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Enhancing Educational Systems on Creating Job Opportunities by Promoting Knowledge-Based Economy in the Sultanate of Oman

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ABSTRACT: Education is the foundation of progress, development, and the growth of individuals and societies. Knowledge-based education plays a significant role in enhancing educational systems, resulting in improved learning outcomes, enriched knowledge, job creation, and reduced unemployment. It also supports the alignment between educational outcomes and labor market needs by continuously adapting to innovations and advancements. In Oman, the educational system is governed and developed using modern technologies, in alignment with Oman Vision 2040. This research outlines strategies and methods to strengthen knowledge-based education in Oman, with the goal of reducing unemployment and providing suitable job opportunities for Omanis across various sectors. This approach heavily depends on the production and utilization of knowledge and information as key resources for economic growth, addressing gaps and shortcomings in the application of the knowledge economy. The proposed model involves leveraging technology, improving education, and fostering research and development with modern technologies and artificial intelligence tools to enhance educational systems and generate employment opportunities. The study aims to explore how education can contribute to reinforcing the knowledge economy in Oman by advancing educational systems and creating new jobs, focusing on the challenges and opportunities within the framework of Oman Vision 2040, which seeks to achieve sustainable economic growth. Additionally, the research discusses differences in averages among respondents' educational qualifications, with the highest average recorded for PhD holders at approximately 4.5% that holders of these qualifications are the ones who can be relied upon to convey and disseminate the culture of the knowledge economy among university and college students. The lowest for diploma holders is at less than 4.2%. The statistical significance (sig.) of the distribution of differences between groups was 0.926% for the first item, 0.601% for the second item, and 0.019% for the third item. The F-statistic in the ANOVA analysis revealed varying percentages, indicating different impacts of the studied factors on improving education and promoting the knowledge economy in Oman.

Keywords: knowledge-based education, Oman vision 2040, technological integration, economic growth.

I. INTRODUCTION

In an era of rapid technological advancement and global economic transformations, knowledge-based education has emerged as a pivotal force for sustainable development [1, 8]. The role of education extends beyond traditional learning models to include a broader function of equipping individuals with the skills and competencies necessary to achieve success in modern innovation-based economies [7]. The Sultanate of Oman has sought to give great attention to education because it is its pillar and the path to development and success in various fields of life. This is evident in integrating knowledge-based education with the strategic objectives of Oman Vision 2040 [2].

The education system in the Sultanate of Oman is undergoing major reforms to meet the requirements of a knowledge economy, which values intellectual capital, innovation and practical competencies [3]. The shift

towards a knowledge-based economy in Oman aims to drive economic diversification, create jobs and reduce unemployment by bridging the gap between academic outcomes and labor market needs [10]. This research examines the status of the education system in the Sultanate of Oman, highlighting the importance of promoting knowledge-based education as a means of reducing unemployment and promoting sustainable economic growth [4]. There is a need for such studies to bridge the gap between higher education outcomes and the labor market related to their fields and study path in universities and colleges [5]. We believe that there is a need to explore the intersection between education, technology and the labor market [6]. This study aims to provide strategic recommendations to enhance educational practices in Oman, ensure their compatibility with the requirements of a knowledge economy and build a generation capable of employing academic outcomes in diverse and sustainable jobs and businesses [9].

1. Analyze the impact of education on the development of educational systems in the Sultanate of Oman and the improvement of economic outcomes.
2. Examine how education can contribute to job creation and the reduction of unemployment rates in the context of the knowledge economy.
3. Provide recommendations and strategies to enhance knowledge-based education in the Sultanate of Oman.

II. THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

The rapid production of knowledge and the digital transformation witnessed worldwide in recent decades have reshaped the global economy, making it primarily reliant on intellectual capital and practical competencies in the production of goods and the provision of services. Education plays a significant role in empowering and equipping individuals with the skills that enable them to become key contributors to the knowledge economy. This is achieved by focusing on the core elements of education: the teacher, the student, and the curriculum. Therefore, educational institutions must collaborate with research and development centers, as well as various industrial and production sectors, to instill both cognitive and practical skills in students, so that they become a valuable resource and a guiding force for the knowledge economy and the information economy. These are integrative links aimed at transforming knowledge into products, initiatives, and projects that seek to establish mechanisms for continuity and sustainability, as illustrated in Figure 1.

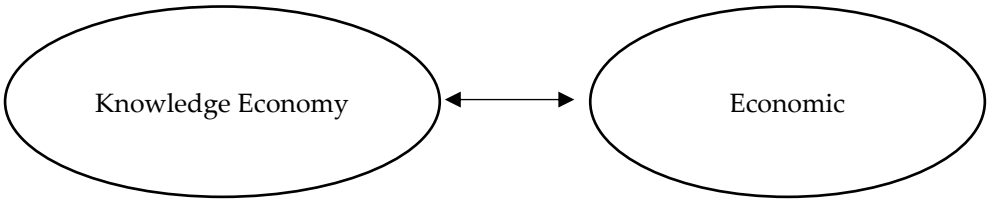

FIGURE 1. Integration of the educational system with economic knowledge economy.

There are many of scientific research, studies, and projects that have recommended the necessity of linking scientific and cognitive content to the student's future career. All of this indicates that conducting such a study will be valuable in its outputs and its compatibility with the state's plan and methodology in this type of study.

III. THE IMPORTANCE OF THE KNOWLEDGE ECONOMY

The knowledge economy is defined as an economic system based on human capital, scientific discoveries, research and development, and technological changes to produce goods and services. It values intellectual processes to shape knowledge-intensive products and services, making knowledge the primary driver of wealth generation, economic growth, and competitiveness. Therefore, economic sectors today focus on generating knowledge based on [19]. The study of [11] emphasizes that today's economies are built on information abundance, not on scarce resources. Knowledge has become the basis for both economic and social growth, shifting the world's focus from seeking valuable resources to seeking and controlling knowledge. This has necessitated the development of strategic plans to support the knowledge economy across its various facets,

reduce the digital and knowledge gaps, and establish the institutional and legislative frameworks that support the knowledge economy.

It is also essential to enhance and refine the educational process to harness the advantages of the information technology revolution and develop labor skills in line with labor market demands. The study found that the knowledge economy is a key determinant of economic growth but over the long term.

Knowledge has become the primary driver of competition in labor markets, adding value to products and services to meet consumer satisfaction. This was confirmed by [4] in their study on the role of the knowledge economy in improving the competitive advantage of economic institutions. They found a strong positive correlation with statistical significance between the knowledge economy and competitive advantage. Knowledge has become the institution's true and distinctive wealth by utilizing and directing human and intellectual capital to serve the institution's interests, ensure its growth, improve its performance, reduce its operational costs, and expand from local to global markets.

Furthermore, [13] discussed the role of universities in supporting knowledge investment. They concluded that the knowledge economy plays a crucial role in developing and advancing societies, as demonstrated by foreign universities that have turned knowledge into a profitable investment. In contrast, Arab countries have not yet reached the stage where knowledge is a source of profit, due to various challenges hindering universities' roles in scientific research and development. Universities need to cultivate a culture of scientific research, emphasize their role in societal development, and equip human resources with the skills necessary for knowledge building and supporting the knowledge economy.

