INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 15, Issue 5, (2025) E-ISSN: 2222-6990

Soft and Hard Total Quality Management and Big Data to Achieve Sustainable Performance in the Jordan Manufacturing: A Conceptual Paper

Ansam Al-Bdeirat, Associate Professor. Dr. Anees Janee Ali*

School of Management, Universiti Sains Malaysia, Penang, Malaysia

Emil: ansamalbdeirat@student.usm.my

*Corresponding Author Email: aneesali@usm.my

To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v15-i5/25410 DOI:10.6007/IJARBSS/v15-i5/25410

Published Date: 19 May 2025

Abstract

Business organizations may be able to improve their sustainability performance by increasing stakeholder awareness of the potential negative impacts industrial companies may have through their operations. This conceptual study aims to examine the factors that influence sustainable performance in the Jordanian industrial sector. Drawing on the resource-based view, this research has developed a model to investigate the influence of soft and hard TQM and big data on sustainable performance; it also analyzes the mediating role of big data. The methodology of the current study was through the quantitative method employed, and data were gathered through cross-sectional questionnaires. The data was analysed using the Smart-PLS 4 structural equation model. This study will provide a guideline for industrial executives to secure sustainability through the adoption of soft and hard TQM concepts and big data.

Keyword: Total Quality Management (TQM), Soft TQM, Hard TQM, Sustainable Performance (SP), Big Data (BD), Resource-based view (RBV) Theory

Introduction

The Global Risks Report 2020 has identified sustainability-related issues among the three most significant risks facing the world today. The persistent economic stagnation, coupled with environmental degradation and the emergence of global pandemics, has resulted in significant challenges such as unemployment, climate change, biodiversity loss, and poverty (World Economic Forum, 2020).Also, the OECD (2017) has indicated that numerous nations are grappling with sluggish economic growth, elevated unemployment rates, and an increase in income inequality and poverty (Viswanathan, 2022).So, organizations in today's global market are becoming more aware of the importance of sustainability management to develop ideal circumstances for addressing 21st-century concerns in business and the environment (Khan et al., 2021). Moreover, firms encounter heightened client knowledge and

evolving demands, with growing worries regarding ecologically harmful business practices (Fok et al., 2023)), and the World Bank (2021) emphasizes that economic disparities and social injustice persist. Furthermore, Trade disputes and geo-economics divisions between the US, EU, and China increase economic uncertainty the Global Risks Report (GRP). Jordan faces several economic difficulties the political unrest along Jordan's borders in Syria and Iraq prevented the private sectors from carrying out their duties and tasks in developing new projects and employment possibilities (Hjazeen et al., 2021). Which led to a decrease in exports to both Iraq and Syria during the year 2015 by about 40%. (Ministry of Industry, Trade, and Supply, 2022), high a sizable budget deficit. High production costs and lack of natural resources (Alshoubaki & Harris, 2018).

Total quality management (TQM) fundamental goal is to enhance operational activities. The scope has been expanded to include social and environmental aspects (Tasleem et al., 2019). Consequently, Total quality management (TQM) can serve as a strategy for companies to achieve long-term sustainability by enhancing their competitiveness advantage (Siddiqui et al., 2009; Saha et al., 2022).

Big data possesses the capacity to transform business, necessitating an understanding of the implications regarding organizational responses to the opportunities and challenges associated with environmentally sustainable business operations (Seles et al., 2018) .However, the conventional methods for acquiring, accessing, and analyzing big data are now obsolete (Seles et al., 2018).The notion of SP in Jordan is relatively nascent, with enterprises perceiving soft and hard TQM as a charitable endeavor rather than recognizing its ecological and societal importance.. Moreover, research regarding the correlation between sustainable performance and total quality management is limited, particularly in poor nations (Abbas, 2020b). On the other hand, there is a scarcity of research that investigates the role that QM plays in the digital revolution (Ponsignon et al., 2019).

Objective of the Study

RO1: To examine the effect of Soft and Hard TQM on improving sustainable Performance in Jordanian large manufacturing firms.

RO2: To examine the relationship between soft and hard TQM, and Big Data in Jordanian large manufacturing firms.

