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Advancing, empowering, and reshaping Saudi society through integrating e-learning technology into higher education

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ABSTRACT

This research endeavors to propel, empower, and transform Saudi society through the strategic integration of technology-led e-learning within the higher educational institutions of the Kingdom. With the imminent future of learning heavily reliant on technology, the potential for ubiquitous and on-demand knowledge acquisition is set to revolutionize education in the upcoming decades. Our findings underscore the profound influence of technology-led learning on higher education in Saudi Arabia, establishing its pivotal role in driving societal progress. Central to our investigation is an in-depth exploration of diverse e-learning technologies and their profound implications on advancement and empowerment, ultimately instigating a substantial metamorphosis in the fabric of Saudi society. By affording individuals access to a tailored technology-led e-learning platform, the study envisages a profound restructuring of the populace, fostering a skilled and adaptive citizenry. A notable aspect of our research is the discernment of the government's instrumental role as a mediator in facilitating the adoption and implementation of technology-led e-learning, particularly in segments of society where access to these resources remains limited or absent. This mediation bears relevance in the context of the nation's vision for 2030 and forms a cornerstone of our contributions to inform the Ministry of Education and the Kingdom at large about the prospects of embracing a technology-led e-learning system. Moreover, our study delves into the scope and limitations surrounding the implementation of technology-led e-learning within higher education, effectively charting a course for societal transformation by invigorating the higher education system with innovative pedagogy. In conclusion, our research expands the horizons for Saudi learners and educational institutions alike, creating pathways for connectivity, talent acquisition, and representation on the global stage through the medium of advancing technology-led e-learning in higher education within the Kingdom.

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1. Introduction

The dynamic influence of technology on the educational landscape in Saudi Arabia is evident in its transformative impact on higher education, rendering it more immersive and engaging. The pervasive presence of e-learning technologies has revolutionized the paradigms of understanding and knowledge acquisition, to the extent that envisioning life without them is now inconceivable. By seamlessly connecting the world through the vast expanse of the internet, e-learning technologies have opened up a multitude of pathways to enhance the effectiveness of learning within higher education institutions. In this context, technology-based learning in higher education necessitates a concerted effort to explore and implement cutting-edge technologies, effectively optimizing institutional practices through the integration of e-learning technologies. This proactive approach seeks to harness the full potential of technological advancements in order to refine and elevate the educational experience within these institutions (Craig et al., 2012; Kopp et al., 2019). E-learning has been rapidly growing for the last two decades because the approachability of the Internet to the public and industry was available in the 1990s. Nowadays, educational institutions may enable technology-led e-learning activities via the Internet/intranet (Sultan et al., 2012). Technology-

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led e-learning tools, such as laptops, mobiles, and iPads, have become integral in online and classroom learning. From elementary to higher education institutions, technology-led learning engages students more and more and learning better. Learning management systems (LMS) allow instructors to monitor and assess learners' performance. Technology-led learning makes learners more efficient in quickly upgrading and building their competence by getting flexibility in their learning pace. E-learning enhanced the students' participation as the physical barriers of time and space get eroded (Kravariti et al., 2018).

Technology-led E-learning is essential for corporate employees as it provides a distinctive way to improve employee competencies and attitudes. Also, it works on learning at anytime, anywhere (Rahmani et al., 2021). Therefore, there is a need to build alliances and partnerships with international and national organizations to apply technological advancement and transformation, leading to social empowerment (Haron et al., 2017; Hur and Im, 2013; Radovanović et al., 2020). Virtual, augmented reality and gamification technology-led e-learning has added value to the learning landscape by making learning more enjoyable. Wearable technologies such as mobiles and tablets also find the more flexible tool for e-learning as "39.5 million adults of age 18 and above in the United States use wearables" (Masters et al., 2016). Big data is being leveraged into industries and providing real-time feedback from learners. Cloud technology made learning anywhere, anytime, as learning resources are accessible via e-learning devices easily.

