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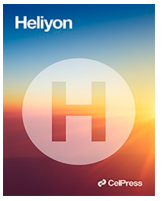

Research article

Exploring factors influencing sustainable human capital development: Insights from Saudi Arabia

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ABSTRACT

This study investigates the critical factors influencing Saudi Arabia's sustainable human capital development. It primarily aims to explore the correlations among the postulated variables and how each variable influences the development of a skilled, adaptable, and socially conscious workforce, in alignment with the objectives of the Saudi Vision 2030. This study utilizes a quantitative approach, employing partial least squares structural equation modeling to analyze the data collected from 203 public personnel in Saudi Arabia through an online questionnaire. The findings reveal that training, community engagement, institutional support, and technology integration are essential in sustainable human capital development. However, learning, education, and access to resources were not statistically significant and did not improve sustainable human capital development in Saudi Arabia. The findings underscore the significance of an educational framework that transcends traditional perspectives, focusing on not only academic preparation but also the holistic development of individuals. This study contributes to understanding how training, community engagement, institutional support, and technology integration are transformative in shaping the future of Saudi Arabia by nurturing a skilled, adaptable, and socially responsible citizenry.

1. Introduction

As part of the Saudi Vision 2030 framework, the Saudi National Transformation Policy endeavors to improve the Saudi Arabian workforce and education system, achieving several strategic goals [1,2]. Saudi Arabia strategic goals prioritize raising employment in the country, creating policies to improve teacher training, encouraging students to think creatively about their education, adapting school curricula to meet job market demands, and strengthening ties between the public and private sectors [1–3].

Along with these objectives, Saudi Arabia is aggressively attempting to lessen its reliance on the oil industry, forge strategic alliances, boost overall productivity, and increase employment possibilities [4]. These programs are cornerstones of the Saudi Arabian plan to promote long-term economic growth and provide employment opportunities. The Saudi Vision 2030 emphasizes

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entrepreneurship training programs for youth and the integration of e-learning resources within the educational landscape [5]. We expect these initiatives to significantly impact Saudi Arabian citizens, particularly youth who live in the significant portion of the rural area.

Ricard et al. [6] reported that the rise in the use of advanced information and communication technology (ICT) in education systems has been transformative in modern education. ICT has raised and revolutionized educational standards worldwide, conventional learning limitations. Moreover, ICT has been instrumental in closing societal, social, and economic gaps within communities by providing numerous opportunities for individuals to enhance their employment skills.

Incorporating ICT into the education system is a critical factor in Saudi Arabia's plan, as it transformational and helps to realize the country's vision of continuous progress and prosperity. Similarly, broader economic growth is consistent with the diverse role of ICT in training, education, and skill development. With its far-reaching effects on workforce productivity and social stability, this study considers learning, education, and training to be the key factors in realizing the Saudi Vision 2030.

A notable knowledge gap in the existing literature pertains to the comparative analysis of the effectiveness of learning, education, and training initiatives in fostering sustainable human capital development across diverse regions within the Middle East. While studies have explored the impact of these factors in individual countries such as Saudi Arabia, there is a lack of comprehensive research that examines how varying socio-economic, cultural, and political contexts influence the outcomes of human capital development strategies in countries across the Middle East. Understanding these contextual nuances and their implications for sustainable human capital development could provide valuable insights for policymakers and stakeholders aiming to enhance workforce skills and capabilities on a broader scale.

This study investigates several research questions related to the role of learning, education, and training in fostering sustainable human capital development in the Middle East. The key research questions examined comprise: the relationship between education and sustainable human capital development; impact of training programs; and effectiveness of learning initiatives in enhancing human capital growth. By examining these research questions, the study aims to uncover valuable insights into the factors that contribute to sustainable human capital development and provide evidence-based recommendations for policymakers and stakeholders in the Middle Eastern region and beyond.

2. Literature review

2.1. Overview of sustainable development

The United Nations outlined the Sustainable Development Goals (SDGs) in 2015 with the primary goal of creating a better and more sustainable future for the worldwide population. Poverty, inequality, environmental degradation, climate change, economic prosperity, peace, and justice are just a few of the global challenges that the SDGs aim to address [7]. Hák et al. [8] proposed a variety of indicators, each with its own set of quality standards, for measuring sustainable development.

The linked nature of the SDGs demonstrates that a holistic approach is required to thoroughly address complex challenges. Therefore, the Saudi Arabian government must achieve all the SDGs by 2030 to ensure that no one falls behind on this collective journey towards a more equitable and sustainable society. As [9] reported, the Saudi Arabian government has consistently demonstrated its commitment to sustainability principles, which are in line with the global commitment to the SDGs [10]. confirmed that numerous sustainability-related challenges have been addressed by Saudi Arabia through the implementation of various initiatives. Under the Saudi Vision 2030 plan, Saudi Arabia is actively directing its economy away from oil dependence by significantly increasing investment in renewable energy sources and promoting the development of smart and sustainable cities, indicating the Saudi government's forward thinking in terms of environmental issues and sustainable practices.

[11] stated that a strategic shift toward adaptation and resilience in the face of the changing Saudi dynamics is indicated by the diversification of the economy. Policies and programs that strengthen women's agency and foster a more welcoming community are manifestations of Saudi Arabia's dedication to gender equality.

Saudi Arabia is committed to tackling the global challenges highlighted in the SDGs because of its involvement in international discussions, partnerships with other countries, and contributions to humanitarian causes. Saudi Arabia is engaging on the global stage by recognizing the need for collective efforts to overcome shared challenges. As such, this team effort aligns with the SDGs' emphasis on interdependence and highlights the significance of global cooperation in attaining sustainable development.

Essentially, Saudi Arabia's efforts demonstrate the country's strong dedication to fostering sustainability on all levels, from the local to global, in the society, economy, and environment. As a model global citizen dedicated to a sustainable and inclusive future, Saudi Arabia is making a significant impact by joining the collective to achieve the SDGs.

2.2. Sustainable human capital development

Organizational intellectual assets are based on human capital, which consists of people's inherent knowledge and abilities [12]. Therefore, human resource management is involved in the processes of selection, development, and usage by to the accumulation of organizational human capital. This trend has the potential to create long-term competitive advantage by developing human capital, ensuring a more focused organization, and reducing competition. However [13], stated that this process begins with selecting qualified applicants while engaging them in training to increase their productivity and promote lifelong learning within the organization. This means that the strategic deployment of human resources is crucial because their full potential can only be reached through productive engagement.

Moreover [14], reported that an organization can achieve sustainable competitive advantage through proactive actions that prohibit competitors from easily leveraging the value of acquired human capital at reduced costs.

Consequently, to achieve sustainable human capital development for citizens, Saudi Arabia needs to establish a comprehensive, enduring framework that transcends traditional educational perspectives. This involves not only academically preparing students but also recognizing the importance of their holistic development and encompassing the social, ethical, and personal aspects. Embracing a paradigm shift, this study views Saudi Arabian citizens as active participants in their personal growth, contributing to the broader fabric of Saudi Arabia. For Saudi Arabian citizens, sustainable human capital development places a strong emphasis on opportunities for lifelong learning, adapting to workforce changes, and fostering the development of social responsibility. This advocates for a broader educational framework that incorporates diverse experiences to promote intellectual and human growth, complementing formal academic instruction.

