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Frugal or Sustainable? The Interplay of Consumers' Personality Traits and Self-Regulated Minds in Recycling Behavior (/2071-1050/15/24/16821)

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Sustainability **2023**, *15*(24), 16821; https://doi.org/10.3390/su152416821 (registering DOI) - 14 Dec 2023

Abstract Through the lens of self-regulation theory (SRT), this study investigates the following: (1) the ways in which consumers' personality traits of conscientiousness, openness, and agreeableness increase their self-regulated mindsets of frugality and green efficacy; (2) whether frugality facilitates green efficacy; and (3) whether **[...] Read more.**

(This article belongs to the Topic **Exploring the Interplay of Psychology and Work-Related Health and Well-Being (/topics/24PVH0CO3E)**)

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Operational Efficiency and Environmental Impacts of Food Service Establishments in Phuket, Thailand (/2071-1050/15/24/16820)

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Sustainability **2023**, *15*(24), 16820; **https://doi.org/10.3390/su152416820 (https://doi.org/10.3390/su152416820)** - 13 Dec 2023

Abstract The expansion of global tourism development has led to an increase in environmental burdens. This study aimed to assess the operational performance and the environmental impacts associated with food service establishments in Phuket, an international tourist island in Thailand. A joint application of **[...] Read more.**

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by Viia Lepane (https://sciprofiles.com/profile/2762495?utm_source=mdpi.com&utm_medium=website&utm_campaign=avatar_name)

Sustainability **2023**, *15*(24), 16819; https://doi.org/10.3390/su152416819 (https://doi.org/10.3390/su152416819) - 13 Dec 2023

Abstract This study aims to investigate if high-resolution dissolved organic matter (DOM) data, obtained from water by chromatographic analyses, enable us to assess whether seasonal climate change and anthropogenic activities in the catchment area have an impact on the ecosystem's sustainability. More specifically, the **[...] Read more.**

(This article belongs to the Special Issue **Advanced Studies of Soil Organic Matter and the Application of Sustainable Soil Management Practices (/journal/sustainability/special_issues/6A10RR533V)**)

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Sustainability **2023**, *15*(24), 16818; https://doi.org/10.3390/su152416818 (https://doi.org/10.3390/su152416818) - 13 Dec 2023

Abstract It is essential to use alternative fuels if we are to reach the emission reduction targets set by the IMO. Hydrogen carriers are classified as zero-emission, while having a higher energy density (including packing factor) than pure hydrogen. They are often considered as **[...] Read more.**

(This article belongs to the Special Issue **Sustainable Maritime Supply Chain (/journal/sustainability/special_issues/Sustainable_Maritime_Supply_Chain)**)

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Ag-Containing Carbon Nanocomposites: Physico-Chemical Properties and Antimicrobial Activity (/2071-1050/15/24/16817)

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Sustainability **2023**, *15*(24), 16817; https://doi.org/10.3390/su152416817 (https://doi.org/10.3390/su152416817) - 13 Dec 2023

Abstract The subject of the present work is the synthesis and analysis of the structural and morphological properties of Ag-containing carbon composites and the investigation of their practical application in water purification and disinfection. A series of composites were synthesized by carbonization of resorcinol–formaldehyde **[...] Read more.**

(This article belongs to the Section **Sustainable Chemical Engineering and Technology (/journal/sustainability/sections/sustainablechemistry)**)

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Open Access Article 18 pages, 8096 KiB (/2071-1050/15/24/16816/pdf?version=1702480165)

An Empirical Modal Decomposition-Improved Whale Optimization Algorithm-Long Short-Term Memory Hybrid Model for Monitoring and Predicting Water Quality Parameters (/2071-1050/15/24/16816)

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Sustainability **2023**, *15*(24), 16816; https://doi.org/10.3390/su152416816 (https://doi.org/10.3390/su152416816) - 13 Dec 2023

Abstract Prediction of water quality parameters is a significant aspect of contemporary green development and ecological restoration. However, the conventional water quality prediction models have limited accuracy and poor generalization capability. This study aims to develop a dependable prediction model for ammonia nitrogen concentration **[...] Read more.**
(This article belongs to the Special Issue **Application of Modeling and Assessment in Sustainable Water Quality Management (/journal/sustainability/special_issues/84X7XX05HM)**)

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Climate Change Implications for Optimal Sizing of Residential Rooftop Solar Photovoltaic Systems in Qatar (/2071-1050/15/24/16815)

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Sustainability **2023**, *15*(24), 16815; https://doi.org/10.3390/su152416815 (https://doi.org/10.3390/su152416815) - 13 Dec 2023

Abstract Climate change poses critical challenges for Qatar's energy-intensive residential building sector. This study evaluates the impact of projected climate warming on optimizing rooftop solar photovoltaics (PV) for villas. An integrated modelling approach is employed, combining building energy simulation, PV system optimization, and performance **[...] Read more.**
(This article belongs to the Special Issue **Advanced Technology in Net Zero Energy Buildings: Solar and Renewable Energy Applications (/journal/sustainability/special_issues/81U0BL7FWV)**)

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***Pinus pinaster* Diameter, Height, and Volume Estimation Using Mask-RCNN (/2071-1050/15/24/16814)**

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Sustainability **2023**, *15*(24), 16814; **https://doi.org/10.3390/su152416814 (https://doi.org/10.3390/su152416814)** - 13 Dec 2023

Abstract *Pinus pinaster*, commonly called the maritime pine, is a vital species in Mediterranean forests. Its ability to thrive in the local climate and rapid growth make it an essential resource for wood production and reforestation efforts. Accurately estimating the volume of wood **[...] Read more.**
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Optimization of Renewable Energy Supply Chain for Sustainable Hydrogen Energy Production from Plastic Waste (/2071-1050/15/24/16813)

by
Ehsan Doniavi (https://sciprofiles.com/profile/author/djdQUGN5WlVpOXM5THpmd3c1Ykkyc0NkakVJNDVnNVY5RDNSM2ZROUVPMD0=?utm
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Rezgar Hasanzadeh (https://sciprofiles.com/profile/1455257?utm_source=mdpi.com&utm_medium=website&utm_campaign=avatar_name)
Sustainability **2023**, *15*(24), 16813; **https://doi.org/10.3390/su152416813 (https://doi.org/10.3390/su152416813)** - 13 Dec 2023

Abstract Disposing of plastic waste through burial or burning leads to air pollution issues while also contributing to gas emissions and plastic waste spreading underground into seas via springs. Henceforth, this research aims at reducing plastic waste volume while simultaneously generating clean energy. Hydrogen **[...] Read more.**
(This article belongs to the Special Issue **Sustainable Development of Materials Recycling and Green Technology (/journal/sustainability/special_issues/F1243231Z8)**)

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Amra Kapo (https://sciprofiles.com/profile/1790312?utm_source=mdpi.com&utm_medium=website&utm_campaign=avatar_name)
Sustainability **2023**, *15*(24), 16812; **https://doi.org/10.3390/su152416812 (https://doi.org/10.3390/su152416812)** - 13 Dec 2023

Abstract Technology is acting as a catalyst for the transformation towards sustainability in education and as a means of reshaping the educational experience. This transformation is part of an overall transformation in our society, and education should be dedicated to creating satisfied students able **[...] Read more.**
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Sustainability **2023**, *15*(24), 16811; **https://doi.org/10.3390/su152416811 (https://doi.org/10.3390/su152416811)** - 13 Dec 2023

