



Service Innovation Performance in Sierra Leone's Banking Sector: An Empirical Analysis

**Samuel Saio Mansaray ^{a*}, Xu Hongyi ^b
and Ibrahim Abdulai Sawaneh ^{c,d}**

^a School of Management, Wuhan University of Technology, Wuhan 430070, P.R. China.

^b Department of Information Studies and Knowledge Management, Fourah Bay College, University of Sierra Leone, Freetown 00232, Sierra Leone.

^c Department of Information and Communication, Ernest Bai Koroma University of Science and Technology, Magburaka 00232, Sierra Leone.

^d Department of Computer Science, University of Management and Technology, Freetown 00232, Sierra Leone.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJESS/2024/v50i51382

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/116106>

Original Research Article

Received: 15/02/2024

Accepted: 20/04/2024

Published: 25/04/2024

ABSTRACT

This study investigates the innovation efficiency of Sierra Leone's banking sector, utilizing Data Envelopment Analysis (DEA) across 14 commercial banks representing 70% of the sector's total assets from 2017 to 2022. By analyzing existing financial and operational data, the study assesses performance variations and identifies disparities in innovation efficiency among these institutions. Findings indicate significant discrepancies in innovation efficiency levels, highlighting the critical role of strategic investment in technology and innovation for enhancing competitiveness and growth. This research contributes theoretically and practically to the literature on service innovation

*Corresponding author: Email: samsaio.mans@yahoo.co.uk; iasawaneh@ebkustsl.edu.sl;

in banking in developing countries. It provides empirical evidence of the efficacy of DEA models in performance evaluation, offering benchmarks and strategic insights that could inform future policy and operational strategies. The study underscores the need for Sierra Leone banks to continually invest in innovative capabilities to maintain and enhance their competitive edge in a dynamic financial environment.

Keywords: Innovation efficiency; Sierra Leone banking; data envelopment analysis; service innovation; bank performance.

1. INTRODUCTION

The banking sector of Sierra Leone, pivotal to the national economy, offers a broad spectrum of financial services crucial for the growth of individuals, businesses, and government functions. This sector, overseen by the Bank of Sierra Leone, features a diverse mix of local and international banks that provide essential banking services such as savings, loans, and investment opportunities. Key players include Sierra Leone Commercial Bank, Ecobank, and Standard Chartered Bank.

Development banks in Sierra Leone play a strategic role in providing long-term financing for infrastructure and agriculture, which are vital sectors for the country's development. These banks help bridge the financial gaps that commercial banks cannot meet, supporting large-scale projects and developmental agendas. Moreover, Microfinance Institutions (MFIs) and mobile money services have significantly expanded financial inclusion, particularly in rural areas where traditional banking infrastructure is limited. These services have become essential in providing financial access to underserved populations, enhancing their economic participation [1].

The research on innovation efficiency within Sierra Leone's banking industry examines how banks can optimize their operations through innovation. It explores various strategies that could enhance the effectiveness of inputs into the innovation process [2]. For instance, focusing on practical applications, improving innovation management, and boosting intellectual property awareness are seen as more effective than merely increasing resource allocation [1].

The study utilizes various methodologies to assess innovation efficiency, employing performance indicators such as cost-to-income ratio (CIR), return on assets (ROA), and return on equity (ROE). These metrics help understand banks' operational, profitability, and technological

efficiencies. The research findings suggest that the optimal value of bank efficiency is not static but varies according to each bank's specific objectives and context, emphasizing the need for tailored strategies that reflect the dynamic nature of the banking sector [2]. This examination not only underscores the importance of strategic innovation in enhancing the competitive edge of banks but also provides a benchmarking framework for them to identify performance gaps and potential areas for improvement. The insights gained from this study are invaluable for policymakers, bank managers, and other stakeholders in the financial sector, guiding them in decision-making processes to foster a more robust and innovative banking environment in Sierra Leone [2].

2. LITERATURE REVIEW

This study examines the influence of service innovation on banking performance in developing economies, synthesizing empirical research, theoretical frameworks, and case studies [3]. It aims to thoroughly understand how innovations affect banking efficiency, customer satisfaction, and financial outcomes. The review also identifies gaps for future research, offering strategic insights for banks in developing regions like Sierra Leone to enhance their market competitiveness and meet customer needs effectively.

