are devoted to the study of the systemic impact of the 4th industrial revolution on society (Schwab, 2017).

In a complex international environment and growing inequality in many countries, industry 4.0 is not a solution to all problems, but rather an additional problem. After all, the renewal of the means of production is only one of the elements of systemic transformations. A new management paradigm is needed, a revision of approaches to training, hiring and monitoring the work of personnel, practically all organisational processes. The development of comprehensive management strategies that take into account both technological and social requirements and constraints is becoming a priority task. Choosing a strategy for Russia, which is overcoming its economic and technological lag under the conditions of sanctions and powerful geopolitical pressure, is becoming no less difficult (Melanina, Verenikina, 2019).

For business, Industry 4.0 is a serious challenge and a test of strength. According to a literary review by Wichmann, Eisenbart and Guericke (Wichmann et al., 2019), an increasing number of companies are competing to stay relevant. They are competing not so much for leadership in their sector as for assurance that their business model is adequate to rapidly changing external conditions.

For Russia at the present stage, the key factors determining the need to introduce Industry 4.0 technologies into production are profit growth and the need to ensure control over the production process (Tarasov, 2018).

At all levels of government, at the level of corporations, small businesses and consumers, for several years, there has been a highly positive assessment of the importance of innovation and the introduction of digital technologies. Nevertheless, the Russian industry lags behind the USA, Germany and China in terms of digitalisation (Yudina, 2020).

In Russia, there is still a significant deterioration of basic production assets. The country purchases equipment and machine tools abroad and, according to Rosstat, the account for more than 40% of imports. Machine tool building in Russia has only recently begun to revive. The share of machine tools with computer numerical control (CNC) in Russia is still small in relation to the total machine tool market (according to various estimates, it is

about 5% of the market, while in the EU countries – 21% (Kommersant, 2020), although it is precisely this equipment that is necessary for the introduction of digital technologies. It is also worth noting the almost complete dependence of our machine tool industry on the import of CNC systems for the production of machine tools.

Currently, the Russian national government is focusing on the development of artificial intelligence technologies, which will allow it to leapfrog and compete on a par with China and the United States. The use of artificial intelligence in Russian enterprises will allow to achieve an increase in productivity of up to 20%, depending on the industry and the available capacities (RBC+, 2020). Russia is able to gain leadership in the use of artificial intelligence in traditionally developed industries such as metallurgy, oil and gas industry and chemical industry.

The digitalisation of production is also constrained by the insufficient degree of distribution of industrial automation systems (for example, MES-systems). This is largely due to the shortage of proven national development. Few enterprises can afford significantly more expensive import solutions. Also, domestic (vs multinational) manufacturers still do not widely use Enterprise Resource Planning (ERP) systems, corporate information systems, which are a set of integrated software packages that allow you to create a unified environment for automating planning, accounting, control and analysis of all major business processes at the enterprise.

Meanwhile, Russia has sufficient prerequisites for a successful transition to Industry 4.0 – the country is one of the leaders in terms of the development of digital infrastructure and the spread and availability of broadband Internet. The largest Russian industrial enterprises have already implemented ERP-systems. Many enterprises have mastered the technologies of virtual modelling and engineering analysis. For example, in the aviation or automotive industry, a large number of situations are simulated digitally, both at the level of development and at the level of product manufacturing.

The country is in demand for solutions for creating systems for continuous monitoring and diagnostics of the state of industrial equipment in real time. Corporations create laboratories for testing and implementing IIoT ("Industrial Internet of Things" – the industrial Internet of Things – a multi-level system that includes sensors, controllers on equipment, means of transferring the collected data and their visualisation, as well as analytical tools for interpreting the information received). For example, the Novolipetsk Metallurgical Plant and SAP, a German ERP solutions company, have opened a joint innovation laboratory (including in the field of IIoT).

Russia has broad prospects for making technological breakthroughs in many areas of economic activity. It is important to create its own priority niches for digital innovations, where it is possible not only to achieve independence in the domestic market at the lowest cost, but also to become a recognised global leader.

The most significant contribution to the digital transformation of the country's economy will come from the implementation of the Digital Economy of the Russian Federation National Programme, developed in accordance with Presidential Decree No. 204 of 07.05.2018 "On National Goals and Strategic Development Objectives of the Russian Federation for the

Period until 2024" and approved in December 2018. The main objective of the National Programme is to create a favourable organisational, legal and infrastructural environment in the country for developing the digital economy to improve competitiveness in the globally (On National Goals and Strategic Development, 2018).

An autonomous non-profit organisation (ANO) has been established to ensure a productive dialogue between business and government in implementing the Digital Economy of the Russian Federation National Programme, which includes Yandex, Mail.Ru Group, Rambler & Co, Rostec, Rosatom, Sberbank, Rostelecom, Skolkovo Foundation and the Agency for Strategic Initiatives. The Digital Economy is also engaged in supporting socially significant projects and initiatives in this area, and assesses the effectiveness of the implementation of strategic directions (Melanina, 2019).

For the development of the digital economy in Russia, the most rational step seems to be the creation of a number of industrial digital platforms under the leadership of relevant ministries or state corporations that will focus their efforts on key areas: transport, telecommunications, energy and data processing. These platforms will create the necessary infrastructure for the fastest possible development of the digital economy and the spread of related technologies, and will make it possible to build a single digital space uniting all industries and sectors in the future. Such an approach will significantly increase the transparency, manageability and flexibility of the country's economy (Strelkova, 2018).

In 2016 the World Bank published « World Development Report 2016: Digital Dividends», which provides an overview of the digital economy in the world and analyses the increasing development benefits of digital technology for countries. The report shows that the Internet contributes to development through three main mechanisms (World development report, 2016):

1. Integration (overcoming information barriers, creating new markets: expanding trade, creating new jobs and increasing access to public services);
2. Efficiency gains (first, the dramatic drop in the price of digital technologies has provided companies and governments with an incentive to replace existing factors of production – labour and capital not related to information and communication technologies (ICTs) – with ICT capital, as well as to automate certain activities. Secondly, digital technology reinforces non-substituted factors of production and increases their productivity);
3. innovation (by enabling virtually seamless communication and collaboration, the Internet can support new delivery models, facilitate collective action and accelerate innovation).

By overcoming information barriers, building productive resources and changing the nature of products, digital technologies can make development more inclusive, efficient and innovative.

The impact of the main mechanisms of digital economy development on various economic entities – enterprises, both small and large, the state and society, as well as on various segments of the economy – is differentiated (see Table 1).

In general, the World Bank's digital economy experts note that its development not only stimulates economic growth, but also tangibly accelerates its pace.

Table 1

Impact of the main mechanisms of digital economy development on economic agents

	Digital technology		
	Integration	Efficiency	Innovation
Companies	Trade	Use of capital	Competitiveness
Population	Employment opportunities	Labour productivity	Consumer welfare
Government	Participation	Public sector capacity	Voice

Source: composed on World Development Report, 2016.

The COVID-19 outbreak has created an imbalance in the global economy due to supply chain disruptions resulting from production closures in China, lockdowns in various countries around the world – either simultaneous or simultaneous (Wang, Melanina, 2021). This has negatively affected investment, profitability and other important production parameters as well as production processes in general. Consequently, the revision of value chain security by both countries and large multinational companies (MNCs) triggered by the global pandemic of new coronavirus infection, especially through the further advancement of digitalisation in this aspect, has become imperative and has significantly affected the global value chain structure and its shaping in the future, as the critical challenge to the viability of the value chain becomes not only its efficiency but also industrial safety.

The impact of COVID-19 on the economy is likely to be less than the impact of stringent policy measures taken to prevent the spread of the virus (Digilina, Lebedeva, 2021). The pandemic caused a severe oil price collapse, the largest since the 1991 Gulf War. As a result of the pandemic, global stock markets recorded their biggest and steepest drop since the global financial crisis in 2008. At the political level, coordinated action by all countries to implement a medical protocol to reduce the spread of the pandemic, as well as fiscal measures to support the manufacturing sector, will be needed to spur economic recovery. Measures that may have a positive impact on economic recovery after the pandemic include reductions in central bank interest rates (based on US experience) to improve access to credit and stimulate investment, as well as reductions in the tax burden on businesses and individuals. If we analyse the list of industries that have benefited from the lockdown, it will be those that are somehow related to the use of digital technology (Drobot, 2020).

It is important to integrate digital technologies into public investments, such as those in cities and infrastructure, to support innovation and the transition to a more sustainable economy. This should be a key objective of regional development funds. For example, public authorities' investments in transport and urban infrastructure to create jobs and develop the local economy should also be smart, i.e. digital. This would reduce traffic congestion and pollution, and improve productivity and quality of life for residents and those who work in the city. Equally, governments should ensure that support for specific sectors, such as agriculture, is directed at enabling such sectors to reduce their environmental impact and move towards more sustainable business models (Teslenko, Digilina, 2021).

Such investments could include:

- Funding to improve the energy efficiency of public buildings and to digitise the building and construction equipment sector to take advantage of the benefits that building automation can create.

- Smart city initiatives for technology ecosystems, where data can be collected on traffic, noise, air quality, energy consumption and movement (related to COVID response). These will lead to informed, sustainable decision-making by authorities
- Encourage remote services for all installed infrastructure as an alternative to services provided solely in person.

In Russia, companies that manufacture equipment with components or spare parts sourced from abroad, as well as companies developing software for transport, tourism and hospitality businesses, are mainly affected due to the introduction of quarantine measures.

Undoubtedly, in today's challenging pandemic and demand constraints across many industries, investing in innovation does not always seem like a good idea. Moreover, the rapid changes in the technology market force businesses to think about the feasibility of investing now with the risk of obsolescence of systems in five to ten years, or to wait a few more years and introduce more advanced technologies. Nevertheless, the organisation that does not move forward, does not just stand still, but lags behind the leaders more and more. Therefore, investment in innovation is necessary for both business and the entire national economy.

2. Methodology of the Research

In our study, we will compare the level of business innovation activity by year for the period 2011-2020. To do this, we will calculate the Index of Innovative Activity of Russian Business. Based on the results obtained, we will try to identify the reasons for the growth and decline in innovative activity in the specified period.

Our research methodology is based on principal component analysis (PCA), which is widely used in multivariate statistics (see, for example, Armeanu, 2008; Park et al., 2016; Doukas at al., 2012; Gavrilets et al., 2019; Kendyuhov, 2013; Petrişor at al., 2012; Tan, 2015; Zhgun, 2017).

In line with a number of studies (see, for instance, Barrington-Leigh, 2018; Pérez-Moreno et al., 2016), we try to avoid any expert judgment in the choice of weighting coefficients when constructing a composite indicator.

The innovative activity of a company is a multidimensional characteristic that includes many indicators $X = \{x_i\}_{i=1}^{n}$ (in this case, n = 30, see Table 1). Each i-th indicator characterises the innovative activity of companies from the sample in year j (j = 1, ..., m; in this case, m = 10). We took data for 2011-2020.

The principal component analysis is a multivariate statistical technique that combines various factors that appear to be nearly incompatible (Aivazian et al., 2006). It converts a set of original variables:

$$X = \begin{pmatrix} x_{11} & \cdots & x_{1m} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{pmatrix} \quad (1)$$

into a set of artificial uncorrelated variables:

$$Z = \begin{pmatrix} Z_1 \\ \vdots \\ Z_n \end{pmatrix} = \begin{pmatrix} z_{11} & \cdots & z_{1m} \\ \vdots & \ddots & \vdots \\ z_{n1} & \cdots & z_{nm} \end{pmatrix} = LX \quad (2)$$

where $Z_1,\ldots,Z_m$ - vectors from the first to the m-th principal component,

$$L = \begin{pmatrix} l_{11} & \cdots & l_{1n} \\ \vdots & \ddots & \vdots \\ l_{n1} & \cdots & l_{nn} \end{pmatrix} \quad (3)$$

- matrix of linear orthogonal transformation.

Principal component loads are eigenvectors of the covariance matrix of the original data:

$$\Sigma: (\Sigma - \lambda I) l_1^T = 0. \quad (4)$$

The corresponding characteristic equation (5) has n real non-negative roots (5) - eigenvalues of the covariance matrix:

$$|\Sigma - \lambda I| = 0 \quad (5)$$

$$\lambda_1 \geq \lambda_2 \geq \ldots \geq \lambda_n \geq 0 \quad (6)$$

The load of the first principal component is defined as the eigenvector corresponding to the largest eigenvalue λ_1. In subsequent main components:

$$Z_k = (z_{k1},\ldots,z_{km}) \quad (7)$$

Other eigenvectors are used as component loads corresponding to successively smaller eigenvalues λ_k, k=2,...,n. λ_k is equal to the variance of the k-th principal component. The total variance of the principal components coincides with the total variance of the primary data, thus (8) is the proportion of the total variance of the primary data explained by the k-th principal component.

$$\rho_k = \lambda_k \Big/ \sum_{k=1}^{n} \lambda_k \quad (8)$$

Source data can be grouped in a row subsets or pillars that reflect certain attributes of a company's activities:

$$X = \begin{pmatrix} \widetilde{X}_1 \\ \vdots \\ \widetilde{X}_\theta \end{pmatrix} \quad (9)$$

where

$$\widetilde{X}_{\alpha} = \begin{pmatrix} X_{n_{\alpha-1}+1} \\ \vdots \\ X_{n_{\alpha}} \end{pmatrix} = \begin{pmatrix} x_{n_{\alpha-1}+1,1} & \cdots & x_{n_{\alpha-1}+1,m} \\ \vdots & \ddots & \vdots \\ x_{n_{\alpha},1} & \cdots & x_{n_{\alpha},m} \end{pmatrix} \quad (10)$$

$1 \le \alpha \le \theta$, $1 \le \theta \le n$.

Aggregate indicator I_j can be broken down into the sum of partial indicators (11), which reflect the impact of certain components on the company's results of operations (12):

$$I_{j\alpha} = \sum_{i=n_{\alpha-1}+1}^{n_{\alpha}} \sum_{k=1}^{n} \lambda_k l_{ki}^2 x_{ij} \Big/ \sum_{k=1}^{n} \lambda_k \quad (11)$$

$$I_j = \sum_{\alpha=1}^{\theta} I_{j\alpha} \quad (12)$$

There are two possibilities: if the indicator corresponds to the case "more is better" (for example, the level of a company's cost to innovation), then we bring it in line with a ranking scale of 1-10 as follows (13). And in the case of "less is better" (for example, obstacles to innovation), the following normalising transformation is applied (14), where x_{ij}^{n} is the normalised variable, and $x_{ij}^{\max}$ and $x_{ij}^{\min}$ - respectively "best" and "worst" value of the initial indicator.

$$x_{ij}^{n} = 1 + 9\left(\frac{x_{ij} - x_{ij}^{\min}}{x_{ij}^{\max} - x_{ij}^{\min}} \right) \quad (13)$$

$$x_{ij}^{n} = 1 + 9\left(\frac{x_{ij} - x_{ij}^{\max}}{x_{ij}^{\min} - x_{ij}^{\max}} \right) \quad (14)$$

Here we use the modified principal component estimates as a weighted sum of all principal component estimates (15):

$$I_j = \sum_{k=1}^{n} \rho_k y_{kj} = \sum_{k=1}^{n} \rho_k \sum_{i=1}^{n} l_{ki}^2 x_{ij} \quad (15)$$

The method was tested in our previous studies (Verenikin et al., 2018, 2020). This avoids negative assessments of principal components as constituent elements of the composite index. The modified principal components y_{kj} are weighted according to the respective fractions of the explained variance ρ_k. In this case, there is no loss of variance of the data under consideration. The explanatory power of the proposed indicator extends to the total variance of the original variables. A distinctive feature of the proposed composite indicator is that it is not sensitive to subjective preferences regarding the relative importance of specific factors in companies' innovative activity.

3. Russian Industry 4.0 – Indicators of Business Innovation

The objective of our research is the public reports of the Russian Union of Industrialists and Entrepreneurs on the state of the business climate for 2011-2020 (RSPP, 2020). We have selected a number of indicators (see Table 2) that are common for the analysis of information on the innovation activity of Russian companies included in the sample. According to the Report, the survey was conducted among member companies of the Russian Union of Industrialists and Entrepreneurs, that is, these are 277 largest Russian companies – industrial, scientific, and financial – in all regions of Russia.

Table 2

Indicators of business innovation activity

Chapter	Subsection
A. Drivers of firm innovation	
A1. Cost of innovation	
Average cost to companies for innovation *,%	A1.1
Median value of the level of innovation costs to companies *,%	A1.2
Percentage of companies in which innovation costs are not incurred	A1.3
Share of companies where innovation costs are less than 5% of revenue	A1.4
Costs for innovation from 5% to 10% of revenue	A1.5
Innovation costs 10 to 20% of revenue	A1.6
Innovation costs over 20% of revenue	A1.7
A2. Using international tech standards	
International technical standards do not apply	A2.1
From 5 to 10% of manufactured products are manufactured using European or other international technical standards	A2.2
From 11 to 20% of manufactured products are manufactured using international technical standards	A2.3
From 21 to 50% of manufactured products are manufactured using international technical standards	A2.4
More than 50% of manufactured products are manufactured using European or other international technical standards	A2.5
A3. The level of automation of production processes,%	
No process is automated	A3.1
Separate technological processes are automated	A3.2
Several processes are automated	A3.3
All functions are performed automatically (automated workshop)	A3.4
B. Key Barriers to Firm Innovation	
Lack of own financial resources	B1.1
Lack of skilled workers and specialists	B1.2
Lack of applied tax incentives	B1.3
Lack of state support for innovations at the federal level	B1.4
Lack of state support for innovation at the regional and/or local level	B1.5
Low predictability of business conditions	B1.6
Difficulty attracting credit	B1.7
Underdeveloped innovation infrastructure	B1.8
Low quality and/or high cost of services provided by Russian scientific and design organisations	B1.9
Lack of the necessary technological solutions on the market	B1.10
Lack of information about scientific organisations and advanced Russian developments	B1.11
Difficulties in obtaining quality engineering services	B1.12
Disinterest of the owners of the company	B1.13
Difficulty in ensuring the required quality of supplies	B1.14

Source: composed by the authors, based on RSPP Reports, 2011-2020.

Further, we grouped the indicators into 2 sections: a) factors contributing to the innovation activity of companies (including 3 subsections – the cost of innovation, the use of international technical standards and the level of production automation) and b) the main obstacles to innovation. The highlighted sections reflect certain features of the studied models and give an idea of the factors of innovative activity of companies, as well as the potential for improvement.

As we have already mentioned, the indicators were normalised in 2 ways: "more – better" and "less is better". In the first group, the following indicators were included: A1.1, A1.2, A1.5, A1.6, A1.7, A2.2, A2.3 A2.4, A2.5, A3.2, A3.3, A3.4, and in the second group the following indicators were included: A1.3, A1.4, A2.1, A3.1 and all the indicators of chapter B. Key Barriers to Firm Innovation (from B1.1 to B1.14).