RO3: To investigate the mediating role of Big Data in the relationship between soft and hard TQM and sustainable performance

Literature Review

Resource-Based View (RBV) Theory

RBV theory explains and assumes that manufacturing organizations are profit-maximizing units. According to that a firm's strategic resources, such as its assets, data, knowledge, and skills (Barney, 1991) or its capital, which includes its human, physical, and technological resources (Grant, 1996), produce a sustained , the resources are of two types of tangibles or intangible. Tangible resources are assets, machines, etc., and intangible resources such as organizational knowledge learning, organizational, intellectual capital, staff skills, etc. (Barney, 1991). The Resource-Based View (RBV) theory has garnered heightened interest across various industries due to advancements in sustainability objectives (Jiménez Jiménez, 2019), and it can elucidate the relationship between Total Quality Management

(TQM) and sustainability performance (Kearney, 2018; Ali AlShehail et al., 2022b). In introducing the Resource-Based View (RBV) theory of the company Wernerfelt (1984) asserts that technological diversification facilitates superior firm returns and fosters the emergence of more advanced ideas. Consequently, firms must continuously enhance their technology capabilities to achieve sustainable success (Tasleem et al., 2019).Because of the advancement of sustainability goals, the resource-based perspective RBV has gained popularity across many industries (Antunes et al., 2021). Investing in developing current resources can lead to long-term competitive advantage (Gürlek & Cemberci, 2020). To achieve this, enterprises must include quality throughout all activities, from resource acquisition to customer service, and even after sale (González-García et al., 2019). The debate about the relationship between soft and hard TQM has been vivid for decades, attracting scholars and practitioners' interest. Scientific contributions in this domain espouse the resource-based view of the firm. The assumption that envisions the mix of soft and hard TQM practices as a distinctive bundle of resources that concurs in building sources of competitive advantage.

Total Quality Management (TQM)

The concept of Total Quality Management (TQM) was initially proposed and championed by the American scholar Edwards Deming (Sader et al., 2019), it gained popularity in Japan as a technique for improving the performance and worldwide competitiveness of Japanese companies (Chen, 2024). There are many definitions of TQM available in the literature, and certain harmonies have been observed among them. TQM refers to a management strategy that aims to improve customer satisfaction and organizational performance by promoting teamwork, customer-driven quality, and continuous improvement of inputs and processes using quality management technologies and tools (Casprini et al., 2023; Ali AlShehail et al., 2022b; Abbas, 2020a); or a management technique that prioritizes efficient resource use and continual improvement to meet and exceed customer expectations (Canbay & Akman, 2023).Previous literature pointed to several benefits that can be acquired due to the implementation of TQM (Chen et al., 2018; Kamble et al., 2020; Jayashree et al., 2021; Saha, Talapatra, et al., 2022). The advantages encompass enhanced organizational performance, heightened customer satisfaction, diminished costs, empowered personnel, expanded market share, and superior overall quality. However, the level of in-country growth and surrounding socioeconomic and cultural factors impacts the effectiveness of TQM implementation (Karia & Mahmoud Saleh, 2022).According to the literature, Wilkinson (1992) was the first researcher to divide Total Quality Management into two categories: soft and hard Total Quality Management (TQM).

Soft TQM

Soft TQM that include social and behavioral aspects, such as organizational culture, leadership and top management commitment, human resources or customer and stakeholder orientation Samson & Terziovski (1999); Prajogo & McDermott (2005).Soft TQM refers to a social system that incorporates human resource management (Addis, 2020; Zeng et al., 2017).According to Margherita & Braccini(2024)the behavioral elements of workers involve the propagation of quality culture and the engagement of workers in quality practices.

Hard TQM

Hard Total Quality Management (TQM) pertains to the technical dimensions of the Quality Management System (QMS), including quality planning, continuous improvement, supplier

management, process management and control, resource management, information management, and product and service design (Samson & Terziovski, 1999; Prajogo & McDermott, 2005) .Hard TQM pertains to procedural and technological dimensions (Addis, 2020; Zeng et al., 2017). In addition, the hard aspect of Total Quality Management (TQM) encompasses technical production elements, including production methodologies, statistical process control, technical instruments, and ISO certifications. The literature indicates that this hard side of TQM significantly influences organizational performance, facilitating continuous enhancement and optimization of product design and operational processes (Margherita & Braccini, 2024).

