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Corporate management of sustainable development goals as a driver for solving global environmental problems

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Corporate management of sustainable development goals as a driver for solving global environmental problems

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Abstract. The article devotes the study of the environmental responsibility of automotive enterprises from the point of view of solving global environmental problems. The authors mainly focus on the issues of financial stability, which determines enterprises' ability to realize sustainable development goals (SDGs). The synthesis of scientific approaches allows for generalizing and developing theoretical foundations for understanding the role of finance and investment in achieving SDGs. The authors proposed a methodology for analyzing the influence of financial stability on the possibilities of realizing SDGs and carried out its approbation on the example of automobile enterprises. In general, the authors identify the main challenges, trends, and problems of financial support for the implementation of sustainable development goals, which allows setting key objectives for the near future. According to the analysis results, an algorithm for sustainable development management was proposed, which differs in complexity and multilevel approach. The role of automotive corporations in shaping the eco-environment in their countries requires further research.

1.   Introduction

The aggravation of global environmental problems highlights the task of implementing sustainable development goals at all levels of society: international, national, and corporate [1].

It is essential, in this case, to provide the necessary amount of funding. According to UNCTAD, 5-7 trillion USD are needed annually to finance the SDGs) [2], but there is a general gap in SDGs funding due to public finance deficits and corporate finance constraints, which are an important component of these processes. According to Bloomberg, the value of global assets combined with ESG criteria will exceed 53 billion US dollars by 2025. This process is quite dynamic, as ESG assets amounted to 22.8 in 2016 and 30.6 trillion US dollars in 2018 [3].

Corporations should become more and more active participants in the implementation of SDGs because, in focus on sustainable economic results, they disturb the balance of the environment and are major polluters. So, 224 companies represent 72% of annual global industrial GHG emissions [4]. In addition, the issues of sustainable development management are left out of consideration in many

more companies. Hence the study of the positive experience of leading corporations is of great scientific and practical importance.

There is WBCSD [5] established in the context of accelerating the transition to a sustainable model of development through corporate initiatives. It includes more than 200 leading companies coordinating efforts to ensure success and sustainability.

The activities of leading companies to achieve SDGs acquire comprehensive characteristics and are carried out, including through foreign divisions in the global dimension. It includes a set of projects that will promote to the education of an ecologically responsible society that benefits biodiversity (from Develop human skills in harmony with nature and Develop biodiversity education up to promote local interaction and the creation of a responsible society) [6].

The success of the 2030 Agenda [7] depends on the use of tools to manage corporations' economic, social, and environmental aspects, the functioning of territories and cities, and the direction of society as a whole. The paper [8] 0offers a comprehensive study of the promotion of sustainable development goals. The authors point out the existence of significant gaps in current research and emphasize the need to apply systemic thinking to achieve SDGs.

In [9] the authors summarize the challenges and obstacles to the implementation of SDGs and propose a practice-oriented approach, outlining the key challenges for scientists on sustainable development.

A systematic approach to the implementation of SDGs and tools for its application proposes in [10]. In general, the authors' vision bases on prioritizing SDGs and mobilization of available resources. On this basis, it is proposed to investigate the best experience in the formation of environmental responsibility and the development of relevant strategies.

The need for deep research summarizing effective practices, along with systematic studies of specific measures to implement SDGs in business schools, is emphasized in the paper [11].

Thus, the study of the implementation processes of SDGs should be based on multilevel, integrated, systematic approaches and focus on the dissemination of positive experiences and effective practices.

Boffo R. and Patalano R. [12] note that despite progress in implementing ESGs, there is a need to intensify continued endeavours by policymakers, investors, and all stakeholders. Many companies are still too superficial about the goals of sustainable development. Therefore, as noted in [13]0, achieving the Agenda 2030 requires more significant changes in business behavior. It is important to apply a new way of thinking about the environmental responsibility of business structures in the future. It requires a holistic approach to interaction with sustainable development goals, in which all internal subsystems must transform. The key issue here is sustainable financing [12], which has increased significantly in recent years, but income indicators have been volatile, raising questions about the real impact of SDGs on productivity.

Corporate governance has some experience in achieving the SDGs and forming sustainable financial support for greening processes. Still, this study focuses on generalizing the experience of automotive companies, and it is appropriate for several reasons.

1. The environment is significantly affected not only by the production activities of car companies but also by their products. 15% of total CO2 emissions are provided by transport, in the particular automobile [14].

2. According to IEA experts [15], there will be a doubling of global transport (in passenger-kilometers) and a 60% increase in the number of car owners due to population growth and income by 2070. Such an increase in demand can be offset solely by reducing emissions from passenger vehicles, i.e., through technological innovation and increasing electric vehicles production.

3. Orientation of global energy to achieve zero CO_2 emissions by 2070 (according to the IEA scenario [15]) involves the gradual cessation of emissions from all types of vehicles. Although emissions from certain types of vehicles will not be completely eliminated by 2070, their significant reduction is expected in many regions of the world [16].

4. Automobile companies are quite active and among the pioneers to start large-scale implementation of SDGs at the corporate level, as evidenced by a comparison of the dynamics of production and CO_2 emissions per unit of output. Thus, there was a gradual reduction in the amount of CO_2 emissions per unit of output (by 4.15% per year) comparing to growth in the production of the automotive industry during 2009-2018 (by 5% per year) [16].

This means that the increase in car production, which is generally observed around the world, is partly due to an increase in the production of cleaner cars. Thus, this indicates a generally positive trend in the implementation of SDGs by car companies.

Some companies representing the automotive industry are market leaders and set trends in the public vision of spreading the concept of sustainable development [17]. Governments, consumers, and investors are also pushing car companies to changing technology, products, and culture in the context of fully transforming sustainability goals into strategic development priorities for the industry as a whole.

The choice of the studied enterprises is based on their significance in the global car market. The key players operating in the global automotive industry are Volkswagen AG (Germany), Toyota Motor Corporation (Japan), General Motors (US), Ford Motor Company (US), Nissan Motor Corporation (Japan), Fiat Chrysler Automobiles (US) and others.

Without claiming to study all the factors, we will focus on determining the importance of forming an effective financial management system to implement SDGs using the experience of the above automobile companies.

The paper [12] reveals the characteristics of sustainable financing. The authors note that investments in the goals of sustainable development are determined by the desire of investors not only to obtain economic results from such investments, but also to make a positive impact on the environment.

Investments and innovations are key factors of progress in business development, and therefore the implementation of SDGs requires consideration of these emphases in the management process. Businesses need new innovative approaches to solving current environmental problems that correlate with SDGs [18]. The solution of existing problems and challenges depends on investment activity of enterprises, i.e., their ability to produce innovations on an ongoing basis. Sustainable innovation is very important, as implementing SDGs can lead to deteriorating financial results and financial instability.

This, in turn, can significantly limit the capacity of enterprises to finance investment and innovation, and thus effectiveness in the field of environmental responsibility. The same companies with unstable financial results do not have the opportunity to maintain adequate financial support for environmental goals. In other words, a stable financial position, sustainable investment is the basis for the implementation of SDGs [19]. That is why incorporating SDGs into the financial management system is relevant and needs research.

Given all the above, this research of sustainable development and financial sustainability using the example of automobile corporations will have both scientific-theoretical and practical significance.

This study aims to study the financial support processes for the implementation of SDGs by automotive corporations from the position identification challenges, trends, and positive experiences.