Table 3

Values of indicators for 2011-2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
A1.1	9	9	9	9	9,9	9,9	9,9	9,9	7,9	9,2
A1.2	5	5	5	5	5	5	6	7	6	5
A2.1	10	9	10	6,2	9,4	2,9	5,2	4,4	7,9	1,4
A2.2	44	41	53	47,7	45,3	45,2	39,6	42,2	49,1	53,5
A2.3	21	29	19	24,6	20,5	18,3	23,3	28,9	25	20,7
A2.4	14	12	9	13,8	17,1	19,2	19	12,6	11,1	16,1
A2.5	11	9	9	7,7	7,7	14,4	12,9	11,9	6,9	8,3
B1.1	25	42	43	37,1	46	39,1	43,4	46,3	41,2	46,5
B1.2	11	13	10	8,8	10,2	7,7	10,9	9,7	10,3	11,1
B1.3	8	5	6	8,8	5,1	7	5,4	10,3	8,2	5,3
B1.4	10	12	10	15,7	10,2	11,9	5,4	11,5	8	7,4
B1.5	49	28	29	29,6	28,5	34,3	34,9	25,7	28,8	29,6
C1.1	5,3	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4
C1.2	56	50,6	50,6	50,6	50,6	50,6	50,6	50,6	50,6	50,6
C1.3	34,2	36,6	36,6	36,6	36,6	36,6	36,6	36,6	36,6	36,6
C1.4	4,5	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2	2,2
D1.1	54	50,7	62,5	62,6	50,6	68,5	57,7	59	47	58
D1.2	35	29,3	35,9	25,9	19,9	31,5	29,7	38	28	40
D1.3	26,2	23,7	27,1	29,9	22,4	30,2	35,4	37	39	49
D1.4	20,9	18,1	25	16,3	22,4	24,8	28	30	27	31
D1.5	19,8	15,6	21,9	19	20,5	20,8	24	22	26	31
D1.6	22,4	22,2	26,6	22,4	27,6	24,8	32,6	26	30	33
D1.7	21,3	24,4	26,6	29,9	25,6	34,9	36	26	19	33
D1.8	11	11,5	7,3	12,9	12,2	10,1	11,4	14	17	27
D1.9	16,3	14,4	15,6	12,2	10,3	12,8	16	13	18	15
D1.10	19	11,5	10,9	12,2	15,4	11,4	14,3	12	10	16
D1.11	10,6	10,4	13	7,5	7,7	10,1	10,3	12	13	24
D1.12	6,8	7,8	7,3	8,8	8,3	5,4	8,6	10	12	12
D1.13	5,3	5,9	4,7	4,8	2,6	2,7	5,1	6	6	3
D1.14	5,7	6,7	5,7	6,1	8,3	5,4	6,9	6	4	8

Source: composed by the authors, based on RSPP Reports, 2011-2020.

The costs of companies for innovation costs include: investments in new machines and equipment, R&D costs, technological preparation of production, acquisition of patents and licenses, digitalisation of production. International standardisation is an effective tool for

improving the technical level and competitiveness of production. The assessment of the level of automation of production processes was carried out only in 2019 and 2020, there is no previous data. Therefore, we had to accept the values of these indicators in 2018-2011 as equal to 2019 (see Table 3).

We used Gretl to calculate principal component loads for all 30 indicators over 10 years. Received 9 vectors of principal components with positive eigenvalues.

The Index of Innovative activity of Russian business I_j in the modified components of the main components y_{kj}, weighted by the form of the proportion of the explained variance ρ_k (see Table 4).

Table 4

Values of the Index and sub-indices of innovative activity of Russian business

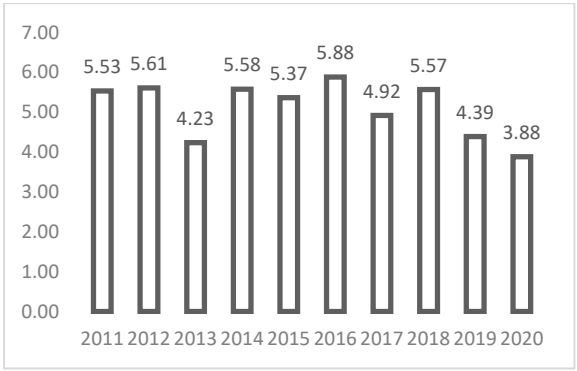
Year	Index value	Rating	Section A.	Rating	Section B.	Rating
2011	5,53	5	2,60	5	2,93	5
2012	5,61	2	2,35	7	3,26	2
2013	4,23	9	1,47	10	2,77	6
2014	5,58	3	2,40	6	3,18	3
2015	5,37	6	1,99	8	3,38	1
2016	5,88	1	2,77	3	3,11	4
2017	4,92	7	2,92	2	2,00	9
2018	5,57	4	3,30	1	2,27	8
2019	4,39	8	1,98	9	2,40	7
2020	3,88	10	2,61	4	1,27	10

Source: composed by the authors.

As we can see (see Figure 1), the value of the Index of Innovative Activity of Russian Business reached its maximum value (5.8807978) in 2016. Indicators for 2012, 2014, 2018 and 2011 are not far behind. 2015, 2017, 2019 and 2013 can be considered problematic for the development of the innovative activity. And finally, the most unsuccessful year for innovation activity was predictably 2020, which is understandable given the lockdown and a serious reduction in the already insignificant investment resources of enterprises.

Figure 1

Russian business innovation activity index



Source: prepared by the authors.

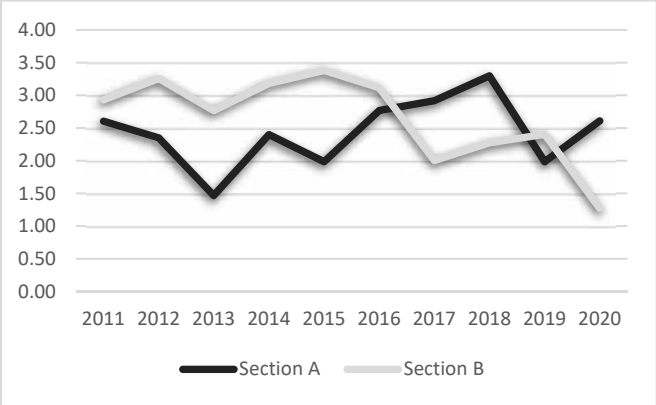
The index of innovative activity of Russian business is a linear combination of the entire set of modified estimates of the main components:

$$I_j = \sum_{k=1}^{n} \left(\lambda_k \sum_{i=1}^{n} l_{ki}^2 x_{ij} \right) \Big/ \sum_{k=1}^{n} \lambda_k \quad (16)$$

Thus, it can be viewed as a composition of partial indices that summarise the weighted modified principal component estimates for each pillar (section) of the data. These sub-indices form the rating for individual components (see Table 3 and Figure 2). As we can see, the contribution of Section B (main barriers to innovation) to the overall index is gradually decreasing, and factors that promote innovation are becoming more important (Section A).

Figure 2

Sub-indices of innovation activity of Russian business



Source: prepared by the authors.

In Russia, the state system for supporting the development of new technologies is currently actively developing. Several programs were adopted at the federal level, for example: the Federal Target Program "Electronic Russia", the Strategy for the Development of the Information Society in the Russian Federation (2008-2015), the State Program "Information Society" (2011-2020), the Strategy for Scientific and technical development (2016-2035), Strategy of the Information Society (2017-2030), state program "Digital Economy" (2017-2030), Resolution of the Government of the Russian Federation of August 28, 2017. N1030 "On the management system for the implementation of the program" Digital Economy of the Russian Federation"; Comprehensive program for the development of biotechnology in the Russian Federation for the period up to 2020; Roadmap for the Development of Biotechnology and Genetic Engineering until 2020, etc., as well as many programs at the regional level.

The current crisis has affected all sectors of the economy in one way or another. The pandemic has reduced demand and sales for many companies, forcing them to cut costs on new equipment, materials, software, labour, etc. In such an environment, it is unlikely that

companies will seek to innovate. Analysts believe that the challenges are a boon for the domestic economy. The previous challenge – sanctions – led to a market cleansing and companies turning to innovation.

The coronavirus pandemic has increased interest in high technology. And while it used to take companies quite a long time to prepare for a technological upgrade, from 2020 they have begun to implement this process rapidly – literally in weeks. Priority areas for digital technology development will be: enabling social distance activities, increasing the efficiency of remote work, study, leisure, and increasing the availability of medical care. Experts believe that the current crisis and its consequences in Russia will accelerate the digitalisation of businesses, not only in such areas as services and retail, but also in the real sector.

After the coronavirus pandemic, the world will not be the same. So forms of distance working and learning will definitely take hold, marking a new modern way of living and working. And the intensified creation of next-generation information technology will enable Industry 4.0 to be implemented everywhere, making the products and services of the national economy competitive on global markets.

4. Conclusion

The level of investment in technological innovation and other indicators characterising the development of the innovation sector indicate so far an insufficiently successful innovation policy in the country. This is partly due to objective reasons, global problems and instability. In many respects – with insufficient domestic demand for innovations and a lack of own financial resources and qualified labour force at the enterprises themselves.

The index the authors have constructed reflects an integrated approach to assessing innovative activity and gives an integral assessment of the current state of innovative activity in Russian business. The authors do not rely on any expert judgment and do not attach subjective weights to factors. This study lays the foundation for the regular (for example, once a year) calculation of the innovation activity index of Russian enterprises. As a direction for improvement, the authors postulate, we can indicate the need to include new indicators that expand the understanding of the factors influencing the innovative activity of a business.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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SOCIO-PSYCHOLOGICAL DETERMINANTS OF FOOD SECURITY IN UKRAINE: CAUSAL ASPECT[5]

Food security should be achieved not only by developing the production capacity and improving the living standards of the population, but also by raising consumer awareness of rational consumption and environmental protection. The aim of this article is to establish the cause-and-effect relationships of socio-psychological determinants of food security and to find ways to improve the approaches to food packaging, strengthen the potential of food affordability and increase consumer awareness of the environmental aspect of food security. The study substantiates the marketing feasibility of greening packaging, developing the mobility of workers in the labour market and choosing the idea of caring for the next generation as a basis for increasing conscious consumption. The methodological framework makes use of existing statistical and factual data, retrieved via the survey run within the period of the study.
Keywords: food security; sustainable development; patterns of consciousness; economic affordability of food; greening
JEL: D12; D31; F18; F64

Introduction

According to the Farm to Fork strategy, approved by the European Commission under the European Green Deal, modern society needs a rational system of sustainable production, distribution and consumption of food. Waste of food is unacceptable from an economic and moral point of view, because the ever-growing population of the planet needs efficient use

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of food resources. Food production must be optimized in the context of food consumption and waste generation. With this in mind, the aim of our study was to examine consumer behaviour in food packaging colour choices in order to identify trends in consumer preferences and persistent patterns of consumer behaviour. The study is cross-disciplinary and is based on an analysis of social and psychological determinants of consumer behaviour in Ukraine. Having analyzed consumer expectations, the study will make it much easier for food producers to tailor production to customer needs, reducing waste and simplifying marketing promotion strategies. In addition, based on previous research on the psychological aspects of consumer behaviour, food producers will be able to form an associative consumer perception of the most desirable products based on technological feasibility and environmental safety.

Food security issues cover a range of issues related to ensuring the affordability of food, setting up food distribution infrastructure, ensuring food quality standards and the safety of food production for the environment. Building a food security system is based on socio-psychological determinants that determine the willingness of consumers and food producers to be responsible for the environment and to promote a culture of processing and zero waste. The aim of this article is to establish the cause-and-effect relationships of socio-psychological determinants of food security and to find ways to improve approaches to food packaging, strengthen the potential of food affordability and increase consumer awareness of the environmental aspect of food security.

Marketing campaigns aimed at shaping the demand for products should help strengthen the conscious attitude of consumers to consumption, green consumer behaviour and the formation of a way of life that would best meet the principles of sustainable development. When using food packaging materials, producers, together with consumers, must demonstrate a responsible attitude towards the environment, taking care of the possibilities of waste sorting, recycling or reuse.

In the process of forming state policy on food security, it is important to understand the causal aspect of socio-psychological determinants that affect the harmonious combination of components of food security. Thus, the development of innovations, improving the quality of education and skills of citizens will create an opportunity to improve the performance of the national economy and strengthen the basis for the formation of economic affordability of food. At the same time, understanding the connection between socio-psychological determinants that shape the responsible attitude of consumers to the environment will create effective mechanisms to support environmental initiatives and strengthen the implementation of the principles of sustainable development.

Literature Review

Aspects of food security are being studied by many scientists around the world. There are several approaches to the analysis of the challenges facing countries in the process of the food security system establishment. Thus, the economic component of the formation of food security is the subject of study by many scientists. For example, a thorough economic analysis of food security indicators based on various international methodologies as well as modelling

the system of food stability was carried out by Babych M. and Kovalenko A. (Babych, 2018). The study conducted by Shebanina O., Klyuchnik A., Burkovska A. and Caruso D. (Shebanina, 2020) confirms the need for the government to create a sustainable system of social standards for the population, providing an adequate level of purchasing power. This article complements existing research by continuing the analysis of the relationship between meeting the food needs of the population and the economic potential of households.

Issues of consumer behaviour and social aspects of food security awareness are widely considered by scientists. For instance, the role of social norms in predicting plastic avoidance, using the theory of normative social behaviour was explored by Borg K., Curtis J. and Lindsay J. (Borg, 2020), who conducted measuring consumer behaviour in relation to four single-use plastic items (bags, straws, coffee cups, and takeaway containers). The study conducted by Escadas M., Jalali M. and Farhangmehr M. (Escadas, 2020) leads to further understanding of the integrated role of emotions on consumer decision-making involving ethical issues, by considering the influence of both positive and negative emotions on the ethical decision-making process. The research carried out by Fray-Andres E. and Martinwz-Salinas E. (Fray-Andres, 2008) improves our understanding of how consumers feel and what attitudes best define their environmental behaviour, moreover this study showed that environmental attitudes have a significant effect on ecological behaviour and that the level of environmental knowledge moderates this relationship. The findings presented by Thogersen J. and Alfinito S. (Thogersen, 2018) suggest that the situational activation of a normative goal can be an effective means to promote sustainable consumer choices in very different national contexts. The study conducted by Yuksel C. and Kaya C. (Yuksel, 2020) revealed the traces of personal and cultural values in the survey participants' perspectives on the sustainability concept. The study by Waites S., Stevens J. and Hancock T. (Waites, 2020) was conducted to investigate trust as an important mediator in explaining the relationship between green marketing and purchase intentions. This article complements existing research, continuing the analysis of the relationship between consumer awareness of sustainable development and willingness to change their consumer behaviour for the benefit of future generations.

To better understand the behavioural patterns of consumers in our study, we relied on previous research by world scientists. For example, the study conducted by Japutra A. and Song Z. (Japutra, 2020) investigates how mindsets (i.e. the beliefs that individuals have about the nature of human characteristics) are associated with compulsive buying behaviour (i.e., the tendency to buy impulsively and obsessively) as well as provides policymakers and marketers with a better understanding of the different motivations that lead to compulsive buying. The results of the paper by Novoradovskaya E., Mullan B. and Hasking P. (Novoradovskaya, 2020) can contribute to the development of evidence-based behaviour change interventions as it is exploring the psychological predictors of those behaviours can assist in developing efficient and cost-effective interventions for people to acquire and maintain them. The article by Kolbe R. and Burnett, M. (Kolbe, 1991) indicates a general need for improvement in the application of content-analysis methods in researches that describe and explain consumer behaviour. This article complements existing research by continuing to search for psychological patterns of consumer behaviour.

The issue of food distribution as an element of its accessibility to consumers is often addressed by scientists. For instance, changing consumer landscape and evolving models of commerce were addressed in the form of communities of benefit exchange by Bajaja N., Odgen S., Steel M. and Rahman K. (Bajaja, 2021).

The component of ecological stability and sustainable development of agriculture in the process of ensuring food security is often the subject of research by world scientists. For example, monitoring and evaluating of the agricultural land sustainability conducted to monitor the process of sustainable agricultural development goals implementation, problems' identification of regions agricultural land use and their causes, improving the efficiency of administrative decisions of central executive authorities, local authorities and the land market actors were carried out by Kotykova, O., Kuzmenko, O. and Semenchuk, I. (Kotykova, 2019). The survey purpose of the paper by Kotykova O., and Albeshchenko O. (Kotykova, 2017) was a comprehensive study of the sustainable development index in order to find patterns and distinctive features for related groups of countries. This article complements existing research by continuing to look for possible ways to reduce the negative impact on the environment by abandoning the variety of colourful packaging.

Research Methods

The study of food security in the context of the study of consumer behaviour led to the development of a questionnaire, which was answered by 130 respondents. The survey was conducted by surveying every tenth visitor of the ATB grocery retail network in Mykolayiv, Ukraine. The purpose of the questionnaire was to gather information to analyze the relationship between consumer preferences in food choices and internalized patterns of colour associations in the subconscious. The influence of the revealed stereotypes of consumer behaviour is offered to be interpreted for the purpose of optimization of marketing campaigns of particular food products on the basis of greening. At the same time, the information obtained during the collection of respondents' answers was used to establish the relationships between socio-economic determinants of personality and environmental awareness in the field of sustainable development of society.

Before the study, hypotheses were formed, which were confirmed during the analysis of the collected data. Hypothesis 1: the use of monochrome polymers, which are less harmful to the environment and easier to use for processing and reuse in the economy (Amare, 2021), may not only be environmentally friendly but also meet consumer expectations, which will strengthen the marketing potential of food producers. Hypothesis 2: the competitiveness and mobility of workers in the labour market, provided by their qualifications and skills, contribute to their ability to better meet the needs of quality nutrition. Hypothesis 3: Consumers who are concerned about the possibility of safe disposal of food packaging are aware of the fate of future generations. The hypotheses mentioned above were tested on the basis of statistical analysis by the method of least squares using JASP software.

The study found a correlation between 1) the state of satisfaction of food needs and socio-economic determinants; 2) indicators of environmental awareness. Variables of econometric models were used for this purpose:

Y1/2 – 1) the vector of the state of satisfaction of food needs (productive, dependent, endogenous variable); 2) the vector of the importance of taking measures for the sustainability of food consumption (effective, dependent, endogenous variable); X1/2 – 1) the vector of socio-economic determinants (factor, independent, exogenous variable); 2) the vector of the impact of food consumption on the lives of future generations; U is the vector of residues (stochastic component).