Abstract With the enhancement of the Internet of Things (IoT), smart cities have developed the idea of conventional urbanization. IoT networks permit distributed smart devices to collect and process data in smart city structures utilizing an open channel, the Internet. Accordingly, challenges like security, **[...] Read more.**
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Abstract Primary and secondary mill scales (MSs) are waste products produced by the surface oxidation of steel during the hot (800 to 1200 °C) rolling process in downstream steelmaking. While the primary MS is comprised of FeO, Fe_3O_4, and Fe **[...] Read more.**
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Optimizing Operational Conditions of Pilot-Scale Membrane Capacitive Deionization System (/2071-1050/15/24/16809)

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Sustainability **2023**, *15*(24), 16809; **https://doi.org/10.3390/su152416809 (https://doi.org/10.3390/su152416809)** - 13 Dec 2023

Abstract In this study, we developed a pilot-scale membrane capacitive deionization (MCDI) system for treating mildly brackish water and examined various operational parameters, including module arrangements, adsorption/desorption times, and flow rates. As we aimed to optimize these parameters to increase total dissolved solids (TDS) **[...] Read more.**
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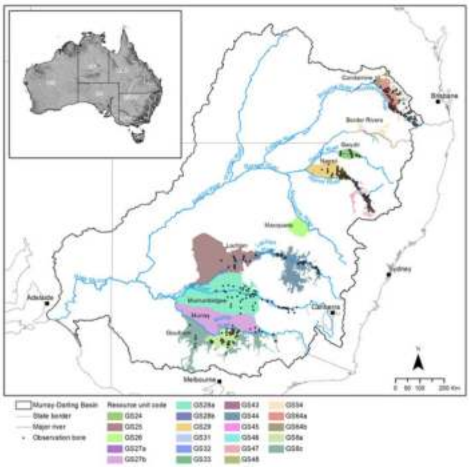

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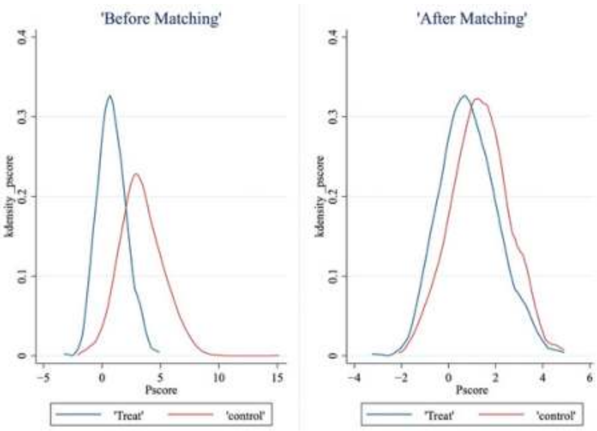

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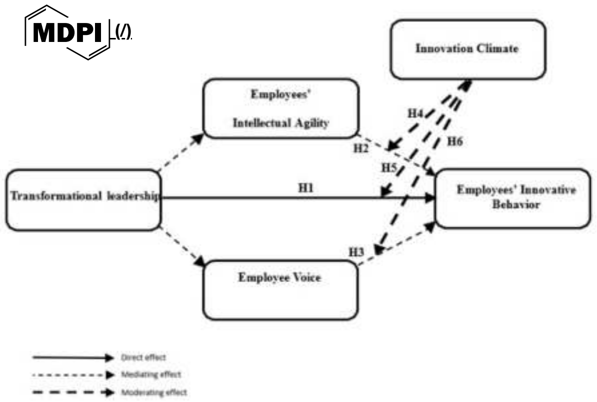

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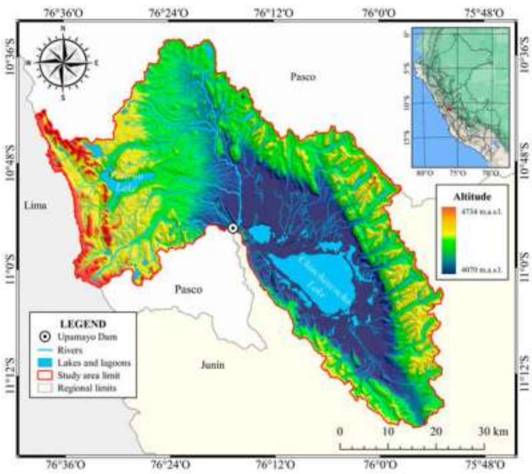

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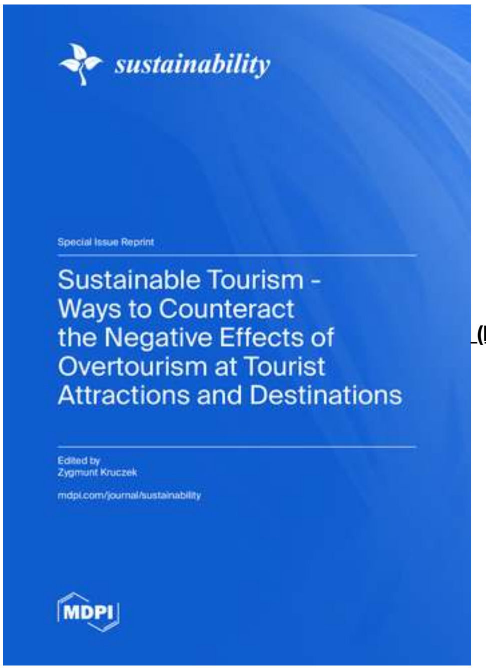

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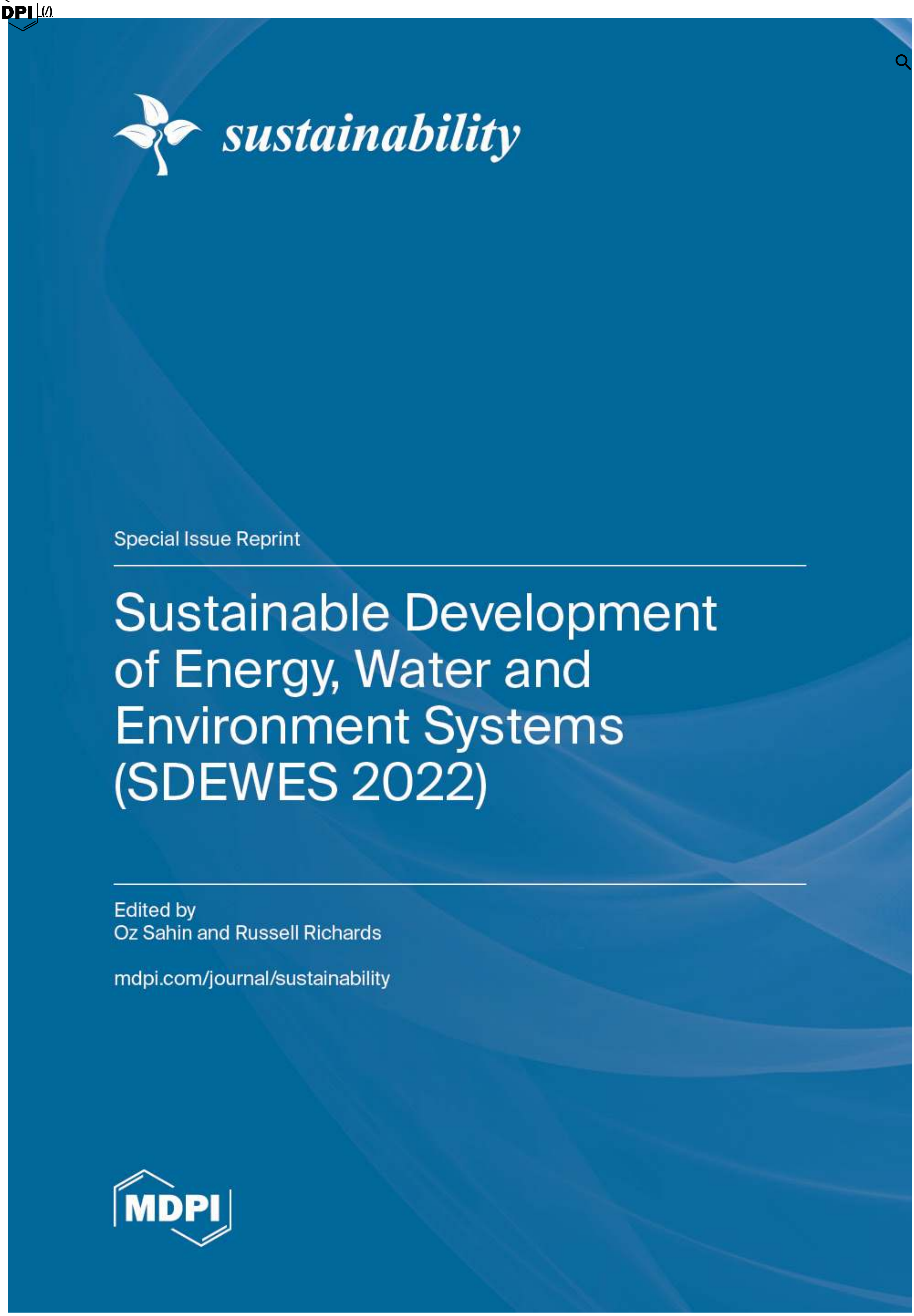