Taking into account the main goal of the article, we consider it necessary to solve the following specific tasks: to summarize the scientific views of scientists on the problems of sustainable development and its analysis; to explore best practices in the management and financing of SDGs on the example of car companies.

2.   Methodology

The issue of methodological support for the analysis of sustainable development of enterprises, on the one hand, has a strong base in the form of a number of works [20-26], from a different perspective, the problem of ensuring stable operation of the enterprise is difficult to predict because it is caused by external factors that are difficult to regulate. In modern conditions, there is a further complication of the external environment in terms of challenges, respectively, the method of analysing the sustainable

business development, identifying the key factors for sustainable development, remains relevant, and the emphasis on financial stability is quite logical.

2.1. The logical basis of the methodology.

It is necessary to form a structural and logical scheme of causal relationships between key components of sustainability and their impact on financial stability in order to substantiate a possible algorithm for analysing the sustainability of enterprise development, which would combine the advantages of existing methodological approaches and allow real research, especially with an emphasis on financial aspects (Figure1).
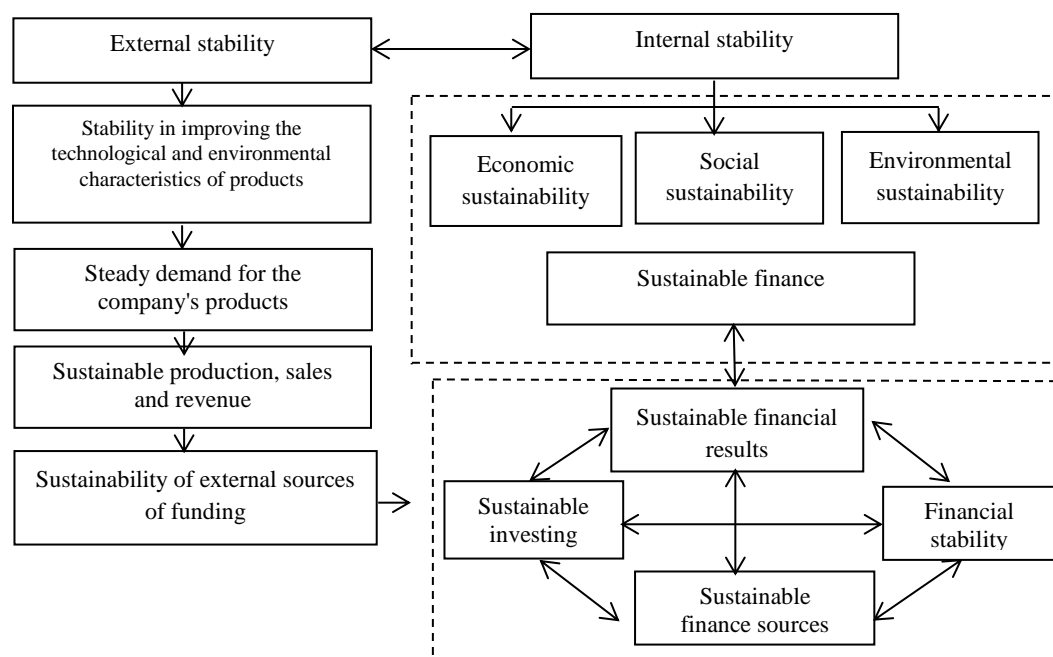

Figure 1. Stability in the coordinates of its various types.
Source: developed by the authors

The condition for ensuring sustainable development in terms of environmental, economic, and social goals is the development of the company's internal potential by the requirements of the external environment. A crucial precondition for achieving the goals of sustainable development is the company's sustainable technological development, which is the basis of their ability to ensure sustainable development of innovation potential and product renewal.

If the market is characterized by the stable dynamics of demand, the manufacturer can hope for stable sales, and hence stable production. Sustainability in sales allows the company to receive stable income and provides financial stability. Based on a sufficient level of financial stability, the company focuses on achieving the full range of goals and finances them at the required level. Sustainable development as the development of economic, ecological and social vectors allows obtaining improved product performance on a regular basis, and therefore meeting consumer demand or even shaping it.

In this study, the authors focus on determining financial stability through the sustainability of production activities. Other sources of financial resources such as loans and government loans are not taken into account.

Focusing on sustainable development goals, which are discussed in this article in the framework of sustainable development management with an emphasis on corporate finance, requires the separation of integrated methods of sustainable development of the enterprise: analysis of the sustainability of financial resources and investment sustainability analysis of financial performance.

The purpose of analysing the impact of SDGs on corporate finance is to determine the company's ability to provide adequate funding for the implementation of the whole set of SDGs and evaluate the results of these actions from the standpoint of economic, environmental and social characteristics.

2.2. The proposed algorithm for analysing the implementation of SDGs into account financial stability.
A comprehensive understanding of the concept of "sustainable development" allows outlining the main directions of analysis and considering financial aspect by highlighting additional important points (Figure 2).
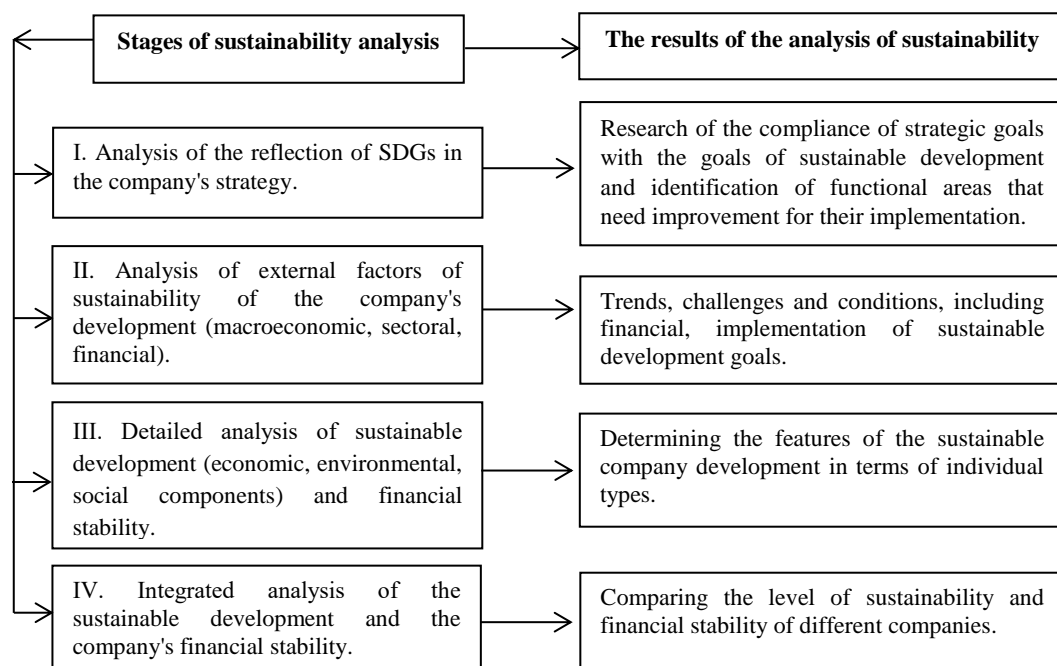
Stages of sustainability analysis	The results of the analysis of sustainability
I. Analysis of the reflection of SDGs in the company's strategy.	Research of the compliance of strategic goals with the goals of sustainable development and identification of functional areas that need improvement for their implementation.
II. Analysis of external factors of sustainability of the company's development (macroeconomic, sectoral, financial).	Trends, challenges and conditions, including financial, implementation of sustainable development goals.
III. Detailed analysis of sustainable development (economic, environmental, social components) and financial stability.	Determining the features of the sustainable company development in terms of individual types.
IV. Integrated analysis of the sustainable development and the company's financial stability.	Comparing the level of sustainability and financial stability of different companies.

