Article

A Divergent View of the Impact of Digital Transformation on Academic Organizational and Spending Efficiency: A Review and Analytical Study on a University E-Service

Hani Brdesee

Computer Information Technology, Faculty of Applied Studies, King Abdulaziz University, P.O. Box 80200, Jeddah 21589, Saudi Arabia; hbrdesee@kau.edu.sa

Abstract: With the aim of achieving a global ranking and academic distinction, a large number of universities have decided to focus on competition and greater academic quality on a global scale. During the course of such a journey, universities have to face numerous challenges, including the enhancement of organizational efficiency. In the context of organizational efficiency, the most significant pillar supporting this drive is recognized as being digital transformation. It is widely accepted that digital transformation allows electronic systems to be used in the process of teaching and learning. These electronic systems (e-services) enhance universities' operational efficiency. Keeping this in mind, this research paper aims to analyze the impact of digital transformation on the organizational and spending efficiency of universities, with a special focus on one particular e-service provided by the Saudi University. For this, the study examines the effort made by the government to spread the culture of rationalization and improve the efficiency of spending through a case study involving a statistical analysis of real data from an electronic system. The results of the study state that an increase in the number of subject withdrawals will weaken the spending and organizational efficiency of the University.

Keywords: academic efficiency; digital transformation; e-services; organizational efficiency; spending efficiency; universities

1. Introduction

1.1. Background to the Study

Saudi Arabia, popularly recognized as a "Kingdom", came up with "Vision 2030" in early 2017. Vision 2030 sets out a plan of action which is intended to transform the social, economic and political situation within the nation [1]. In the same year, the Council of Economic and Development Affairs was established. This council started to examine the fundamental projects, their mechanisms and their impacts on the nation's economy. Meanwhile, new committees and departments were established in order to evaluate actions. The Council of Economic and Development Affairs conducted a meeting in 2017 with the mission of adopting a list of 12 programs in order to achieve the goals of Vision 2030. Of these 12 programs, the plan to attain financial balance and national transformation by 2020 is recognized as the most important program. It aims to make specific commitments towards the government and other sectors [2]. It has been found that this particular program strengthens the nation's financial management as well as its spending efficiency by restructuring its financial position, through mechanisms that examine revenue and expenditure, and finally by its mechanism of accreditation. In addition, the national vision primarily aims to develop and diversify the nation's economy, to identify and launch the capabilities of non-oil sectors, and to develop the digital economy of the nation [2].

Vision 2030 foresees that all government sectors will exhibit a strong commitment to increase the spending efficiency of the public and ultimately achieve efficiency through

a reduction in waste and the utilization of the appropriate resources. In short, the transformation plan of 2020 and the financial balance program will examine the financial laws and regulations of the government in a comprehensive manner. The Qawam program's main focus is to achieve the specific objectives put forward by the government to preserve resources and assets, along with the intent to disseminate the spending efficiency culture of all government entities, irrespective of their level [3]. Through all of these efforts, the Saudi government was ranked as the seventh largest in the world in terms of spending efficiency in 2018 by the World Economic Forum [4].

1.1.1. Digital Economy and Financial Development

The Digital Economy has always been an interesting area of discussion for society as well as for nations, as it particularly contributes to the economic and technical development of a country. In general, the digital economy is understood as an economy based entirely on information and innovative technology [5]. It involves every stage of education, from education, culture and training, to the manufacturing of computer parts, including hardware and software programs such as smartphone programs, mobile applications and other internet-based programs. It is widely believed that the digital economy of a country cannot be created without adequate higher-level legislation from the respective governments [6]. The primary aim of Saudi Arabia's national transformation plan or national vision is to invest in the digital economy through the financial balance program or the financial sector development program. This financial balance program monitors and evaluates the financial performance of the nation by maximizing non-oil revenue, increasing the spending efficiency of the government, managing the associated risks, and maintaining financial reserves in order to achieve financial sustainability [5,6].

1.1.2. Financial Reforms, Spending Efficiency and Digital Transformation

The majority of Saudi Arabia's economic and financial reforms were formed in order to encourage economic and financial transformation, thereby ensuring that public finances are sustained. By doing so, the economy of the nation will develop and a spending efficiency can be maintained [5]. By the year 2023, it is estimated that the revenue of Saudi Arabia will reach 1.154 billion. The general financial estimates of Saudi Arabia from 2018 to 2023 are shown in Figure 1, below.
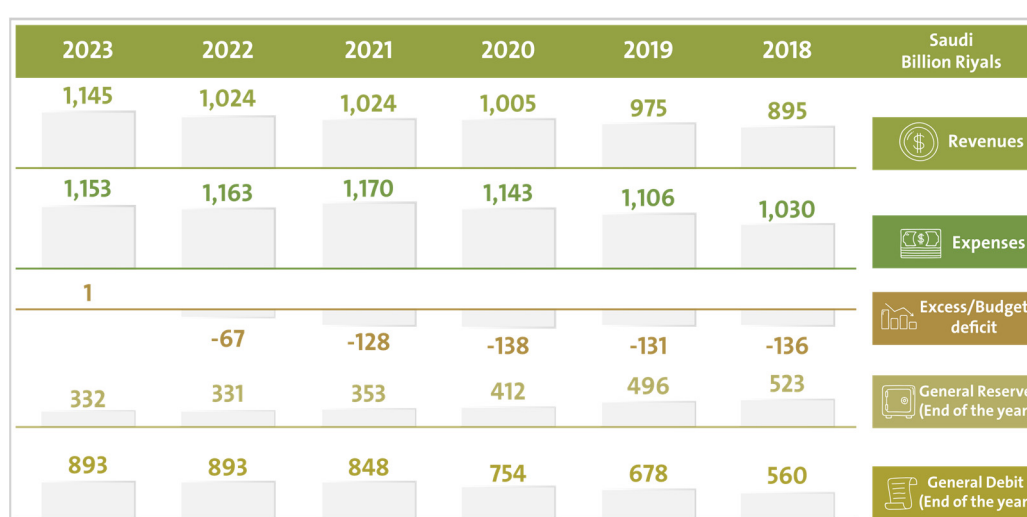

2023	2022	2021	2020	2019	2018	Saudi Billion Riyals
1,145	1,024	1,024	1,005	975	895	Revenues
1,153	1,163	1,170	1,143	1,106	1,030	Expenses
1						Excess/Budget deficit
	-67	-128	-138	-131	-136	
332	331	353	412	496	523	General Reserve (End of the year)
893	893	848	754	678	560	General Debit (End of the year)

Figure 1. Saudi Arabia's General Financial Estimates from 2018 to 2023 (Source: Fiscal Balance Program 2019 update, Vision 2030, Kingdom of Saudi Arabia).