The future of learning is all about technology-led learning by enabling learning anywhere, anytime in the coming decades. Academicians, learners, and enterprises leverage technology-led learning at their workplace to revamp the pedagogy (Elahi and Rehman, 2013), leading to efficiency, effectiveness, and entertainment. Technology-led learning looks set to impact higher education in the Kingdom of Saudi Arabia significantly. One of the biggest challenges in ICT for the instructors is to promote it and to improve the quality of education (Carrión-Martínez et al., 2020). Improving learning improves the curricula, and teaching methods creating values and core skills for the students, and creativity and innovation lead to fulfilling the demand of job markets (Singh and Alshammari, 2021). Continuous learning results in increased opportunities for employment, socialization, diversity management, and the capability to meet new business challenges (Alshammary and Singh, 2017). Continuous learning serves as a pivotal mechanism for attaining employability, effectively navigating diversity and empowerment, fostering active citizenship and social engagement, and developing the capacity to adapt to the ever-evolving business landscape and career transitions.

This research presents a novel contribution by addressing the advancement, empowerment, and reshaping of Saudi society. While existing literature extensively covers topics related to youth/women empowerment and sustainable development, there remains a dearth of published research that explicitly examines the collective impact of integrating e-technology in higher education on advancing, empowering, and reshaping Saudi society. The current study sheds light on the transformative potential of e-technology in higher education, as it pertains to the advancement, empowerment, and restructuring of Saudi society, with a particular focus on the mediating role played by government policies. By expanding the scope of Saudi learners to connect, acquire, and showcase their talents on a global scale, the present research broadens the horizons of technology-led e-learning within the Kingdom's higher education landscape. This article seeks to bridge an existing gap in the literature by introducing advancement and reshaping (restructuring) as additional constructs, complementing the prevailing emphasis on social empowerment and sustainable development in past research endeavors.

The present study aims to undertake a comprehensive analysis of the progress and societal enrichment brought about by the technology-driven and e-learning-centered higher education system in Saudi Arabia. Specifically, the following key objectives will be pursued:

1. To meticulously examine the advancements facilitated by the integration of technology and e-learning methodologies within the higher education landscape, with a focus on their capacity to foster empowerment across various strata of Saudi society.
2. To rigorously investigate the efficacy of the technology-driven and e-learning-based higher education system in bridging prevailing gaps within the industrial domain, thereby engendering a proficient and sought-after workforce capable of promoting social upliftment.
3. To critically assess the transformative impact of technology and the e-learning-led higher education paradigm on Saudi society, particularly in terms of its ability to address existing skill disparities and contribute towards a more skilled and adaptable populace.

The present study posits the following hypotheses:

H1: Technology and e-learning-led higher education system is advancing and empowering Saudi society.
H2: Technology and e-learning-led higher education system is robust to fill in the gap in the industry by generating the associated and desirable workforce leading to social empowerment.
H3: Technology and e-learning-led higher education system is reshaping Saudi society, helping to fill the skill gap and leading to social empowerment.
H4: Saudi government has been mediating between e-learning technologies and advancing Saudi society.

H5: Saudi government has been mediating between e-learning technologies and reshaping Saudi society.
H6: Saudi government has been mediating between e-learning technologies and advancing Saudi society.

2. Literature survey

Infrastructure needs to be strengthened to stand up against any situation during and after any natural crisis/disaster. Such crises/disasters are sometimes beneficial to adopt the changes and bring surprising innovations. It will motivate us to adopt innovative technologies and e-learning tools in higher education (Tull et al., 2017). The technology and maintenance costs should be minimized to facilitate the learners more and more; also, the higher educational institutions make sure that no learners have been deprived of such e-learning opportunities/platforms due to their location and social level in the Kingdom (Dhawan, 2020). Information and communication technologies (ICT) led people's lives in developed counties through communication and connectivity in higher education. Integration of Information and communication technology (ICT) is significantly related to education and sustainable development (Carrión-Martínez et al., 2020). In addition, digital transformation is not a novel phenomenon (Kopp et al., 2019; Leszczyński et al., 2018).