Figure 2. Stages of the analysis of sustainable enterprise development with an emphasis on financial stability.
Source: developed by the authors

The emphasis on financial stability determines the need to specify its components in forming analytical information and the definition of significant trends.

The ability of the enterprise to form stable financial resources from internal and external sources allows for sustainable investment, which generally characterizes the enterprise's financial condition as stable, and ultimately allows obtaining stable financial results.

Thus, the company's sustainable development concept is inextricably linked to its financial potential because the acquired capacity and opportunities to increase it are a practical basis for restoring the state of equilibrium in the development process.

To ensure a complete analysis of sustainable development, it is necessary to systematize indicators that will form an appropriate information base. Since the quantification of environmental and social sustainability and even comparison with the economic component is a complex process, using indicators with different measures. In addition, there is a significant problem of forming a set of unified sustainability indicators because there are no requirements for Sustainability Reporting, and companies that compile such reports independently determine the list of indicators and their units of measurement.

The issue of systematization of sustainable development indicators is revealed in detail in the works [20-23], in which the authors presented the complete list of indicators. Various companies use a fairly wide range of indicators and international agencies; however, there is a problem of unification of

the set of indicators and their comparability. In this study, we limit ourselves to those indicators that most of the studied automotive companies most often use and therefore allow for analysis.

As we consider the goals of sustainable development and the quantitative indicators that characterize them, in comparison with financial stability, the set of indicators should be expanded by: indicators that characterize the stability of financial resources, investment stability, financial stability, and stability of financial results. These indicators are formed based on existing methods of analysis of financial stability [27-30].

Such system of indicators should become an effective tool for managing the enterprise's sustainability and give a comprehensive view of the financial condition, organizational efficiency, use of modern equipment and technology, and use of market position in achieving strategic and tactical development goals. The analysis of indicators can determine the initial situation at the enterprise, strengths in comparison with competitors, and substantiate the direction of the achievement of the set strategic purposes. To analyse the stability, the authors systematize and introduce a list of key indicators (Table 1).

Table 1. Key performance indicators of integrated assessment of sustainable development.

Economic sustainability	Social sustainability	Environmental sustainability
Total Sales (millions of units)	Employees	Energy consumption of production (absolute) (Electricity, Heat, Fuel gases)
Vehicle production (consolidated)	Male/Female	
Market share	Top Management Positions (Male/Female)	
Revenue		Energy consumption (specific)
Assets	Total Salary Hires	Energy Intensity (MWh/vehicle)
Fixed assets, % of assets	Newly-hired employees	Water Intensity (M3/vehicle
Intangible assets, % of assets	Average period of employment	Waste Intensity (kg/vehicle)
Productiveness	Total Turnover Rate	CO_2 emissions per unit produced (in tons/unit
Assets ratio	Ratio of basic salary and remuneration of women to men (base salary only)	VOC emissions (in kg/vehicle, in tonnes/year)
Capital Investment, % of Revenue	Employees who feel personal growth	
R&D Expenses, % of Revenue	Total expenses for social contribution activities	Environmental protection costs (Investments, Operating costs)

Financial sustainability			
Stable of financial resources	Sustainable investing	Stable financial position	Stable financial results
Internal (sales revenue)	Capital investing	Liquidity	Net Income, EBIT, EPS, EVA, MVA, ROI, ROA
External (loans)	R&D expenditure	Profitability	
	Environmental protection costs (investing)	Market valuation	

Source: [20-23, 27-30, 31-33]

An essential source of information on the sustainable development of the enterprise is the report on sustainable development. An increasing number of companies are starting to compile a Sustainable Development Report. Reporting on sustainable development helps the users understand the company's business model and its impact on society and the environment better. Both detailed and integrated analyses can be performed using the indicators presented in the reports. This approach is proposed in [34]. The authors propose a classification of single indicators (on operational and strategic levels) and combined measures.

SDGs are quite multifaceted, combining both quantitative and qualitative development targets in economic, environmental, and social components.

The presented indicators allow to carry out both the detailed and the complex analysis of the stability of development of the enterprise. The analysis of the presented indicators allows comparisons with competitors and to define critical characteristics of lag in the cut of separate components of stability. In addition, based on a set of indicators (X_n^i), it is advisable to calculate integrated indicators (index of sustainability of economic development ($p_{ij_{econ}}$), index of sustainability of environmental development ($p_{ij_{ecol}}$), index of sustainability of social development ($p_{ij_{soc}}$). We need integrated indicators because we can determine the connection between the components of sustainability. Through the calculation of the corresponding partial integral indices, it is advisable to determine the generalized integrated sustainability index (I_{sust}).

Financial indicators (X_n^{fin}) can be used to calculate the integrated index of financial stability (I_{sust}^{fin}). Monitoring the enterprise's development in terms of sustainability components is important in understanding the progress of implementation of SDGs and opportunities for their implementation through financial stability. The structural and logical scheme of the survey of sustainability indicators (economic, ecological and social) with the indicators that comprehensively characterize financial stability is presented in Figure 3.
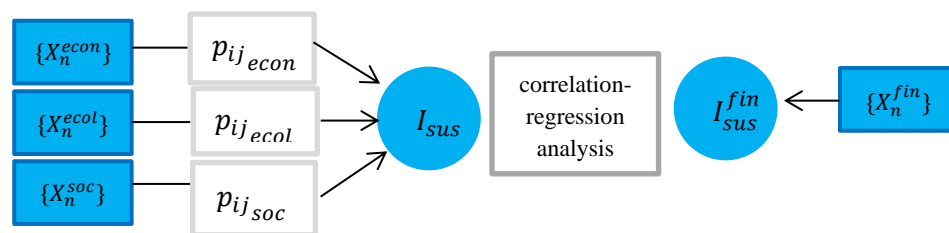

Figure 3. Research Model.
Source: authors

The following important issue is the choice of information processing methods.

In general, the following basic methods is recommended to use in the study to characterize the stability of economic processes using quantitative and qualitative indicators: structural and logical analysis (to find out the factors of enterprise sustainability); economic and statistical analysis (to establish dynamic changes and analyse the main trends of the main indicators of sustainable development); methods of economic-mathematical modelling, correlation, and regression analysis (for composite (consolidated) analysis of large data sets to assess latent indicators of sustainable development of enterprises and further calculation of the integrated index, as well as to establish close relationships between individual types of stability and financial indicators); the abstract-logical method is used to summarize the results and formulate research conclusions.

For any indicator presented in the table, authors have a dynamic range of values, and therefore for their processing, authors use two approaches: from the standpoint of the achieved level in absolute values and from the standpoint of stability of dynamics in relative terms - to determine trends in the studied processes.

The analysis at a certain point in time allows to compare sustainable development indicators of enterprise with other competitors and identify challenges by the components of sustainability that exist. The analysis in dynamics allows to establish the efficiency of the processes of transformations caused by the implementation of sustainable development purposes and their reflection in other economic and financial indicators. The study of the stability of the dynamics is carried out using the indicators presented in [35-37]. In this article, to determine the stability of the dynamics, will be used the following indicators:

The percent relative range (PRR) – reflects the relationship between the minimum and maximum increments, i.e. allows you to determine the stability of the absolute values of indicators (can be calculated as an index and in percent):

$$PRR = \frac{X_{max} - X_{min}}{\frac{(X_{max} + X_{min})}{2}} \times 100\% \qquad (1)$$

where X_i – the specific meaning of the variable feature (X_{max}, X_{min} – maximum and minimum value);

$\overline{X}$ – the average value of the sign.

