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Article

Prospects and obstacles of digital quality management in Saudi Arabia universities. A systematic literature review from the Last Decade

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OPERATIONS MANAGEMENT | REVIEW ARTICLE

Prospects and obstacles of digital quality management in Saudi Arabia universities. A systematic literature review from the Last Decade

Saad Aziz Al-Otaibi^{1*} and Hasna Balaj Albaroudi²

Abstract: Higher education institutions throughout the world are facing difficulties from political, economic, and technical causes, demanding the adoption of innovative management techniques and organisational structures to preserve their places in the global market. In this environment, digitization has emerged as a vital instrument for boosting educational quality in institutions throughout the world. A relatively new idea, digital quality management, has gained traction in higher education institutions. The purpose of this study is to investigate the role of digital quality management in supporting exceptional development in Saudi Arabian institutions through the digital transformation process. The research technique adhered to the PRISMA 2020 statement, resulting in the selection of 36 papers on digital quality management. There were three key data classifications that developed, including education and learning, digital transformation, and quality management studies. The evaluation discovered significant weaknesses in higher education institutions' quality management systems for digital development. Existing research has mostly focused on traditional methodologies for evaluating quality management, such as lean six sigma, comprehensive quality management, and quality management systems used by Saudi institutions. Establishing and maintaining high-quality assurance and management in higher education is critical for long-term advancement since continuous quality review is critical to success. The findings of this study will help higher education institutions identify their digital quality management strengths and areas for improvement, encouraging academics to reevaluate quality objectives and digital learning management strategies in order to improve overall learning quality. Finally, via the process of digital transformation, digital quality management provides an effective outlet for Saudi Arabian institutions to build long-term competitive advantages and promote outstanding development.

Subjects: Management of IT; Business, Management and Accounting; Higher Education Management; Teaching & Learning;

Keywords: quality management; digitalization; universities; digital learning; quality management system; Saudi Arabia

1. Introduction

The nature of digital technology is a critical differentiator that is generating huge changes in the competitive landscape and within organisations. We have reached a tipping point where the impact of digital technology is manifesting “in full force” and allowing “unprecedented things” (Zaki, 2019a). Today, mobile, location-based, virtual reality, digital twins, blockchains, artificial intelligence (AI), wearable technologies, chatbots, neuroscience, business process automation, and machine-to-machine interactions via the Internet of Things (IoT) are all merging (Shahatha Al-Mashhadani et al., 2021). The discoveries are built on and magnified by combining several technologies across the physical, digital, and social domains (Zaki, 2019b). Furthermore, digital technologies have the agility and global connectivity structures that enable instant interaction and access to a vast amount of data and computing power; these features are reflected in today’s learning and teaching environment and enable a more extensive reach (of people) regardless of geographic location (Bolton et al., 2018; Khan et al., 2022). The digital transformation is enhancing the abilities of institutes and organizations not only in terms of quality development but also quality management in digital mediums (Caena & Redecker, 2019). Higher education institutions are keen to deploy the digital quality management system to improve educational operations in industrialized countries. A rise in accuracy and quality is driving the adoption of digital transformation (Khan et al., 2020). A rise in accuracy and quality is driving the adoption of digital transformation. That is highlighted because virtual universities have become increasingly popular in recent years (Jurva et al., 2020). They allow students to select courses from a worldwide range, significantly different from the past. Other advantages of digital quality management at universities include improved teaching quality, high-tech learning settings, worldwide networking, and employment prospects (Jiang & O’Neill, 2017).

In recent years, universities worldwide have seen dramatic transformations fueled by technology developments and societal e-trends toward digitalization. Digital transformation, like all substantial shifts, necessitates a great degree of adjustment and re-adjustment. As a result of the global economy, significant changes in the socioeconomic-educational system have occurred, notably in higher education, including changes in educational standards, quality, decentralization, virtual and independent learning (Mohamed Hashim et al., 2021a). That strategy places a greater focus on the students than on the technology and the learning opportunities. The learning environment has also enhanced due to digital devices and transformation; the outcome of the digital environment has been promising over time (Hanelt et al., 2021). However, digital technologies and learning are in the infancy stage in countries like Saudi Arabia. Even though Saudi Arabia has made significant investments in the field of education. Despite fast development and significant capital contributions to educational buildings, the Saudi Education Ministry has not met all of its goals (Alaboudi & Alharbi, 2021a).

However, Saudi Arabia has embraced various educational forms and models, including the blended approach (Zakaria et al., 2013). According to studies, Saudi Arabian students are exposed to and have access to new technologies daily (Abdel-Salam et al., 2019). Educators’ and the government’s constant concern about improving learning outcomes and meeting needs and expectations led to the creation of novel learning methodologies (Alaboudi & Alharbi, 2021b). In addition to this, digital quality management is a severe concern for Saudi institutions in terms of quality education, student engagement, and instructor skills and abilities (Almuhaideb & Saeed, 2020). Higher education establishments in Saudi Arabia are anticipated to be more focused on digital transformation than in previous years, and they used digital transformation techniques to increase the quality of education, instructor skill, and student learning capacities (Abdulrahim & Mabrouk, 2020).

