






Modeling the Impact of the Creative Industry on National Sustainable Educational Development in France



Svitlana Kryshchanovych^{1*}, Ihor Lapychak², Oleh Sydorko³, Maryan Ostrovskyy³, Roman Petryna⁴

¹ Department of Pedagogy and Psychology, Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv 79000, Ukraine

² Department of Football, Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv 79000, Ukraine

³ Department of Water and Non-Olympic Sports, Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv 79000, Ukraine

⁴ Department of Gymnastics and Choreography, Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv 79000, Ukraine

Corresponding Author Email: skryshchanovych@ldufk.edu.ua

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ABSTRACT

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The principal aim of this article is to delineate the models that illustrate how creativity impacts a country's sustainable development. The object of this study is the creative industry within various domains of public life in France, including the sports sector. It also encompasses the sustainable development system and its essential indicators, such as the evolution of creative elements across different industries, and the workforce specializing in these sectors. The scientific task at hand is the formulation of a model demonstrating the sustainable influence of creative industries on the sustainable development system. The methodology adopted for this research integrates "cost-output" modeling methods and a computational general equilibrium model. As an outcome of this investigation, we present the cost-output model and its multipliers, as well as a computational general equilibrium model. The innovative aspect of this article lies in the calculated results showcasing the sustainable effect on the country from the creative industry. The study's boundaries are defined by the sustainable development system of France alone, as well as the chosen research methods and the types of creative industries considered for investigation. Future research prospects should focus on probing the influence of creative industries from other sectors within the country, including an in-depth examination of the sports sector and other industries.

1. INTRODUCTION

Today, one of the most priority areas for sustainable educational development in most countries of the world is significant support for the sectors of the economy that belong to the creative industries. France is no exception. This process is explained by a number of factors, including a gradual transition to a creative economy, which, in turn, leads to the need for certain changes in the state as a whole. The sustainable development of creative industries are important components of modern society and are necessary for the further sustainable development of the states of the world.

Summarizing, this is a way of organizing the activities of a society in which it can exist in the long term. It strives to achieve social and economic justice, preserve the environment and restore used natural resources. Gradually, more and more attention at different levels is paid to the products of human intellectual and creative activity, creative industries are rapidly coming to the fore. All this leads to the need for changes both in the economy and business, and in the field of law, in terms of the rules governing these issues. These factors in the modern world are one of the fundamental for the development of a modern state.

The main result of the sustainable educational development

of modern economic systems for the intellectualization of the economy is the generation of new ideas commercialized in innovation. Innovation and its creative use are becoming the most valuable economic resources, and creativity is the main source of economic value. Accordingly, the success of an enterprise is determined by the effectiveness of the synthesis of creativity, entrepreneurship and technological innovation. Creative industries and services emerging at the intersection of art, culture, business and technology today form the basis of a sustainable, developed and self-sufficient sector of the global economy. In the context, creative industries and creative entrepreneurship are relatively new concepts, but for more than ten years they have been well known in Europe, the United States and other developed countries due to the possibility of practical adaptation.

The impact of creativity on the economy is determined by such indicators as the creation of new jobs, the ability to attract investments and use them effectively, the creation of value chains in which representatives of the "traditional" and creative industries combine and interact.

The creative industries include a variety of activities, the oldest of which are theater, music, visual arts, and some very young and appeared with the advent of digital technologies. These are cinema, information technology, the development of

mobile applications, video games of generations with virtual or augmented reality.

Thus, today the creative industries play a key role in ensuring sustainable development around the world, including in France. However, an important problem is that, despite the significant relevance, there are still no effective methodologies for assessing the impact on the sustainable development system of France from the creative industries.

The main purpose of the article is to define models of the influence of creativity on the sustainable development in France. The scientific task is to form a model of the sustainable impact of creative industries on the system of sustainable development. The object of the study is the creative industry and the system of sustainable educational development.

2. LITERATURE REVIEW

2.1 The essence of creative industries in the modern realities of sustainable growth

Researchers in the literatures [1-3] note that the essence and place of creative industries in the modern realities of the life of the population of a country, region, city can be noted that they are becoming the most important tool for the sustainable development of society. It is the products of the creative industry, more than other types of production, that influence the formation of the worldview of society. The symbiosis of cultural and creative industries in the economy creates conditions for the emergence of new types of entrepreneurial activity and affects the revival and further sustainable development of almost all sectors of the economy.