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- Editorial Board (/journal/sustainability/editors)
- Reviewer Board (/journal/sustainability/submission_reviewers)
- Topical Advisory Panel (/journal/sustainability/topical_advisory_panel)
- Instructions for Authors (/journal/sustainability/instructions)
- Special Issues (/journal/sustainability/special_issues)
- Topics (/topics?journal=sustainability)
- Sections & Collections (/journal/sustainability/sections)
- Article Processing Charge (/journal/sustainability/apc)
- Indexing & Archiving (/journal/sustainability/indexing)
- Editor's Choice Articles (/journal/sustainability/editors_choice)
- Most Cited & Viewed (/journal/sustainability/most_cited)
- Journal Statistics (/journal/sustainability/stats)
- Journal History (/journal/sustainability/history)
- Journal Awards (/journal/sustainability/awards)
- Society Collaborations (/journal/sustainability/societies)
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Go to page **1** 2 (/journal/sustainability/editors?page_no=2) 3 (/journal/sustainability/editors?page_no=3) 4 (/journal/sustainability/editors?page_no=4
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Abstract The COVID-19 pandemic has significantly impacted the tourism and hospitality industry. This study aims to reconceptualize the concept of customer perceived value (CPV) in Isfahan's five-star hotels during the pandemic using the grounded theory (GT) approach in the context of qualitative research. The **[...] Read more.**
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Abstract Adopting Artificial Intelligent Technology in an Educational Organization is often problematic due to many internal and external environmental reasons, and often fails to attain the desired goals. This study aims to design a framework for adopting AI technology in the education sector. Most [...]
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Previous Issue
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Concept Paper

Leading Edge or Bleeding Edge: Designing a Framework for the Adoption of AI Technology in an Educational Organization

Sayed Fayaz Ahmad [1,*], Muhammad Mansoor Alam [2], Mohd. Khairil Rahmat [3,*], Muhammad Khalil Shahid [4], Mahnaz Aslam [5], Nur Agus Salim [6] and Mohammed Hasan Ali Al-Abyadh [7]

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Abstract: Adopting Artificial Intelligent Technology in an Educational Organization is often problematic due to many internal and external environmental reasons, and often fails to attain the desired goals. This study aims to design a framework for adopting AI technology in the education sector. Most of the research focuses on the acceptance of a particular technology and ignores the study of what else is needed for a technology acceptance. The framework in this study provides a step-by-step process of the Technological Transformation of an organization never designed before. We recommend that before making any technological changes in an organization, generally and in the educational organization particularly, the processes must be followed for the successful and meaningful adoption of AI technology.

Keywords: technology acceptance model; technology adoption model; artificial intelligence; education

Citation: Ahmad, S.F.; Alam, M.M.; Rahmat, M.K.; Shahid, M.K.; Aslam, M.; Salim, N.A.; Al-Abyadh, M.H.A. Leading Edge or Bleeding Edge: Designing a Framework for the Adoption of AI Technology in an Educational Organization. *Sustainability* **2023**, *15*, 6540. https://doi.org/10.3390/su15086540

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1. Introduction

New technology is not good nor evil in itself. It's all about how people choose and use it. Artificial Intelligent Technology is entering every walk of life [1], and education is one of them. From admission to the final degree-awarding, the application of AI is there. It assists the administrative tasks of educational institutions and academic activities inside the classrooms [2] and plays an important role in education [3]. Many academic and administrative works of educational organizations ("*any organization to educate and develop the capabilities of individuals through instruction by means of operating or contributing to the support of a school, academy, college, or university*") [4] are now automated. Almost all universities are adopting AI technology worldwide if not already adopted or will adopt it in the future [5]. AI technology, on the one hand, assists and simplifies administrative tasks and, on the other hand, helps deliver the lecture beyond geographic boundaries [6]. Through AI technology applications, educational institutions faced the challenge of the recent COVID-19 pandemic and successfully continued the process of education and learning [7]. AI technology is an advanced form of technology and should not be confused with the word "technology" in this paper. "Technology is the application of knowledge to reach practical goals in a specifiable and reproducible way" [8], while "AI technology refers to systems or machines that mimic human intelligence to perform tasks and can iteratively improve themselves based on the information they collect" [9].

AI is, nowadays widely used in the educational sector and creates new opportunities and potential in educational practices [10]. For instance, it automates various tasks of a teacher, such as grading a test, evaluation of homework, progress report making, resource organization, and lecture material management [11]. Another significant use of AI technology in the education sector is personalized learning. It provides education to individuals according to their needs, progress, preferences, and personal characteristics. It is more efficient for individuals having special needs [12]. It makes universal access to education possible, and regardless of time and specific boundaries, students can avail access to education from anywhere, anytime [13]. Another use of AI in education is in the form of digital content [14]. Unlike traditional AI made it possible to create digital content in the form of simulation and visualization, which has significant benefits in training, medical education, students with special needs [15], etc. AI also makes available comprehensive knowledge about something at the fingertips of a teacher. It makes them updated on the current knowledge and prepare them to teach according to the demand of the day [16]. With the help of AI, classroom weaknesses can also be identified. For example, if a student misses something, it will alert the teacher [17]. AI, in the form of bots, etc., is providing services round the clock to students who need something. Students just need an internet connection and access to a particular site or AI application [18]. AI is used in education in many ways. Task automation, personalized learning, universe access, smart content creation, identifying classroom weaknesses, teaching the teachers, and 24/7 access, to name a few, are examples of AI usage in education [19]. In addition, other examples of AI in education are Personalized Education, AI-based Grading/Assessments, Learning Analytics, AI assistance in admissions, social robots, smart learning, intelligent tutoring system, etc. [2,3].

To be very conclusive, AI, while creating new windows in education, also addresses new challenges the education sector is facing [10]. It would not be wrong to say that these challenges also invite scientists to develop AI technology for education. In the education sector, AI focuses on the development of statistical reasoning processes [20], visualization of data [15], and learning analytics [21] which make the practices of education easy and more efficient. AI facilitates the learning process through computer-supported collaborative learning with the help of discourse analysis [22]. With the help of data mining, academic performance can also be predicted [23].