The term "digital transformation" is closely associated with investment in human thoughts as well as behavioral changes, factors that may help to transform the digitization process in a radical manner. This digital transformation serves its purpose for the nation

in a much better and faster manner. Digital Transformation is a significant kind of digital investment [7,8]. It is widely accepted that digital transformation possesses the potential to build competitive, effective and sustainable communities, and has the capacity to provide various services to the public whilst at the same time improving their productivity and experiences by means of a series of effectively implemented processes.

According to Safiullin and Akhmetshin [9], Digital Transformation has the following specific features or characteristics. Digital Transformation allows the restructuring of the ways in which people think, work, live, interact and communicate with each other based on the technology available, as well as planning and practical experiences. It improves the organizational efficiency and reduces the cost of spending by introducing new services with more flexibility. Digital Transformation provides a radical change in terms of the services provided to people working in various areas, such as safety, security, education and health. It also improves people's productivity and experiences. It promotes the acceptance of changes in existing working models, as well as in the mentalities of the human mind. Digital Transformation utilizes modern technologies to their maximal capacities and provides flexibility at work with enriched predictability and planning. It enables desired successes to be achieved through faster innovation. Lastly, it provides a strategy to create and enrich competitive value, and creates a sustainable culture of innovation [10–12]. Speaking of the benefits of Digital Transformation, it replaces all of the existing traditional processes with digital processes, increases the time available for development, modifies working models and people's mentalities, reduces errors, enhances working efficiency, speeds up daily work, applies services with more flexibility and innovativeness, and enhances the quality, performance, productivity, viability and satisfaction of investors and beneficiaries [13]. The following are Digital Transformation Techniques that are used prevalently in organizations, especially those in the education sector.

1.1.3. Center of Spending Efficiency (CSE)

The Council for Economic Affairs and Development established an independent unit named the Centre for Spending Efficiency (CSE) to review and approve the recommendations raised with respect to spending efficiency and operational spending [14]. This center caters for the financial requirements of programs listed in Vision 2030 by examining the cost of spending and the later set up of the spending priorities based on the requests proposed by higher authorities. A few studies have discussed the primary roles and responsibilities of the Center of Spending Efficiency (CSE), which include operating with multiple government agencies and recognizing various ways to increase spending efficiency; developing government initiatives and plans to increase the pending efficiency of a nation; formulating mechanisms, laws, and regulations to increase spending efficiency; conducting regular follow-ups with government agencies on spending efficiency and finding possible solutions, which reduces any obstacles in the process of improving the spending efficiency and eventually achieving the desired goals [15]. In order to carry out the roles and responsibilities of the CSE, the center has come up with tasks to achieve better results.

The tasks include the development of strategies, plans, policies and programs that aim to attain greater spending efficiency by government agencies. This should be done by coordinating with internal departments and following up with them; reviewing the details of the expenditure and other practices in government agencies; identifying opportunities to improve spending efficiency and then initiating ways to save; putting forward suggestions associated with spending efficiency; proposing amendments to the spending efficiency; adopting and developing standards to measure spending efficiency; developing methods and tools that will help government agencies to achieve efficient spending; preparing reports and conducting follow-ups on the spending efficiency of government agencies; submitting reports to the Council for Economic Affairs and Development; proposing plans and programs to improve spending efficiency; examining the initiated programs to achieve Saudi Arabia's Vision 2030 and ensure that objectives related to the spending efficiency

are achieved; proposing adequate changes to achieve an increased spending efficiency; coordinating with government agencies to collet details on expenditure and other cultural practices; planning, conducting and organizing meetings, conferences, seminars and special training programs to achieve efficiency in spending; collecting opinions from experts and consultants in the area of spending efficiency; meeting spending efficiency targets in cooperation with government agencies; preparing and publishing studies and research papers in the area of spending efficiency; providing technical advice in the area of spending efficiency; and, lastly, encouraging government agencies to provide incentives related to their spending efficiency.

1.1.4. National Initiatives Supporting Digital Transformation in Saudi Arabia

The Saudi Arabian government has come up with several national initiatives, such as the Fintech initiative, telework platform, Etimad Platform, Digitizing Health Service, Digital Transformation in Justice Services, and We Are All Giving Initiative to support digital transformation. Figure 2 presents the various national initiatives of the Saudi Arabian government that support the process of digital transformation [16–18].
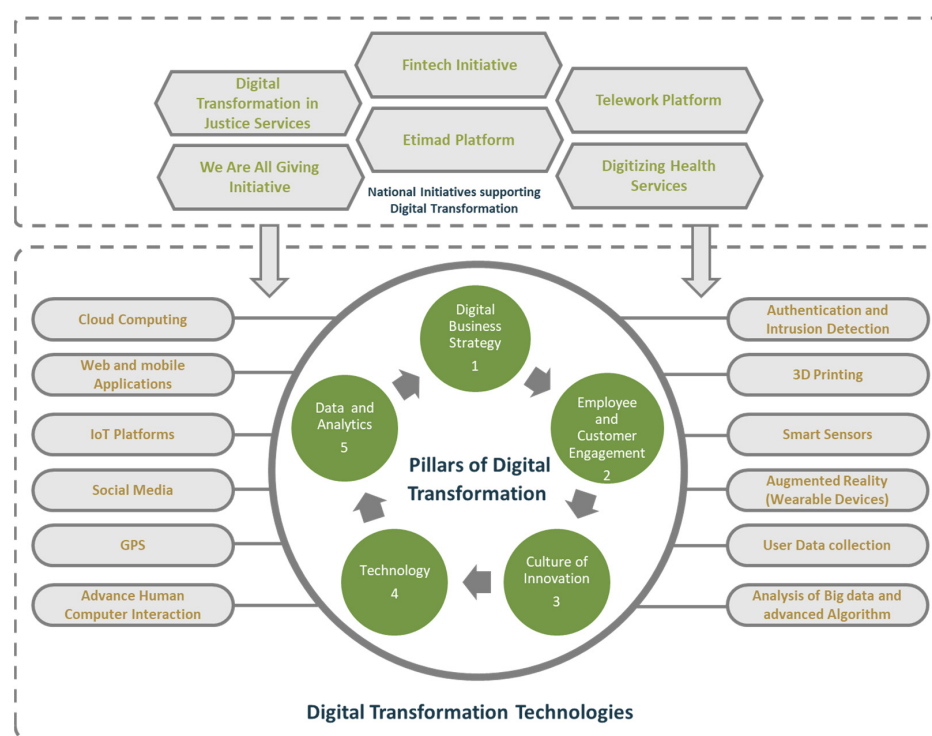

Figure 2. Technologies, initiatives and pillars of digital transformation.

The Fintech Initiative was proposed and developed in the year 2018 by the Saudi Monetary Authority in order to transform the Kingdom into a technological hub of finances which contributes to and supports the inclusion of all finances. This initiative is intended to increase the number of digital transactions along with digital investments. In the same year, the government started a news service named the Mawid application, which allowed Saudi Citizens to use digital technology, support the digital economy and contribute to digital investment by accessing several health services. This application allows citizens to make an appointment at their nearest health center. It is estimated that around 2.5 million users are registered on this application [19].