Big data (BD) refers to information assets that are high velocity, high variability, high value, high validity, and high visualization. These assets require innovative and effective ways to collect, store, distribute, manage, and analyze data (Shi, 2022), as well as enhanced enterprise resource planning responsiveness (Bandara et al., 2024).Businesses need to create a data-driven strategy if they want to succeed and obtain a competitive advantage. Information technology ensures the efficient use of large data volumes in addition to analysis enabled by traditional database technologies, which alludes to the increase in data that is challenging to handle and store (Hashem et al., 2015). Datasets that surpass program storage, administration, and processing capacities are referred to by (Imran et al., 2018). As sustainable development and the digital revolution progressed simultaneously (Awan et al., 2022; Ertz et al., 2022), a new wave of research began to examine how BDA affected businesses' sustainability initiatives (Dubey et al., 2020; Jum'a et al., 2022).

Sustainable Performance

Contemporary organizations in the global market increasingly recognize the significance of sustainability management in creating optimal conditions for tackling 21st-century challenges in business and the environment. This business strategy incorporates social, environmental, and economic factors, aiming to ensure that both current and future generations benefit from the resultant outcomes. This approach is referred to as Triple Bottom Line (TBL) management Khan et al., 2021) .It is an all-encompassing objective that improves many things, and it pushed companies to change their current practices to meet its sustainability targets. Albloushi et al.(2023).The effort needed to achieve SD is widely recognized in Jordan as being crucial for the advancement of the country's social life, economic prosperity, and preservation of its natural and environmental resources (Zafar et al., 2020).

Soft TQM and Sustainable Performance

The Resource-Based View (RBV) posits that internal operations significantly impact organizational sustainability, hence facilitating a competitive advantage. Thus, the Resource-Based View asserts that a company's critical internal assets—such as proficient personnel, internal processes, and technological competencies—can be leveraged to establish a competitive advantage and generate value in various manners, with sustainability potentially incorporated into organizational applications. The success of the company is influenced by the commitment levels of senior managers, who are strategic decision-makers, goal-setters, and resource allocators in today's environment (Arinaitwe et al., 2024; Memon et al., 2022). Additionally, when upper-level management shows concern for ecological issues, employees will have a more favorable impression of improved environmental-responsible behavior (Haldorai et al., 2022). On the other hand, Human resources are an essential element of the

TQM framework, encompassing many organizational development techniques, including efficient training, recruitment processes, health and safety protocols, recognition, empowerment, engagement, and collaboration. The objective of TQM is to guarantee ongoing enhancement inside organizations and to ensure the efficient utilization of resources (Shafiq et al., 2020), in order to attain the dimensions of sustainable development (Zhang et al., 2022). Prior studies have established a probable positive correlation between Total Quality Management (TQM) and sustainability performance (Abbas, 2020b; Ali AlShehail et al., 2022a; Tasleem et al., 2019) , as well as between TQM and organizational performance (Khan et al., 2020).

Hard TQM and Sustainable Performance

Process management is essential for the quality management system, since the establishment of procedures allows leaders, individuals, and teams to continuously demonstrate the necessary values and competences (Mi Dahlgaard-Park & Dahlgaard, 2010). Also, effectively managed processes can result in superior operational quality performance (Acquah et al., 2023), as process management offers a framework to consistently deliver the same quality service. Organizations can improve their operational efficiency, leading to enhanced product quality and progress in other competitive areas, including cost reduction (Purbowo & Waluyowati, 2022; Faeq et al., 2021). Conversely, quality information and analysis signify the availability of performance-related quality data that enables the swift identification of quality concerns, assisting managers in making informed decisions. Robust TQM processes, encompassing quality information and analysis, have demonstrated a substantial impact on sustainable performance within manufacturing sectors (Ali & Johl, 2022).Multiple studies support these relationships, that hard TQM practices significantly enhance financial, social, and environmentally sustainable performance in manufacturing industries (Ali & Johl, 2022). Similarly, Chen et al.(2020) demonstrate hard TQM significantly affects a firm's sustainable competitive advantage. It shows that it has a substantial impact on the financial and operational performance of hospitals (Zehir & Zehir, 2023).

