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**The Impact of Digital Transformation on Research Effectiveness at PNU's
Research Center**

أثر التحول الرقمي على فعالية البحث في مركز أبحاث جامعة الأميرة نورة

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1.0 Introduction:

Kingdom of Saudi Arabia has witnessed rapid developments in various fields, including social, political, economic, cultural, informational, technological revolution, digital education and other fields that are related to technological scientific progress, and in our current era and with the advent of digital transformation, the world has followed great steps towards change that has brought about a qualitative transfer at the personal, professional and human level throughout Kingdom of Saudi Arabia, and digital transformation has become part of people's interaction to access knowledge and information in work or scientific research.

Interest in information and communication technologies (ICT) has increased around the world, such as distance learning, continuous learning, smart cities, and e-governments to improve the quality of economic growth and digital transformation, which prompted developed countries to develop information infrastructure and digital transformation (Martyakova, Gorchakova, 2019). As digital technology becomes increasingly integrated with the real economy, the digital economy is emerging as a predominant new force driving global economic development, gradually supplanting the traditional economy (Zhao, et al. 2024.p1).

Mechanical headways like savvy gadgets, the Web of Things (IoT), manufactured brainpower (simulated intelligence), increased reality (AR) and computer-generated reality (VR), blockchain innovation, and different programming applications have made new roads for further developing instructing and learning. These developments have fundamentally upgraded instructive (Gaol & Prasolova-Førland, 2021; OECD, 2021).

Subsequently, as of late, schooling systems overall have expanded their interest in the coordination of data and correspondence innovation (ICT) (Fernández-Gutiérrez et al., 2020; Lawrence & Tar, 2018). also, focused on their instructive plans to adjust methodologies or strategies around ICT coordination (European Commission, 2019). The latter brought about issues regarding the quality of teaching and learning with ICTs (Bates, 2015).

Saudi Arabia has experienced a number of changes because of digital transformation, which prompted the creation of the National Committee for Digital Transformation in Kingdom to advance changes in the public and private sectors in line with Saudi Arabia's Vision 2030 (Alshuaibi,2023).

The Ministry of Communications and Information Technology has noted that 4IR will be essential in achieving Vision 2030 objectives, given Kingdom is undergoing a process of comprehensive change and reform at all levels. Vision 2030 is considered one of the most significant engine drivers unlocking major economic purpose and enabling the diversification, that Saudi economy requires going forward. (Mabrouk, & Abdulrahim,2020). Kingdom has actively prioritized research, development, and innovation (RDI) within Vision 2030, realizing the critical role that RDI plays as a catalyst for economic growth in leading nations (Research, Development, and Innovation Authority ,2023).

Scientific research is one of the most prominent elements of Vision 2030, and this comes through the efforts made by Saudi universities in improving the quality of scientific research and by seeking to publish the results of many researches in local and international publishing journals, and cooperating with research bodies inside and outside Kingdom by exchanging knowledge and expertise, and providing modern means of communication and scientific publications. Kingdom has more than eighty-eight diverse research centers that include complex engineering systems, space and aviation, bio-nanotechnology, advanced materials and manufacturing, green nanotechnology, petrochemicals, telecommunications applications, nanomaterials for clean energy applications, common genetics, nanomedicine, water, and energy research, building and construction technology, and physics. building and construction technology, applied physics, communications technology and information security, electronics and photonics, biology and environmental research, agricultural and pharmaceutical technology, the Space Research Institute, the Nuclear Science Research Institute, and the Atomic Energy Research Institute, which aims to harness and develop nuclear technology to serve development in all its fields (Zahran,2023).

Princess Nourah bint Abdulrahman University sensed the need to achieve leadership in information and communication technology services and the transformation into e-government transactions. It also recognized the significant role that ICT plays and the challenges that it must overcome to stay ahead of the curve and become a smart scientific campus. It also understood how important it was to work on utilizing contemporary ICTs to support the needs of education. As a result, they become conduits for communication between the university community and its goals related to academics, research, creative industries, and administration. As a result, it changes from a conventional learning environment to an innovative learning environment, setting an example of success that should be emulated (Princess Nourah bint Abdurrahman University ,2024).