In 2020, the Saudi government started a Telework Program with the aim of investing in and enhancing the digital economy. This program was launched by the Ministry of Human Resource and Social Development. The main objective of this platform is to bridge the existing gap between employers and jobseekers. Both employers and jobseekers have stated

that there are several barriers to obtaining better employment opportunities. Keeping this in mind, this program was initiated for the whole national workforce so that they could join the market irrespective of gender, disability and other inhibitory factors such as a lack of transport, an unsuitable workplace environment for women or elderly people, and so forth [20]. The Etimad platform is an electronic government procurement system which consolidates and facilitates competition procedures. This platform also comes with the principle of maintaining transparency between government agencies and suppliers, as it will exert a positive influence on the quality of procurement. Electronic agencies were launched to digitally transform justice services for its citizens and provide quality services for beneficiaries. This initiative allowed people to avoid attending notarial offices and thereby made them fully digital in all sectors, including the judiciary sector [21].

The Ministry of Communications and Information Technology, which was initiated as a non-profit specialized initiative, is intended to spread digital awareness among citizens. It has been observed that the education sector has transitioned from a traditional mode of teaching to the use of virtual or online classes. The education process has been transferred completely into a digital process; hence, it has become quite important to spread digital awareness among the government, and the public and private sectors [22]. This initiative allows citizens to obtain complete knowledge of the technical tools and skills required to deal with innovative technologies.

Saudi Arabia has witnessed new developments and a renaissance in almost all fields at various levels, especially in the field of education. It has been observed that, in the Kingdom's next generation, there will be strong pillars such as public or general education, as well as university education. Education at the basic, secondary and university levels is considered the strongest pillar that influences the development of any nation. Saudi Arabia's education shareholders have identified various changes in the field of education, such as financing, changing labor market requirements, privatization and foreign competition [1]. Saudi Arabia's education policy provides an opportunity for education for all of its citizens, which will increase the quality of outputs, increase the effectiveness of research-oriented education, foster creativity and innovation in the field of education, develop community-oriented partnerships, and upgrade the skill sets and abilities of training staff. Through this, the nation will transform into a new renaissance and showcase consistent development in terms of educational progress.

The Minister of Education pointed out that the basic, secondary, public and university education sectors will ensure a bright future for all citizens, as envisaged in Saudi Arabia's Vision 2030. The government has already spent SR193 billion on the education sector, and this will reach SR202 billion by 2020. Keeping this in mind, the present research paper tries to examine the effort put across by the government to spread the culture of rationalization, increase the efficiency of spending, and promote digital transformation in the education sector. This study also discusses the objectives associated with national vision 2030 along with the government's initiatives to support the national digital economy. Furthermore, the study discusses the technical investment and spending efficiency of universities in Saudi Arabia.

2. Literature Review

2.1. Concept of Digitization

Digitization is defined as the process of transforming information or data into a digital format [7,23,24]. All of the information received is organized into bits. In terms of finance, digitization is any means of payment method that uses electronic devices. Digital money can be transferred from one account to another using computers or electronic gadgets. Over time, digitization can become an essential part of any nation's economy. Woishi [7] defined digitization as the process of transforming analog material into a digital format in order to store and use it through computers or electronic gadgets. In the 21st century period, information is created within the blink of an eye through various methods. Hence, it can be confirmed that the world is undergoing constant change through digitization.

Technology is allowing people to participate in the digital economy and improve the process of digitization. PwC [23] stated that the group adoption of digital applications by means of connected services and devices is also identified as digitization. These digital applications are capable of delivering multiple services for industries, and they act as job and wealth creators.

The impact of digitization can be evidently found in the associations among customers, employers, jobseekers and workers. Individuals are highly interested in online transactions rather than using traditional means; therefore, they use digital money to serve their purposes. Worldwide, digital money seems to attract the attention of everyday people. The digital economy has been proven to have enormous benefits for individuals as well as government agencies. In addition, the process of digitization has led to multiple employment opportunities worldwide. Thus, it can be claimed that digitization has had significant influences on different nations [7,23,24]. In a country like Saudi Arabia, the development of digitization is completely led by the Ministry of Commerce and Investment. The Ministry of Commerce and Investment introduced several digital services and made the process of extracting information technology-friendly. Digitization in Saudi Arabia also brought about significant changes in the labor market. This process had created several jobs by 2020. It is estimated that digitization will shape the future of work, and will create 17.9 million jobs by 2025 [24].

2.2. Digital Transformation in Saudi Arabia

Saudi Arabia is known as the largest spender on Information and Communication Technology (ICT) across the whole Middle East [25]. Technology is rapidly being adopted by citizens of the Kingdom, and the adoption of ICT has increased among individual users. Private and public enterprises have also started to adopt ICT or technology in their businesses at an increasing rate in recent years. The majority of Saudi Arabian industries, such as tourism, healthcare, education and so forth, have begun to embrace the use of technology and provide better services. It is widely accepted that technology has the potential to enhance the existing services of industries and offer appropriate services to customers, visitors, investors and beneficiaries. Manufacturing is one industry where the internet supports manufacturers in combining technology and innovation to produce different products. The blueprint of Saudi Arabia's Vision 2030 is designed in such a way that ICT or technology usage and digitization helps government agencies to drive the nation's economic, social and political development with an enhanced security system. Thus, digitization plays a central role in achieving the milestones listed in the National Transformation Plan [25]. Government agencies have come up with digital platforms and other national initiatives to support the digital transformation of the nation. Research studies have pointed that 40% of the goals of vision 2030 have been achieved due to the implementation of the Digital Transformation program. As a first initiative, the government of Saudi Arabia aimed to implement the National Transformation Plan 2020. It was also noted that Saudi Arabia is ranked fifth for the use of digitization, and is referred to as a digital government, especially in the education sector.

Balyer and Öz [26] discussed the digital services provided by organizations, and confirmed that a large number of organizations are being operated with the help of digitization. The entire world is connected digitally through personalized digital services. The study claimed that the success of an organization is entirely dependent on the ways in which it produces and uses information. Organizations use and produce new knowledge with the help of digitization. It is widely accepted that digital transformation influences the essential components of any organization, from infrastructure to operations. Other research studies have identified that organizations do not transform through their own choice, but instead fail to evolve along with the technological advancements [27]. Three different terms—namely digitization, digital transformation and digitalization—are entirely different from each other. Digitization represents the transformation and representation of

material objects into a digital format. On the other hand, digitalization is understood as a process of enhancing digitized data and other types of information [12].