Higher educational institutions must be concerned with preparing potential professionals in ICT to face any future challenges and be ready to provide appropriate solutions (Bond et al., 2018). Also, societal transformation is possible only through integrating technology in e-learning in higher education, which will lead to societal empowerment and sustainable development (Abad-Segura et al., 2020; Calhoun, 2019; Haron et al., 2017). Kopp et al. (2019) delineated five hindrances in technology-based e-learnings: Change, pace, technology, competitiveness, and financing. Craig et al. (2012) reviewed the e-learning technologies: Asynchronous, synchronous, digital repositories, shared documents, social networking, social bookmarking, blogs, wikis, and virtual world concerning teaching and learning. Effective e-learning emphasizes teaching and learning, research, theories, and ethics, benchmarking the quality of teaching and learning (Lei and Cheong, 2022; Hodges et al., 2020). It has become evident that the future of higher education is susceptible to the COVID-19 pandemic as physical delivery in higher education gets much and more affected (Lei and Cheong, 2022). The COVID-19 pandemic has negatively affected many activities worldwide, including higher educational activities, and these institutions get moved from physical platforms to e-learning platforms (Olasile and Emrah, 2020). Technology-based E-learning has removed the physical barriers in higher education and increased the number of students' participation by providing the platform anywhere-everywhere (Kravariti et al., 2018). Higher educational institutions have accelerated e-learning with profound technologies, and outcomes are robust for faculty and students in distinguishing knowledge segments (Turnbull et al., 2021). Baig et al. (2022) conducted a study based on 47 relevant articles from 2011 to 2019. The study focuses on e-learning and challenges in higher education. Acquiring technology-led learning skills is pivotal for lifelong learning (Singh et al., 2022a; Alshammary and Singh, 2017) and sustainable development (Radovanović et al., 2020; Singh et al., 2022a; 2022b).

The article applied some aspects of the Technology Acceptance Model (TAM and TAM2) (Davis, 1989) in association with of theory of constructivism (Elliott, 2000; Vygotsky and Cole, 1978). Where the TAM is based on the usage behavior of an individual's acceptance of technology, on the other hand, the constructivism theory is related to the human-centric approach where human being constructs their knowledge in the respective fields by learning and under the social, economic and political influence (Vygotsky and Cole, 1978; Davis, 1989; Elliott, 2000; Singh et al., 2022a; Tapanjeh and Singh, 2015).

3. Methodology

This article is founded upon data collected through questionnaires, encompassing respondents' demographic information and their perspectives on e-learning technologies, as well as their implications for the advancement and reshaping of Saudi society. The mediating variable under scrutiny is the role of government policies in this context. Regarding the advancement of Saudi society, the study emphasizes several key aspects, including capacity building for employment, entrepreneurship, personal and professional development, the facilitation of supportive technology, and fostering global collaborations. As for the factors contributing to the restructuring of Saudi society, the analysis identifies critical elements such as the development of technical infrastructure, higher governmental policies, the national curriculum, research and development frameworks, industry linkages, and a prevailing orientation towards employment and entrepreneurship. These aspects collectively contribute to the transformation of Saudi society. Additionally, the research underscores various factors that engender social empowerment within the Kingdom, encompassing per-capita income, literacy rates, human resource development, gender equality, overall health, and the cultivation of lifelong skills. The study also considers the role of government policies as a mediating variable, scrutinizing various governmental initiatives undertaken by the Saudi government to promote and integrate e-technology, thereby reshaping, restructuring, and advancing the Kingdom. Furthermore, the relationship between Saudi society and pertinent stakeholders, including corporations, capacity building efforts, pedagogical enhancements, and national learning strategies, is explored in conjunction with e-technologies. These aspects

further elucidate the interconnections between societal development and the strategic implementation of e-learning technologies.

3.1. Pilot survey

The study distributed the questionnaire to 5 experts from 2 industry experts and three university professors to verify the questionnaire. The questions implemented the modification in the questionnaire as per the recommendations of the experts to give the final shape to the questionnaire.

3.2. Survey and data collection

This study relies on a survey questionnaire designed to capture the perceptions of students, instructors, and experts, encompassing both males and females from the Hai'l region of the Kingdom of Saudi Arabia. The primary objective of this questionnaire development was to establish an effective tool for eliciting the opinions of these key stakeholders regarding the implementation of technology and e-learning-led systems in Higher Education within the Kingdom. Specifically, the study sought to gauge their perspectives on how such advancements could contribute to the advancement, empowerment, and reshaping of Saudi society.