Based on the above, the knowledge economy is an economic approach that relies primarily on the use of information and knowledge to achieve economic development. It has become a competitive advantage that distinguishes any institution and ensures its survival and growth in the face of fierce competition in the labor market. Many countries in the world have adopted the knowledge economy and invested in it, such as East Asian countries and many Arab countries. The Gulf countries have also begun to rely heavily on this type of economy, as the knowledge base on which it relies is constantly renewed and developed with use.

IV. THE ROLE OF EDUCATION IN ENHANCING THE KNOWLEDGE ECONOMY

Education is considered the backbone of the knowledge economy. The global focus on economic growth has led to the restructuring and realignment of higher education and academic professions to achieve economic goals, which are responsible for the sustainable economic growth of nations. This is achieved through the educational institutions' roles in educating the workforce, supporting research and development, enhancing the value of general knowledge, linking education to both local and global economies, and fulfilling social responsibility [15]. This new role has been assigned to higher education institutions, which were not previously responsible for it. Education is no longer merely consumed as it was in the past but is now a massive investment with both immediate and future returns [12].

Higher education institutions contribute to this by facilitating access to knowledge, preparing infrastructure, supporting research and development, allocating financial resources, developing human capital, and collaborating with industrial sectors. These efforts have led to the transformation of labour-intensive economies into knowledge-based economies, contributing to achieving sustainable economic development goals in societies [22].

Given the importance of the role higher education institutions play in supporting the knowledge-based economy, this area has become one of the key indicators by which universities are evaluated globally. One example is the focus on industrial income and patents, which are indicators used by The Times Higher Education rankings to assess world universities. This reflects the recognition that today’s universities can support innovative industries, inventions, and consultancy services, which are fundamental academic tasks in the knowledge economy. This measure aims to track knowledge transfer by considering the research income a university generates from industry compared to the number of academic staff members. It also indicates the university's ability to attract research investment from companies and their willingness to fund and adopt research [25].

In this regard, [12] concluded in his study that knowledge economies are an absolute necessity in modern developmental economies. Intellectual outputs and products from graduates must be enhanced in both quantity and quality through investment in higher education and its development. The study also pointed out that skilled labour, along with natural, financial, and material resources, are logically insufficient to foster economic growth

and achieve comprehensive developmental goals. Therefore, investment in education, particularly higher education, is essential to fulfilling society's goals and aspirations. The economic achievements of advanced nations can be attributed to their significant attention to higher education and their financial support for education, research, and development, which has positively impacted their national economies.

Moreover, the global economy is currently facing noticeable deterioration and requires a recovery strategy, with higher education being a key component of this strategy. This is due to its role in developing human capital, which serves as the primary driver of intellectual production and the source of innovative solutions to economic problems.

The innovative economy, or what is known as the knowledge economy, heavily relies on human capital and the skills and competencies that qualify individuals to play their role within knowledge economies. Higher education serves as an environment that equips human resources with the skills and competencies needed to participate in the knowledge economy and improve productivity. It not only prepares human capital for economic and social performance in an ever-changing technological world, but also provides individuals with the skills necessary for continuous improvement of their competencies, known as lifelong learning.

The knowledge acquired by an individual is not solely for personal benefit but becomes a public asset that others can also benefit from. A person who has received higher education is not just a specialist; they play a role in developing and transferring knowledge to human capital. Modern educational systems focus on developing general knowledge, cultural awareness, the ability to learn and access knowledge, and personal competencies that enable continuous improvement of skills [34]. Highly capable human resources play a crucial role in the welfare and economic growth of societies [23]. In this context, [33] pointed out that human capital in creative and cultural industries possesses high-level skills, but it lacks diversity. Higher education plays a key role in developing and diversifying graduates' abilities to contribute to positive societal change.

The study of [10] confirmed this in their study on the role of higher education in the context of the knowledge economy in Algeria, using the Knowledge Index (GKI) methodology. The researchers found that Algeria ranks low according to the Global Knowledge Index due to the knowledge gap in higher education institutions. While Algeria ranks highly in terms of inputs, thanks to the substantial financial allocations provided by the state for education which has resulted in an increase in the number of higher education institutions and the number of enrollees the output index is low. This is based on indicators and studies that measured the impact of scientific investment in higher education on the growth of the knowledge economy in the country.

The study recommended building a scientific and educational system that helps produce graduates whose skills align with the needs of knowledge-based economies, providing appropriate infrastructure for information and communication technology, supporting research and innovation activities, and linking them with productive institutions. It also suggested adopting a strategic policy that aligns the outputs of higher education institutions with the country's economic needs and encouraging academics to engage in knowledge production.

Based on the above, education is one of the fundamental pillars of the knowledge economy. Academic institutions today have been assigned a new role: producing graduates who can lead the creation of a sustainable knowledge economy. They do this by educating graduates in knowledge, equipping them with the skills and competencies needed to participate in the knowledge economy, continuously developing their abilities, supporting research and development, and collaborating with industrial sectors to support the educational process.

The Sultanate of Oman, represented by the government and private sectors, seeks to work rapidly to produce a generation capable of benefiting from knowledge and transforming it into an economy and a sustainable source of income. There are many academic, training and awareness plans in this regard to focus attention on this type of economy. Many centers have been established that implement programs and activities that help university, college, institute and other students to continue transforming knowledge into a product. There are signs of a group of them becoming pioneering and productive projects capable of entering the labor market and making it a sustainable source of income.

V. TECHNOLOGY AND THE KNOWLEDGE ECONOMY

1. DIGITAL TRANSFORMATION AND THE KNOWLEDGE ECONOMY

Digital transformation plays a significant and essential role in supporting the knowledge economy. The integration of technology and knowledge is the foundation of economic progress. One-third of business leaders

worldwide believe their companies will lose their competitive advantage if they do not transition to digital operations [9]. Digital transformation enhances transparency by facilitating the transfer and exchange of information and reducing corruption and bureaucracy through efficient and effective technological infrastructure. It also helps expand and spread the operations of institutions to a wide range of beneficiaries [2].

Studies also indicate that all types of information systems in business management direct information toward knowledge management. These systems facilitate access to information, help encode, use, create, and reconstruct it [4].

In addition, technology plays a critical role in enhancing processes and improving performance. Information technology has become closely tied to this type of economy, playing a major role in transforming raw data into valuable information that helps improve operations and decision-making. Technology has also strengthened collaboration between institutions and led to the emergence of the shared economy, facilitating the exchange of knowledge and resources to achieve advanced and sustainable economic growth [32].

Furthermore, digital transformation plays a significant role in diversifying economic activity and increasing investment. By relying on new technologies, particularly those related to communications and information, it helps create new intangible products linked to ideas, designs, and software. This increases productivity, ensures better use of resources and productive capacities, and achieves the most efficient utilization of productive potential. Investing in modern technologies also contributes to renewing productivity by replacing old capital assets with new ones [7].

2. HIGHER EDUCATION AND TECHNOLOGY UTILIZATION

Technological sciences, investment in research, development, and innovation are among the most critical fields shaping 21st-century skills for the workforce and creating job opportunities in future industries [14]. Higher education institutions play an essential role in supporting students' technological skills by creating advanced educational systems and fostering an environment conducive to scientific research, centered on the use of modern and advanced technology [30]. Technological tools attract educators to utilize them in enhancing teaching and learning, making the educational process more efficient and interactive. Several studies have widely documented that technological tool especially interactive technologies—will contribute to the development of education and teaching with the rapid spread of these technologies. One of the latest studies in this area, conducted by the World Economic Forum in December 2019 on the future of jobs globally, indicated that 58% of the institutions surveyed would adopt interactive technologies in their operations by 2022 [24].