2.3. Hypotheses developments

2.3.1. The relationship between learning and sustainable human capital development

[12]argued that there is a significant correlation between learning and human capital development. They suggested that retaining confidential knowledge acquired via experiential learning can potentially give an organization a competitive edge. Besides, information sharing outside the scope of the organization results in challenges including limiting the preservation of benefits and granting competitors an unjust advantage [15]. proclaimed that human capital becomes evident in achieving long-term competitive advantage through cost-reduction efforts and ongoing education. As it is based on personal relationships and human abilities, lifelong learning is essential in protecting organizational confidential information as a valuable strategic asset that is difficult to imitate.

[16]asserted that multiple factors impact the correlations between learning and human capital, such as the characteristics of knowledge and how it is shared. Thus, learning methods are significant in developing individuals' human capital within the wider scope of citizen development. This includes enhancing individual knowledge, skills, and overall preparedness for future employment. Formal education offers a structured base and important theoretical knowledge, but incorporating various teaching methods improves the practical application of concepts in real-life situations. Experiential learning, workshops, internships, and interactive technology enhance the development of a well-rounded skill set in an organization [17]. As such, engaging in real-world projects and gaining practical experience are crucial for developing problem-solving skills and cultivating a proactive mindset.

As explained by Refs. [18,19], mentorship programs and collaborative learning opportunities are vital in fostering teamwork and interpersonal skills, which are integral aspects of human capital. They further argued that engaging in diverse learning activities enables citizens to acquire a wide range of skills and cultivate resilience and adaptability, which in turn prepares employees to effectively navigate the ever-changing demands of the workplace. Hence, the development of versatile individuals capable of significant contributions to both the workforce and society depends on the successful integration of various learning methods within the educational system. Based on the findings of [18,19], the dynamic correlation between learning and sustainable human capital development is vital in shaping citizens' abilities and workforce readiness. While experiential learning and interactive technologies are two pedagogical approaches that might improve the knowledge's practical applicability, a solid theoretical grounding is required to provide dynamic learning and sustainable human capital development.

Saudi Vision 2030 towards sustainable development of human capital has considered the ever-changing character of the modern workplace and the need to effectively combine various learning methods [1,2]. This means that Saudi Arabian citizens will be better prepared to handle the intricacies of society and the workforce when offered a well-rounded skill set through an effective learning strategy. Because human capital encompasses both theoretical knowledge and practical application, combining formal education with experiential learning is necessary.

To cultivate a competent and responsible workforce, it is essential to use learning methodologies that are interdependent with sustainable human capital development. As such, we postulate the following hypothesis:

H1. There is a significant positive relationship between learning and sustainable human capital development.

2.3.2. The relationship between education and sustainable human capital development

[20]highlighted the mutual reliance of education and human capital development, underscoring their contribution to both economic success and the welfare of their citizens. According to Ref. [21], education has emerged as a catalyst for economic expansion and a source of competitive edge in the twenty-first century. Therefore, devoting a significant proportion of a nation's financial resources to education is considered one of the most vital investments, acting as the fundamental basis for the growth of human capital development.

[22–24] submitted that education is considered a tool for improving personal skills, capabilities, and proficiencies and encourages both self-empowerment and involvement in society and civic participation [23]. further argued that education provides access to job prospects, resulting in both monetary and non-monetary benefits towards enabling professional advancement. Nevertheless, the potential of education to bring about significant change is not fully realized in numerous developing nations due to inadequate financial resources allocated for the generation and application of knowledge [25]. Therefore, substantial investments in education are essential not just for the purpose of imparting knowledge and skills but also for inculcating values, ideas, attitudes, and aspirations that are vital for a nation's prosperity.

Based on the findings of [22,23,25], accessibility and alignment of education with labor market demands are considered crucial factors that contribute to economic growth [26,27]. concluded that higher education, specifically, is fundamental in developing the

necessary human development for creating knowledge, with a focus on its influence on innovation, economic expansion, and the spread of knowledge. Furthermore [26], emphasized the importance of continuous efforts and investments in education to fully utilize its transformative power, as it is pivotal in empowering individuals and advancing society.

[16]expressed that the correlation between human capital development and educational programs are important in shaping the trajectory of citizens' intellectual and professional growth. Educational programs refine citizens' knowledge, hone their skills, and foster critical thinking abilities, equipping them with the essential tools to navigate an increasingly complex environment successfully. Beyond the confines of traditional classrooms, educational programs contribute to the development of a diverse set of capabilities, fostering creativity, adaptability, and problem-solving skills towards human development in a given society. This means that the quality of educational programs has a profound impact on human capital development. Therefore, a robust educational foundation empowers individuals to make meaningful contributions to society, underscoring the symbiotic relationship between education and the cultivation of human capital. This dynamic correlation ensures that citizens not only excel in their chosen fields but also gain a broader awareness of societal issues and challenges.

[28]concluded that the collaborative efforts of human capital development and educational programs dynamically provide citizens with the knowledge and skills that are essential for success in their respective fields. Simultaneously, this process contributes to molding individuals into competent members of their local communities and the global workforce. Therefore, as Saudi Arabian citizens engage in high-quality educational programs, they are not only acquiring expertise but also cultivating a holistic understanding of their roles as contributors to both their immediate surroundings and the broader global context. This interconnected process ultimately shapes individuals into well-rounded and proficient members of society. Hence, we hypothesize as follows:

H2. There is a significant positive relationship between education and sustainable human capital development.

2.3.3. The relationship between training and sustainable human capital development

[1,2] underscored the importance of training in Saudi Arabia, especially in relation to the Vision 2030 plan. They argued that competent people possess the ability to create knowledge through practical learning, therefore promoting sustainable development. They highlighted the connection between training activities and the creation of enduring employment prospects, emphasizing the impact on human development in Saudi Arabia. The correlation between training programs and human development is essential for closing the knowledge gap between classroom learning and real-world application [29]. stated that training programs extend beyond standard education as they offer individuals practical experiences and specialized skills that are crucial in real-life situations, serving as a dynamic supplement to conventional academic endeavors. Through workshops, internships, and cooperation with other relevant industries, these initiatives improve people's employability by providing practical experience and knowledge in the professions they aim to pursue.

This study postulates that an effective training program is not solely based on teaching technical skills but also on fostering essential soft skills such as communication, teamwork, and adaptability, which are vital in determining the growth of human capital. This means that by engaging in hands-on learning experiences, individuals not only enhance their theoretical understanding but also cultivate the practical competencies essential for achieving success in their desired professional trajectories. Hence, the interdependent correlation between training programs and the development of human capital is crucial in generating proficient and versatile individuals who are prepared to confront the demands of the labor market with assurance and aptitude. Thus, we submit the following hypothesis:

H3. There is a significant positive relationship between training and sustainable human capital development

2.3.4. The relationship between community engagement and sustainable human capital development

According to Ref. [30], building strong community engagement relies on community involvement and long-term human capital development. However [31], stated that community engagement is considered to be a complex web of relationships that focus on the value of social capital at the community level, which is built through trust and reciprocity in civic activities. As such, community engagement and human capital development are perceived as crucial components for combating socioeconomic marginalization while increasing civic engagement and knowledge.

Furthermore, according to Ref. [32], community engagement is a game-changer because it gives previously disengaged community members a voice in decision-making and empowers them to build community resources. It forms a foundation for broad civic involvement by offering possibilities for the creation of social and human capital.