Coefficient of variation (ύ), which is the standard deviation ratio to the mean value of the sign:

$$\acute{v} = \frac{\sigma}{\overline{X}} \times 100\% \qquad (2)$$

where σ – dispersion.

Analysis ύ is carried out taking into account such scale:

to 10% – slight variation;

10-25% – significant variation;

> 25% – significant variation.

$$\sigma = \sqrt{\frac{\sum(X_i - \overline{X})^2}{n}} \qquad (3)$$

n – the average value of the sign.

To carry out an integrated assessment of the enterprise stability and the calculation of complex indicators, it is necessary:

1. To standardize the values of selected and systematized indicators [38]:

$p_{ij} = \frac{x_{ij} - \overline{x}_j}{\sigma_j}$, where x_{ij} – the value of indicators of stability (assessment by species classification of stability), $i = \overline{1, m}$ – the amount of research periods, $j = \overline{1, n}$ – the amount of indicators, $\overline{x}_j = \frac{1}{m}\sum_{i=1}^{m} x_{ij}$ – average value of the indicator, $\sigma_j = \sqrt{\frac{\sum_{i=1}^{m}(x_{ij} - \overline{x}_j)^2}{m}}$ – standard deviation of the indicator, which ensures the alignment of variances and values of indicators.

2. To calculate the integrated indicator of stability:

$$I_{sust} = \sqrt[3]{p_{ij\,sociology} + p_{ij\,economy} + p_{ij\,ecology}} \qquad (4)$$

where $p_{ij\,sociology}$ – standardized value of social sustainability, $p_{ij\,economy}$ – standardized value of economic sustainability, $p_{ij\,ecology}$ – standardized value of environmental sustainability.

At this stage, it is also advisable to use the distance method to compare the indicators of the analysed enterprises (divisions) with the reference indicators. The distance method [39] is relevant for strategic analysis of the level of enterprise sustainability operating in a particular industry, as it allows for identifying the differences in terms of different types of sustainability and targets for further development strategy. As a reference, we will accept the conditional enterprise with the best values of the presented indicators.

A slightly different approach is proposed using relative indicators. At the same time, we should once again turn to the concept of stability.

The concept of "sustainability" should be clarified when choosing the methods of information processing for the purposes of analysis. Its understanding is the basis for the choice of criteria for the interpretation of sustainability indicators.

According to [40], «stability is a property of the system S to coincide in terms of {Ss} before and after changes {C}, which are caused by the action of a set of factors {F}». Among the main types of stability, there are such types of stability as inertia, symmetry, adaptability, homeostasis, delayed, and compositional stability.

The development of the system, respectively, is a sequence of its states, which are determined by both quantitative indicators and qualitative characteristics. The trajectory of economic indicators can be characterized by the development in terms of characteristics «slowly-fast» or cyclically, but we can determine how progressive it is based on the additional information, including in terms of the traditional triad of components.

Emphasizing the concept of «sustainability» in analytical terms, i.e. considering its manifestation as a fixed dynamics of indicators, we propose to consider sustainable development as a development with a value that characterizes the dynamics of a particular indicator as a constant value. Theoretically, sustainable development is a process of improving the internal qualitative subsystems when the growth of quantitative values of indicators is an almost constant value. When the quantitative value of the increase has increasing indicators, it is an accelerated development.

$$T\%_t^{n(i)} = \frac{X_t^{n(i)}}{X_{t-1}^{n(i)}} \qquad (5)$$

where $T\%_t^{n(i)}$ – change in the percentage of the n-th indicator of the i-th component (environmental, economic, social) stability at time t.

Accordingly, the condition for sustainable growth is a positive and constant value of the studied indicators. Achieving such a situation in practice is impossible, which means that the characteristics of sustainable development are more meaningful than mathematical:

A positive trend for the economic and social components is the positive dynamics (increase) of key indicators over a certain period of time. Regarding the environmental component, a sign of positive dynamics is a decrease in the absolute values of indicators at a steady pace.

Accordingly, the procedure of normalization of indicators, i.e. reduction to a comparable form, should be used to determine the integrated indices.

Economic sustainability $\{X_n^{econ}\}$	Sociological sustainability $\{X_n^{soc}\}$	Ecological sustainability $\{X_n^{ecol}\}$
stability conditions		
$100 < T\%_t^{n(i)} \cong const$	$100 < T\%_t^{n(i)} \cong const$	$100 > T\%_t^{n(i)} \cong const$
positive trend		
$T\%_{t-1}^{n(i)} < T\%_t^{n(i)}$	$T\%_{t-1}^{n(i)} < T\%_t^{n(i)}$	$T\%_{t-1}^{n(i)} > T\%_t^{n(i)}$
Financial sustainability		
$\{X_n^{fin}\}$		
Stable of financial resource Sustainable investing	Sustainable investing	Stable financial results
positive trend		
$T\%_{t-1}^{n(i)} < T\%_t^{n(i)}$		

At this stage, it is also advisable to use the distance method to compare the indicators of the analyzed enterprises (divisions) with the reference indicators [39]. Also in the process of analyzing the sustainability of enterprise development and the balance of stability of individual species, it is advisable to use correlation-regression analysis [41]. In this study, it is planned to use the Pearson correlation coefficients r_p and Spearman correlation r_s.

At the last stage, to compare the enterprise's sustainability on the integrated index and the enterprise's financial stability, it is advisable to use OLS (Linear) Regression [36, 41]. The ordinary least square method is a mathematical description of the dependence of one variable on another. Therefore, it allows to summarize the results of generalized indices of sustainable development and partial indices (economic, environmental, and social sustainability) compared to the financial stability index.

In general, the presented analysis algorithm, which provides for the use of both a set of metrics and integrated indices, allows to identify key trends in the effectiveness of the implementation of SDGs compared to key indicators of financial stability.

3. Results
Sustainable development goals, formally or indirectly, have been the basis of long-term corporate governance and the development of appropriate strategies for automotive corporations for a long time. This experience is vital because automotive corporations, on the one hand, have significant achievements and devote significant resources to sustainable development, and on the other hand, even in recent years, they have been constantly facing the issues of adverse environmental impacts and development instability.

The purpose of analysing the sustainability of the studied automotive companies is to determine the main trends in the processes of resource, in particular financial support and the realization of SDGs.

3.1. Analysis of the sustainability of automotive companies.
In order to determine the best experience in the realization of SDGs, we will further compare the experience of the studied corporations. At the same time, we will analyse the sustainability of development in general from the perspective of the triad of components, conduct the analysis of the financial potential of the studied corporations to determine financial opportunities in order to increase costs to ensure SDGs.

The study of the sustainability of automotive corporations was conducted over two periods of 2008-2010 (crisis period) and 2011-2020.