In [18] highlighted in his study that digital transformation tools are increasingly being used to create, implement, and evaluate educational processes in higher education institutions. These tools play a crucial role in enhancing graduates' skills and competencies, equipping them with 21st-century skills for the labour market, such as communication skills, critical thinking, teamwork, and more. These tools also provide students with the experience of practicing and developing these skills over time in the workplace. This was confirmed by [6] in their study, where they noted that the use of technology in teaching helps increase students' learning capacity, provides immediate feedback, strengthens the relationship between students and faculty, and meets labour market demands.

In this context, the study by [31] found that higher education helps develop and transform the economy of Cameroon into a knowledge economy. Higher education improves individuals' technological and research skills. The study recommended that policymakers, the private sector, and society should double their efforts to develop the education sector to diversify Cameroon's economy and transition to a knowledge-based economy. It also recommended that the government provide financial incentives for the private sector to invest in technology, research, and development, and to collaborate with universities and institutions abroad in this field to transform and enhance its economy.

Furthermore, increasing investment in the information technology sector and effectively utilizing it contributes to economic growth and improves living standards [1]. It helps reduce unemployment rates and creates new job opportunities by updating and developing academic programs in universities and colleges to meet labour market needs, as well as by developing and supporting technological business incubators [3]. This was confirmed by [8] in their study, where the researchers attributed Algeria's delay in keeping pace with the knowledge economy, compared to Arab and foreign countries, to the lack of investment in the technological field and the absence of infrastructure that supports this area.

Thus, technology and digital transformation are among the most important pillars of the knowledge economy, as they improve processes, enhance efficiency, and increase interaction and communication between businesses. This, in turn, helps diversify economic activities and increase investment. Higher education institutions play a crucial role in supporting the technological skills of graduates by creating advanced educational systems based on the use of modern technology.

3. RESEARCH AND DEVELOPMENT (R&D) AND THE KNOWLEDGE ECONOMY

R&D activities are among the most significant contributors to advancing and supporting modern economies. Developing the scientific research system generates valuable knowledge outputs that help advance scientific research and transfer it to a competitive economic environment. Today, most economic institutions aim to achieve a competitive advantage by improving their products, which is made possible through scientific research [5].

Knowledge has become the primary driver of global economic markets. A successful and competitive economy prioritizes the creation, transfer, and preservation of knowledge. In this context, a study by [28] found that achieving competitive advantage and sustainability for any country lies in R&D. The focus on the knowledge economy increases the level of sustainable living. The study also emphasized that increasing financial allocations for R&D enhances sustainable knowledge economies and creates a competitive environment. In the future, scientific research tasks should not only aim to create a knowledge economy but also assess their impact on competitiveness to build a sustainable knowledge economy.

Additionally, [5] in their study concluded that Algeria is making significant efforts to develop R&D activities, allocating both human and material resources to this role. However, the reality shows otherwise, due to several reasons: weak investment in R&D activities to support the knowledge economy, and ineffective educational policies that do not encourage innovation and creativity, as they still rely on traditional methods such as memorization and rote learning. The study also found that encouraging R&D activities can only be achieved by increasing the budget allocated for this purpose, activating research centers and laboratories, and providing them with sufficient and advanced tools. The lack of activation in these centers and labs is due to researchers' limited awareness of their objectives and missions. The study recommended involving the private sector to promote R&D and innovation, transforming these research efforts into goods and services that benefit the economy. Additionally, laws should be enacted to protect intellectual property and patents related to R&D activities.

Furthermore, industrial sectors play a significant role in supporting scientific research, as emphasized by [20], who highlighted the strong relationship between R&D (research centers) and industry. Research helps identify the real gaps in industry and leverages researchers' expertise to find solutions. Therefore, financial incentives for R&D, workshops, and equipping laboratories with necessary tools are essential. [11] added that specialized institutions should be established to adopt and develop new research ideas, turning them into tangible goods or services.

In conclusion, R&D is one of the fundamental pillars of the knowledge economy. It fosters and creates a competitive environment that meets labour market demands and addresses industrial gaps by developing new solutions and creating innovative technologies. Therefore, countries must support R&D by allocating a portion of the national and institutional budget to invest in this sector. Research centers should be established to turn ideas into reality, equipped with all the necessary tools for researchers. Moreover, industrial sectors should be involved in guiding and supporting research efforts to bring them to fruition.

4. INTEGRATION OF THE EDUCATIONAL SYSTEM WITH THE LABOR MARKET

The integration between the educational system and the labour market is crucial in producing qualified individuals for the workforce and ensuring sustainable development for nations [27]. The importance of higher education has increased recently, as both governments and individuals have expanded their investment in higher education due to its role in shaping policies that promote economic growth. Higher education enhances productivity and increases a country's GDP [26, 29, 35] noted in his study that, given the rapid economic growth in the world, the labour market requires qualified employees whose skills align with the demands of the new job market. Universities play an essential role in shaping these skills, as highly skilled human resources are crucial for economic growth and the welfare of nations. The study of [4] emphasized that global higher education reforms help develop graduates' competencies and equip them with the knowledge and skills needed in the labor market, thereby increasing employment opportunities through the development of academic programs that provide the skills and knowledge demanded by the job market.

Additionally, there is an urgent need to strengthen the partnership between the academic and industrial sectors to improve higher education institutions and meet labor market needs [24]. Several studies support this view, including one by [21], which highlighted the need to involve industrial sectors in higher education to address weaknesses in curricula and to change students' perceptions of the labor market. Academic subjects should be restructured in partnership with the industrial sector. In this regard, [29] proposed four models of interaction between career centers in universities and partner companies (industrial institutions), as there is a gap between the academic qualifications of young people and labor market requirements. They concluded that the activities of career centers in universities significantly impact graduates' competitiveness in the labor market. The study also found that collaboration between universities and the external labor market helps implement a set of methods and measures that ensure an appropriate level of professional education tailored to labor market needs. This collaboration helps address the issue of involving companies in providing job opportunities for graduates based on their qualifications and encourages university employees to participate in scientific research on topics proposed by companies.

The [17] discussed ways to integrate higher education institutions with labor market representatives by creating a council that includes both higher education institutions and labor market representatives. This council would be responsible for the following technical tasks: collaborating to improve and enhance academic programs, coordinating to provide practical training for higher education students, organizing scientific and practical conferences, seminars, and discussion sessions to address educational and research aspects, and conducting research that benefits the labor market. This council would also help attract labor market participation in developing internal university educational systems to enhance the skills and competencies of graduates.

In this context, investment in higher education is one of the most important indicators that helps improve educational systems and increase students' competencies. Study in [27] discussed this in their study on the relationship between education and the labor market across three levels of education investment (high, medium, and low) in the European Union. The study found that high investment in education, coupled with integrating education with vocational training programs, led to increased practical productivity, improved employee wages, and reduced unemployment among those with primary and secondary education. It also noted increased employment rates for higher education graduates. In countries with medium investment in education, there was a negative impact on wages and practical productivity for students in primary and secondary education, but educational activities and training programs played a role in increasing practical productivity. The major effect was on higher education outcomes, where unemployment rates increased. Low investment had a significant negative impact across all educational levels, resulting in lower wages, higher unemployment, and reduced practical productivity.