[33] suggested that, to promote many aspects of personal and professional development and inculcate a feeling of social responsibility, it is essential to engage in community activities, thereby contributing to the development of citizens' human capital. Opportunities to apply classroom knowledge to real-world problems are provided via community involvement programs, which broaden the educational experience beyond the classroom. This means that citizens gain valuable interpersonal skills, cultural competency, and a nuanced understanding of other perspectives through community service, internships, and joint projects.

[34] postulated that human capital development in this ever-changing environment goes beyond the basic acquisition of knowledge and should include the development of skills such as empathy, leadership, and clear communication. Especially in today's globally integrated workplace, these qualities are crucial for achieving success. Therefore, citizens who are always willing and eager to participate in community engagements not only perform better in school, but also become adaptable to different situations, are conscious of social issues, and can make a difference on a local and global scale [35]. As such, building well-rounded individuals who can have a positive influence on both their local community and globally relies on the mutually beneficial relationship between community participation and human capital development. Hence, we hypothesize as follows:

H4. There is a significant positive relationship between community engagement and sustainable human capital development.

2.3.5. The relationship between access to resources and sustainable human capital development

[36] theorized that a person's educational and professional paths are significantly shaped by the relationship between their access to resources and their efforts to develop their human capital. Similarly [37], claimed that having an ample supply of learning resources, including libraries, technology, and mentorship, is essential for fostering citizens' cognitive capacity and skills. Furthermore [38], reinforced the fact that academic success is realized through these many resources, ranging from online databases to well-equipped classrooms.

As reported by Ref. [39], access to resources is regarded as an integral component of the educational ecosystem and allows individuals to realize their full potential, thereby producing a new generation of knowledgeable and capable individuals who are prepared to contribute significantly to the society and workforce. Therefore, based on [40], a generation of individuals who are prepared to confront modern world problems and actively contribute to its advancement can be fostered by this symbiotic relationship between resource accessibility and human capital development. Hence, the following hypothesis is postulated:

H5. There is a significant positive relationship between access to resources and sustainable human capital development.

2.3.6. The relationship between institutional support and sustainable human capital development

[41]surmised that the intersection of institutional support and human capital development is critical in determining individuals' holistic growth and success. Furthermore [42], pointed out that the creation of a positive learning environment that supports citizens' mental and emotional health is facilitated by adequate institutional support, which includes a variety of elements such as counseling services and mentorship programs. This means that a conducive learning environment and human capital development are both greatly enhanced when institutions place an emphasis on a supportive infrastructure. In doing so, the citizen's ability to facilitate networking, skill development, and career guidance contributes to individuals' holistic growth. As such [43], showed that citizens with strong institutional support networks are capable of adapting and thriving in the ever-changing world of education and the workforce.

[44]stated that the creation of conditions that promote academic, professional, and personal success is the correlation. This is because institutional support facilitates the multifaceted growth of citizens and enables them to flourish in various aspects of their lives, as they prioritize the provision of a supportive atmosphere. Thus, the interdependence of these elements in promoting the well-being of citizens is emphasized by the synergy between human capital development and institutional support. Hence, we hypothesize as follows:

H6. There is a significant positive relationship between institutional support and sustainable human capital development.

2.3.7. The relationship between technology integration and sustainable human capital development

Incorporating technology in education, which transforms the nature of learning and skill development, is substantially linked to human capital development of citizens [45]. argued that technological advancements are a driving force behind new and improved educational practices aimed at providing adaptable resources. According to Ref. [46], integrating technology also helps with digital

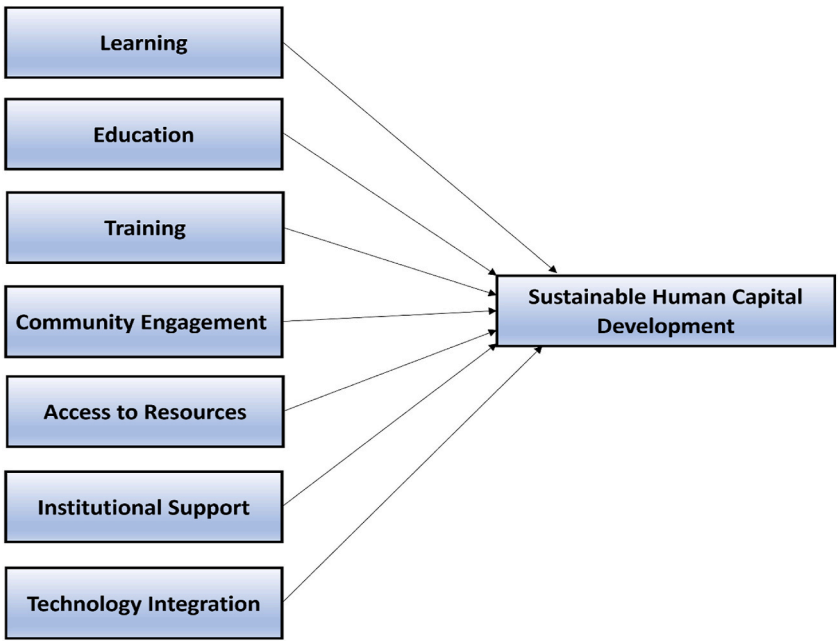

Fig. 1. The hypothetical model.

literacy and problem-solving skills, which are important for building human capital in the digital world. For instance Ref. [47], highlighted that interactive learning platforms and immersive virtual simulations allow citizens to apply theoretical knowledge in real-world contexts.

The needs of the rapidly evolving global workforce are being met by citizens who employ cutting-edge technologies. They acquire technical proficiency, critical thinking skills, and the ability to adapt. Digital tools have a revolutionary impact and form individuals who are proficient academically and technologically. This equips them to navigate the complexities of today's professional milieu, which is supported by the correlation between technological integration and human capital development. Hence, we propose the following hypothesis:

H7. There is a significant positive relationship between technology integration and sustainable human capital development.

Following the theoretical foundations and hypothesis development, the conceptual model for the study is depicted in Fig. 1. Each hypothesis depicted in the model is postulated to have a direct and positive relationship.

3. Methodology

A quantitative approach was utilized to explore the relationship among various variables in the study. To accomplish this, the study employed the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique, facilitated by SmartPLS V.4.1.0.0 software, to assess both the measurement and structural models. PLS-SEM, recognized for its non-parametric and multivariate nature, is a widely accepted method for estimating the pathways between latent variables. This study was exploratory in nature and delved into the impact of learning, education, and training on fostering sustainable human capital development in Saudi Arabia. Moreover, the study's framework encompassed multiple independent variables, aiming to scrutinize the conceptual interplay between the independent and the dependent variable. Thus, PLS-SEM was deemed the appropriate method for analyzing the study's data.

3.1. Population and sampling

The primary target group comprised public personnel working in Saudi Arabia and the "unit of analysis" consisted of public servants who were residing in Saudi Arabia. This was because all the survey items were tailored to this particular demographic. This study primarily aimed to investigate the influence of learning, education, and training on the advancement of sustainable human capital development within the setting of Saudi Arabia. The data required for the study were gathered directly from the public personnel in Saudi Arabia.