The Mediating Role of Big Data Technology

The Resource-Based View (RBV) theory posits that a firm's internal dynamics influence its organizational sustainability. It posits that a company's significant internal assets can be leveraged to generate value and establish a competitive advantage in many manners (Al-Dhaafri et al., 2016; Collis, 1994). Utilizing the Resource-Based View (RBV), several scholars have demonstrated the correlation between sustainable performance—encompassing economic, social, and environmental dimensions—and Total Quality Management (TQM) across multiple contexts (Jiménez-Jiménez et al., 2020).

Big data is primarily responsible for the automated aspect of knowledge. This information may be incorporated into company policies, programs, strategies, and practices, though, provided it is absorbed and shared throughout the organization. Big data is anticipated to enhance overall business performance as learning new information promotes profitability (Nickerson & Zenger, 2004). Big data helps new products succeed as well (Xu et al., 2016). According to Ali & Johl (2023) and Zhu & Yang (2021), banks that dedicate themselves to appropriate client data monitoring enhance their informational resources and knowledge, hence accomplishing goals related to operational efficiency and sustainability. Jum'a et al.

(2022) discovered similar outcomes since big data supports supply chain sustainability by offering greater information and stronger resources.

Big Data (BD), a crucial element of Industry 4.0, assists executives in the current global economy in understanding the value and advantages of using big data analytics to solve their issues for ongoing enhancements and uncover creative remedies (Marshall et al., 2015). TQM Leadership aims to create unity in the purpose, wherein the entire workforce participates in order to achieve the firm's quality goals and innovative performance (Ooi et al., 2012). In every TQM program, supplier relationship management is essential (Jiménez-Jiménez et al., 2020).

Conceptual Framework

The study's conceptual framework was built based on the aforementioned literature reviews: The Factors included in the conceptual framework are Soft and Hard TQM, Big Data and Sustainable performance. (Fig. 1)

Figure 1: Conceptual framework
Source: Researcher, 2025

Jordanian Industry Sector

Jordan's industrial sector is regarded as an important pillar of support for the national economy due to its major contributions to Jordan's social and economic development. These benefits are demonstrated by its 25% direct GDP contribution as well as by its tight ties to, capacity to function in, and stimulation of numerous other industries. About 40% of the GDP is contributed by it (JCI, 2023). As industry is one of the largest contributors to environmental pollution, it has caused a significant impact on the environment and humans (Wang and Yang, 2021). As a result, businesses started to adopt sustainable performance in the industrial sector. Is suffering like the rest of the industries in the world due to the repercussions of the global financial crisis, and the most prominent challenges facing the industrial sector are (Jordan Investors Association. 2023).A lack of capital, problems related to employment, high production costs, declining demand, increasingly debt, intense competition from other nations, geopolitical events in the region https://www.britannica.com

Methodology

The literature review paper used a methodological approach that focused on thoroughly and methodically exploring pertinent academic literature in order to examine the hard and soft TQM with sustainable performance and the mediating role of Big Data. The approach included a thorough search using carefully chosen keywords and search terms relevant to sustainable performance success across reliable databases like PubMed, Scopus, Web of

Science, and Google Scholar. The inclusion criteria were restricted to academic publications and peer-reviewed journal papers published within a given period in order to guarantee currency and relevance. The literature review's conclusion identified research gaps and offered a sophisticated understanding of Jordan's industry sector's sustainable performance. The evaluation also included information on potential avenues for future study and applications.

Conclusions

This study aims to conduct a comprehensive review of the literature to investigate the impact of applying soft and hard TQM practices and big data on sustainable performance, along with the mediating effect of big data in the releatin soft and hard TQM and sustainability performance in manufacturing in Jordan. Soft and hard TQM, as a strategy contributes to enhancing an organization’s sustainability performance, reduces errors and improves operational performance, it helps an organization increase customer satisfaction which directly contributes to organizational sustainability. This finding confirms earlier research (Tasleem et al., 2019 ; Abbas, 2020; Ali AlShehail et al., 2022). However, the results of previous studies on the relationship between soft and hard TQM and sustainability performance are still inconsistent. also the mediating effect to big data technology Therefore, this study will explore the relationship to obtain new, more comprehensive results. it is essential for all stakeholders, including large firms, relevant ministries, and business associations, to collaboratively facilitate the adoption of big data technology to achieve sustainable performance. Future studies could take into account different mediating factors that could enhance sustainable performance with soft and hard TQM, such as block chain.

