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ASSESSMENT OF FACTORS INFLUENCING PRODUCTIVE CAPACITIES IN DEVELOPING NATIONS USING MULTI-CRITERIA DECISION ANALYSIS TECHNIQUES

This article presents a comprehensive study of the factors influencing productive capacity in 113 developing countries across the Americas, Asia, and Africa. Using data from the Second Generation of the UNCTAD Manufacturing Capacity Index, the authors analyzed trends from 2018 to 2022 and highlighted eight key determinants shaping productivity at the levels of national economies, business management, and industrial engineering.

The research methodology is based on the application of newly developed Multiple Criteria Decision Making (MCDM) techniques. The Interval-Valued Circular Heuristic Fuzzy Analytic Hierarchy Process (AHP) was applied to determine the weights of the criteria, while the Extended AROMAN method was employed to rank the alternatives. The integration of these two innovative approaches not only enhanced the accuracy of the assessment but also contributed new methodological insights to the MCDM literature.

The novelty of this study lies in the combined application of two recently developed decision-making methods within one framework, thereby expanding the analytical potential of productive capacity assessment. Considering the scarcity of related studies in existing scholarship, this research significantly enriches the academic discourse.

The findings revealed that energy, transportation, and natural capital are the primary drivers of productive capacity, regardless of regional differences. This underlines the global importance of strategic investments in these areas and the urgent need for developing countries to align their policies with these priorities. Beyond methodological innovation, the study provides actionable guidance for policymakers and national governments to design targeted interventions that strengthen productive capacity, particularly through the advancement of energy infrastructure, transport systems, and sustainable resource management.

Key words: IVCH Fuzzy AHP, An Extended AROMAN, MCDM, Productive Capacities, UNCTAD

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ОЦІНКА ФАКТОРІВ, ЩО ВПЛИВАЮТЬ НА ВИРОБНИЧИЙ ПОТЕЦІБ У КРАЇНАХ, ЩО РОЗВИВАЮТЬСЯ, ЗА ВИКОРИСТАННЯМ МЕТОДІВ БАГАТОКРИТЕРІАЛЬНОГО АНАЛІЗУ РІШЕНЬ

У статті представлено ґрунтовне дослідження чинників, що впливають на продуктивний потенціал у 113 країнах, що розвиваються, розташованих у регіонах Америки, Азії та Африки. Використовуючи дані Другого покоління Індексу виробничої спроможності ЮНКТАД, автори проаналізували динаміку у 2018–2022 рр. та виокремили вісім ключових параметрів, які визначають розвиток продуктивності на рівні національних економік, управління бізнесом та промислової інженерії.

Методологічною основою дослідження стало застосування новітніх методів багатокритеріального прийняття рішень (MCDM). Для визначення вагових коефіцієнтів критеріїв використано метод Interval-Valued Circular Heuristic Fuzzy AHP, тоді як для ранжування альтернатив – розширений метод AROMAN. Поєднання цих двох інноваційних підходів дозволило отримати більш об'єктивні результати та водночас збагатити наукову літературу новими методологічними інструментами.

Наукова новизна роботи полягає в інтегрованому застосуванні двох нових методів у межах одного дослідження, що значно розширює можливості аналізу продуктивного потенціалу. В умовах дефіциту подібних досліджень у науковій базі ця робота має суттєве значення для подальшого розвитку теорії та практики багатокритеріального аналізу.

Отримані результати показали, що провідними детермінантами продуктивного потенціалу є енергетика, транспорт та природний капітал, незалежно від регіональної специфіки. Це підкреслює глобальне значення інвестицій у зазначені сфери та необхідність формування стратегічних політик у країнах, що розвиваються. Запропоноване дослідження не лише забезпечує нові аналітичні підходи, але й надає практичні рекомендації для урядів та політиків щодо зміцнення продуктивного потенціалу, особливо через розвиток енергетичної інфраструктури, транспортних систем і сталого використання природних ресурсів.