2.1 Service Innovation

Service innovation (SI) has become a critical facet of global economic competitiveness in the era of globalization, as nations and organizations strive to develop unique advantages. This drive for competitiveness encourages the development of new and distinctive niches, supported by advancements in technology and the adoption of market-friendly business models and processes [4-6]. SI plays a significant role in enhancing performance and delivering unique customer benefits through both product and process innovations [7,8]. It involves introducing new

services or significantly improving existing ones, and it often includes co-creation with customers to ensure the innovations meet real-world needs and preferences [9].

The significance of SI extends beyond mere business performance; it is increasingly recognized as a key driver of economic growth, quality of life, and industrial competitiveness [10]. The service sector has seen substantial growth in its contribution to GDP, reflecting the shift towards a service-dominant logic in economic activities. Moreover, the rise of comprehensive service science underlines the importance of innovation in services, which has become central to maintaining competitiveness in both service and manufacturing sectors [11-13].

The study suggests that SI is crucial not only for addressing economic challenges but also for ensuring sustainable development, particularly in contexts like Sierra Leone's banking sector, which faces unique challenges such as recovery from civil unrest and public health crises. Enhancing innovation efficiency, therefore, is vital for optimizing resource use and achieving desirable outcomes. This review explores how Sierra Leone can leverage SI to improve its banking sector's efficiency and overall economic health.

2.2 Empirical View of Service Innovation

As the National Academy of Engineering and the OECD noted, service innovation is crucial for societal advancement, contributing significantly to the GDP [10]. This trend is mirrored in developed and developing regions, where innovations such as mobile money services enhance financial inclusion [14]. In healthcare, wearable technologies are revolutionizing patient care, underscoring the need for integrated digital solutions in organizational structures [15]. However, understanding service innovation remains complex, with researchers like [16], pointing out its novelty and the challenges in scholarly comprehension.

Service terms often encompass a broad range of definitions, from tangible products to intangible relationships, highlighted by scholars like Miles. This ambiguity extends to the innovation processes, where incremental improvements and new service experiences coalesce to form what is known as service innovation. As argued by [17], emphasizes that modern service innovation

transcends traditional product enhancements, involving a holistic organizational process that leverages service-dominant logic to foster value through integrated resources [18].

Therefore, the authors define service innovation as a multifaceted construct that includes new service concepts, customer interactions, business models, and technological systems aimed at enhancing the service sector's responsiveness and value delivery [19]. This broad perspective highlights the importance of adaptable, context-dependent service provisions that cater to evolving customer needs and contribute to sustainable business practices.

2.3 Existing Evaluation of Service Innovation and Efficiency

The pivotal role of service sectors in the global economy, especially in Sierra Leone's banking sector, is underscored by their substantial contribution to GDP, employment, and international trade. From 2006 to 2014, the service sector's share in global output has significantly increased, reflecting its growing importance [20]. The sector supports direct economic growth through business services and fosters innovation, with varying efficiencies observed across regions [21]. Western European nations typically exhibit high innovation efficiencies, contributing to intellectual property development [22-25]. However, despite the improvement, emerging economies and regions like Sub-Saharan Africa display diverse efficiencies [26]. This scenario presents an opportunity for Sierra Leone to enhance its banking services through targeted innovation strategies, potentially elevating its position in the global innovation index and improving its economic resilience. Such an approach could leverage the existing upward trends in service innovation to transform the banking sector's impact on the national economy [26].

2.4 Service Innovation and Efficiency in Sierra Leone

Under the leadership of President Retired Brigadier Julius Maada Bio, Sierra Leone has initiated a transformative era with the establishment of the Directorate for Science, Technology, and Innovation (DSTI) in 2018, led by Dr. Moinina David Sengh as the first Chief Innovation Officer. The DSTI's mandate is to leverage technology, big data, and design to drive national development [27]. The subsequent

launch of the National Innovation and Digital Strategy (NIDS) in 2019 aims to digitize various sectors across the country, enhancing digital identity, economy, and governance [27].