Digital Transformation is understood simply as a process of organizational transformation. This type of transformation allows organizations to build and develop new models and competencies inclusive of digital technologies in a strategic manner [28]. This type of organizational transformation allows organizations to improve their operational performance, which includes the implementation of technological solutions. Indeed, digital transformation can produce desired outcomes for organizations because it is aimed at improving their efficiency and organizational readiness [11]. According to Chaurasiya [10], Digital Transformation is designed not only to transform technology, processes and tools but also to transform business models. Digital Transformation alters the way any business or organization functions, operates and interacts with the world and itself.

Schwab [29] identified digital transformation as an essential element in the facet of industrial revolution. Digital Transformation can be further broken down into three main attributes, namely creating value, optimizing processes to improve customer experience, and building foundational capabilities that support the entire structure. Several studies have been conducted in order to understand the reasons behind organizational digital transformation, and it has been found that the main reason for organizational digital transformation is to allow organizations to gain a competitive advantage and survive. The study also found that digital transformation in the education sector is driven by elements such as profitability, competitiveness, user experience and agility [30]. It has also been observed that digital transformation transcends technology by implementing new digital technologies, and that it can achieve a competitive advantage and superior performance. In this way, organizations transform the entire education or business model with the aim of providing a good user experience and exerting an influence on individuals and other networks [30]. Other studies have revealed that, in order to achieve a national vision and become a smarter nation with smart cities, digital technologies should be integrated [11,30]. Digital transformation, especially in the field of education, is highly influenced by government policies, initiatives and other development strategies [31].

Past research studies have examined the process of digital transformation in the higher education system and argued that digital transformation is a significant factor in the redefinition and redevelopment of educational services and operational processes [32]. Universities or other educational institutions allow digital transformation, and this will encourage the process of learning from any place and at any time. This digital transformation enables learners to prepare for their examinations, tutoring and other study programs. With respect to organizational and spending efficiency, digital transformation supports the education system in transforming unstructured data or information as well as internal and external data, discovering the hidden patterns underlying performance in different areas, tracking admissions, optimizing enrolment, managing grants, and enhancing academic advising. It also helps educational institutions to conduct descriptive and predictive analyses, and make wise decisions [33].

2.3. Spending Efficiency

Several studies have been conducted to analyze the efficiency of educational institutions, of which a few evaluated the efficiency and the productivity of educational institutions in developed and developing countries [34,35]. Educational institutions in countries such as Australia, the United Kingdom and other European countries have been analyzed in terms of their spending efficiency and productivity. In the context of Saudi Arabia, Alabdulmenem [36] measured the efficiency of approximately 25 universities and found that the majority of them were efficient in terms of the utilization of the available resources. Likewise, Al-Mutairi and Al-Shami [37] conducted a study involving a descriptive analysis of research publications in around 25 public universities in Saudi Arabia, and found that the organizational and spending efficiency of the universities were average.

Several other studies have discussed the technical investment and spending efficiency of universities. Studies have stated that technology shapes the lives of individuals. Sectors like management, business, education and so forth can gather information, store data, organize data and access data in an easy manner through technological advancements. The main benefit of technological systems is to enhance their planning processes and education programs, and eventually to improve their standards. Technical investment allows universities to integrate different sectors and departments, and further create effective communication between the members of educational institutions. Another significant benefit of technology is that it helps us to save time and effort. In addition, it allows us to perform all of our tasks effectively, with high quality and efficiency. Technology also allows us to store information or data using several types of digital transformation technology which can be used by educational institutions like universities.

3. Problem Identification and the Motivation of the Study

Several studies have examined the spending and organizational efficiency of educational universities worldwide [38–40]. Likewise, several studies have investigated the impact of Digital Transformation on Saudi Arabia's national economy and other areas [11,26,41,42]. However, the current study identifies several gaps that have been left untouched. The relationships among digital transformation, digitization and the digital economy have been analyzed in earlier studies. Several studies have tried to explore the efficiency differentials between Saudi higher education institutions [35].

However, no study has examined the impact of digital transformation on academic organizational efficiency and spending efficiency, especially with respect to university electronic services or e-services. Thus, this study aims to examine the impact of digital transformation on academic organizational efficiency and spending efficiency, which is identified as a research gap in this study. This study is motivated by the objectives associated with the national vision, including the provision of education to all students, the promotion of the skills of students, the diversification of innovative sources and ways of funding, the enhancement of the efficiency of financial spending for the education sector, and the strengthening of the capacity of the education system so that market needs are addressed and developed to a greater extent. In addition to this, the development of several government initiatives to support the national digital economy, such as the National Digital Education Platform, the Saudi Digital Library, Smart Schools and so forth, motivated us to conduct this study.

4. Proposed Research

The main objectives of this study are:

1. To examine the impact of digital transformation on academic organizational efficiency and spending efficiency;
2. To evaluate the e-services provided by the Saudi Arabian University and their effects on spending efficiency.

5. Methodology

The growth and development of educational and academic processes in Saudi Universities has become highly significant, and this will help the Kingdom to achieve its overall vision [43]. A clear and appropriate vision is required to accomplish Saudi Arabia's Vision 2030 by means of a national transformation program that was implemented in the year 2020 within Saudi Universities. Hence, it has become crucial to expand the university services offered to students, as mentioned in the document program and framework of King Abdulaziz University (KSA) [44]. For this, OUDS PLUS software was employed to provide recommendations with a scientific background. It was observed that the University started to provide high quality services to the students enrolled in the University courses [45,46].

The university wanted to show that their programs aim to enhance the whole educational process in such a way that it allows students to communicate easily with training

staff, while meeting scientific recommendations. The new services or programs provided by the university were intended to distinguish among various services offered to students. Indeed, the university enhanced the process of delivering resources, eventually leading to the successful management of the educational process [45–47]. The above statements motivated us to conduct a further analysis and enhance university learning systems that aid students in their educational processes.

A research methodology is generally understood as the procedure that describes, explains and predicts the phenomena under study. These procedures are set out by the researcher. It is widely known that the research methodology deals with the psychological processes that are considered to be obligatory to examine and evaluate the issues associated with the material. In other words, the research methodology is defined as a systematic method or technique employed in a research study in order to carry out further analysis, test a hypothesis, and analyze the proposed research objectives.

It is argued that the research methodology is the guide that is used by researchers to conduct their research. Untouched areas can be illuminated through the adoption of various data analysis methods and techniques. Commonly, the research methodology has several advantages, such as enhancing the wealth of human mankind, creating and developing analytical and critical thinking skills, developing a systematic attitude towards research, and developing an observational nature as well as critical thinking and evaluation skills.

Generally, a research paper will adopt a research methodology that may include action research, surveys, questionnaires, case studies, and so forth. The relationships among the variables under study can be identified by conducting a case study. Action research, on the other hand, enables the researcher to identify appropriate solutions for existing problems or concerns. When aiming to fulfil the goals or objectives of a research project, the research design should act as a blueprint. The research design specifies the methods and techniques used to collect information from various sources. The primary aim of a research project is to explain, describe and explore untouched research areas.