Theoretical and Practical Implications

This study enhances organizational understanding by examining the impact of both soft and hard Total Quality Management (TQM) deployment on Big Data, a topic that has not been sufficiently addressed by researchers. This work may necessitate more investigation in the manufacturing industry sector. This study examines the deficiency in the analysis of Big Data's mediating function in prior literature, therefore contributing theoretically to this research domain. This study sought to investigate the synergistic impacts of soft and hard Total Quality Management (TQM) alongside Big Data on organizational sustainability performance. The findings suggest that the use of both soft and hard Total Quality Management (TQM) might substantially improve sustainability within the manufacturing sector when Big Data is utilized. This outcome illustrates the intrinsic resilience of Big Data, since its benefits can only be actualized when its technologies are actively tailored to the industry's environment and aim to enhance existing management methods and practices.

The results demonstrate that the use of both soft and hard Total Quality Management approaches, alongside Big Data, may significantly influence organizational sustainability within the manufacturing sector. A comprehensive understanding of the synergistic effects of TQM and Big Data on sustainability performance can aid practitioners, administrators, and policymakers, especially in developing nations, in setting realistic expectations during implementation. Additionally, it can enable business organizations to secure a competitive edge that differentiates them from rivals and enhances their market presence. Moreover, acknowledging the synergistic connection with mediating effects aids executives in foreseeing

challenges to organizational sustainability enhancement, so preventing futile actions and unproductive expenditures.

References

Abbas, J. (2020a). Impact of total quality management on corporate green performance through the mediating role of corporate social responsibility. *Journal of Cleaner Production*, *242*, 118458.

Abbas, J. (2020b). Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. *Journal of Cleaner Production*, *244*, 118806.

Acquah, I. S. K., Quaicoe, J., & Arhin, M. (2023). How to invest in total quality management practices for enhanced operational performance: findings from PLS-SEM and fsQCA. *The TQM Journal*, *35*(7), 1830–1859.

Addis, S. (2020). An exploration of quality management practices in the manufacturing industry of Ethiopia. *The TQM Journal*, *32*(1), 127–142.

Al-Dhaafri, H. S., Al-Swidi, A. K., & Yusoff, R. Z. Bin. (2016). The mediating role of total quality management between the entrepreneurial orientation and the organizational performance. *The TQM Journal*, *28*(1), 89–111.

Albloushi, B., Alharmoodi, A., Jabeen, F., Mehmood, K., & Farouk, S. (2023). Total quality management practices and corporate sustainable development in manufacturing companies: the mediating role of green innovation. *Management Research Review*, *46*(1), 20–45.

Ali AlShehail, O., Khan, M., & Ajmal, M. (2022a). Total quality management and sustainability in the public service sector: the mediating effect of service innovation. *Benchmarking: An International Journal*, *29*, 382–410.

Ali AlShehail, O., Khan, M., & Ajmal, M. (2022b). Total quality management and sustainability in the public service sector: the mediating effect of service innovation. *Benchmarking*, *29*(2), 382–410. https://doi.org/10.1108/BIJ-08-2020-0449

Ali, K., & Johl, S. K. (2022). Impact of total quality management on SMEs sustainable performance in the context of industry 4.0. *Proceedings of International Conference on Emerging Technologies and Intelligent Systems: ICETIS 2021 (Volume 1)*, 608–620.

Ali, K., & Johl, S. K. (2023). Impact of total quality management on industry 4.0 readiness and practices: does firm size matter? *International Journal of Computer Integrated Manufacturing*, *36*(4), 567–589.

Alshoubaki, W., & Harris, M. (2018). The impact of Syrian refugees on Jordan: A framework for analysis. *Journal of International Studies (2071-8330)*, *11*(2).