3.2. Research of the general indicators of stability.
The first indicator of the sustainability of companies is the dynamics of production volumes (Figure 4).
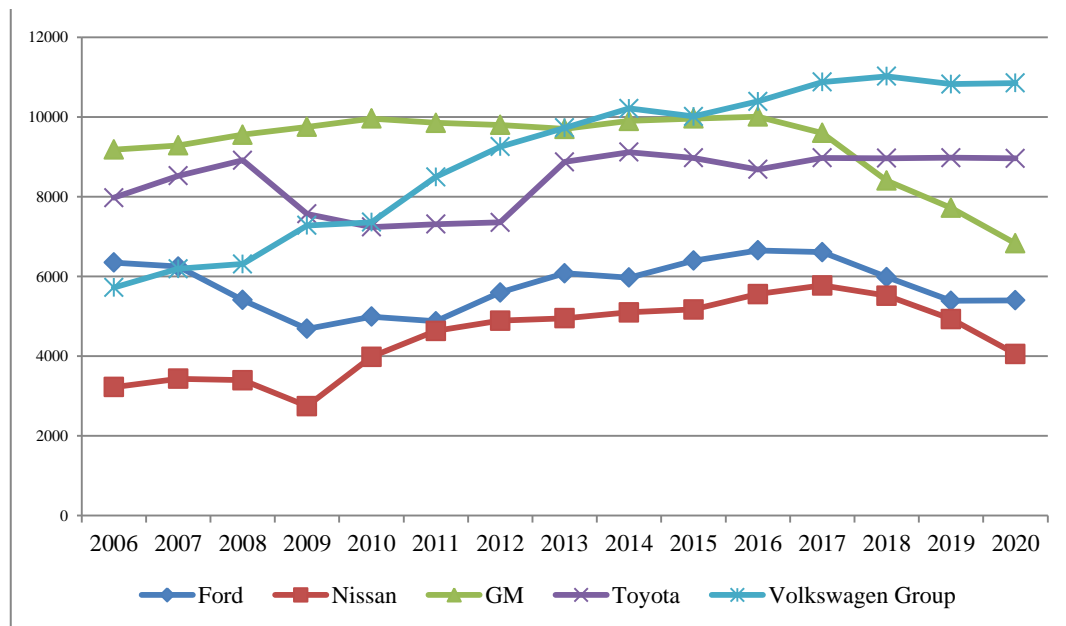
Figure 4. Sustainability of production of selected automotive manufacturers.
Sources: [42-46]

The presented data indicate generally unstable dynamics of production in all surveyed enterprises. During 2006-2020, the average annual production dynamics in terms of enterprises were Volkswagen Group - 104.81%, Nissan - 102.7%, Toyota - 101.1%, Ford - 99.2%, General Motors Company - 98.04% (Fig. 4). That is, not all car manufacturers have a general tendency to increase production. Ford and General Motors did not reach the pre-crisis level in 2020. Particularly volatile dynamics were observed during the crisis of 2008-2010 and in recent years under the influence of Covid-19.

Thus, automakers can use the potential for dynamic development of the car market due to the environmentally responsible trend, which is clearly formed under the influence of consumers, governments, and other stakeholders due to growing demand for electric vehicles only by investing in this area.

3.3. Research of economic, ecological, and social components sustainability of enterprise development.
Analytical study of environmental, social, and economic components has some difficulties from the standpoint of forming the information base because the company began to form reports on sustainable development on a systemic basis not so long ago. TESLA, for example, only started compiling a report on sustainable development in 2019, although environmental trends in the industry generally determine its activities. The experience of General Motors Company starts since 2009, and Toyota since 2002. Therefore, conducting a fully coordinated and comprehensive study of these issues is quite a challenge.

There will be considered the key achievements and guidelines for further sustainable development of the studied automotive companies using individual indicators and processing those using distances (Appendix A).

The presented board in the generalized form allows comparing the level of stability of enterprises' development on separate components and from the perspective of separate indicators. Understanding the type and level of lagging in terms of individual indicators and a component of sustainable development in general allows determining the content of measures, the implementation of which will maximize the focus on best practices in the industry.

Generally, the studied enterprises have a comparable level of sustainability of development, despite some differences in terms of individual components. Each of the surveyed corporations actively participated in attaining a climate-neutral footprint worldwide by 2050 at the latest. The realization of this and related goals requires not only the cooperation of corporations with business and society but

also the performance of the driver's functions in the formation of the eco-environment in their countries. Companies shape the values of sustainable development and try to spread them in society.

The ambitious goals of sustainable development concern, first of all, environmental responsibility, require corporations to mobilize all resources and thus to develop human resources and strengthen economic potential.

The importance of social sustainability and proper attention to it is based on simple logic: socially stable working conditions, economically appropriate forms of remuneration, opportunities for self-realization, and career growth through professional development are the basis of creativity and creativity of employees that promotes innovation, and hence environmental and economic sustainability.

The development of digital technologies will raise the role of the professional workforce, as there will be the elimination and improvement of jobs. In the context of increasing the level of social stability, car companies are actively working in the context of all these areas.

3.4. Financial sustainability analysis of automobile manufacturing enterprises.
Concluding on the inevitability of further movement of automotive corporations to increase the level of sustainable development, it is necessary to analyze their financial stability and determine the financial potential for further sustainable development goals.

To analyse the financial stability in the dynamics, we use several indicators that characterize the stability of financial resources, the stability of investments, the consistency of the financial status and results (Appendix B).

Revenues of enterprises, as the central financial resource of activity, are characterized by unstable dynamics. Their magnitude was affected by both the crisis of 2007-2010 and the pandemic of 2019-2020. The average annual dynamics of the last decade is only slightly higher than in the crisis period. In general, during the study period from 2006 to 2020, the authors can note a gradual increase in revenues of Toyota and Volkswagen, and only their tenfold increase over the period from 2014 to 2020 on the example of Tesla. Thus, some analogies can be drawn. It should be argued that all automotive companies should use the growth potential of demand for electric vehicles to increase income sustainability.

The highest level of dynamics (instability) is an indicator of profit in all surveyed companies. First, that the crisis of 2007-2010 affected American companies more significantly, while Volkswagen worked with profits, and Toyota and Nissan had losses in only one of the crisis years (2009 and 2008, respectively). The year 2020 of all companies, except Tesla, is characterized by a decrease in profits and even entering the loss zone (Ford and Nissan). Tesla, which operated at a loss during 2008-2019 and made a profit for the first time in 2020, demonstrates a fundamentally different performance.

Despite the instability of the leading financial results (income and profit), car companies are actively financing the development of the economic base of their activities, as evidenced by the dynamics of assets. Thus, from 2009 to 2020, GM's assets grew by 72 percent, for the period from 2006 to 2020, respectively: Volkswagen 3.3 times, Toyota - almost twice, Nissan - 48%. Only Ford had a decrease in total assets. Tesla, whose assets increased 400 times in 2009-2020, demonstrates an outstanding example of dynamic development. The company, established in 2003 in an industry where other representatives have a long history, established competition and achievements, on the idea of achieving sustainable development goals, identifies trends in innovative development of other enterprises and demonstrates the extra-dynamics of production capacity. However, the scale of Tesla's activity is in a different weight category.

The amount of working capital for each company should have its optimal value and allow the core business to operate smoothly is unstable in the Volkswagen Group, General Motors, Tesla. However, the Current Ratio went beyond the allowable value (1) only in some years.

Since SDGs require long-term financing, it is vital to consider the debt/equity ratio, which allows establishing the potential of the company's financial leverage based on the study of the ratio of debt and equity (Table 2). If the most acceptable ratio is 60% of borrowed capital and 40% of equity (ratio = 1.5), the data of the surveyed enterprises indicate excessive financial dependence on external sources.