3.3. Research method and tools

The present study will employ structural equation modeling (SEM) techniques to conduct data analysis and derive meaningful results. The data will be subjected to suitable statistical tools, namely SPSS and PLS-SEM-4. The study's targeted sample size was initially set at 500 or more respondents. However, ultimately, a total of 368 complete responses were received from students and instructors. Out of the total 372 responses, 24 were found to be incomplete and were consequently excluded from the study. The final dataset comprised 348 responses, including undergraduate students, instructors affiliated with the University of Hai'l, and working professionals from various locations across Saudi Arabia. In compliance with ethical considerations, the study ensured strict confidentiality and data security for all respondents, assuring that the researcher would not disclose any data records to the college/university or any external party.

Fig. 1 shows the measurement model representing the relationship of E-learning technologies with the Advancement, Empowerment, and Reshaping of Saudi Society with the mediating role of the Saudi government to delineate the desired outcome.

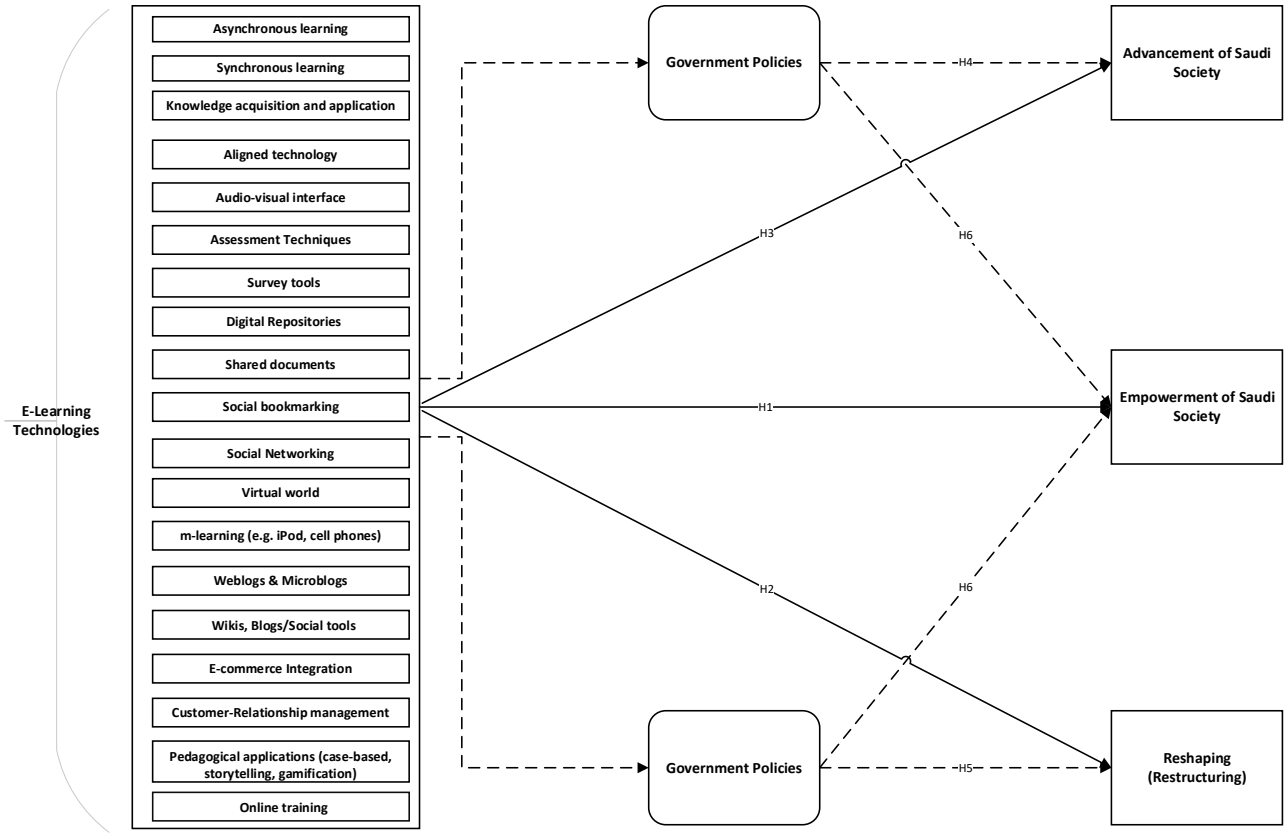

Fig. 1: Measurement model

4. Findings and analysis of data

Table 1 analyzes the personal data of 348 respondents consisting of their age, gender, nationality, respondent category, and area of specialization. Table 2 describes the construct loading, showing that all the factors in the constructs are within the range of threshold value (β≥0.70) (Sarstedt et al., 2020; Singh, 2020). The Cronbach alphas values shown in Table 3 are within the