To obtain a sample that was representative of the population, the study utilized snowballing sampling techniques to obtain. This was aimed to maximize the generalizability of the findings while ensuring that each unit had an equal chance of being selected. The combination of these sampling methodologies accomplished the study's purpose of obtaining in-depth knowledge of the viewpoints and experiences of the targeted population.

3.2. Sample size and selection

Following the suggestions by Ref. [48], an appropriate sample size for structural equation modeling (SEM) should ideally range between 200 and 400 respondents. Therefore, the researchers applied the G Power software to determine the suitable sample size. Considering an effect size of medium magnitude (0.05), alpha level of 0.05, a power of 0.8, and seven independent factors in addition to one dependent variable, a minimum of 320 respondents would be required to detect the anticipated.

In addition [49], pointed out that the response rates in Saudi Arabia often fall between 20 and 30 percent. Therefore, to obtain the suitable number of responses, the researchers sent 1000 surveys to public personnel all over Saudi Arabia through various WhatsApp group platforms. To ensure a random and unbiased selection, the ministries from which participants were drawn were selected randomly from the Council of Ministers membership database.

3.3. Data collection

A total of 212 completed questionnaires were received by the researchers throughout the data collection period, which lasted from January 2024 to March 2024. The data was then meticulously cleaned for statistical analysis. The criterion for complete responses included answering all questions; partial responses or missing data were excluded.

Additionally, instances of straight-lining responses, whereby respondents systematically select the same answer across a large number of questions without any variance, were identified. Finally, 9 responses were excluded from the dataset, resulting in 203 complete responses.

Nonetheless, there were minimal instances with regard to the discriminant validity during the analysis. Following further examination, three items—COMUN7, ACC_R7, and INS_SUPP7—exhibited correlations with other items that were significantly higher than average. Consequently, these three elements were regarded as unnecessary and, therefore, were eliminated from the dataset. This refinement process resulted in a dataset with 54 items that were deemed appropriate for the final data analysis.

3.4. Measurement items

The assessment was conducted based on the thoughts and attitudes of the respondents, who were evaluated using a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). The measurement items used in this scale were drawn from previous studies and modified for the settings of this particular investigation. Table 1 lists these measurement items, together with the relevant sources.

The item purification process involved several steps to ensure the accuracy and reliability of the measurement tools used in this study. The researchers carefully selected measurement items drawn from reliable and related studies. These items were then modified to suit the specific context of the investigation in the Middle East region. The selection of measurement items was performed carefully to align with the requirements typically utilized in the public sector. Additionally, minor adjustments were made to the terminology to ensure appropriateness for the study's focus. The fundamental concepts of the measurement items were preserved throughout this process to maintain consistency and validity. This systematic approach aimed to enhance the robustness of the findings by ensuring the accuracy and reliability of the measurement tools used in the study.

4. Data analysis and results

The first step of the analysis comprised utilizing SPSS version 25.0 to assess the characteristics of the respondents as well as the relevant data. This detailed exploration enabled the researchers to gather insights into the demographic mix and characteristics of the participants.

The demographic characteristics of the study participants, as detailed in Table 2, reveal more male (54.7 %) respondents compared to female participants (45.3 %). In terms of age distribution, the vast majority of respondents were aged between 18 and 30 years (99 %), with only a small percentage falling in the 31–40 and 41–50 age brackets. These demographic characteristics may have both positive and negative impacts on the study topic of sustainable human capital development in the Middle East.

Favorably, the gender distribution provides a balanced representation of male and female perspectives, allowing for a more comprehensive analysis of how learning, education, and training initiatives impact human capital development across genders. This inclusivity can lead to a more nuanced understanding of the challenges and opportunities faced by both male and female workforce participants in the Middle East. Additionally, the predominance of younger respondents in the 18–30 age group may indicate a focus on early career professionals and students, offering insights into the effectiveness of educational and training programs in shaping the skills and capabilities of the next generation workforce in the Middle East.

However, the limited representation of older age groups (31–50) in the study sample could potentially overlook the perspectives and experiences of mid-career and senior professionals, who may have valuable insights into the long-term impact of learning and training on career progression and human capital development. This demographic imbalance may restrict the generalizability of the study findings across different age cohorts within the workforce, highlighting a potential limitation in capturing a holistic view of sustainable human capital development practices in the Middle East.

The data reveal that majority of respondents were single (97 %), with a small percentage being married (3 %). This indicates that single individuals may have more flexibility and time to engage in continuous learning, training programs, and career development initiatives, potentially leading to higher levels of skill acquisition and professional growth. However, the limited representation of married respondents in the study sample may overlook the unique challenges and responsibilities faced by this demographic group, such as balancing work, family commitments, and educational pursuits. Understanding the impact of marital status on human capital development can provide valuable insights for designing tailored programs that cater to the diverse needs of both single and married individuals in the workforce.

In terms of respondent qualifications, the data show a diverse distribution among respondents, with the majority holding bachelor's degrees (56.2 %), followed by high school qualifications (42.4 %). This indicates that individuals with higher educational qualifications may possess advanced skills, critical thinking abilities, and specialized knowledge that can contribute to sustainable human capital development in the region. These individuals may be more adept at adapting to changing work environments, acquiring new competencies, and driving innovation within their organizations. Nevertheless, the representation of individuals with high school qualifications highlights the importance of addressing educational disparities and providing opportunities for skill development and upskilling among this group to enhance their contribution to the workforce.

The data indicate that the majority of respondents had a monthly income of less than 5000 SAR (95.6 %), with small percentages

Table 1
Constructs measurement.

S/N	Construct	No of items	Sources
1	Learning	7	[12,50,51]
2	Education	7	[52,53]
3	Training	7	[54,55]
4	Community engagement	7	[56–58]
5	Access to resources	7	[59–61]
6	Institutional support	7	[53,62–65]
7	Technology integration	7	[66–68]
8	Sustainable human capital development	8	[69–72]

Table 2
Demographic data.

Variables	Scale	Frequency	Percent
Gender	Male	111	54.7
	Female	92	45.3
	Total	203	100
Age	More than 18 and less than 30	201	99
	31–40	1	0.5
	41–50	1	0.5
	Total	203	100
Marital Status	Single	197	97
	Married	6	3
	Total	203	100
Qualification	High School	86	42.4
	Diploma	1	0.5
	Bachelor	114	56.2
	Master	1	0.5
	PhD	1	0.5
	Total	203	100
Monthly Income	Less than 5000 SAR	194	95.6
	More than 5000 and less than 10,000 SAR	6	3
	More than 10,000 SAR	3	1.5
	Total	203	100

earning more than 5000 SAR but less than 10,000 SAR (3 %) and more than 10,000 SAR (1.5 %). Individuals with higher income levels may have greater access to resources for continuous learning, professional development courses, and training programs, enhancing their human capital potential. Conversely, individuals with lower income levels may face financial constraints that limit their ability to invest in educational opportunities and skill-building initiatives, potentially hindering their career advancement and overall human capital development. Understanding the relationship between income levels and access to learning opportunities is crucial for designing inclusive policies and programs that promote equitable human capital development across different socio-economic groups in the region.

Next, the complex measurements and structural model analyses were conducted with the facilitation of SmartPLS version 4.1.0.0.

4.1. Assessment of measurement model

4.1.1. Construct validity

The study contained 57 items, of which the lower factor loading led to the deletion of three due to poor factor loadings. The authors retained 54 items. The authors subsequently assessed the reliability and validity of the constructs by conducting tests for reliability, convergence, and discriminant validity [73]. Table 3 presents the reliability and validity analyses results.