The indicators of Toyota correspond to the optimal value (and throughout the study period); in other companies, the values are twice or more times higher than recommended. This indicates that the financial stability of the surveyed enterprises is not at a high level.

Table 2. Summary of the leading indicators of financial stability in terms of the periods 2006-2010 and 2011-2020.

Company	Revenue		Total Assets		Net Working Capital (average annual value)		Curent Ratio (average annual value)		Debt/equity ratio		ROI (average annual value)	
	2006-2010	2011-2020	2006-2010	2011-2020	2006-2010	2011-2020	2006-2010	2011-2020	2006-2010	2011-2020	2006-2010	2011-2020
Volkswagen Group	106.9	104.8	111.8	108.4	13.4	6.7	1.16	1.04	3.75	2.96	8.4	10.2
General Motors	92.5	99.2	-	105.5	2.5	3.0	1.13	1.07	1.29	3.73	8.7	0.03
Ford	95.6	100.1	87.9	105.0	73.3	59.8	1.97	2.92	-66.43	7.68	1.4	5.2
Tesla	224.3	191.7	-	171.6	0.0	1.3	1.31	1.31	0.17	4.12	-40.2	-19.4
Toyota	104.9	103.2	107.9	104.2	8.9	6.4	1.08	1.04	1.74	1.64	75.4	7.5
Nissan	98.4	101.5	101.8	103.7	14.5	35.4	1.34	1.60	2.37	2.42	6.3	14.3

Sources: authors' calculations

The increase in costs for implementing environmental goals does not lead to a significant deterioration in the dynamics of financial income.

Several companies, in particular Volkswagen and Toyota, provide information on Environmental protection costs (investment and operating costs) in their Sustainability Reports. However, the allocation of financial resources for sustainable development is also reflected in other financial flows, in particular, capital investment, R&D investments. Investments in fixed assets include the purchase, first of all, of more modern and therefore energy-efficient equipment, and R&D investments are the costs of developing new products with better environmental performance. Thus, it is difficult to single out those aimed at achieving SDGs. Therefore, the total amount of investment should be considered as investment in the company's development, which is entirely directed at achieving the SDGs.

The next important step in the analysis of financial encouragement for the SDGs realization is to study the level of sustainability of enterprises in terms of individual types in comparison with indicators of financial stability using the OLS Regression method. Table 3 presents the results of this analysis.

Table 3. Analysis of the financial stability ratio and components of sustainable development of the enterprise.

Company	Financial sustainability and Economic sustainability	Financial sustainability and Ecological sustainability	Financial sustainability and Social sustainability
Toyota	$y = 0.0007x^2 + 0.056x + 87.106$ $R^2 = 0.693$	$y = 1.5273x^2 - 294.24x + 14256$ $R^2 = 0.230$	$y = 0.1302x^2 - 24.129x + 1204.2$ $R^2 = 0.341$
General Motors Company	$y = 0.0004x^2 - 0.0052x + 95.384$ $R^2 = 0.640$	$y = -0.4079x^2 + 78.861x - 3733.3$ $R^2 = 0.039$	$y = 0.1174x^2 - 26.444x + 1543.5$ $R^2 = 0.303$
Volkswagen Group	$y = 0.0003x^2 + 0.1032x + 97.423$ $R^2 = 0.668$	$y = 0.022x^2 - 7.2409x + 605.58$ $R^2 = 0.1103$	$y = 0.0007x^2 - 0.24x + 119.99$ $R^2 = 0.515$
Ford	$y = -0.0003x^2 + 0.1648x + 86.587$ $R^2 = 0.967$	$y = 0.0017x^2 - 0.8402x + 188.23$ $R^2 = 0.035$	$y = 0.1961x^2 - 40.079x + 2147.2$ $R^2 = 0.248$

Sources: authors' calculations

In general, the average level of correlation between financial and economic sustainability should be noted, the links between financial and social sustainability are slightly below the average, and the links between financial and environmental sustainability are insignificant. This state of affairs indicates the

importance of sustainable development goals, the progress in achieving which car companies provide regardless of the stability of financial resources and results.

The final stage of this investigation was a simile of indices of financial stability and the integrated index of sustainability of the studied automotive companies, calculated for the period from 2007 to 2019 (Figure 5).
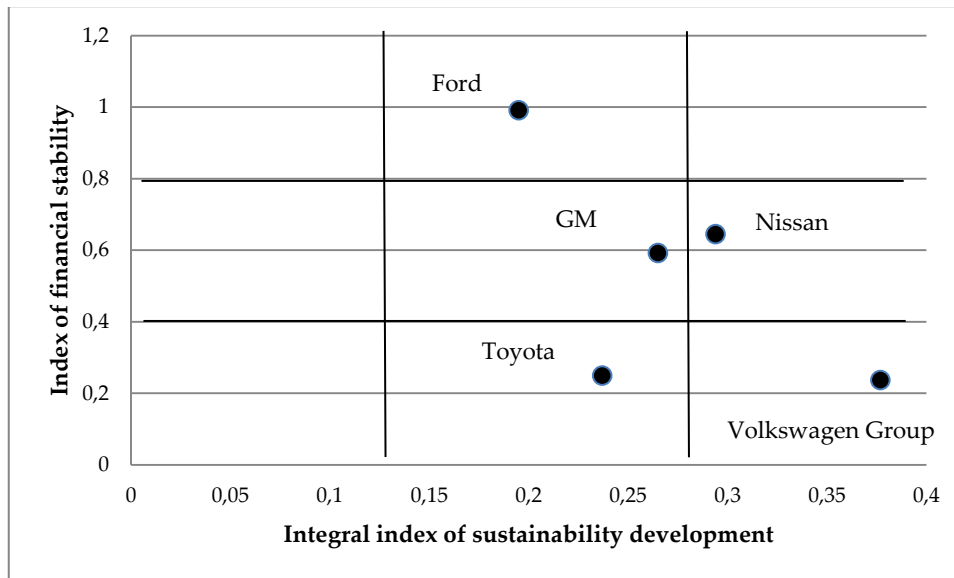

Figure 5. Sustainability of enterprise development in comparison with financial stability.
Sources: authors' calculations

The smaller the value of the generalized indices of stability, the less variability the studied indicators show.

The presented results of comparing the stability of integrated indices of sustainable development in comparison with the generalized index of financial stability, conducted using the example of car companies, reflect the following main trends:

firstly, all surveyed enterprises show progress in environmental and social sustainability, but the dynamics of both actual and integrated indicators indicate a low level (slight variation) against the background of relatively high financial instability;

secondly, the studied automobile enterprises differ in the sustainability development level (taking into account the components) and financial stability. Volkswagen Group and Nissan are showing more progress in ensuring sustainable development against the background of low and medium levels of financial stability. Ford has the lowest level of sustainability index against the background of the highest level of financial instability.

thirdly, the calculations of the correlation between indicators of sustainable development (economic, environmental, and social components) and financial stability showed a low level of dependence. This means that enterprises implement SDGs against the background of different levels of variability of financial stability.

Such trends formulated based on calculations confirm Hypothesis 1 on the best results in the implementation of SDGs of companies with a higher level of financial stability. Indeed, enterprises that have a higher level of financial stability simultaneously have higher absolute indicators and positive dynamics in the components of sustainable development of the studied enterprises, particularly economic and social.

Considering investments (indicators for one employee are taken for the analysis), the authors see the following tendencies during the studied period: R&D investments are gradually increasing; investments in fixed assets, given the level of capital intensity and capital adequacy of employees, tend to decrease.