Despite the fact that AI is irrevocable in the educational sector and the latter must benefit from its countless applications, the implementation of new technology is expensive and risky. In addition, mostly, people and organizations are often reluctant to adopt or accept it. Furthermore, the new technology requirement of each educational organization is different and is dependent on the vision and mission of the organization, so for each organization, the technological transformation or adoption is not easy and invites many challenges and issues and often leads to technological failure. The following are the questions this paper tries to answer.

1. How should AI Technology be selected by an educational organization?
2. What are factors that make AI technology more acceptable (For Teachers, students, and organizations)?

The objective of this study is to design a framework for AI technology adoption in educational organizations. Scientists are rapidly developing and enhancing AI technology applications, and it isn't easy to choose and implement a specific type of technology in an educational organization [24]. There may be two big reasons for that. Initially, it may be due to the suitability of the technology for an organizational purpose [25] or may be due to the advancement in a particular technology [26]. These two big reasons are causing and enhancing other threats such as security, privacy, trust, vulnerability, unacceptability, etc., or shortening our discussion and not leading the organization to obtain its strategic goals effectively and efficiently [27]. In addition, employees also resist changes, and change management in a manner acceptable to them is essential [28].

Currently, many researchers are focusing on the Technology Acceptance Model for education [29–32], and very few are focusing on the adoption of AI technology in education [33,34]. Both are pretty different; TAM is just a part of technology adoption. A general framework was designed for the AI technology adoption, comprising five processes, "identify the right use cases, create a collective data platform, adopt the right tools and technologies, integrate the AI decision within the process, and create a culture of experimentation" [35]. We are trying to extend the second part, i.e., technology adoption. We propose a framework for the implementation and adoption of AI technology. It is the duty of scientists, academicians, policymakers, etc., to work together in order to find out tremendous opportunities and address the new challenges of AI applications and revolution. The framework provides guidance for different parties to "why, how, and when to collaborate" for the adoption or implementation of sustainable and effective AI technology in any educational organization. Advanced technology may not necessarily fit for achieving organizational goals and vice versa. Therefore, there is a need to explore and determine the parameters upon which the adoption of AI technology in the education sector depends.

The importance and role of AI in the education sector are clear, and its acceptance is vital, but the role of instructors and organizations is also critical to accepting and implementing AI technology in educational settings. As AI is relatively new for teachers (as they are less experienced in using AI), for students (they need to learn the use of the new technology), and for an educational organization (as it is expensive and needs a huge investment), and instructors are reluctant to accept AI due to "on-the-spot response from AI applications [36]. It is necessary to design a framework for the successful implementation/adoption of AI technology in educational organizations.

2. Literature Review

Nowadays, the world is facing many challenges which are affecting almost all types of industries and organizations across the globe. In order to address these challenges, technological change is necessary for all of them [18], and the education sector is one of them. Technology in many firms is changing the educational industry in many ways, including the mood of teaching, keeping records, admissions, and many other types of academic and administrative work [3]. Technology developers and educational institutions must develop and adopt the technology most appropriate for potential changes and improvements in the sector. Early adopters of AI technology will lead the industry because of the advanced tools and techniques used in the educational environment [37] but make it crucial for others to adopt the AI technology to sustain [38]. Sometimes it may be the choice of the external environment to adopt modern technology, i.e., the COVID-19 pandemic pushed the educational sector a lot for technology adoption and use [39].

Even though early adopters of the new technology are uncertain that the technology will be fruitful [40]. Many times AI technology as a solution to one-problem solution creates other problems [41], and the probability of such risks increases when there is blind trust in the technology [42]. Moreover, organizational instability increases the difficulties in technological change inside the organization [43]. To address the issue, we are highlighting the main aspects of AI technology for adoption and making a conceptual model for the same.

2.1. Theories

2.1.1. Technology Acceptance Model

Technology Acceptance Model (TAM) is a theory used to study how users use and accept technology. It says that the acceptance of new technology depends upon behavioral intention (which leads to technology use) and attitudes (general impression of technology) [44]. This attitude influences the behavioral intention of the users. Perceived usefulness and perceived ease of use are the two main behavioral factors that influence the acceptance of new technology.

1. Perceived Usefulness: "The degree to which a person believes that using a particular system would enhance their job performance" [45].
2. Perceived Ease of Use: "The degree to which a person believes that using a particular system would be free from effort" [46].

If a technology is perceived to be useful for a particular purpose or for what it is intended to do, the acceptance chance will be high. Similarly, if the use of technology is easy, the user will accept it more easily as compared to those which are believed to be complicated. There are also external variables such as trust, security, etc., which also have a major impact on the acceptance of technology. Gender differences in perception of a particular technology exist.

This model was continuously modified, and its extended forms are TAM-2 [47], UTAUT [48], and TAM-3 [49]. TAM focuses on the user, usefulness, ease of use, etc., and ignores the social processes of technology development and implementation. In addition, it also lacks the social consequences of technology and looks only at the ease of use and usefulness of technology during its adoption of technology [50]. Due to these issues, it is often criticized.

2.1.2. The Diffusion of Innovations

The Diffusion of Innovations (DOI) was initially proposed in 1962 in Everett Rogers's book, Diffusion of Innovations. It explains why, how, and how quickly information, technology, and ideas spread. He argued that through diffusion, innovation spreads in a society [51]. According to this theory, the main factors which influence the diffusion of innovation are: "the innovation itself, adopters, communication channels, time, and a social system."

1. The innovation: Innovation itself has a major role in the diffusion process. For example, if innovation is attractive and severely important for society or an organization, then the rate of diffusion will be high. In other words, if it fits the "how" and "why" of the diffusion of innovation, then the "speed" of diffusion will be high [51].
2. Adaptors: There are two main types of technology adopters: early adopters and laggards. The early adopters are the leaders, and the laggards are the followers. Financially strong organizations are more likely to adopt new technology because they can afford the cost. All they need is to either retain their competitive position in the market or to achieve one. They are more concerned with the goals than with the costs. Followers will follow them if the results of the technology adoption are good and reasonable [52]. The technology adoption curve further divides the adopters into five types of innovators, early adopters, early majority, late majority, and laggards. However, it should also be noted that innovators are only 2.5%, early adopters are 13.5%, the early majority 34%, the late majority are 34%, and laggards are 16% [53].
3. Communication Channels: The diffusion of innovation is dependent on the spread of information and awareness about a specific technology, as well as the communication channels through which that information is spread in a society [54].
4. Time: Time is perhaps the most important factor in technology adoption. The adoption of technology by education sector organizations in recent COVID-19 is the best example. When an organization needs technology, it has to adopt it [51].
5. Social System: What is the possible impact of innovation on a social system? If people believe that innovation poses no potential threats to the function and structure of a social system. Then the diffusion will be speedy [55].

2.1.3. Technology-Organization and Environment

Technology-Organization-Environment (TOE) explains the influence of technology, organization, and environment on the process of technological implementation and adoption. This theory focuses on the analysis of technology, organizational attributes, and environmental factors necessary for the intended changes or at least influencing the process [56]. For example, if an organization adopts a technology, it must know the technology trends, its competitive position, etc. It must answer questions like, "Why do I need this technology? [57]. What is the possible impact of this technology on the organization structure, and how will it influence it? What factors from the environment compel the firm to adopt the technology, and what environmental factors must be considered before adoption?

Although it is widely used, it has some limitations also. For example, it is too generic in the context of technological, organizational, and environmental contexts [58].