As noted in the literatures [4-6], the accelerated pace of sustainable growth contributes to the accumulation of capital, which positively affects the sustainable development of the social infrastructure of the city, thereby improving the quality of life of the population and ensuring the achievement of such sustainable development goals: the elimination of poverty in all its forms; ensuring healthy lifestyles and promoting well-being for all at all ages; promoting steady, inclusive and sustainable economic growth; full and productive employment and decent work for all; rational forest management, combating desertification, stopping the process of land degradation and loss of biological diversity.

2.2 Features of the development of creative industries in the modern realities of the economy

As noted in the literatures [7-10], the impact of the creative industry on the economy has different levels. First of all, they consider the direct impact of the creative industry on the economy, an example of which is the increase in output in the creative industries is equivalent to the amount of additional final consumer spending of the general government sector on goods and services of the creative industry. Creative industries simultaneously consume and supply goods and services to other industries, and also require an additional increase in their own intermediate consumption to produce a finished product. This leads to the formation of indirect influences on output growth due to additional demand for finished products or services. With an increase in the output of industries, households engaged in manufacturing receive more income, which means an increase in their consumption. The impact of increased consumption is called induced.

It is correctly understood in the literatures [11-13] that the creative industries are defined as having distinct characteristics from other sectors of the economy, which means that they need to be studied separately. The final products of the creative industries are subjective, their consumption depends on personal preferences, which makes it impossible to predict economic success in advance. Secondly, participants in these sectors receive non-monetary rewards for their products, such as: creative self-realization, which makes it difficult to regulate or determine the quality, characteristics and quantity of artists for producers. Third, creative items can come in an unlimited variety of shapes, and some of them require a wide range of crafting abilities.

According to the review of the literature, we can state that to date, most scientific sources confirm the importance of the impact of creative industries on the sustainable educational development of countries. However, it should also be noted that today there are practically no generally accepted methods for assessing the impact and analysis of the indicators of creative industries on sustainable educational development. Considering this the scientific task is to form a model of the sustainable effect of creative industries on the country's sustainable development system.

Within the framework of the current research question, a number of key goals should be implemented: to choose the most appropriate method and formulas for research, to form a specific model and highlight key results.

3. METHODOLOGY

3.1 Characteristics of the main methods

There are several ways to measure the overall impact (including direct and indirect effects) of creative industries on sustainable development. In particular, the main methods are the use of input-output tables and multipliers, as well as the use of econometric models that assess the broad impact of the creative industry on the sustainable development of a country or region. It should be noted at the outset that this study is quantitative in that it presents objective values for the impact of creative industries on sustainable educational development in France.

To calculate the economic impact of the creative industry on sustainable development as a whole, we use two methods. The first method is the cost-output model, which allows you to calculate how an exogenous increase in final consumer spending of the general government sector on CI goods and services will affect sustainable development. That is, in addition to the direct effect of the increase in costs in the industry, the multiplier effect caused by the increase in intermediate consumption is taken into account, as well as the induced effect, that is, the additional growth of the economy from the increase in consumption by households that received additional income. At the second stage, the computable general equilibrium model (computable general equilibrium models (CGE)) was used. CGE model is efficient tool for assessing the possible consequences of a particular course of economic policy of sustainable development with their help, it is especially convenient to model the effect of changes in the influence of individual areas on the economy and sustainable educational development. The advantage of these models and that, unlike purely econometric models with empirically established causal relationships, regional CGE models are

based on the basic provisions of modern economic theory.

The latter makes it possible to measure not only the impact of additional government consumption in the industry, but also the impact of increased capital in the creative industry.

Computable general equilibrium models (CGE) combine economic theory and real economic data to evaluate sustainable policies. The theory is expressed by a set of equations that describe the behavioral response of economic agents (sectors of the economy, households, government, external sector). The model is based on the general theory of equilibrium and is aimed at analyzing the long-term effects of economic changes in detail (at the level of individual industries, sectors). The principle of general equilibrium means that a set of separate markets is a complete reflection of the economic system, the goods and services produced, as well as factors of production, are fully consumed. Resources in the system are limited, economic agents compete for resources. The model assumes that markets are perfectly competitive. Equilibration of markets occurs through appropriate pricing, which is the usual balancing of supply and demand.

