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Optimizing Customer Satisfaction Through Sustainable Service Quality in ISO 17025 Accredited Calibration Laboratories

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ABSTRACT

This paper investigates how dimensions of sustainable service quality (SSQ) impact customer satisfaction, particularly in ISO 17025 accredited calibration laboratories in Saudi Arabia and Bahrain. The research addresses the challenge of maintaining customer satisfaction while enhancing competitive advantages through sustainable calibration services. Adopting the Stimulus-Organism-Response (S-O-R) theoretical model, this study employs a quantitative approach to test the proposed measurement model using Smart PLS 4. A pilot study with 35 respondents was conducted to validate the conceptual framework, which was based on the S-O-R theory. The pilot test confirmed the reliability of the constructs, though the sample size is limited. The findings provide preliminary support for the relationship between sustainable service quality and customer satisfaction. Future research will expand the dataset and conduct hypothesis testing to further inform practices in ISO 17025 laboratories.

1. INTRODUCTION

Advantages of the implementation of a formal quality management system, such as ISO 17025, include increased international recognition, fewer testing errors, and avoidance of non-necessary tests that economize resources. Such economies enable the organization to utilize its additional resources in its core business and help in maintaining consistent standards of quality, therefore allowing improvement in customer satisfaction and yielding positive financial results [1]. The ISO 17025 system supports stability in the industries of Saudi Arabia and Bahrain in all three dimensions: social, environmental, and economic. The system has supported stability in these industries: social, environmental, and economic in Saudi Arabia [2].

Yet, against the backdrop of these gains, limited research on service innovation in general and calibration laboratory contexts enhances environmentally sustainable product-service systems. The study looks at how sustainability service quality affects customers' satisfaction with ISO 17025 accredited laboratories in Saudi Arabia and Bahrain [3].

The present study will add to the body of literature by examining the relationship between SSQ and customer satisfaction; this, therefore, provides real means that calibration laboratories can use to improve sustainability practices. Moreover, policymakers are informed on how to improve customer and stakeholder satisfaction using evidence-based decision-making. In the end, the findings are likely to illustrate how SSQ can increase customer loyalty and operational transparency and cost management toward higher business performance in the calibration laboratories.

1.1 Theoretical background: The Stimulus-Organism-Response (S-O-R) framework

The Stimulus-Organism-Response (S-O-R) model, first proposed by Mehrabian and Russell (1974), posits that external stimuli (S) trigger emotional reactions (O), which in turn lead to behavioural responses (R) [4-6] pointed out that this model has been widely used in consumer behaviour research to explain how external factors influence internal psychological processes and ultimately drive behaviour. The S-O-R model effectively links external stimuli, such as service quality and operational transparency, with internal elements like attitudes, beliefs, and cognitive capabilities, though it may not fully describe their interaction with technology acceptance levels. This model has been successfully applied in research contexts, such as safety leadership, knowledge, motivation, and behaviour, to control safety outcomes in laboratory settings.

