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A COMPARATIVE STUDY OF DEMAND MOTIVES IN EDUCATION AND KNOWLEDGE PRODUCTION USING DATA ENVELOPMENT ANALYSIS (DEA)

Abstract. Education serves as the primary avenue for preparing, training, and empowering individuals, endowing them with the necessary skills for continuous innovation and creativity. It plays a pivotal role in furnishing society with the competencies required to effectively fulfill responsibilities and undertake developmental endeavors. Crucially, education enhances the cognitive capacities of individuals, enabling them to actively and competently engage in the knowledge-based society and the ongoing information revolution. This research aims to underscore the economic significance of education, highlighting that expenditures on education constitute not mere consumption but rather investments yielding substantial economic and social dividends and have a great importance in the production of knowledge. The findings of this study substantiate multiple economic benefits of education. On an individual level, a direct correlation exists between educational attainment and personal income. Moreover, education fosters heightened worker productivity, thereby contributing to a discernible upsurge in the gross national product. At the macro level, employing the method of Data Envelopment Analysis, we assessed economic efficiency across 49 countries worldwide. The study reveals that, on average, efficiency, assuming variable returns to scale (TEVRS), stood at 88.7%. Particularly noteworthy is the discovery that 14 countries, constituting 28.6% of the sample, attained maximum efficiency.

Keywords: education, human capital, economic returns to education, efficiency, Data Envelopment Analysis.

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Introduction. The educational landscape amidst the knowledge revolution of the third millennium is undergoing rapid metamorphosis. This transformation is characterized by a surge in the demand for educational services, heightened academic mobility transcending national borders, and an array of evolving teaching and learning methodologies and technologies. The shift towards knowledge societies necessitates several key adaptations: the establishment of enduring centers for continuous and lifelong

learning, heightened expectations for transparency and contemporary quality assurance mechanisms, the diversification of university structures and governance policies, and the imperative to diversify funding streams while ensuring financial sustainability. These imperatives underscore the need for a reevaluation of strategies, future trajectories, and policies aimed at enhancing education capabilities across governance, quality assurance, accessibility, and resource optimization.

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To achieve competitiveness within knowledge and educational systems, two fundamental types of services are deemed essential. Firstly, there is a necessity to cultivate a broad pool of human resources adept at navigating the intricacies of the knowledge society in the third millennium. Secondly, there lies an imperative to ensure the sustainability, evolution, and modernization of knowledge itself. This underscores the criticality of lifelong educational services that empower individuals to adapt to change and equip them with the qualifications requisite for continuous learning.

This paper endeavors to scrutinize the primary drivers behind both public and private demands for education, as well as the underlying motivations driving investments in the field owing to its returns. Commencing with a theoretical framework delineating the importance, essence, and pivotal indicators of education, we delve into an exploration of the rationales underpinning the overarching demand for education, the incentives for national investments in the field, and ensuing theories, notably those centered on human capital investment as the primary catalyst for societal advancement and development. Finally, we delve into an examination of individual and global demands for education and their motivations, recognizing wages as a principal driving force. We delve into theories positing that higher levels of educational attainment correlate with amplified returns and income, a concept commonly referred to as the economic return to education.

The significance of this study lies in its endeavor to:

- Reconceive education as an investment expenditure, departing from its conventional characterization.

- Illuminate its role in cultivating individuals' cognitive assets and the resultant returns yielded therein.

This study investigates the educational sector's demand for knowledge production and the public demand for education and spending on it in order to achieve the highest levels of knowledge production.

Education from growth to development. Development thought has been preoccupied with explaining the relationship between education and economic and social growth for a long time, but this relationship did not emerge clearly until the economy jumped to the forefront of societies' concerns through the first industrial revolution, and the fundamental changes it brought about in the economic and social structures.

Theories based on economic construction. These are the theories that linked education to the economy and made it a basis for explaining economic growth processes and accelerating its growth rates on the basis that increasing economic growth will lead to an increase in the income of the educated person, and thus bring about social, political and cultural changes.