threshold value range (α>0.95), indicating that all the items in the construct consistently represent the corresponding construct. The composite reliability (construct reliability), which is a measure of internal consistency, is within the acceptable range (≤0.95) in scale items except ELTEC (0.96) (Hair et al., 2022). Table 2 shows that the Average variance extracted (AVE) for the construct items is between 0.57 to 0.72, which means these five items explain the variations in the perceived value of the students and instructors (Hair et al., 2022; Netemeyer et al., 2003; Sarstedt et al., 2020; Singh, 2020).

Table 3 describes the Heterotrait-Monotrait ratio and shows that all values are significantly less than the threshold value (<0.85) (Hair et al., 2022; Henseler et al., 2015). Thus, the construct has discriminant validity in its items.

Table 4 describes the Fornell-Lacker criterion indicating that the square root (Sqrt) of each of the five construct average variance extracted (AVEs) is greater than the correlations with other latent constructs showing a better variance of its own than the other latent constructs (Fornell and Larcker, 1981; Singh, 2020).

Table 1: Personal data of the respondent

Ingredients	Frequency	Percentage (%)
Age		
Less than 21 years	35.46	14.3
21-30 years	127.97	51.6
31-40 years	32.74	13.2
41-50 years	46.38	18.7
50 years and above	5.46	2.2
Gender		
Female	90.02	36.3
Male	157.98	63.7
Nationality		
Saudi	198.90	80.2
Non-Saudi	49.10	19.8
Category		
Students	166.16	67
Instructor	70.93	28.6
Working professional	10.91	4.4
Self-employed	Nil	Nil
Any other, please specify	Nil	Nil
Area of specialization		
Business management	84.57	34.1
Information systems	51.83	20.9
Accounting	49.10	19.8
Economic and finance	38.19	15.4
Health science/medical	21.58	7.7
Computer science /analytics	2.73	1.1
Engineering	Nil	Nil
Arts/basic sciences	Nil	Nil
Law	Nil	Nil
Any other, please specify	Nil	Nil

Table 2: Construct validity, reliability and average variance extracted

Constructs	Construct name	Construct loading	Collinearity statistics (VIF)	Cronbach alpha	Composite reliability (CR)	Average variance extracted (AVE)
ADVSS1	Advancing Saudi society	0.811	2.466	0.926	0.939	0.659
ADVSS2		0.81	2.422			
ADVSS3		0.804	2.313			
ADVSS4		0.832	2.826			
ADVSS5		0.829	2.856			
ADVSS6		0.8	2.657			
ADVSS7		0.818	2.953			
ADVSS8		0.788	2.533			
ELTEC 1	Education learning technologies	0.774	2.757	0.958	0.962	0.571
ELTEC 2		0.764	2.348			
ELTEC 3		0.748	2.38			
ELTEC 4		0.765	2.526			
ELTEC 5		0.73	2.227			
ELTEC 6		0.769	2.646			
ELTEC 7		0.741	2.257			
ELTEC 8		0.759	2.68			
ELTEC 9		0.755	2.532			
ELTEC 10		0.696	1.992			
ELTEC 11		0.733	2.192			
ELTEC 12		0.747	2.531			
ELTEC 13		0.745	2.522			
ELTEC 14		0.759	2.592			
ELTEC 15		0.812	3.087			
ELTEC 16		0.761	2.643			
ELTEC 17		0.77	2.854			
ELTEC 18		0.769	2.679			
ELTEC 19		0.758	2.331			
GOVP1	Government polices	0.848	2.406	0.906	0.93	0.726
GOVP2		0.849	2.481			
GOVP3		0.862	2.554			
GOVP4		0.856	2.574			
GOVP5		0.847	2.436			
RESS1	Restructuring Saudi society	0.829	2.6	0.929	0.943	0.70
RESS2		0.869	3.205			
RESS3		0.842	2.795			
RESS4		0.833	2.744			
RESS5		0.832	2.768			
RESS6		0.824	2.446			
RESS7		0.827	2.457			
SOEMP1	Social empowerment	0.856	2.913	0.928	0.941	0.665
SOEMP2		0.837	2.632			
SOEMP3		0.853	2.785			
SOEMP4		0.805	2.483			
SOEMP5		0.794	2.336			
SOEMP6		0.795	2.371			
SOEMP7		0.778	2.165			
SOEMP8		0.801	2.419			