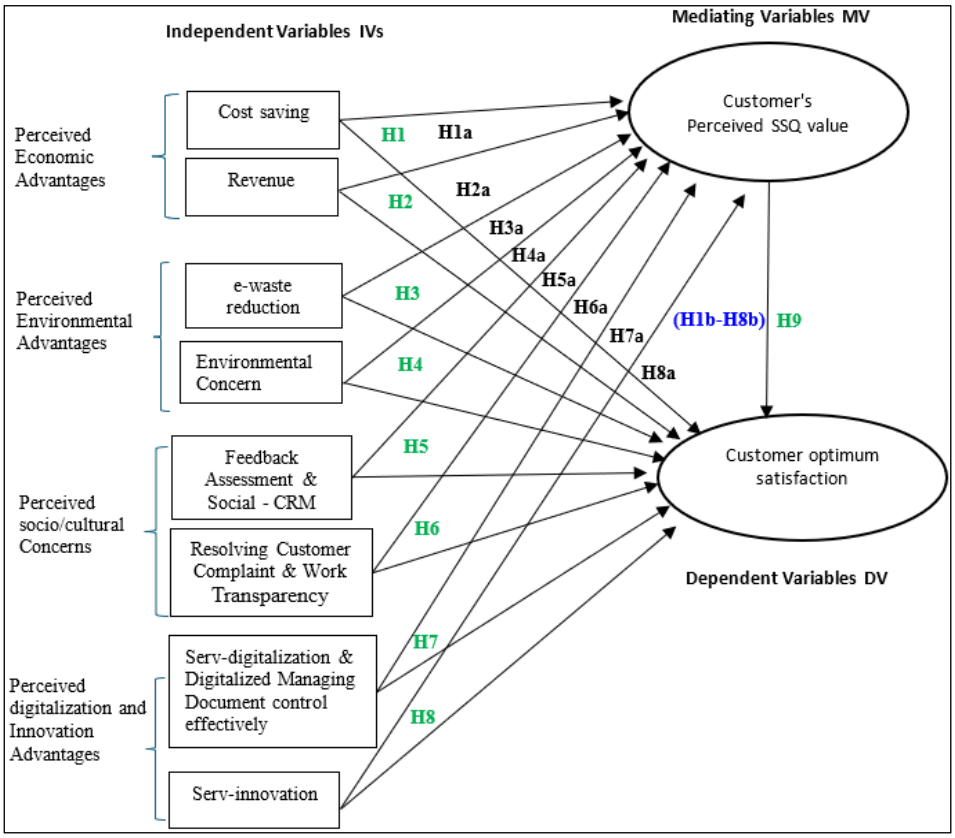
1.2 Justification for applying the S-O-R model in this study

The S-O-R model is well-suited for this study as it allows for the examination of both external and internal influences on behaviour. This study seeks to determine the impact of sustainable service quality (SSQ) on customer satisfaction in calibration laboratories. By applying the S-O-R model, this research can analyze how external factors, such as perceived economic and environmental advantages directly enhance both SSQ value and customer satisfaction. Similarly, socio/cultural concerns and digitalization and innovation contribute to these outcomes. This approach provides a clearer understanding of how SSQ drives customer satisfaction, thereby supporting the justification for using the S-O-R model in this research.

2. PROPOSED THEORETICAL FRAMEWORK

The research framework for optimizing customer satisfaction through sustainable service quality in ISO 17025 lab calibration is grounded in the Stimulus-Organism-Response (S-O-R) theory. As shown in Figure 1, the framework categorizes independent variables into four key dimensions based on the sustainability concept: perceived economic advantages, perceived environmental advantages, perceived socio/cultural concerns, and perceived digitalization and innovation.

These independent variables directly influence the dependent variables: the customer's perceived sustainable service quality (SSQ) value and customer optimum satisfaction. The model suggests that perceived economic advantages (such as cost savings and revenue) and perceived environmental advantages (e-waste reduction and environmental concerns) directly enhance both SSQ value and customer satisfaction. Similarly, perceived socio/cultural concerns (feedback assessment and resolving customer complaints) and digitalization and innovation (service digitalization and service innovation) contribute to these outcomes. Additionally, the framework incorporates indirect relationships, where SSQ value mediates the impact of the independent variables on customer satisfaction. This integrated approach underscores the importance of sustainable practices and innovations in fostering customer satisfaction within the context of ISO 17025 lab calibration.



H1-H8: Direct relations from IVs → DV, **H1a-H7a:** Direct relations from IVs to MV, **H1b-H8b: Indirect relations from** IVs→MV→ DV, **H9:** Direct relation from MV→ DV (where, IVs denoted as Independent Variables, MV as Mediation Variables, DVs as Dependent Variables)

Figure 1. Proposed conceptual framework

3. FACTORS AFFECTING LABORATORY CUSTOMER' OPTIMAL SATISFACTION

The section portrays factors impinging on customer satisfaction of ISO 17025 accredited laboratories, focusing on perceived economic, environmental, socio-cultural, and digitalization/innovation matters.