Antunes, M. G., Mucharreira, P. R., Justino, M. R. T., & Texeira-Quirós, J. (2021). Effects of total quality management (Tqm) dimensions on innovation—evidence from smes. *Sustainability (Switzerland)*, *13*(18). https://doi.org/10.3390/su131810095

Arinaitwe, A., Bagire, V., Tukamuhabwa, B., & Sulait, T. (2024). Energy management in small and medium manufacturing firms: examining the enhancing role of top management commitment in a developing country context. *International Journal of Energy Sector Management*, *18*(5), 980–998.

Bandara, F., Jayawickrama, U., Subasinghage, M., Olan, F., Alamoudi, H., & Alharthi, M. (2024). Enhancing ERP responsiveness through big data technologies: an empirical investigation. *Information Systems Frontiers*, *26*(1), 251–275.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of*

Management, *17*(1), 99–120.

Canbay, K., & Akman, G. (2023). Investigating changes of total quality management principles in the context of Industry 4.0: Viewpoint from an emerging economy. *Technological Forecasting and Social Change*, *189*, 122358.

Casprini, E., Pucci, T., Fiorini, N., & Zanni, L. (2023). Blending "hard" and "soft" TQM for academic excellence: the University of Siena experience in the field of Life Sciences. *The TQM Journal*, *35*(9), 231–255.

Chen, J. K. (2024). Identifying critical success factors of total quality management via comprehensive assessment of soft and hard factors. *The TQM Journal*, *36*(3), 679–701.

Chen, R., Lee, Y.-D., & Wang, C.-H. (2020). Total quality management and sustainable competitive advantage: serial mediation of transformational leadership and executive ability. *Total Quality Management & Business Excellence*, *31*(5–6), 451–468.

Chen, R., Wang, C.-H., & Lee, Y.-D. (2018). Total quality management (TQM) is the lifeline of an organization's sustainable development: Leadership is the impetus to change'. *International Journal of Innovative Studies in Sociology and Humanities*, *3*(4), 5–18.

Collis, D. J. (1994). Research note: how valuable are organizational capabilities? *Strategic Management Journal*, *15*(S1), 143–152.

Dubey, R., Gunasekaran, A., Childe, S. J., Blome, C., & Papadopoulos, T. (2020). Big data and predictive analytics and manufacturing performance: integrating institutional theory, resource-based view and big data culture. *British Journal of Management*, *30*(2), 341–361.

Faeq, D. K., Garanti, Z., & Sadq, Z. M. (2021). The Effect of Total Quality Management on Organizational Performance: Empirical Evidence from the Construction Sector in Sulaymaniyah City, Kurdistan Region–Iraq. *UKH Journal of Social Sciences*, *5*(1), 29–41.

Fok, L., Morgan, Y.-C., Zee, S., & Mock, V. E. (2023). The impact of organizational culture and total quality management on the relationship between green practices and sustainability performance. *International Journal of Quality & Reliability Management*, *40*(6), 1564–1586.

González-García, S., Gullón, P., & Gullón, B. (2019). Bio-compounds production from agri-food wastes under a biorefinery approach: exploring environmental and social sustainability. *Quantification of Sustainability Indicators in the Food Sector*, 25–53.

Grant, R. M. (1996). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science*, *7*(4), 375–387.

Gürlek, M., & Cemberci, M. (2020). Understanding the relationships among knowledge-oriented leadership, knowledge management capacity, innovation performance and organizational performance: A serial mediation analysis. *Kybernetes*, *49*(11), 2819–2846.

Haldorai, K., Kim, W. G., & Garcia, R. L. F. (2022). Top management green commitment and green intellectual capital as enablers of hotel environmental performance: The mediating role of green human resource management. *Tourism Management*, *88*, 104431.

Hashem, I. A. T., Yaqoob, I., Anuar, N. B., Mokhtar, S., Gani, A., & Khan, S. U. (2015). The rise of "big data" on cloud computing: Review and open research issues. *Information Systems*, *47*, 98–115.

Hjazeen, H., Seraj, M., & Ozdeser, H. (2021). The nexus between the economic growth and unemployment in Jordan. *Future Business Journal*, *7*(1), 1–8.