Algoblan, Sawy, Y & Alhaif, (2023) Emphasizes Princess Noura bint Abdulrahman University recognizes the importance of digital transformation in the academic sector, as digital resources play an effective role in enhancing scientific life, especially in improving the quality of research and information circulation, and it also achieves a great deal in achieving job satisfaction for faculty members at Princess Noura bint Abdulrahman University. The Saudi Digital Library has a significant impact on the advancement of teaching and scientific research processes due to the interest of the university administration in this regard. Elements of excellence of digital resources lead to enhancing the quality of scientific life such as Ease of research and freshness of information, and that faculty members rely on publishing in international publishing observatories such as WOS, SCOPUS, EBSCO, with Recording researchers' master data in data monitoring observatories.

Digital resources facilitate the users to access resources electronically through the internet, especially research community is the largest user of digital resources. Along with usage research from IT field are also contributing in it. The purpose of my contribution is improving the speed and easy access from various locations such as work or home (Khan, Kumari, & Firdaus,2015).

According to some scholars, digital resources have only one that is online which only make difference as compared to traditional or manual resources. Online or digital resources are the combination of other digital resources which are connect through network and have digital form of data i.e., articles and e-books which facilitate users to access digital form of data from different (Abbas A, & Faiz,2013).

And the higher education sector has always been the backbone of overall society development. While it helps reshape the community of youth Researchers into full functioning members of society, it is also a fertile ground for creativity, innovation, and scientific research. Enhancing an educational system necessitates a comprehensive assessment of its operational dynamics encompassing organizational structure, functional processes, instructional methodologies, and educational curricula, inclusive of the integration of innovative technological pedagogical tools aligned with contemporary and refined content, thereby establishing a discernible standard of educational excellence. A multitude of both highly developed and burgeoning nations have embarked upon a concerted endeavor to integrate increasingly sophisticated technological and digital pedagogical modalities within their educational frameworks Accordingly, this research was conducted to identify The Impact of Digital Transformation on Research Effectiveness at PNU's Research Center.

2.0 Problem of the Study:

Previous studies indicate that public strategies that address digitization in teaching and learning still lack many requirements and face many issues, most notably outdated planning, and traditional leadership, which has affected the quality of scientific research centers (Bates, 2015; Selwyn, 2016). One example relates to the adoption of digitization in higher education institutions. The results indicate that although most HEIs have a digital transformation, they are still not achieving the desired goals of this transformation, citing difficulties related to readiness and lack of support for this transformation (Simmons et al., 2015).

Although digital transformation in higher education is an emerging area of research, the exact scope and meaning of digital transformation in higher education institutions is still insufficiently defined. "Digital transformation" in universities has become the subject of much hype and excitement, and the term is often overused and misuse (Gkrimpizi, Magnisalis, 2024).

Research centers are considered one of the facilities that need digital transformation because digital transformation will reflect the importance of raising the level of quality, improving the level of access to knowledge, and benefiting students and researchers from scientific research centers. (Khalil, 2016) that the centers face many obstacles that affect the desired change processes, including the weak scientific research budgets allocated. Lack of availability of electronic devices and rooms necessary to support the transformation necessary to carry out research, Difficult administrative procedures., Insufficient numbers of researchers, Low scientific level of newly graduated researchers. And Lack of auxiliary

Although the existence of research centers in universities is important, it is necessary to have research centers in universities that aim to improve the outputs that universities aim to achieve. These research centers should have great capacities to improve the development and promotion of research and make it more useful for academic and graduate research, collaboration, and capacity building among staff. The roles of research centers need significant support to make their role more positive (Jo-Celene, Simone, &, José ,2023).

Sadek .H, Abdelhak D, Samar S,(2021) points out that scientific research centers in the Middle East in general need proper planning and leadership with clear leadership that works to make the digital transformation successful and benefit from it, as well as need to address the issues facing funding for this digital transformation, and the digital infrastructure is very important and needs great efforts so as not to weaken the readiness for the digital technological transformation has affected the level of research publication globally and the lack of technological support has weakened the focus of these centers on writing and publishing scientific, medical and engineering research.