General model:

$$Y = f(X, u) \quad (1)$$

Model parameters β_0, β_1 were estimated by a system of normal equations:

$$\begin{cases} \beta_0 n + \beta_1 \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i \\ \beta_0 \sum_{i=1}^{n} x_i + \beta_1 \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i y_i \end{cases}, \quad (2)$$

Microsoft Exel was used to analyze, organize, group, process and encode information. After the initial processing of the data obtained in the form of respondents' answers using a questionnaire, JASP software was used for statistical analysis of data sets and construction of correlation matrices of dependences of the studied changes based on the linear regression model.

Results and Discussion

The study identified the following trends in the formation of internalized patterns of colour attributions (Table 1). Thus, mostly, the sweet taste is associated with pink and yellow. Sour taste, according to respondents, is mostly associated with yellow, green or lime. The salty taste was mostly identified with white. Regarding the bitter taste, most associations arose with brown and black colours. The spicy taste was mainly associated with red. According to the respondents, the neutral taste is mostly associated with white and beige colours.

In support of the previous theory regarding the relationship of internalized patterns of the subconscious with consumer behaviour, we obtained the following results (Table 2). Thus, with the same ingredients, price and volume of the product, if the brand is unknown, when buying milk, consumers prefer white packaging. When buying meat products – red or white packaging. When buying fish products, preferably choose blue or blue packaging. When buying eggs, they prefer white and beige packaging.

When choosing food, consumers often associate the taste of the product with the colour of the packaging in which it is packaged. Thus, under conditions of equal price and volume of production, consumers tend to prefer those products whose packaging colour evokes taste associations that meet consumer expectations. Moreover, if understanding the principle of subconsciously choosing packaging of the colour that evokes the expected taste associations, it is possible to form a successful marketing policy and packaging recycling strategy.

Table 1

Colour attributions of consumers in relation to tastes

Question	What colour in your imagination is associated with:					
Answer options	Sweet taste	Sour taste	Salty taste	Bitter taste	Spicy taste	Neutral taste
White	14	0	64	0	0	39
Beige	4	0	3	3	2	31
Gray	0	0	16	7	2	18
Black	0	0	1	30	10	1
Dark blue	0	4	5	2	0	6
Light blue	0	0	6	1	1	15
Violet	2	2	0	1	1	4
Lilac	11	2	0	1	0	3
Green	3	38	16	9	2	5
Lime	3	34	3	6	0	0
Yellow	29	46	8	8	2	2
Orange	8	0	4	12	9	0
Pink	38	0	0	0	1	5
Red	14	4	1	4	98	0
Brown	4	0	3	46	2	1

Source: developed by authors, based on the results of a survey.

Table 2

Patterns of consumer behaviour in terms of packaging colour selection

Question	What colour packaging are you most likely to choose, given the same ingredients, price and volume of the product, if the brand is unknown, when buying:			
Answer options	milk	meat products	fish products	eggs
White	69	22	17	52
Beige	2	14	2	25
Gray	1	1	15	12
Black	2	13	7	6
Dark blue	22	2	42	4
Light blue	27	1	29	0
Violet	0	4	2	2
Lilac	1	2	3	2
Green	2	10	4	4
Lime	1	1	2	2
Yellow	1	4	0	14
Orange	0	4	1	2
Pink	0	13	2	1
Red	1	33	3	0
Brown	1	6	1	4

Source: developed by authors, based on the results of a survey.

Thus, when choosing a colour association of salty taste, 64% of respondents named white, 30% of respondents associate a neutral taste with white. White packaging was preferred by 53% of respondents when buying milk and 40% of respondents when buying eggs.

Beige was chosen by 24% of respondents, characterizing the neutral taste. Every 5th respondent chooses a beige package when buying eggs.

Gray colour was described by respondents as being associated with a neutral (14%) or salty (12%) taste. In addition, every tenth respondent chooses grey packaging when buying fish products and eggs. Black packaging is chosen by every tenth consumer of meat products, associating this colour with a spicy taste (23%).

Blue packaging is chosen by a third of respondents when buying fish products and almost every fifth consumer of milk, associating this colour with neutral (5%) and salty (12%) flavours. Blue packaging was chosen by every 5th consumer of fish products and milk, associating this colour with neutral (12%) and salty (5%) flavours.

Green packaging, which is associated mainly with sour and salty flavours, was chosen by 8% of meat consumers. 11% of egg consumers chose yellow packaging. Pink and red packaging was preferred by 10% and 25% of meat consumers, respectively (Table 3).

Thus, in terms of particular food products, consumer choice based on taste and colour attributes is as following (Table 4): white (53%), light blue (21%) and dark blue (17%) packaging is mostly preferred for milk; red (25%), pink (10%), white (17%) and beige (11%) colours in packaging are mostly preferred for meat products. Fish products are commonly chosen in dark blue (32%), light blue (22%), white (13%) or grey (12%) packaging. Eggs are usually preferred in white (40%), beige (19%), yellow (11%) and grey (9%) packaging.

Table 3

Attributive characteristics of colours in the associative range of food flavours

Colour	Predominant taste associations, %	The main products of the associative range, %
White	salty (64%) neutral (30%) sweet (11%)	milk (53%) eggs (40%) meat products (17%) fish products (13%)
Beige	neutral (24%)	eggs (19%) meat products (11%)
Gray	neutral (14%) salty (12%)	fish products (12%) eggs (9%)
Black	bitter (23%) spicy (8%)	meat products (10%)
Dark blue	salty (12%) neutral (5%)	fish products (32%) milk (17%)
Light blue	neutral (12%) salty (5%)	fish products (22%) milk (21%)
Green	sour (29%) salty (12%)	meat products (8%)
Yellow	sour (35%) sweet (22%)	eggs (11%)
Pink	sweet (29%)	meat products (10%)
Red	spicy (75%) sweet (14%)	meat products (25%)

Source: developed by authors, based on the results of a survey.

Table 4

Attributive characteristics of food in the associative range of colour selection of packaging

Product	Predominant taste associations, %	The main colours of the associative range, %
milk	neutral (55%) sweet (44%)	white (53%) light blue (21%) dark blue (17%)
meat products	neutral (52%) salty (32%) spicy (14%)	red (25%) white (17%) beige (11%) pink (10%)
fish products	salty (59%) neutral (33%)	dark blue (32%) light blue (22%) white (13%) gray (12%)
eggs	neutral (84%) salty (12%)	white (40%) beige (19%) yellow (11%) gray (9%)

Source: developed by authors, based on the results of a survey.

The study showed the following stereotypes about certain groups of consumer products (Table 5). So, when buying milk, consumers mostly expect to get a product with a neutral or sweet taste. The meat is expected to have a neutral or salty taste. When buying fish, respondents hope to get a predominantly salty or neutral product. When buying eggs, the most anticipated taste is neutral.

Table 5

Statistics of attributive characteristics of colours in the associative range of food flavours

Question	What taste of product do you expect to get when buying:			
Answer options	pack/bottle of milk	meat/meat products	fish/fish products	eggs
Sweet	57	4	7	4
Sour	2	0	1	0
Salty	0	41	77	15
Bitter	0	0	0	1
Spicy	0	18	2	1
Neutral	71	67	43	109

Source: developed by authors, based on the results of a survey.

When choosing perishable foods, consumers prefer cardboard, glass and plastic containers, given the same price, quality and volume of the product. At the same time, when buying long-lasting products, the main advantage is given to packaging made of glass, provided the same price, quality and volume of the product (while the share of cardboard and plastic containers remains significant) (Table 6).

Table 6

Statistics of the choice of the packaging material when buying food

Question	What material packaging will you choose when buying food:	
Answer options	perishable, given the same price, quality and volume of the product?	non-perishable, given the same price, quality and volume of the product?
Glass	48	73
Plastic / polyethylene	25	19
Cardboard	50	27
Wood	6	6
Metal	1	5

Source: developed by authors, based on the results of a survey.

Recent studies confirm the strong impact of coloured plastic on the environment (Amare, 2021). Thus, the use of toxic dyes in the manufacture of coloured polymeric materials often leads to food poisoning and in the process of decomposition of plastic in landfills has a negative impact on the quality of soils and groundwater. The influence of the use of coloured polymers on the microclimate of the root zone of plants (Amare, 2021), the change of soil temperature and the input into the greenhouse effect is proved. According to scientists (Amare, 2021), the use of polymers of white, black, blue and silver colours is the most rational in terms of agricultural technology, although it has many disadvantages in terms of environmental stability.

As the results of our study show, the use of white packaging and its shades (beige, grey) is universal, because this is the packaging chosen by consumers when buying the vast majority of the food. In addition, dark blue, light blue, red and black colours remain quite popular in terms of packaging choice, which correlates with the previously described study and allows the use of further processed polymers in agricultural production. That is why our research strengthens the framework of previous experiments, arguing the expediency of colour "restraint" in the design and manufacturштп of food packaging, which corresponds to the formed colour patterns of consumer consciousness and strengthen the environmental aspect of manufacturing, use, processing and disposal.

When researching the food safety of consumers, it is important to assess the degree of economic affordability of food and to identify possible ways to increase this indicator. To do this, we proposed a model of the impact of socio-economic determinants (monthly budget, competitiveness in the labour market, labour market mobility, cost structure and type of income sources) on the state of satisfaction of food needs. The model is based on the initial data collected on the basis of processing the responses of respondents (Table 7).

The affordability of food directly depends on the level of income of consumers, which is determined by their mobility in the labour market, as well as the availability of skills that best meet the modern needs of technological transformation of labour relations. The "value" of an employee in the labour market can be determined by various criteria, depending on the region of his residence, the economic conditions prevailing in the country, the level of technological development, etc. However, scientists identify the main factors that have the greatest impact on the economic success of the employee as a potential consumer (Kotykova, 2017). The results of the analysis of the initial data allow to build a correlation matrix (Table

8), which describes the relationship between the state of satisfaction of food needs, the monthly budget of respondents, their competitiveness in the labour market, labour market mobility, consumption structure and sources of income.

Table 7

Statistics of satisfaction of food needs and socio-economic determinants of consumers

№	Questions	Answer options	Number of answers
1.	Describe your typical state of satisfaction of food needs:	Famine	2
		There is a significant lack of food	0
		I refuse to consume certain groups of products (meat, fish) because of lack of money to buy them	9
		Nutritional needs are fullfilled, but I do not consume expensive food (delicacies)	78
		Full satisfaction of food needs, including delicacies	41
2.	My monthly budget is:	Less than UAH 2102	23
		From UAH 2,102 to UAH 6,000	53
		From UAH 6,000 to UAH 10,000	30
		From UAH 10,000 to UAH 18,500	17
		More than UAH 18,500	7
3.	On a scale of 1-5, rate your skills that affect competitiveness in the labour market:	I have no additional skills to improve my qualification	11
		I have the same skills as most able-bodied people	30
		I am in the process of acquiring skills that are in demand in the labour market	80
		Have a high level of foreign language or is a specialist in IT / finance/marketing / advertising/engineering	7
		I speak a high level of a foreign language, is a specialist in IT / finance/marketing / advertising/engineering, I have experience of internships and project work	2
4.	Evaluate your own mobility in the labour market on a scale of 1-5:	I'm afraid of losing my job because I don't have a chance to get a similar one in terms of benefits	14
		I'm afraid of losing my job, although I think I have a chance to get a similar one elsewhere	11
		I could quit if I don't like the job, but I prefer stability	53
		I can resign, but finding a job can take a long time	31
		I can easily resign and quickly get a similar job	21
5.	The largest share in the structure of my monthly expenses are:	Food	8
		Food + housing	29
		Expenditures on basic needs (food, housing, clothing, medicine)	53
		Expenditures on basic needs + self-development, recreation	33
		Education, rehabilitation, recreation	7
6.	Describe the type of sources of your income:	Fixed income from social benefits/assistance	36
		Fixed income from employment	51
		Income from employment with KPIs (possibility to increase depending on efficiency)	9
		Income from basic employment + passive income	26
		Several stable sources of income, including own business and passive income	8

Source: developed by authors, based on the results of a survey.

Table 8

Correlation matrix describing the relationship between the state of satisfaction of food needs and socio-economic determinants

		Nutrition sufficiency	Monthly budget	Expenditures share	Income sources	Working skills
Nutrition sufficiency	Pearson's r	—				
	p-value	—				
Monthly budget	Pearson's r	0.148	—			
	p-value	0.092	—			
Expenditures share	Pearson's r	0.224*	0.343***	—		
	p-value	0.010	< .001	—		
Income sources	Pearson's r	0.197*	0.529***	0.288***	—	
	p-value	0.025	< .001	< .001	—	
Working skills	Pearson's r	0.061	0.227**	0.069	0.197*	—
	p-value	0.492	0.010	0.436	0.025	—
Labour mobility	Pearson's r	0.309***	0.207*	-0.004	0.252**	0.163
	p-value	< .001	0.018	0.968	0.004	0.064

* p < .05, ** p < .01, *** p < .001
Source: developed by JASP.

The calculated correlation coefficients show that food adequacy increases simultaneously with the improvement of the structure of consumer expenditures (when consumers spend most of their income not only on food, but also on self-development, recreation, etc.), increasing labour mobility in the labour market and creating additional sources of income in addition to earnings. The monthly consumer budget increases in direct proportion to the improvement of the cost structure, the creation of additional sources of income, the acquisition of skills that increase the competitiveness of the employee in the labour market, as well as increasing mobility in the labour market. Improving the structure of consumer spending according to the model (when consumers spend most of their income not only on food but also on self-development, recreation, etc.) directly depends on the availability of additional sources of income. At the same time, the creation of additional sources of income is directly proportional to the increase in monthly income, improving the cost structure, as well as improving work skills and employee mobility in the labour market. In turn, the acquisition of work skills that improve the competitiveness of workers in the labour market directly depends on monthly income and the creation of additional sources of income. These dependencies can be represented in the form of a diagram (Figure 1).

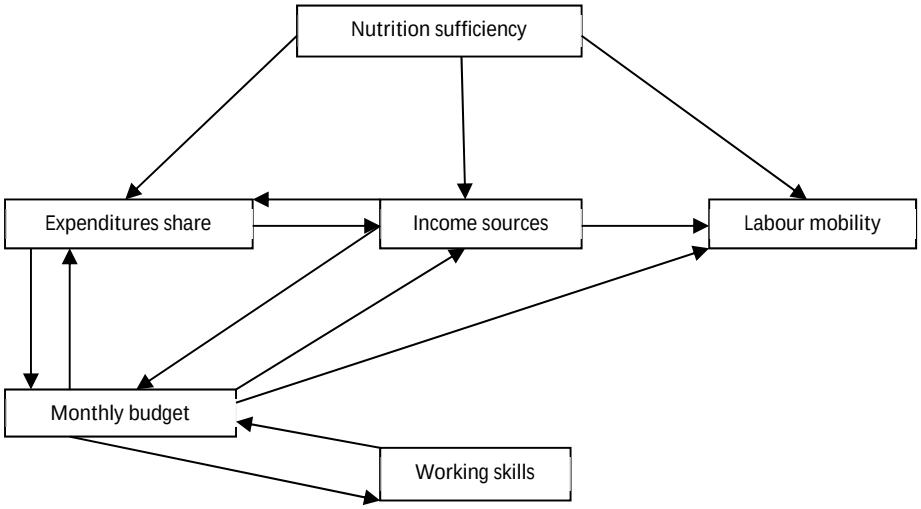
Thus, the established links form a chain, the unifying element of which is the mobility of workers in the labour market, which directly affects the affordability of food for consumers and the main factors influencing the formation of economic affordability of food - the monthly budget of consumers and sources of income. Thus, by developing the mobility of workers in the labour market, it is possible to significantly improve the affordability of food, as increasing the mobility of workers:

- deepens the experience, expertise and professionalism, increases the value of the employee in the labour market;

- reduces psychological stress;
- promotes professional development;
- promotes innovation, knowledge exchange and business development, etc.

Figure 1

The relationship between the state of satisfaction of food needs and socio-economic determinants



It is possible to create the necessary conditions for improving the mobility of workers in the labour market, providing them with decent wages, by:

- stimulating job creation;
- subsidizing entrepreneurship;
- creation of innovation centres;
- the direction of social policy to improve the skills of employees and improve the quality of education.

In addition to the above, stimulating the growth of household incomes should bring to the fore the problems of environmental protection and strengthen the importance of the environmental component of food security in the minds of citizens. Most often, conscious buyers are guided by the principles of preserving the Earth for future generations, trying to minimize the amount of industrial waste, and conserve natural resources by finding and using alternative and other environmentally friendly initiatives. On a domestic scale, this can mean reducing the number of plastic bags, plastic cups and straws used, sorting waste, and eliminating all that is unnecessary.

Scientists (Kotykova, 2019) have calculated the possible impact of individual consumer decisions to achieve the goals of the Paris climate agreement. According to a realistic scenario in which people reduce their consumption of carbon-intensive products, invest in energy-efficient technologies, but do not completely abandon their consumption habits, their efforts will help to reduce CO2 emissions only by 20%. Systemic transformation across all industries and services would need to reduce CO2 emissions by 60% to achieve the targets.

In recent years, Ukraine has decided on the direction of development – the introduction of European living standards in the country. Europeanism is not only belonging to a certain geopolitical space or membership in certain military-political organizations, it is, first of all, the acceptance of certain, special values.

Declaratively, Ukrainians demonstrate an ecocentric vision of the coexistence of humanity and nature: they believe that human beings and the environment have a really close and equal relationship. At the same time, Ukrainians continue to use plastic bags for packaging goods, but intend to switch to environmentally friendly packaging and their own reusable containers. The idea of limiting the consumption of meat and goods made from animal materials (leather, fur) is supported mainly by young people. To improve the environmental situation, Ukrainians are ready to sort garbage, but they are hindered by the lack of special infrastructure (containers, garbage collection services). Material incentives are more important for men than for women when sorting garbage.

Most respondents agreed that man and nature should coexist in harmony and equality (87%, of whom 72% agreed), the least – that nature should be preserved for its own sake (66%, of which 59 % agreed in full).

The judgments proposed for evaluation cannot be called neutral, they include social expectations, which can encourage giving socially approving answers. Therefore, the gender distribution of responses was interesting: in four out of five judgments, the differences in the responses of men and women are significant. Thus, women are much more likely than men to fully agree with the following statements:

- “The humanity and nature must coexist in harmony and equality” (77% vs 66%).
- “The humanity and nature coexist in unity, they are interconnected” (73% vs 62%).
- “Environmental problems need to be solved immediately, the existence of humanity depends on them” (66% vs 52%).
- “Solving environmental problems is a matter for each of us” (68% vs 57%).

This may indicate that women are more ecocentric, or that women may be more likely to behave as conformists to social expectations.

About half of Ukrainians try to limit themselves in the use of environmentally hazardous materials in their lives, and a slightly smaller part also limits the consumption of goods made from animal materials, but the vast majority are not inclined to limit the consumption of meat. Young people are more likely than older people to limit themselves to meat and goods made from animal materials.

About half of respondents limit themselves in the use of environmentally hazardous materials in their lives (53%), another 29% plan to start doing so. Only 4% of respondents said they were not going to limit themselves and another 14% were undecided.