Significant digital initiatives include deploying Blockchain technology for financial inclusivity, promoting digital governance to improve public services, and implementing tech-driven projects like the Human Capital Development (HCD) Incubator to support educational access. The strategy integrates local experiences, as seen in the development of health applications informed by past epidemic responses. Innovations such as mobile money for tax payments, drone technology for medical deliveries, and technologies producing potable water from the air demonstrate Sierra Leone's commitment to using technology to solve pressing national issues [27].

2.5 The Data Envelopment Analysis

Over the past decade, the evaluation of business efficiency has significantly evolved, from using fundamental financial ratios to advanced models like Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) [28,29]. Early methods centred on profitability and revenue efficiencies, while later approaches like DEA expanded to a multi-dimensional performance assessment across various sectors. DEA has been praised for its flexibility and robustness in assessing the efficiency of decision-making units without requiring a predefined production function, as it uses a nonparametric input-output analysis model [30].

The popularity of DEA has surged due to its adaptability, evidenced by its extensive application in sectors such as banking, healthcare, and education, and its ability to accommodate dynamic changes and integrate undesirable outputs in its models [30]. This method has been crucial in diverse geographical banking studies, from India to the European Union, and is instrumental in analyzing efficiencies post-financial crises and in rapidly changing markets [31-33].

This study aims to employ DEA models to conduct a thorough efficiency analysis of Sierra Leone's banking sector. This approach will allow us to identify and quantify inefficiencies, providing a foundational tool for enhancing sectoral performance and contributing to the broader economic stability and development of Sierra Leone [34-36].

2.6 Significance of the Study

This study presents the path for enhancing competitiveness in Sierra Leone's banking sector through innovation efficiency analysis. It underscores the pivotal role of innovation in stimulating economic development and offers empirical insights into innovation practices within the sector. These insights assist banks in pinpointing improvement areas and formulating growth strategies, contributing to the literature on banking innovation, especially in developing contexts. Furthermore, the findings guide policymakers in crafting supportive innovation policies and provide benchmarks for banks to gauge and elevate their innovation efficiency. This research fosters sectoral growth and aims to expand financial inclusion through innovative banking services, thus supporting broader economic progress in Sierra Leone.

3. MATERIALS AND METHODS

In addressing the challenge of accurately evaluating the efficiency, productivity, profitability, and competition within Sierra Leone's banking sector, this study employs Data Envelopment Analysis (DEA) models. Traditional performance metrics like Return on Equity (ROE) and cost-to-income ratios have proven inadequate for capturing the complex dynamics of the banking environment. Consequently, the research adopts the DEA methodology, a non-parametric approach pioneered by Farrell and elaborated by Charnes, Cooper, and Rhodes, which assesses efficiency by comparing decision-making units (DMUs) based on their ability to transform multiple inputs into outputs.

The study's procedure involves collecting primary data on various financial and operational metrics from a selection of retail banks that collectively represent a significant portion of the sector's market share. These banks serve as the DMUs in the DEA model. Data sources include bank financial statements, regulatory filings, and market performance reports, which provide the necessary inputs and outputs for the DEA analysis.

The DEA's application utilizes the CCR and BCC models to cater to constant and variable returns to scale, enabling a distinct bank performance analysis under different operational scales. Despite DEA's sensitivity to data quality and inability to perform statistical hypothesis testing directly, its capacity to handle multiple inputs and

outputs and identify efficiency benchmarks makes it highly suitable for this study's objectives. The research aims to derive actionable insights into how banks can enhance their operational efficiencies better to support Sierra Leone's economic stability and growth.

3.1 Study Area

The study area is the retail banking sector in Sierra Leone, a country on Africa's west coast. Sierra Leone's banking industry is crucial for the nation's economic stability, offering various financial services such as personal savings, loans, payments, and business ventures. The sector comprises a mix of large and small banks catering to the population's diverse needs. However, the industry faces challenges in managing and analyzing performance, particularly regarding efficiency, productivity, profitability, and competition.