Imran, M., Hameed, W. ul, & Haque, A. ul. (2018). Influence of industry 4.0 on the production

and service sectors in Pakistan: Evidence from textile and logistics industries. *Social Sciences*, *7*(12), 246.

Jayashree, S., Hassan Reza, M. N., Malarvizhi, C. A. N., Maheswari, H., Hosseini, Z., & Kasim, A. (2021). The impact of technological innovation on industry 4.0 implementation and sustainability: an empirical study on Malaysian small and medium sized enterprises. *Sustainability*, *13*(18), 10115.

Jordan Chamber of Industry (JCI). (2023). *Company size classification guidelines*. https://jci.org.jo/Chamber/Services/Sectors/80095?l=en

Jordan Investors Association. (2023). *JIA holds its regular annual meeting for 2023*. https://jia.org.jo/en/newsdtls/950/JIA-holds-its-regular-annual-meeting-for-2023

Jiménez-Jiménez, D., Martínez-Costa, M., & Para-Gonzalez, L. (2020). Implications of TQM in firm's innovation capability. *International Journal of Quality & Reliability Management*, *37*(2), 279–304.

Jiménez Jiménez, I. (2019). Poder, redes y corrupción en Perú (1660-1705). *Sevilla, Editorial Universidad de Sevilla*.

Jum'a, L., Ikram, M., Alkalha, Z., & Alaraj, M. (2022). Do companies adopt big data as determinants of sustainability: Evidence from manufacturing companies in Jordan. *Global Journal of Flexible Systems Management*, *23*(4), 479–494.

Kamble, S., Gunasekaran, A., & Dhone, N. C. (2020). Industry 4.0 and lean manufacturing practices for sustainable organisational performance in Indian manufacturing companies. *International Journal of Production Research*, *58*(5), 1319–1337.

Karia, N., & Mahmoud Saleh, F. I. (2022). The effect of TQM practices on INGOs' staff work-related attitudes. *Benchmarking: An International Journal*, *29*(2), 596–621.

Kearney, R. (2018). *Public sector performance: management, motivation, and measurement*. routledge.

Khan, I. S., Ahmad, M. O., & Majava, J. (2021). Industry 4.0 and sustainable development: A systematic mapping of triple bottom line, Circular Economy and Sustainable Business Models perspectives. *Journal of Cleaner Production*, *297*, 126655.

Khan, R. A., Mirza, A., & Khushnood, M. (2020). The role of total quality management practices on operational performance of the service industry. *International Journal for Quality Research*, *14*(2).

Margherita, E. G., & Braccini, A. M. (2024). The impact of Industry 4.0 technologies and the soft side of TQM on organisational performance: a multiple case study analysis on manufacturing organisations. *The TQM Journal*, *36*(3), 812–831.

Marshall, A., Mueck, S., & Shockley, R. (2015). How leading organizations use big data and analytics to innovate. *Strategy & Leadership*, *43*(5), 32–39.

Memon, S. B., Rasli, A., Dahri, A. S., & Hermilinda Abas, I. (2022). Importance of top management commitment to organizational citizenship behaviour towards the environment, green training and environmental performance in Pakistani industries. *Sustainability*, *14*(17), 11059.

Mi Dahlgaard-Park, S., & Dahlgaard, J. J. (2010). Organizational learnability and innovability: A system for assessing, diagnosing and improving innovations. *International Journal of Quality and Service Sciences*, *2*(2), 153–174.

Nickerson, J. A., & Zenger, T. R. (2004). A knowledge-based theory of the firm—The problem-solving perspective. *Organization Science*, *15*(6), 617–632.

Ooi, K.-B., Lin, B., Teh, P.-L., & Chong, A. Y.-L. (2012). Does TQM support innovation performance in Malaysia's manufacturing industry? *Journal of Business Economics and*

Management, *13*(2), 366–393.

Ponsignon, F., Kleinhans, S., & Bressolles, G. (2019). The contribution of quality management to an organisation's digital transformation: a qualitative study. *Total Quality Management & Business Excellence*, *30*(sup1), S17–S34.