About a third of respondents do not restrict the consumption of goods made of materials of animal origin (32%), the same number – do (also 32%). One-fifth of respondents do not buy such goods at all (20%), 6% do not pay attention to the material, another 10% hesitated to answer. Representatives of the younger age group (18-29 years) significantly more often answered that they do not buy goods of animal origin (29%), while older people (41-55 years) gave such an answer significantly less often (14%).

Almost all respondents (96%) do not limit themselves in meat consumption. Among those surveyed, only 2% were vegetarians and less than one percent were vegans. Another 1% of respondents do not eat meat for personal reasons.

Respondents tend to pay attention to the environmental safety of packaging at the time of purchase, but do so infrequently. They consider paper, cardboard and glass to be environmentally friendly materials, but products in stores are usually packed in plastic bags. At the same time, a significant part of Ukrainians is willing to pay more for goods with environmentally friendly packaging and buy food in their own reusable containers.

About a third of respondents already sort garbage (37%), 43% do not sort, but plan to do so. 14% of respondents do not sort garbage and do not plan to do so, another 6% could not answer.

The main reasons that motivate respondents to sort garbage or plan to start doing so are awareness of the need to care for the environment (75%) and the example of developed countries (32%). A quarter of respondents said that sorting garbage is not a problem / not difficult for them (24%). Less than 5% cited the example of relatives, acquaintances, friends and the fashion for sorting garbage (4% and 3%, respectively).

The main reasons for respondents' refusal to sort garbage are the underdevelopment of the relevant infrastructure in the country (lack of appropriate conditions – 56% and getting garbage to the same landfills – 48%). 12% of respondents believe that waste sorting is a waste of their time, 5% – that it is not significant in improving the environmental situation, and another 4% do not know how to sort waste.

The main factors motivating garbage sorting for respondents are the provision of special containers for various types of garbage (74%) and the establishment of a system of utilities for garbage collection (66%). Encouragement from the authorities or commercial organizations was indicated by 26% of respondents, information materials about the correct way of sorting garbage – 23%, and awareness of sorting garbage in their locality – 19%.

We propose to assess the relationship between environmental awareness indicators such as concerns about packaging recycling, the impact of production on the environment, animal welfare, the safety of product components and the sustainability of production technologies used and their safety for future generations (Table 9).

Table 9

Statistics of public consciousness of greening in the context of food security

№ з/п	Questions	Answer options	Statistics of answers, persons
1.	Do you concern about the possibility of recycling packaging when choosing food?	Yes	81
		No	49
2.	Do you concern about the environmental impact of the manufacturing of this product when choosing food?	Yes	92
		No	38
3.	Do you concern about the conditions of keeping animals involved in the production process when choosing food?	Yes	93
		No	37
4.	Do you concern about the safety of ingredients for consumers when choosing food?	Yes	119
		No	11
5.	Do you concern about the impact of the manufacturing of particular products on the lives of future generations when choosing food?	Yes	102
		No	28

Source: developed by authors, based on the results of a survey.

Thus, there is a significant direct link between all components of the environmental consciousness of food consumers. In addition, the understanding of the importance of packaging recycling is largely related to concerns about the environmental impact of food production (0.582, p-value <.001). Concerns of food consumers about the impact of production on the environment are mostly related to concerns about the impact of production on the lives of future generations (0.568, p-value <.001) and the conditions of animals involved in food production (0.457, p-value < .001). Understanding the importance of keeping animals involved in food production strongly correlates with concerns about the safety of product ingredients for consumers (0.421, p-value <.001). The importance of food safety for consumers is strongly related to concerns about the impact of production on the lives of future generations (0.379, p-value <.001).

Thus, the relationship between environmental awareness, such as concerns about packaging processing, the impact of production on the environment, animal welfare, product safety and sustainability of production technologies, as well as their safety for future generations, can be considered in the form of a diagram (Figure 2).

Thus, the concern about packaging recycling is essentially due to environmental concerns and the safety of the products consumed, and ultimately allows to create preconditions for the safe impact of food production on the lives of future generations.

The ecological consciousness of man is formed under the influence of its structural elements – behavioural, emotional, and cognitive. Ecological consciousness is influenced by culture, traditions, personal needs and experience, the values of the environment in which a person grows and stays, and so on. Sources of influence on eco-consciousness can be divided into internal (self-education, family upbringing, personal experience, etc.) and external (influence of state measures, non-governmental environmental organizations, religious organizations, media, social values, etc.) (Thogersen, 2020).

Table 10

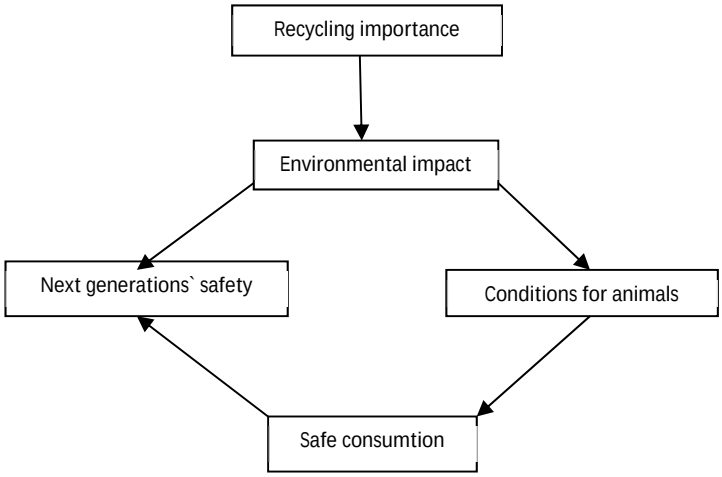
Correlation matrix that describes the relationship between indicators of environmental awareness

		Recycling importance	Environment impact	Conditions for animals	Safe consumption
Recycling importance	Pearson's r	—			
	p-value	—			
Environment impact	Pearson's r	0.582***	—		
	p-value	< .001	—		
Conditions for animals	Pearson's r	0.494***	0.457***	—	
	p-value	< .001	< .001	—	
Safe consumtion	Pearson's r	0.334***	0.230**	0.421***	—
	p-value	< .001	0.008	< .001	—
Next generations` safety	Pearson's r	0.558***	0.568***	0.250**	0.379 ***
	p-value	< .001	< .001	0.004	< .001

* p < .05, ** p < .01, *** p < .001
Source: developed by JASP.

Figure 2

Relationship between environmental awareness indicators



Thus, the development of environmental awareness of the population is one of the goals of the environmental policy of the state. The strategy of eco-policy envisages measures to raise public awareness and develop environmental education. The challenge of environmental policy is taking into account environmental issues in the decision-making process as an equal and not a secondary factor, ensuring the continuity of educational activities, and their dissemination to a wide range of people, including government officials. It is important to provide a detailed explanation of the provisions of the legislation, innovations, methods of their implementation, as well as compliance with environmental regulations, collection and dissemination of relevant data on the state of the environment.

Conclusions

As the results of our study show, the use of white packaging and its shades (beige, grey) is universal, because this is the packaging chosen by consumers when buying the vast majority of the food. In addition, dark blue, light blue, red and black colours remain quite popular in terms of packaging choice, which correlates with the previously described study and allows the use of further processed polymers in agricultural production. That is why our research strengthens the framework of previous experiments, arguing the expediency of colour "restraint" in the design and manufacturшtп of food packaging, which corresponds to the formed colour patterns of consumer consciousness and strengthens the environmental aspect of manufacturing, use, processing and disposal.

Concerns about packaging recycling are essentially due to concern for the environment and the safety of the products consumed, and ultimately create the preconditions for the safe impact of food production on the lives of future generations. To increase the level of environmental awareness of Ukrainians and the formation of values to the environment, it is necessary to implement legislative, institutional, and budgetary solutions:

- to initiate systematic sociological research on the state of environmental consciousness of Ukrainians;
- to develop the implementation of these measures, attract international financial assistance, mechanisms of public-private partnership, disseminate information om the ways to comply with environmental regulations, etc.

The calculated correlation coefficients show that food adequacy increases simultaneously with the improvement of the structure of consumer expenditures (when consumers spend most of their income not only on food, but also on self-development, recreation, etc.), increasing labour mobility in the labour market and creating additional sources of income in addition to earnings. Established links form a chain, the unifying element of which is the mobility of workers in the labour market, which directly affects the affordability of food for consumers, and the main factors influencing the formation of economic affordability of food – the monthly budget of consumers and sources income. Thus, by developing the mobility of workers in the labour market, it is possible to significantly improve the affordability of food.

According to its purpose, the study demonstrated the possibility of reviewing marketing approaches to meet consumer needs, simplifying the technological methods of food packaging and reducing the negative impact on the environment due to recycling and subsequent disposal of packaging. These studies may serve as a basis for further consideration of this problem, as well as to draw the attention of policymakers to the possibility of direct regulation of the types of packaging used in the food industry.

Further research on the possibility of using alternative types of packaging for consumer products, including reusable packaging in terms of safety, convenience, economical and environmental feasibility and consumer readiness for such an innovation would be relevant.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

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INSTITUTIONAL ENVIRONMENT OF THE LAND RESOURCES AND LAND USE MANAGEMENT IN UKRAINE: PROBLEMS OF COORDINATION OF THE INSTITUTIONAL STRUCTURE, FUNCTIONS AND AUTHORITIES[8]

The article presents findings of the research on the institutional environment of land resources and land use management in Ukraine as a sustainable development factor (safe human living and social welfare). The work highlights the main institutional problems of the country, which have consequently caused ineffective use of the land and resource potential and have resulted in soil degradation and economically unjustified use of land, as well as exacerbation of other global problems. According to the official statistical data, Ukraine's arable lands occupy 54 % of its area, but its land resource potential is insufficiently used, whereas, in the countries of Europe, the area of arable land is only 27.4 %. Another considered problem is that in Ukraine, some authorities are repeated, whereas some responsibilities concerning land and land use are dropped out. Analysis of the current institutional environment confirms the authors' hypothesis that it requires substantial transformations in the system of governmental management of land resources and land use.

Keywords: land reform; land resources management; management of land use; land fund; sustainable development; public welfare; institutional environment; State Service of Ukraine for Geodesy; Cartography and Cadastre (StateGeoCadastre); climate change; land degradation
JEL: H83; Q15; Q24; Q28; Q56

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Introduction

The growing demand for food, fodder, fuel and raw materials has forced an increased burden on land and competition for land and other natural resources located on it. Moreover, the area of available productive lands is getting smaller because of their degradation. The driving forces of land degradation include external factors, which directly or indirectly influence the health and productivity of land, as well as related resources such as soil, water and biological diversity. Therefore, protection of the functions of land and other natural resources, placed on it, is an important contribution to human safety, because it provides an excess of food and water, permanent employment and maintenance of life, resistance to climate change and extreme weather conditions, as well as the general safety of human life and public welfare.

Ukrainian scientists believe that the multi-stage land reform, which started in Ukraine in 1990 and is currently not completely implemented, is responsible for the reduced market price of land, deteriorates conditions and components of the environment, increased ecological hazard in the process of economic activities, particularly blunts efficiency of farming and competitive capacity of not only some economic entities, i.e. land-users, but also local and national economies (Tretiak et al., 2021).

Ukraine is one of the largest countries in Europe in terms of arable lands as its land fund has 60 354.9 thousand ha, including 32 541.3 thousand ha of agricultural lands or almost 54% of the total area of Ukraine, i.e. about 3% of the area of Europe. To compare characteristics of the land use in the countries of Europe, the EU member states and Ukraine on the example of agricultural lands, the authors of the research have composed Table 1.

Table 1

Comparative characteristics of land use conditions in the countries of Europe, the EU member states and Ukraine

Index	Unit	Ukraine	Countries of Europe	EU member states
Area of lands	million ha	60.4	1015.6	437.4
	%	100	100	100
Area of fertile black lands	million ha	28	84	18
	%	46.4	8.3	4.1
Area of agricultural lands	million ha	42.7	474.8	177.7
	%	70.7	46.8	40.6
Area of arable lands	million ha	32.5	277.8	115.7
	%	53.8	27.4	26.5
Area of agricultural lands, certified as organic	million ha	0.3	11.6	5.3
	%	0.5	1.1	1.2
Area of irrigated lands	million ha	0.5	20.8	11.1
	%	0.8	2.0	2.5
Area of agricultural lands per one resident	ha/per 1 person	0.7	0.6	0.4
	%	1.2	0.1	0.1
Share of leased agricultural lands	%	65	62	53
Price of investments, thousand USD	per 1 ha	1	4	5.5
Export of cereals	million ton	34.8	130	38.5
Price of 1 hectare of agricultural lands	thousand USD	1.0	3.7	7.2

Source: composed with the use of Cabinet of Ministers of Ukraine, 2017b.

Data from the Table confirm a great unemployed potential of land resources, particularly of Ukrainian agricultural lands (46.4% – fertile black lands) as compared to the countries of Europe (8.3%), and prove that without an effective institutional environment of the land resources and land use management, land resources and other natural resources, placed on it, cannot reach the average European level of capitalization and greening.

The hypothesis of the present research suggests that under the global negative changes of climate and ecosystems and their impact on land and other resources, insufficient measures concerning fight with land degradation, openness of the market of agricultural lands, implementation of conceptual changes in the field of power decentralization in Ukraine and accomplishment of the land reform, Ukrainian land policy needs significant institutional changes in the system of governmental management of land resources and land use. It is one of the main factors stagnating effective development of the country, particularly the policy concerning the effective implementation of the land reform, organization of the rational use and protection of land resources, capitalization and greening of land use. All the aspects are studied in the present work.

Materials and Methods

Theoretical aspects of the land resources and land use management in Ukraine, as one of the main constituents of economic and ecological relations, are considered in the researches of domestic scientists, namely M. Heiets, V. Horlachuk, A. Danylenko, D. Dobriak, P. Kulinich, R. Kuryltsiv, A. Miroshnychenko, A. Martyn, R. Marusenko, O. Mordvinov, O. Novotorov, V. Trehobchuk, A. Tretiak, H. Sharyi, M. Khvesyk and others. However, the issue of effective performance of the organizational structures of land resources and land use management in conditions of global tendencies is not properly studied.

In the research, the authors referred to the legislative and normative documents of Ukraine in the field of land relations, official statistical materials, data of the State Service of Ukraine for Geodesy, Cartography & Cadastre (StateGeoCadastre), as well as publications, devoted to the solution of the most important global tasks, preconditions of sustainable development and aspects of land resources management, as well as regulation and administration of land relations.

To conduct the research, the following general scientific methods of research were used, particularly analysis and synthesis, theoretical generalization and comparison – to study the institutional environment concerning organizational structures of the land resources and land use management, to analyze the systems of managerial bodies while assessing the efficiency of their regulatory impact on land resources and concerning the effective implementation of the land reform, organization of the rational use and protection of land resources, capitalization and greening of land use.

The research refers to the recent available public data about the land fund of Ukraine, provided by the State Service of Ukraine for Geodesy, Cartography & Cadastre. Nowadays, the mentioned process of transfer of the state statistical reporting data on quantitative accounting of land is not completed, verifying the present research hypothesis.

Results and Discussions

International commitments and European integration attempts of Ukraine, primarily concerning the FAO principles implementation in the national land policy, determine institutional transformations and the necessity to change logics and approaches to the effective economical, ecological and social development and management of land resources and land use.

Unfortunately, nowadays, Ukraine faces great risks of escalating ecological hazards, caused by pollution of air, water and soil, exhaustion and pollution of land, forest, water and other natural resources because of irrational economic activities. Thus, local and national ecological problems aggravate global problems, primarily negative processes of the increased level of land degradation and desertification, making a negative impact on climate changes (Tretiak et al., 2021).

Analysis of the land fund of Ukraine confirms an extremely high level of living space development and significant ploughing, i.e. correlation of anthropogenic and natural environment-stabilizing lands is 3:1 (Table 2), including 45 279.3 thousand hectares (75%) of Ukraine's area engaged for economic needs, and only 15 075.6 thousand hectares (25%) are environment-stabilizing lands. The presented figures confirm current institutional problems of ineffective land resources and land use management that cause an increased environmental hazard in the process of economic activities.

Table 2

Land fund at the beginning of 2016, thousand ha

Anthropogenic area		Natural land area	
Agricultural lands, including:	42726.4	Forests and other forest-covered areas	10633.1
arable land	32541.3	Swampland	982.3
grassland	233.7	Dry open land, covered by specific vegetation	13.2
perennials	892.4	Open land without vegetation or with insignificant vegetation	1020.6
hay fields	2406.4		
pastures	5434.1		
Build-up land	2552.9	Water bodies	2426.4
Total, thousand ha	45279.3	Total, thousand ha	15075.6
Referring to the total area, %	75.0	Referring to the total area, %	25.0

Source: composed by the authors according to the latest data of the State Service of Ukraine for Geodesy, Cartography & Cadastre.

Therefore, to identify the negative factors of impact on the efficiency of land relations regulation and administration of land use in Ukraine, the authors of the research have conducted an analysis of the institutional environment concerning organizational structures of the land resources and land use management.

At the legislative level, the essence of land resources and land use management is defined in the Land Code of Ukraine, approved in October 2001 (Verkhovna Rada of Ukraine, 2001). According to the Land Code of Ukraine (Article 9-14), regulation of land relations is conducted by the village, settlement, city, district, regional councils and the Verkhovna Rada of Ukraine. The system of land resources and land use management consists of three blocks:

- legislative authorities;
- executive authorities;
- prosecutorial and judicial authorities.

Concerted efforts of the authorized state bodies with the managerial mechanisms (methods, principles, functions of management, etc.) represent the system of land resources and land use management.

According to the articles 15, 151, 152 of the Land Code of Ukraine, governmental management in the field of use and protection of lands is performed by the Cabinet of Ministers of Ukraine, Government of the Crimean Autonomous Republic, local state administrations, State Services of Ukraine for Geodesy and Cartography (StateGeoCadaster), Ministry of Agrarian Policy and Food of Ukraine, Ministry of Ecology and Natural Resources, Ministry of Health of Ukraine, State Agency of Water Resources of Ukraine (State Water Agency) and other authorized state bodies according to their competences. Moreover, according to the article 15/1 of the Land Code of Ukraine and Decree of the President of Ukraine of May 13, 1996, the StateGeoCadaster is the central body of state executive power that implements policy in the field of land relations in Ukraine and is directly subordinated to the Cabinet of Ministers of Ukraine.

In the field of jurisdiction, control is made by the Supreme and High Arbitration Courts of Ukraine.