On the other hand, the integration of the higher education system with the labor market faces several challenges, including: weak investment in higher education, limited collaboration between higher education institutions and the labor market (industrial institutions), failure to develop curricula and teaching methods in line with modern technological requirements, limited public investment in higher education, restricted involvement of relevant stakeholders, and brain drain [17, 27].

To summarize, the partnership between higher education sectors and industrial sectors helps in developing and improving academic programs, providing practical training for higher education students, directing scientific research to meet labor market needs, attracting investment in higher education to enhance education systems, and organizing conferences and seminars that strengthen this partnership.

5. SUMMARY OF PREVIOUS STUDIES

Education is the cornerstone from which the knowledge economy emerges and is the foundation for many ideas, projects, and diverse innovations. Therefore, educational institutions must improve and enhance educational systems, utilize available technology, encourage research and development, and strengthen partnerships with industrial sectors to play their role in building the knowledge economy and creating job opportunities for their graduates. This study aims to analyze the impact of education on the development of educational systems in the Sultanate of Oman and improve economic outcomes. It also examines how education can contribute to job creation and reduce unemployment rates within the context of the knowledge economy, and provides recommendations and strategies to enhance knowledge-based education in Oman, summarized as follows:

- Previous studies show that the knowledge economy plays a major role in diversifying economic activities, increasing investment, and creating a sustainable economy. It is based on knowledge, which is a renewable resource that grows and evolves with use.
- Education plays a crucial role in promoting the knowledge economy, with higher education institutions being key players. They are responsible for generating knowledge, equipping graduates with 21st-century skills, supporting research and development, and aligning curricula with labor market needs while enhancing educational infrastructure to meet the demands of the knowledge economy.
- Technology is a fundamental pillar of the knowledge economy. It improves processes, enhances efficiency, and fosters interaction between business sectors. Higher education institutions play a vital role in supporting the technological skills of graduates by creating advanced educational systems based on modern technology to foster interaction and innovation within the learning environment.
- Research and development (R&D) are primary drivers of the knowledge economy. R&D helps build on existing knowledge to solve specific problems, and it aids in discovering new products and services or improving existing ones.

Therefore, there must be integration between educational institutions and industrial sectors, fostering collaboration to direct individuals' skills and abilities towards productive assets. These efforts will produce goods, offer services, contribute to curriculum development, provide practical training for graduates, guide scientific research to serve the labor market, and attract investment in the education sector by equipping it with the latest technologies to improve the quality of education.

VI. METHODOLOGY

The research begins with an extensive study of the current educational situation in the Sultanate of Oman. This analysis includes a comprehensive review of various aspects of the educational system, such as curriculum structure, quality of education, and educational infrastructure. The gaps and challenges that may hinder the improvement of the educational system are analyzed to better understand the current strengths and weaknesses. This approach is based on adaptation in work, continuous and proper growth, followed by development and innovation, and finally controlling these outcomes. Figure 2 illustrates the integration and interconnection of these aspects. The questionnaire was distributed to the targeted groups and samples related to the study at the levels of holders of different academic degrees to obtain results, interpretations and outputs related to the objectives and determinants of the study. More than 400 responses were obtained according to the questions and axes that were designed in the questionnaire. The SPSS program was used to analyze the outputs and results of the questionnaire, where analytical data for the study was extracted based on the questionnaire inputs and relevant dimensions, and questionnaire scales were created, focusing on the quantitative scope related to improving educational systems and creating job opportunities by promoting knowledge-based education in the Sultanate of Oman.

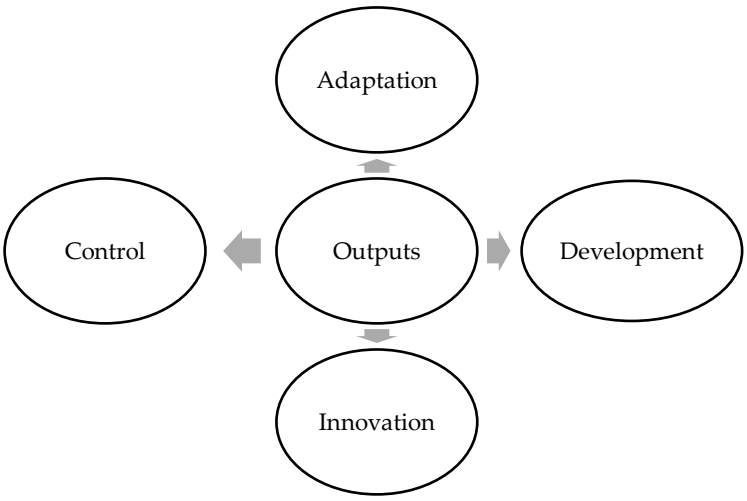

FIGURE 2. Educational system components and knowledge economy interconnection.

1. *UTILIZING SUPPORTIVE TECHNOLOGIES:*

- Data Analysis: The research relies on data analysis techniques to understand the current progress and identify trends and patterns. This may include both quantitative and qualitative data analysis to gain accurate insights.
- Artificial Intelligence: AI technologies are used to enhance the research's ability to understand complex relationships and draw analytical conclusions. It can be applied to big data analysis and identifying major trends.
- Information Technology: IT is used to facilitate data collection and storage in a secure and efficient manner. Learning management systems and online interaction technologies can also be utilized to improve the learning experience.

Using this methodology, the research aims to gain a deep understanding of the educational situation in the Sultanate of Oman and identify the factors that contribute to achieving the goals of knowledge-based education. Thanks to supportive technologies, analysis accuracy can be improved, enabling informed strategic decisions to develop the educational system and achieve Oman Vision 2040's goals regarding knowledge development. This also ensures continuous monitoring of progress and guarantees the achievement of maximum benefit by providing job opportunities and creating diverse jobs aligned with modern transformations and developments, as illustrated in Figure 3.

2. *KNOWLEDGE DEVELOPMENT, IMPROVED OUTCOMES, JOB AND EMPLOYMENT CREATION*

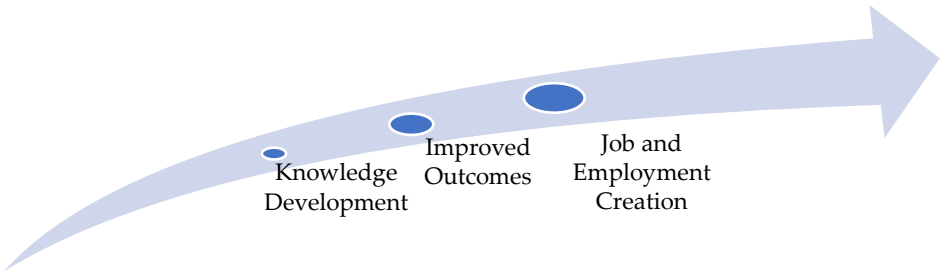

FIGURE 3. Knowledge development, improved outcomes, and job creation framework.

It is expected that this research will contribute to identifying ways to improve the educational system in the Sultanate of Oman in line with the requirements of the knowledge economy, thereby stimulating development, innovation, and achieving integration between education and the labour market.