Education and human capital theory. The period 1960-1970 is the stage in which this field flourished and applied studies and research developed. There are those who call it the stage of enthusiasm.

Theodore Schultz argued that investments in people, particularly education, are crucial for economic growth. Schultz viewed education as a form of "human capital" that

directly benefits individuals and boosts their economic potential [1]. He further categorized investments in human capital into five areas: health, job training, formal education, adult education, and migration for better job opportunities [2].

Becker, a key contributor to human capital theory, focused on how investments in human capital (education, health, migration) increase both material and non-material income. He differentiated between general and specialized training. Individuals typically bear the cost of general training, as these skills are transferable across jobs. Conversely, organizations often invest in specialized training, as those skills are specific to their needs. Since specialized training is expensive and non-transferable, organizations try to retain employees with high wages and good working conditions to avoid losing this "capital investment" [3].

Mincer aimed to understand how investments in training (formal, informal, and experience) affect income distribution [4]. He identified three research goals: 1) measuring resource allocation for training, 2) calculating the return on investment, and 3) using cost-benefit analysis to explain individual behavior. Mincer's research found that higher education levels lead to more training and higher wages. He also concluded that high job turnover and unemployment rates increase training costs, while investment in training, especially specialized training, improves employee retention and stability [5].

Economist Kenneth Arrow's filter theory (1973) criticizes human capital theory's view of education boosting productivity and income. Arrow argues that education acts as a "filter" sorting

individuals based on pre-existing skills, not creating them. Skilled people naturally seek higher education to signal their abilities to employers, leading to higher wages. While education may enhance individual productivity, Arrow suggests it doesn't necessarily increase societal productivity from an employer's perspective. This theory challenges, but doesn't entirely dismiss, the claims of human capital theory [6].

The residual factor theory. Building on Schultz's work, economist Ed Denson emphasized education's direct role in boosting national income. Denson studied the growth of the US national product and found a significant unexplained increase that couldn't be attributed to changes in human capital (labor force) or physical capital. In a later study, he estimated that investment in education contributed roughly 23% to US national income growth by increasing worker education levels. This effect, Denson suggested, varied between industrialized and developing countries and decreased over time (from 23% pre-1950 to 15% in the 1950s and 1960s) [7].

Education and labor market segmentation theory (P. B. Doeringer, M. J. Piore). This theory analyzes the link between education and individual income by examining the labor market's structure. It argues that factors like industry type, market conditions, technology, and labor management practices all influence job composition and how workers are allocated across different sectors. Unlike a single market, the theory sees the labor market as a collection of sub-markets, each with its own needs for specific skillsets and education levels. This approach highlights the importance of tailoring

education to meet the demands of different economic sectors. By preparing a workforce with the right skills, this theory suggests we can both justify investment in education and reduce the risk of unemployment among educated individuals [8].

Theories based on economic and social structures. This approach views education and development as mutually reinforcing, where each drives the other. It encompasses various theoretical models, but aligns with the United Nations Development Programme's focus on human capital. This approach prioritizes people over material capital and sees education as the key to skill development, knowledge acquisition, and ultimately, development itself. The passage emphasizes the consensus that cultural and educational environments have a significant impact on development, with better conditions leading to faster development [9].

Educational demand for knowledge production: A comparative study through the use of data envelopment analysis. This study investigates the educational sector's demand for knowledge production through a comparative analysis using Data Envelopment Analysis (DEA).

Developed by Farrell (1957), DEA was later popularized and further developed by Charnes et al. (1978) [10]. It has become a widely used quantitative method for evaluating the efficiency of decision-making units, with applications in diverse fields like banking and education. Since its introduction, DEA has emerged as a prominent non-parametric technique employed in various fields, including agriculture, finance, supply chains, transportation, and public policy [11].