The current study intends to examine the relevance of digital quality management in Saudi Arabian institutions in the age of digital transformation. In addition, the study investigates how digital quality management might assist Saudi universities in establishing long-term competitive advantages by supporting outstanding sustainable development in higher education establishments. The importance of how Saudi institutions should leverage digital quality management skills

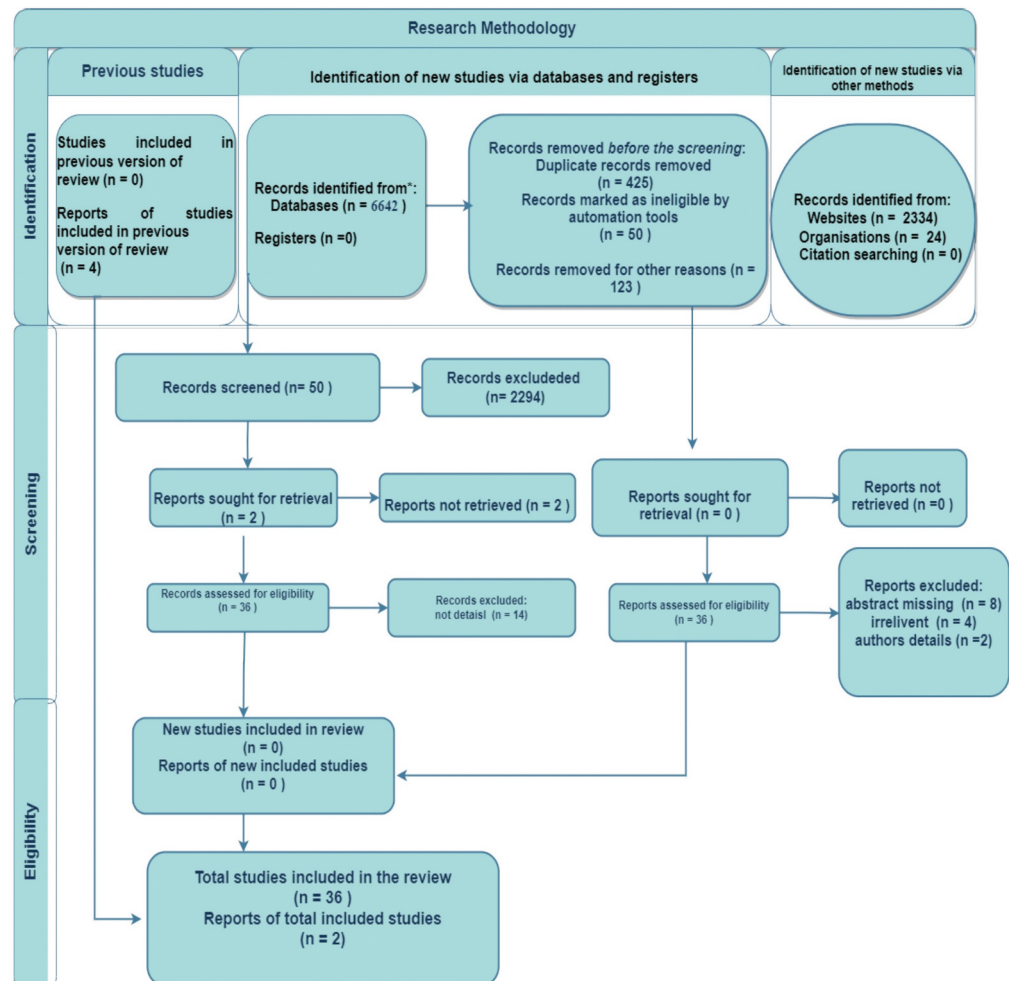
to alter delivery and experience is significant. Developing a competitive advantage for universities is still inadequate; nonetheless, the article gives first-hand insight into the significant changes affecting universities and how they might adapt to their benefit. It also fosters healthy debates, particularly on topics that have received little attention in the literature.

2. Materials and methods

The current analysis combines content from Scopus, a widely utilized database among academics worldwide. We conducted a literature search using the phrases “digital,” AND “quality management,” AND “universities.” The database initially returned a total of 9,890 entries. For record filtering, we used the PRISMA framework 2020, as detailed by Moher et al. (2009) and represented in Figure 1. The PRISMA statement 2020 is an updated version of the framework that was created in 2009 and 2015, and it provides comprehensive selection and rejection criteria. Furthermore, computer science, engineering, social science, business management, accounting, economics, econometrics, and finance were the only subjects covered at Saudi Arabian universities. As a consequence, the number of records in the database was reduced to 6,642.