To implement the land reform, the Cabinet of Ministers of the Ukrainian SSR made resolution № 124 of July 20, 1991, on the establishment of the State Committee for Land Resources. In 1992, the resolution of the Cabinet of Ministers of Ukraine № 73 of February 14, 1992, approved the regulations about the State Committee for Land Resources. According to paragraph 1 of the document, the State Committee of Ukraine for the land reform accomplishment (State Committee of Ukraine for Land Resources) was declared as the central body of state management, directly subordinated to the Cabinet of Ministers of Ukraine. It was defined that the State Committee of Ukraine for Land Resources was responsible for the state land policy in Ukraine, particularly land reform implementation, rational use and protection of land resources.

Resolution of the Verkhovna Rata of Ukraine № 2200-XII of March 13, 1992, "On acceleration of the land reform implementation and land privatization", stressed on the importance of that special authority of the central executive power. Paragraph 6 of that Resolution declared that normative documents and instructions of the State Committee concerning reforming land relations, which did not violate the laws of Ukraine, were mandatory for exercising by local authorities and administrations, land owners and land users regardless of the forms of ownership and departmental possession.

The decree of the President of Ukraine № 340/96 of May 13, 1996, approved a new regulation about the State Committee for Land Resources, which specified its status and tasks, particularly that the State Committee for Land Resources was the central body of state executive power, subordinated to the Cabinet of Ministers of Ukraine and was included in the structure of the agro-industrial complex. It was responsible for the state policy in the field

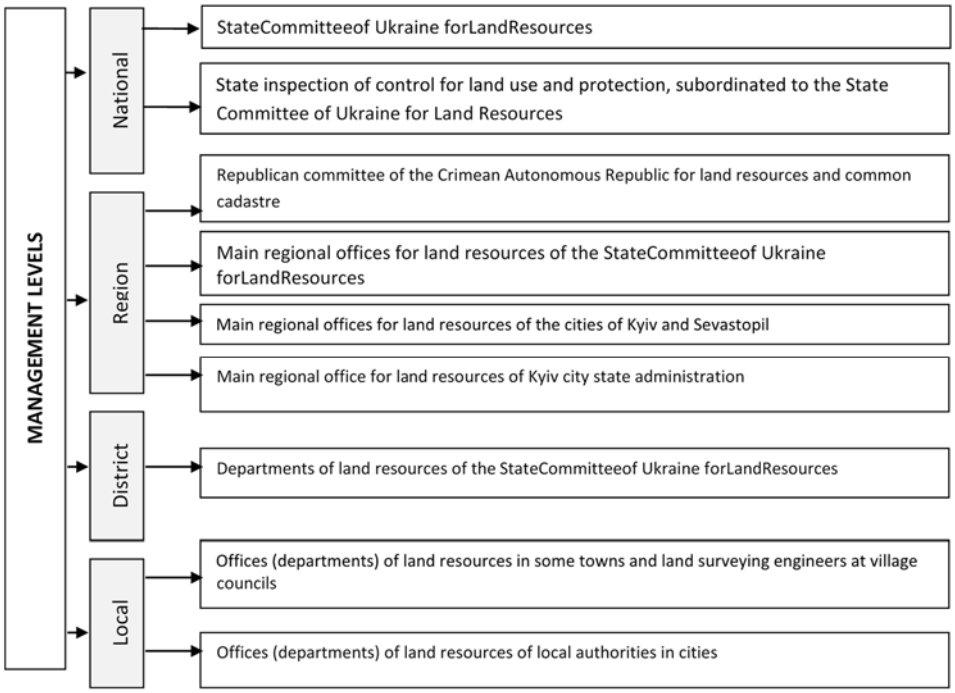
of land relations, and implemented the land reform. The State Committee for Land Resources was authorized to conduct the state management of land resources, to control the performance of the subordinated state bodies in charge of land resources, to secure the rational use and protection of land resources.

Moreover, continuous changes in the land laws and lobbying for the interests of certain powerful groups resulted in the appearance of rather contradictory standards and changes in the system of the State Committee for Land Resources. Thus, the authority lost its key position in implementing the land reform, as well as in shaping and conducting the state policy in the field of land relations. At the start of the land reform, implementation, development and approval of legislative acts and bylaws were made by involving some research institutions, interdepartmental working groups, analysis of changes and their possible impact on the society and development of the national economy, whereas over time, the attitude to the legislative acts development changed.

The structure of the system of authorities in charge of land resources of the State Committee for Land Resources in Ukraine and local authorities is shown in Figure 1.

Figure 1

Management levels in the system of authorities in charge of land resources of the State Committee of Ukraine for Land Resources and local authorities



Analysis of the tasks and functions, defined in the new Land Code of Ukraine (2001) and the Resolution about the State Committee of Ukraine for Land Resources, shows that structure of the State Committee of Ukraine for Land Resources was not correspondingly transformed. In particular, after the process of agricultural lands parcelling was finished in 2000, they expected to initiate the process of land organization and land surveying and aimed to establish an ecological network at the regional and local levels, land holdings and land uses of agricultural enterprises, to develop a new market-oriented land structure that consequently resulted in launching the transformational reform of the State Committee of Ukraine for Land Resources.

It is worth noting that the lack of an effective mechanism for the multi-level management of land resources and land use has resulted in overlapping of power authorities' competencies within one managerial unit. Particularly, having analyzed the distribution of the responsibilities and authorities of the subjects of land resources and land use management, the authors of the work have developed a matrix of responsibilities for the performance of the functions and regulatory mechanisms of management (Table 3) (Tretiak et al., 2021).

Studying the current institutional structure of the land resources and land use management in Ukraine, it is worth noting that the efficient (acting) management in that field is a multi-level and complex process. It is caused by the extended period of the structural transformation from a centre-planned national economy to a centralized one, focused on the market, as well as by the impact of dynamic political changes and the absence of a common idea as to the expected results of institutional transformations (Tretiak et al., 2021).

However, political decisions concerning the central body of power that implemented the state policy in the field of land relations were different. Since 2007, some reorganizations happened, particularly on April 13, 2007, the State Committee of Ukraine for Land Resources was reorganized into the State Agency of Ukraine for Land Resources; on April 14, 2008, the State Committee of Ukraine for Land Resources was reestablished; on July 15, 2013, the performance of the Committee was stopped and State Agency of Ukraine for Land Resources was reactivated; on September 10, 2014, it was transformed into the State Service of Ukraine for Geodesy, Cartography and Cadastre (StateGeoCadastre)according to the Resolution № 442 of the Cabinet of Ministers of Ukraine.

In August 2016, the Cabinet of Ministers of Ukraine signed the resolution "On reforming of territorial bodies of the State Service of Ukraine for Geodesy, Cartography and Cadastre" (Cabinet of Ministers of Ukraine, 2016), in which it agreed to the proposals of the Ministry of Agrarian Policy and Food of Ukraine and the State Service of Ukraine for Geodesy, Cartography and Cadastre that the interregional and city-district offices of the Service, offices (departments) of the Service in districts and cities were the structural units of the corresponding offices of the State Service of Ukraine for Geodesy, Cartography and Cadastre. Therefore, the district link of executive authorities was liquidated, including those in charge of land resources management.

Table 3

Matrix of distribution of the responsibilities and authorities of managerial bodies in terms of performance of the functions and regulatory mechanisms of land resources and land use management

Functions and regulatory mechanisms	Bodies of management and their authorities									
			Central bodies of executive power							
	Verkhovna Rada of Ukraine (VRU)	Bodies of local government (region, district, village, settlement, city councils)	Cabinet of Ministers of Ukraine (CMU)	which secure shaping of the state policy in the field of environmental protection, and land relations	which exercise the state policy in the field of environmental protection, and land relations	which secure shaping of the state policy in the field of land relations	which secure implementation of the state policy in the field of land relations	local state administrations for land relations	state bodies of privatization in the field of land relations	Land-owners and land users (residents/ non-residents)
Forecasting development of land use	-	+	+	+	+	+	+	+	+	+
Planning development of land use	+	+	+	+	+	+	+	+	+	+
Assessment of resource and land property	-	+	-	+	+	+	+	-	+	+
Organization of use and protection of land	-	+	+	+	+	+	+	+	+	+
Motivation of efficient land reclamation	-	+	+	+	+	+	+	+	+	+
Control for use and protection of land	-	+	+	-	+	-	+	-	-	-
Accounting of lands, land plots and land holdings	-	+	-	-	-	-	+	-	-	+
Monitoring of use and protection of lands, land relations, forms of land use	-	+	+	-	+	-	+	-	-	-

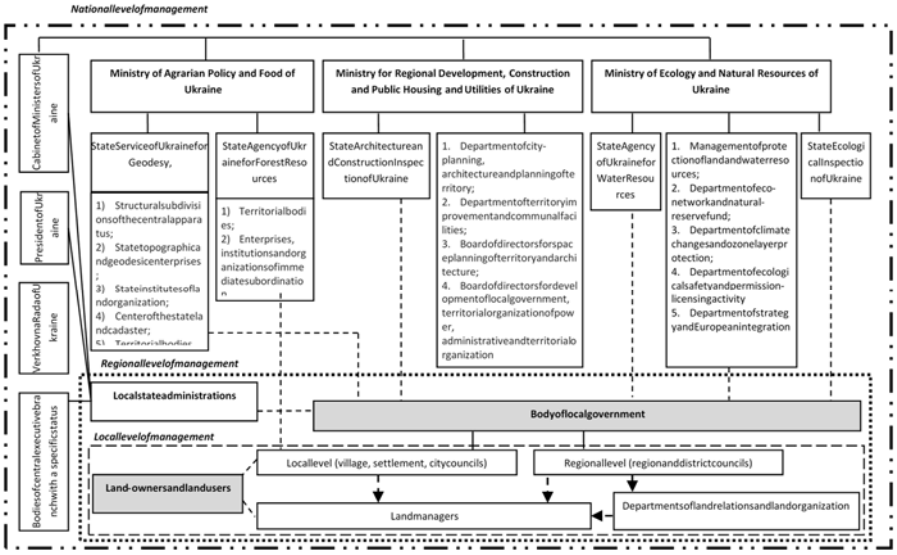
Source: completed by the authors with the use Khvesyk (Khvesyk et al., 2013; Verkhovna Rada of Ukraine, 2001).

Figure 2 demonstrates the institutional structure of the land resources and land use management in Ukraine, valid as of August 28, 2019. According to the current land policy of Ukraine, the following institutional frames of responsibilities and authorities of the main power bodies in charge of land resources and land use management in Ukraine should be considered (Tretiak et al., 2021).

Examination of the majority of the central and local power bodies or their affiliates in charge of the land resources and land use management confirms a considerable differentiation and scattering of managerial functions among the numerous state institutions. However, the greatest problem is that there is no adequate coordination of managerial actions and control for the performance of the authorities and responsibilities, no control for making relevant managerial decisions concerning land and land use (Tretiak et al., 2021).

Figure 2

Institutional structure of land resources and land use management in Ukraine



——— Direct coordination, management relation

– – – Indirect coordination, management relation in the field of land cadastre and geodesy (control).

Sources: completed by the authors with the use the legislation of Ukraine (Cabinet of Ministers of Ukraine, 2014a, 2014b, 2014c, 2014d, 2015a, 2015b, 2015c, 2017a; Ministry for Regional Development, Construction and Public Housing and Utilities of Ukraine, 2015; Ministry of Ecology and Natural Resources of Ukraine, 2019; Verkhovna Rada of Ukraine, 1997, 1999, 2001, 2011a).

Resolution of the Cabinet of Ministers of Ukraine № 1118 “Issues of performance of territorial bodies of the State Service of Ukraine for Geodesy, Cartography and Cadastre” of November 16, 2020 states (Cabinet of Ministers of Ukraine, 2020):

1) To liquidate territorial authorities of the State Service of Ukraine for Geodesy, Cartography and Cadastre as legal entities of public law according to the list in supplement 1.

2) To agree to the proposal of the Ministry of Economy, Trade and Agriculture Development concerning the establishment of territorial authorities of the State Service of Ukraine for Geodesy, Cartography and Cadastre as structural affiliates of the apparatus of the mentioned Service according to the list in the supplement 2. According to that resolution, main departments in regions were liquidated, whereas offices of the State Service of Ukraine for Geodesy, Cartography and Cadastre were established in all regions of Ukraine. The staff was reduced from 10 thousand to 4317 thousand people (Cabinet of Ministers of Ukraine, 2021).

In 2018 and 2021, the structure of the apparatus of the State Service of Ukraine for Geodesy, Cartography and Cadastre included the following departments (Table 4).

Table 4

Structure of the apparatus of the State Service of Ukraine for Geodesy, Cartography and Cadastre in 2018 and 2021

№	Name of structural units in the corresponding year	Year	Numberofunits	↑↓
1	Management	2018	3	+3
		2021	6	
2	Department of the state land cadastre	2018	22	+6
	Departmentforkeeping records inthestatelandcadastre	2021	28	
3	Departmentforlandorganization, use and protection of land	2018	23	=
		2021		
	Office of land organization	2018	6	+1
		2021	7	
	Officeofagriculturallanduse	2018	6	-1
		2021	5	
	Office of land protection	2018	5	=
		2021		
	Officeofnon-agriculturallanduse	2018	5	=
		2021		
4	Department of human resource policy	2018	22	-1
	Department of staff management	2021	21	
5	Department of control for land use and protection	2018	22	-1
		2021	20	
6	Department of finance	2018	23	-1
	Departmentoffinanceandaccounting	2021	22	
7	Juridical department	2018	29	-5
		2021	24	
8	Office of service supply	2018	17	+5
	Department of service supply	2021	22	
9	Department of state expert estimates	2018	18	+1
	Department of state expert estimates, certification and control in the field of land organization	2021	19	
10	Departmentoftopographic-geodesicandcartographicactivities	2018	22	-1
	DepartmentofdevelopmentandstandardizationoftheNational infrastructure of geo-spatial data	2021	21	
11	Department of international cooperation and land market	2018	22	-7
	Department of land market and land assessment	2021	15	
	Office of land market	2018	4	+1
		2021	5	
	Office of land assessment	2018	4	+1
		2021	5	
	Office of auction activities	2018	4	=
		2021		
	Department in charge of the European integration and international cooperation	2021	9	+9
12	Departmentofprevention and discovery of corruption	2018	11	-4
	Department in charge prevention and discovery of corruption	2021	7	
13	Office of internal audit	2018	6	+1
		2021	7	
14	Department of public claims and access to public information	2018	7	+4
	Departmentinchargeofworkwithpublicclaimsandaccess to public information	2021	11	
15	Office of information protection and online administration	2018	8	+2
	Department of information technologies and information protection	2021	10	
16	Office of control	2018	5	-5
17	Office of material and technical supply	2018	5	-5
21	General office	2018	5	-5
22	Sector of archives	2018	2	-2
TOTAL		2018	274	-
		2021	241	33

Source: composed with the use of the sources (Ministry of Digital Transformation of Ukraine, 2018, 2021).

Analysis of the apparatus of the State Service of Ukraine for Geodesy, Cartography and Cadastre in 2018 and 2021 shows that in the period of increased burden on land resources, there was no functional affiliate or department, responsible for the state regulation of land relations in the structure of the State Service of Ukraine for Geodesy, Cartography and Cadastre. Moreover, the analysis confirms that the state administrating (economic, land-surveying and legal) of the land use and protection, coordination of that direction with the Ministries, executive authorities and territorial communities is performed by the Department of land organization, land use and protection, which is much smaller than the Juridical department.

Moreover, the current Ukrainian system of management of the state budget funds in the field of land relations and organization of land use and protection is still far from being perfect, in spite of the high costs spent for service maintenance in decentralization conditions (Table 5).

Table 5

State budget funds, allocated for the State Service of Ukraine for Geodesy, Cartography and Cadastre, thousand USD

Year	Name according to the department and program classification of costs and the state budget funding								Total, thous USD
	Administration and management in the field of land resources	Advanced training of staff	Issue of state acts certifying the right of ownership of a land plot on rural area	Implementation of the land reform	Construction of anti-erosion hydro-technical units and reclamation of disturbed lands	Protection, reclamation and rational use of land resources	National topographic-geodesic and cartographic works, demarcation and delimitation of the state border	Inventory of lands and updating of the cartographic base of the State Land Cadastre	
2002	13341	4	-	6725	704	-	-	-	20773
2003	14632	4	-	6687	713	-	-	-	22035
2004	16220	3	764	6248	-	844	-	-	24081
2005	25858	3	877	5293	-	943	-	-	32975
2006	38007	40	2812	8377	-	953	-	-	50188
2007	45997	39	842	9708	-	1881	-	-	58467
2008	66629	39	595	13789	-	1881	-	-	82933
2009	39956	18	455	947	-	61	-	-	41437
2010	50831	17	14851	913	-	59	-	-	66671
2011	51284	15	11608	1509	-	177	-	-	64593
2012	108716	-	29208	12069	-	-	-	-	149994
2013	75961	-	13375	59624	-	-	2593	-	151553
2014	63102	-	-	1051	-	-	414	-	64567
2015	33199	-	-	2841	-	-	319	-	36359
2016	24945	-	-	1884	-	-	212	-	27040
2017	37427	-	-	3927	-	-	189	-	41542
2018	51461	-	-	16133	-	-	179	-	67773
2019	51723	-	-	8639	-	-	179	-	60541
2020	58231	-	-	2153	-	-	1333	10044	71762
2021	42543	-	-	1807	-	-	1119	8428	53897
Total	910063	182	75388	170323	1417	6799	6537	18472	1189180
Average in a year, thousand USD	47898	10	3968	8964	75	358	344	972	62588
$/ha	0.794	0.000	0.066	0.149	0.001	0.006	0.006	0.016	1.038

** since September 2014 – called the* State Service of Ukraine for Geodesy, Cartography and Cadastre

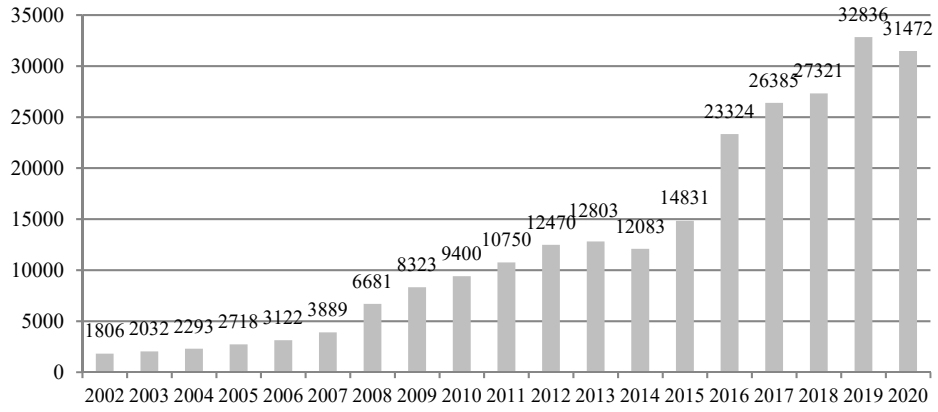
*Source: composed by the authors on the basis of the Laws of Ukraine "On the State budget of Ukraine" in the corresponding year (*Ministry of Finance of Ukraine, 2008*;* Kurs-Dollar-Euro.ru, 2021).