3.2 Data Collection and Sampling

The analysis encompasses the top 14 commercial banks in Sierra Leone that have been operational for over ten years. The final sample includes data on the measure of innovation efficiency for six years, from 2017 to 2022, for the following 14 banks: Access Bank (AB), Bank PHB (PHB), Ecobank, First International Bank (FIB), Guaranty Trust Bank (GTB), International Commercial Bank (ICB), Rokel Commercial Bank (RCB), Sierra Leone Commercial Bank (SLCB), Sky Bank (SB), Standard Chartered Bank (SCB), Union Trust Bank (UTB), United Bank of Africa (UBA), Zenith Bank (ZB), and Mattru Commercial Bank (MCB). This results in a maximum sample size of 84 (14 banks * 6 years) observations.

3.3 Data Collection Instruments

The study utilized unpublished data derived from the quarterly and annual financial and operational reports of the 14 banks. The internal banking system of these banks served as the primary data source for the research. According to Kornegay and Segal [37], the combination of observational data and existing data enhances the efficiency and power of research. However, the study was confined to using existing operational and financial data. The inputs and outputs for the research were collected from the bank's annual reports and information available on the Central Bank of Sierra Leone's official website. Since 2020, the study has compiled

data on the selected input and output variables for DEA over three years. The data sample for this analysis includes fourteen commercial banks in Sierra Leone, which collectively represent 70% of the total assets in the country's banking sector.

3.4 Data Collection Technique

The data collection technique employed for this study involved data mining and record review to extract existing data from the internal databases of the 14 commercial banks and their available quarterly and annual reports from 2017 to 2022. The data mining technique was deemed suitable due to the large volumes of data in most databases, which may contain irrelevant information for research purposes [38]. Additionally, the official website of the Central Bank of Sierra Leone was utilized to gather comprehensive financial banking data that might not be included in the banks' database systems.

Data preparation in data mining techniques requires expertise in data cleaning, data integration, data selection, data transformation, and pattern evaluation. Therefore, it was crucial to involve managerial expertise from the internal banking system to ensure the accuracy and relevance of the data [39]. Given the complexity of managing multiple variables and potential data quality issues, challenges related to the timely collection of existing data were anticipated.

Before proceeding with the correlational analysis and reporting, the data underwent a classification process, and checks were conducted for missing data and outliers. Remedial measures were implemented for any potential violations to ensure the integrity of the data for analysis [39].

4. RESULTS AND DISCUSSION

The study on the innovation efficiency of Sierra Leone's retail banking sector highlights substantial disparities among the 14 evaluated commercial banks. This variation is notably reflective when contrasted with global benchmarks where innovation directly correlates with performance outcomes. The pronounced discrepancies in innovation efficiency can be attributed to differing levels of technological adoption and process optimization across the banks. This study advances the discourse by employing DEA models, offering a robust framework for comparing multi-faceted bank

performances, a method underutilized in previous regional research.

The findings provoke crucial considerations for future research, particularly in identifying specific barriers to innovation that distinct banks face and the potential regulatory or market conditions influencing these disparities. Further studies could explore the causal relationships between specific innovation strategies and bank performance, providing deeper insights into effective interventions for lagging banks. This could include longitudinal studies to track the impact of strategic changes over time or sector-wide studies to propose standardized innovation benchmarks for the Sierra Leone banking industry. This could lead to more targeted strategies that address the underperformance in innovation within the sector.

5. CONCLUSION AND IMPLICATIONS

5.1 Conclusion

The study evaluated the innovation efficiency within Sierra Leone's banking sector, mainly focusing on 14 commercial banks representing a significant market share. Using Data Envelopment Analysis (DEA), it analyzed the banks' performance from 2017 to 2022. Results highlighted considerable variations in innovation efficiency across the banks, underlining the critical importance of strategic technological investments and process optimizations for enhancing competitiveness and growth. The study suggests that banks in Sierra Leone need to continue developing their innovation capabilities to maintain and enhance their market position. By providing a systematic framework for assessing bank performance, the research offers benchmarks and strategic insights that can inform policy and decision-making in the banking sector, contributing to its literature, especially in developing economies like Sierra Leone.

5.2 Implications

Theoretical implications: The study makes a significant contribution to the existing literature on innovation efficiency in the banking sector, particularly within the context of developing countries such as Sierra Leone. By focusing on a region often underrepresented in banking research, the study provides valuable insights into the challenges and opportunities banks face in these environments. It highlights the critical

role of innovation in driving competitiveness and growth, which is especially relevant for banks operating in dynamic and rapidly evolving markets.