Furthermore, the current study only included articles, reviews, and book chapters, reducing the total number of records to 2,334 that were suitable for inclusion. This study’s specific criteria were the publication of articles in English that were important to the field of digital quality management. The study’s scope was confined to the years 2012 to 2021, and it included only materials released in the previous decade. Furthermore, the records evaluated were solely from Saudi

Figure 1. PRISMA statement 2020 selection and rejection of records.



Arabia, with publications from other nations barred from consideration, resulting in the elimination of 50 items. Subsequently, a comprehensive selection was made for each discovered categorization to evaluate related documents, and only 36 publications were chosen to be included in the assessment to synthesize it, the irrelevant records and duplication were removed during the detailed reviewing process. Figure 1 depicts the current study's complete PRISMA statement 2020 selection and rejection procedure.

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3. Results

3.1. Descriptive analysis

Figure 2 depicts the interdisciplinary character of the study issue and highlights the participation of the many fields in digital quality management in Saudi Arabian universities. With nine studies included in the analysis, business, management, and accounting is the most contributory field, accompanied by computer science with eight relevant studies, engineering with six studies. The remaining contributions come from various fields of study such as economics, econometrics, finance, and social sciences.

In addition, the records extracted from 2012 to 2021 and the Year-based publication are shown in Figure 3. That is essential for assessing the impact of digital quality management in Saudi Arabia's universities research. Figure 3 indicated the growing increase in the number of published articles each year, with the highest frequency of publication count in 2022 with 14 records. A total of six articles were recorded from 2021, three records from 2018 and 2017 consecutively chosen.

Finally, the articles included from the Saudi Arabia universities are detailed illustrated in Figure 4. The King Saud University contributes the significant records on the digital quality management with the number is 12, the other articles with more numbers are included from the King Abdulaziz University with the nine records for the current study. The Scope of the current study is related to the Saudi Arabia universities, and the records only included from Saudi Arabia. In addition to this, the College of Sciences contributed the five records in the current study. The other significant contributors were Imam Abdulrahman Bin Faisal University, Umm Al-Qura University, and King Khalid University. The details of the affiliations of records are depicted in Figure 4.

Figure 2. Distribution of subject for records inclusion.

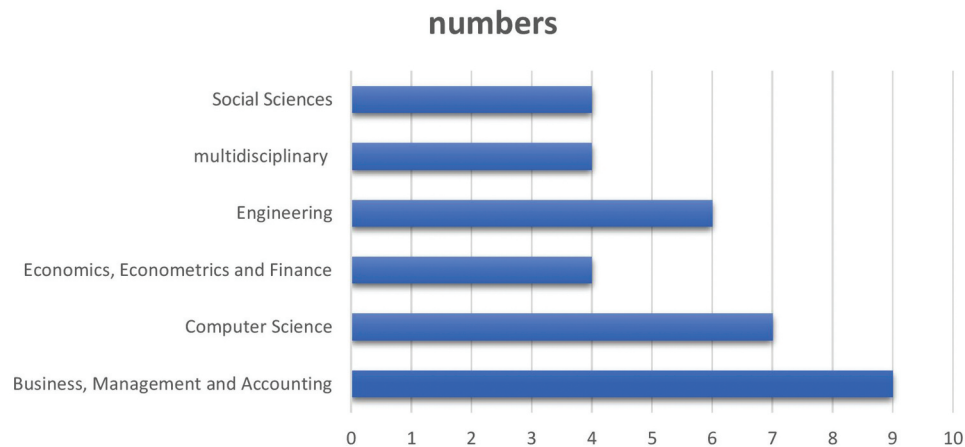


Figure 3. Distribution of records selected from 2012–2021.