Table 3: Discriminant validity (Heterotrait-Monotrait ratio (HTMT Matrix))

Constructs	ADVSS	ELTEC	GOVP	RESS	SOEMP
ADVSS					
ELTEC	0.755				
GOVP	0.711	0.661			
RESS	0.78	0.733	0.846		
SOEMP	0.833	0.665	0.691	0.744	

Table 4: Discriminant validity (Fornell-Larcker criterion)

Constructs	ADVSS	ELTEC	GOVP	RESS	SOEMP
ADVSS	0.812				
ELTEC	0.721	0.756			
GOVP	0.653	0.622	0.852		
RESS	0.724	0.698	0.777	0.837	
SOEMP	0.772	0.638	0.637	0.693	0.815

Fig. 2 presents the second-order structure equation model consisting of e-learning technologies (ELTEC) as an independent variable and Advancing Saudi Society (ADVSS), Societal empowerment (SOEMP), and Reshaping the Saudi Society (RESS) as dependent variables along with government policy as a mediator between them. The independent variable 'e-learning technologies' consist of 19 items to justify the robustness of the construct. On the other hand, ADVSS and SOEMP consist of eight items each in the construct, and RESS consists of seven items in its construct. The mediating construct of 'government policies' consists of 5 items in the analysis.

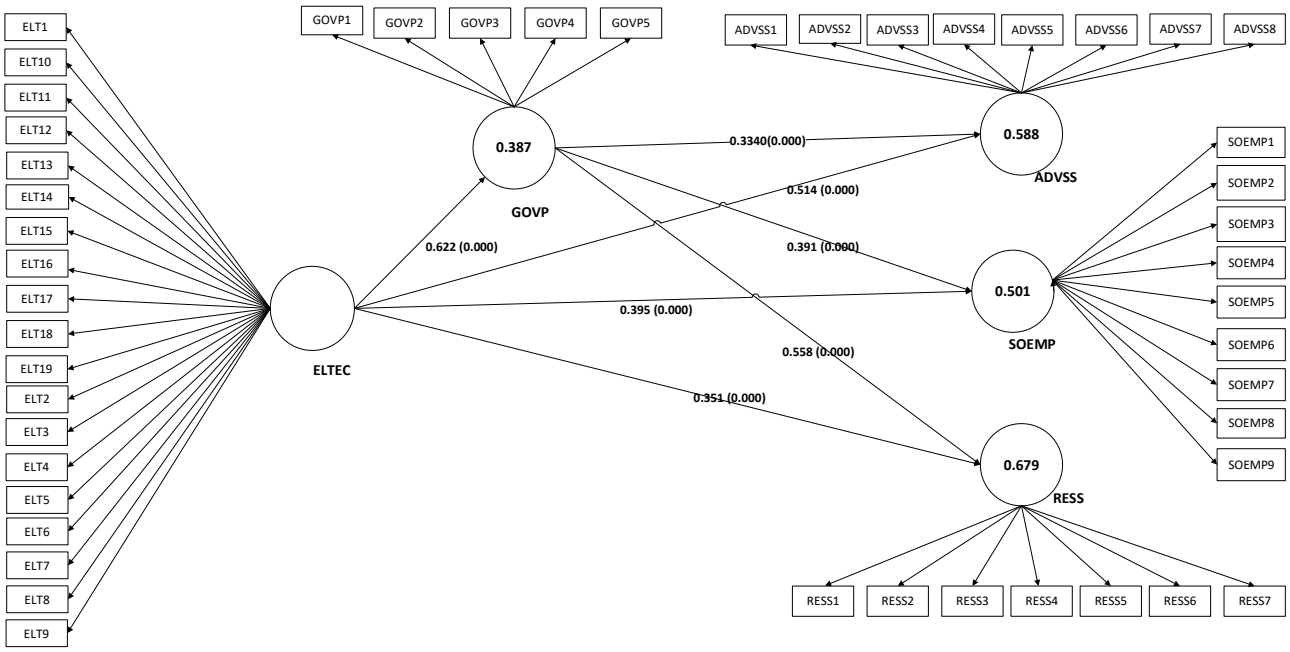

Fig. 2: Structure equation model

Table 5 presents the results of the hypotheses, examining the direct impact of e-learning technologies (ELTEC) on Advancing Saudi Society (ADVSS), Societal Empowerment (SOEMP), and Reshaping the Saudi Society (RESS), along with the presence of government policy as a mediator between them.

