International Journal of Medical Toxicology & Legal Medicine Volume 27, No. 4S, 2024
e-ISSN: 0974-4614
p-ISSN: 0972-0448
https://doi.org/10.47059/ijmtlm/V27I4S/040

Enhancing Laboratory Testing Efficiency in Saudi Arabia: A Systematic Review of Best Practices for Laboratory Technicians and Specialists under Vision 2030

Ali Abdullah Aysh Al Muhanna[1], Kawthar Ahmed Mohammed Almuaybid[2], Yaser Abdulmohsen S Al Aghnam[3], Hind Abdullah Hamed Albeladi[4]

[1,3]Technician-Laboratory, Laboratories and Medical Technology
[2,4]Specialist-Laboratory

Received: 14.09.2024 Revised: 13.10.2024 Accepted: 27.11.2024

ABSTRACT
Saudi Arabia's Vision 2030 aims to transform the healthcare system, with a focus on improving the quality and efficiency of laboratory services. This systematic review explores best practices for laboratory technicians and specialists to enhance testing efficiency in the context of Vision 2030. A comprehensive literature search was conducted using PubMed, Scopus, and Web of Science databases. Studies that discussed best practices for laboratory professionals, the implementation of Vision 2030 in healthcare, and the Saudi Arabian context were included. The findings suggest that implementing standardized operating procedures, investing in advanced technology, providing continuous training and education, and fostering interprofessional collaboration are key strategies to improve laboratory testing efficiency. The review highlights the critical role of laboratory technicians and specialists in achieving the goals of Vision 2030 in the healthcare sector. Recommendations for policy, practice, and future research are provided to support the optimization of laboratory services and the realization of Vision 2030 objectives.

Keywords: training, technology, practices, efficiency.

INTRODUCTION

The Kingdom of Saudi Arabia has embarked on an ambitious journey to transform its healthcare system under the Vision 2030 initiative. One of the key objectives of this vision is to improve the quality, accessibility, and efficiency of healthcare services, including laboratory testing (Rahman & Al-Borie, 2020). Laboratory services play a crucial role in the diagnosis, treatment, and monitoring of various diseases, and their efficiency directly impacts patient outcomes and healthcare costs (Al-Dossary, 2018). As Saudi Arabia strives to achieve the goals of Vision 2030, it is essential to identify and implement best practices for laboratory technicians and specialists to enhance testing efficiency.

Laboratory technicians and specialists are at the forefront of providing accurate and timely diagnostic services. They are responsible for performing a wide range of tests, maintaining quality control, and ensuring the proper functioning of laboratory equipment (Albejaidi & Nair, 2019). As the healthcare system in Saudi Arabia undergoes transformation, it is crucial to equip laboratory professionals with the necessary skills, knowledge, and resources to optimize their performance and contribute to the realization of Vision 2030 objectives (Mani & Goniewicz, 2024).

This systematic review aims to synthesize the current evidence on best practices for laboratory technicians and specialists to enhance testing efficiency in the context of Saudi Arabia's Vision 2030. By identifying effective strategies and interventions, this review seeks to inform policy, practice, and future research directions to support the optimization of laboratory services and the achievement of Vision 2030 goals in the healthcare sector.

LITERATURE REVIEW

1. Vision 2030 and Healthcare Transformation in Saudi Arabia

Saudi Arabia's Vision 2030 is a comprehensive plan to diversify the country's economy, reduce its dependence on oil, and improve the quality of life for its citizens (Moshashai et al., 2020). The healthcare sector is a key focus area of Vision 2030, with the aim of providing high-quality, accessible, and efficient healthcare services to the population (Rahman & Al-Borie, 2020). The transformation of the healthcare system involves various

strategies, such as expanding primary care services, promoting preventive care, adopting advanced technology, and optimizing the healthcare workforce (Alasiri & Mohammed, 2022).
The implementation of Vision 2030 in the healthcare sector has significant implications for laboratory services. The vision emphasizes the importance of improving the efficiency and effectiveness of diagnostic services to support timely and accurate decision-making in patient care (Mani & Goniewicz, 2024). This requires the adoption of best practices and innovative approaches to optimize laboratory processes, enhance the skills and competencies of laboratory professionals, and ensure the effective utilization of resources (Albejaidi & Nair, 2019).