2.1.4. Unified Theory of Acceptance and Use of Technology

This theory was composed after the review and merging of the theories of reasoned action, motivational model, TAM, theory of planned behavior, diffusion of innovation, social cognitive theory, model of personal computer uses, and a combined theory of planned behavior. The objective of UTAT is to describe the intention to use and the consequent behavior of a user after using an information system [48]. It discusses the acceptance of technology from a unified point of view. It has four main components:

Performance expectancy: Users of technology will first look into the performance expectations of any technology they are adopting or using. In other words, if they see that the performance is high, then the chance of using the technology will be high and vice versa [59].

Social influence: The user of the technology will also consider the possible social influence the new technology is bringing to the organization. If they see that the technology has a positive social influence (from supervisors, team members, etc.) on the organization and the users, the chance of acceptance is high. Otherwise, they will be reluctant to accept or adopt the new technology [60].

Effort Expectancy: This refers to how much effort users put in and what they receive in return. In other words, if users believe that the effort they are putting forth to complete a specific task or that their performance is high while using technology is reasonable, then that technology's acceptance will be high [61]. For example, if their efforts are higher than the return, then they will be reluctant to accept and use the technology.

Enabling Conditions: They describe the environment or conditions of the organization, whether they are favorable for technological change or not. Can the organization afford the cost of technology? Does the user possess the skills and knowledge to use the technology properly? Do the users trust the technology, its consequences, and its outcomes? These are the conditions that are necessary for the acceptance of technology [62].

2.2. Ethical Concerns about AI Technology in Education

Technology always comes with ethical issues [63]. Some of the main ethical issues of AI in the education sector are benefits vs. harm, fairness, justice, transparency, and the nature of moral motivation and agency [64]. Many of the ethical issues and challenges of AI are due to sudden development [65], sociocultural changes, issues of predictability, responsibility, and the handling of huge amounts of data [66].

Slowly and gradually, AI is replacing the jobs and duties of humans, which may increase in the future [67]. With each passing day, AI replaces human decision-making, actions, perceptions, and emotions [68]. In addition, AI has a transformative nature, and it's difficult to assess and evaluate the ratio of benefits and harms in the future [64]. This further clarifies that the ethical issues associated with AI will be increasing in the future, and they must be taken into consideration when developing or implementing AI. For example, the ethical issues coming from self-driving cars [69] and robotics (and their vast applications in different fields) need to be addressed [70].

The goals of AI research and development should be based on the principles that it should be economical, according to the law, and ethical [71]. Factors such as transparency [72], safety [73], privacy [74], human control [75], etc., must be considered while working on the development or adoption of AI. In the education sector, in particular, ethical issues related to privacy, safety, transparency, cost, trust, user-friendliness, etc., must be considered [64]. For example, if an AI technology has some privacy issues, neither the teachers nor the students will accept it, and neither will the educational organization choose it to adopt or implement [74]. Similarly, if it is costly, many educational organizations will not be able to afford it [76]. Again, this will create parity in society, and a significant part of it will not be able to benefit from it [77]. If the transparency is not good, the users will be reluctant to accept it. Trust also has the same effect on acceptance [72]. AI must also benefit those with special needs. If students or teachers with special needs do not benefit as much as the average person, it raises ethical concerns [36].

AI is also impacting the mental health of students and teachers. When they use AI technology, their power to make decisions decreases, and they become more dependent on technology [72]. This dependency further increases the dependency on AI technology and decreases the use of mental power [78]. AI is also making people lazy as many tasks are performed automatically etc., [79]. It is also important to mention here that, as discussed above, the ethical issue of AI technology in the education sector will also increase in the future, as presently, it is not fully assessed and evaluated nor developed to its final extant. Therefore, such as in other sectors, while the educational sector implements or adopts AI technology, it must assess its possible ethical issues and challenges and the extent to which it will impact the users and organizational objectives.

2.3. Towards the Conceptual Framework for Adoption of Technology Model

2.3.1. Identification of Organizational Needs for Adoption of Technology

AI Technology, such as in other sectors, is also offering tremendous applications in society [80] and education [3]. Educational institutions are adopting AI technology much faster than before COVID-19 [81]. They are implementing different types of AI technologies for their organizations but choosing the most appropriate one is always a challenge for the education sector [82]. The only choice left for selecting the most appropriate technology for an organization is to adopt it after the easements of needs [83].

It is essential to answer the question, "Why do you need a specific AI technology for your organization?" [84]. This question can be answered after finding the gap between a present organizational position and the problem the organization wants to solve [85]. The process of finding the gap between the current and the desired position organization intends to achieve is known as need assessment [86]. Through this process, organizations identify the technology's actual needs for adoption [87]. Researchers have validated the need assessment process and believe it is the essential step in adopting new technology in the education sector [88].

The process of the identification of needs is time-consuming. It requires a thorough analysis of the organizational data available, such as budgets, student achievements, and all the relevant data which contributes [89]. In addition to the public records or data, experts can also obtain information through interviews and focus groups. The information regarding organizational goals and objectives provides additional information for identifying needs [90].

Technology adoption by any organization has a more significant relationship with the organization's external and internal environments [91]. We mean organizational policies, employees, student risks, etc.; by the external environment, we mean government regulation, culture, competitors, and threats. It should be known why the organization needs the technology and how it will impact the organizational rules and policies [92]. What is the possible impact on teachers, students, and other employees working in an educational setting?

In addition, it should also be explored that it is permissible and approved by the government to adopt a technology, as in many areas and levels, distant learning is not acceptable [93]. What is the possible reaction of the culture while adopting a particular technology, as maybe some cultures are very resistant to new technology and maybe more for the one, they believe is harmful to their values etc.? Competitors also have a more significant influence over the choice of technology, especially in the case of followers [94]. Early adaptors will opt for the available technology, but the follower will opt for an advanced one compared to their competitors [95]. This again creates more options to choose from and increases the uncertainty in the choice-making process.

No technology comes without risks [96]. The only difference is the degree of risk a new technology has. Advanced technology is believed to be less risky but costly. Low-level technology will be more difficult but cost-efficient. Now the question is, "what type of technology does an educational organization need to opt for." The main concerns and costs are safety, cyber security, health impact, etc. Other primary problems are related to using a particular technology. It is essential to determine whether the institutional and educational staff can use the technology according to their need or are capable of doing it, and similarly, the students [97]. The risk will be high if the educational staff and students are not skilled and trained. To summarize, educational institutions need to identify the problems and gaps they want to address and fill before making any choice for technology adoption. In addition, also look deeply into their internal and external environment and assess each related factor as discussed.

2.3.2. Strategic Organizational Objective of AI Transformation

To face the rush of competition and to remain in existence, organizations need to change their strategies, processes, structure, and culture [98]. Every organization has short-term and long-term AI technology objectives; setting them is the primary step toward a meaningful accomplishment [99]. Strategic goals define "where we are now and where we want to be" [100]. In addition, based on that objective, organizations adopt changes in the context of technology adoption. Technology impacts both the management routine work and the operational work related to the industry, e.g., production and manufacturing, and any organization needs to adopt technology according to the need it wants to fulfill and the goal it wants to achieve [100]. To achieve the desired objective, the organization changes itself in the context of acquisition and merging, culture, structure, procedure, and technology [101]. This study focuses on the AI technological transformation or change, and the goal associated with it is replacing existing technology with a new one for better products and services [102]. Now the question to answer is, "what are the goals of AI technology Transformation in educational setting". Before making any decision regarding AI technology, first of all the goals must be defined clearly.

For example, for medical education, the AI technology may be different, or maybe the same AI technology for medical and engineering education may give a different result. The same is the case for distance and classroom education. Perhaps technology is suitable for distant but not for the real-time classroom environment. Similarly, if the organizational focus is to transform the operational work, e.g., administrative tasks may require different techniques to help tutors deliver lectures. Every priority has its path, and so does it is technology [103]. Based on the goals, AI technology must be selected. Clear goals and alignment of AI technology transformation will not only give the educational organization the possible suitable technology but also minimize the chance of failure, enhance the technology's productivity and provide a quality solution at the minimum cost [104].