The current study examined the impact of digital transformation on academic organizational efficiency and spending efficiency. It also analyzed the ways in which financial waste can be reduced in universities and investigated how to improve the spending efficiency of universities without compromising on the quality of the education. The study also evaluated e-services provided by universities, such as information on students' withdrawal from courses or subjects from a particular college or university, and the ways in which the spending efficiency can be improved. The analysis of the study used primary and secondary data.

The primary data were collected through a case study, and from the On Demand University Service (ODUS) of King Abdulaziz University. The incorporation of the ODUS Plus system into data on student withdrawals would be a helpful addition for universities. The required data were collected from the Deanship of Admission or Registration from all of the university branches, and included data on both male and female students. The data collected from the case study were analyzed using descriptive statistics, pie charts and other graphical representations. Various other tests like the sign test, chi-square test, and Cramer's test were employed in order to arrive at conclusions. The secondary data were collected from published and unpublished sources such as magazines, books, journals, reports, newspapers and other research papers connected with the education sector and universities. Therefore, the study was descriptive and involved a case study, followed by the discovery facts, the formulation of a hypothesis and the arrival at a conclusion.

6. Data Analysis

In order to carry out this study, the researcher conducted a case study to identify the electronic services or e-services provided by King Abdulaziz University to its students. The case study also aimed to examine the impacts of the e-services on the university's spending efficiency. For this, the study selected an e-service provided by the King Abdulaziz University, i.e., the withdrawal of students from subjects in the middle of the semester.

This service was altered from the traditional method of filling in forms and then later passing information on to other internal departments, the admission department and the registration department to an electronic (or "e-") method. This allowed the process of decision-making to occur within two days, unlike the traditional method. The traditional method required at least several weeks for the course withdrawal. Nevertheless, this study assumed that the adoption of this e-service by the university eventually led to effective operational functioning or efficiency. At the same time, the selected e-service had an impact on the spending efficiency of the university.

The data collected for the study included data provided by the Admission and Registration Department with respect to the applications received for course withdrawal, irrespective of the course duration and the university level. The data were collected from all of the university-level courses, including Bachelors, Masters, and even Diplomas, and from all of the university branches, at both main campuses and the other sub-campuses. Data were collected from both genders without discrimination. The study excluded students who joined Jeddah University.

Descriptive statistics (pie charts/bar charts), the sign test, chi-square test indecency, and Cramer's V test were adopted in order to find the strengths of the relationships.

The Kolmogorov–Smirnov (K–S) test is a non-parametric statistical test. This test is used to test a proposed hypothesis that explains two different problems [46]. There are two tests that can be used to examine the data collected: the one-sample K–S test and the two-sample K–S test. The K–S test tests the sample data exhibiting an experimental probability distribution, along with the distribution parameters. Here, the null hypothesis is the experimental distribution of the sample data. In the two-sample K–S test, the sample data series with different levels of experimental probability is shown along with the same probability distribution. Here, the zero hypothesis is the experimental distribution of the sample data [48].

On the other hand, in a binomial test, two classes of audience exist, and the data are obtained by dividing the values observed in the two classes. In these cases, the observations are classified. This test is used especially when there are only two possible results that are expressed in a ratio form [49]. The chi square test is a very similar approach which tests a hypothesis and decides if it is true. In this method, the sample distribution is shown as a chi-square distribution, and the test determines whether it is true [50]. Similarly, symmetric measures are based on chi-square statistics.

7. Results and Discussion

The data collected on student course withdrawal over a duration of 3 years show that 81.71% of the applications submitted by students in electronic format—irrespective of their gender—were accepted, while only 18.10% of the applications were rejected. These results were analyzed from different viewpoints, e.g., by students, academic guides, vice-deans and deanships. The results of the statistical analysis are presented in Figure 3.

The study also tried to analyze the impact of student course withdrawals on the spending and organizational efficiency of the university, and found that an increase in the number of subject withdrawals will weaken the spending and organizational efficiency of the university. Table 1 represents the total number of students who have withdrawn from different subjects.

From the data collected from the university, it was observed that the majority of student course withdrawals (8713) occurred during the spring of 2018 and 2019. The above-identified statistics are represented in graph form as shown in Figure 4.

7.1. Course Withdrawals from Colleges and Campuses

The statistical data collected from the admission and registration departments of the selected university show that the Arts and Humanities Colleges had the most withdrawals from courses or subjects (16,376), followed by Science Colleges (10,876), as shown in Figure 5.

7.2. Results of the Sign Test

As the data collected do not follow a normal distribution, the sign test was employed in order to examine the relationship between student withdrawal from subjects and student delay. The results of the sign test are presented in Table 2.
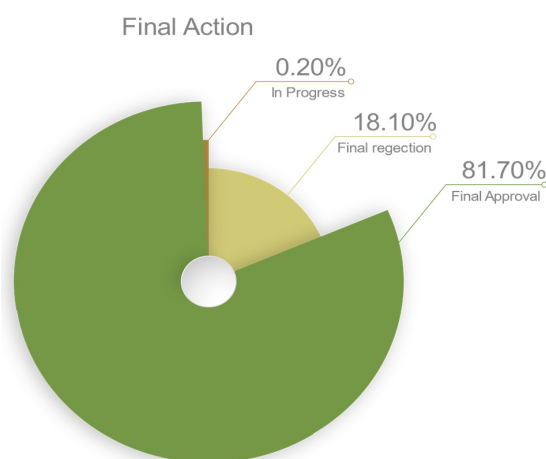

Figure 3. Course withdrawal decision-making conducted through e-services provided by the university.

Table 1. Total number of students who have withdrawn from various subjects.

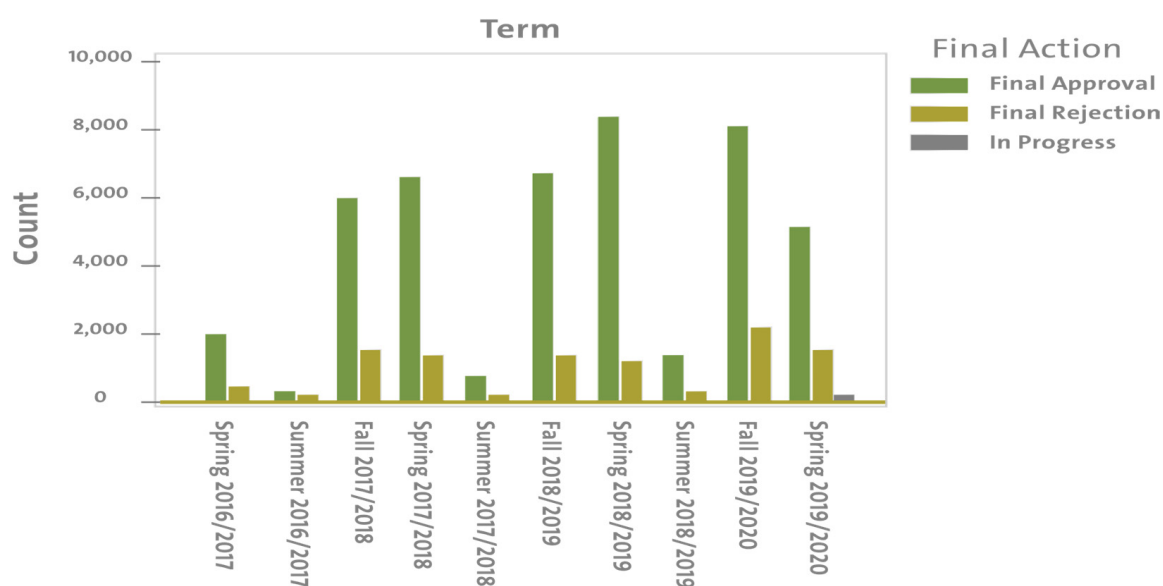| Number of Subjects Withdrawn	Number of Students Withdrawn
Less than 2 subjects	19,373
3–6	5278
7–9	1193
10–12	279
13–15	69
16 subjects or more	30