Furthermore, the study demonstrates the applicability and effectiveness of Data Envelopment Analysis (DEA) models in evaluating the innovation efficiency of banks. By employing DEA models, the research offers a robust framework for assessing the performance of banks in terms of their ability to innovate and utilize resources effectively. This adds to the banking industry's theoretical understanding of performance measurement, showcasing DEA as a versatile tool for analyzing innovation efficiency.

The study enriches the literature on banking innovation and performance measurement, providing valuable insights for academics, practitioners, and policymakers interested in enhancing the innovation capabilities of banks in developing countries. The findings underscore the importance of prioritizing innovation and offer a methodological approach for assessing innovation efficiency in the banking sector.

Practical implications: Banks in Sierra Leone can use this study's findings as a benchmark to assess their innovation efficiency relative to their peers. By understanding their position on the innovation efficiency spectrum, banks can identify specific areas where they excel and areas that require improvement. This benchmarking process is crucial for strategic planning, as it allows banks to allocate resources effectively and prioritize initiatives that will enhance their innovation capabilities. By focusing on areas that need improvement, banks can develop targeted strategies to enhance their operational processes, invest in technology, and foster a culture of innovation, ultimately improving their competitiveness and growth prospects.

Policymakers and regulatory authorities can also leverage the insights from this study to formulate strategies that encourage an enabling environment for innovation in the banking sector. By understanding the factors contributing to innovation efficiency, policymakers can design policies and regulations that support innovation activities, provide incentives for investment in technology, and promote collaboration between banks and fintech companies. Regulatory authorities can also use the findings to establish

benchmarks for innovation efficiency and monitor banks' progress in achieving these benchmarks. By fostering an environment that supports innovation, policymakers can contribute to developing a more dynamic, resilient, and competitive banking sector in Sierra Leone.

6. RECOMMENDATIONS AND FUTURE RESEARCH DIRECTION

6.1 Recommendations

To enhance their efficiency and competitiveness, banks in Sierra Leone should prioritize investments in technological advancements and innovative banking solutions. Embracing digital transformation can lead to development new products and services, streamlined operations, and improved customer experiences. Mobile banking, blockchain, artificial intelligence, and data analytics can revolutionize how banks operate and interact with customers. By staying abreast of technological trends and integrating innovative solutions into their operations, banks can better meet the evolving needs of their customers and stay ahead in a competitive market.

In addition to technological investments, continuous training and development of staff in innovation and technology-related areas are essential for maintaining a competitive edge. Banks should invest in programs that equip their employees with the skills and knowledge to leverage new technologies and drive innovation. This includes training in digital literacy, data analysis, cybersecurity, and fintech trends. By fostering a culture of continuous learning and encouraging creativity and experimentation, banks can build a workforce that is agile, adaptable, and capable of driving innovation. This investment in human capital is crucial for sustaining long-term competitiveness and success in the rapidly evolving banking landscape.

6.2 Future Research Direction

Further research into banking innovation in Sierra Leone could provide valuable insights for practitioners and policymakers. One potential avenue for future studies is to explore the impact of specific innovation strategies on the efficiency and performance of banks in Sierra Leone. This could involve examining different approaches to innovation, such as digital transformation initiatives, adopting fintech solutions, or

implementing new service delivery models. By understanding the effectiveness of various strategies, banks can make informed decisions about where to focus their innovation efforts.

Another critical area for future research is investigating the role of regulatory policies and government support in fostering innovation efficiency in the banking sector. This could include studies on the impact of regulatory frameworks on innovation activities, the effectiveness of government incentives for technology adoption, and the influence of public-private partnerships on developing innovative banking solutions. Understanding the interplay between regulation, government support, and innovation can help policymakers design policies that promote innovation while ensuring financial stability and consumer protection.

Further research in these areas can contribute to a deeper understanding of the factors that drive innovation in the banking sector and provide insights for developing strategies that enhance the efficiency and competitiveness of banks in Sierra Leone.