DEA models are characterized by specific assumptions concerning efficient boundaries, categorized by returns to scale and orientation. The initial DEA model CCR was named after its creators, Charnes, Cooper, and Rhodes. Subsequently, the BCC model, developed by Banker, Charnes, and Cooper, incorporated the concept of variable returns to scale, acknowledging that efficiency is not always directly proportional to increased resource usage.

DEA can do many things like Benchmarking and Improvement, Data Envelopment Analysis (DEA) facilitates comparative analysis, identifying top performers (efficient units) and those with potential for improvement (inefficient units). This enables benchmarking, allowing inefficient units to learn from the best practices of efficient ones and enhance their performance.

Identifying Cost-Saving Opportunities. DEA can quantify the potential cost savings and resource reallocation opportunities achievable by inefficient units if they operate at the same level as efficient units. This provides tangible targets for improvement and efficiency gains.

Optimized Resource Allocation. DEA equips inefficient units with insights into how efficient units utilize resources. This information can be used to rationalize future spending by aligning it with best practices and optimize resource allocation.

Management Insights and System Transformation. DEA generates valuable management data on the performance of individual service units. This data can inform system-wide transformations and initiatives that share expertise

from successful managers and efficient units with less efficient ones. Ultimately, this leads to improved outcomes, reduced operating costs, and increased profitability [12].

Certain conditions, as identified by W. Cooper's studies, must be met to ensure the validity and accuracy of DEA results. Failure to follow these conditions can weaken the model's ability to differentiate between efficient and inefficient units.

The sample size (SS) must be greater than three times the product of the number of inputs (I) and outputs (O) used in the analysis. This rule, expressed as $SS > 3 * I * O$, ensures sufficient data points for robust analysis.

To maintain a meaningful distinction between efficient and inefficient units, the number of units deemed fully efficient (100% efficiency) should not exceed one-third of the sample size. This "one-third rule" helps prevent inflated scores and ensures a more realistic distribution of efficiency levels.

By adhering to these conditions, users can improve the reliability and clarity of their DEA results and gain

more accurate insights into the relative efficiency of their decision-making units [13].

$S_{*1/3} < \text{Efficients } 100\% \text{ Decision Making Units.}$

This research employed a heterogeneous dataset encompassing 49 nations, representing a broad spectrum of geographical regions and economic statuses. The examination comprised nine pivotal variables deemed essential for evaluating the efficacy of educational systems. The criteria for selection revolved around two principal considerations:

1. Economic Status. The categorization of countries was based on the income groups delineated by the World Bank, which are determined by the Gross Domestic Product (GDP).

2. Geographical Representation. Additionally, countries were stratified based on their geographical locations and corresponding regional affiliations across the globe.

Tables 1 and 2 present a geographical and income-level distribution of the countries included in the study, as defined by the World Bank database.

Table 1

Distribution of study countries by region

Countries	Region
Indonesia, Japan, Malaysia, Mongolia, New Zealand	East Asia and the Pacific
Albania, Poland, Austria, Azerbaijan, Belgium, Bulgaria, Czechia, Denmark, Finland, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine	Europe and Central Asia
Argentina, Chile, El Salvador, Honduras, Mexico	Latin America and the Caribbean
Algeria, Iran, Lebanon, Malta, Morocco, Saudi Arabia, United Arab Emirates, Oman	Middle East and North Africa
United States of America	North America
India, Pakistan, Sri Lanka	South Asia
Guinea, Sierra Leone, South Africa, Zimbabwe	Sub-Saharan Africa

Source: The World Bank (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>).

Table 2

Distribution of countries by income level

Countries	Income level
Guinea, Zimbabwe	Low-income economics
El Salvador, Honduras, India, Indonesia, Mongolia, Morocco, Pakistan, Sri Lanka, Ukraine	Economics income below average
Albania, Algeria, Argentina, Azerbaijan, Bulgaria, Iran, Lebanon, Malaysia, Mexico, Romania, Russia, Arabs, South Africa, Turks	Upper-middle income economics
Austria, Belgium, Chile, Czechia, Denmark, Finland, Norway, New Zealand, Malta, Luxembourg, Japan, Italy, Ireland, Hungary, Oman, Poland, Saudi Arabia, Spain, Slovakia, Sweden, Switzerland, the United Arab Emirates, the United States of America	High-income economics

Source: The World Bank (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>).