3.1 Perceived economic benefits

3.1.1 Reduced cost by digitalization of calibration processes

The digitalization in service provision enables customers to increase value creation by means of reduced operation costs for the customer and the laboratory service provider [7-10]. The hypotheses to be put forward are:

H1: *Customer satisfaction is directly and positively influenced by perceived economic benefits such as cost savings from ISO/IEC 17025 laboratories.*
H1(a, b): *Cost savings in the ISO/IEC 17025 laboratories have a positive impact on sustainable service quality and thus act as a mediator to customer satisfaction.*

3.1.2 Revenue through sustainability initiatives

Different strategic initiatives, such as enhanced information management and resources management, will enable improved financial performance and competitiveness regarding the calibration industry [7-10]. The attention to digitizing supply chains is unravelling for market leaders. The hypotheses to be considered include the following:

H2: *Revenue generated by sustainable calibration services has a positive direct impact on customer satisfaction.*
H2(a, b): *Revenue that emanates from these services contributes to sustainable service quality positively and therefore mediates the association with customer satisfaction.*

3.2 Perceived environmental benefits

3.2.1 Electronic waste reduction for service sustainability

ISO 17025 accreditation may translate to potential cost savings and a reduced amount of electronic waste. The preventive maintenance offers a chance to reduce certain incidences of equipment damage and thus electronic wastes improve service efficiency [1, 8-10]. The following hypotheses can be related to that:

H3: *Electronic waste reduction positively impacts customer satisfaction.*
H3(a, b): *E-waste reduction positively influences sustainable service quality, thereby mediating the relationship with customer satisfaction.*

3.2.2 Environmental care in laboratory processes

Efficient environmental management would address issues related to sustainable practices, such as clean production along with renewable energy. Yet, the inability to monitor the environmental concerns about temperature and storage of chemicals is always observed to be very poor [1, 11-14]. Some of the hypotheses proposed are:

H4: *Environmental concern positively influences customer satisfaction.*
H4(a, b): *Environmental concerns positively influence the quality of sustainable services, consequently mediating the relationship to customer satisfaction.*

3.3 Perceived socio-cultural concerns

3.3.1 Evaluation of feedback and management of social CRM

(1) Periodic Collection of Feedback: Annual surveying of customers by service performances, in harmony with ISO 17025, enables deeper insights into the analysis that needs to be performed in a given case.

(2) Strategic Analysis of Feedback: Analyzing customer feedback leads to the recognition of strengths and weaknesses in service provision that help in competitive benchmarking. The studies [15-17] confirm this view. Hypothesis statement:

H5: *Evaluation of feedback and managing social CRM have a positive impact on customer satisfaction.*
H5(a, b): *These aspects contribute positively to sustainable service quality by influencing the level of customer satisfaction.*

3.3.2 Complaints resolution and transparency

Effective complaint management and work transparency lead to more customer trust and satisfaction. Transparency can be improved using digital solutions, as audit logs. The studies [1, 18-20], hence, advance the following hypotheses:

H6: *Effective resolution of customer complaints and improvement of work transparency will positively influence customer satisfaction.*
H6(a, b): *The mentioned factors will have a positive influence on sustainable service quality, and hence serve as a mediator in a relationship with customer satisfaction.*

3.4 Perceived digitalization and innovation

3.4.1 Serv-digitalization and document control

Digitalization also enhances metrological traceability and service delivery through the automation of calibration processes and hence reduces human error [14, 16, 21]. Hypotheses:
H7: *Serv-digitalization and digitized document control positively influence customer satisfaction.*
H7(a, b): *These practices positively impact sustainable service quality hence mediating customer satisfaction.*

3.4.2 Service innovation

The innovative approach in maintenance and inventory management boosts customers' satisfaction since the service provided becomes effective and the products on offer also increase [22-25]. The hypotheses proposed are:

H8: *Service innovation positively impacts customers' satisfaction.*
H8(a, b): *Service innovation positively impacts sustainable service quality, which, in turn, mediates customers' satisfaction.*