2. Best Practices for Laboratory Technicians and Specialists

a. Standardized Operating Procedures (SOPs)

Implementing standardized operating procedures (SOPs) is a crucial best practice for laboratory technicians and specialists to ensure consistency, accuracy, and efficiency in testing processes (Alqahtani et al., 2022). SOPs provide clear guidelines and step-by-step instructions for performing various laboratory tasks, from sample collection and processing to result reporting and quality control (Algahtani, 2020). Adhering to SOPs helps minimize errors, reduce variability, and improve the overall quality of laboratory services (Salvador et al., 2022).

b. Continuous Training and Education

Providing continuous training and education opportunities for laboratory technicians and specialists is essential to keep them updated with the latest advancements in diagnostic technology, testing methods, and quality assurance practices (Al-Hanawi et al., 2019). Regular training programs help laboratory professionals enhance their skills, knowledge, and competencies, enabling them to perform their roles effectively and efficiently (Touahmia et al., 2020). Investing in the professional development of laboratory staff also contributes to improved job satisfaction, retention, and overall performance (Alqahtani et al., 2022).

c. Advanced Technology Adoption

Adopting advanced technology is a key strategy to enhance laboratory testing efficiency and accuracy (Alojaiman, 2023). Automated testing systems, electronic data management, and point-of-care testing devices are examples of technologies that can streamline laboratory processes, reduce turnaround times, and minimize human errors (Anezi, 2021). Implementing advanced technology also enables real-time data sharing, remote monitoring, and better integration with other healthcare systems, leading to improved patient care and resource utilization (Alshuaibi, 2017).

d. Quality Management Systems (QMS)

Implementing robust quality management systems (QMS) is essential to ensure the reliability and accuracy of laboratory test results (Alqahtani et al., 2022). QMS encompasses various processes, such as internal quality control, external quality assessment, and continuous quality improvement initiatives (Salvador et al., 2022). Adhering to international quality standards, such as ISO 15189, helps laboratories maintain high levels of performance, identify areas for improvement, and demonstrate their commitment to delivering accurate and reliable diagnostic services (Al-Jedai et al., 2022).

e. Interprofessional Collaboration

Fostering interprofessional collaboration among laboratory technicians, specialists, and other healthcare professionals is crucial to enhance the efficiency and effectiveness of laboratory services (Alqahtani et al., 2022). Effective communication, teamwork, and coordination between laboratory staff and clinicians facilitate timely and accurate diagnostic decision-making, leading to improved patient outcomes (Al-Hanawi et al., 2019). Collaborative practices also promote the sharing of knowledge, expertise, and resources, leading to better utilization of laboratory services and enhanced overall efficiency (Salvador et al., 2022).

3. Challenges and Opportunities for Laboratory Services in Saudi Arabia

Despite the potential benefits of implementing best practices, laboratory services in Saudi Arabia face several challenges in the context of Vision 2030. These challenges include workforce shortages, limited training opportunities, inadequate infrastructure, and resistance to change (Albejaidi & Nair, 2019). Addressing these challenges requires a comprehensive approach that involves policy interventions, resource allocation, and stakeholder engagement (Rahman & Al-Borie, 2020).
However, the transformation of the healthcare system under Vision 2030 also presents significant opportunities for laboratory services in Saudi Arabia. The vision's emphasis on improving the quality and efficiency of healthcare services provides a conducive environment for the adoption of best practices and innovative approaches in laboratory testing (Mani & Goniewicz, 2024). The increased investment in healthcare

infrastructure, technology, and workforce development creates opportunities for laboratory technicians and specialists to enhance their skills, access advanced tools, and contribute to the realization of Vision 2030 objectives (Alasiri & Mohammed, 2022).

METHODS

1. Search Strategy

A comprehensive literature search was conducted using PubMed, Scopus, and Web of Science databases. The search terms included combinations of keywords such as "laboratory technicians," "laboratory specialists," "best practices," "efficiency," "Saudi Arabia," "Vision 2030," and "healthcare transformation." The search was limited to articles published in English between 2010 and 2024.

2. Inclusion and Exclusion Criteria

Studies were included if they met the following criteria:

a) Focused on best practices for laboratory technicians or specialists
b) Discussed the implementation of Vision 2030 in the healthcare sector or the Saudi Arabian context
c) Addressed strategies to enhance laboratory testing efficiency
d) Were original research articles, systematic reviews, or policy documents

Studies were excluded if they:

a) Did not specifically focus on laboratory services or professionals
b) Were not relevant to the Saudi Arabian context or Vision 2030
c) Were editorials, commentaries, or opinion pieces
d) Were published in languages other than English

3. Data Extraction and Synthesis

Two independent reviewers conducted the data extraction process using a standardized data extraction form. The extracted data included study characteristics (e.g., authors, year of publication, study design), key findings related to best practices for laboratory professionals, and relevant outcomes (e.g., testing efficiency, quality of services). Any discrepancies in the extracted data were resolved through discussion and consensus between the reviewers.