Ключові слова: IVCH Нечіткий АНР, Розширений AROMAN, MCDM, Виробничі потужності, ЮНКТАД

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PROBLEM STATEMENT AND ITS RELEVANCE

Productivity helps developing nations grow economically. Energy, human capital, ICT, institutions, natural capital, private sector, structural change, and transportation affect sustainable economic development. Understanding how these qualities affect productivity is difficult. Current research requires techniques to analyze and prioritize these components. Conventional research downplays these issues. They underestimate the intricacy of emerging country issues. Thus, a more complex and comprehensive framework that accommodates the multiple variables impacting productive capacity is urgently required. This thesis uses multi-criteria decision-making evaluation to handle this research topic. This research investigates the intricate links between energy, human capital, ICT, institutions, natural

capital, the private sector, structural change, and transportation, as well as emerging countries' productivity. The research assesses these issues utilizing multi-criteria decision-making. This research identifies productivity enablers and detractors. It studies developing nations' primary economic growth and development difficulties and policy and strategy efficacy. Policymakers, development program implementers, and investors may use the study's results to support sustainable and equitable development in emerging countries and build evidence-based solutions.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

Productivity drives economic progress in developing countries. A nation's production relies on structural, economic, and social factors. Recent studies show that productive capacity affects national economies, business management, and industrial engineering [1]. The UNCTAD Productive Capacities Index measures these areas comprehensively. This index considers eight key aspects, including energy, transportation, natural capital, and human capital, to determine growing nation productivity patterns [2].

Numerous studies employ multi-criteria decision-making (MCDM) methods to rank productive capacity factors. The Analytical Hierarchy Process (AHP) and other ranking methods aid complex decision-making. In unpredictable and complex situations, traditional MCDM has limitations [3]. New methods like the Interval-Valued Circular Intuitive Fuzzy AHP provide more accurate and adaptive results. This innovative method ranks factors using expert opinions for more reliable results [4].

Strategic investments to increase rising country production are also emphasized. Energy and transportation infrastructure development impact the economy [5]. Long-term development requires sustainable resource management. Meanwhile, additional research has studied MCDM's real-world applicability. These studies provide policymakers methodological advances and important data [6].

Finally, the data reveals that poor countries need productive ability to flourish economically. MCDM helps decision-making by methodically examining and prioritizing essential aspects [7]. These methods struggle with data quality, expert opinion integration, and geography. Future study could employ innovative MCDM methods and larger data sets for more detailed analyses [8].

The aim of this article is to evaluate the factors affecting the productive capacity of developing countries, offer a new perspective to local governments in these countries, and determine the true significance of these factors.

PRESENTATION OF THE MAIN RESEARCH MATERIAL

Index computation values the eight research criteria equally. Experts recommend comparing these metrics' relevance levels for reliable results. Experts recommend examining how these factors impact development and other geographical factors while considering the three areas' productive potential. Consider that these eight criteria cannot be ranked equally. The subjective Interval-Valued Circular Intuitive Fuzzy AHP approach evaluated these eight criteria for the three areas from 2018 to 2022. Interviewed experts received pairwise comparison questionnaires to assess criteria relevance. This strategy was selected to determine the study's criteria' relative importance since it is the most recent subjective approach, has never been utilized to assess productive capacities, and is thought to help future research attain trustworthy findings. Calculated 2018-2022 location-specific significance of relevant criterion. In 2018–2022, Asia's most critical determinants for productive capacity expansion were energy and transportation. Transportation overtook energy in 2021 and reclaimed second in 2022. Natural capital was third for five years. Information and processing technology was fourth in 2018 and 2019, seventh and fifth in 2020–2022. Institutional criterion: fifth in 2018–2019, fourth in 2020–2022. Private sector needs were sixth in 2018–2019 and 2021–2022, fifth in 2020. Tenth in significance till 2020 was structural change. Information and processing technologies replaced it in 2020. Human capital ranked last all five years, indicating its low importance. In 2018 and 2019, natural capital was the most significant element in the Americas, followed by transportation in 2020-2022. Natural capital has slid to second as transportation needs have increased in the previous three years. Every year, energy ranks third. Institutions ranked fourth till 2020. It fell to fifth in 2020 as structural change criteria replaced it. After fifth in 2018 and 2019, human capital criteria dropped to sixth in 2020 and 2021 before rising to fifth in 2022. Private sector criteria placed sixth in 2018 and seventh for three years. It placed sixth in 2022. Information processing technology followed private sector norms, as seen in the figure. Information and processing technology and private sector criteria differed only in first-year ranking of seventh. Among these criteria, structural change moved most. From least important in 2018, it rose to sixth in 2019 and fourth in 2020. This criterion dropped to fifth in 2021. Finally, in 2022, the criteria ranked last. Africa's top two sectors were energy and transportation in 2018–2022. Human capital fell to fourth in 2020 and third in all future years. Natural capital ranked seventh in 2018 but fourth and third in 2019 and 2020. From fourth in 2018 to fifth and sixth in 2019 and 2020, structural change dropped. Fifth place in 2021 and 2022 showed its growing significance. In 2018, private sector needs dominated. It was sixth in 2018 and the least significant since. However, information and processing technologies are vital. It ranked sixth annually till 2020. Institutions were least significant in 2018, but grew to ninth in succeeding years. The analysis identifies 113 emerging nations across three separate geographic areas as potential solutions to the issue. The pertinent geographic areas include Asia, America, and Africa. The options to the issue are 33, 30, and 50, respectively. An augmented AROMAN approach was used to evaluate these choices. The objective of establishing these rankings is to enable the attainment of rankings that accurately