DATA AVAILABILITY STATEMENT

The data supporting this study's findings are available from the Bank of Sierra Leone (BSL), but restrictions apply to the availability of these data, which were used under license for the current study and so are not publicly available. The data are, however, available from the authors upon reasonable request and with the permission of the Bank of Sierra Leone (BSL). From: <https://www.centralbanking.com/central-banks/2480911/bank-of-sierra-leone>

ACKNOWLEDGMENTS

The authors extend their heartfelt gratitude to the Bank of Sierra Leone (BSL) and the 14 commercial banks mentioned in the study. Furthermore, key bank managers and stakeholders of the University of Sierra Leone (USL) for their contributions to heightening banking operational processes and elevating the quality of education in Sierra Leone. Special thanks are accorded to Professor Kelleh G. Mansaray, Deputy Vice-Chancellor of the Fourah Bay College (FBC), USL; Mr. Munda Lebbie, Registrar USL; Mr. Brima Pateh Bah, Deputy Registrar, FBC; Professor John Abdul Kargbo, Dean of the Faculty of Communication, Media and Information Studies (CMIS), USL; Mr. Calvin Macauley, HRM USL; and Dr. Brima Sesay of the Faculty of Social Science, USL, as well as

Prof. Edwin J.J Momoh, Vice-Chancellor and Principal, Ernest Bai Koroma University of Science and Technology for their role in promoting quality education in Sierra Leone. Their efforts in facilitating and championing educational excellence are highly appreciated.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Central Banking. Retrieved from Available:<https://www.centralbanking.com/central-banks/2480911/bank-of-sierra-leone>.
2. Foday Dabohm Ezekiel K, Duramany-Lakkoh. Performance evaluation of The Sierra Leone banking sector using camel rating framework. *Journal of Applied Finance & Banking*, Scienpress Ltd. 2023; 13(3):1-1.
3. Coffta M. Literature review: What is a Literature Review? *LibGuides*; 2020.
4. Dereli DD. Innovation management in global competition and competitive advantage [J]. *Procedia - Social and Behavioral Sciences*. 2015;195:1365-1370.
5. Ivanova E, Cepel M. The impact of innovation performance on the competitiveness of the Visegrad 4 countries. *J. Compet*. 2018;10:54-72.
6. Rajapathirana J, Hui Y. Relationship between innovation capability, innovation type, and firm performance. *Journal of Innovation & Knowledge*. 2018;3.
7. Koellinger PD, Harden KP. Using nature to understand nurture. *Science*. 2018;26, 359(6374):386-387.
8. Dodgson MK, Agoglia CP, Bennett GB, Cohen JR. Managing the auditor-client relationship through partner rotations: The experiences of audit firm partners. *Accounting Review*. 2020;95(2):89–111.
9. Bouwman H, Nikou S, de Reuver M. Digitization, business models, and SMEs: How do business model innovation practices improve performance of digitizing SMEs? *Telecommunications Policy*. 2019; 43(10).
10. Miles I. From knowledge-intensive services to knowledge-intensive service systems. *International Journal of Services, Technology and Management*. 2011;16(2): 141–159.
11. Marzi G. The necessity and the drawbacks of product and process innovation. In: uncertainty-driven innovation. Palgrave Macmillan, Cham; 2022.
12. OECD/Eurostat. Oslo Manual. Guidelines for collecting, reporting and using data on innovation, 4th edition. The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing. Paris/Eurostat, Luxembourg; 2018.
13. Gustafsson A, Snyder H, Witell L. Service innovation: A new conceptualization and path forward. *Journal of Service Research*. 2020;23(2):111-115.
14. OECD/Eurostat. Oslo Manual. Guidelines for collecting, reporting and using data on innovation, 4th edition. The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing. Paris/Eurostat, Luxembourg; 2018.
15. Vial G. Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*. 2019;28(2):118–144.
16. Goduscheit RC, Faullant R. Paths toward radical service innovation in manufacturing companies service-dominant logic perspective. *Journal of Product Innovation Management*. 2018;35(5):701–707.
17. Carlborg P, Kindström D, Kowalkowski C. The evolution of service innovation research: A critical review and synthesis. *Service Industries Journal*. 2014;34(5): 373–398.
18. Lusch RF, Nambisan S. Service innovation: A service-dominant logic perspective. *MIS Quarterly*. 2015;39(1): 155–175.
19. den Hertog P, van der Aa W, de Jong MW. Capabilities for managing service innovation: Towards a conceptual framework. *Journal of Service Management*. 2010;21(4):490-514.
20. Valencia AMP, Sauv e P. A new growth paradigm? The services economy in the pacific alliance. *Inter-American Development Bank*; 2017.
21. Loungani P, Mishra S, Papageorgiou C, Wang K. World trade in services: Evidence from a new database. *IMF Working Paper*; 2017.
22. Chiu M, Cheng T, Lin C. Driving open innovation capability through new knowledge diffusion of integrating intrinsic and extrinsic motivations in organizations: Moderator of individual absorptive