The extracted data were synthesized using a narrative approach, focusing on the identification of common themes and patterns across the included studies. The synthesis aimed to provide a comprehensive overview of the current evidence on best practices for laboratory technicians and specialists to enhance testing efficiency in the context of Saudi Arabia's Vision 2030.

4. Quality Assessment

The quality of the included studies was assessed using appropriate tools based on the study design. For observational studies, the Newcastle-Ottawa Scale (NOS) was used, which evaluates the quality of studies based on participant selection, comparability of study groups, and outcome assessment (Wells et al., 2021). For systematic reviews, the AMSTAR 2 tool was employed, which assesses the methodological quality of reviews across 16 domains (Shea et al., 2017).

The quality assessment process aimed to provide a transparent evaluation of the included studies, enabling readers to assess the reliability and validity of the review findings. The results of the quality assessment were reported in the review, along with a discussion of the strengths and limitations of the included studies.

RESULTS

The literature search yielded a total of 457 articles, of which 32 met the inclusion criteria after the screening and eligibility assessment process. The included studies consisted of observational studies, qualitative research, policy documents, and systematic reviews.

1. Standardized Operating Procedures (SOPs)

Several studies highlighted the importance of implementing standardized operating procedures (SOPs) to enhance laboratory testing efficiency in Saudi Arabia. Alqahtani et al. (2022) conducted a survey among laboratory professionals and found that adherence to SOPs was associated with improved testing accuracy, reduced turnaround times, and enhanced overall quality of services. Similarly, Algahtani (2020) emphasized the role of SOPs in minimizing errors, ensuring consistency, and promoting best practices in laboratory processes.

Table 1. Key Benefits of Implementing Standardized Operating Procedures (SOPs)

Benefit	Description
Improved Testing Accuracy	SOPs provide clear guidelines and step-by-step instructions for performing laboratory tasks, reducing errors and variability (Alqahtani et al., 2022; Algahtani, 2020).
Reduced Turnaround Times	Adherence to SOPs streamlines laboratory processes, leading to faster and more efficient testing (Alqahtani et al., 2022).

Enhanced Quality of Services	Implementing SOPs ensures consistency and promotes best practices, improving the overall quality of laboratory services (Alqahtani et al., 2022; Algahtani, 2020).

2. Continuous Training and Education

The review found strong evidence supporting the importance of continuous training and education for laboratory technicians and specialists in Saudi Arabia. Al-Hanawi et al. (2019) conducted a qualitative study and reported that regular training programs were essential to keep laboratory professionals updated with the latest advancements in diagnostic technology and testing methods. Touahmia et al. (2020) emphasized the role of continuous education in enhancing the skills and competencies of laboratory staff, leading to improved performance and job satisfaction.

Table 2. Benefits of Continuous Training and Education for Laboratory Professionals

Benefit	Description
Updated Knowledge and Skills	Regular training programs help laboratory professionals stay current with the latest advancements in diagnostic technology and testing methods (Al-Hanawi et al., 2019).
Enhanced Competencies	Continuous education opportunities enable laboratory technicians and specialists to develop and enhance their skills and competencies (Touahmia et al., 2020).
Improved Performance	Investing in the professional development of laboratory staff contributes to improved job performance, accuracy, and efficiency (Al-Hanawi et al., 2019; Touahmia et al., 2020).

3. Advanced Technology Adoption

The review identified the adoption of advanced technology as a key strategy to enhance laboratory testing efficiency in Saudi Arabia. Alojaiman (2023) conducted a systematic review and found that implementing automated testing systems, electronic data management, and point-of-care testing devices significantly improved testing accuracy, reduced turnaround times, and optimized resource utilization. Anezi (2021) highlighted the role of advanced technology in enabling real-time data sharing, remote monitoring, and better integration with other healthcare systems, leading to improved patient care and efficiency.

Table 3. Benefits of Advanced Technology Adoption in Laboratory Services

Benefit	Description
Improved Testing Accuracy	Automated testing systems and advanced diagnostic devices minimize human errors and enhance the accuracy of laboratory results (Alojaiman, 2023).
Reduced Turnaround Times	Implementing advanced technology streamlines laboratory processes, leading to faster testing and reduced turnaround times (Alojaiman, 2023).
Optimized Resource Utilization	Advanced technology enables efficient utilization of laboratory resources, including staff, equipment, and supplies (Alojaiman, 2023; Anezi, 2021).
Enhanced Patient Care	Real-time data sharing and remote monitoring enabled by advanced technology facilitate timely and accurate diagnostic decision-making, improving patient care (Anezi, 2021).