Figure 4. Withdrawal requests from students.

The above table shows that students delayed their semesters because there were considerable number of course withdrawals, which ultimately reduced the spending efficiency of the university.

7.3. Results of the Chi-Square Tests

From the results of the chi-square test, it can be inferred that there is a relationship between attendance at the college campus and a student's decision to withdraw from courses or subjects. However, the relationship between the two is weak, with a score of 0.087 and a *p*-value of 0 < 0.05. The results of the chi-square test are presented in Table 3.
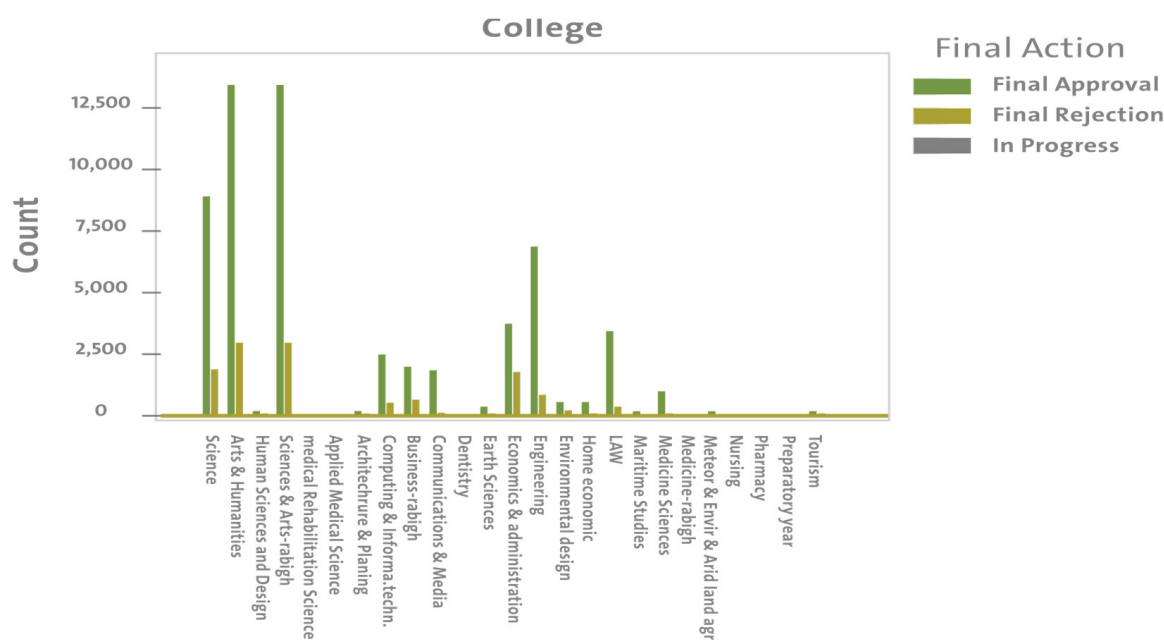

Figure 5. List of Colleges with the greatest numbers of withdrawal requests.

Table 2. Results of the sign test.

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-Tailed)
Frequency	Group 1	≤3	22,146	0.94	0.70	0.000
	Group 2	>3	4124	0.18		
	Total		27,240	1.10		

Table 3. Relationship between the campus and the course withdrawal decision.

Chi-Square Results			
	Value	**df**	**Asymptotic Significance (2-Sided)**
Pearson Chi-Square	2061.089 [a]	48	0.000
Likelihood Ratio	1979.891	48	0.000
Linear-by-Linear Association	2.381	1	0.123
N of Valid Cases	57,050		

[a] In total, 29 cells (38.7%) have an expected count of less than five. The minimum expected count is 0.00.

Likewise, the study conducted the chi-square test in order to analyze the relationship between the academic advisor and the student's decision to withdraw from a course. The results show that there is a relationship between the academic advisor and the student's decision to withdraw from a course. Hence, the results presented in Table 4 show that the academic advisor plays a crucial role in the student's decision to withdraw (with a score of 0.662). Table 5 shows Relationship between the academic advisor and course withdrawal.

Table 6 represents the result of the chi-square test that was conducted in order to examine the relationship between the vice-dean and the student's decision to withdraw from a course. The results show that a relationship exists between the vice-dean and the student's decision to withdraw from a course in the middle of a semester. Hence, it can be

stated that the vice-dean plays a strong role in the decision of a student to withdraw from a course or subject (score of 0.911). The chi-square results presented in Table 6 show that the approval rate for students' withdrawal applications is high, implying that the academic delay of students will affect the spending efficiency of the university.

Table 4. Relationship between the academic advisor and course withdrawal.

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-Sided)**
Pearson Chi-Square	49,944.619 [a]	12	0.000
Likelihood Ratio	14,248.281	12	0.000
Linear-by-Linear Association	2044.337	1	0.000
N of Valid Cases	57,050		
Symmetric Measures			
		Value	**Approximate Significance**
Nominal by Nominal	Phi	0.936	0.000
	Cramer's V	0.662	0.000
N of Valid Cases		57,050	

[a] In total, six cells (28.6%) have an expected count of less than five. The minimum expected count is 0.00.

Table 5. Relationship between the vice-dean and the student's course withdrawal decision.

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-Sided)**
Pearson Chi-Square	94,633.323 [a]	16	0.000
Likelihood Ratio	51,718.840	16	0.000
Linear-by-Linear Association	47,281.288	1	0.000
N of Valid Cases	57,050		
Symmetric Measures			
		Value	**Approximate Significance**
Nominal by Nominal	Phi	1.288	0.000
	Cramer's V	0.911	0.000
N of Valid Cases		57,050	

[a] In total, six cells (22.2%) have an expected count of less than five. The minimum expected count is 0.08.