The Table demonstrates that after approval of the Land Code of Ukraine, the land policy was not focused on the supply of the ecologically rational use of land resources. Since 2002, funds have been distributed in the following way, in particular 6 799 thousand UDS – for reclamation and rational use of land resources and land protection, 1 417 thousand USD – for construction of anti-erosion hydro-technical units and reclamation of disturbed land, 270 720 thousand USD – for measures of the land reform implementation and land organization. The Table of costs also shows that since 2012, no funds have been allocated for the State Service of Ukraine for Geodesy, Cartography and Cadastre for the purposes of protection, reclamation and maintenance of the rational use of land resources. It confirms ineffective governmental policy concerning the management of the land and resource potential, which is under particular protection of the state as it is declared in the Constitution of Ukraine.

After approval of the current Land Code of Ukraine, i.e. 19 years ago, the average funding of the above-mentioned measures made 0.24 $/ha annually, as well as 0.79 $/ha – for managerial structures, whereas payments for the land provided 18 $/ha of revenues to the budgets of different levels (Figure 3).

Figure 3

Revenues from payment for land to the consolidated budget of Ukraine and its share in the total amount of revenues from the specific use of natural resources, million USD



In particular, revenues from payments for land increased in the period starting from 2016, demonstrating a significant uptrend. It is worth noting that improvement of the system of administrating the payment for land, which is paid in the form of land tax and lease payment (they are considered financial instruments, which are used to regulate the possession and use of land assets) is an important step to increase the volume of funding for reclamation and protection of land resources.

The above-mentioned factors provoke economic, ecological problems, particularly weak capitalization of land use, and therefore reduced revenues to budgets from payments for land.

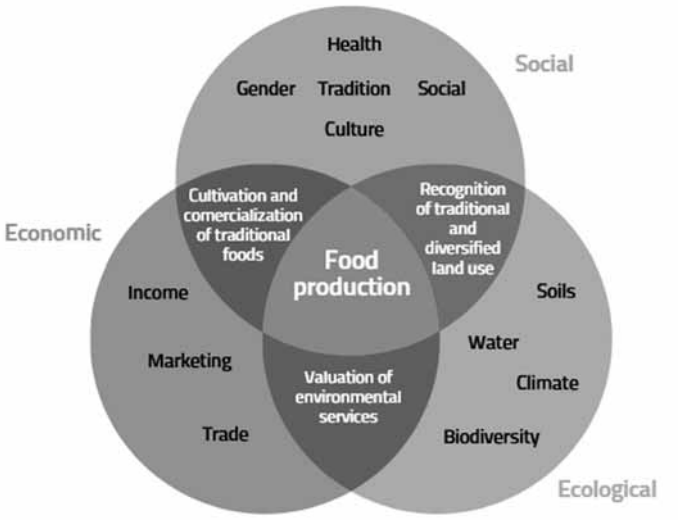
Transformation of the system of land resources and land use management in Ukraine requires appropriate improvement of the institutional environment, both at the legislative and regulatory levels, that is functional at different hierarchical levels, especially for the territorial communities. In addition, climate changes and the rapidly growing demand for food are intensifying the burden on land resources. Significant transformations are needed to overcome the current development trends and to move to a sustainable agriculture and food production model. The FAO (2017) identified five interconnected principles for that transition:

1) improved efficiency of the resource use;
2) protection of natural resources;
3) improved living conditions on rural areas;
4) increase of stability;
5) increase of controllability.

Therefore, the FAO recognizes that sustainable use and management of land resources is important for achieving the Sustainable Development Goal 2 – producers and managers in the field of natural resources adopt practices that increase and improve the supply of products and services in agricultural production in a sustainable manner. Implementation of the five principles of transition to the sustainable agriculture and food production and integration of three sustainable development strands – social, economic and environmental (Figure 4) – require a new approach to the land resources and land use management at different levels and in relation to competing destinations of land use (Tretiak et al., 2021).

Figure 4

Three dimensions of sustainable development as a basis for land resources and land use management



Sources: FAO, 2017.

Thus, in the period of transformational changes, it is necessary to develop the national land policy, which will define the goals, priority tasks and instruments of land relations regulation and administration of land use. Fulfilment of the tasks will crucially change the vector of their development with the focus on the protection and growth of the country's land potential for the medium-term and long run with consideration of the FAO principles.

Conclusions

Analysis of the institutional environment of the land resources and land use management provides the conclusion that in the period of negative changes of climate and ecosystem, demand for measures to fight with land degradation, as well as openness of the agricultural land market, the Ukrainian institutional environment needs crucial transformations with consideration of the principles, recommended by the UNO. In particular, the research outlines negative factors of the institutional environment of the organizational structures of land resources and land use management, which consequently cause stagnation of the efforts on implementation of the land policy principles, determined by the Land Code of Ukraine, Laws of Ukraine "On land protection", "On land organization", "On environmental protection" and others, as well as concerning effective fulfilment of the land reform measures, greening and capitalization of land use, protection of land and other natural resources. Therefore, an examination of the State Committee of Ukraine for Geodesy, Cartography and Cadastre shows there is no functional department or affiliate, which performs the functions of state regulation of land relations. The function of state administration (economic, land-surveying and legal) of land use and protection, as well as coordination of that direction, is exercised by the Department of land organization, land use and protection, having staff of 23 people.

Unfortunately, approval of the Land Code of Ukraine did not reorient the land policy onto the ecologically rational use of land resources. Since 2002, funds have been distributed in the following way, in particular 6 799 thousand UDS – for reclamation and rational use of land resources and land protection, 1 417 thousand USD – for construction of anti-erosion hydro-technical units and reclamation of disturbed land, 270 720 thousand USD – for measures of the land reform implementation and land organization. Moreover, since 2012, no funds have been allocated for the State Service of Ukraine for Geodesy, Cartography and Cadastre for the purposes of protection, reclamation and maintenance of the rational use of land resources. During 19 years, the average funding of the above-mentioned measures made 0.24 $/ha annually, as well as 0.79 $/ha – for managerial structures, whereas payments for land provided 18 $/ha of revenues to the budgets of different levels. Such figures confirm ineffective governmental policy concerning the management of the land and resource potential, which is under the particular protection of the state as it is declared in the Constitution of Ukraine. Those factors provoke economic, ecological problems, social and budget (for territorial communities) problems, namely weak capitalization and greening of land use, and consequently reduced revenues to budgets from payments for land. Therefore, the following researches should be devoted to the optimization of the managerial structures both in the system of the State Service of Ukraine for Geodesy, Cartography and Cadaster and in the systems of territorial communities, greening and capitalization of land use.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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ASSESSING THE ACTIVITIES OF INSURANCE COMPANIES DUE TO THE DISEASE OF PRIVATE PENSION[5]

The purpose is to develop a methodological approach and confirm the hypothesis of low risk of the entire market of life insurance companies in Ukraine according to the financial statements to ensure private pensions. Subject – methodological support for risk assessment of insurance companies for life insurance according to the financial statements to ensure private pension. Object – the process of assessing the risk of the activities of insurance companies for life insurance. Research base – the whole market of insurance companies for life insurance of Ukraine, which provide services for non-state pension. The adaptation method of integral risk index (hereinafter – IRI), which allows to divide insurance companies into four zones, was used in the study: catastrophic IRI; critical IRI; acceptable IRI; risk-free IRI. Each zone is determined by the level of compliance of the insurance company's performance indicators with the regulatory limits in Ukraine. A complete list of life insurance companies providing private pension provision in Ukraine was selected as a study. The method is based on a score on T. Saaty's scale, which allows determining the rank of the entities in the insurance market according to their risk. All evaluated life insurance companies in the Ukrainian private pension market reliably build a risk management strategy which allows to assess this market with low risk. In order to have risk-free activity, it is necessary for the companies of allowable risk zone to strengthen some indicators, namely to increase the appropriate level of investment and balance the levels of accounts payable and receivable. The obtained results of establishing the risk levels of all life insurance companies which provide private pension provision through the definition of IRI allow to form an individual risk assessment of the insurance company and develop measures for prevention and counteraction of risks, establish general trends of the insurance market development from the private pension scheme of the country by means of the detailed assessment of particular indicators. The practical effectiveness of the suggested experimental approach is potential and it can be tested in the activities of other insurance companies, while new indicators of changes in the regulation system of the Ukrainian insurance market as to the suggested algorithm will be the basis for determination

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of risk zones which are adapted for the changes. The scientific novelty is to develop a methodological approach to risk assessment of life insurance companies to provide private pensions, which consists in a systematic combination of evaluation stages using the proposed financial indicators, how to measure and integrate them, the formation of the proposed scale risk and its interpretation, which allows for constant monitoring of the level of risk of the entire market of life insurance companies to provide private pensions on the basis of public financial reporting. This approach allowed to assess the risk of all life insurance companies in the market of private Ukrainian pension scheme that proved the low level of risk in this market which is positive for consideration of its development strategies.
Keywords: Integral risk index; life insurance companies; private pension; risk zone; financial services market
JEL: G22; G23

1. Introduction

The current state of the economic system in the world demonstrates the low adaptability of the financial services market to the unexpected and stressful mode of functioning. A change in the regulations and conditions of insurance activity is an additional factor of risk for Ukraine. Nowadays, risk management carried out by the financial market entities requires a better strategy than currently existing in responding to the circumstances of force majeure. The corona crisis significantly weakened the socio-economic situation in Ukraine, which is confirmed by statistical information from the National Bank of Ukraine (hereinafter – the NBU). In 2020 the total profitability of banks' assets decreased from 5.2% at the beginning of the year to 4% at the end. According to the NBU a decrease by more than 1 percentage point resulted from the risks caused by the corona crisis, the beginning of the external debt restructuring procedure, the escalation of the military conflict in the East of the country and other events that affected the financial stress index of the banking industry during the year.

As to the profitability of the Ukrainian banks' capital, the situation is the following: it decreased from 30.75% in the first quarter to 24.40% in the third quarter of 2020. Such decrease is characterized by a sub-optimal structure of revenues, expenditures and capital during 2020. Compared to the first quarter of 2021, the negative trend continues, banks' profits, in general, decreased by another 2.5 times. In modern times, the domestic bank policy, management that maintains the balance between assets and liabilities is not effective and, as a result, there is a decrease in the rate of return on capital.

The pandemic has affected not only the banking industry but also the activity of insurance companies during the quarantine period, which has also significantly suffered. Thus, according to the information of the National Commission for State Regulation of Financial Services Markets (National commission) and the NBU available on the official portal Forinsurer (https://forinsurer.com/stat.), the profit of the insurance companies decreased by a total of 516 million hryvnia for the first half of 2020, which indicates negative market trends, low insurance reserves and the presence of the ineffective measures for prevention of risks (stress). Under such conditions of the financial services market, the assessment of risk and its prevention is a priority that requires reasonable decisions. According to the authors, the implementation of a risk-oriented approach to the management of financial institutions may be forward-looking in terms of loss prevention.

While considering in detail the concept of risk-based approach taking into consideration the existing definition in the Ukrainian legislation as well as its essential content – generally, it is a process that includes the identification, assessment and understanding of risk. Namely, the process of implementing the approach under current conditions of the financial services market is in the plane of analysis of the conditions of risk and its assessment. As to the financial services market entities – each entity has common and individual risks. Special attention has to be paid to the insurance companies because their activities are based on the client's risk that may arise with a certain probability (as of 2020 196 institutions where only 19 insurance companies provide life insurance services while all others carry out services in the risk area (Official site of the National Bank of Ukraine)). Insurance is the only financial service, the result of which is directly dependent on the occurrence of the risk, and, therefore, the economic results of the market entity of the financial institutions that provide financial services are directly proportional to it.

In the current conditions of the insurance companies' functioning the financial service of pension provided by the life insurance companies is becoming increasingly important (as of January 1st, 2021, there are 19 aforesaid companies in Ukraine). Thus, the amount of pension payments of these financial institutions for 9 months of 2020 amounted to 51.8 million hryvnia, which is 5 million hryvnia (or 10.7%) higher as for the corresponding previous period (for 9 months of 2019 – 46.8 million hryvnia) (https://forinsurer.com/stat.). That is, despite the small number of life insurance companies, the latter show a positive growth rate in the accumulated financial resources during 2020. Such trends lie in the clients' need for pension security and independence.

Thus, the relevance of risk assessment of financial services market entities, in particular, life insurance companies, is beyond doubt due to the fact that the prospect of determining the real financial state using a risk-oriented approach and the ability to quick reaction to the risks arising in today's fast-paced economic conditions, namely, in the pension market, is a substantial and necessary condition for the functioning of the financial market entities.

2. Literature Overview

Many scientists studied the issue of insurance, namely: Roedel K. T., Graf S., Kling A., who consider the solvency of life insurance companies through the prism of modeling interest rate guarantees in order to determine long-term prospects for assessing their own risks (Roedel, Graf, Kling, 2021); Budska P., Fleischmann L., who considered the competitive advantages of the Czech insurance sector using the Herfindahl-Hirschman index in the long run (Budska, Fleischmann, 2021); Biagini F., Huber T., Jaspersen Johannes G., Mazzon A., studying the German life insurance market under different scenarios of further market development (Biagini, Huber, Jaspersen Johannes, Mazzon, 2021); Osei-Bonsu A., Abotsi Anselm K., Carsamer E., who considered the causal relationship between insurance and economic growth due to the impact of innovation in the insurance industry (Osei-Bonsu, Abotsi Anselm, Carsamer, 2021); Wang H., Zhang D., Guariglia A., Fan G.-Z., who studied the demand for life insurance in China and concluded that it is necessary to increase the level of financial literacy of the population in order to increase the percentage of life insurance services in the

country (Wang, Zhang, Guariglia, Fan, 2021); Bazylevych V. D., who studied the theoretical foundations of insurance with taking into account the processes of risk management in it and the basics of pension through supplementary pension insurance (Bazylevych, 2008); Demyanyshyn V. G., who considered insurance services as possible objects of fraud (Demyanyshyn, Klapkiv, 2020, p. 66); Osadets S. S. and Murashko O. V., Furman V. M., Baranov A. L., Baranova O. V., Zaletov O. M., Nechiporenko V. I., considered the financial aspects of managing the processes of creation and effective use of the insurance organizations' potential – insurance management (Osadets, Murashko, Furman, Baranov, Baranova, Zaletov, Nechiporenko, 2011, p. 333; Osadets, Murashko, Furman, Baranov, Baranova, Zaletov, Nechiporenko, 2008).

Francisco Ceballos and Miguel Robles analyzed highly specialized problems of insurance risk, covering the impact of weather indices on the formation of risk which is the basis for the insurance service (Ceballos, Robles, 2020), Heinrich T., Sabuco J., Farmer J. D., studying the problems of risk homogeneity in the process of modeling the insurance industry, which is expressed in the simulation of profits and losses of financial institutions (Heinrich, Sabuco, Farmer, 2021); Ettlin N., Farkas W., Kull A., Smirnow A., who studied the process of risk transfer for insurance companies in order to optimize their profitability (the author explains the process of finding a unique solution through the theory of cooperative games) (Ettlin, Farkas, Kull, Smirnow, 2020, pp. 39-47); Dankiewicz R., Simionescu M. investigated the prospects of insurance by macroeconomic and microeconomic indicators and established a linear relationship between reimbursement and gross income of written-off premiums (Dankiewicz, Simionescu, 2020, pp. 248-261). Li X ., Liu H., Tang Q., Zhu J. investigated the liquidation risk in the field of insurance, conducted a probabilistic analysis for the rehabilitation of an insurance company that has reached a low barrier to the value of its assets (Li, Liu, Tang, Zhu, 2020, pp. 36-49). Curak M., Kovac D. managed the insurance company's risks through the use of securitization, focusing on property insurance that is not related to pensions or the health of customers (Curak, Kovac, 2020, pp. 287-302). Scientists from Italy and Great Britain Bakinello A.-R., Biffis E., Millosovych P. in their researches consider the impact of the death risk in life insurance on the pricing the contract (Bakinello, Biffis, Millosovych, 2009, p. 27). They substantiate their own researches with corresponding models developed by them in order to determine the algorithm for estimating the value of the life insurance contract. Similar modelling methods were used by the following scientists: Mahboubeh Shadabfar, Longsheng Cheng, who developed a probabilistic approach of the formation an optimal portfolio in the capital market (Mahboubeh Shadabfar, Longsheng Cheng, 2020, p. 3381). NeleVandaele and Michèle Vanmaele studied the deeper aspects of risk formation and its development in view of the impact of time, in their studies, they provide appropriate hedging models that minimize the risk of life insurance companies' activity (NeleVandaele, Michèle Vanmaele, 2009, p. 16). Lai G., Nakamura H., Yamamoto S., Yoneyama T. examined mortality rates in detail and correlated them with the balance of losses in the context of term life insurance (Lai, Nakamura, Yamamoto, Yoneyama, 2021). The researches of the said scientists are full of mathematical calculations and they aim to establish the dependence of risk and its price formation, but the issues of risk assessment for the insurance activity are not covered in these works.

In addition, the authors broadly demonstrate the feasibility of using a risk-oriented approach to solve problems of assessing the activity of insurance companies (Vnukova, Kavun,

Kolodiziev, Achkasova, Hontar, 2020, p. 151). Other scientists consider the general aspects of life insurance under pension reform (Pikus, Khemii, 2018, pp. 223-232), the problems of private pension scheme in view of the insurance companies' services (Achkasova, 2020). Bottan N., Hoffmann B., Vera-Cossio Diego A. study the issue of pensions during the systemic crisis, including pandemics and have a corresponding positive effect from participation in the state program, even without contributions, which provides social protection to clients in the form of remittances and unemployment insurance (Bottan, Hoffmann, Vera-Cossio, 2021). Belkina T.A., Konyukhova N.B., Slavko BV dealt more deeply with the issues of risk strategies of pension insurance, namely the singular problems of integrated-differential equations, which are compared according to traditional solvency criteria, which are taken into account when calculating probabilistic models of investment companies (Belkina, Konyukhova, Slavko, 2020, pp. 1621-1641).

Life insurance has become even more popular in the world under modern quarantine conditions, which is why scientists such as Liedtke P.M. dedicate their work, emphasizing the need to attract private investment to the insurance sector, which will balance the safety of insurers and market efficiency (Liedtke, 2021); Farooq U., Nasir A., Bilal, Quddoos M. Umer, who have accumulated a huge number of insurance companies around the world to study the effects of the coronary crisis on the value of shares in the market (Farooq, Nasir, Bilal, Quddoos Umer, 2021). Bhatia R., Bhat Anil K., Tikoria J., who presented a systematic review of the behaviour of consumers of life insurance products, which allowed to identify gaps in the field in various scenarios of future development, including COVID-19 (Bhatia, Bhat Anil, Tikoria, 2021). By the way, the efficiency of insurance companies worries scientists from different countries. Thus, the study of technical efficiency of insurance in the Vyshgrad group was carried out by Preckova L., Paleckova I., who established a certain trend over time in the development of the industry, which explained the volume of written-off premiums and net income, high costs (Preckova, Paleckova, 2020, pp. 862-880). Life insurance in India is taken care of by the scientist Siddiqui S., who emphasizes the full efficiency of the entire sector in the country in the presence of technologies and methods of capital regulation (Siddiqui, 2020, p. 72-80).