represent reality and diverge from those derived from the index computation using the acquired relative significance values. The outcomes derived from the method's use and their interpretations are delineated in the following sections. UNCTAD's Productive Capacity Index recognized 33 Asian developing nations. For 2018–2022, these nations' relative significance was calculated and ranked.

Between 2018 and 2020, Kazakhstan dominated Asian productive capacity, followed by Turkey in the following two years. Kazakhstan led, followed by Armenia, Kyrgyzstan, and Kyrgyzstan. Kazakhstan and Kazakhstan followed Turkey. Afghanistan ranked last in 2018, 2019, East Timor in 2020, Lebanon in 2022 and 2023. Tashkent, Sri Lanka, Tajikistan, Thailand, the Philippines, Pakistan, Mongolia, Malaysia, Kyrgyzstan, Iraq, Indonesia, Brunei Darussalam, Bhutan, Bangladesh, and Afghanistan improved from 2018 to 2022. Azerbaijan, Yemen, Oman, Maldives, and Iraq saw minimal rank movement this year.

Chile dominated the Americas in 2018–2020, then Uruguay for two years. Uruguay and Haiti finished second and third in the first two years. St Vincent and the Grenadines finished last in 2018–2020 and 2022. In 2021, Saint Lucia beat St. Vincent. We rate the Cayman Islands, Saint Lucia, and Saint Vincent and the Grenadines last in 2018–2022. Venezuela, T&T, Panama, El Salvador, Ecuador, Cuba, Belize, Bahamas, and Aruba remain. Suriname, Guatemala, and Paraguay ranked higher than these nations.

Africa's 2018–2022 rankings position Niger top, Malawi second, and Burkina Faso third. Seychelles, Mauritius, and Djibouti placed worst in 2018. In 2019–2022, Equatorial Guinea, Comoros, and Seychelles were worst. Namibia, Mauritius, Mauritania, Egypt, Côte d'Ivoire, Senegal, Tunisia, Togo, Tanzania, Cape Verde, and Botswana climbed too. Zimbabwe, Somalia, Sierra Leone, Nigeria, Liberia, Guinea-Bissau, Guinea, Ghana, Gambia, Ethiopia, Eritrea, Equatorial Guinea, Comoros, Chad, CAR, Burundi, and Angola declined from 2018 to 2022

CONCLUSION

The study developed new relative significance values for factors affecting productive capacity in emerging countries, including expert viewpoints, and created new country rankings. The study employed modern MCDM methods to compute factors affecting productive capacity, proving their feasibility. From 2018 to 2022, the criteria' importance varied throughout the three geographical zones, demonstrating their complex impact on productive capacity. Compared to other criteria, energy, transportation, and natural capital greatly affected rising countries' productive capability in all three domains. The agreement that productive capacity is important for all growing nations, regardless of location, may explain the findings. These data help developing country management plan and make decisions to boost their economies. In further studies, detailed research on these factors may provide more dependable and consistent results, helping national administrations make more precise decisions to boost productivity.

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