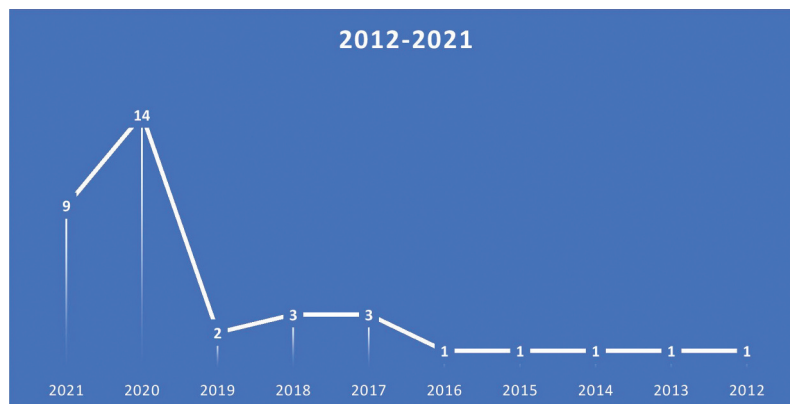
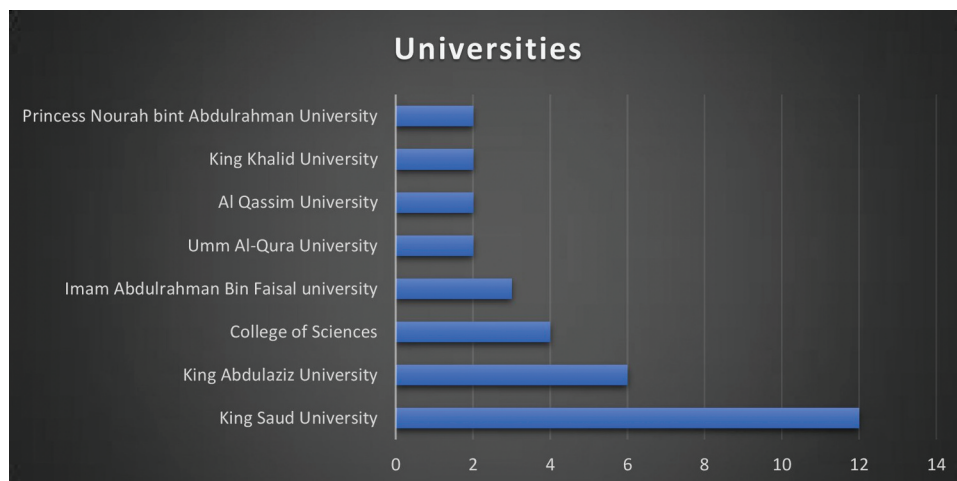


Figure 4. Distributions of records affiliations from the Saudi Arabian universities.



4. Literature mapping

Digital quality management is constantly growing in Saudi universities, and researchers are deeply considering this area of research. We used the keywords digital quality, quality management, and Saudi Arabia to recognize the most common keywords employed in the studies. As stated above, there were 539 studies contained in the keywords at literature review phase 1; in addition, these records were used to recognize the literature classifications from these keywords, as Table 1 shows.

The table explains four significant classifications occurrence percentage and education and learning percentage is highest with 48, and total occurrences of the critical terms are 27, and relevance score of each term is also shown. The second primary classification percentage is financial inclusion with 28% with 18 key terms, and a relevance score is shown in Table 2. Finally, the digital transformation percentage is 24 percent with 15 key terms and relevance score during the co-occurrence analysis. The results indicate that digital quality management has a significant percentage over other digital education and learning, digital transformation, and quality management.

In addition, the papers were subjected to content analysis to identify the study's categories. The content of published literature is analyzed using VOS Viewer software, which creates data clusters on the text to group related concepts. The current study found that researchers' keywords and keywords defined more specifically in the journals' indexing technique detailed in the databases are equally accurate for bibliometric analysis to reveal the structures of the examined field. As

a result, we used both types of terms for the co-occurrence analysis within the research area connected with digital quality management. The investigation included 36 records, with 63 keywords generated from the data. We meticulously researched and picked just the 36 most common terms that appeared in at least three entries.

The content analysis findings are depicted in Figure 5—the group is divided into four significant clusters, each represented in various colours in Figure 5. Quality assurance and management are represented by yellow in the cluster. Digital transformation, artificial networks, and quality assurance are all part of the green cluster. In the end, the purple cluster is learning, studying, Saudi Arabia, and growing.

5. Classification of literature

The literature on digital quality management research at Saudi Arabian universities during the previous decade was addressed in this part. The literature focuses mainly on the three key data themes derived from the VOS viewer, which the authors analyze in-depth using the terminology co-occurrence streams.

6. Education and learning

Saudi Arabian academic institutions have been keen to embrace digital education or online education to develop educational processes in the previous decade. The importance of digital learning stems from the increasingly global culture we now live in. Everyone can have equal access to the same resources, allowing them to participate in all aspects of life, including education, business, and health care (Syed et al., 2021). According to Ahmed et al. (2020), digital learning will aid in the efficient management of resources such as location and time. The online learning environment aids in the resolution of the issue of insufficient resources and facilities, such as books, classrooms, labs, and teaching personnel. In addition, the notion of securing online learning management systems arose because of the emergence of such threats. The growing use of digital learning methods and the integration of new technological approaches in higher education schools and institutes has resulted in many issues and risks (Mehmood et al., 2017). Digital