The application of mathematical methods for the sustainable development of the economy has a long tradition. Many modeling approaches, such as optimization models and computable general equilibrium models, have become classics [14]. Today, econometric models cost-output model and computable general equilibrium models (CGE) are considered to be the main tool for economic modeling.

The proposed methods involve the use of a number of indicators generally accepted in the context of their implementation technique. But all the equalities and data used in this study concerned the realities of France.

3.2 Explaining the processes for applying methods

Based on the output flow table data, we start the analysis from the symmetric table of intermediate consumption and calculate the matrix of coefficients of intermediate consumption (A). For this, each cross-industry operation is divided by the total volume of output. The element a_{ij} of matrix A denotes the amount of output of industry i, which is used by industry j in its production. Gross output (X) is equal to the sum of intermediate consumption (AX) and exogenous final consumption expenditure (F). I denotes the identity matrix.

Let's call $(I-AX)^{-1}$ the matrix L. This is the multiplier matrix or the inverse Leontiev matrix and shows the cumulative effect of an exogenous change in demand on all industries. In the input-output model, the inverse matrix is the difference between the identity matrix and the technology matrix. The sum of the coefficients of the -jth column is the multiplier of the j industry (1):

$$(X_{mult})_j = \sum L_{ij} \quad (1)$$

Let V_i denote the share of gross value added in the gross output of industry i. Then the multiplier of gross value added for the j-th industry will be equal to (2):

$$(V_{mult})_j = \sum V_i L_{ij} / V_j \quad (2)$$

The value added multiplier is the ratio of the total direct and indirect change in value added to the direct change in value added for a particular sector. It is also possible to compare the volume of growth in gross value added and the increase in final consumption of the general government sector. The formula of

such a multiplier is equal to the numerator of the previous indicator, but the comparison goes to the initial change in costs, so the division by the share of value added does not occur (3):

$$(V_{mult})_j = \sum V_i L_{ij} \quad (3)$$

When the effect of intermediate consumption is taken into account, this is a Type I multiplier. To include the additional effect of household income and expenditure, we add the household account matrix A (compensation of employees and household final consumption expenditure). New coefficients for the expanded matrix come out, and the rest of the procedures are identical. This is a type II multiplier.

The cost-output model assumes a linear relationship between costs and output, as well as between final demand and output. It is assumed that all firms in every industry have the same production technology and that domestic supply is perfectly elastic, i.e., there are no production capacity issues. These assumptions are often not true. For example, if the government increases consumption, firms may not have the capacity to meet that demand. In addition, the industry should receive resources that are limited in the economy. Additional revenues are valued through consumption rather than investment. To address these shortcomings, we also use the second approach, namely the computational general equilibrium model.

3.3 Limitations

Taking into account all aspects, it should be noted that the vast majority of the presented indicators to one degree or another depend on the dynamics of the external environment, and, accordingly, changes in the latter will cause changes in the indicators.

It should also be noted that the methods we have chosen have problems and disadvantages. Key issues relate to the fact that as a result of a dynamic external environment, the creative industry in France is in constant change, and it may happen that these methods can no longer correctly describe and analyze all the influences of the creative industries.

One of the key criteria for authenticity was the presentation of exclusively official statistics. All calculation results were verified with strict observance of the rules and mechanisms for using these methods.

The main one that we chose as part of our study was the creative industry and the sustainable development system of France. One should always narrow one's research within one socio-economic system, since each such system has its own specifics. All data covers 2018-2022. Considering that at the time of writing, the data for 2023 was not yet in full. The data obtained was taken from official French static sources related to the development of the creative industries, part of the data on sustainable development was obtained from Eurostat statistics for France.

4. RESULTS OF RESEARCH

4.1 Identification of trends and dynamics of the influence of the creative industry on the sustainable educational development of France

Summarizing the information obtained from scientific and

practical literature, we got the result that the impact of the creative industry on sustainable development has different levels. First of all, they consider the direct impact of the creative industry on sustainable development - this is the direct quantitative contribution of these industries to overall production, value added, income and employment. They also highlight the indirect and induced impact of the creative industry on sustainable development through their positive multiplier effect on the overall economy and other sectors (production, income, employment) that are connected by intersectoral links with the creative industry through supply and consumption chains. The direct and indirect and induced effects of the creative industry on sustainable development, in turn, also affect government tax revenues (Figure 1).