Compared to Arab countries in general and Saudi Arabia in particular, it is still at the beginning of its path towards developing the aspect of scientific research by relying on digital transformation plans. Saudi universities still need to ensure and maintain the high quality of their outputs to remain competitive and progress overall, by adopting digital transformation strategies and improving the overall quality of learning. Finally, through the process of digital transformation, digital transformation management provides an effective outlet for Saudi organizations to build long-term competitive advantages and foster differentiated development. Therefore, it is necessary to identify the issues that prevent the realization of the significant role of digital transformation in universities (Al-Otaibi, & Al-Baroudi, 2024).

Princess Noora University faces many obstacles and challenges imposed on it by the new system, which confirms its need to rely on strategic studies to overcome planning obstacles to advance the development centers and make them more related to the needs of society and contribute to solving its issues by scientific methods and raising the level of local and global leadership and investing knowledge in theoretical and applied research fields, which requires consideration of the management of these centers and how to develop them for greater benefit, as research centers need an administrative unit specialized in knowledge development and digital transformation in knowledge management, as well as there are (Al-Namla ,2022).

Within the framework of the university's endeavor to achieve Kingdom's Vision 2030, there remains a need to review its strategic objectives to suit this new stage and introduce Vision 2030 within its mission, vision, performance measurement indicators, outputs and returns through overlapping processes adopted by leaders when setting goals, programs and projects that link their tasks, educational structures, digital transformation and systems in order to serve the achievement of Vision 2030.

3.0 Study Importance:

This research will help determine the importance of digital transformation for higher education institutions in Kingdom of Saudi Arabia, especially at Princess Nourah University, and identify the issues that hinder this digital transformation, and contribute to the awareness of universities and their leaders of the importance of digital transformation and inspire their leaders to increase digital maturity. Researchers and those interested in the topic of digital transformation and its impact on supporting research quality can use the results of this research to understand the status of higher education institutions compared to other sectors in implementing digital transformation initiatives.

4.0 Study objectives:

4.1 The study aims to identify:

- The impact of digital transformation on research effectiveness at PNU's research center.
- the obstacles facing digital transformation and its impact on the effectiveness of research at PNU's research center.

5.0 Study questions:

5.1 The study will answer the following questions:

- What is the impact of digital transformation on research effectiveness at PNU's research center?
- What are the obstacles facing digital transformation and its impact on the effectiveness of research at PNU's research center?

6.0 Research hypotheses.

6.1 The main hypothesis :

6.1.1 There is an impact of digital transformation on the effectiveness of research at the PNU Research Center.

6.1.2 Sub-hypotheses:

6.1.2.1 There is a statistical significance to the structural and organizational effectiveness of research (Scientific research tool, Obstacles of research centers, Quality of research centers) at the PNU Research Center.

7.0 Previous Study:

Gkrimpizi, Peristeras, & Magnisalis (2023) point out in their study that in today's technology-driven world, the digital transformation of higher education institutions is of paramount importance. However, there are many barriers that hinder the successful implementation of digital transformation programs in higher education organizations. Barriers were identified and categorized based on the use of case study analysis. The results showed that there are twenty different barriers to digital transformation in higher education. These barriers were then classified into six categories: environmental, strategic, organizational, organizational, technological, technological, people-related, and cultural barriers.

Nikša (2021) study focuses on assessing the subject matter, research and innovation drivers, and digital transformation in higher education institutions (HEIs) of the Southeast Asia-European Union (SEA-EU) alliance and the results of the SEA-EU survey. The level of digital transformation was assessed according to eleven specific criteria selected to describe the maturity levels of research, development, and innovation (RDI). This study showed that there are criteria that must be achieved for the selected universities, and there must be a set of solutions to improve digital transformation plans in universities and work to train human resources and develop their skills, work to create a collaborative partnership to modernize the infrastructure, provide digital communications and research sites in order to increase the ability to digitize and learn, conduct an annual evaluation and benchmark measurement of digital transformation.

Qarzi, F. meqnaqy, S. & al-Nadawi, H. (2022) study aims to investigate the reality of the use of research tools, whether provided by university libraries and the Internet by a sample of graduate students at the universities of Constantine / Algeria and Babylon / Iraq. Constantine / Algeria and Babylon / Iraq (120 students), using the descriptive method and the questionnaire as a tool for data collection. The study reached a number of results, the most important of which are that students' use of research tools in the two universities is characterized by generality and randomness. The tendency was towards general research tools rather than specialized or academic tools. It was also found that the most important reasons. According to the study, the most important reasons for this are the lack of awareness of these research tools and the lack of control of the sample members research methods.