Various internal and external factors also affect organizational goals and technology adoption. Competitors, government regulation, environment also impact the choice of technology [94]. Similarly, internal factors such as financial status, employees' skills, and other facilities also influence the decision. These factors even influence the goals and objectives of the organization. For example, the recent COVID-19 pandemic not only forced educational firms to adopt new technology for the smooth running of organizational operations administratively but also for delivering lectures and taking examination. In some countries, the governments enforced the same, and in many cases, the competitors did. As technology adoption, such as any other transformation, is not so easy, education firms must set clear strategic objectives for it without clearly knowing where to go and what to achieve; otherwise, AI technology transformation will be a challenge in all possible manners from huge cost sacrifice to failure, from unsuitability to liability and may negatively impact the current routine work. In the view of Lawrence J. Peter, "If you don't know where you are going, you will probably end up somewhere else."

In short, before the transformation of AI Technology in an organization, organizations need to look at the strategy and strategic objectives, and there must be alignment between the new technology and the organization's approach [105]. This will help the organization achieve its strategic goals through the new technology and will effectively fulfill the purpose. Organizations have to start from the strategic goals and objectives to select a suitable technology and lead to the adoption or selection of new technology. This will help them to achieve their goals and minimize any setbacks.

2.3.3. Selection of Appropriate Technology

After recognizing the strategic goals, the next step is to select the most appropriate technology for achieving those goals [83]. Organizations must be ready regarding readiness, resources, infrastructure, managerial commitment, etc., for the technology transformation [101]. The current era is very different from the past technological revolutions when technology was not so advanced. Nor was it revolutionized or adopted with such a high speed. However now, the evolution is exponential, the nature is significantly troublesome [106], and there is a greater need for better coordination and management of technology adoption or transformation projects. Such projects should be looked after strategically [107].

Although technology has influenced various disciplines in the past, the speed at which it impacts them today was never before [108]. In addition, it is essential to ensure that the desired changes have been made without compromising the organization's strategic goals [109]. Even then, lessons can be learned from the experience and the influence of technological advancements for the management and adoption of technology in the current era or future [110]. Therefore, selecting the appropriate technology must consider all of the essential factors. Unfortunately, it is challenging to compile those factors, and no such research has been undertaken to present a complete masterpiece [111]. There are many reasons why the issue is alive, e.g.,

1. Every organization, even in the same sector, has different strategic goals and will select the technology according to them.
2. The suitability of Strategically fit technology varies from sector to sector, and it is mostly not possible for the technology of one industry to be suitable for another.
3. Even if the technology is advanced, the risk factor is always there.
4. In some cases, the technology is suitable for strategic goals, but the organization is not ready regarding human skills, management support, etc.
5. Other factors of the internal and external environment may also influence the process, e.g., competitors, government, etc.

This shows that before selecting appropriate technology, organizations have to ask a few questions themselves.

1. Why does the organization need a technological transformation?
2. Do the desired changes align with the organization's strategic goals?
3. What are the possible risks or barriers in technological transformation or adoption?
4. What are the possible choices available for the required technology?

Like all other sectors, education is also adopting AI technology for its desired objectives [112]. As said earlier, COVID-19 has exponentially increased the speed of technological transformation of teaching and learning. Almost all higher educational institutes and universities have brought technological changes and are looking for advanced AI technology. AI technical implementation or modification is not as easy as it looks and costs a high price if not appropriately selected. By appropriate, we don't mean advanced, but the one suitable for attaining strategic goals. Therefore, the proper procedure for selecting AI technology should be made before any decision. To make it short, keeping the above questions in mind, the organization must survey the various AI technology available in the market, analyze them correctly according to the strategic goals, select the most appropriate one, and then analyze it in the context of possible challenges and risks. A final decision should be made regarding the selection of proper AI technology.

The following steps should be taken during the selection of technology, as shown in Figure 1.

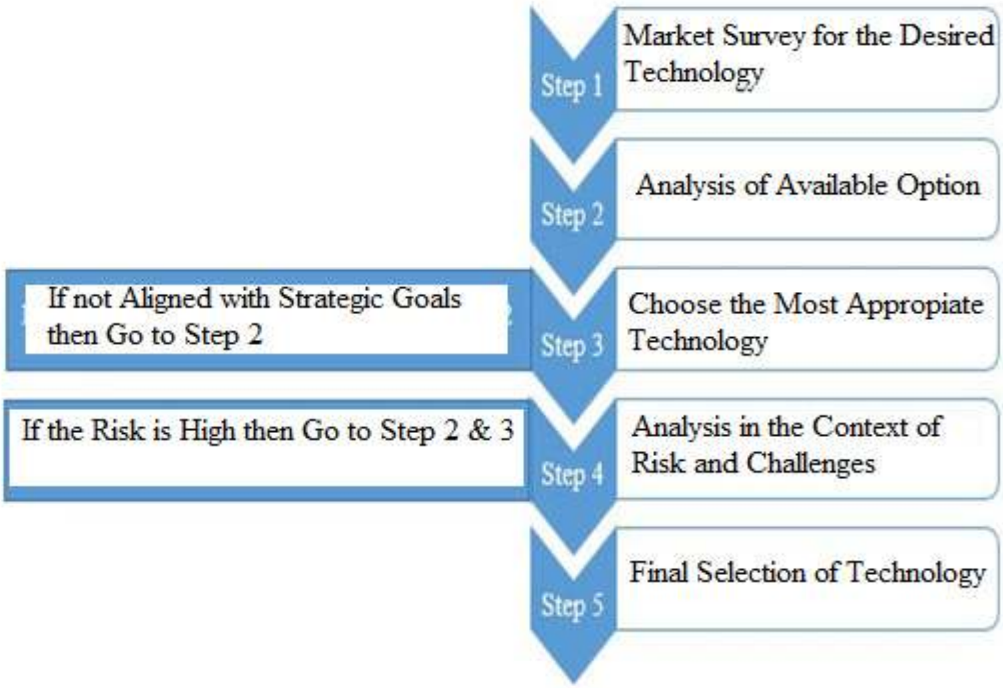

Figure 1. Technology selection process.

Market survey for the desired technology: It is necessary for the organization to perform a market survey or search for the technology it needs. A market survey is important for finding different options as there are many options available to address a particular issue or achieve a particular goal, yet a market survey is important for finding different options.

Analysis of Available Options: All available types of technologies that the organization requires should be analyzed and compared to one another and to the issue that the organization must address.

Choose the Most Appropriate: After the analysis of the available options, the organization must select the most appropriate type. The new technology must be in accordance with the strategic objectives, vision, and mission of the organization. This type is not necessarily the most advanced or latest one, but it should be the one to fulfill the organization's needs.

Analysis in the Context of Risks and Challenges: Once the most appropriate technology has been identified. The organization should analyzes it in the context of the risks and potential challenges that the new technology will bring or pose. The most important are the ethical concerns.

Final Selection of Technology: After the above four steps, the final selection of technology should be made.

2.3.4. Train the Users

After selecting the appropriate technology, the next step is how to use it [113]. One of the main reasons technology transformation or adoption fails or is negatively affected is the lack of knowledge and skills in using it [114]. Training increase performance [115]. Various reasons emphasize the importance and output of training on any new technology such as digital or soft skills [116].