Meanwhile, the peculiarities of pension scheme provided by life insurance companies remain insufficiently studied in the world and require a deeper risk analysis, especially in the context of a risk-oriented approach to its management (P1).

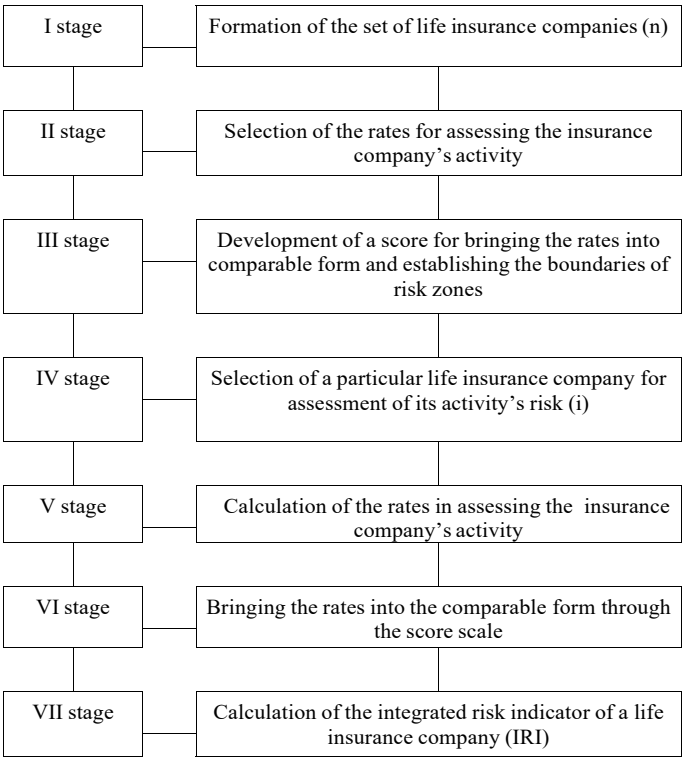
3. Methodology

It is suggested that a risk assessment of life insurance companies should be carried out by the method of integrated risk indicator (hereinafter – IRI), which was developed by Smolyak V. A. in order to determine the financial and economic condition of the enterprises (Smolyak, 2005). In order to be more effective, the method was adapted by the authors to the activity of life insurance companies that provide financial services for a private pension.

The adapted algorithm for the application of the IRI method is given in Figure 1.

Figure 1

Stages of the integrated risk indicator of a life insurance company's activity



Source: adapted from Smoliak, 2005.

As shown in Figure 1, the IRI method is voluminous and full of some calculations, which begin with the definition of the studied set of insurance companies. The formation of a set of life insurance companies is a stage that requires special attention, as the adequacy and validity of the results obtained depend on the selected population.

Stage II is the selection of coefficients to assess the performance of objects formed in the previous stage. This stage is subjective due to the range of existing methods and the need to choose between them, but regardless of the selected indicators, the evaluation process includes, under any circumstances, the main activities of the insurance company, which allows to reach an objective conclusion about the real state of the financial institution.

Regarding stage III – the indicators selected at stage II have certain normative values, which should be carefully presented as a cumulative result. An effective means for this is a score on a scale that takes into account all the options for the error of the coefficients, thereby standardizing them. The next two stages are the direct calculation of the selected performance ratios on the example of one (any) insurance company. Most often, the calculation is based on officially presented statistical information that is made public.

The penultimate stage includes the process of applying a pre-designed score scale to the calculated indicators in stage V. The last stage is final and presents the result of all these stages in the form of an integrated indicator that compiles the calculations and clearly demonstrates the risk area of the insurance company.

4. Empirical Results

For further calculations, it is suggested to take into consideration the particular list of life insurance companies that provide financial services for pension. In total, there are 19 life insurance companies in Ukraine, among which only 10 financial institutions have pension programs. It's worth noting that none of the 19 insurance companies is listed in the Register of Financial Institutions (Official site of the National Bank of Ukraine) for the implementation of their pension programs and the only way of their detection is an individual search. The full list of the Ukrainian life insurance companies that provide financial services for pension and act as a general totality for further research (n) is represented in Table 1.

Table 1

General research (n) by the IRI method

List of life insurance companies in Ukraine	Availability of a pension program	Life insurance companies which provide pension scheme and act as a sample for the study
MetLife	+	MetLife
TAS (Life)	+	TAS (Life)
PZU Ukraine Life	+	PZU Ukraine Life
ASKA-life	+	ASKA-life
Kniazha Life	+	Kniazha Life
INGO Life	+	INGO Life
KD-Life	+	KD-Life
GRAVE Ukraine Life	+	GRAVE Ukraine Life
Forte Life	+	Forte Life
Swiss Classic Life	+	Swiss Classic Life
UNIQALife	-	-
ARX Life	-	-
Greenwood Life Insurance	-	-
Arsenal Life	-	-
Oranta Life	-	-
Megagarant Life	-	-
Sun Life	-	-
Classic Life	-	-
Class Life	-	-
19 life insurance companies	10/19*100 % = 52 %	10 life insurance companies (n) which have pension programs

Source: compiled by the author.

As shown in Table 1, 52% of life insurance companies decided to provide insurance with a pension as a financial service.

The second stage of determining the IRI is to select the rates for assessment of life insurance companies' activity that provide pension. The indicators of assessment of the insurance

company's stress resistance suggested by A. Yermoshenko (2016, pp. 369-377) were chosen due to the fact that their calculation is based on the process of risk prevention. Chosen indicators (p) are divided into the following groups (m):

1. Liquidity indicators of the insurance company (quick, critical and complex liquidity rate).
2. Indicators of the analysis of receivables and payables of the insurance company (rates of dependence on receivables and payables, the level of receivables for the payment of insurance premium).
3. Indicators of dependence on reinsurers (participation of reinsurers in the insurance premium, in occurred losses, an indicator of participation of reinsurers in insurance reserves).
4. Indicators for assessing insurance liabilities (ratio of insurance reserves and net premiums, deficit (surplus) of insurance reserves).
5. Indicators of solvency (actual and statutory solvency reserve (the largest of the values), the current solvency rate).
6. Indicators of assessment of own funds of insurance companies (level of coverage of liabilities by own funds, level of coverage of insurance reserves by own funds).

The third stage of determining the IRI is to develop a scale which allows to bring the nominal values of the said rates into comparable form, the development of which is based on the requirements for constructing an interval scale suggested by T. Saati (Lyamets, Uspalenko, 2015, p. 100) taking into account the psychophysiological differences of the subjects during the assessment. The obtained scale is represented in Table 2.

As shown in Table 2, the interval assessment of score value (1; 9) was used in bringing the nominal values of the rates into the scores (BZ), so the further gradation of risk zones for sharing the integral index (IRI) is established by dividing this interval into four zones: catastrophic IRI (0; 2.25]; critical IRI [2.25; 4.5]; acceptable IRI [4.5; 6.75]; risk-free IRI (6.75; 9].

A catastrophic risk zone indicates non-compliance with the standards of solvency, liquidity, profitability, which as a result calls into question the activities of the insurance company, in general. The risk-free zone, on the other hand, provides a high level of performance, which reflects the security of the financial service client. The critical zone characterizes the limit of indicators that do not partially meet the standards, and thus pose a risk to the client. The eligible zone is comfortable for both the client and the insurance company, because the performance indicators are within the standards, but there are no certain stocks of indicators that do not allow them to move to a risk-free zone.

The next two stages (see Figure 1) include the calculation of the chosen indicators, for example, one life insurance company that provides pension services. According to the authors, the obtained rate should be immediately converted into scores (the 6th stage of the algorithm, shown in Figure 1).

Table 2

Score scale of bringing the nominal values of the chosen rates of assessment of insurance companies' activity into a comparable form

Score	Correspondence of the nominal value of rate to the statutory one*:		Direction of change of rate in dynamics	Explanation
	Reporting period	Previous period		A particular score is assigned to the rate if its nominal value…
1	–	–	Negative	… does not correspond to the statutory and has deteriorated during the reporting period in comparison with the previous one.
2	–	–	Without change	… does not correspond to the statutory and is not changed during the reporting period in comparison with the previous one.
3	–	–	Positive	… does not correspond to the statutory and there is a tendency of improvement during the reporting period in comparison with the previous one.
4	–	+	Not considered	… does not correspond to the statutory but it is within range in the previous period.
5	+	–	Not considered	… corresponds to the statutory in the reporting period but it is beyond it in the previous one.
6	+	+	Without change	… corresponds to the limit value of the statutory both in the reporting period and in the previous one.
7	+	+	Negative	… corresponds to the statutory and there is a tendency of deterioration during the reporting period in comparison with the previous one.
8	+	+	Without change	… corresponds to the statutory and is not changed during the reporting period in comparison with the previous one.
9	+	+	Positive	… corresponds to the statutory and has improved during the reporting period in comparison with the previous one.

* – «+» – correspond; «–» – not correspond.
Developed by the authors on the basis of interval scale of T. Saati (Lyamets V. I., Uspalenko V. I., 2015, p. 100)

METLIFE insurance company was chosen for the calculations due to the fact that it is currently the leader in the rank of life insurance companies (https://forinsurer.com/stat.) and has pension insurance programs. The results of the calculations of the indicators made on the basis of the official financial statements of the company (Official site of the METLIFE insurance company) are given in Table 3.

The last stage of the study is the calculation of the integrated risk indicator (IRI) of the life insurance company. There are a huge number of ways to determine the integrated risk indicator. The main difference between all methods is the risk that needs to be assessed, and hence the indicators that underlie its calculation. Thus, the scientist Shamileva L.L. (2008, pp. 166-176), determines the integrated indicator of social risk, based on the use of the arithmetic mean of the normalized indicators that assess this risk. Scientist Trunova O.V. (2009, pp. 217-227) determines the integrated indicator of production systems by calculating the weighted average risk, which includes the specific gravity of the indicator and the coefficient of risk. And scientists Pokataeva O.V. and Slavina M.A. (2019, pp. 157-161) carry out the calculation of the integrated risk indicator of the banking sector through the normalization of the system of indicators by the method of variation and synthesis of their

values according to the multiplicative model. All these methods of determining the integrated risk indicator are correct and logically justified within the tasks they solve in the individual study, but none of them meets the need to determine the risk of the insurance company given the available score of the risk area. Therefore, it is proposed to determine the integrated risk indicator of the life insurance company according to the formula proposed by Smolyak V.A. (2005), which takes into account the necessary features of the zoning process:

Table 3

The calculation results of the indicators for IRI determination (on the example of SC METLIFE)

Indicator	Period		Score of the indicator (table 2)
	2018	2019	
Indicators of the insurance company's liquidity (g1)			
Index of quick liquidity, %	213, 0	110, 0	9
Index of critical liquidity, %	51,8	31,4	3
Index of complex liquidity, %	13,9	15,7	3
Indicators of the analysis of the receivables and payables of the insurance company (g2)			
Index of the dependence on the receivables, %	1,82	1,57	3
Index of the dependence on the payables, %	5,9	5,3	3
Index of receivables for payment of insurance premiums, %	4,98	4,42	3
Indicators of the dependence on reinsurance (g3)			
Reinsurers' participation in the insurance premium, %	1,47	1,34	9
Reinsurers' participation in the occurred losses	0	0	9
Indicator of the reinsurers' participation in the reserves, %	0,03	0,05	7
Indicators for assessment of the insurance liabilities (g4)			
Ratio between insurance reserves and net-premiums, %	53,6	51,7	9
Deficit (surplus) of the insurance reserves, thousand of hryvnia	5 809 7,71		9
Indicator of the insurance company solvency (g5)			
Actual (net-activated) plateau capacity, thousand of UAH	352525	332213	9
Current solvency ratio, %	74,3	76,01	9
Indicators of valuation of the insurance company's own funds (g6)			
Level of coverage of liabilities with own funds,%	12,0	14,5	1
The level of coverage of insurance reserves with own funds,%	12,97	1,5	3

Source: compiled by the author.

$$IRI = \frac{\sum_{m=1}^{g} \frac{\sum_{p=1}^{k} S_{pm}}{k}}{g}, \quad (1)$$

where:

S_{pm} is a score of the p rate within m group;

k – number of rates in the group of indicators;

g – number of groups of the indicators.

As shown in formula (1), for IRI calculation, it is necessary to find the arithmetic mean of the obtained scores for each group and then evaluate the insurance company's activity according to all 6 groups of indicators. The calculation is a simple arithmetic operation that does not require any supplements or visual clarity. Therefore, the obtained IRI of the life insurance company METLIFE was 6.05, which corresponds to the allowable risk zone of the developed scale at stage 3.

This algorithm underlines the effective implementation of a risk-oriented approach in the practice of insurance company METLIFE, implementation of a well-grounded risk prevention policy and availability of appropriate management, which allows being within the corresponding scope of allowable risk. It should also be noted that under today's economic conditions, it is almost impossible to manage the risk-free activity, that is why a financial institution in the zone of acceptable risk is a positive trend in the development of financial services, in particular, pensions.

In accordance with the suggested algorithm for IRI calculation, a similar assessment was made for the activities of all life insurance companies included in the analytical group (general set). The results of the calculations are represented in Table 4.

Table 4

Results of risk assessment of life insurance companies which provide pension services (general set)

A set of life insurance companies that provide pensions and act as a sample for the study	Score of the rate (Table 2)	Risk zone
TAS (Life)	5.67	Allowable
PZU Ukraine Life	5.67	Allowable
ASKA-life	6.89	Risk-free
Kniazha Life	7.72	Risk-free
INGO Life	5.39	Allowable
KD-Life	7.89	Risk-free
GRAVE Ukraine Life	7.56	Risk-free
Forte Life	8.56	Risk-free
Swiss Classic Life	7.89	Risk-free

Source: compiled by the author.

As shown in Table 4, six insurance companies have a high score and are under the risk-free zone, three insurance companies are under the allowable risk zone. Taking into account the results of the risk assessment of Metlife's activity the private pension insurance market has low risk or almost risk-free activity, which creates positive preconditions for its development.

Risk is a broad concept that characterizes not only the negative impact on the activities of the insurance company, but also determines the level of protection of the client, who is, for example, a user of insurance services under the pension program. That is, with the available information on the risk areas of insurance companies, you can quickly assess not only the state of their development, but also the ability to meet obligations to the client. Yes, an insurance company in a risk-free zone is potentially more attractive to a customer than an insurance company in a critical zone. The demand of the insurance company can be estimated by the ratio of insurance payments (reimbursement) to the attracted insurance premiums, which are considered a payment for the risk of the insurance company (Table 5).

Table 5

Demand ratio of life insurance companies providing pension services in Ukraine

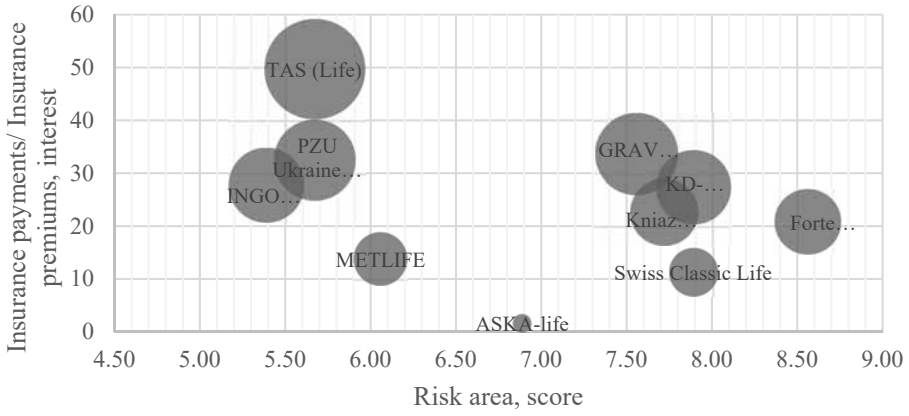
A set of life insurance companies that provide pensions and act as a sample for the study	Insurance payments / Insurance premiums, interest
TAS (Life)	49,7
PZU Ukraine Life	32,6
ASKA-life	1,6
Kniazha Life	22,7
INGO Life	27,9
KD-Life	27,4
GRAVE Ukraine Life	33,7
Forte Life	20,8
Swiss Classic Life	11,3
METLIFE	13,8

Source: compiled by the author.

As can be seen from Table 5, the ratings of insurance (https://forinsurer.com/stat.) for life insurance, built on the volume of insurance premiums, do not coincide with the demand for insurance services, which expresses the received demand indicator. Thus, the insurance company METLIFE due to the uneven distribution between insurance payments and premiums towards the small amount of insurance payments, is only the eighth out of ten place among insurers in the market. In turn, insurance companies such as TAS (Life) and PSU Ukraine Life have a high level of the ratio of insurance premiums and insurance payments, which justifies the trust of customers and their position in the ranking (https://forinsurer.com/stat.). This is due to the policy of the life insurance company on the procedure for payment of compensation to clients, the availability of an extensive list of financial services provided by TAS (Life) and PSU Ukraine Life, including the availability of pension programs. More clearly, the position of each insurance company on the results of the calculated demand can be seen in Figure 2.

Figure 2

Demand ratio of insurance companies



Source: compiled by the author.

As can be seen from Figure 2, all life insurance companies are in an acceptable or risk-free zone – this is due to the inability of such companies to operate in other conditions through the financial service they provide, then they cause customer confidence. The chart shows that the best for cooperation between insurance payments and insurance premiums is GRAVE Ukraine Life, which is in a risk-free zone. That is, this insurance company can be the optimal choice for the client for protection. In turn, the market leader in insurance services insurance company METLIFE, has a low level of extended display of customer protection due to the low share of payments to your customers and a high amount of insurance premiums, which are not reflected in meeting the needs of policyholders. Although, without a conditional, large number of people involved, the insured's trust in the insurance company and large-scale customer base should be reported. The amount of insurance premiums not only reflects the funds earned by the insurance company under the contracts, but also indicates a certain scale of the customer base. In turn, the amount of insurance payments indicates the feedback of the insurance company with the client, namely the amount of compensation by the insured in the event of an insured event. The ratio of these two indicators can be interpreted as the amount of the insurance company's obligations to customers. The higher this relative indicator, the more payments made by the life insurance company, in turn, significantly inflated compared to the reimbursement of insurance premiums, characterizes the presence of a large number of customers, among whom insurance payments are received by units. Such a situation should not inspire confidence on the part of clients in the insurance company, which defends its own interests much more intensively, than the client's desire to eliminate the risk.