4. CUSTOMER'S PERCEIVED SUSTAINABLE SERVICE QUALITY (SSQ)

The role of digital transformation with respect to SSQ in ISO 17025 laboratories is still an area that demands further research across industries. The hypothesis of Kim et al. [26], therefore, goes on to state:

H9: *SSQ positively influences customer satisfaction and mediates the association between all independent variables and customer satisfaction.*

4.1 Measurement model: Pilot test and initial results

The statistical data analysis confirmed that the measurement model had been validated by validity and reliability. The main assessments included:

Indicator Reliability: The factor loadings were all well above 0.5 but mostly above 0.70, hence showing the construct with good validity.

Internal Consistency: Cronbach's Alpha was between 0.553 and 0.849, hence above the threshold of acceptability at 0.70.

Convergent Validity: The AVE and CR values were greater

than 0.50 and 0.70, respectively. Discriminant Validity: The square root of AVE for each construct was greater than the inter-construct correlations, as per the criterion of Fornell and Larcker. Overall, the measurement model, as validated through SmartPLS, was satisfactory, with minimum thresholds on AVE and CR, hence reliable and valid.

4.2 Limitations and planning for future research

One limitation of ISO 17025 is its narrow scope, as it primarily focuses on technical competence rather than broader aspects of service quality and customer satisfaction. As a result, the comprehensive approach to service quality was not fully considered in this study. Additionally, acquiring confidential data from ISO 17025-accredited labs can be challenging, as these labs often have restrictions on sharing information, which may limit the scope of analysis. The findings from studies conducted in specific labs may also be unique to those labs or industries due to variations in lab processes and customer demographics.

The complexities of calibrating lab instrumentation, particularly when integrating sustainability, may involve trade-offs between cost, efficiency, and customer satisfaction, further complicating the research. In such a highly technical context, not all dimensions of service quality may be captured, especially those related to sustainability, which also posed challenges in measuring customer satisfaction.

Future research could expand the scope beyond ISO 17025 by exploring additional factors that complement the quality management system with other standards or sustainability frameworks. Longitudinal studies could also add value by evaluating the long-term relationship between sustainable practices and customer satisfaction. A useful area of investigation would be to compare ISO 17025-accredited labs that have successfully implemented sustainability practices with those that have not, to better understand the effects on customer satisfaction.

Cross-industry research could further enhance understanding by examining how other industries manage sustainable service quality in lab calibration, helping to identify channel-specific requirements. Additionally, more advanced models for measuring customer satisfaction, which integrate sustainability dimensions, could improve the utility and reliability of future findings. Engaging stakeholders, including customers, regulators, and sustainability experts, in the research process would likely result in fuller data disclosure and a more comprehensive understanding of the topic.

Lastly, an exciting direction for future research would be to explore how innovative technologies, such as AI and IoT, can influence sustainable service quality and customer satisfaction in real time, offering new ways to enhance service delivery in calibration labs.

Table 1. Pilot test and initial results construct reliability and validity

	Item's Code	Outer Loading Value	Cronbach's Alpha	Composite Reliability (CR)	Average Variance Extracted (AVE)
Service Digitalization Management (SDM)	SDM1	0.849	0.867	0.881	0.607
	SDM2	0.774			
	SDM3	0.886			
	SDM4	0.825			
	SDM5	0.676			
	SDM6	0.631			
Resolving Customer Complaint & Work Transparency (RCW)	RCW1	0.937	0.970	0.973	0.849
	RCW2	0.857			
	RCW3	0.936			
	RCW4	0.949			
	RCW5	0.939			
	RCW6	0.927			
	RCW7	0.901			
Feedback Assessment & Social-CRM (FS)	FS1	0.866	0.948	0.950	0.794
	FS2	0.816			
	FS3	0.924			
	FS4	0.882			
	FS5	0.944			
	FS6	0.908			
Customer Optimum Satisfaction (COS)	COS1	0.559	0.929	0.948	0.711
	COS2	0.943			
	COS3	0.859			
	COS4	0.833			
	COS5	0.814			
	COS6	0.942			
	COS7	0.891			
Cost Saving (CST)	CST1	0.791	0.858	0.885	0.634
	CST2	0.737			
	CST3	0.886			
	CST4	0.779			
	CST5	0.782			
Environmental Concern (ENC)	ENC1	0.916	0.909	0.957	0.696
	ENC2	0.931			
	ENC3	0.867			
	ENC4	0.831			
	ENC5	0.862			
	ENC6	0.533			
E-Waste Reduction (EWR)	EWR1	0.725	0.801	0.827	0.553
	EWR2	0.863			
	EWR3	0.698			
	EWR4	0.612			