Technology is transforming the mood of operations and how an organization produces goods and offers services [117], and the education sector is non to be excluded. For approximately a decade, AI has been transforming the education industry through various means such as Virtual reality, distant learning, social robots, and chatbox, to name a few [3]. Although technology cannot replace the environment of a natural classroom environment, it has successfully faced and addressed many challenges of the current era. The use of AI technology in medical fields, engineering, science, and various types of training proves that the education sector cannot ignore AI technology. Similarly, the administrative work of educational institutes is also assisted and performed by technology successfully, such as attendance keeping, student records keeping, marking, examination, etc. [3].

Now the question is, "Is it possible to use AI technology without training and understanding? As said earlier, choosing and using technology makes it successful and unsuccessful. After selecting the appropriate technology, the next step is appropriately training the user to use the new technology [114]. In the case of education, all of the staff members, administrative employees and academic ones, and students must be able to use AI technology. If any of them fail to do so will hinder the other two from obtaining the technology use goals. Therefore, the expected use of a specific technology must be trained before the adoption or technology transformation [118]. Students must be given enough training on how to obtain lectures, and course materials, upload assignments, attendance marking, ask questions, take part in the discussion, etc., all that students do in a natural classroom environment. Similarly, training is enough essential and needful for the faculty members [119]. They must be trained about how to use the technology for the strategic purpose such as delivering lectures, uploading materials, keeping records, asking questions from students, generating rooms for discussion, taking exams, and assignments, etc., without proper training about the new AI technology, adoption and implementation will not obtain the objectives [120].

Training not only gives users a sense of trust in the technology but also eliminates fear from their hearts regarding any negative consequences they may face after adopting new technology [121]. Administrative staff training is equally important for teachers and students [122]. As they work in the admission department, examination department, finance, etc., they are equal stakeholders in the successful implementation of AI technology as teachers and students in any educational institution. Training also creates confidence in accepting the technological changes among the employees and will ensure the adoption process is successful as required by the organization [123].

2.3.5. Monitoring and Controlling the Process

What if technology does not give the outcomes for which it was adopted in many organizations? Why may the same technology result differently in different organizations? Or why does technology fail to obtain the desired goals? These are some essential questions to be addressed before and after the technology adoption. Technology is getting more advanced and so more complex [69]; its adoption at any firm is getting highly uncertain and risky [124]. AI Technology adoption comes with expectations and solutions, but the uncertainty and risks associated with every technology demand monitoring and controlling the technology adoption process and the outcomes [125]. If a technology does not fulfill the goals of an organization, then the reason must be found out and addressed. It must be ensured that the technological change for which it was similarly undertaken results as expected. If there is any deviation, it must be addressed as soon as possible. We call this process "monitoring and controlling the technological adoption." Technology Acceptance Models (TAM) summarizes various factors such as usefulness, ease of use [45,46], and [126] "relative superiority, compatibility, complexity, testability, and observability of technologies" [127]. TAM focuses on the technical specifications of technology that make the technology adoption successful and acceptable but does not focus thoroughly on the above questions [128]. This shows that the technology's technical characteristics are not the only ones to make the technology adoption successful. Still, some organizational factors also accompany the successful adoption of the technology.

Many organizational factors such as existing technology within an organization [129], communication, leadership, and empowerment [130] also make the adoption results different. In addition, management strategies [131], culture [132], organizational politics [133], etc., are the factors having a significant impact on successful adoption. We argue that both the technological aspects (of existing technology and the newly adopted technology) and organizational and managerial factors must be monitored and controlled for the successful implementation/adoption/transformation of new technology and must be changed and managed according to the corporate strategic goals. It is not only the technology itself that is responsible for the results but also the organization's environment [134].

To summarize the monitoring and controlling of the technology adoption process, first, we argue that the new technology should be adequately monitored to align its output and satisfy organizational needs. Technically, the technology must be appropriate and reasonable for the intended objectives. Uncertainty, new skills requirements, and other risks always hinder successful adoption and results. So, it is best to address this as soon as possible to properly manage and control and minimize the cost to be paid. Secondly, organizational elements other than the technology itself must be monitored and contained in such a way as to assist the new technology in achieving its goals. Change is not simple, and neither is technological evolution in any organization. Conflicts may arise between the organizational structure and the new technology, hindering the adoption process. So, it is essential to fill the gaps in technology or organizational structure before and after technology adoption to push technology to achieve its goals in fulfilling corporate purposes.

3. Discussion

The advancement of AI and its applications in different sectors is an irrevocable fact. Neither can we ignore its applications in education, nor do we sustain without it in the contemporary technologically advanced era [135]. Due to the importance and roles of technology, many researchers have studied and are studying the technological transformation or adoption in any organization under the title of Technology Acceptance Models [136]. It is, without doubt, essential and crucial to explore and find out the factors that impact or are associated with technology acceptance [137]. It is also a fact that if a technology is unacceptable to the employees or users, it is never successful. These factors are trust, ease of use, usefulness, relative superiority, compatibility, complexity, testability, observability, etc., [138].

As much as AI is important for educational organizations, it is difficult to select a sustainable and suitable technology [139]. The suitability and sustainability of any AI technology start with the need assessment of the technology, the strategic objectives of technology adoption or transformation; the selection of appropriate technology; the user's knowledge about the use of technology [140]; and monitoring and controlling the output or results of technology. On the one hand, AI technology benefits the education sector; on the other hand, it poses many ethical concerns, which mostly lead to a hindrance between technological transformation and its acceptance. This further urges scientists, academicians, and researchers to find a way to make technology not only suitable but also ethical and sustainable [139,140]. For example, it is necessary to consider whether the technology is trustworthy [141], secure to protect the personal information of its users [142], has transparency, is affordable, user-friendly, etc., to name a few [143]. Other important factors which must be taken into consideration are its impact on the health of users [144], its impact on decision-making [145], on those with special needs [146], on the organizational environment [147], and the opportunities it is expected to create [148]. These are some of the concerns to be considered before and during the adoption or development of AI technology for an educational setting.

Suppose that if at the time of needs assessment, which is the basis for technology adoption, an organization only focuses on finding out about the needs and not on the ethical issues to be raised if the needs are fulfilled, then its acceptability will be at stake. It is common that the adoption or implementation of technology invites problems while addressing some of the issues (in this case, the needs) [149]. This shows that while doing the assessment of needs, the educational organization needs to think through the ethical and challenging issues that may possibly or deliberately come after the technological transformation or adoption or implementation for the needs that already existed and for which the change was made. Similarly, the process will not be sustainable in the long run and will pose different types of risks [150]. Therefore, needs assessment must be performed as the primary step to AI technology adoption such that if they become fulfilled, they will not create other problems.

The strategic goals of any organization have a strong relationship with technology adoption or transformation. Educational organizations take steps to achieve the desired changes according to these goals. For example, during the recent COVID-19 pandemic, many educational organizations shifted their routine practices online and adopted technology [151]. Similarly, with the advent of modern technology, it is much desired to use the same AI technology for many purposes [152]. For example, for creating virtual environments for training such as driving, flying, and airplanes, in medical classes, etc., where the use of AI technology is more beneficial [153]. In addition, AI technology is also helpful to be used in labs for creating the desired environment or applied where the reach of humans physically is not possible or dangerous [154]. Educational organizations also use AI technology to assist students and teachers with special needs to obtain and deliver education [155]. Other types of strategic objectives such as cost control, research, and access can also be obtained through the use of AI technology [156]. Therefore, it is important for any educational organization to revisit the existing goals and align them with the goals of AI technology adoption. The organizational objective of digital transformation must be clear, e.g., whether it is for an administrative task or for academics, whether it is needed for classrooms or distance-learning, whether it is for those with special needs or for normal people, [3], etc. For AI technology to be more suitable and sustainable, it must be implemented according to the goals it was adopted or implemented for. Education organizations have administrative and academic tasks, and when they go for an AI technology, they need to select the most appropriate technology [2]. Mostly, the same AI technology is used for administrative tasks such as admission, course registration, results checking, exam paper or assignment submission and checking, attendance, etc., and for academic tasks such as taking online classes, lecture sharing, etc., but there is also specialized AI technology which is used for very specialized purposes such as the one used by those having special needs, in labs, and for creating an artificial classroom or learning environments [157]. For each purpose generally and for a specific purpose specifically, appropriate AI technology is needed, otherwise it will not fulfill the desired needs and goals for which it is adopted or implemented.