The outcome of Hypothesis H1 (ELTEC->ADVSS: T=7.725, p≤0.000; p=0.000) demonstrates a significant positive relationship, affirming that the technology and e-learning-led higher education system have been instrumental in advancing Saudi society.

Furthermore, Hypothesis H2 (ELTEC->RESS: T=7.484, p≤0.000; p=0.000) establishes that the technology and e-learning-led higher education system exhibit substantial efficacy in addressing industry gaps and generating a competent and desirable workforce, thereby contributing to social empowerment.

Hypothesis H3 (ELTEC->RESS: T=5.606, p≤0.000; p=0.000) reveals that the technology and e-learning-led higher education system effectively reshape Saudi society by addressing skill gaps and consequently promoting social empowerment.

Moving on to Hypothesis H4 (ELTEC->GOVP->ADVSS: T=3.676, p≤0.000; p=0.000), it indicates that government policies partially mediate the relationship between e-learning technologies and advancing Saudi society. The Saudi government plays a significant, albeit weak-mediating role in this context.

Likewise, Hypothesis H5 (ELTEC->GOVP->RESS: T=6.051, p≤0.000; p=0.000) indicates that government policies exert a strong partial mediation effect between e-learning technologies and reshaping the Saudi society. Here, the Saudi government plays a substantial and significant mediating role.

Lastly, Hypothesis H6 (ELTEC->GOVP->SOEMP: T=3.879, p≤0.000; p=0.000) illustrates that government policies have a moderate-mediation effect between e-learning technologies and societal empowerment. In this regard, the Saudi government serves as a moderate mediator between the two.

Overall, the findings confirm that e-learning technologies have a profound impact on advancing, empowering, and reshaping Saudi society, with the Saudi government playing varying degrees of

mediating roles in different aspects of societal development (Cohen, 2013; Hair et al., 2019).

Table 5 shows the R2 statistics that e-learning technologies have 58.87% explanatory power about advancing Saudi society, 67.9% explanatory power about restructuring Saudi society, and 50% explanatory power about societal empowerment with the government policies a mediator (R2 values of 0.75 (substantial), 0.50 (moderate), and 0.25 (weak) (Hair et al., 2011). The Q2 statistics show that the structural equation model has strong-predictive relevance for advancing Saudi society (52%), restricting Saudi society (49%), and societal empowerment (41%) with government policies as a mediator (Baron and Kenny, 1986; Shmueli et al., 2019; Hair et al., 2019). The model fit statistics of the saturated model show shows that the NFI=0.80, within the range of the threshold value (NFI≥0.70), and the SRMR=.07, within the range of the threshold value (SRMR≤0.08) (Hu and Bentler, 1999).

Table 5: Path coefficient

Path	Sample mean (M)	Std. deviation (STDEV)	T statistics (O/STDEV)	R^2 (Q^2)	Decision
ELTEC -> ADVSS	0.712	0.061	11.865**		Significant total effect
ELTEC -> GOVP -> ADVSS	0.208	0.056	3.676**	0.5887(0.52)	Significant indirect effect (29.21%)
ELTEC -> ADVSS	0.504	0.066	7.725**		Significant direct effect
ELTEC -> RESS	0.69	0.062	11.181**		Significant total effect
ELTEC -> GOVP -> RESS	0.344	0.057	6.051**	0.679(0.49)	Significant indirect effect (49.85%)
ELTEC -> RESS	0.346	0.047	7.484**		Significant direct effect
ELTEC -> SOEMP	0.629	0.072	8.817**		Significant total effect
ELTEC -> GOVP -> SOEMP	0.244	0.063	3.879**	0.501(0.0.41)	Significant indirect effect (38.79%)
GOVP -> SOEMP	0.392	0.07	5.606**		Significant direct effect