VII.STUDY DESIGN AND IMPLEMENTATION

The analysis was conducted using the SPSS program, through which the analytical data for the study were extracted based on the inputs from the questionnaire and the relevant dimensions. The questionnaire scales were created, focusing on the quantitative scope related to improving educational systems and creating job opportunities by promoting knowledge-based education in the Sultanate of Oman. Approximately 400 responses were gathered, distributed according to the study's target group.

The study included two main scales:

- First scale: Demographic data, which includes a set of variables (gender – age – job – academic qualification).
- Second scale: Study-related dimensions, which consist of 26 dimensions covering all aspects of the study and linking them to the study's objectives and methodology.

Table 1 includes 26 questions, with responses structured according to the five-point Likert scale (1-Strongly Disagree / 2-Disagree / 3-Neutral / 4-Agree / 5-Strongly Agree).

Table 1. Demographic data of survey respondents.

Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**1**
Strongly Disa-gree	3	2	6	3	2	4	10	6	1	10	25	7	4	6	4	3	4	3	4	2	0	9	8	2	4	2	3
Disa-gree	8	7	8	8	9	4	33	25	9	52	49	9	14	10	9	10	6	5	4	4	12	46	33	8	7	4	8
Neutral	31	38	66	37	42	23	86	50	24	91	130	31	39	52	34	53	44	42	33	25	34	78	94	33	40	38	31
Agree	197	175	205	135	129	151	162	138	132	124	123	153	161	183	159	157	160	157	160	157	166	140	146	154	163	166	197
Strongly Agree	153	170	109	211	210	207	100	173	225	114	65	188	172	139	180	161	173	161	173	179	179	112	108	191	174	177	153
Total	**392**	**392**	**394**	**394**	**392**	**391**	**391**	**392**	**391**	**391**	**392**	**388**	**390**	**390**	**386**	**384**	**387**	**386**	**386**	**385**	**386**	**385**	**389**	**388**	**388**	**387**	**392**

The dimensions were classified based on the priority and sequence of the objectives regarding the enhancement of knowledge-based education within the educational system in Oman. The development of educational programs focused on the knowledge economy is expected to contribute to job creation in Oman. On the other hand, some dimensions addressed the challenges and obstacles facing the implementation of the knowledge-based economy, including needs, updates, and the readiness of infrastructure to achieve the knowledge economy.

1. *FIRST SCALE: ANALYSIS AND INTERPRETATION OF DEMOGRAPHIC DATA ITEMS*

Table 2 provides an explanation of the fields and the number of unfilled cells in the demographic data scale.

Table 2. Analysis of missing data in demographic responses.

Demographic Data	Gender	Nationality	Age	Job	Academic Qualification
Valid	392	392	393	393	394
Missing	5	5	4	4	3

The highest number of entries was in the academic qualification field, with 394 entries and only 3 missing fields. The job and age fields had one fewer entry, with 393 entries, while the nationality and gender fields had 5 missing cells. This indicates that the input ratio in the study is high, and the missing data is minimal, which does not affect achieving the study's objectives or the expected outcomes, as will be clarified in the following tables.

As for Table 3, it shows the distribution of the responses from the target groups by gender. It demonstrates that there is approximately a 60% response rate from females, with 233 responses, compared to 159 responses from males, which represents 40%. This suggests a strong interest and engagement from females in studies of this kind, which have a forward-looking approach and vision regarding the knowledge economy in the Sultanate of Oman and the benefits derived from it.

Table 3. Gender distribution of survey respondents.

Gender	Frequency	Percentage	Total Percentage	Cumulative Percentage
Male	159	40%	41%	
Female	233	59%	59%	41%
Total (Responses Entered)	392	99%		100%
Missing (Missing Percentage)	5	1%		
Overall Total	**397**	**100%**		

As for the ages of the respondents, they were categorized according to the age groups shown in Table 4, along with the number and percentages of responses obtained. The age group of 18-30 years ranked first, with 313 responses, representing approximately 80%. This indicates that this age group is considered one of the most important target groups for such studies, as it includes academic students, job seekers, emerging entrepreneurs, and others who should follow the path of benefiting from the knowledge economy, applying it in various entrepreneurial fields and ambitious projects, and striving toward achieving benefits and a successful career future.

Table 4. Age Distribution of Survey Respondents

Age	Frequency	Percent	Valid Percent	Cumulative Percent
18-30	313	79%	80%	80%
31-40	63	16%	16%	96%
41 and above	17	4%	4%	100%

Total (valid)	393	99%	100%
Missing (System)	4	1%	
Overall Total	**397**	**100%**	

The demographic data axis also included the "job" category, due to its importance in classifying groups and their occupations, and how they relate to this study on the knowledge economy. The jobs identified were: (Academic – Educator – Government Employee – Private Sector Employee – Entrepreneur – Student – Other), as shown in Table 5 with the number of responses and distribution percentages for each. The category of students accounted for 151 responses, representing 38%, which is a significant portion, especially university and higher education institution students. They can benefit from their academic studies to begin establishing entrepreneurial projects and initiatives linked to transforming knowledge into products that provide suitable and sustainable future opportunities.

Table 5. Job distribution of survey respondents.

Job	Frequency	Percent	Valid Percent	Cumulative Percent
Academic	23	6%	6%	6%
Educator	20	5%	5%	11%
Government Employee	54	14%	14%	25%
Private Sector Employee	42	11%	11%	35%
Entrepreneur	10	3%	3%	38%
Student	151	38%	38%	76%
Other	93	23%	24%	100%
Total (Valid)	**393**	**99%**	**100%**	
Missing (System)	4	1%		
Overall Total	397	100%		

As shown in Table 5, the lowest percentage obtained from the survey results regarding job categories is for the "Entrepreneur" category, with only 10 responses, accounting for just 2.5% of the total responses in this category. The following chart illustrates the distribution of these percentages and categories.

The academic qualification is considered one of the key elements in this study, as it is based on knowledge and the educational level, which enables the creation and adoption of projects and initiatives aimed at transforming knowledge into useful and sustainable products. Table 6 shows the number of responses and the distribution percentages for the academic qualification category identified in this study. The number of respondents with a bachelor's degree exceeded 150, accounting for nearly 40% of the total academic qualifications included in the study. This was followed by the diploma category, with approximately 30%, where the number of responses reached 117, which is a very reasonable number. This is because the bachelor's and diploma categories include university and college students, as well as individuals capable of utilizing the knowledge they are studying to turn it into products, projects, and initiatives that ensure a successful and sustainable career future.

Table 6. Academic qualification distribution.

Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
PhD	11	3%	3%	3%
Master's	6	2%	2%	4%
Bachelor's	154	39%	39%	43%
Diploma	117	30%	30%	73%
High School	91	23%	23%	96%
Total (Valid)	394	99%	100%	
Missing (System)	3	1%		
Overall Total	**397**	**100%**		

On the other hand, the master's degree category accounted for only 1.5% with 6 responses, which is a low percentage, followed by the PhD category with only 11 responses, representing nearly 3%. However, this does not significantly affect the course of the study, as most individuals with master's and PhD qualifications are already employed or have their own projects. Nonetheless, they may benefit from developing and updating their knowledge in the context of the knowledge economy, as illustrated in Figure 4.