All surveyed automotive companies are increasing investment, including investment in innovation. Only vital funding for innovation allows companies to research all necessary areas to ensure compliance with market requirements: safety, efficiency, environmental friendliness, design, disposal. That is, the realization of SDGs depends on the enterprise ability to have a high innovation performance and activity.

The amount of investment directed to the goals that include sustainable development is influenced by such quantifiable factors as the amount of enterprise income (x1); its level of profitability (x2); economic potential (value of assets) (x3); the amount of working capital (because it is difficult to finance long-term projects in case of inadequate current liquidity) (x4); profitability of previously implemented projects (ROI) (x5); the ratio of the borrowed assets and equity (x6).

The study of the closeness of the relationship was conducted using these indicators as characteristics of key factors.

This model represents the relationship between the investment (performance indicator) and indicated factors:

$$Y = f(x_1, x_2, x_3, x_4, x_5, x_6) \qquad (6)$$

Given that these factors affect the performance indicator, assuming they are not interrelated, it is appropriate to use the correlation-regression methods.

The correlation analysis (Appendix C) shows that the dynamics of investment in the studied enterprises depend on income and economic potential, but not on other financial condition indicators. This means prioritizing investment financing and, therefore, the importance of ensuring long-term sustainable development goals.

The world's leading car companies manage the goals of sustainable development of society, which have several levels of implementation: at the strategic level (the goals determine the content of sustainable development strategies); at the functional level (they are embodied in specific targets, formed under the environmental, social and economic components); at the operational level (provide for the formation of a set of detailed activities and tools to achieve the objectives).

In order to fill the processes of sustainable development management based on the generalization of scientific approaches and taking into account the positive experience, a comprehensive approach to sustainable development management was proposed through the separation of conceptual, strategic, operational, and analytical levels.

4. Conclusion

The world's leading car companies carry out financial management taking into account the SDGs, which have several levels of implementation: at the strategic level (the goals determine the content of sustainable development strategies); at the functional level (they are embodied in specific targets, formed under the environmental, social and economic components); at the operational level (provide for the formation of a set of detailed activities and tools to achieve the objectives).

Based on the systematization of existing methodological approaches to sustainability analysis, the authors propose to consider sustainability as the ability of the system to achieve goals, as a balance of internal resources, as stability of interaction with the external environment, and as an adaptation of the business model.

To study the processes of financial support for sustainable development, the authors formed a method of analysis. The novelty of the work is an attempt to consider indicators of sustainable development of the enterprise in the view of economic, environmental, and social objectives, and also from the standpoint of financial stability.

The procedure for analysing the sustainability of enterprises is proposed to be carried out at the following main stages: overview of the reflection of SDGs in the strategy, analysis of external factors of sustainability, comprehensive and integrated analysis of sustainability with an emphasis on financial stability. The article systematizes the indicators of economic, environmental, social, and financial sustainability, based on which it is advisable to perform a sustainability analysis.

Exploration of SDGs realization by automotive companies allows identifying the main sustainability challenges and determining the key trends in developing strategies regarding sustainable development.

SDGs adopted by automotive companies under the Global Agenda are a real challenge in terms of environmental responsibility, as their achievement requires efficiency in the field of innovation and proper investment.

Since the development of companies is influenced by factors of the internal and external environment, this paper analyses the influence of trends in the world economy. The external global environment creates clear environmental, social and economic challenges for internal sustainability subsystems. Moreover, although the dynamics of the global economy have a medium level of impact on the sustainability of automotive enterprises in the end, as the analysis shows, there is a clear synchronization of development dynamics in the short term, especially during crises.

Because the crisis in the global economy, no matter what the root cause is, is displayed in the financial system and the activity's progress, the SDGs' realization is always related to financial stability. The financial condition of automobile enterprises during the crisis in the economy is unstable. The examined enterprises received state support in one form or another. However, sustainable development goals are being funded properly. Transformations in the automotive industry are becoming an essential factor and even a driver in the SDGs realization, as they directly relate to production technologies and the technical characteristics of cars.

The analysis of the sustainability of development provides for defining tendencies in the current stage of development of leading automotive companies:

firstly, there is an unstable dynamics of production volumes in general, but with a gradual increase in production of electric vehicles, accompanied by the improvement of business models of enterprises;

secondly, there are some differences between the studied enterprises in the characteristics of social and environmental sustainability, despite the similarity of the targets;

thirdly, the ratio of different subsystems of financial stability, which the authors give as an example of car companies, has the following general characteristics: relatively stable financial resources - stable investments - financial stability - varying financial results.

As the analysis showed, the selected companies have unstable financial resources and financial results but progress in achieving the key sustainable development goals.

Understanding these trends will provide an opportunity to improve financial management mechanisms and approaches, including at the regional and state levels.

All of this calls for further research on the question of the effect of ecological responsible on the socio-ecological area.

Appendix A

Table A1. Scoreboard of key indicators of sustainable development of automotive corporations

Indicators	Absolute values of indicators					Values of indicators after processing using the distance method				
	General Motors	Volks wagen	Toyota	Ford	Nissan	General Motors	Volkswagen	Toyota	Ford	Nissan
Economic sustainability										
Market share, %	7.07	10.7	10.79	6.58	5.95	0.66	0.99	1.0	0.61	0.55
Fixed assets	34.4	50.5	54.1	48.0	34.6	0.64	0.93	1.0	0.89	0.64
Capital Investment per employee, in US dollar	45739	24507	35740	30870	35020	1.0	0.54	0.78	0.67	0.77
R&D Expenses per employee, in US dollar	41460	24640	28400	38170	35927	1.0	0.59	0.68	0.92	0.87
Index of Economic sustainability						*0.83*	*0.76*	*0.87*	*0.77*	*0.71*
Social sustainability										
Number of learners, in % of employee	42.6	31.5	26.4	33.2	12.3	1.00	0.50	0.62	0.78	0.29
Training hours per employee	10.73	11.7	9.3	8.7	4.3	0.92	1.00	0.79	0.74	0.37
Hours per leaner	25.1	23.2	25.6	24.2	26.0	0.97	0.89	0.98	0.93	1.00
Employees who feel personal growth, %	79.6	81.2	82.1	80.2	79.5	0.97	0.99	1.00	0.98	0.97
Index of Social sustainability						*0.96*	*0.85*	*0.85*	*0.86*	*0.66*
Ecological sustainability										
Energy intensity, in	2.13	2.18	1.81	2.14	2.08	0.82	0.79	1.00	0.82	0.85

| MWh/vehicle										
Waste volume per unit, in kg/unit	42.2	44.8	46.2	43.45	41.9	0.99	0.93	0.90	0.96	1.00
CO_2 emissions per unit produced	0.62	0.436	0.387	0.58	0.51	0.40	0.87	1.00	0.50	0.68
VOC emissions, in kg/vehicle	2.55	1.59	1.66	2.15	2.34	0.40	1.00	0.96	0.65	0.53
Water Intensity, M3/vehicle	4.17	3.74	4.1	4.2	4.81	0.89	1.00	0.90	0.88	0.71
Index of Ecological sustainability						*0.70*	*0.92*	*0.95*	*0.76*	*0.76*
Index of Sustainability Development						***0.83***	***0.84***	***0.89***	***0.80***	***0.71***