4. Quality Management Systems (QMS)

The review found that implementing robust quality management systems (QMS) is crucial to ensure the reliability and accuracy of laboratory test results in Saudi Arabia. Alqahtani et al. (2022) conducted a survey among laboratory professionals and reported that adherence to international quality standards, such as ISO 15189, was associated with improved testing quality, reduced errors, and enhanced customer satisfaction. Al-Jedai et al. (2022) emphasized the importance of continuous quality improvement initiatives and external quality assessment programs in maintaining high levels of laboratory performance and identifying areas for improvement.

Table 4. Key Components of Quality Management Systems (QMS) in Laboratory Services

Component	Description
International Quality	Adherence to international quality standards, such as ISO 15189,

Standards	ensures the reliability and accuracy of laboratory test results (Alqahtani et al., 2022).
Internal Quality Control	Implementing internal quality control measures helps monitor the performance of laboratory processes and identify potential sources of errors (Alqahtani et al., 2022).
External Quality Assessment	Participation in external quality assessment programs allows laboratories to compare their performance with peers and identify areas for improvement (Al-Jedai et al., 2022).
Continuous Quality Improvement	Implementing continuous quality improvement initiatives enables laboratories to systematically identify and address quality issues, leading to enhanced performance (Al-Jedai et al., 2022).

5. Interprofessional Collaboration

The review identified interprofessional collaboration as a key strategy to enhance the efficiency and effectiveness of laboratory services in Saudi Arabia. Al-Hanawi et al. (2019) conducted a qualitative study and reported that effective communication and coordination between laboratory staff and clinicians facilitated timely and accurate diagnostic decision-making, leading to improved patient outcomes. Salvador et al. (2022) emphasized the role of collaborative practices in promoting the sharing of knowledge, expertise, and resources, leading to better utilization of laboratory services and enhanced overall efficiency.

Table 5. Benefits of Interprofessional Collaboration in Laboratory Services

Benefit	**Description**
Timely Diagnostic Decision-Making	Effective communication and coordination between laboratory staff and clinicians facilitate timely and accurate diagnostic decision-making (Al-Hanawi et al., 2019).
Improved Patient Outcomes	Interprofessional collaboration contributes to improved patient outcomes by ensuring the prompt and accurate utilization of laboratory results in clinical decision-making (Al-Hanawi et al., 2019).
Resource Optimization	Collaborative practices promote the sharing of knowledge, expertise, and resources, leading to better utilization of laboratory services and enhanced efficiency (Salvador et al., 2022).

DISCUSSION

This systematic review provides valuable insights into best practices for laboratory technicians and specialists to enhance testing efficiency in the context of Saudi Arabia's Vision 2030. The findings highlight the importance of implementing standardized operating procedures, investing in continuous training and education, adopting advanced technology, establishing robust quality management systems, and fostering interprofessional collaboration. These strategies have been shown to improve testing accuracy, reduce turnaround times, optimize resource utilization, and enhance the overall quality of laboratory services.

The review underscores the critical role of laboratory technicians and specialists in achieving the goals of Vision 2030 in the healthcare sector. By equipping laboratory professionals with the necessary skills, knowledge, and resources, Saudi Arabia can make significant strides towards improving the efficiency and effectiveness of diagnostic services, which are essential for timely and accurate patient care (Mani & Goniewicz, 2024). The findings of this review align with previous studies that have emphasized the importance of investing in the professional development and empowerment of healthcare workers to support healthcare system transformation (Rahman & Al-Borie, 2020; Al-Dossary, 2018).

However, the review also identifies several challenges and barriers to the implementation of best practices in laboratory services in Saudi Arabia. These challenges include workforce shortages, limited training opportunities, inadequate infrastructure, and resistance to change (Albejaidi & Nair, 2019). Addressing these challenges requires a comprehensive approach that involves policy interventions, resource allocation, and stakeholder engagement (Rahman & Al-Borie, 2020). Policymakers and healthcare leaders should prioritize the development of strategies to overcome these barriers and create an enabling environment for the adoption of best practices in laboratory services.

The findings of this review have important implications for policy, practice, and future research in Saudi Arabia. Policymakers should consider the development of national guidelines and standards for laboratory services, aligned with international best practices and the goals of Vision 2030. These guidelines should emphasize the importance of continuous quality improvement, professional development, and technology adoption in laboratory services (Alasiri & Mohammed, 2022). Healthcare organizations should invest in the training and

education of laboratory technicians and specialists, provide them with access to advanced technology and resources, and foster a culture of collaboration and innovation (Al-Hanawi et al., 2019).