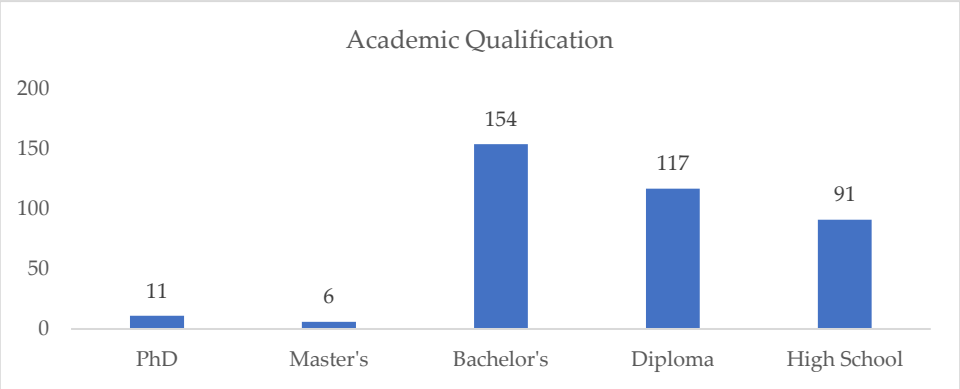

FIGURE 4. Academic qualifications distribution.

Based on the responses and the study results, the indicators suggest that there is a need to link, integrate, and connect educational systems, students' futures, and job sustainability with the knowledge transformation and the creation of knowledge-based products. These products should be marketed in a modern way, taking steps towards entrepreneurship and ensuring suitable job opportunities.

2. *SECOND DIMENSION: ANALYSIS AND INTERPRETATION OF SURVEY RESPONSES*

The dimensions were classified according to the three objectives of the study as follows:

1.1 Objective 1: Analyzing the impact of education on developing educational systems in the Sultanate of Oman and improving economic outcomes:

a. I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman.
b. I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman.
c. There are challenges facing the educational systems in Oman when aiming to enhance knowledge-based education.
d. I see a need to update educational curricula in Oman to include knowledge economy skills.
e. I believe that information and communication technology play a significant role in improving educational systems and creating job opportunities.
f. I see the need to promote distance education as a means to improve educational systems in Oman.
g. I believe there is a need to strengthen practical and applied education in Oman's educational curricula.
h. I believe that the skills that should be enhanced in Oman's educational programs must align with the needs of the knowledge economy labor market.
i. I believe there is a need to develop and increase vocational and technical education programs in schools and universities in Oman because of their impact on the knowledge economy.
j. I see that there are additional services that educational institutions should provide to enhance job opportunities for students, build future skills, and support the knowledge economy.
k. I feel that communication and teamwork skills receive sufficient attention in Oman's educational programs, focusing on a knowledge-based economy.

Objective 2: Examining how education can contribute to job creation and reduce unemployment rates in the context of the knowledge economy:

a. I believe that developing educational programs focused on the knowledge economy can contribute to job creation in Oman.
b. I believe that there are many skills that students should acquire to gain future skills for the knowledge economy labor market.
c. I feel that the current educational system in Oman can meet the needs of the knowledge economy labor market.
d. I believe that promoting knowledge-based education can help reduce unemployment rates in Oman.
e. I believe that young people face challenges when entering the knowledge economy labor market in Oman.
f. I believe that providing continuous training and development opportunities contributes to improving job opportunities and employing future skills for the knowledge economy in Oman.
g. I believe there are enough job opportunities after graduation in knowledge economy fields in Oman over the coming years.
h. I encourage enhancing cooperation between universities, industries, and economic institutions to identify the actual needs of the labor market and enable young people to have a successful future.
i. I see a gap between the skills taught in schools and universities and what the labor market and future skills actually require.
j. I believe that providing volunteering opportunities can help students develop their skills, improve their job prospects, and turn knowledge into beneficial products.

Objective 3: Providing recommendations and strategies to enhance knowledge-based education in the Sultanate of Oman:

a. I prefer to receive education that focuses more on practical and applied skills than on theoretical knowledge.
b. I can easily access digital and technological content in my institution.
c. I believe that there are enough continuous training and development opportunities for teachers and trainers in Oman.
d. I see that using modern technologies like virtual reality and augmented reality in education increases opportunities for applying the knowledge economy.
e. It would be better to include digital and technological skills training courses in educational curricula.
f. There is a need to develop educational programs focused on entrepreneurship, innovation, and transforming knowledge into a product linked to the knowledge economy.

Table 7. Survey responses to study objectives and knowledge-based education.

Value	Statistics
N (Valid)	387
Missing	10
Mean	4.32
Median	4
Mode	5
Standard Deviation	0.735
Variance	0.54
Minimum	1
Maximum	5

The study results indicate a significant increase in the positivity and importance of the study in transforming knowledge into products that contribute to enhancing economic efficiency and enabling individuals to sustainably build and manage future projects. Additionally, the utilization of technology and future skills plays a major role in continuing progress toward a knowledge-based economy, as highlighted in the readings in Table 7.

3. *ANALYSIS OF THE ONE-WAY ANOVA FOR THE STUDY:*

Hypothesis Question: Are there statistically significant differences in the inclination towards utilizing the knowledge-based economy among individuals with different educational qualifications (PhD – Master's – Bachelor's – Diploma – High School – Other)?

- Null Hypothesis: There are no statistically significant differences in the inclination towards utilizing the knowledge-based economy among individuals with different educational qualifications (PhD – Master's – Bachelor's – Diploma – High School – Other).
- Alternative Hypothesis: There are statistically significant differences in the inclination towards utilizing the knowledge-based economy among individuals with different educational qualifications (PhD – Master's – Bachelor's – Diploma – High School – Other).

This will be proven by selecting one item from each axis and linking it to the academic qualification. The study has three objectives, and a question related to each objective was selected and compared with the readings and outcomes of the respondents' academic qualifications, which amounted to nearly 400 responses distributed across the six academic qualification options. These will be compared with the significant mean output at a comparison level of 0.05 as a benchmark for the analytical and statistical readings of the study's one-way ANOVA pattern.

Statistical operations (mean – median – standard deviation – maximum value – minimum value – total) were extracted for each question related to the study objective and compared with the academic qualifications of the respondents. The total confidence factor mean between the three selected questions was 4.17%, 4.21%, and 4.29% as the lowest levels, while the percentage increased for the highest levels among the three questions to 4.32%, 4.36%, and 4.45%, as shown in Table 8, which illustrates the readings and description of the axes and inputs (academic qualification with one question per axis related to the study objective).