Table 1. Keyword occurrences, classification, occurrence percentage, and relevance score

| Classification | relevance score | Occurrences | Occurrences | Relevance score |
|------------------------|-----------------|---------------------------|-------------|-----------------|
| Digital transformation | 24% | adoption | 7 | 0.8327 |
| | | artificial intelligence | 3 | 0.6232 |
| | | artificial neural network | 3 | 0.8318 |
| | | benefit | 5 | 0.8105 |
| | | big data | 4 | 0.3532 |
| | | big data analytic | 3 | 0.7285 |
| | | blockchain | 3 | 1.5521 |
| | | cloud | 8 | 1.1994 |
| | | cloud service provider | 4 | 1.7473 |
| | | communication | 3 | 1.8907 |
| | | condition | 3 | 0.8006 |
| | | genetic algorithm | 3 | 1.16 |
| | | iot | 7 | 0.6183 |
| | | reliability | 4 | 0.3916 |
| term | 3 | 0.4264 | | |
| | | Total | 63 | |

(Continued)

| Classification | relevance score | Occurrences | Occurrences | Relevance score |
|------------------------|-----------------|------------------------|-------------|-----------------|
| Education and learning | 48% | context | 3 | 0.4709 |
| | | contribution | 4 | 0.7745 |
| | | covid | 3 | 2.2643 |
| | | education | 6 | 1.4907 |
| | | end | 4 | 0.6761 |
| | | evaluation | 4 | 1.0701 |
| | | factor | 4 | 1.1554 |
| | | field | 4 | 0.6929 |
| | | food | 3 | 0.4402 |
| | | healthcare | 3 | 1.2621 |
| | | implication | 5 | 0.9658 |
| | | industry | 5 | 0.5034 |
| | | learning | 6 | 1.3993 |
| | | life | 4 | 1.4382 |
| | | outcome | 5 | 0.5171 |
| | | person | 3 | 0.4144 |
| | | privacy | 3 | 1.907 |
| | | processing | 4 | 1.1633 |
| | | protocol | 4 | 1.0031 |
| | | qos | 4 | 1.0537 |
| | | risk | 4 | 1.161 |
| | | self | 3 | 0.3886 |
| | | sensor | 5 | 1.1173 |
| skill | 5 | 1.0904 | | |
| state | 3 | 0.4961 | | |
| student | 7 | 1.3015 | | |
| study | 15 | 0.3666 | | |
| transparency | 3 | 0.7847 | | |
| | | Total | 126 | |
| Quality assurance | 28% | access | 4 | 1.4207 |
| | | accessibility | 3 | 0.9989 |
| | | accountability | 3 | 1.1141 |
| | | accuracy | 5 | 0.6626 |
| | | assessment | 4 | 1.9623 |
| | | capability | 5 | 0.7149 |
| | | data management | 4 | 1.7002 |
| | | data owner | 3 | 1.9187 |
| | | data privacy | 3 | 1.907 |
| | | digital transformation | 4 | 0.8103 |
| | | lack | 3 | 0.6974 |
| | | large amount | 4 | 1.2183 |
| | | monitoring | 4 | 0.5235 |
| need | 7 | 0.4499 | | |

(Continued)

Table 1. (Continued)

| Classification | relevance score | Occurrences | Occurrences | Relevance score |
|----------------|-----------------|-------------------|-------------|-----------------|
| | | node | 4 | 1.2627 |
| | | number | 4 | 0.6562 |
| | | quality assurance | 3 | 1.0731 |
| | | saudi arabia | 4 | 1.356 |
| | | smart city | 3 | 1.3804 |
| | | Total | 74 | |

learning is far better and distinct as compared to traditional learning. When compared to traditional learning, digital learning is different because it enhances student learning outcomes, faculty members' technical system implementation skills, and staff productivity (Abdulrahim & Mabrouk, 2020).

Furthermore, while online learning or digital education is not a new tool or topic of debate for academics and educators, the present pandemic has drawn all of them together to discuss future education and learning while also looking at the digital quality management of online learning (Qureshi et al., 2020). Finally, the education and learning processes in the current time are more significant and efficient due to the technological involvement in higher education institutes. The following section discusses the digital transformation tools and mediums that effectively contribute to the digital quality management process. Finally, thanks to technology engagement in higher education facilities, education and learning processes are more significant and efficient in the current period. The next part discusses the digital transformation tools and channels that successfully contribute to the digital quality management process.

7. Digital transformation

Due to the enormous need for individuals' online and digital learning requirements, digital technologies adaption in higher education establishments has been considerably adopted in recent years (Mustapha et al., 2021). According to Bhatti et al. (2021), from producing to delivering value to clients, digital transformation integrates digital technology into all aspects of business, education, health, and manufacturing. That notion is critical for a company's and the economy's long-term success. Digital transformation integrates the various industries and sectors for the growth of economies significantly; Industries have gotten even brighter as computing, networking, sensor, and cloud computing technologies have proliferated (Hossain et al., 2018). Furthermore, the application of IoT and AI technologies has the potential to positively modify conventional educational processes in universities, including (a) enhanced use of data obtained from intelligent sensors; and (b) regulating and supervising internal activities inside the online class environment (Alreshidi, 2019). The use of technologies is on peek due to the COVID-19 pandemic, and researchers emphasize the latest technologies to utilize educational effectiveness.