4.1.2. Convergent validity

To evaluate convergent validity, several measures were used, including cross-loadings, Cronbach's alpha, average variance extracted (AVE), and composite reliability (CR) of the components. The assessment results are shown in Table 3 and Fig. 2. The loadings of each item varied between 0.589 and 0.814, all of which were above the minimum threshold of 0.40 [74,75]. proposed that a factor loading should exceed 0.4 for meaningful interpretation, while [76] contended that all standardized factor loadings should be no less than 0.5 and preferably at least 0.7. Simply, the construct should account for a minimum of 25 % or, ideally, a minimum of 49 % of the variability in each indicator.

The reliability of the constructs was evaluated by analyzing both the Cronbach alpha and the CR scores. The results, as presented in Table 3, demonstrate sufficient reliability. Both the Cronbach alpha and CR ratings for each construct surpassed the required threshold of 0.70 [77]. The CR values fell within the range of 0.972 and 0.953, surpassing the minimum requirement of 0.70. The Cronbach's alpha coefficient for all the items was greater than 0.70 [78–80], indicating that the internal consistency criterion was satisfied.

The constructs' validity was evaluated by the implementation of convergent and discriminant tests. Convergent validity was evaluated using AVE. A desired AVE score is 0.5 or above, indicating that a construct should be capable of explaining over 50 % of the variance in its indicators. The AVE ratings, as indicated in Table 3, indicate that all the constructs surpassed the recommended minimal threshold. The AVEs ranged from 0.800 to 0.811, surpassing the 0.50 threshold.

4.1.3. Discriminant validity

The discriminant validity test assesses whether the constructs utilized in the investigation are clearly distinguishable from one another inside the route model. The assessment of discriminant validity was conducted using the Fornell-Larcker criterion. Based on this criterion, the AVE of the latent variable should exceed the squared correlations between the latent variable and all other variables [81–83].

According to the results in Table 4, all constructs demonstrated adequate discriminant validity.

Table 3
Reliability and validity.

Construct	Items	FL	CA (≥0.7)	CR (≥0.7)	AVE (≥ 0.5)
Learning (L)	L1	0.840	0.965	0.966	0.830
	L2	0.930			
	L3	0.949			
	L4	0.923			
	L5	0.907			
	L6	0.905			
	L7	0.917			
Education (EDU)	EDU1	0.904	0.963	0.964	0.822
	EDU2	0.907			
	EDU3	0.902			
	EDU4	0.911			
	EDU5	0.894			
	EDU6	0.919			
	EDU7	0.910			
Training (T)	T1	0.827	0.958	0.960	0.800
	T2	0.869			
	T3	0.921			
	T4	0.948			
	T5	0.900			
	T6	0.908			
	T7	0.885			
Community Engagement (COMUN)	COMUN1	0.874	0.953	0.957	0.811
	COMUN2	0.914			
	COMUN3	0.871			
	COMUN4	0.894			
	COMUN5	0.904			
	COMUN6	0.944			
	COMUN7	Deleted			
Access to Resources (ACC_R)	ACC_R1	0.902	0.959	0.959	0.831
	ACC_R2	0.922			
	ACC_R3	0.917			
	ACC_R4	0.914			
	ACC_R5	0.919			
	ACC_R6	0.895			
	ACC_R7	Deleted			
Institutional Support (INS_SUPP)	INS_SUPP1	0.920	0.953	0.956	0.812
	INS_SUPP2	0.834			
	INS_SUPP3	0.906			
	INS_SUPP4	0.926			
	INS_SUPP5	0.907			
	INS_SUPP6	0.912			
	INS_SUPP7	Deleted			
			0.885	0.891	0.809
Technology Integration (Tech_int)	Tech_int1	0.897			
	Tech_int2	0.919			
	Tech_int3	0.923			
	Tech_int4	0.901			
	Tech_int5	0.918			
	Tech_int6	0.820			
	Tech_int7	0.915			
Human Capital Development (Hum_de)	Hum_dev1	0.902	0.972	0.972	0.838
	Hum_dev2	0.921			
	Hum_dev3	0.919			
	Hum_dev4	0.906			
	Hum_dev5	0.925			
	Hum_dev6	0.911			
	Hum_dev7	0.919			
	Hum_dev8	0.917			

** Construct, Items, Factor Loadings (FA), Cronbach's alpha (CA), Composite reliability (CR), Average variance extracted (AVE)**.

4.2. Structural model

To test the correlation among the factors of learning, education, and training in fostering sustainable human capital development, this study employed the five-step procedure recommended by Ref. [84] to assess the structural model. The steps involve assessing: (1) the collinearity issues; (2) path coefficient; (3) level of R^2; (4) effect size (f^2); and (5) predictive relevance (Q^2).

Prior to analyzing the structural model, it is crucial to verify the presence of lateral collinearity. The Variance Inflation Factor (VIF) values for all the independent constructs were below 5.0. Consequently, there was no problem with lateral collinearity in this