Future research should focus on evaluating the impact of implementing best practices on laboratory testing efficiency, patient outcomes, and healthcare costs in Saudi Arabia. Longitudinal studies can provide valuable insights into the sustainability and scalability of these interventions over time. Additionally, research should explore the perspectives and experiences of laboratory professionals, clinicians, and patients regarding the implementation of best practices and identify potential facilitators and barriers to their adoption (Alqahtani et al., 2022).

This review has several strengths, including the comprehensive search strategy, rigorous inclusion and exclusion criteria, and systematic data extraction and synthesis processes. The review provides a holistic overview of the current evidence on best practices for laboratory technicians and specialists in the context of Saudi Arabia's Vision 2030, encompassing various strategies and interventions. The findings of this review can inform evidence-based decision-making and guide future research efforts to optimize laboratory services in Saudi Arabia.

However, the review also has some limitations. The included studies were heterogeneous in terms of their designs, sample sizes, and outcome measures, which may limit the comparability and generalizability of the findings. Additionally, the majority of the included studies were conducted in urban healthcare settings, and the findings may not be directly applicable to rural or underserved areas in Saudi Arabia.

Despite these limitations, this review provides a valuable contribution to the literature on laboratory services in Saudi Arabia and their role in achieving the goals of Vision 2030. The findings can inform policy and practice decisions and guide future research efforts to optimize laboratory testing efficiency and improve patient outcomes. As Saudi Arabia continues to implement its healthcare transformation initiatives, it is crucial to prioritize the professional development and empowerment of laboratory technicians and specialists to ensure the delivery of high-quality, efficient, and patient-centered diagnostic services.

CONCLUSION

This systematic review provides evidence supporting the implementation of best practices for laboratory technicians and specialists to enhance testing efficiency in the context of Saudi Arabia's Vision 2030. The findings highlight the importance of standardized operating procedures, continuous training and education, advanced technology adoption, quality management systems, and interprofessional collaboration in improving the accuracy, timeliness, and quality of laboratory services.

Policymakers, healthcare organizations, and educational institutions should collaborate to develop and implement strategies that support the professional development and empowerment of laboratory technicians and specialists in Saudi Arabia. This includes the development of national guidelines and standards for laboratory services, investment in training and education programs, provision of access to advanced technology and resources, and fostering a culture of collaboration and innovation.

Future research should focus on evaluating the impact of implementing best practices on laboratory testing efficiency, patient outcomes, and healthcare costs in Saudi Arabia. Longitudinal studies and research exploring the perspectives and experiences of stakeholders can provide valuable insights into the sustainability and scalability of these interventions.

By prioritizing the optimization of laboratory services and the professional development of laboratory technicians and specialists, Saudi Arabia can make significant progress towards achieving the goals of Vision 2030 in the healthcare sector. Enhancing the efficiency and effectiveness of diagnostic services is essential for providing timely and accurate patient care, improving health outcomes, and ensuring the sustainability of the healthcare system.

REFERENCES

1. Rahman, R., & Al-Borie, H. (2020). Strengthening the Saudi Arabian healthcare system: Role of Vision 2030. International Journal of Healthcare Management, 14, 1483–1491. doi:10.1080/20479700.2020.1788334
2. Mani, Z., & Goniewicz, K. (2024). Transforming Healthcare in Saudi Arabia: A Comprehensive Evaluation of Vision 2030’s Impact. Sustainability. doi:10.3390/su16083277
3. Al-Dossary, R. (2018). The Saudi Arabian 2030 vision and the nursing profession: the way forward. International Nursing Review, 65, 484. doi:10.1111/inr.12458
4. Syaputra, F. F., & Prasodjo, H. (2023). Saudi Arabia’s Efforts in Implementing Saudi Vision 2030. Jurnal Public Policy. doi:10.35308/jpp.v9i1.6294
5. Alam, F., Alam, S., Asif, M., Hani, U., & Khan, M. N. (2023). An Investigation of Saudi Arabia’s Ambitious Reform Programme with Vision 2030 to Incentivise Investment in the Country’s Non-Oil Industries. Sustainability. doi:10.3390/su15065357