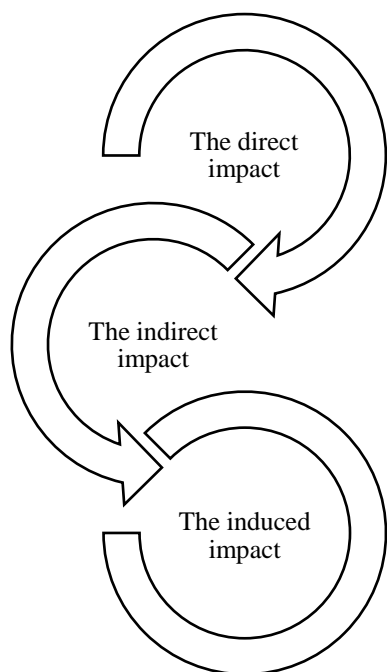


Figure 1. Levels of influence of the creative industry on sustainable development

Let's conduct a biased analysis of the dynamics of the development of the creative industry in France (Figure 2).

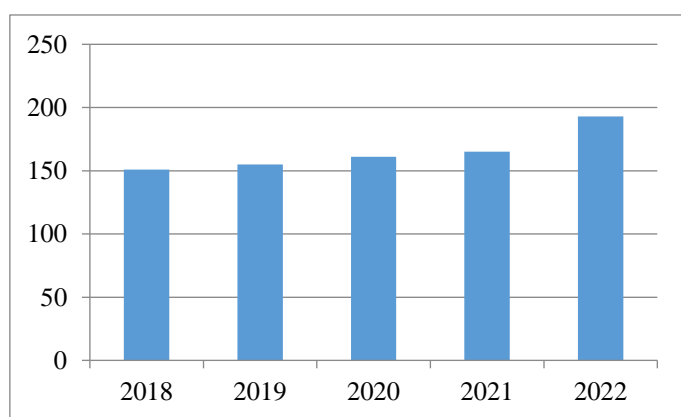


Figure 2. Trend analysis of the dynamics of the number of creative industry firms in France [15]

The model of public spending multipliers in the creative industries of France in the framework of sustainable development is presented in Table 1.

Table 1. Model of multipliers of public spending in the creative industries of France in the framework of sustainable development [15]

Industry	Gross Output Multiplier		Gross Value Added Multiplier		Additional Euro of Government End-Use Spending to Increase Gross Value Added
	Type 1	Type 2	Type 1	Type 2	
Creative industries	1.78	2.88	1.72	2.20	0.88
Manufacture of jewelry, bijouterie, musical instruments	1.82	3.1	1.61	2.21	0.82
Publishing house	1.90	2.77	2.47	3.32	0.59
Audiovisual and auditory art	2.1	3.67	2.13	2.9	1.01
Sport sector	1.78	2.69	1.76	2.17	0.84
Public relations, marketing, advertising	1.68	2.93	1.4	1.75	1.06
Architecture	2.21	3.55	2.74	3.72	0.87
Design, photography, translation activities	2.03	3.11	2.39	3.06	0.85
Performing and other arts	1.53	3.04	1.52	2.19	0.84
Libraries, museums, archives	1.63	2.31	3.17	4.31	0.44

4.2 The formation of CGE model in the framework of sustainable development

Therefore, with an increase in demand for goods and services of the creative industries by 1 euro, the total gross output increases by 2.88 euros. Of this amount, 1 euro represents a direct increase in spending on the creative industries, 78 coins represent the effect of intermediate consumption (indirect effect) and another 1 euro 10 coins adds the effect of increased household final consumption expenditure (induced effect).

The overall gross value added multiplier is 2.20. This means that an increase in the value added created by the creative industries by 1 euro causes an increase in the gross value added in the economy by 2.20 euros. That is, an additional 1.20 euros of added value was created. Of these, 72 coins come from intermediate consumption (indirect impact) and 48 coins from additional consumption by households (induced impact).