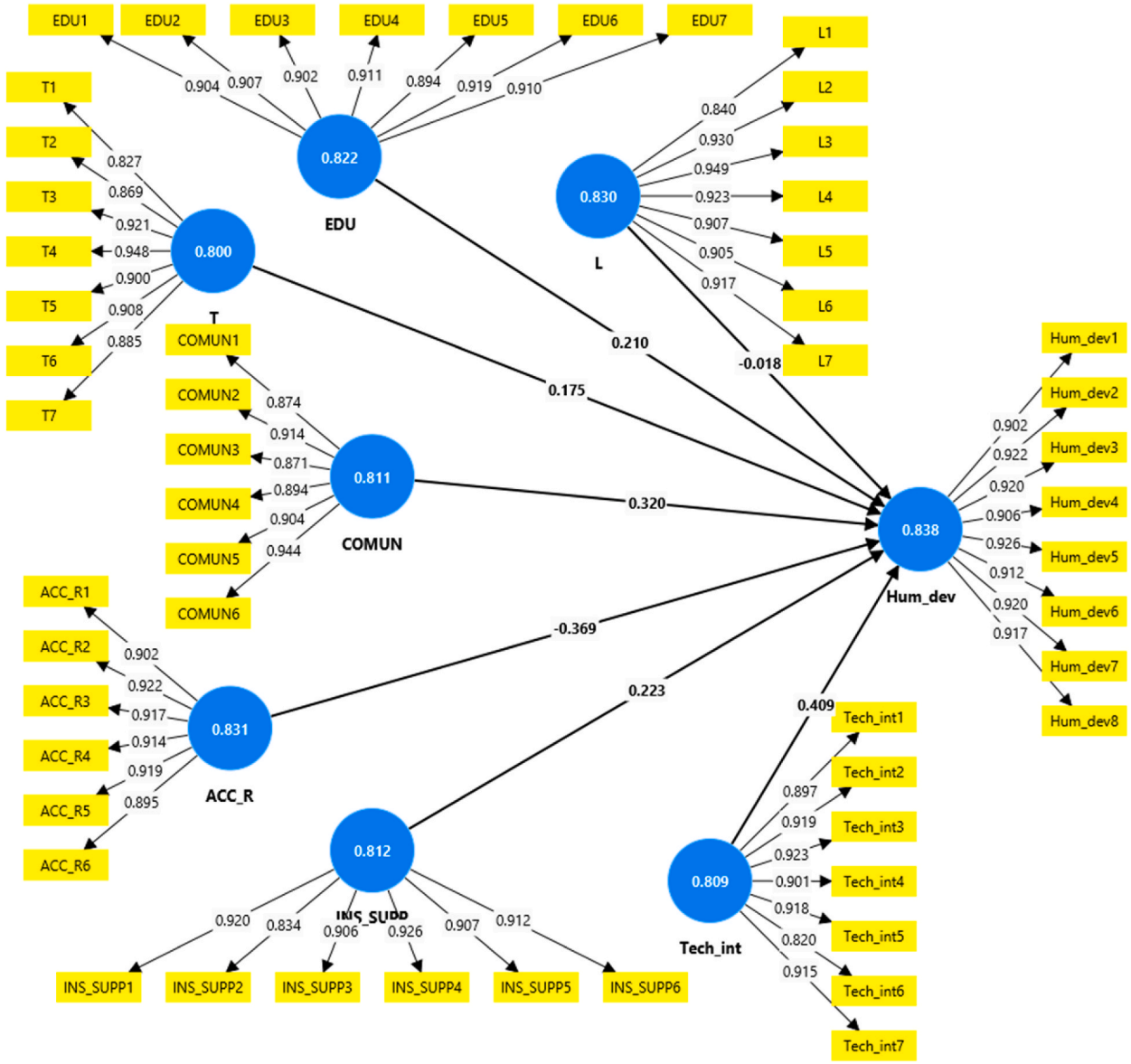

Fig. 2. The measurement Model.

Table 4
Discriminant validity (Fornell and Larcker).

	L	EDU	T	COMUN	ACC_R	INS_SUPP	Tech_int	Hum_de
L	0.910							
EDU	0.904	**0.906**						
T	0.881	0.890	**0.894**					
COMUN	0.860	0.862	0.890	**0.900**				
ACC_R	0.817	0.820	0.887	0.894	**0.911**			
INS_SUPP	0.822	0.808	0.892	0.898	0.896	**0.901**		
Tech_int	0.835	0.819	0.893	0.880	0.879	0.889	**0.899**	
Hum_de	0.829	0.837	0.880	0.881	0.818	0.875	0.880	**0.915**

**Learning (L), Education (EDU), Training (T), Community Engagement (COMUN), Access to Resources (ACC_R), Institutional Support (INS_SUPP), Technology Integration (Tech_int), and Human Capital Development (Hum_de). **.

investigation.

The results of the analysis are presented in Fig. 2, indicating that learning (L), education (EDU), and access to resources (ACC_R) do not influence sustainable human capital development in Saudi Arabia. Hence, hypotheses 1, 2, and 5 are rejected. Fig. 3 displays the Bootstrapping model used for the analysis.

On the contrary, training (T), community engagement (COMUN), institutional support (INS_SUPP), and technology integration (Tech_int) are found to have a strong influence on sustainable human capital development in Saudi Arabia, supporting hypotheses 3, 4, 6, and 7 (see Table 5).

The R^2 results for the endogenous constructs, specifically sustainable human capital development in Saudi Arabia, are displayed in Table 6. As per [84], R^2 values of 0.75, 0.50, or 0.25 are classified as strong, moderate, and weak, respectively.

An R^2 value of 0.853 for sustainability (Table 6) indicates that the exogenous constructs—training (T), community engagement (COMUN), institutional support (INS_SUPP), and technology integration (Tech_int)—account for 85.3 % of the variability in sustainable human capital development in Saudi Arabia, demonstrating a robust explanatory power [85–87]. Additionally, the adjusted R-squared (R^2) value for sustainability stands at 0.847, affirming that the overall regression model supports the research hypotheses.

The effect size (f^2) measures the significant impact of external influences on internal variables by considering their distinct variances rather than their common variation [85].

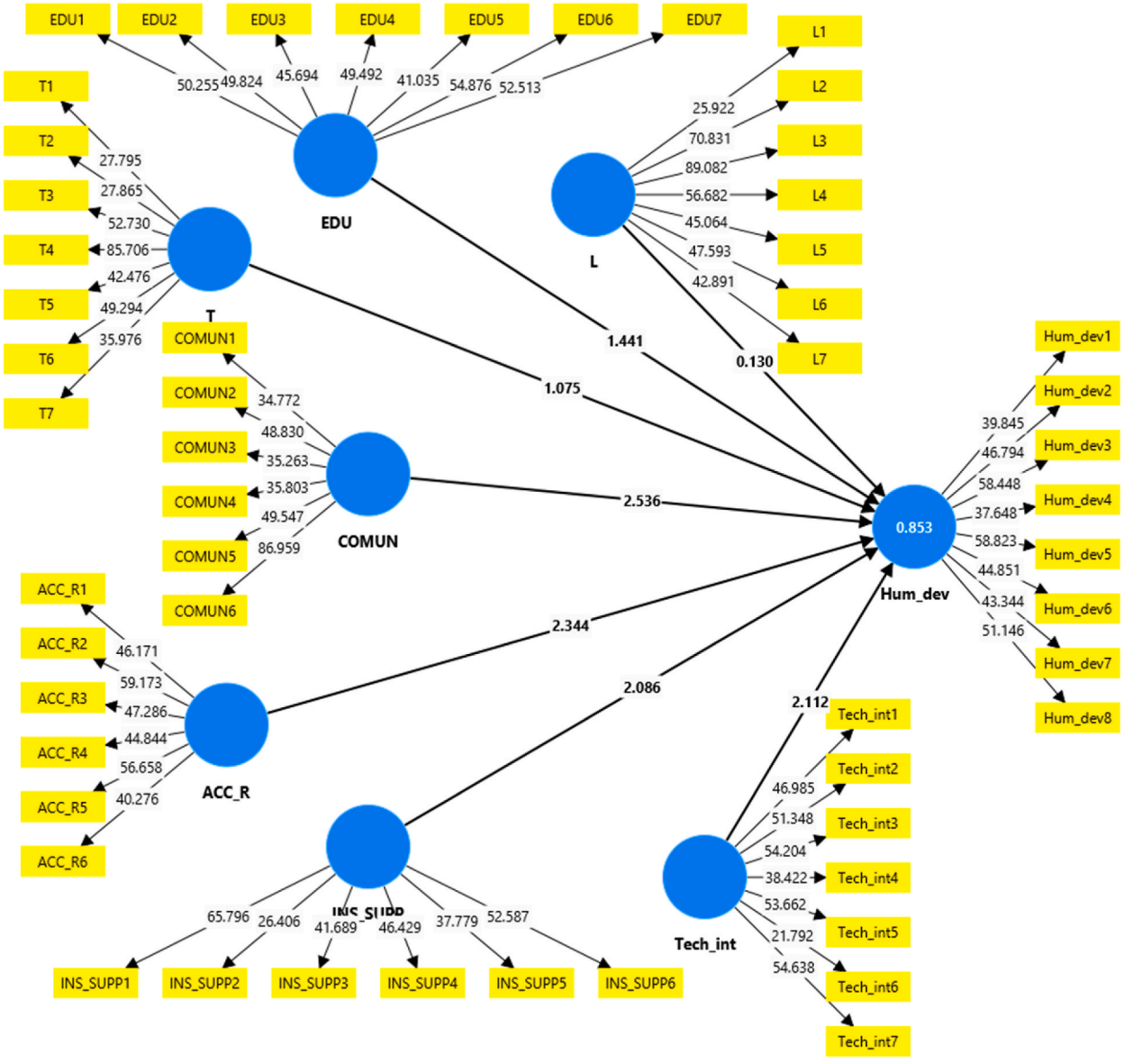

Fig. 3. Bootstrapping model.