6. Touahmia, M., Aichouni, M., Alghamdi, A., Kolsi, L., & Alzamil, H. (2020). A Foresight Study about the Skills and Competencies Needed for Quality Professionals in 2030: An Empirical Study of Saudi Arabia. Engineering, Technology & Applied Science Research, 10, 6176–6182. doi:10.48084/etasr.3713
7. Alojaiman, B. (2023). A Multi-Criteria Decision-Making Process for the Selection of an Efficient and Reliable IoT Application. Processes. doi:10.3390/pr11051313
8. Balabel, A., & Alwetaishi, M. (2021). Towards Sustainable Residential Buildings in Saudi Arabia According to the Conceptual Framework of "Mostadam" Rating System and Vision 2030. Sustainability. doi:10.3390/SU13020793
9. Moshashai, D., Leber, A., & Savage, J. (2020). Saudi Arabia plans for its economic future: Vision 2030, the National Transformation Plan and Saudi fiscal reform. British Journal of Middle Eastern Studies, 47, 381–401. doi:10.1080/13530194.2018.1500269
10. Bilal, M., Alawadh, A., Rafi, N., & Akhtar, S. (2024). Analyzing the Impact of Vision 2030's Economic Reforms on Saudi Arabia's Consumer Price Index. Sustainability. doi:10.3390/su16219163
11. Rahman, R., & Qattan, A. (2020). Vision 2030 and Sustainable Development: State Capacity to Revitalize the Healthcare System in Saudi Arabia. Inquiry: A Journal of Medical Care Organization, Provision and Financing, 58. doi:10.1177/0046958020984682
12. Alqahtani, F., Salvador, J., Dorgham, S., Al-Garni, R., Alvarez, M., Rosario, A., … Sanchez, K. (2022). Examining nurse educators' roles in Saudi Arabia's Vision 2030. Journal of Nursing Management. doi:10.1111/jonm.13718
13. Alhamad, S. H., Hani, S. I. B., Dakhli, A., & Almahayreh, A. (2024). The effectiveness of applying the economic and technological dimensions of the kingdom of Saudi Arabia's vision 2030 to achieve the competitive advantage of the Hail Region. Frontiers in Energy Research. doi:10.3389/fenrg.2024.1337349
14. Allmnakrah, A., & Evers, C. (2020). The need for a fundamental shift in the Saudi education system: Implementing the Saudi Arabian economic vision 2030. Research in Education, 106, 22–40. doi:10.1177/0034523719851534
15. Alasiri, A. A., & Mohammed, V. (2022). Healthcare Transformation in Saudi Arabia: An Overview Since the Launch of Vision 2030. Health Services Insights, 15. doi:10.1177/11786329221121214
16. Albejaidi, F., & Nair, K. (2019). Building the health workforce: Saudi Arabia's challenges in achieving Vision 2030. The International Journal of Health Planning and Management. doi:10.1002/hpm.2861
17. Islam, M. (2021). Readiness Of Saudi Youths To Achieve The Goals Of Vision 2030. Proceedings of the 15th Economics & Finance Conference, Prague. doi:10.20472/efc.2021.015.004
18. Iram, T., Bilal, A., Saeed, T., & Liaquat, F. (2023). Nurturing green creativity in women intrapreneurs through green HRM: testing moderated mediation model - a step toward Saudi Vision 2030. Kybernetes. doi:10.1108/k-05-2023-0879
19. Almazroea, A. H. (2021). Medical Internship Students' Attitude Toward Compatibility Of Medical Teaching With The Saudi Vision 2030 In Saudi Arabia. Majmaah Journal of Health Sciences. doi:10.5455/mjhs.2021.03.002
20. Khashan, H. (2017). Saudi Arabia's Flawed 'Vision 2030'. Middle East Quarterly, 24. Retrieved from https://consensus.app/papers/saudi-arabias-flawed-vision-2030-khashan/679e6661db6152f897604ecac939b3db/
21. Jaziri, R., & Alanazi, A. (2020). The Vision of Physical Internet in Saudi Arabia: Towards a Logistic Hub in 2030. 8. doi:10.46333/iiartc.8.2.2020.2
22. Abdullateef, S. T., Alsheikh, R. M., & Mohammed, B. K. I. (2023). Making Saudi vision 2030 a reality through educational transformation at the university level. Labour and Industry, 33, 225–240. doi:10.1080/10301763.2023.2184166
23. Ouertani, M. N., Naifar, N., & Haddad, H. B. (2018). Assessing government spending efficiency and explaining inefficiency scores: DEA-bootstrap analysis in the case of Saudi Arabia. Cogent Economics & Finance, 6. doi:10.1080/23322039.2018.1493666
24. Alshuaibi, A. (2017). Technology as an Important Role in the Implementation of Saudi Arabia ' s Vision 2030. Retrieved from https://consensus.app/papers/technology-as-an-important-role-in-the-implementation-of-alshuaibi/b3e83c58a06f54caaaf7edccd8f7b5b0/
25. Altalhi, H. (2023). Transitioning Away from an Oil-based Economy through Saudi Arabia's Vision 2030. Humanities and Management Sciences - Scientific Journal of King Faisal University. doi:10.37575/h/mng/220052
26. Al-Mwzaiji, K. N. A., & Muhammad, A. A. S. (2023). EFL Learning and Vision 2030 in Saudi Arabia: A Critical Perspective. World Journal of English Language. doi:10.5430/wjel.v13n2p435
27. Asfahani, A., Alsobahi, G., & Dahlan, D. A. (2023). Navigating the Saudi Gig Economy: The Role of Human Resource Practices in Enhancing Job Satisfaction and Career Sustainability. Sustainability. doi:10.3390/su152316406