Sources: authors' calculations

Appendix B

Table B 1. Dynamics of the main indicators of sustainability of development

Company	2015	2016	2017	2018	2019	2020	Trends
Revenue, in million US dollars							
Volkswagen Group	236696	240427	260739	278537	282947	254600	
General Motors	135725	149184	145588	147049	137237	122485	
Ford	149558	151800	156776	160338	155900	127144	
Tesla	4046	7000	11759	21461	24578	31536	
Toyota	247834	235745	256653	264415	272031	275355	
Nissan	103514	101173	108996	107560	104168	90885	

Company	2015	2016	2017	2018	2019	2020	Trends
Net Income, in million US dollars							
Volkswagen Group	-1755	5692	12833	13967	14947	9519	
General Motors	9687	9427	-3880	7916	6581	6247	
Ford	7373	4589	7731	3677	47	-1279	
Tesla	-888	-674	-1962	-976	-870	690	
Toyota	19777	19195	17029	22445	16945	19100	
Nissan	4347	6170	6722	2872	-6175	-4217	

Company	2015	2016	2017	2018	2019	2020	Trends
Total Assets, in million US dollars							
Volkswagen Group	423844	453409	477204	541082	546639	567853	
General Motors	194338	221690	212482	227339	228037	235194	
Ford	224925	237951	258496	256540	258537	267261	
Tesla	8067	22664	28655	29740	34309	52148	
Toyota	434341	393649	453376	452774	467432	484660	
Nissan	155115	144201	171315	168722	170571	156185	

Net Working Capital							
Volkswagen Group	-3,44	-24,12	-0,31	18,39	21,88	33,74	
General Motors	-1,81	-8,98	-8,15	-6,95	-9,92	1,01	
Ford	20,25	99,18	22,2	19,08	15,92	19,55	
Tesla	-0,03	0,43	-1,11	-1,68	1,43	12,47	
Toyota	13,83	1,38	6,34	0,18	10,29	10,24	
Nissan	31,31	40,04	46,39	36,51	31,17	35,06	
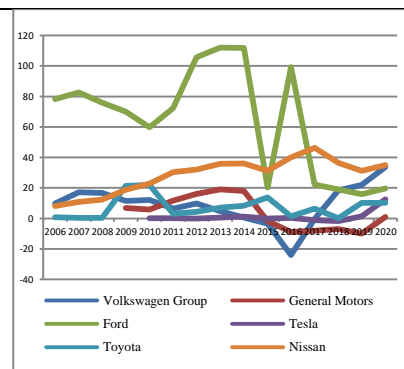
ROI							
Volkswagen Group	9.6	8.2	12.1	11	11.2	6.5	
General Motors	7.26	9.07	8.21	4.02	4.67	5.21	
Ford	10.07	4.28	3.72	2.3	0.42	-3.06	
Tesla	-23.7	-10.5	-11.5	-2.66	-0.39	7.81	
Toyota	10.11	7.82	7.4	8.52	8.32	5.7	
Nissan	8.19	7.99	5.83	5.04	0.61	-2.76	
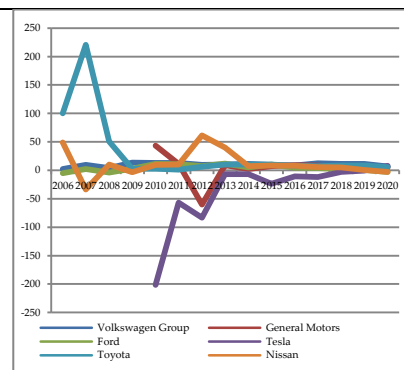
R&D expenditure per employee, in US dollars							
Volkswagen Group	26679	25857	24345	24437	24640	24879	
General Motors	34884	29333	40556	45087	41460	42330	
Ford	33668	36318	39604	41206	38950	38170	
Tesla	54909	46901	36705	29908	27970	21200	
Toyota	27846	28863	27156	27502	25990	28400	
Nissan	33289	34084	34048	35927	35890	34980	
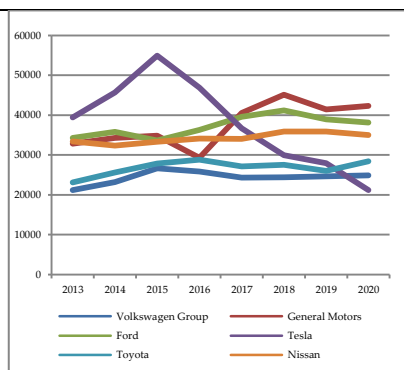
Investments in fixed assets per employee, in US dollars							
Volkswagen Group	25757	25071	24280	24364	24507	24600	
General Motors	36294	41777	46111	50289	45739	44500	
Ford	35678	34328	34896	48713	40168	30870	
Tesla	125211	71983	90962	43020	27740	44760	
Toyota	32639	35340	31719	33666	36340	35740	
Nissan	29978	32618	33333	35020	35120	34770	
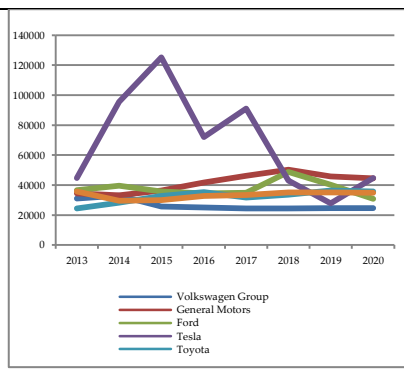
Sources: [42-47]

Appendix C

Table C 1. The results of correlation analysis

Volkswagen Group

	y	x1	x2	x3	x4	x5	x6
y		0,968	-0,35	0,977	0,06354	-0,5546	-0,3156
x1			-0,44	0,9862	0,099714	-0,60213	-0,36573
x2				-0,352	-0,02744	0,299116	-0,07851
x3					0,192891	-0,60952	-0,4012
x4						-0,01119	-0,27183
x5							0,32999
x6							

General Motors Company

	y	x1	x2	x3	x4	x5	x6
y		0,2765	-0,198	0,56651	-0,3134424	-0,3638775	0,619941
x1			-0,830	-0,3476	0,1292765	0,1156681	0,01262988
x2				0,1745	-0,00743	-0,25731	-0,03397
x3					-0,77639	-0,02905	0,772513
x4						-0,23424	-0,70161
x5							0,006876
x6							

Toyota

	y	x1	x2	x3	x4	x5	x6
y		0,8284	0,6397	0,58273	-0,2519216	0,2764967	-0,4219992
x1			0,9115	0,89829	-0,3380505	0,0241881	-0,7331428
x2				0,8223	-0,54207	0,161549	-0,64513
x3					-0,18496	-0,23604	-0,90118
x4						-0,36349	0,168723
x5							0,284665
x6							

Nissan

	y	x1	x2	x3	x4	x5	x6
y		0,8446	0,3224	0,87792	0,5731495	-0,2289875	0,3422739
x1			0,6898	0,8906	0,5251836	-0,2927152	0,4128872
x2				0,4511	0,550077	0,104498	0,018077
x3					0,557861	-0,51678	0,413806
x4						0,089118	-0,0117
x5							-0,35341
x6							

		Ford					
	y	x1	x2	x3	x4	x5	x6
y		0,8472	-0,356	0,82722	-0,5764233	-0,7214181	0,4712286
x1			-0,207	0,89162	-0,3557031	-0,878311	0,5644874
x2				-0,38	0,324326	0,33132	0,173779
x3					-0,54678	-0,88928	0,189962
x4						0,348716	0,007346
x5							-0,30435
x6							

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