The input-output model estimates the impact of an increase in general government final consumer spending and assumes that domestic supply is perfectly elastic, i.e., there are no production capacity problems. These assumptions are exaggerated. Economic resources are limited and industries compete for them. Thus, an increase in one industry can cause an outflow in other industries. Moreover, in addition to the effect of increasing the final consumption of the general

government sector, for example, the purchase of printed materials (books for students), ordering a design or holding a concert, the state can also contribute to the capital of the creative industry, which will contribute to the sustainable development of the capacities of the creative industries. In

general, among public spending on culture, it is difficult to distinguish between consumption and investment.

The results of calculations of the CGE model within the framework of ensuring sustainable development are presented in Table 2.

Table 2. Calculation results of the CGE model in the framework of sustainable development [15]

Industry	The Size of Capital Investments	The Size of Capital Investments in % of GDP	Final GDP Change	Final GDP Change in %	The Final Change in GDP Per 1 Euro of Capital Investment
Manufacture of jewelry, bijouterie, musical instruments	14 950	0.00042	29 503	0.00083	1,973
Publishing house	58 950	0.002	122 967	0.003	2,086
Audiovisual and auditory art	194 950	0.005	377 638	0.011	1,937
Programming	2 150 250	0.06	6 802 233	0.191	3,163
Public relations, marketing, advertising	1 050 400	0.029	2 068 238	0.058	1,969
Architecture	58 950	0.002	122 967	0.003	2,086
Design, photography, translation activities	106 150	0.003	207 856	0.006	1,958
Performing and other arts	111 550	0.003	225 783	0.006	2,024
Libraries, museums, archives	5 000	0.00014	10 793	0.0003	2,159

The CGE model allows us to assess the impact of investment in creative industries. The calculation results indicate that the effect of additional investments and capacity expansion significantly exceeds the effect of additional consumption in the input-output model. The results of the industry's capital growth by 5% are presented. Since the absolute value of capital is different, the absolute change in capital is also different. However, the results do not change significantly with changes in the size of investments and are stable. The sizes of multipliers for creative industries in most cases are on the same level. The exception is the programming industry, for which the total GDP growth for one Euro of capital investments is 3.2 Euro. For other industries, such a multiplier is 1.9-2.2, which is significantly higher compared to the estimate of 0.4-1.0 in the input-output model.

Thus, the end result of the study is to confirm the theses about the importance of searching for and presenting new methodological approaches to assessing the level of influence of creative industries on sustainable development. The presented tables represent the calculations required for the calculation results of the CGE model in the framework of sustainable development.

One of the key limitations and reservations when using these models is the fact that the external environment changes dynamically. It can undermine the reliability of the results in cases of large and critical changes.

Consequently, investment in the creative industries has a much larger effect on sustainable growth than simply increasing government consumption. Thus, we can conclude that with public spending in the creative industries, in order to achieve a more significant sustainable effect, it is necessary not only to increase the costs for industries and the consumption of their products, but also to focus on the sustainable development of the production capacity of these industries.

Discussing the results of our study, it should be noted that, returning to the literature review section, we established the importance of the influence of creative industries on the sustainable development of different countries, including France. The results obtained once again confirm the opinion put forward in the previous sections.

5. DISCUSSIONS

5.1 Multiplier effects and spillovers

When discussing our results, we should compare them with similar ones and highlight the uniqueness of our own. Scientists [16-18] have brought as a result that the unique properties of human capital, talent, knowledge can become an impetus for the sustainable development of the domestic economy, be realized in the form of creative industries and act as a tool for generating added value on a nationwide scale, supplying the consumer with innovative products. In France, the adoption of a strategic policy document is relevant, within the framework of which the state will carry out purposeful work on the formation and sustainable development of creative potential. At the state level, it is necessary to address issues of supporting creative industries, which consist in the simultaneous sustainable development of the following areas: 1) the formation of policies and protection, the improvement of the activities of professional networks and unions; 2) strengthening organizational conditions, in particular through the introduction of special education and lifelong learning; 3) expanding the functions of incubators and accelerators; 4) organization of clusters, hubs and co-working spaces; 5) internationalization and globalization.