Table 8. Comparison of mean scores across educational qualifications.

statement	Qualification	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum
						Lower Bound	Upper Bound		
I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman.	PhD	11	4.27	1.009	0.304	3.59	4.95	2	5
	Master's	6	4.17	0.753	0.307	3.38	4.96	3	5
	Bachelor's	152	4.3	0.708	0.057	4.18	4.41	1	5
	Diploma	117	4.21	0.741	0.068	4.08	4.35	2	5
	High School	91	4.2	0.819	0.086	4.03	4.37	1	5
	Other	14	4.29	0.611	0.163	3.39	4.64	3	5
Total		**391**	**4.25**	**0.748**	**0.038**	**4.17**	**4.32**	**1**	**5**
I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman.	PhD	11	4.45	1.036	0.312	3.76	5.15	2	5
	Master's	6	4.33	0.816	0.333	3.48	5.19	3	5
	Bachelor's	154	4.35	0.71	0.057	4.24	4.46	1	5
	Diploma	115	4.19	0.736	0.069	4.06	4.33	2	5
	High School	91	4.27	0.817	0.086	4.1	4.44	1	5
	Other	14	4.21	0.699	0.187	3.81	4.62	3	5
Total		**391**	**4.28**	**0.754**	**0.038**	**4.21**	**4.36**	**1**	**5**
I prefer receiving education that focuses more on practical	PhD	11	3.55	1.368	0.413	2.63	4.46	1	5
	Master's	6	4	1.549	0.632	2.37	5.63	1	5
	Bachelor's	154	4.38	0.81	0.065	4.25	4.51	2	5
	Diploma	116	4.42	0.736	0.068	4.29	4.56	2	5
	High School	90	4.38	0.728	0.077	4.23	4.53	2	5

and applied skills rather than theoretical knowledge.	Other	14	4.43	0.514	0.137	4.13	4.73	4	5
Total		**391**	4.37	0.805	0.041	4.29	4.45	**1**	**5**

The examination of statistical functions and their relationship in the process of testing the homogeneity of variances and extracting Levene's statistics for each statistical operation (mean – median) and comparing them with degrees of freedom 1 and 2, as well as analyzing the proximity of the sig. value, is illustrated in Table 9.

Table 9. Statistical functions and homogeneity of variances analysis.

Statement	Levene Statistic	df1	df2	Sig.
1-I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman.	Based on Mean	0.62	5	385
	Based on Median	0.416	5	385
	Based on Median and with adjust	0.416	5	344.5
	Based on trimmed mean	0.569	5	385
2-I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman.	Based on Mean	0.62	5	385
	Based on Median	0.416	5	385
	Based on Median and with adjust	0.416	5	344.5
	Based on trimmed mean	0.569	5	385
5-I prefer receiving education that focuses more on practical and applied skills rather than theoretical knowledge.	Based on Mean	0.62	5	385
	Based on Median	0.416	5	385
	Based on Median and with adjust	0.416	5	344.5
	Based on trimmed mean	0.569	5	385

4. ANOVA TEST EXAMINATION

The ANOVA test is used to examine the relationship between one variable and another to verify the significance of the differences between means and connect them to a single variable. Table 10 illustrates the distribution of means among the selected items and axes in this analysis. The F-statistic for the item "I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman" is 0.277%. The next item, "I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman", has an F-statistic of 0.731%. The F-statistic for the third item, "I prefer receiving education that focuses more on practical and applied skills rather than theoretical knowledge," is 2.743%.

Table 10. One-way ANOVA results for educational impact on knowledge economy.

Statement	Sun of Squares	df	Mean Square	F	Sig.
1-I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman.	Between Groups	0.782	5	0.156	0.277
	Within Groups	217.648	385	0.565	
	Total	**218.43**	**390**		
2-I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman.	Between Groups	2.083	5	0.417	0.731
	Within Groups	219.406	385	0.57	
	Total	**221.488**	**390**		
5-I prefer receiving education that focuses more on practical and applied skills rather than theoretical knowledge.	Between Groups	8.692	5	1.738	2.743
	Within Groups	244.009	385	0.634	
	Total	**252.701**	**390**		

Considering the null hypothesis and the alternative hypothesis:

$$H_0 : \mu_1 = \mu_2 = \cdots = \mu_r$$
$$H_a : \mu_1 \neq \mu_2 \neq \cdots \neq \mu_r \quad (1)$$

The null hypothesis suggests that all the means are equal, which did not occur in the analytical and statistical readings of the variance analysis for the axes and variables, and their connection to the determining factors of this analysis. In contrast, we find that there are differences between the means, as indicated by the alternative hypothesis, which suggests that there are differences between some of them.

Here, we present the results of Table 11 concerning the variance analysis using ANOVA in terms of:

Table 11. Distribution of sum of squares in ANOVA analysis.

#	Function
Squares Between Sum of Groups	$SSTR = \sum_{i=1}^{r} n_i \left(\bar{Y}_{i.} - \bar{Y}_{..}\right)^2$
Squares Within Groups Sum of	$SSE = \sum_{i=1}^{r} \sum_{j=1}^{n_i} \left(Y_{ij} - \bar{Y}_{i.}\right)^2$
Sum of Squares Total	$SSTO = \sum_{i=1}^{r} \sum_{j=1}^{n} \left(Y_{ij} - \bar{Y}_{..}\right)^2$
Degrees of Freedom (df)	$(r-1=3)$ ، $\left(\sum_{i=1}^{r} n_i - r\right) = 8$ و $\left(\sum_{i=1}^{r} n_i - 1\right) = 11$

According to the ANOVA analysis table, we can reject the null hypothesis due to the results not being equal to the standard mean level of 0.5%. Thus, we can accept the alternative hypothesis, which states that "there are

statistically significant differences in the inclination toward employing the knowledge-based economy among individuals with different educational qualifications (PhD, Master's, Bachelor's, Diploma, High School, and others)." The sig. value for the distribution of the sum of squares between groups was 0.926% for the first item and 0.601% for the second question related to the relevant objective. The value for the variance of group differences for the third item was 0.019%.

The plotting related to the axis and the first question "I believe that promoting knowledge-based education can improve the educational system in the Sultanate of Oman" shows, through the line graph in Figure 5, that the highest response rate among degree holders came from individuals with a Bachelor's degree, where the mean approaches 4.3%. The lowest response rate was from those with a Master's degree, with a mean of less than 4%.

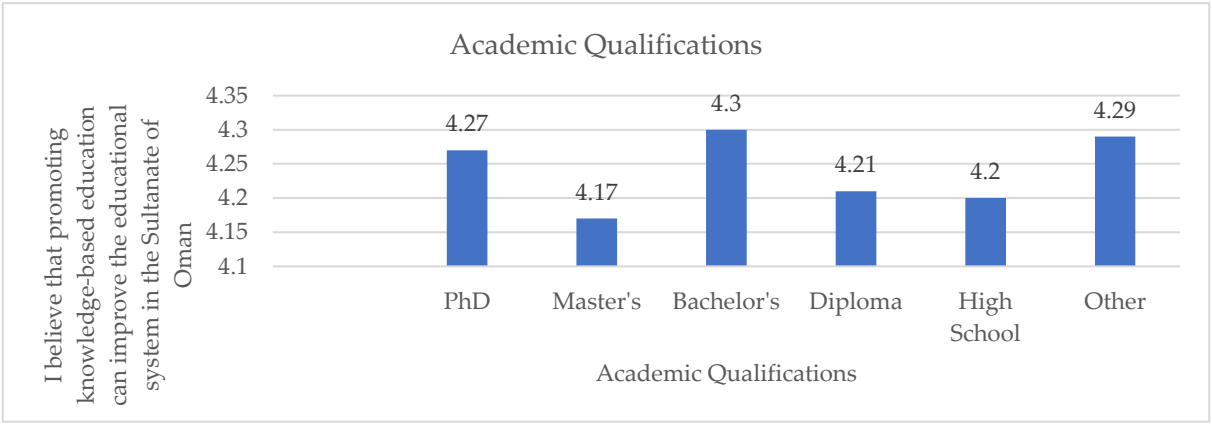

FIGURE 5. Promoting knowledge-based education to improve the educational system.