However, the digital transformation using recent technologies like artificial intelligence and blockchain is still infancy stage in the education institutes in Saudi Arabia. According to Mohammed et al. (2021), artificial intelligence is essential to digital transformation because of its educational advantages (Mühleisen, 2018). It allows for academic conversation with the learner, tends to make teaching and learning more pleasurable, and aids in the presentation of scientific material in an interactive, tangible manner, as well as continuous evaluation processes, all of which are features that have drawn attention to him in the development of educational programs, particularly in higher education (Zaki, 2019b). At the same time, the use of blockchain in the academic area is still in its beginning phases (Abad Segura et al., 2020). A small number of

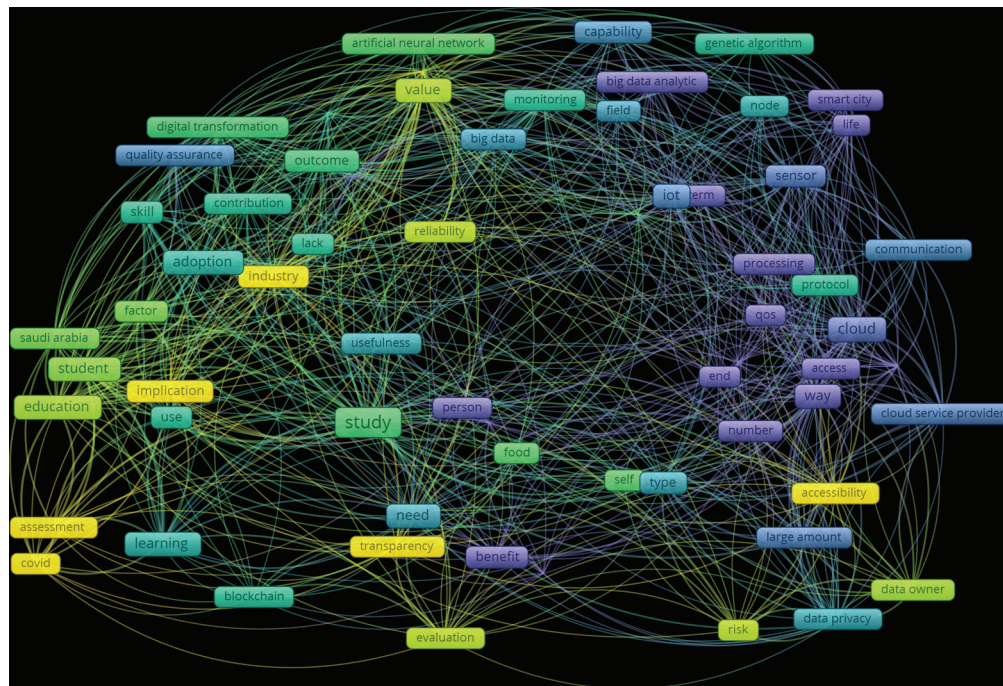
Table 2. Results of records, authors, year, setting, and classification

| Authors | Year | Cited by | Settings | Segment |
|--|------|----------|--|--|
| Alshammari S.T., Alsubhi K., Aljahdali H.M.A., Alghamdi A.M. | 2021 | | cloud data | cloud computing environment |
| Zulfa M.I., Hartanto R., Permanasari A. E., Ali W. | 2021 | | 5 G technology, edge computing, and the Internet of Things (IoT) | Artificial Intelligence |
| Alkhowaiter W.A. | 2020 | 41 | digital payments and baking | digital banking |
| Altaf S., Ahmad S., Zaindin M., Soomro M.W. | 2020 | 6 | Wireless Sensor Networks (WSNs) | Artificial Neural Network (ANN) |
| Ren Y., Qi J., Cheng Y., Wang J., Alfarraj O. | 2020 | 15 | digital continuity | electronic record |
| Alaya B., Khan R. | 2020 | 2 | online video content | load management and replication algorithms |
| Shahid A., Almogren A., Javaid N., Al-Zahrani F.A., Zubair M., Alam M. | 2020 | 47 | Supply chains | complex networks |
| Ghaffar Z., Ahmed S., Mahmood K., Islam S.H., Hassan M.M., Fortino G. | 2020 | 15 | Cyber-physical-social systems | Cloud storage |
| Shorfuzzaman M., Masud M. | 2019 | 3 | data cloud | quality of service |
| Rani S., Chauhdary S.H. | 2018 | 7 | Internet of things (IoT) | Smart City |
| Sahi M.A., Abbas H., Saleem K., Yang X., Derhab A., Orgun M. A., Iqbal W., Rashid I., Yaseen A. | 2017 | 61 | e-Healthcare | privacy requirements |
| Hassan M.M., Albakr H., Al-Dossari H., Mohamed A. | 2017 | 8 | cloud-assisted body | healthcare applications |
| Malik S.U.R., Khan S. U., Ewen S.J., Tziritas N., Kolodziej J., Zomaya A.Y., Madani S.A., Min-Allah N., Wang L., Xu C.-Z., Malluhi Q. M., Pecero J.E., Balaji P., Vishnu A., Ranjan R., Zeadally S., Li H. | 2016 | 37 | 'Digital Age | cloud computing |

educational institutions use blockchain technology, and the bulk of these organizations use it to assess and communicate academic credentials and learning objectives. According to industry experts, blockchain technology, on the other hand, has a lot more to offer and can potentially revolutionize the profession (Rahman et al., 2018).