- capacity. *Journal of the Knowledge Economy*; 2023.
23. Łačka I, Brzezicki Ł. The Efficiency and productivity evaluation of national innovation systems in Europe. *SSRN Electronic Journal*. 2021. DOI:10.2139/ssrn.3922778.
 24. Corrente S, Garcia-Bernabeu A, Greco S, Makkonen, T. Robust measurement of innovation performances in Europe with a hierarchy of interacting composite indicators. *Economics of Innovation and New Technology*. 2023;32(2):305-322.
 25. Xu K, Mei R, Liang L, Sun W. Regional convergence analysis of sustainable innovation efficiency in European Union countries. *Journal of Environmental Management*. 2023;325(B):116636.
 26. World Intellectual Property Organization (WIPO). *The global innovation index 2023*. WIPO Headquarters, Geneva, Switzerland; 2023.
 27. Directorate of Science, Technology and Innovation (DSTI). *Sierra Leone national innovation & digital strategy (2019 – 2029)*. DSTI, GoSL; 2019.
 28. Zhang H, Yuan F, Cui Y, Li G. Research on the construction and measurement of inclusive finance evaluation index system. *Procedia Computer Science*. 2022;199: 1152-1159.
 29. Elyasi M, Altan B, Ekici A, Özener OO, Yanıkoğlu I. Stochastic production planning with flexible manufacturing systems and uncertain demand: A column generation-based approach. *IFAC-Papers Online*. 2022;55(10):3040-3045.
 30. Charnes A, Cooper WW, Rhodes E. Measuring the efficiency of decision-making units. *European Journal of Operational Research*. 1978;2(6):429-444.
 31. Banker RD, Charnes A, Cooper WW. Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*. 1984; 30(9):1078-1092.
 32. Kumbhakar SC, Parmeter CF, Zelenyuk V. Stochastic frontier analysis: Foundations and advances II. In: Ray SC, Chambers RG, Kumbhakar SC (Eds). *Handbook of Production Economics*. Springer, Singapore; 2022.
 33. Madaleno M, Moutinho V. Stochastic frontier analysis: A review and synthesis. In: Macedo P, Moutinho V, Madaleno M. (Eds). *Advanced mathematical methods for economic efficiency analysis. Lecture Notes in Economics and Mathematical Systems*. Springer, Cham. 2023;692.
 34. Wong WP, Deng Q. Efficiency analysis of banks in ASEAN countries. *Benchmarking*, 2016;23(7):1798–1817.
 35. Wild J. Efficiency and risk convergence of Eurozone financial markets. *Research in International Business and Finance*. 2016; 36:196–21.
 36. Wanke P, Barros CP, Emrouznejad A. Assessing productive efficiency of banks using integrated Fuzzy-DEA and bootstrapping: a case of Mozambican banks. *Eur. J. Oper. Res.* 2016;249(1): 378–389.
 37. Kornegay C, Segal JB. Selection of data sources. In: Velentgas P, Dreyer NA, Nourjah P et al. Editors. *Developing a protocol for observational comparative effectiveness research: A user's guide*. Rockville (MD): Agency for Healthcare Research and Quality (US). 2013;8.
 38. Maryoosh A, Hussein E. A review: Data mining techniques and its applications. *International Journal of Computer Science and Mobile Applications*. 2022;10:1-14.
 39. Jassim MK, Abdulwahid SN. Data mining preparation: Process, techniques and major issues in data analysis. *IOP Conference Series*. 2021;1090(1):012053.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:

<https://www.sdiarticle5.com/review-history/116106>