Prajogo, D. I., & McDermott, C. M. (2005). The relationship between total quality management practices and organizational culture. *International Journal of Operations & Production Management*, *25*(11), 1101–1122.

Purbowo, D., & Waluyowati, N. P. (2022). The effect of leadership on operational performance: The mediating role of quality improvement. *International Journal of Research in Business and Social Science (2147-4478)*, *11*(1), 108–116.

Sader, Husti, I., & Daróczi, M. (2019). Industry 4.0 as a key enabler toward successful implementation of total quality management practices. *Periodica Polytechnica Social and Management Sciences*, *27*(2), 131–140.

Saha, Palash, Talapatra, Subrata, Belal, H. M., & Jackson, V. (2022). Unleashing the Potential of the TQM and Industry 4.0 to Achieve Sustainability Performance in the Context of a Developing Country. *Global Journal of Flexible Systems Management*, *23*(4), 495–513.

Saha, Talapatra, Jackson, & & Belal, H. M. (2022). Unleashing the Potential of the TQM and Industry 4 . 0 to Achieve Sustainability Performance in the Context of a Developing Country. *Global Journal of Flexible Systems Management*, *23*(4), 495–513. https://doi.org/10.1007/s40171-022-00316-x

Samson, D., & Terziovski, M. (1999). The relationship between total quality management practices and operational performance. *Journal of Operations Management*, *17*(4), 393–409.

Seles, B. M. R. P., de Sousa Jabbour, A. B. L., Jabbour, C. J. C., de Camargo Fiorini, P., Mohd-Yusoff, Y., & Thomé, A. M. T. (2018). Business opportunities and challenges as the two sides of the climate change: Corporate responses and potential implications for big data management towards a low carbon society. *Journal of Cleaner Production*, *189*, 763–774.

Shafiq, M., Lasrado, F., & Hafeez, K. (2020). The effect of TQM on organisational performance: empirical evidence from the textile sector of a developing country using SEM. *Total Quality Management & Business Excellence*, *30*(1–2), 31–52.

Shi, Y. (2022). Advances in big data analytics. *Adv Big Data Anal*, *10*, 978–981.

Siddiqui, F., Haleem, A., & Wadhwa, S. (2009). Role of supply chain management in context of total quality management in flexible systems: A state-of the-art literature review. *Global Journal of Flexible Systems Management*, *10*, 1–14.

Tasleem, M., Khan, N., & Nisar, A. (2019). Impact of technology management on corporate sustainability performance: The mediating role of TQM. *International Journal of Quality & Reliability Management*, *36*(9), 1574–1599.

Viswanathan, R. (2022). *desarrollo sostenible : Una revisión sistemática*. *6*, 1–25.

Wang, S., & Yang, D. (2021). Policy experimentation in China: The political economy of policy learning.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, *5*(2), 171–180.

Wilkinson, A. (1992). The other side of quality:'soft'issues and the human resource dimension. *Total Quality Management*, *3*(3), 323–330.

Xu, Z., Frankwick, G. L., & Ramirez, E. (2016). Effects of big data analytics and traditional marketing analytics on new product success: A knowledge fusion perspective. *Journal of*

Business Research, *69*(5), 1562–1566.

Zafar, A. U., Qiu, J., & Shahzad, M. (2020). Do digital celebrities' relationships and social climate matter? Impulse buying in f-commerce. *Internet Research*, *30*(6), 1731–1762.

Zehir, S., & Zehir, C. (2023). Effects of Total Quality Management Practices on Financial and Operational Performance of Hospitals. *Sustainability*, *15*(21), 15430.

Zeng, J., Zhang, W., Matsui, Y., & Zhao, X. (2017). The impact of organizational context on hard and soft quality management and innovation performance. *International Journal of Production Economics*, *185*, 240–251.

Zhang, L., Zhang, X., An, J., Zhang, W., & Yao, J. (2022). Examining the role of stakeholder-oriented corporate governance in achieving sustainable development: evidence from the SME CSR in the context of China. *Sustainability*, *14*(13), 8181.

Zhu, X., & Yang, Y. (2021). Big data analytics for improving financial performance and sustainability. *Journal of Systems Science and Information*, *9*(2), 175–191.