Revenue (RVN)	EWR5	0.795	0.856	0.889	0.577
	RVN1	0.708			
	RVN2	0.808			
	RVN3	0.774			
	RVN4	0.707			
	RVN5	0.812			
	RVN6	0.741			
Service -Innovation (SIN)	SIN1	0.879	0.940	0.946	0.806
	SIN2	0.862			
	SIN3	0.893			
	SIN4	0.917			
	SIN5	0.937			
Sustainable Service Quality (SSQ)	SSQ1	0.923	0.877	0.899	0.684
	SSQ2	0.845			
	SSQ3	0.852			
	SSQ4	0.882			
	SSQ5	0.589			
	SSQ1	0.923			

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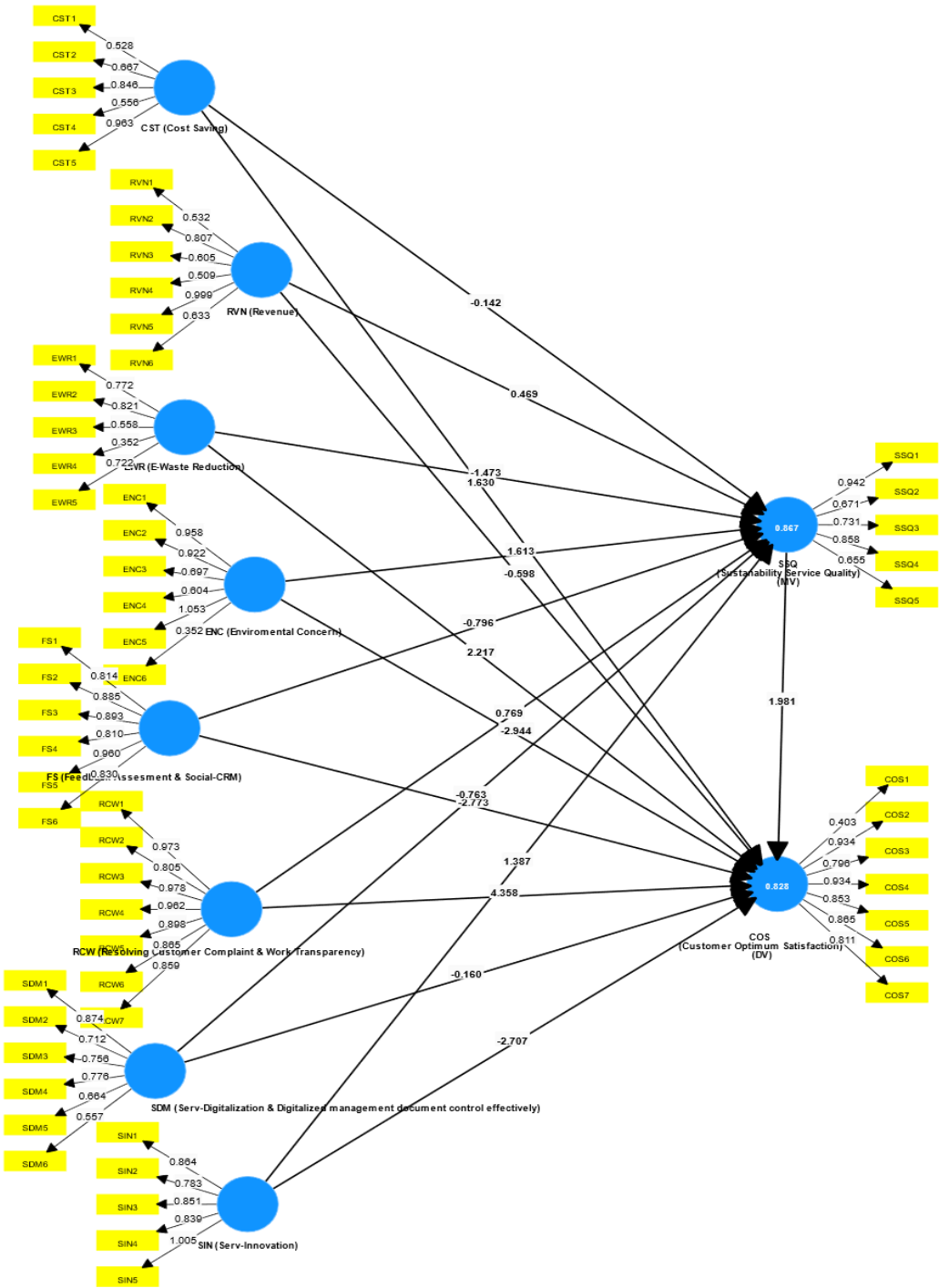