For the *study variables*, the meticulous choice of inputs and outputs holds paramount importance in DEA as it significantly influences the interpretation, application, and reception of results. This study undertook the task of categorizing variables into distinct inputs and outputs as follows:

Inputs:

- Expenditure on Education.
- Human Capital (Comprising University and Pre-university Enrollment Rates).

Outputs:

- Cognitive Indicators of Education, encompassing six variables:
 - Number of Patent Applications.
 - Quantity of Scientific Articles Published per Million Individuals.
 - Knowledge Index.
 - Education and Human Resources Index.
 - Creativity Index.
 - Information and Communication Technology Index.

The data primarily relied on information from the year 2021 for most of the variables examined.

Technical Efficiency under Constant Returns to Scale (TE_{CRS}). Merely 9

nations, constituting less than one-fifth of the sample, demonstrated optimal efficiency, signifying their adept utilization of inputs and outputs. This efficient subset comprised four high-income countries, one upper-middle-income nation (Romania), two lower-middle-income countries, and two low-income countries. Mongolia exhibited the lowest efficiency rate at 44.2%. Conversely, the rest of the countries boasted technical efficiencies surpassing 50%, with an average efficiency rate of 78.2%.

Technical Efficiency under Variable Returns to Scale (TE_{VRS}). The mean technical efficiency stood at 88.7%, with 14 nations attaining full efficiency, denoting a 100% score. The United States emerged as the frontrunner across the majority of output metrics, with Switzerland, Finland, and Japan also demonstrating notable proficiency in distinct domains. Conversely, Algeria recorded the lowest efficiency at 58.1%, positioning it at the bottom of the ranking.

Efficiency Distribution by Income Level and Region. Among the high-income nations, seven countries, constituting less than one-third of the

total, attained full efficiency, averaging a commendable efficiency rate of 91.9%. Other efficient nations encompassed two low-income, two lower-middle-income, and three upper-middle-income countries, achieving an average efficiency of 81.5%. North Africa and the Middle East region exhibited the lowest average output efficiency compared to other regions (Table 3).

For *scale efficiency*, regarded as the primary diagnostic tool for pinpointing the roots of inefficiency, becomes apparent through the findings of the output-oriented study. Notably, weak technical efficiency under constant returns to scale (TECRs) emerges as a prevalent factor.

The investigation reveals that nine countries have attained complete volumetric efficiency, comprising two low-income, two lower-middle-income, and one upper-middle-income nation. With an average efficiency rate of 94.6%, this indicates a potential 5.4% enhancement in cognitive outputs utilizing existing inputs. Particularly noteworthy is the case of Algeria, which demonstrates high volumetric efficiency (92.6%) juxtaposed with low technical efficiency (60%), indicating inefficiency stems from resource utilization rather than allocation.

Similarly, Iran exhibits a divergence between its low technical efficiency and high volumetric efficiency (90.9%), implying a potential 9.1% increase in output.

Mongolia stands out with the lowest volumetric efficiency at 57.6%, while three countries (Oman, Malta and Mexico) fall within the 61-70% range. Five countries achieve efficiency rates between 71-80%, followed by 12 countries in the 81-90% range, with eight of them situated in Europe or Central Asia. The largest portion of the sample, comprising 22 countries, attains complete volumetric efficiency.

Further delineating efficiency, returns to scale categorization reveals that nine countries operate under constant returns to scale, wherein output increases proportionately with input increments. Lebanon emerges uniquely with increasing returns to scale, achieving a volumetric efficiency ratio of 99.6%. Conversely, the rest of the countries operate under decreasing returns to scale, wherein output growth lags behind input increases.

The distribution of volumetric efficiency rates is illustrated in Table 4.