5.2 Strategies for maximizing sustainability impacts

In particular, scientists [19-21] have come to the conclusion that the creative industry is an important engine of economic and social innovation in the economy. They support innovation in many other sectors (i.e., industrial innovation) through the provision of creative ideas for new products (i.e., innovative content), creative goods and services used in manufacturing processes (i.e., software), and marketing support for innovative products (innovative design). They also contribute to the sustainable development of flexible, mobile and multidisciplinary networks, project organization of work processes, sustainable development of human capital and creative abilities (creative problem-solving skills). Accordingly, the creative industry contributes to the introduction of new ideas and technologies in other sectors,

increasing their productivity and competitiveness.

Discussing the levels of impact on sustainable development that we have obtained, it should be noted that some other scientists [22-24], in addition, single out a wider impact of the creative industry on society and the economy through the dissemination of concepts, ideas, skills, knowledge, which contributes to the sustainable development of innovation, technological progress, increase quality of life (these are the so-called external effects of the creative industry - Spillovers or positive externalities). Creative industry externalities can also influence cross-industry linkages and change indirect and induced influences.

Comparing our studies with similar ones, it should be noted that our study has a number of similarities. For example, in affirming the fact that ensuring sustainable development is essential for every socio-economic industry.

Thus, our conclusions allow us to state that the proposed methodological approach develops the spectrum of sustainable development.

5.3 Limitations and directions for future research

The innovative elements of the article present the results of calculating the sustainable effect for the country from the creative industry.

Discussing the practical significance of the results obtained, it should be noted that it is based on the use of the proposed methodological approach in the practical activities of leaders of creative industries in the context of optimizing their contribution to the sustainable development of the country.

Comparing our study with existing ones, we should also note its limitations. Thus, the study is limited to taking into account only the sustainable development system of France, while only key creative industries were selected, which may create minor errors in reproducing the whole picture and analyzing sustainable development in this country. In addition, the study is limited to a number of methods that have been used, which also have both advantages and disadvantages. The prospects for further research should be devoted to studying the impact of the creative industry on other industries and countries.

6. CONCLUSIONS

6.1 Key takeaways regarding the sustainable impact of the creative industry

In summary, the importance of the creative industries, which lies at the crossroads of art, business and technology, is constantly growing - both at the national level and in comparison with the competitiveness of countries at the international level. Creative industries in France include visual arts, performing arts, publishing, design, fashion, IT, audiovisual arts, architecture, advertising, libraries, archives and museums, folk arts and crafts.

The transformation of the education system requires a radical reform aimed at bringing the quality of specialist training in line with the requirements of a creative economy. A modern professional should not only have certain knowledge and skills, but also be able to generate them during his life. Yes, it is necessary to introduce programs to support creative entrepreneurship, work on grants, introduce educational programs in this area, facilitate the opening of new

enterprises in the creative economy sector, and provide soft loans for them.

To estimate the sustainable effect of creative industries, this paper used the cost-output model, as well as the computational general equilibrium (CGE) model. The first method allows you to calculate how the increase in government consumption of products and services of the creative industry affects the entire system of sustainable development. That is, in addition to the direct impact of the increase in costs in the industry, the multiplier indirect impact caused by the growth of intermediate consumption is taken into account, as well as the induced impact, that is, additional stable growth from the increase in consumption by households that received additional income. At the second stage, the CGE model was used, which makes it possible to measure not only the impact of additional government consumption in the industry, but also the impact of capital investments.

6.2 Practical implications, limitations and directions for future research

The study presented by us fills a gap in the search for new methodological approaches to optimizing the impact of creative industries on the country's sustainable development system.

The key recommendations that we can give as a result is the search for resource support for the implementation of the model of the influence of creative industries on the country's sustainable development system.

In the future, in our opinion, there should be an optimization of the resource provision of these processes.

As a result of the study, the input-output model and its multipliers and the computational general equilibrium model were presented. Discussing the practical significance of the results obtained, it should be noted that it is based on the use of the proposed methodological approach in the practical activities of leaders of creative industries in the context of optimizing their contribution to the sustainable development of the country.

The study is limited to taking into account the sustainable development system of France only, as well as the selected research methods and types of creative industries that were taken for the study. Prospects for further research should be devoted to the study of the impact of the creative industry on other industries and countries.

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