Figure 2. The measurement model

4.3 Measurement model pilot test and initial results for construct reliability

Table 1 presents the reliability and validity statistics for the constructs in the proposed research framework, as illustrated in Figure 2. Each construct is measured using multiple items, with outer loadings indicating the relevance of each item. Cronbach's alpha values, ranging from 0.801 to 0.942, confirm internal consistency. Composite reliability (CR) values exceed the 0.7 threshold, ensuring the reliability of the constructs. Average Variance Extracted (AVE) values, mostly above 0.5, confirm convergent validity, although two constructs E-Waste Reduction and Revenues fall slightly below the standard. Overall, the results support the robustness of the measurement model in evaluating sustainable service quality and customer satisfaction in ISO 17025 lab calibration.

4.4 Limitations and planning for future research

One limitation of this study is that the measurement model was tested using a pilot sample of only 35 respondents. This small sample size may not fully capture the variability needed to provide a comprehensive assessment of the constructs' reliability and validity, potentially resulting in biased or unstable estimates. Consequently, the findings from this pilot test should be interpreted with caution, as they may not be representative of the larger population.

Future research should focus on collecting a more extensive dataset with a larger and more diverse sample of respondents. Expanding the sample size will enhance the robustness of the measurement model and provide stronger support for the generalizability of the results. With a larger sample, the study can proceed with hypothesis testing and structural model analysis, which will enable a more thorough validation of the proposed relationships within the framework.

By addressing these limitations, future research can provide a more comprehensive understanding of the factors that influence sustainable service quality and customer satisfaction in ISO 17025 accredited calibration laboratories. This will not only strengthen the theoretical foundation but also offer practical insights for laboratories aiming to optimize service quality through sustainable practices.

5. CONCLUSION

The study opens a window of valued insight into how SSQ can be used to boost customer satisfaction within ISO 17025 accredited calibration laboratories, with particular attention to Saudi Arabia and Bahrain. In this perspective, the research findings show, after the development and validation of a conceptual framework based on the Stimulus-Organism-Response model, an increase both in service quality and in customer satisfaction because of economic advantages, environmental concerns, digitalization, and customer relationship management.

The pilot test results seemed to indicate good construct reliability and validity, suggesting again that the measurement model is adequate and can be used for further analysis. However, the support is there for the initial findings from the positive relationship between SSQ and customer satisfaction, and perceived service quality serving as a partial mediator. The sample size of 35 respondents is limited and thus suffers from generalizability issues; therefore, such a framework needs verification from future research based on a larger sample.