In order to attain full output efficiency, the program establishes target benchmarks for countries and

Table 3

Average output-oriented efficiency by region

Region	Average efficiency
North America	1.000
Sub-Saharan Africa	1.000
Latin America and the Caribbean	0.981
Europe and Central Asia	0.913
Middle East and North Africa	0.873
South Asia	0.856
East Asia and the Pacific	0.838

Source: Results of Data Envelopment Analysis Program (DEAP).

Table 4

Volumetric efficiency rates

Volumetric efficiency, %	Number of countries
less than 60	1
61-70	3
71-80	5
81-90	12
91-100	22

Source: Results of Data Envelopment Analysis Program (DEAP).

decision-making units across different income brackets (Table 5). For nations classified within the "income below average" category, such as Ukraine, the following proposed enhancements are outlined:

- Increasing patent applications by 66.45%;
- Doubling the number of scientific articles published per million individuals;
- Elevating the knowledge index from 3.20 to 4.83;
- Enhancing the education and human resources index from 37.9 to 66.2;
- Raising the creativity index from 3.3 to 5.5;
- Augmenting the information technology index from 3.9 to 5.9.

Similarly, for countries categorized as "upper-middle-income", like Algeria, substantial improvements are suggested due to its lowest efficiency within this group. These enhancements include:

- Increasing patent applications more than eightfold, from 840 to approximately 8,000;
- Doubling all other relevant indicators, underscoring the considerable effort required by Algeria to optimize its knowledge outputs.

In the "high-income" category, exemplified by Poland, which exhibits the lowest efficiency at 70.6%, proposed improvements encompass:

- Ramping up patent applications from 4,411 to 46,480;

- Elevating the quantity of published scientific articles from 28,753 to 40,724.8;

- Enhancing the knowledge index from 29.0 to 41.1;

- Increasing the education and human resources index from 37.6 to 60.3;

- Augmenting the creativity index from 3.3 to 5.1;

- Raising the information technology index from 4.0 to 5.7.

Conclusion. Numerous scholars and researchers within the realm of education economics advocate for the implementation of public policies rooted in education, recognizing it as a fundamental variable for augmenting production and alleviating poverty. They assert that social and economic advancement remains unattainable without a concurrent increase in educational attainment. Throughout this research, we have extensively discussed the centrality of education and its significance. Commencing with an exploration of the theory that elucidates the nexus between education and the economy through the lens of the economics of education, we delved into its pivotal dimensions and various indicators.

Moreover, we underscored the imperative of investing in education and delineated its resultant consequences both at the individual and aggregate levels. While developmental thought