Table 6. Relationship between the vice-dean's approval of withdrawal applications and the spending efficiency.

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-Sided)**
Pearson Chi-Square	63,947.842	32	0.000
Likelihood Ratio	24,034.750	32	0.000
Linear-by-Linear Association	3506.964	1	0.000
N of Valid Cases	57,050		
Symmetric Measures			
		Value	**Approximate Significance**
Nominal by Nominal	Phi	1.059	0.000
	Cramer's V	0.529	0.000
N of Valid Cases		57,050	

8. Discussion and Conclusions

The current study examined the impact of digital transformation on the academic organizational and spending efficiency of a university. We provided a lengthy review of the national effort to achieve the goals of the Saudi Vision 2030. We showed that the vision aims to improve the culture of spending efficiency in all governmental sectors. The educational sector is an important sector that should apply these goals alongside digital transformation. This research assumed that rapid transformation into digitization without rules and regulations to organize its utilization would be costly. Thus, this study evaluated a university e-service to examine the indirect negative impact of digital transformation on organizational and spending efficiency. The electronic subject withdrawal e-service was selected for the purpose of this research. The traditional method of subject withdrawal takes several weeks to carry out. However, the digitized service might require three days for a withdrawal to be approved by university admins. This acceleration without regulations has led to students withdrawing from subjects unwisely, leading to a delay in graduation. It is assumed that withdrawal from three or more courses causes graduation to be delayed by an extra semester. This delay for thousands of students costs the nonprofit university time, effort and money. The study also tried to analyze the impact of student course withdrawals on the spending efficiency and organizational efficiency of the university, and found that an increase in the number of subject withdrawals weakens the spending and organizational efficiency of the university.

The above results show that an increased rate of student withdrawal from courses adversely affects the spending efficiency of the university and, at the same time, impacts the academic organizational performance of the university. Universities can reduce their financial waste and enhance their spending efficiency by changing their rules and regulations regarding subject withdrawal, depending on the requirements of the education sector.

This research endorses the following recommendations to increase efficiency: (1) a student can only withdraw from five courses throughout the entire academic program, (2) a previously withdrawn subject cannot be withdrawn from again, (3) the academic department should put extra effort into academic advising to guide students, (4) extra regulations should be implemented and programmed into the e-service, and full automation should be achieved. The results of this study are limited to a Saudi Arabian university for a particular service. Future researchers could include other countries worldwide and other e-services in order to improve the understanding of the impact of digital transformation on university spending and organizational efficiency.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Secured and private datasets were analyzed in this study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. KSA Vision 2030 and Education. Available online: https://www.moe.gov.sa/ar/Pages/default.aspx (accessed on 11 May 2021).
2. National Transformation Program Document. Available online: https://www.vision2030.gov.sa/sites/default/files/attachments/NTP%20Arabic%20Public%20Document%202810_0.pdf (accessed on 11 May 2021).
3. Qawam Spending Efficiency Program. Available online: https://www.vision2030.gov.sa/ar/node/126 (accessed on 11 May 2021).
4. The Kingdom's IT Spending Grows above the Global Average. Available online: https://www.alwatan.com.sa/article/1034351 (accessed on 11 May 2021).
5. Grand, S.; Wolff, K. Assessing Saudi vision 2030: A 2020 Review. Available online: https://www.atlanticcouncil.org/wp-content/uploads/2020/06/Assessing-Saudi-Vision-2030-A-2020-review.pdf (accessed on 11 May 2021).

6. Financial Balance Program Document. Available online: https://www.vision2030.gov.sa/sites/default/files/attachments/FBP%202019%20Update%20Arabic_0.pdf (accessed on 11 May 2021).
7. Woishi, W. The impact of digitization on the economy of KSA in the context of Vision 2030. *Int. J. Eng. Appl. Sci. Technol.* **2019**, *4*, 312–316. [CrossRef]
8. Alharbi, A.S. Assessment of organizational digital transformation in Saudi Arabia. In Proceedings of the 2019 6th International Conference on Computing for Sustainable Global Development, (INDIACom), New Delhi, India, 13–15 March 2019; pp. 1292–1297.
9. Safiullin, M.R.; Akhmetshin, E.M. Digital transformation of a university as a factor of ensuring its competitiveness. *Int. J. Eng. Adv. Technol.* **2019**, *9*, 7387–7390. [CrossRef]
10. Chaurasiya, D. Digital Transformation. Available online: https://www.researchgate.net/publication/340385414_Digital_Transformation (accessed on 11 May 2021).
11. Norton, A.; Shroff, S.; Edwards, N. *Digital Transformation: An Enterprise Architecture Perspective*; Publish Nation Limited: London, UK, 2020.
12. Mahlow, C.; Hediger, A. Digital transformation in higher education-Buzzword or opportunity? eLearn Mag. 2019, 1–12. Available online: https://elearnmag.acm.org/featured.cfm?aid=3331171 (accessed on 11 May 2021).
13. Yucel, S. Estimating the benefits, drawbacks and risk of digital transformation strategy. In Proceedings of the 2018 International Conference on Computational Science and Computational Intelligence (CSCI), Las Vegas, NV, USA, 12–14 December 2018; pp. 233–238. [CrossRef]
14. Center for Spending Efficiency. Available online: https://sabq.org/QFMPqm (accessed on 11 May 2021).
15. Moshashai, D.; Leber, A.M.; Savage, J.D. Saudi Arabia plans for its economic future: Vision 2030, the National Transformation Plan and Saudi fiscal reform. *Br. J. Mid. East. Stud.* **2020**, *47*, 381–401. [CrossRef]
16. Various National Initiatives Supporting Digital Transformation. Available online: https://www.vision2030.gov.sa/ar/vision-progress (accessed on 11 May 2021).
17. We Are All Giving Initiative. Available online: https://attaa.sa/pages/view/4 (accessed on 11 May 2021).
18. E-Health Services. Available online: https://www.moh.gov.sa/eServices/Pages/sehha-app.aspx (accessed on 11 May 2021).
19. Saudi Fintech. Available online: https://fintechsaudi.com/?lang=ar (accessed on 11 May 2021).
20. Telework Program. Available online: https://teleworks.sa/ar/ (accessed on 11 May 2021).
21. Digital transformation in justice services. Available online: https://ajel.sa/MFxp5k/ (accessed on 11 May 2021).
22. Ministry of Education. Available online: https://www.moe.gov.sa/ar/Pages/default.aspx (accessed on 11 May 2021).
23. Sabbagh, K.; Friedrich, R.; El-Darwiche, B.; Singh, M. Maximizing the Impact of Digitization. *Strategy* **2012**. Available online: https://www.strategyand.pwc.com/m1/en/reports/maximizing-the-impact-of-digitization.pdf (accessed on 12 May 2021).
24. Ilmola-Sheppard, L. *Digitalization Will Transform the Global Economy*; PB-20; IIASA Policy Brief: Laxenburg, Austria, 2018. Available online: https://iiasa.ac.at/web/home/resources/publications/IIASAPolicyBriefs/pb20-web.pdf (accessed on 12 May 2021).
25. Technology is Key to Saudi Arabia's National Transformation Program under Vision 2030. Available online: http://www.thenextsiliconvalley.com/2017/03/03/7171-technology-is-key-to-saudi-arabias-national-transformation-program-under-vision-2030/#.YJtZztUzZ1s (accessed on 12 May 2021).
26. Balyer, A.; Öz, Ö. Academicians' views on digital transformation in education. *Int. Online J. Edu. Teach.* **2018**, *5*, 809–830. Available online: http://iojet.org/index.php/IOJET/article/view/441/295 (accessed on 12 May 2021).
27. Thompson, J.B. *Merchants of Culture: The Publishing Business in the Twenty-First Century*; Polity: Cambridge, UK, 2010.
28. Marks, A.; Al-Ali, M.; Rietsema, K. Learning management systems: A shift toward learning and academic analytics. *Int. J. Emerg. Technol. Learn.* **2016**, *11*, 77–82. [CrossRef]
29. Schwab, K. *The Fourth Industrial Revolution*; World Economic Forum: Geneva, Switzerland, 2016.
30. Maltese, V. Digital transformation challenges for universities: Ensuring information consistency across digital services. *Cat. Classif. Q.* **2018**, *56*, 592–606. [CrossRef]
31. Walker, R.; Voce, J.; Jenkins, M. Charting the development of technology-enhanced learning developments across the UK higher education sector: A longitudinal perspective (2001–2012). *Interact. Learn. Environ.* **2016**, *24*, 438–455. [CrossRef]
32. Sandkuhl, K.; Lehmann, H. Digital transformation in higher education—The role of enterprise architectures and portals. In *Digital Enterprise Computing*; Rossmann, A., Zimmermann, A., Eds.; Gesellschaft für Informatik: Bonn, Germany, 2017; pp. 49–60. Available online: https://dl.gi.de/bitstream/handle/20.500.12116/119/paper04.pdf?sequence=1&isAllowed=y (accessed on 12 May 2021).
33. Brdesee, H. Outstanding Development in Student E-Services: A Case Study Of The Electronic Standardized Letters Of Recommendation (E-SLOR). In Proceedings of the ICERI2019 Conference, Seville, Spain, 11–13 November 2019; pp. 1095–1102, ISBN 978-84-09-14755-7.
34. Wolszczak-Derlacz, J.; Parteka, A. Efficiency of European public higher education institutions: A two-stage multicountry approach. *Scientometrics* **2011**, *89*, 887–917. [CrossRef] [PubMed]
35. Mousa, W.; Ghulam, Y. Exploring efficiency differentials between Saudi higher education institutions. *Manag. Decis. Econ.* **2019**, *40*, 180–199. [CrossRef]
36. Alabdulmenem, F. Measuring the efficiency of public universities: Using data envelopment analysis (DEA) to examine public universities in Saudi Arabia. *Int. Educ. Stud.* **2017**, *10*, 137–143. [CrossRef]