The plotting related to the axis and the second question, which states "I believe that developing educational programs focused on the knowledge economy can contribute to job creation in the Sultanate of Oman," is shown in Figure 6. The graph indicates that the highest average response was recorded among PhD holders, with a mean close to 4.5%, while the lowest average was among diploma holders, with a mean of less than 4.2%.

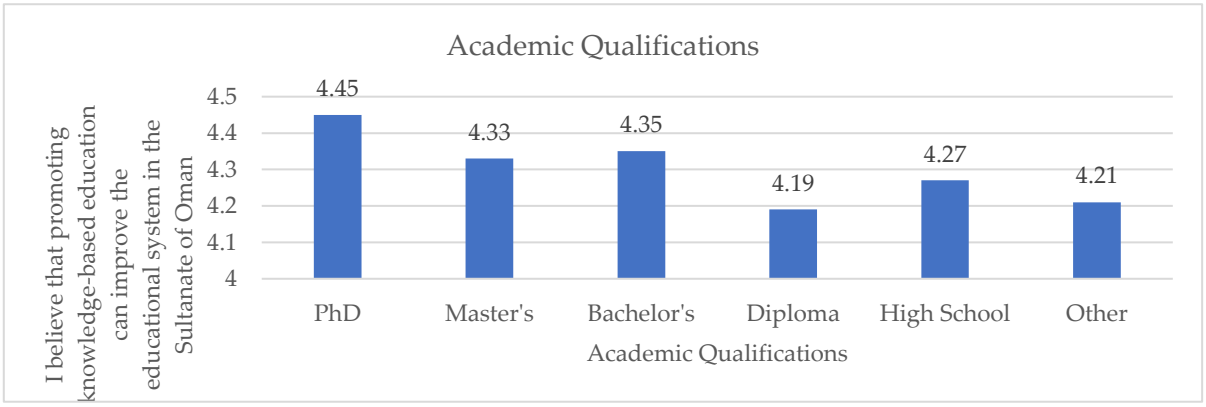

FIGURE 6. Contribution of knowledge-based educational programs to job creation.

The plotting related to the axis and the fifth question, as shown in Figure 7, which states "I prefer receiving education that focuses more on practical and applied skills rather than theoretical knowledge," shows a converging trend in the response averages for qualifications (Bachelor's – Diploma – High School – Other). These averages ranged between 4.25% and 4.50%, indicating differences in the averages among qualifications and the close proximity of percentages to the upper range of the averages, compared to the constant mean value of 0.5%. All of this confirms the alternative hypothesis of the study, which states that there are differences in the means.

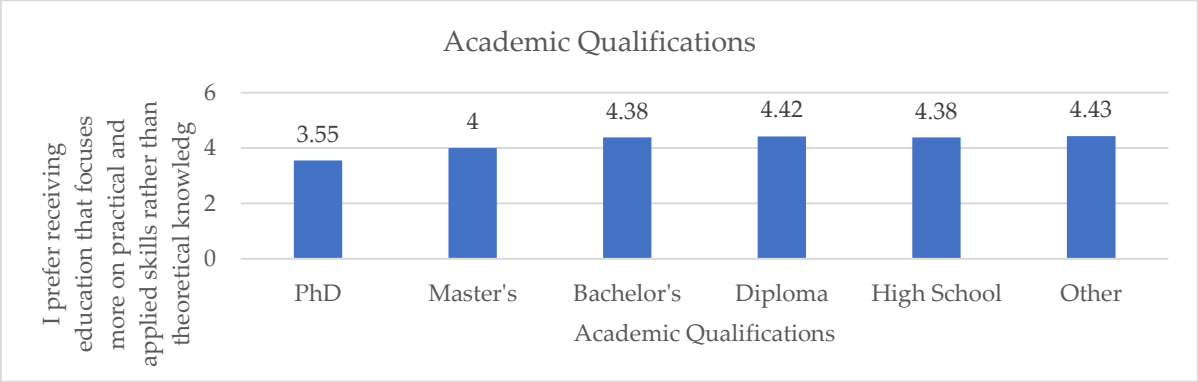

FIGURE 7. Preference for practical and applied skills over theoretical knowledge.

Interpretation of One-Way ANOVA Analysis for this Study: The analysis was conducted by identifying the dependent variable (one question for each objective) and the independent variable, which was the educational qualification of the target samples.

5. *CHALLENGES AND BARRIERS OUTCOMES:*

There are several obstacles and challenges that may affect this type of study during its implementation among the target groups in the Sultanate of Oman:
- The desire of many university students to obtain government or private jobs reduces the opportunity for them to continue in the knowledge economy.
- Financial and human support to continue implementing studies and projects related to the knowledge economy.
- Lack of experienced staff and researchers in this type of orientation.
- Inability to self-manage these projects and fear of stumbling and losing the business.

6. *RECOMMENDATIONS:*

Previous studies indicate that the knowledge economy plays a major role in diversifying economic activities, increasing investment, and creating a sustainable economy. Higher education institutions are key players in the knowledge economy as they are responsible for generating knowledge, providing graduates with 21st century skills, supporting research and development, and aligning curricula with labor market needs while enhancing educational infrastructure to meet the requirements of the knowledge economy.

Technology is a fundamental pillar of the knowledge economy. It improves processes, enhances efficiency, and promotes interaction between business sectors. Higher education institutions play a vital role in supporting graduates' technological skills by creating advanced educational systems that rely on modern technology to enhance interaction and innovation within the learning environment. Previous studies have shown that research and development are key drivers of the knowledge economy. Research and development help build on existing knowledge to solve specific problems and contribute to discovering new products and services or improving existing products and services.

Thus, this study integrate with the previous studies and the findings shows the following recommendation points:

- Enhancing the Integration between Education and the Labor Market: Curricula need to be developed to align with the changing needs of the labor market, focusing on practical and technological skills that contribute to enhancing the knowledge economy. This can be achieved through partnerships between educational institutions and local companies and industries.
- Investment in Research and Development: It is essential to allocate sufficient budgets for research and development in the fields of education and technology. This can help in finding innovative solutions to improve the quality of education and raise the efficiency of the educational system in line with global advancements.

- Using Modern Technology in Education: Adopting modern educational technologies such as e-learning and artificial intelligence to improve teaching methods and provide innovative learning experiences. Training and support must be provided for teachers and students to use these technologies effectively.

VIII.CONCLUSION

This study highlights the importance of developing educational systems in the Sultanate of Oman to achieve a knowledge-based economy, contributing to improving economic outcomes and creating sustainable job opportunities. By analyzing the current state of education and identifying gaps and challenges, the study concludes that education is a key driver of economic and social development.

The study focuses on three main recommendations to enhance the educational system: First, fostering the integration between education and the labor market to ensure that the skills gained align with market needs. Second, investing in research and development to provide innovative solutions and continuously update curricula. Third, utilizing modern technology in education to improve teaching methods and provide advanced learning experiences.

The study affirms that implementing these recommendations can significantly contribute to achieving Oman Vision 2040, which aims to build a diverse and sustainable knowledge-based economy. Therefore, the study calls for further future research to deepen understanding and provide additional strategies to enhance education in Oman in line with global developments.

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Author contribution

All authors made an equal contribution to the development and planning of the study. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data available upon request from the corresponding author.

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