Table 5

Suggested improvements to achieve full output-oriented efficiency

Country	Information and Communications Technology		Creativity Index		Education and Human Resources Index		Knowledge Index		Scientific Articles per million		Patent Applications	
	Proposed Value	Original Value	Proposed Value	Original Value	Proposed Value	Original Value	Proposed Value	Original Value	Proposed Value	Original Value	Proposed Value	Original Value
Albania	5.7	4.1	4.6	2.4	57.0	27.1	27.6	19.2	5090.6	183.6	1551.1	4
Algeria	5.3	2.4	4.3	1.9	50.1	29.1	30.3	17.6	6288.1	3652.5	7999.2	840
Argentina	5.8	4.1	5.1	2.9	62.2	36.7	39.3	26.6	11346.9	8053.1	6885.8	4772
Austria	5.7	5.0	5.3	5.0	62.3	36.7	43.6	36.8	17002.3	1203.1	28618.8	2406
Azerbaijan	4.9	4.9	3.7	3.5	33.2	25.5	16.6	13.7	4947.0	481.8	2467.7	156
Belgium	5.7	5.1	5.6	5.0	64.9	54.0	49.0	41.8	27404.1	16511.3	62041.1	876
Bulgaria	5.4	4.1	5.1	3.2	54.8	35.7	46.1	35.0	14547.4	2677.3	1910.0	297
Chile	5.7	5.1	4.9	3.0	59.9	31.5	34.2	26.3	7821.2	5157.6	3449.5	3072
Czech Republic	5.3	4.3	5.2	4.1	56.6	45.7	47.4	38.3	150650.8	14022.4	237809.2	1081
Denmark	5.8	5.4	5.5	4.9	65.7	60.4	49.9	41.9	13478.2	12482.4	6951.5	1534
El Salvador	4.9	4.2	3.6	2.7	30.1	19.1	18.9	13.0	6296.9	35.4	3764.9	183
Honduras	4.4	4.2	3.1	2.8	27.5	26.8	27.8	15.9	202.0	20.0	222.9	217
Hungary	5.3	4.4	4.8	3.5	50.4	40.2	49.5	44.9	221714.5	6249.3	300304.4	708
Iceland	5.8	5.0	5.6	4.4	66.3	60.9	51.8	37.3	11183.2	575.9	1776.4	46
India	5.3	5.0	4.5	3.1	50.8	27.7	36.5	34.5	169544.0	93349.4	232309.1	43031
Indonesia	4.9	4.5	4.3	3.9	34.3	24.3	28.1	24.3	24832.3	2927.7	54986.5	7450
Iran	5.4	4.1	4.4	3.3	52.2	35.3	27.7	20.9	43678.2	32964.8	56560.5	11643
Ireland	5.4	5.2	5.4	4.0	59.9	59.3	56.2	55.6	198206.8	6874.0	262275.3	390
Italy	5.2	4.1	4.6	4.0	50.3	43.2	47.1	41.7	281899.6	66310.3	388844.3	9212
Lebanon	5.2	3.3	4.1	2.6	46.2	37.1	27.5	19.0	5968.2	1050.3	1299.5	355
Malta	5.6	5.4	5.1	3.2	59.3	33.6	46.5	44.8	8181.9	259.2	1402.0	17
Mexico	5.5	4.7	4.4	3.1	48.7	31.9	27.6	23.4	19139.1	13112.4	18227.5	15444
Mongolia	5.7	4.4	4.9	3.1	60.1	29.6	34.4	16.3	6576.6	163.9	1605.7	265
Morocco	5.0	4.2	3.7	2.6	36.1	30.5	27.4	23.2	5796.5	2536.46	2609.1	1144
New Zealand	5.9	5.2	5.5	4.1	66.0	54.9	48.0	37.2	13718.0	7244.3	7648.3	6781
Norway	5.9	5.5	5.6	4.7	67.2	55.2	50.7	36.1	10558.3	9853.6	2354.1	1749
Oman	5.8	4.7	5.0	3.4	61.2	33.8	37.0	20.1	7148.1	657.6	0	0
Poland	5.7	4.0	5.1	3.3	60.3	37.6	41.1	29.0	40724.8	28753.0	46480.6	4411
Russia	5.4	3.6	4.9	3.3	57.9	44.1	41.8	30.4	295626.4	35542.6	409359.7	44914
Saudi Arabia	5.5	5.2	4.8	3.9	56.1	39.8	38.1	24.8	8111.1	7635.6	3739.7	931
Serbia	5.3	3.4	5.2	2.5	55.5	36.7	50.8	33.6	224015.1	5169.1	348070.9	221
Slovakia	5.5	4.3	5.0	2.9	55.8	39.5	42.5	33.3	12346.8	4729.9	1826.2	210
Spain	5.5	4.9	5.0	3.5	57.5	47.9	41.6	36.8	60247.1	53342.1	72144.2	3244
Turkey	5.7	4.6	4.9	3.4	59.4	29.8	37.4	30.4	37419.2	30402.3	44357.3	4661
Ukraine	5.9	3.9	5.5	3.3	66.2	37.9	48.3	32.0	14150.1	7217.8	8143.9	5412

Source: Results of Data Envelopment Analysis Program (DEAP).

predominantly focused on elucidating the interplay between education, growth, and socioeconomic development, theories rooted in economic construction illustrated that investing in the human capital through education constitutes expenditure with a return. Such investment augments individual skills and capabilities, thereby enhancing the scale and efficiency of production. Furthermore, it fosters the proliferation of knowledge within society and catalyzes innovation. As highlighted by Sakharoupolis, Baker, Schulters, and others, every dollar allocated to education exerts a positive impact on growth and development. This proposition gains further credence from theories grounded in social construction and human development, all of which underscore the pivotal and efficacious role of education in fostering economic development.