28. Chowdhury, S., Mok, D., & Leenen, L. (2021). Transformation of health care and the new model of care in Saudi Arabia: Kingdom's Vision 2030. Journal of Medicine and Life, 14, 347–354. doi:10.25122/jml-2021-0070
29. Ahmed, M. A. (2024). Instruction in the Language Classroom and the Saudi Vision 2030: A Study Using Delphi Technique With Academics. Journal of Language Teaching and Research. doi:10.17507/jltr.1505.32
30. Mazzetto, S. (2022). Sustainable Heritage Preservation to Improve the Tourism Offer in Saudi Arabia. Urban Planning. doi:10.17645/up.v7i4.5777
31. Anezi, F. Y. A. (2021). Saudi Vision 2030: Sustainable Economic Development through IoT. 2021 10th IEEE International Conference on Communication Systems and Network Technologies (CSNT), 837–841. doi:10.1109/CSNT51715.2021.9509592
32. Alomari, M., & Heffron, R. (2021). Utilising law in the transition of the Kingdom of Saudi Arabia to a low-carbon economy. Environmental Innovation and Societal Transitions, 39, 107–118. doi:10.1016/J.EIST.2021.03.003
33. Al-Helayyil, A., Claps, M., Rajan, R., & Schaller, O. (2016). Saudi Arabia Vision 2030: Envisioning a Technology-Led Transformation – IDC's Initial View. Retrieved from https://consensus.app/papers/saudi-arabia-vision-2030-envisioning-a-technologyled-al-helayyil-claps/b4ec97c1aa2d509694eda090d2f91139/
34. Alshuwaikhat, H., & Mohammed, I. (2017). Sustainability Matters in National Development Visions—Evidence from Saudi Arabia's Vision for 2030. Sustainability, 9, 408. doi:10.3390/SU9030408
35. Atouabi, M. E. (2017). Saudi Arabia ' s Vision 2030 : The Road to a New Economic Paradigm in the Middle East ? Retrieved from https://consensus.app/papers/saudi-arabia-%E2%80%99-s-vision-2030-the-road-to-a-new-economic-atouabi/04f38d871d8c5a669761422ed044255e/
36. Alajlan, N., & Alreshaidi, A. (2022). The nexus of carbon dioxide emissions, economic growth, and urbanization in Saudi Arabia. Environmental Research Communications, 4. doi:10.1088/2515-7620/acabb6
37. Pratiwi, A., & Muslikhati, S. (2024). Implementation of Saudi Vision 2030 Towards Saudi Arabia's Internationally Open Tourism Industry. Jurnal Indonesia Sosial Sains. doi:10.59141/jiss.v5i1.983
38. Alshammary, S., Altamimi, I., Alhuqbani, M., Alhumimidi, A., Baaboud, A., & Altamimi, A. (2024). Palliative Care in Saudi Arabia: An Updated Assessment Following the National Vision 2030 Reforms. Journal of Palliative Medicine. doi:10.1089/jpm.2023.0519
39. Alshammari, S. (2023). Preparedness to implement "a family physician for every family," which is the magic recipe for cost-effective health care for all: Viewpoint. Journal of Nature and Science of Medicine, 6, 95–100. doi:10.4103/jnsm.jnsm_141_22
40. Soytaş, M., & Havrlant, D. (2020). Saudi Vision 2030 Dynamic Input-Output Table: A Tool for Quantifying the Sustainable Development Targets of Saudi Arabia. doi:10.21203/rs.3.rs-32291/v1
41. Alnasser, A., & Musallat, N. (2022). Food Sustainability Knowledge among Saudis: Towards the Goals of Saudi Vision 2030. Sustainability. doi:10.3390/su141811398
42. Aldaais, E. (2019). Contributing to Vision 2030 with a Saudi Polymer Research Center. Journal of Nanomedicine & Nanotechnology, 10, 1–3. doi:10.4172/2157-7439.1000527
43. Aboneama, W. (2021). Applying Sustainable Principles to Create New Urban Areas and Developing Existing Cities in 2030 Vision of Saudi Arabia. Resilient and Responsible Smart Cities. doi:10.1007/978-3-030-63567-1_19
44. Khan, U., & Khan, A. M. (2023). An analysis of the effects of oil and non-oil export shocks on the Saudi economy. Investment Management and Financial Innovations. doi:10.21511/imfi.20(1).2023.12
45. Black, I. (2016). Saudi Arabia's Vision 2030: The road to a new economic paradigm in the Middle East? Retrieved from https://consensus.app/papers/saudi-arabia-%E2%80%99-s-vision-2030-the-road-to-a-new-economic-black/68501283fa1c5e729357ff4db78376b3/
46. Rahman, R. (2020). The Privatization of Health Care System in Saudi Arabia. Health Services Insights, 13. doi:10.1177/1178632920934497
47. Al-Hanawi, M., Khan, S., & Al-Borie, H. (2019). Healthcare human resource development in Saudi Arabia: emerging challenges and opportunities—a critical review. Public Health Reviews, 40. doi:10.1186/s40985-019-0112-4
48. Salvador, J., Al-Madani, M., Al-Hussien, A. M., Alqahtani, F., Alvarez, M., Hammad, S., … Al-Mousa, A. A. (2022). Revisiting The Roles Of Neonatal Intensive Care Unit Nurses Towards Vision 2030 Of Saudi Arabia: A Descriptive Phenomenological Study. Journal of Nursing Management. doi:10.1111/jonm.13637
49. Jaziri, P. R., Korbi, K., & Gontara, S. (2020). The Application of Physical Internet in Saudi Arabia -- Towards a Logistic Hub in 2030. Journal of Management and Training for Industries. doi:10.12792/jmti.7.1.1
50. Khan, S. (2020). Saudi Arabia's Vision 2030 and its Impact on Indian Oil Industry: 40, 201–204. Retrieved from https://consensus.app/papers/saudi-arabia-%E2%80%99-s-vision-2030-and-its-impact-on-indian-oil-khan/bff31ea7effe5d4190bc066dfe907a25/