Greater implications are drawn for both academia and the calibration industry as a whole. In an increasingly competitive and exacting environment, the pursuit of sustainable service practices would provide a strategic opening to enhance operational efficiency through fostering customer loyalty. This research, therefore, aims at contributing to such efforts by delineating those dimensions of SSQ impacting on customer satisfaction and thus providing certain strategies that ISO 17025 laboratories can apply to enhance their service quality and sustainability performance.

REFERENCES

[1] Mahdi, A.M., Alomari, K., Naser, I.H. (2021). Development the quality management system in construction central laboratory of the engineering consulting bureau in engineering college/Thi-Qar University according to International Standard (ISO 17025). Solid State Technology, 64(2): 1752-1765.

[2] Al-Alqam, M.S., Rehman, A.U., Alsultan, M. (2023). Sustainability indexing model for Saudi manufacturing organizations. Sustainability, 15(2): 953. https://doi.org/10.3390/su15020953

[3] Tseng, M.L., Wu, K.J., Chiu, A.S., Lim, M.K., Tan, K. (2019). Reprint of: Service innovation in sustainable product service systems: Improving performance under linguistic preferences. International Journal of Production Economics, 217: 159-170. https://doi.org/10.1016/j.ijpe.2019.09.013

[4] Hu, X.A., Dang-Van, T. (2023). Emotional and behavioral responses of consumers toward the indoor environmental quality of green luxury hotels. Journal of Hospitality and Tourism Management, 55: 248-258. https://doi.org/10.1016/j.jhtm.2023.04.009

[5] Juliana, J., Sianipar, R., Lemy, D.M., Pramezwary, A., Pramono, R., Djakasaputra, A. (2023). Factors influencing visitor satisfaction and revisit intention in Lombok Tourism: The role of Holistic Experience, Experience Quality, and Vivid Memory. International Journal of Sustainable Development and Planning, 18(8): 2503-2511. https://doi.org/10.18280/ijsdp.180821

[6] Abdullah, K.H., Abd Aziz, F.S. (2020). Safety behaviour in the laboratory among chemical engineering students: An S-O-R paradigm. TEST Engineering and Management, 83: 22330-22346.

[7] Manser Payne, E.H., Dahl, A.J., Peltier, J. (2021). Digital servitization value co-creation framework for AI services: A research agenda for digital transformation in financial service ecosystems. Journal of Research in Interactive Marketing, 15(2): 200-222. https://doi.org/10.1108/JRIM-12-2020-0252

[8] Alshareef, H. (2019). Space optimization and process improvement. https://digitalcommons.kennesaw.edu/egr_srdsn/27/.

[9] Bharosa, N., Marangio, F., Petti, C., Janssen, M. (2021). Engaging citizens in digital public service innovation ecosystems-insights from the Netherlands and Italy. In Proceedings of the 14th International Conference on Theory and Practice of Electronic Governance, Athens Greece, pp. 509-512. https://doi.org/10.1145/3494193.3494269

[10] Hendra, F., Hutasoit, J., Agung, K., Haryani, Y. (2022). Performance assessment to improve the quality of performance and service in Jakarta Ppishp food security department using balanced Scorcard. Scientific Journal of Reflection: Economic, Accounting, Management and Business, 5(2): 414-426. https://doi.org/10.37481/sjr.v5i2.476

[11] Costa, A.J., Curi, D., Bandeira, A.M., Ferreira, A., Tomé, B., Joaquim, C., Santos, C., Góis, C., Meira, D., Azevedo, G., Inácio, H., Jesus, M., Teixeira, M.G., Monteiro, P., Duarte, R., Marques, R.P. (2022). Literature review and theoretical framework of the evolution and interconnectedness of corporate sustainability constructs. Sustainability, 14(8): 4413. https://doi.org/10.3390/su14084413

[12] Molero, A., Calabrò, M., Vignes, M., Gouget, B., Gruson, D. (2021). Sustainability in healthcare: Perspectives and reflections regarding laboratory medicine. Annals of Laboratory Medicine, 41(2): 139-144. https://doi.org/10.3343/alm.2021.41.2.139