The culmination of this research lies in the theory of the economic return to education, elucidating the primary incentive driving individuals to pursue education: namely, the economic returns it promises, along with the accruing benefits of enhanced knowledge, awareness, skills, and individual earnings.

The structure of this applied study aims to maximize cognitive outputs within a fixed spending framework. Leveraging the benchmarking feature, the study sampled 49 countries and examined nine variables, three of which pertained to inputs into the education process and six to cognitive outputs. The study revealed a non-linear relationship among these variables, necessitating the adoption of variable returns to scale (VRS), commonly known as the BCC method, in the measurement process.

A comprehensive analysis of the study's findings underscores that despite Algeria's notable strides in promoting and investing in education, it still lags behind other nations in this domain. This deficiency can be attributed to the absence of clear educational objectives guiding spending policies. Consequently, the state's approach to education revolves around mere attainment of a certain level of awareness rather than fostering value creation in society – a hallmark of developed nations. Both the lack of investment in education and the educational system's deficiencies contribute to these outcomes, characterized by a banking education paradigm focused solely on regurgitating knowledge during exams or upon employment.

Building upon the insights garnered from our research and its outcomes, we proffer the following recommendations:

- A paradigm shift in conceptualizing education from mere consumer spending to investment expenditure aimed at nurturing individuals' skills and awareness, yielding benefits for both the individual and society.

- Adoption of a curriculum predicated on setting educational goals to transform educational costs into value-added contributions within the framework of public policy.

- Facilitation of private sector involvement in education, either through training based on their specific needs or by establishing private schools or universities to augment the training process.

- Emulation of successful education and sustainable development policies from reference countries identified in this study.

- Formulation of a clear and cogent strategy or vision for the educational sector aimed at catalyzing advancements in education and sustainable development.

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ПОРІВНЯЛЬНЕ ДОСЛІДЖЕННЯ МОТИВІВ ПОПИТУ НА ОСВІТНІ ТА ДОСЛІДНИЦЬКІ ПОСЛУГИ ЗА ДОПОМОГОЮ МЕТОДУ DATA ENVELOPMENT ANALYSIS (DEA)

Анотація. Освіта є основним інструментом для підготовки, навчання та надання індивідам необхідних навичок для постійних інновацій і творчості. Вона відіграє ключову роль у забезпеченні суспільства компетенціями, необхідними для ефективного виконання обов'язків та реалізації ініціатив розвитку. Освіта розширює когнітивні можливості індивідів, дає їм змогу бути активними й компетентними членами суспільства, що базується на знаннях, в умовах інформаційної революції. Дослідження має на меті підкреслити економічне значення освіти, наголошуючи на тому, що витрати на освіту є не просто споживанням, а інвестиціями, які приносять чималі економічні та соціальні вигоди, а також мають велике значення у виробництві знань. Результати цього дослідження підтверджують численні економічні переваги освіти. На індивідуальному рівні існує пряма кореляція між рівнем освіти й особистим доходом. Окрім того, освіта сприяє підвищенню продуктивності праці, а отже, й помітному зростанню валового національного продукту. За допомогою методу Data Envelopment Analysis (аналіз середовища функціонування) проведено оцінку економічної ефективності 49 країн світу. У середньому ефективність, враховуючи змінну віддачу від масштабу (TEVRS), дорівнювала 88,7 %. При цьому 14 країн, які становлять 28,6 % вибірки, досягли максимальної ефективності.

Ключові слова: освіта, людський капітал, економічна віддача від освіти, ефективність, Data Envelopment Analysis.

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