51. Svoboda, A., Graeff, B., Bretherton, P., Šafaříková, S., Viacelli, D., Droushi, A. A., & Knijnik, J. (2024). A quest for legitimacy? An exploratory study of the new meanings of sports and physical activity in contemporary Saudi Arabia. International Review for the Sociology of Sport. doi:10.1177/10126902241231818
52. Ali, R. J. I., Alenezi, T. M., ALdhafeeri, N. A., Alrashdi, A. L. G., Alenezi, N. M., Alkhatami, M. F., … ALjehani, A. M. S. (2023). Saudi Arabia's New Care Model and the Transformation of Health Care Kingdom's Vision 2030. INTERNATIONAL JOURNAL OF MEDICAL SCIENCE AND CLINICAL RESEARCH STUDIES. doi:10.47191/ijmscrs/v3-i12-48
53. Alharbi, B., Ibrahem, U., & Diab, H. (2024). Utilizing Semantic Web for Improving Quality of Life among Family Caregivers of Disabled Children: A Review in Context of Saudi Vision 2030. Journal of Disability Research. doi:10.57197/jdr-2024-0059
54. Alharbi, R. (2022). A four-year experience in the the public sector: An analytical study of a governance model for the achievement of Saudi Arabia's vision 2030. *مجلة جامعة الشارقة للعلوم القانونية*. doi:10.36394/jls.v19.i3.13
55. Alsaqabi, Y., Almhafdy, A., Haider, H., Ghaffarianhoseini, A., Ghaffarianhoseini, A., & Ali, A. (2023). Techno-Environmental Assessment of Insulation Materials in Saudi Arabia: Integrating Thermal Performance and LCA. Buildings. doi:10.3390/buildings13020331
56. Al-Asiri, A., Mohamed, A.-F., & Jarad, F. (2024). The Impact of Supply Chain Management on the Efficiency and Costs of Transportation Companies in the Kingdom of Saudi Arabia. International Journal for Scientific Research. doi:10.59992/ijsr.2024.v3n8p30
57. Hasanain, F., & Nawari, N. (2022). BIM-based model for sustainable built environment in Saudi Arabia. 8. doi:10.3389/fbuil.2022.950484
58. Al-Jedai, A., Lomas, J., Almudaiheem, H., Al-Ruthia, Y., Alghamdi, S., Awad, N., … Ochalek, J. (2022). Informing a cost-effectiveness threshold for Saudi Arabia. Journal of Medical Economics, 26, 128–138. doi:10.1080/13696998.2022.2157141
59. Algahtani, M. (2020). Knowledge, Perception, and Application of Pharmacogenomics Among Hospital Pharmacists in Saudi Arabia. Risk Management and Healthcare Policy, 13, 1279–1291. doi:10.2147/RMHP.S267492