Thus, it can be concluded that all companies in the market of insurance services that provide pension services reliably build a risk management strategy that allows them to maintain an effective level of their activity by means of compliance with the regulations. However, those insurance companies under the acceptable risk zone need to strengthen their rates in order to gain a more comfortable risk zone.

The existing problems of insurance companies that provide financial services for life insurance caused by the current risks of the insurance market need to be settled.

Forenshurer (https://forinsurer.com/stat) published the TOP 10 risks faced by the life insurance companies in their activity. These risks include: technology, profitability of investment, management, cyber risk, change management, rates of interest, macroeconomics, competition, human talent and business practices. In the example of IC METLIFE by comparing the results of the risk assessment of the life insurance company providing a pension service and this list of risks, we can determine the following conclusions.

First of all, the inappropriate level of investment influences the complex liquidity index, which needs to be improved in this insurance company (Table 3); secondly, the discrepancy between the levels of accounts payable and receivable demonstrates the problems of change regulation and management that need to be implemented into this insurance company. The solving of its problems is logically possible by means of reaching a balance between investment assets, receivables and payables.

The calculation process according to the suggested algorithm is logically balanced but requires some time expenditures. Meanwhile, the result of determining the risk level of a life insurance company providing pension services through the definition of IRI allows to form

an individual risk assessment of the insurance company and develop measures in prevention and counteraction of risks and establishing general trends in the market of private pension services through a detailed assessment of individual indicators.

The proposed experimental approach of risk management and gaining a risk-free zone for life insurance companies is acceptable for insurance companies that provide private pension services and if they are under an acceptable or risk-free zone. It allows to determine of any level of risk, but those financial institutions that are in critical or catastrophic risk zone will have a different balance structure which will require more significant influence of management and implementation of other risk-based measures.

The article gives an example of the application of the results of the presented approach to determine the level of client protection, which allows on the basis of insurance payments and insurance premiums to make a choice towards an insurance company that conducts balanced activities to ensure timely payments within the permissible risk zone. That is, the obtained risk areas allow to build of a system of development of life insurance companies that provide pension services, in general, and a "map" of choice for policyholders, in particular.

Further research should profoundly analyze the scope of activity of each individual insurance company, the amount of funds raised from life insurance in the private pension market in accordance with a certain risk zone. Also, in order to assess the level of risk of the insurance company and identify possible trends of change from one risk zone to another, it is advisable to support the study with similar calculations in the dynamics.

5. Concluding Remarks

A review of the specialized literature and analysis of the research results on the determination of the risk zones of life insurance companies providing pension services confirmed the position (P1) on the relationship between a determined level of risk of the insurance company and the possibility of managerial influence on its behaviour by means of the established indicators in order to strengthen the policy of prevention and counteraction of risks by applying some managerial decisions. The possibility of determining general recommendations in order to strengthen the risk management policy is contingent on the full coverage of all subjects of the life insurance market for private pension scheme based on the financial statements which were used in conducting the study. The practical effectiveness of the suggested method is potential and it can be tested in the activities of other insurance companies while determined risk zones may be adapted to new indicators that will correspond to the changes in the regulation system of the Ukrainian insurance market.

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SUMMARIES

Stefan Petranov, Dimitar Zlatinov, Ilia Atanasov

THE SHADOW ECONOMY IN BULGARIA DURING THE PERIOD 2006-2019

The main objective of the article is to obtain an estimate for the size and the trend of the shadow economy in Bulgaria. Based on the monetary approach, we find that the shadow economy in Bulgaria for the period 2006-2019 tends to decline as a ratio to GDP: from 31.7%, it shrinks to 21.1%. This trend could be explained by the country's accession to the European Union, as this process is associated with the harmonisation of the domestic legislation, stricter procedures, and targeted measures to curb the shadow economy by several successive governments. Despite the declining trend, the share of the shadow economy in the country remains still relatively high. This is an obstacle to its economic and social development and there is a clear need for an in-depth analysis of this phenomenon and further measures to limit it and bring it to a much lower level.
Keywords: shadow economy; monetary approach; currency-demand approach; Bulgaria
JEL: E26; E41; F15; O17; O43

Nguyen Chien Thang, Tran Thi Mai Thanh

TRADE RELATIONS BETWEEN VIETNAM AND BULGARIA: PERFORMANCE AND ITS DETERMINANTS

Economic cooperation of countries across the world has led to the integration of stock and commodities markets. The group of seven countries (G7) represents the world's most industrialised and developed economies. In an integrated market, understanding the price discovery mechanism and volatility spillover across markets is crucial for traders, investors and other stakeholders. This paper investigates the return dynamics and volatility Spillover among the stock markets of G7 countries, oil and gold. We apply VAR and GARCH to examine the relationship between the returns and the transmission of volatility between commodities and stock markets. The research is based on the major stock indices of G7 countries for the years between 2009 and 2018. Oil and gold are taken as a proxy for the commodities market. This study begins by examining the cointegration of the stock and commodities market using the Johansen cointegration test. Stochastic volatility models are used to estimate the volatility and its spillover effect. We estimate the volatility spillover index using variance decomposition. The results indicate the presence of an asymmetric volatility spillover effect between the stock and commodities market. The outcome of the study would facilitate the investors and portfolio managers to understand the return dynamics and volatility spillover effect, which is a prerequisite for an investment decision.
Keyword: Return dynamics; Volatility spillover; Cointegration; Commodities market
JEL: C23; O51; O52; O57; Q02

Halyna V. Kaplenko, Inna M. Kulish, Andrii V. Stasyshyn, Volodymyr Ya. Burak, Svitlana M. Synchuk

INNOVATIVE NATURE OF SOCIAL ENTREPRENEURSHIP AT THE PRESENT STAGE

The paper reveals that social entrepreneurship as a type of activity aimed at solving certain problems of society, first emerged in the former Soviet Union in the form of enterprises in the society of the blind; and, accordingly, in Ukraine, which at that time was part of the Soviet Union. These events took place more than fifty years earlier than in the United Kingdom, which is now considered the founding father of social enterprises. The conditions in which the first social enterprises were created

and functioned, the influence of public administration and regulations on this process are shown, and it is shown how social enterprises created on the basis of humanism became an instrument of coercion by the state and thus lost their essence. The example of Costa Rica (first place in the world in the Happy Planet Index) and Norway (second place in the world in terms of Prosperity) shows that methods of supporting social entrepreneurship can range from full-fledged institutional support at all levels to almost complete lack of influence and control by the state. The existing classifications, features and concepts of social enterprises were analysed, mistakes made in the past were taken into account, and in particular, the need for non-discrimination was emphasised. And on this basis, the authors proposed to identify four features that are mandatory and relevant to each social enterprise. It is emphasised that none of the components of the "Triple Bottom Line" can be defined as the most important because they are all equally important. It is shown that a social enterprise is not identical to a charitable organisation. It has been established that a classic enterprise may have the characteristics of a social enterprise, but a social enterprise obligatory must have these characteristics in order to fulfil its mission. It has been shown that the same organisations can be sources of funding or social entrepreneurs, depending on what services it provides in specific conditions. The instruments of state support of social entrepreneurship in Ukraine are considered and it is shown that they are insufficient. The labour market and the number of people with disabilities in Ukraine are analysed, the existence of problems with the employment of people with special needs is shown and the need to strengthen state aegis and provision of regulatory and legal support for social entrepreneurship in Ukraine is emphasised. The obtained results are planned to be used in further research, which will relate to the opportunities for social entrepreneurship in the field of environmental services.

Keywords: social entrepreneurship; humanism; innovation; social values; environment; people with special needs
JEL: L26; L31; M29

Petko Atanasov, Jean-Guy Degos

THE RELATIVE NATURE OF SUCCESS AND FAILURE – FUNCTION OF TIME AND CONTEXT

In this paper, we study three long-term projects, with a life cycle of several centuries, where the environment and the economic conditions change: as well as the borders and the political regimes of the countries, the behaviours and the aspirations of men, the daily life and the perception of the world. For these large projects, their life cycle, including the classic stages of beginning, maturity and completion, the end may be far away... but sometimes it already gives an idea of the outcome of the project. To show the relativity of their success and failure, we have chosen to evoke three large projects of the same nature: whose failure or success can be appreciated nowadays. We will first study, respecting the chronology, the oldest waterway, the Canal du Midi, the most important large project of the 17th century (1667-1682), which was a success as long as it enjoyed a natural monopoly. We will then evoke the Suez Canal, which was a success, and which remains so (1859-1869). Finally, we will study the Panama Canal, which was a resounding failure under the French government (1881-1903), but which later became an undisputed success when completed by the Americans (1904-1914). Many factors have modified the destiny of these great projects, and we will try to analyze them. For these three projects, we have used archives and testimonies somewhat forgotten in time, which raises our second objective – to inform and communicate the existence of these resources because their volume requires much more effort than ours.

Keywords: Large project financing; Controversial markets; Natural monopoly; Large project risks; Man-made waterways
JEL: N60; N61; N63; N65; N65; N70; N71; N73; N75; N77; O18

Amrita Shergill

TESTING FOR STRUCTURAL BREAKS IN THE GROWTH OF THE SERVICES SECTOR IN INDIA: A REASSESSMENT

There has been an ongoing debate amongst economists about whether or not the economic reforms of the early 1990s induced a spurt in the growth of the Services sector in India. The focus of this paper is thus to analytically re-examine the nature and magnitude of the structural breaks in the growth of the share of the Services sector in the gross domestic product over 1950-1951 to 2013-2014 with an intention to further probe this issue. The results of this exercise show that the structural break in the growth of the share of the Services sector in gross domestic product occurred in the early 1980s, much before the economic reforms set in, coinciding with the hypothesis that the early 80s marked the structural break in India's economic growth. The increases in per capita incomes over 30 years since independence seemed to have led to the structural break in this sector in the early 1980s, plausibly because the demand for services is highly income elastic. There is no denying though that economic reforms in the 1990s helped in maintaining and propagating the growth of the Services sector triggered in the early 1980s. The sub-period analysis has also hinted at the slowdown in the growth of the Services sector, which could have serious economic implications in coming times.
Keywords: Services sector; Structural Breaks; Gross Domestic Product; Indian Economy; Dummy Variable Technique
JEL: C1; C22; H00; F63

Radko Radev

STRATEGIC ENTREPRENEURSHIP AS A MAIN FACTOR FOR THE DEVELOPMENT OF ECONOMIC ZONES IN BULGARIA

Although the field of strategic entrepreneurship in business organisations is well-established, it is relatively understudied in government organisations and NGOs. It is even more understudied as regards economic zones. The main goal of this article is to prove the leading role of strategic entrepreneurship in developing economic zones. In view of achieving this goal, the article presents the main types of economic zones and the factors for developing their competitiveness. Three main stakeholder organisations related to the economic zones are set forth, considering their characteristic Entrepreneurship-Strategic Management Interface – ESMI. A theoretical framework of strategic entrepreneurship in economic zones is proposed, and qualitative research is carried out by considering two case studies in Bulgaria. These two cases differ in ownership (public and private), goals, strategies, and management. The research results show the importance of strategic entrepreneurship as a factor for the development of economic zones in Bulgaria. This significance is manifested in both surveyed organisations.
Keywords: economic zones; entrepreneurship; strategic management; strategic entrepreneurship; total entrepreneurship
JEL: L21; L31; L12

Tatiana Bencová, Andrea Boháčiková

DEA IN PERFORMANCE MEASUREMENT OF TWO-STAGE PROCESSES: COMPARATIVE OVERVIEW OF THE LITERATURE

Standard non-parametric Data Envelopment Analysis (DEA) introduced by Charnes, Cooper, Rhodes (1978) does not provide adequate detail to identify the specific sources of inefficiency embedded in the activities on the level of production sub-processes of an enterprise, without considering the internal structure of the business. One of the DEA applications is to evaluate the efficiency of two-stage processes, where all outputs of the first stage are intermediate measures, which are considered

as inputs of the second stage. In recent years, there has been an exponential growth in the number of publications related to theory and applications of efficiency measurement for two-stage systems. These models assess both the overall efficiency score of the whole process and each of the individual sub-processes. Results from the analysis give an approach to the significant more detailed information that would otherwise remain hidden in the „black box" of efficiency analysis. Opening the black box of efficiency analysis offers managers to monitor and measure the efficiency of their production sub-processes. The management is able to early detection of the inefficiencies in the production process.
The aim of the paper is twofold. The first task is to survey and classify the Two-stage DEA models and present the applications of these models across the literature. The second aim is to offer important support to future researchers, providing a „new" knowledge base regarding network DEA methods and encourage researchers to collect data suitable for this type of network analysis.
The objective of the work is to review the network DEA literature, because the number of studies which seek to measure the efficiency and productivity of decision-making units with internal structures has increased in the last years dramatically. This paper aims to support future researchers on this topic.
Keywords: Data Envelopment Analysis; Efficiency; Intermediate product; Internal structures; Two-stage process; Two-stage NDEA
JEL: C61; Q12; Q19

Anna Verenikina, John Finley, Alexei Verenikin, Maria Melanina

BUSINESS INNOVATION ACTIVITY AND THE FOURTH INDUSTRIAL REVOLUTION IN RUSSIA

The research is devoted to a comparison of the level of Russian companies' innovation activity for the period 2011-2020. The authors propose the Index of Innovative Activity based on the integrated indicator calculation, which combines a range of factors reflecting different aspects of business innovation activities. The generalised principal component approach, which was the basis of this study, didn't neglect any residual dispersion of source data and allowed us don't give any subjective weights to the factors. Based on the study results, the authors try to identify the reasons for the growth or decline in innovative activity in the specified period. The research illustrates that the role of barriers to innovation is gradually decreasing, and factors that promote innovations are becoming more important. Our study lays the foundation for the regular calculation of the index to assess the trends.
Keywords: Industry 4.0; innovations; technological development; principal component analysis (PCA)
JEL: C38; L21; O14; O31

Anna Burkovska, Olena Shebanina, Tetyana Lunkina, Alla Burkovska

SOCIO-PSYCHOLOGICAL DETERMINANTS OF FOOD SECURITY IN UKRAINE: CAUSAL ASPECT

Food security should be achieved not only by developing the production capacity and improving the living standards of the population, but also by raising consumer awareness of rational consumption and environmental protection. The aim of this article is to establish the cause-and-effect relationships of socio-psychological determinants of food security and to find ways to improve the approaches to food packaging, strengthen the potential of food affordability and increase consumer awareness of the environmental aspect of food security. The study substantiates the marketing feasibility of greening packaging, developing the mobility of workers in the labour market and choosing the idea of caring for the next generation as a basis for increasing conscious consumption. The methodological

framework makes use of existing statistical and factual data, retrieved via the survey run within the period of the study.
Keywords: food security; sustainable development; patterns of consciousness; economic affordability of food; greening
JEL: D12; D31; F18; F64

Nataliia Tretiak, Oksana Sakal, Andrii Kovalenko, Olena Vrublevska, Volska Anheliia, Halyna Shtohryn, Ivan Behal

INSTITUTIONAL ENVIRONMENT OF THE LAND RESOURCES AND LAND USE MANAGEMENT IN UKRAINE: PROBLEMS OF COORDINATION OF THE INSTITUTIONAL STRUCTURE, FUNCTIONS AND AUTHORITIES

The article presents findings of the research on the institutional environment of land resources and land use management in Ukraine as a sustainable development factor (safe human living and social welfare). The work highlights the main institutional problems of the country, which have consequently caused ineffective use of the land and resource potential and have resulted in soil degradation and economically unjustified use of land, as well as exacerbation of other global problems. According to the official statistical data, Ukraine's arable lands occupy 54 % of its area, but its land resource potential is insufficiently used, whereas, in the countries of Europe, the area of arable land is only 27.4 %. Another considered problem is that in Ukraine, some authorities are repeated, whereas some responsibilities concerning land and land use are dropped out. Analysis of the current institutional environment confirms the authors' hypothesis that it requires substantial transformations in the system of governmental management of land resources and land use.
Keywords: land reform; land resources management; management of land use; land fund; sustainable development; public welfare; institutional environment; State Service of Ukraine for Geodesy; Cartography and Cadastre (StateGeoCadastre); climate change; land degradation
JEL: H83; Q15; Q24; Q28; Q56

Nataliya Vnukova, Daria Davydenko, Svitlana Achkasova, Olexandr Yagolnitskyi

ASSESSING THE ACTIVITIES OF INSURANCE COMPANIES DUE TO THE DISEASE OF PRIVATE PENSION

The purpose is to develop a methodological approach and confirm the hypothesis of low risk of the entire market of life insurance companies in Ukraine according to the financial statements to ensure private pensions. Subject – methodological support for risk assessment of insurance companies for life insurance according to the financial statements to ensure private pension. Object – the process of assessing the risk of the activities of insurance companies for life insurance. Research base – the whole market of insurance companies for life insurance of Ukraine, which provide services for non-state pension. The adaptation method of integral risk index (hereinafter – IRI), which allows to divide insurance companies into four zones, was used in the study: catastrophic IRI; critical IRI; acceptable IRI; risk-free IRI. Each zone is determined by the level of compliance of the insurance company's performance indicators with the regulatory limits in Ukraine. A complete list of life insurance companies providing private pension provision in Ukraine was selected as a study. The method is based on a score on T. Saaty's scale, which allows determining the rank of the entities in the insurance market according to their risk. All evaluated life insurance companies in the Ukrainian private pension market reliably build a risk management strategy which allows to assess this market with low risk. In order to have risk-free activity, it is necessary for the companies of allowable risk zone to strengthen some indicators, namely to increase the appropriate level of investment and

balance the levels of accounts payable and receivable. The obtained results of establishing the risk levels of all life insurance companies which provide private pension provision through the definition of IRI allow to form an individual risk assessment of the insurance company and develop measures for prevention and counteraction of risks, establish general trends of the insurance market development from the private pension scheme of the country by means of the detailed assessment of particular indicators. The practical effectiveness of the suggested experimental approach is potential and it can be tested in the activities of other insurance companies, while new indicators of changes in the regulation system of the Ukrainian insurance market as to the suggested algorithm will be the basis for determination of risk zones which are adapted for the changes. The scientific novelty is to develop a methodological approach to risk assessment of life insurance companies to provide private pensions, which consists in a systematic combination of evaluation stages using the proposed financial indicators, how to measure and integrate them, the formation of the proposed scale risk and its interpretation, which allows for constant monitoring of the level of risk of the entire market of life insurance companies to provide private pensions on the basis of public financial reporting. This approach allowed to assess the risk of all life insurance companies in the market of private Ukrainian pension scheme that proved the low level of risk in this market which is positive for consideration of its development strategies.
Keywords: Integral risk index; life insurance companies; private pension; risk zone; financial services market
JEL: G22; G23