37. Al-Mutairi, K.A.; Al-Shami, S.A. Scientific research in Saudi universities: Science thrives in the desert. *Glob. J. Biol. Agric. Health Sci.* **2015**, *4*, 85–90. Available online: https://www.longdom.org/articles/scientific-research-in-saudi-universities-science-thrives-in-the-desert.pdf (accessed on 12 May 2021).

38. Kuo, J.S.; Kuo, C.S.; Ho, Y.C. Relative efficiencies of public and private institutions of learning in Taiwan. In Proceedings of the Annual Meeting of the Public Choice Society, San Antonio, TX, USA, 1 March 2005.

39. Kempkes, G.; Pohl, C. The efficiency of German universities: Some evidence from nonparametric and parametric methods. *Appl. Econ.* **2010**, *42*, 2063–2079. [CrossRef]

40. Kantabutra, S.; Tang, J.C. Efficiency analysis of public universities in Thailand. *Tert. Educ. Manag.* **2010**, *16*, 15–33. [CrossRef]

41. Marks, A.; Al-Ali, M.; Atassi, R.; Abualkishik, A.Z.; Rezgui, Y. Digital transformation in higher education: A framework for maturity assessment. *Int. J. Adv. Comput. Sci. Appl.* **2020**, *11*, 504–513. [CrossRef]

42. Bounfour, A. From IT to digital transformation: A long term perspective. In *Digital Futures, Digital Transformation: From Lean Production to Acceluction*; Bounfour, A., Ed.; Springer: Cham, Switzerland, 2016; pp. 11–29. [CrossRef]

43. Alsaggaf, W.; Asad, S.; Algrigri, N.; Alsaedi, N.; Brdesee, H. An electronic students attendance system using indoor positioning and mobile apps technologies. In Proceedings of the 11th Annual International Technology, Education and Development Conference (INTED2017), Valencia, Spain, 6–8 March 2017; pp. 7781–7788. [CrossRef]

44. Brdesee, H.S. An online verification system of students and graduates documents and certificates: A developed strategy that prevents fraud qualifications. *Int. J. Smart Educ. Urban. Soc.* **2019**, *10*, 1–18. [CrossRef]

45. Brdesee, H.; Alsaggaf, W. Academic advising and social media: A case study on the twitter account of the deanship and registration of King Abdulaziz University. In Proceedings of the Conference of Academic Advising in Higher Education of the Gulf Cooperation Council States: Reality and Hope, Jeddah, Saudi Arabia, 2–3 November 2015; pp. 253–267.

46. Brdesee, H. A mixed method analysis of the online information course withdrawal system. *Behav. Inf. Technol.* **2018**, *37*, 1037–1054. [CrossRef]

47. Noaman, A.; Madbouly, A.; Brdesee, H.; Fouad, F. Assessing the electronic academic advising success: An evaluation study of advisors satisfaction in higher education. In Proceedings of the 11th Annual International Technology, Education and Development Conference (INTED2017), Valencia, Spain, 6–8 March 2017; pp. 7701–7709. [CrossRef]

48. Khomytska, I.; Teslyuk, V.; Kryvinska, N.; Beregovskyi, V. The nonparametric method for differentiation of phonostatistical structures of authorial style. *Procedia Comput. Sci.* **2019**, *160*, 38–45. [CrossRef]

49. Asano, S.; Murata, H.; Matsuura, M.; Fujino, Y.; Asaoka, R. Early detection of glaucomatous visual field progression using pointwise linear regression with binomial test in the central 10 degrees. *Am. J. Ophthalmol.* **2019**, *199*, 140–149. [CrossRef] [PubMed]

50. Doğan, O.; Taşpınar, S.; Bera, A.K. A Bayesian robust chi-squared test for testing simple hypotheses. *J. Econ.* **2021**, *222*, 933–958. [CrossRef]