Higher education institutions can use digital transformation to incorporate new technology. Digital learning is regarded as one of the educational system's fundamental foundations, and

Figure 5. The classification of literature using the VOS viewer.



the performance of educational systems is linked to the quality of his preparation (Lodhi et al., 2021). To stay up with the changes of the digital era and keep up with contemporary educational trends in light of future responsibilities, it has become vital to focus on creating preparatory programs. Monitoring the performance of professors, students, and other aspects of the digital educational process at Saudi Arabian institutions is also critical. The following section examines the quality assurance context literature of digital quality management at Saudi institutions.

8. Quality management

In recent years, universities worldwide have seen rapid transitions, spurred by technological advancements and social e-trends toward digitalization. Like all other significant changes, digital transformation involves a significant deal of adjustment and re-adjustment (Zulfa et al., 2021).

The higher education institutes are improving the changes in educational standards, quality, decentralization, virtual learning, and autonomous learning through implementing digital technologies (Khan et al., 2020). According to Ghaffar et al. (2020), educational quality has become a long-term aim for many universities worldwide; although it is an intrinsic but contextual metric, it necessitates a lot of emphasis and empirical discussion. In addition, scholars, researchers, institutions, regulators, and governments are becoming more aware of the strategic relevance of education quality. Managing educational quality is a difficult task since it is a multifaceted topic. Universities prioritize quality as one of their most essential characteristics, as seen by their actions (Shahid et al., 2020).

According to Papanthymou & Darra (2017) the integration of quality management system in HEIs boosts the institutional as well as the performance of individual students. Van Schalkwyk & Steenkamp (2019) said that quality management, with a special focus on leadership commitment, enables Higher education institutions to achieve excellence in their operations. Quality focus Higher education institutions focus on the development of their students through excellent faculty, research and development facilities and training on different techniques (Qasrawi et al., 2017). Psomas & Antony (2017) studied TQM practices adopted by Higher education institutions in Greek and said that it has significantly improved quality in Higher education institutions performance,

enhanced faculty members and staff satisfaction and has had a positive impact on society. Top management commitment, stakeholder involvement, and continuous improvement of culture and processes are all essential components of quality management system in universities. The key attributes that comprise quality management system frameworks in higher education institutes/universities are customer and process focus, effective decision-making, continuous improvement, and leadership commitment (Abbas et al., 2021).

However, in Saudi Arabian universities, digital quality management is likely to be a novel concept. Higher education institutions' adoption of procedures and processes is fraught with difficulties (Nadeau, 2017). The past research focuses on the lean six sigma and total quality management methodologies in the previous literature, and digital quality assurance is still a massive gap for the control of digital learning methods in universities. According to Alshammari et al. (2021) in earlier studies, the focus has been on lean six sigma and total quality management procedures, and digital quality assurance remains a significant gap in the regulation of digital learning methods in universities.

The digital transformation also introduces a slew of new technologies that will revolutionize remote learning and dramatically increase the use of digital media during the present pandemic. After the virus spread, universities worldwide continued to provide online education (Sharifi et al., 2021). In Saudi Arabian universities, the digital style of education has also been used. However, there is a massive gap in the skills and competencies necessary to use digital devices and resources. The introduction of digital technology at the university level came as a shock, and students and professors lacked the necessary abilities (Hoq, 2020). Furthermore, digital quality management is a novel idea in the Saudi university, and academics must concentrate their efforts in this area to advance their study.

9. Discussion

In light of the highly debated idea of quality education, the issue of improving the quality of higher education within the framework of modern transformational processes is a challenge. The term "Quality in higher education" has a huge impact on the development of the country and elevates the institute. For the institute to generate high-quality work and avoid errors, it needs highly skilled faculty, an excellent infrastructure, a market-oriented curriculum, among other factors (Allam, 2020). The future of higher education is being significantly shaped by technological advancements. It includes altering the classroom, the growing significance of online learning, workforce diversity, corporate-university collaboration, and acknowledging the difficulties associated with reshaping education (Abdulrahim & Mabrouk, 2020). Higher education institutes worldwide are embracing online education for digital learning. For example Budarina & Polupan (2019), analyse the idea of digital quality management in higher education to highlight the theoretical basis and practical application of digital quality management in higher education. According to the findings, digital management allows for the familiarisation, research, and consideration of all participants in the educational process's thoughts, arguments, and reflections.