8.0 Literature review

8.1 Digital transformation

Digital transformation is the process an organization uses to integrate digital technology into all areas of the business. This process fundamentally changes the way universities deliver value to customers. Organizations are adopting innovative digital

technologies to make cultural and operational transformations that better align with changing customer demands, and there are many definitions of the concept of "digital transformation", depending on how it is currently used in today's world. According to Maltaverne (2017), it refers to "transforming from traditional to delivering new value to customers".

According to Schallmo, A., & Daniel, R. (2018), digital transformation is defined as digitally enabling the accomplishment of business tasks and creating new value for stakeholders. Chaurasiya (2023) emphasized that "digital transformation is not just a transformation based on digital tools and digital processes, but a transformation that encompasses all business models in a radical way. It has a major impact on the way work is done and is a change in mindset that is evolving faster than we are adapting to it.

Marks, A., & Al-Ali, M. (2020). Argue that Digitization is a tool for promoting change, not an end in and of itself. We can only fully appreciate the power of digital technologies to support the members of an organization when we view the digitization process as a means of transforming it for the better. Transformation through digitization of an organization entails a shift in culture and mindset, the de-bureaucratization of activities, and placing the user at the center of the systems while optimizing the use of information.

Higher education institutions have made digital transformation a top priority because universities play a critical role in the development and empowerment of societies. Digital transformation is a rapidly expanding trend that has caught the attention of institutions and stakeholders worldwide (Alenezi, & Akour, 2023) Higher education institutions need additional changes, from technical issues to certification issues, to support the growing needs of digital learning (Burik & Kim, 2020).

Digital transformation in universities means enabling technology in all the work of the university system, whether it is in the field of education, teaching, scientific research, and administrative tasks. The importance of digital transformation in universities comes to improve research and educational outputs, improve access to more education, and support the quality of academic research achievement of all kinds to serve society. Examples of technological and digital transformation in universities are learning platforms such as Blackboard, Canvas and Moodle, and these platforms have become important and necessary in the learning process and academic achievement, as they have a significant role in facilitating students ' access to electronic courses. And the completion of duties, participation in the completion of academic research and access to websites that contribute to the collection of information and benefit from it in obtaining knowledge (Alenezi, & Akour ,2023).

A number of studies have also asserted that digital transformation is not just about integrating technology into business processes. Digital transformation is a process of creating new methods and practices that are evolutionary and effective in pursuing the

mission of higher education. so, Universities have been quick to enable digital transformation in their practices, business models, and operations (Alenezi,2021).

A study (Ebert Duarte, ,2018) and (Spear,2020) examined the goals of digital transformation on the social and economic levels as follows: At the institutional and community level. Cooperation Promoting the development of more innovative technological systems and financial culture Change the education system to provide new skills and future guidance for people to achieve excellence in digital work., Establishing and maintaining digital communications infrastructure, ensuring its management and accessibility, and striking a balance between service quality and delivery costs., Enhancing digital data protection, transparency, ensuring independence requirements, and enhancing trust, Calculate the accessibility of services, and establish controls, mechanisms and quality of digital services provided to the community Apply new and innovative business models and improve the regulatory framework and technical standards. Achieving the principle of integrity and transparency because of the establishment of roles and responsibilities without relying on the traditional hierarchy Which is characterized by routine and bureaucracy.

8.2 Research Methodology

8.2.1 Preface

This chapter indicates the methodology used in the study, study population, study sample, study instrument with its consistency and reliability, variables of the study, and ethical considerations. and statistical analysis procedure.

9.0 Study Approach:

The study will utilize the quantitative approach to gather numeric data that is concerned with frequencies of the elements and interpret this data numerically.