[13] Samuel, G., Lucassen, A.M. (2022). The environmental sustainability of data-driven health research: A scoping review. Digital Health, 8: 20552076221111297. https://doi.org/10.1177/20552076221111297

[14] Mustapää, T., Nummiluikki, J., Viitala, R. (2022). Digitalization of calibration data management in pharmaceutical industry using a multitenant platform. Applied Sciences, 12(15): 7531. https://doi.org/10.3390/app12157531

[15] Harzli, I. (2021). Application to risk management as part of the transition of the quality management system from ISO 17025 v2005 to ISO 17025 v2017: Case of Multilab laboratory in Tunisia. Journal of Business and Management Sciences, 9(3): 130-144. https://doi.org/10.12691/jbms-9-3-5

[16] Karthiyayini, N., Rajendran, C. (2021). An approach for benchmarking service excellence in accredited services of Indian calibration and testing laboratories. Materials Today: Proceedings, 46: 8218-8225. https://doi.org/10.1016/j.matpr.2021.03.216

[17] Korathad, Y., Boonpattarakan, A. (2017). Factors influencing trust and relationship commitment to use the calibration service: A case study of oil & gas companies in Thailand. Review of Integrative Business and Economics Research, 6: 250-259.

[18] Casey, E., Souvignet, T.R. (2020). Digital transformation risk management in forensic science laboratories. Forensic Science International, 316: 110486. https://doi.org/10.1016/j.forsciint.2020.110486

[19] Wu, Q., He, Z., Wang, H., Wen, L., Yu, T. (2019). A business process analysis methodology based on process mining for complaint handling service processes. Applied Sciences, 9(16): 3313. https://doi.org/10.3390/app9163313

[20] Zang, X., Krebs, E., Min, J.E., Pandya, A., Marshall, B.D.L., Schackman, B.R., Behrends, C.N., Feaster, D.J., Nosyk, B., Behrends, C.N., Del Rio, C., Dombrowski, J., Feaster, D.J., Gebo, K., Golden, M., Granich, R., Kerr, T., Kirk, G., Marshall, B.D.L., Strathdee, S.A. (2020). Development and calibration of a dynamic HIV transmission model for 6 US cities. Medical Decision Making, 40(1): 3-16. https://doi.org/10.1177/0272989X19889356

[21] Mustapää, T. (2022). Digitalisation of metrology for improving trustworthiness and management of measurement data in industrial IoT systems. Doctoral Theses, Aalto University. https://aaltodoc.aalto.fi/handle/123456789/116996.

[22] Al-mijrab, A.S.A., Elgharib, M.E., Al-Griw, M.A. (2019). Critical success factors of ISO/IEC 17025 implementation within Arabic countries: A case study of Libyan Research Centres and Laboratories (LRCL). In 23rd International Conference on ISO & TQM, UIC, China, 6(6): 1-11.

[23] Chua, W.Z. (2020). Innovate Malaysia design competition 2020 1 intelligence maintenance management system via predictive analytics. Innovate Malaysia Design Competition 2020. https://chuazhe.github.io/MY032.pdf.

[24] Opazo-Basáez, M., Vendrell-Herrero, F., Bustinza, O.F. (2022). Digital service innovation: A paradigm shift in technological innovation. Journal of Service Management, 33(1): 97-120. https://doi.org/10.1108/JOSM-11-2020-0427

[25] Pimpan, S., Ruaguttamanun, C., Wongkhae, K. (2021). Sustainable marketing strategy and marketing success of ISO 14001 certified manufacturing businesses in Thailand. Journal of Humanities and Social Sciences Thonburi University, 15(3): 37-48.

[26] Kim, S., Choi, B., Lew, Y.K. (2021). Where is the age of digitalization heading? The meaning, characteristics, and implications of contemporary digital transformation. Sustainability, 13(16): 8909. https://doi.org/10.3390/su13168909