The digital revolution is a topic of great interest and profound benefit to the education systems of Saudi Arabia. We believe that by better addressing digital transformation in educational policies and adapting them in the education institutions can be beneficial for higher education institutes. Previously, only lecturers were responsible for the quality of education, but now quality is on the agenda of various external parties such as governmental authorities, higher education institutions, and the corporate sector. As part of organisational responsibility, quality has become a critical issue of institutional quality management. The university administration has recognised the increasing significance of effective quality management in providing quality education and competitive graduates to potential stakeholders. Because the output of higher education is the backbone of the entire country and society, the need to use digital technologies to reconsider the current quality management system has evolved.

10. Conclusion

This research investigated the methodology and trends surrounding digital quality management in Saudi higher education institutions from 2012 to 2021. The primary objective of this article was to explore how Saudi Arabian universities can leverage digital quality management to gain a competitive advantage amidst the ongoing digital revolution of the past decade. The findings underscored that digital transformation is a potent and dynamic strategy that necessitates various changes in learning, development, technology, processes, and cultural aspects within universities. It emphasizes the importance of embracing digital quality management as a catalyst for institutional growth and success in the rapidly evolving digital landscape (Mohamed Hashim et al., 2021b; Vaicondam et al., 2022). Universities in Saudi Arabia adopted the digital learning process early on, and research suggests that universities are eager to upgrade lecturers' and students' digital abilities. Furthermore, according to the research, universities prioritize the development of learning processes and online learning mechanisms for the expansion of digital education. According to (Omar & Almaghthawi, 2020a), Saudi Arabia is a developed country with many public and private universities founded in the past decade. In line with the national goal of Saudi Vision 2030, the implementation of the National Transformation Program (NTP) in Saudi Arabia has taken place. One of the key objectives of the NTP is to establish and expedite the execution of "digital infrastructure projects." In pursuit of this goal, Saudi universities have been actively collaborating to develop and implement digital education programs and strategies. Recognizing the significance of effective quality management, university administrations in Saudi Arabia have acknowledged the need to ensure quality education and produce competitive graduates who can contribute to the nation's progress. Given that the output of higher education plays a vital role in the development of the entire country and society, the demand for a digital quality management system has become increasingly evident.

11. Practical implication and future agenda

The current study reveals significant deficiencies in the quality management system for digital quality management in higher education institutions despite their efforts and modifications to the country's existing educational system. Many scholars researched lean six sigma, integrated quality management, and quality management systems, but there was little study on online learning and education performance evaluation. These are classic quality management assessment approaches employed by Saudi institutions. However, continuous quality management is so important to higher education success that building and maintaining high-quality assurance and management in higher education has become crucial to their long-term growth (Omar & Almaghthawi, 2020b). In addition, the appealing and demanding trend toward using digital quality management resources in education and learning is both intriguing and challenging. One strategy to enhance and build quality management in universities is to provide a technology environment that encourages students to use online learning to promote successful teaching and learning processes. A requirement for the successful integration of digital technologies in active learning environments is staff professional development (Børte et al., 2020).

Finally, the current study's practical implications will help researchers and higher education institutions identify strengths and areas for improvement in digital quality management, as well as encourage academicians to reconsider quality objectives and techniques for digital learning management in order to improve overall learning quality. The ICT cluster methods have opened new doors and presented new challenges to both students and teachers (Akhmedov, 2021). As a result, the responsibility for learning tasks has shifted to the learners, substantially altering the roles of teachers. So, the implementation of ICT is important for digital transformation of the universities of the Kingdom of Saudi Arabia. The management of a university's system has a significant impact on the quality of education. It depends on the administration of the educational programme creating the specific conditions required for obtaining the desired outcomes, developing readiness for continuous improvement and correction in line with the established strategy, and taking into account current technological developments (Abdulrahim & Mabrouk, 2020; Alenezi, 2021; Jung et al., 2021; Petrovskiy & Agapova, 2016). As a result, the findings of this

study might be used to help other academics design programmes to help Saudi Arabia's digital quality management system grow. Given the current situation of the so-called "new normal" caused by the COVID-19 pandemic.

12. Theoretical implications

The curriculum emphasises digital technology's revolutionary impact and the need of digital quality management in higher education, particularly in Saudi Arabia. The report emphasises the potential for digital transformation to give institutions with a competitive advantage, improve educational results, and improve the learning environment. It also emphasises the importance of continual quality assurance and management in the context of digital learning. The material recognises the shortcomings and problems of the present quality management system and urges for more study and development in this area. Finally, the findings have practical significance for academics and higher education institutions that want to improve digital quality management practises and overall learning quality in the digital age.

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Correction

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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