Quantitative research techniques were utilized to examine occurrences impacting the study's sample population. Different numerical data is gathered using various techniques in this form of investigation, with statistical analysis used to combine, compare, or illustrate relationships between the data. Quantitative research methods involve surveys, controlled observations, and experiments. It is the collection and analysis of numerical data to explain, predict, or manage variables. This form of research is useful for examining causal connections between variables, forecasting outcomes, and applying findings to larger groups of people. Quantitative research aims to evaluate a pre-established theory or hypothesis and determine its validity through the findings. Researchers use quantitative data analysis to identify patterns in data sets over time (Sreekumar, 2023).

Apuke (2017) mentioned that a quantitative research approach involves measuring and examining variables to produce outcomes. It includes using statistical methods to examine

numerical data and provide answers to questions regarding who, how much, what, where, when, how many, and how.

Additionally, quantitative research involves collecting, analyzing, interpreting, and reporting the findings of a study. The methodology of data analysis employed by the researcher involves the use of mathematical models. Three significant changes in quantitative research are related to how research is planned, how tests and measurements are conducted, and how data is analyzed statistically. Quantitative research entails gathering numerical data and analyzing it using mathematical models as the primary method of data analysis. Furthermore, the researcher utilizes inquiry methods to guarantee consistency with the methodology for collecting statistical data (Williams, 2007). This approach is suitable for recognizing The Impact of Digital Transformation on Research Effectiveness at PNU's Research Center.

9.1 Sampling:

9.1.1 Sample size and selection of sample.

The studies population will consist of all faculty members at Princess Nourah University, graduate students, master's and doctoral students, and employees of King Abdullah bin Abdulaziz University Hospital at Princess Nourah University.

9.1.2 Sampling techniques:

The study sample will be randomly sampled of all faculty members at Princess Nourah University, graduate students, master's and doctoral students, and employees of King Abdullah bin Abdulaziz University Hospital at Princess Nourah University

9.1.3 Data Collection

9.1.3.1 Data Collection tools

The study will employ an electronic questionnaire to gather data. With careful design, questionnaires can produce high-quality, useable data, achieve good response rates³, and offer anonymity, which encourages more candid and open responses than, say, interviews. All these factors can help to reduce bias (Marshall,2005).

According to Sreejesh (2014), a questionnaire is a prearranged list of questions that are given to interviewees along with explicit instructions outlining the order and selection criteria. This type of tool is highly adaptable and can be used in a variety of research fields, including experimental design and survey research. It gives researchers a methodical framework for gathering information for data collection and analysis.

With benefits like affordability, accessibility, and the ability to reach a wide range of demographics, questionnaires provide researchers with a

powerful and adaptable tool for data collection across a variety of research domains. However, because of its structured format, which facilitates standardized data collection, organization, and analysis, they are especially useful for quantitative research projects (Dalitso,2024) Because of this importance of the questionnaire, the research will adopt the questionnaire to answer the study questions.

9.1.3.2 Data analysis

To achieve the study objectives several appropriate statistical methods were employed using the Statistical Package for the Social Sciences (SPSSversion 25) program, which is abbreviated as (SPSS). The following statistical measures were computed Frequencies and percentages were calculated to identify the functional characteristics of the study participants and determine the responses of the study sample to the study instrument's axes.

10.0 Validity Tool:

10.1 In the initial form, the questionnaire will be presented to a group of experts and specialists to solicit their opinions regarding the clarity of the statements, the appropriateness of the wording of the statements, and the relevance of the statements to the themes.

10.2 The questionnaire will be revised after receiving expert feedback.

10.3 Ethical considerations

Ethical procedures for scientific research will be applied in the context of ethical adherence, and ethical approval to conduct the study will be obtained from the designated authorities.

10.4 Data security

will use the Google platform to collect data. It provides a high degree of security to protect data stored on its servers by adopting a variety of security measures that include the use of an advanced encryption system and strong passwords (google. 2024). Access to data will be restricted to authorized persons only, and data protection security measures such as two-factor authentication and secure login will be used to prevent unauthorized access. The data obtained will be backed up so that it is not lost in case of an emergency, and the file will be password protected to prevent unauthorized access.

11.0 Study Limitation

The study is limited to The Impact of Digital Transformation on Research Effectiveness at PNU's Research Center. The electronic questionnaire will be adopted and applied to a

sample of faculty members, master's and doctoral students and employees of King Abdullah bin Abdulaziz University Hospital at Princess Nourah University during the academic year 1445.

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