As said earlier, AI technology is quite a new technology, and it is difficult to use new technology properly. Therefore, there is also a need for the technology to be used by those who know its use. This leads to the necessity of giving training to the users [140]. It is highly important to mention that in addition to the ethical concerns of AI technology, if it is not used by skilled users, it will pose or create additional concerns [158]. Skilled people will use AI technology efficiently, and the possibility of misuse and ethical concerns will be kept to a minimum [159]. The usage and performance of AI must be monitored and controlled continuously, and if anything appears undesirable, it must be resolved. The possibility of such undesirable results or outcomes or concerns is great for two reasons. Primarily, the technology always comes with issues, and secondly, the users are less trained to use it. This process should continue to eliminate the weaknesses in AI technology and make it more suitable and sustainable for educational organizations.

Many concerns, such as the fear of losing jobs, mental health, etc., can be resolved by giving training to AI technology users [140]. Some jobs in an educational organization are riskier, technical, and not repetitive and need advanced training as there is the use of AI and the human mind, while some are repetitive and need fewer skills. AI technology may not give good results in jobs where human emotions, interactions, etc., are involved [160]. Therefore, extra attention is required there. Although with the advancement of AI technology, such issues are also likely to be resolved to a greater extent. We believe that the final control and decision-making power must be in the hands of humans, even though we also believe that AI is assisting them in many ways in educational organizations. Educational organizations must benefit from AI technology but not at the cost of ethical concerns.

In short, as much as technology is becoming the need of the day, researchers have often shown less interest in developing the technology adoption process, as they showed in TAM. Before adopting or implementing any AI technology in an educational organization, there is a need to choose the most appropriate technology that can efficiently and effectively fulfill the organizational needs and is aligned with the organization's strategic objectives. It is also necessary that the users of the technology must have enough knowledge and skills to use the technology effectively. However, users often lack the required knowledge and skills to use new or advanced technology, and sometimes they have no trust (acceptability) in it. Therefore, to develop the required skills and trust (acceptability), an organization must train the users of the technology for successful adoption. Even then, the technology may not give satisfactory results/outcomes; therefore, monitoring and controlling are needed regularly to avoid failure. We conclude our discussion on designing the following framework, as shown in Figure 2.

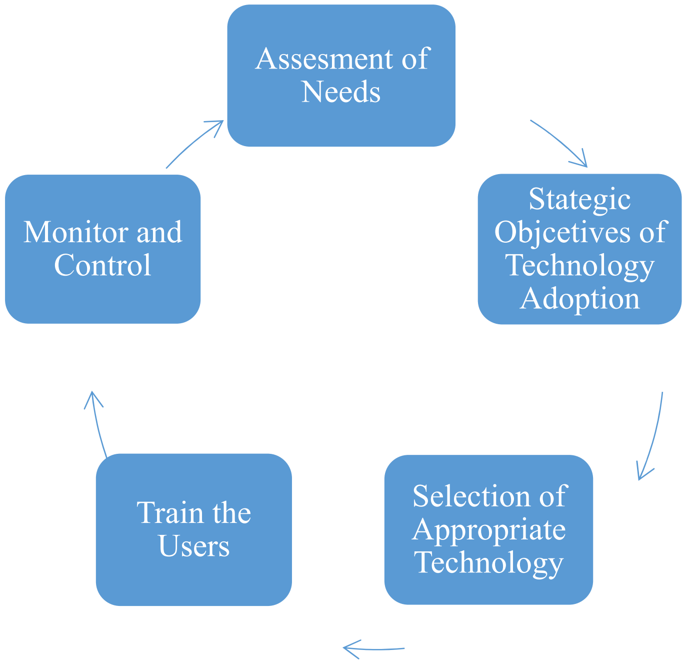

Figure 2. Adoption of Technology Model.

4. Conclusions

This framework is about the adoption of technology in an organization and is different from other technology acceptance theories such as TAM, TAM-3, UTAUT, DOI, and TOE in some different ways. For instance, TAM focuses on the attitudes and behavioral elements influencing how people accept technology. TOE describes the role of technological characteristics and organizational and environmental factors in the acceptance of technology. According to DOI, factors including innovation itself, adopters, communication avenues, time, and social structure are crucial in determining whether new technology is adopted. UTAUT merges theories of reasoned action, motivational model, TAM, theory of planned behavior, diffusion of innovation, social cognitive theory, model of personal computer uses, and a combined theory of planned behavior for technology acceptance. It says that performance expectancy, social influence, effort expectancy, and enabling conditions have a major role in the acceptance of a particular technology. Directly or indirectly, these theories focus on the acceptance of technology and lessen the focus on the adoption of technology in an organization. Unlike these theoretical models, the objective of this model is to look into the acceptance or adoption of new technology from the organization (which is implementing the new technology). This framework believes that the organization should adopt a particular technology not only because of its advanced level, price, etc., but should also consider factors such as the organizational needs, organizational strategy (vision and mission), knowledge and skills of the users, and continuously monitoring and controlling the outcomes of the technology. For example, if a technology does not fulfill the needs of an organization, it will never be successfully adopted or accepted in that organization, but maybe it successfully fulfills the needs of another organization. For successful adoption, a thorough assessment of needs is necessary. Similarly, the strategic fit is also a key to successful adoption. The selection of appropriate technology and user knowledge and training are other factors that lead to successful adoption. Lastly, technology adoption in any organization is not a one-time process and should not be forgotten when implemented but should be continuously monitored and controlled for the desired results, i.e., they need fulfillment. In short, this framework focuses on the parameters an organization must have to meet for the successful adoption of AI technology.

AI Technology adoption is different from technology acceptance and must not be mixed but must be explored, designed, and tested individually. For the adoption of AI technology, organizations need to analyze, recognize and assess the needs for which the technology is required, then check whether it is aligned with the strategic or long-term objectives of the organization or not. Technology transformation decisions are not easy, and any price may be high, so it's better to check its alignment with the organization's strategic goals or objectives. In the next step, the most appropriate technology will be selected. By proper, we mean relevant in cost and benefits, suitability, acceptability, and environmentally friendly. After that, training the users, e.g., teachers, students, and other staff, using the technology is essential. If they cannot use it, the technology adoption will fail and not give the desired results. In the last step, it must be monitored and controlled regularly to avoid any mistakes and to take corrective actions if needed in the context of technology, user, and environment.

4.1. Limitations

It is without a doubt that there is always space for improvement and limitations in every model or framework. Primarily, this framework focuses on the internal process of technology adoption and having a party focus on the external environment. Therefore, it may not cover the surroundings other than the vision, mission, and strategic objectives of the organization. Secondly, it is a proposed framework for the adoption of technology in education, not on the factors that have an impact on the general acceptance of technology, as discussed in TAM, UTAT, etc. Thirdly, it is not quantitatively evaluated.

4.2. Future Research

1. As discussed in the limitations, it would be better to properly convert it into the other technology theories and models.
2. Proper evaluation is another direction for the research on this model.

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