**: Represents significant value (p< 0.01)

5. Discussion

The study's findings provide valuable insights into the substantial impact of technology-led learning within higher education institutions on the advancement, empowerment, and reshaping of Saudi society, synergistically with the government policies of the Kingdom. To comprehensively explore this topic, the study examines 19 distinct aspects (items) related to e-learning technology, thereby enhancing the scope and underscoring the critical factors essential for fostering empowerment and keeping pace with technological advancements to benefit the people of Saudi Arabia through a robust technology-led e-learning system. The analysis reveals compelling evidence supporting the pivotal role of e-technologies in higher education's contribution to societal advancement. By equipping individuals with effective e-learning tools and techniques, the education system empowers learners and facilitates the transformation of traditional educational pedagogy into state-of-the-art methodologies. Consequently, e-learning technologies have emerged as indispensable assets for educational institutions in the Kingdom, proving instrumental in overcoming unforeseen challenges, as exemplified by their resilience during the COVID-19 pandemic. Moreover, these technologies have proven to be a blessing for segments of the Saudi population who face constraints in attending in-person classes due to time limitations or physical disabilities. Another significant advantage of e-learning technologies lies in their capacity to connect individuals from diverse locations, enabling seamless participation, promotion, exchange, and acquisition of knowledge, skills, and competencies across national and global boundaries (Alshammari and Singh, 2021).

Crucially, the study affirms the substantial and supportive role played by the Saudi Arabian government in the implementation of e-learning technologies within higher educational institutions. Aligned with the nation's visionary objectives for 2030, these government initiatives have made significant contributions to advancing, empowering, and reshaping the populace of Saudi Arabia, fostering the integration of national talent with global counterparts. In conclusion, this research underscores the transformative power of technology-led learning in higher education and highlights the indispensable partnership between the government and educational institutions in advancing societal progress and harnessing the potential of e-learning technologies to shape a brighter future for Saudi Arabia.

6. Conclusions

The study highlights the profound impact of e-learning technology-led learning within higher education on the advancement, social empowerment, and reshaping of Saudi society. In this context, the Saudi government's initiatives assume a significant mediating role, facilitating the correlation between e-learning technologies and societal advancement, social empowerment, and the transformation of the Kingdom in alignment with its vision for 2030. Through a comprehensive examination of the effective implementation of e-learning technologies, in conjunction with pedagogical advancements in higher education, the study elucidates their potential to bolster Saudi society and reshape the higher education system by fostering global connections. This technological advancement empowers the people of Saudi Arabia, enabling them to emerge as leaders and present their talents to the global stage. Additionally, higher educational institutions can leverage e-learning solutions to efficiently engage top national and

international resources, thus economically enhancing student training. However, the study acknowledges certain limitations regarding the scope of technology-led e-learning in higher education, particularly in remote areas of the Kingdom where connectivity issues persist due to limited service providers. Moreover, the need for increased access to digital devices remains a critical factor to facilitate internet access for the population. Overall, the research underscores the transformative potential of e-learning technology-led learning in higher education, emphasizing its role in shaping a progressive and empowered society in Saudi Arabia while recognizing the importance of addressing challenges related to connectivity and access to digital resources in certain regions (Stecuła and Wolniak, 2022).

7. Study implications

The technology-led and e-learning higher education system in Saudi Arabia is playing a pivotal role in advancing and empowering society, effectively addressing the existing industry gap by cultivating a skilled, desirable, and versatile workforce (Tapanjeh and Singh, 2015). Furthermore, this study sheds light on the transformative influence of technology-led e-learning within higher education, fostering the emergence of a talented workforce to bridge the prevailing gap in the Kingdom. The research findings are expected to yield valuable insights, serving as robust input for the Ministry of Education and the Kingdom at large, regarding the adoption and implementation of technology-led e-learning systems within higher education. Additionally, the study comprehensively delineates critical aspects concerning the successful integration of technology-led e-learning in the Kingdom.

By enabling Saudi learners to establish connections, acquire knowledge, and showcase their talents on a global scale, the present research significantly broadens the horizons of technology-led e-learning within the Kingdom's higher education landscape.

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Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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