Table 5
Bootstrapping.

H	Direct Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Findings
H1	L - > Hum_dev	−0.01777	−0.02681	0.136588	0.130075	0.448256	Not Supported
H2	EDU - > Hum_dev	0.20994	0.195994	0.145696	1.440945	0.074831	Not Supported
H3	T - > Hum_dev	0.17488	0.165222	0.162711	1.07479	0.04126	**Supported**
H4	COMUN - > Hum_dev	0.320305	0.326331	0.126313	2.535809	0.005624	**Supported**
H5	ACC_R - > Hum_dev	−0.36949	−0.35384	0.157613	2.344275	0.009552	Not Supported
H6	INS_SUPP - > Hum_dev	0.223443	0.230769	0.107098	2.086339	0.018499	**Supported**
H7	Tech_int - > Hum_dev	0.408817	0.413674	0.193597	2.111693	0.017381	**Supported**

**Learning (L), Education (EDU), Training (T), Community Engagement (COMUN), Access to Resources (ACC_R), Institutional Support (INS_SUPP), Technology Integration (Tech_int), and Human Capital Development (Hum_de). **.

Table 6
Variance explain in the endogenous latent variable.

Variable	R-square	R-square adjusted
Hum_dev	0.853	0.847

Table 7
Effect size.

Relationship	Values	Effect size
L - > Hum_dev	0.002	Small
EDU - > Hum_dev	0.002	Small
T - > Hum_dev	0.006	Small
COMUN - > Hum_dev	1.201	Large
ACC_R - > Hum_dev	0.003	Small
INS_SUPP - > Hum_dev	0.006	Small
Tech_int - > Hum_dev	0.166	Medium

**Learning (L), Education (EDU), Training (T), Community Engagement (COMUN), Access to Resources (ACC_R), Institutional Support (INS_SUPP), and Technology Integration (Tech_int) and Human Capital Development (Hum_de). **.

The effect sizes of seven external factors on the endogenous human capital development (Hum_de) constructs are shown in Table 7. Community engagement (COMUN) had a noteworthy influence, whereas technology integration (Tech_int) had a minor impact on the endogenous construct. By contrast, the variables learning (L), education(EDU), training (T), access to resources (ACC_R), and institutional support (INS_SUPP) show minimal impact sizes. However, it can be difficult to guarantee that the overall guidelines provide a significant effect size, as the effect size may differ based on the framework's characteristics and the study region.

5. Discussion

The study investigated the importance of learning, education, and training in cultivating sustainable human capital development in Saudi Arabia. Additionally, the findings present significant implications.

Based on the results in Tables 6 and it can be concluded that H1, which states that learning has a significant impact on sustainable human capital development in Saudi Arabia, is not supported. This conclusion contradicts that of [12], who argued that there is a substantial association between learning and human capital development. This suggests that there are several aspects, such as improving individual knowledge, skills, and general readiness for future employment, which are insufficient to effectively promote human capital development in Saudi Arabia. Engaging in real-world projects and acquiring practical experience, such as experiential learning, workshops, and internships, are essential for the development of human capital in Saudi Arabia.

Similarly, H2 posited that education has a significant impact on sustainable human capital development in Saudi Arabia. However, the results did not support this hypothesis, as there was no evidence of a positive relationship between education and sustainable human capital development in Saudi Arabia ($\beta = -0.050$, $T = 1.401$, $p < 0.164$). This discovery contradicts the research findings of [22–24]. Due to a possible lack of effective information implementation, Saudi Arabian education fails to fully realize its potential to produce substantial changes at various levels. Hence, significant allocations of resources towards education are crucial not only for the transmission of information and skills but also for instilling values, ideas, attitudes, and aspirations, which are crucial for a nation's economic success.

H3 in Table 6 indicates that the correlation between training and sustainable human capital development in Saudi Arabia has a significant influence ($\beta = 0.087$, $T = 2.524$, $p < 0.013$). This finding corroborated the research conducted by Refs. [1,2], who contended that training holds great importance in Saudi Arabia, particularly in regard to the Vision 2030. Within this context, this study hypothesized that a successful training program relies not only on instructing technical abilities but also on cultivating crucial soft skills such as communication, teamwork, and flexibility, which significantly influence the development of human resources. By participating in these interactive learning activities, individuals not only improve their academic knowledge but also develop the practical skills necessary for succeeding in their chosen careers. Therefore, the mutually dependent relationship between training programs and the cultivation of human capital is essential in producing skilled and adaptable individuals who are ready to confidently meet the requirements of the job market in the near future.

Similarly, H4 posited that community engagement had a major influence on sustainable human capital in Saudi Arabia, which was supported ($\beta = 0.797$, $T = 36.560$, $p < 0.000$). This indicates that Saudi Arabian citizens exhibit a consistent willingness and enthusiasm to actively engage in community activities. This not only leads to improved academic performance but also fosters their ability to adjust to diverse circumstances, heightens their awareness of social concerns, and empowers them to effect positive change at both local and global levels, as suggested by Ref. [35]. Developing individuals with a broad range of skills and knowledge who can positively impact their local community and the world depends on the mutually advantageous connection between community involvement and the development of human capital.

The results suggest that the accessibility of resources has no substantial effect on the sustainable growth of human capital in Saudi Arabia ($\beta = -0.052$, $T = 1.548$, $p > 0.125$). In their study [39], emphasized the significance of resource accessibility in the education system, as it empowers individuals to fully utilize their capabilities. Nevertheless, according to the results of this study, it seems that there is a deficiency or insufficiency in terms of having access to such resources. This highlights the significance of guaranteeing a plentiful provision of educational materials, such as libraries, technology, and mentorship, to foster the cognitive capacities and skills of individuals. The presence of online databases and well-equipped classrooms helps to strengthen the academic accomplishments that are supported by these various resources.

H6, which suggests that institutional support is significant in sustainable human capital development in Saudi Arabia, was also supported ($\beta = 0.053$, $T = 2.054$, $p < 0.043$). This finding aligns with the conclusions of [4], who asserted that the intersection of institutional support and human capital development is pivotal in shaping individuals' overall growth and success. It is argued that institutional support is essential for nurturing a conducive environment that fosters academic, professional, and personal achievements, thereby facilitating holistic development. The significance of institutional support lies in its capacity to empower individuals across various facets of their lives, emphasizing the creation of an enabling ecosystem. The symbiotic relationship between human capital development and institutional assistance underscores the pivotal role played by institutional support in enhancing citizens' welfare.

H7, which suggests the significant influence of technology integration on sustainable human capital development in Saudi Arabia, was also supported (β value of 0.285, a T value of 12.620, and a p-value less than 0.000). This finding aligns with the perspective put forward by Ref. [45] regarding the pivotal role of technological advancements in fostering innovative educational practices with flexible resources. Similarly [46], discovered that integrating technology assists individuals in cultivating digital literacy and problem-solving skills, which are essential components for enriching human capital in today's digital landscape. Consequently, individuals equipped with technical proficiency, analytical acumen, and adaptability are effectively meeting the evolving demands of the global workforce. These competencies have a transformative impact, enabling individuals to successfully navigate the complexities of the modern professional arena.

6. Implications

The study's findings regarding the significance of learning, education, and training in nurturing sustainable human capital development in Saudi Arabia have substantial implications on various societal aspects and policymaking. The research offers valuable insights for policymakers in Saudi Arabia in crafting and executing educational and training programs geared toward sustainable human capital development. This endeavor can aid in aligning national strategies with the objectives of Vision 2030, thereby fostering a skilled and adaptable workforce.

The study underscores the necessity for comprehensive educational frameworks that transcend conventional paradigms, emphasizing holistic individual development. The importance of integrating social, ethical, and personal dimensions into the education curricula to foster well-rounded individuals is highlighted. The correlation between training programs and human capital development emphasizes the significance of investing in practical learning experiences and specialized skills training to reduce the gap between theoretical learning and practical implementation and cultivate a more proficient workforce.

Lifelong learning and adaptation to workforce changes emerge as essential components of sustainable human capital development. Promoting continuous learning can enable individuals to remain relevant in a swiftly evolving job market, contributing to societal progress. Focusing on sustainable human capital development can bolster Saudi Arabia's global competitiveness by nurturing a skilled, adaptable, and socially responsible populace. This can culminate in heightened innovation, productivity, and economic expansion in the long run. Thus, the study underscores the importance of ongoing research and development endeavors for in-depth exploration of the nexus among education, training, and sustainable human capital development. Such initiatives can facilitate the identification of optimal practices and strategies for maximizing the efficacy of learning initiatives.

However, the theoretical implications stemming from this study hold significant importance in advancing our comprehension of the nexus among education, training, and human capital development. The findings bolster the concept of lifelong learning as integral

to sustainable human capital development. By emphasizing the imperative of adapting to evolving workforce dynamics and acquiring fresh skills over one's career, this study resonates with the premise of lifelong learning theory, underscoring the necessity for perpetual personal and professional growth.

Illuminating the role of human resource management in organizational human capital development, this study accentuates the processes of human capital selection, development, and utilization within organizations. This contributes to our comprehension of how strategic management of human resources can confer a competitive edge and foster enduring organizational triumph. This study advocates for holistic educational frameworks that transcend conventional paradigms, accentuating the holistic nurturing of individuals. This underscores the significance of incorporating social, ethical, and personal dimensions into educational endeavors to cultivate well-rounded individuals, enriching ongoing conversations on educational reform and curriculum design. Moreover, by highlighting the value of real-world projects, experiential learning, workshops, and internships in human capital development, this study emphasizes the importance of hands-on learning experiences in bridging theoretical knowledge and practical application. This aligns with theories emphasizing the pivotal role of experiential learning in skill acquisition and knowledge enrichment.

Furthermore, the practical implications stemming from this provide actionable insights for diverse stakeholders engaged in education, workforce development, and policy-making. This study underscores the necessity for curriculum reforms geared towards holistic educational frameworks that encompass not only academic knowledge but also social, ethical, and personal dimensions. Therefore, educational institutions should integrate practical learning experiences and specialized skills training into their curricula to better equip students for the workforce.,

Organizations and educational institutions should design and invest in training programs that address both technical and soft skills such as communication, teamwork, and adaptability to foster human capital development. Highlighting the correlation between training programs and human capital development, this study demonstrates the importance of providing employees with opportunities for practical learning experiences and specialized skills training. This can help bridge the gap between theoretical learning and real-world application, fostering a more proficient and adaptable workforce.

Similarly, the emphasis on lifelong learning and adaptability underscores the need for promoting continuous learning initiatives in educational and organizational settings. Encouraging individuals to engage in ongoing skill development and professional growth can enhance their employability and contribute to sustainable human capital development. By offering valuable insights for policymakers, the study recommends designing and implementing policies that support sustainable human capital development. This entails allocating resources to education, training, and lifelong learning initiatives aligned with Vision 2030 objectives to foster the growth of a skilled and socially responsible populace. The significance of community involvement in nurturing sustainable human capital development is demonstrated in this study, which advocates fostering strong community relationships and empowering individuals in decision-making processes. This enables creation of social and human capital, contributing to societal advancement. Therefore, the study findings furnish actionable recommendations for enhancing human capital development in Saudi Arabia through targeted interventions in education, training, workforce planning, and community engagement. Implementing these recommendations can pave the way for cultivating a more skilled, adaptable, and socially conscious workforce, aligning with Vision 2030 objectives and fostering the nation's long-term prosperity.

7. Limitations and directions for future research

The study's limitations concerning sample size and the representativeness of participants may impact the extent to which the generalizability of the findings. Future research endeavors could opt for larger and more diverse samples to bolster the external validity of the findings. The utilization of a particular research methodology, such as PLS-SEM, may have inherent limitations in capturing the intricacies of the relationships between learning, education, and human capital development. Subsequent studies could explore alternative methodologies to offer a more comprehensive analysis. Relying on an online questionnaire for data collection may have introduced biases associated with self-reporting and response rates. Future investigations could integrate multiple data collection approaches, such as interviews or focus groups, to triangulate findings and fortify the robustness of the outcomes. By concentrating on the specific context of Saudi Arabia, the study's findings may have limited applicability to other cultural or socio-economic contexts. Subsequent research initiatives could delve into the ramifications of learning, education, and training on human capital development across varied settings to yield a more nuanced understanding.

Moreover, employing longitudinal studies to monitor the enduring effects of learning, education, and training initiatives on sustainable human capital development could yield valuable insights into the evolution of skill acquisition and workforce preparedness over extended periods. Undertaking comparative studies across various countries or regions could facilitate the identification of exemplary practices for promoting sustainable human capital development through learning and education. By scrutinizing differences in education systems and training programs, researchers can uncover effective strategies adaptable to diverse contexts. Integrating qualitative research methodologies, such as interviews or case studies, could offer deeper insights into the experiences and perspectives of individuals participating in learning and training programs. Qualitative data can provide nuanced insights into the factors influencing human capital development.

Subsequent studies could concentrate on evaluating the outcomes of specific educational interventions or training programs for human capital development. By assessing the efficacy of targeted initiatives, researchers can inform evidence-based policies and practices aimed at enhancing workforce readiness. Investigating the role of technology in facilitating learning and skill enhancement for sustainable human capital could represent a promising avenue for future research. Analyzing the effects of digital tools, online platforms, and virtual learning environments on human capital outcomes can shed light on innovative educational methodologies.

By addressing these limitations and exploring avenues for future research, scholars can advance our comprehension of the intricate

relationship between learning, education, and training in fostering sustainable human capital development. This, in turn, can lead to more informed policies and practices in workforce development and education.

Data availability statement

Data will be available upon request.

CRediT authorship contribution statement

Aliyu Alhaji Abubakar: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Data curation, Conceptualization, Validation. **Yaser Hasan Al-Mamary:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Validation. **Harman Preet Singh:** Writing – review & editing, Writing – original draft. **Ajay Singh:** Writing – review & editing, Writing – original draft. **Fakhre Alam:** Writing – review & editing, Writing – original draft. **Vikas Agrawal:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e35676.

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