Learning Beyond the Brick and Mortar: A Review of Prospects and Challenges of E-learning Innovation

Lamin B. Ceesay[1]

University of Verona, School of Legal and Economic Sciences, Verona, Italy.
e-mail: laminb.ceesay@univr.it

Abstract

Increased proliferation of IT services in all sectors has reinforced the adoption and diffusion across all levels of education and training institutions. However, lack of awareness of and knowledge about the key challenges and opportunities of e-learning, seem to allude policymakers, resulting in low adoption or increased failure rate of many e-learning projects. Our study tries to address this problem through a review of relevant literature in e-learning. Our goal was to draw from the existing literature, insights into the opportunities and challenges of e-learning diffusion, and the current state-of-research in the field. To do this, we employed a systematic review of literature on some of the salient opportunities and challenges of e-learning innovation for educational institutions. These results aimed to inform policymakers and suggest some interesting issues to advance the research and adoption and diffusion of e-learning. Moreover, the bibliometric analysis shows that the field is experiencing high research attraction among scholars. However, several research areas in the field witnessed relatively low research paucity. Based on these findings, we discussed topics for possible future research.

Keywords –e-learning, information technology services, e-learning adoption, e-learning diffusion, systematic review, bibliometric analysis*.*

I. INTRODUCTION

The proliferation of information technology and its related systems, and services, have intensified the adoption of e-learning in traditional brick and mortar institutions of learning, teaching and research. This surge in ICT and the internet, provide unique opportunities for educational institutions.

Scholars have used different terms to described various forms of technology-delivered learning: *digital lecture,* where an instructor delivers lessons through live streaming, or a digital version of the lecture is available to students on-demand

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[1] https://orcid.org/0000-0002-5967-7281

in a synchronized manner [1],[2],[3],[4]. This form of e-learning depends on the use of Skype technologies, Zoom, Google classroom, to stream live video feed. Second, is *e-lectures*, involving the instructor to record lessons in studios, and transmit this recorded version to virtual audiences [3]. Such mode enables learners to access e-lessons in various forms of audio and recorded video feeds. Generally, these are all important aspects of *e-learning* innovation, which characterizes learning, teaching and research conducted via internet and other digital technologies, allowing access to digital contents (e.g., live video feed, pictures, games, e-books, and articles) thus engaging learners and stimulating the learning experience [5],[6],[7],[2].

While previous traditional reviews, seems to have focused on the "determinants of e-learning adoption" (e.g., [8],[9],[10]), and "challenges of e-learning success" (e.g., [11],[12]) in a much less integrated fashion, in our study, however, instead of identifying these issues in isolation, we try to integrate these findings. Specifically, this study thus tries to provide insights into the current state of the literature, identify and synthesize literature according to the opportunities and challenges of e-learning adoption and diffusion, and discuss agenda for future research. To do this, we perform a systematic review and bibliometric techniques to map the field and address the research questions. We use the Web of Science database by scooping out relevant papers in the field of education. VOSviewer software was used to illustrate bibliometric techniques (e.g., co-citation, and bibliometric coupling).

Synthesis the findings of the literature, we report that increasing growth of e-learning innovation in various educational institutions over the period 2015-2020. In fact, up to August 2020, e-learning research has gained immense popularity, and this reason could be associated with the recent Coronavirus pandemic. The pandemic has intensified the adoption and diffusion of e-learning across educational institutions due to the social distancing and lockdown, as popular means of curbing the spread of the virus. Schools have resort to e-learning innovation for learning, teaching, and research collaboration. Our results show numerous opportunities for e-learning innovation across educational institutions (Universities, Colleges, and Schools) globally. It was observed that e-learning accelerates the quality of education [7], stimulates learning experience [4],[11], lessons the situational and cost barriers to access education [2],[3], and encouraging interaction and immediate feedback between students, and their instructors [6]. Despite the numerous benefits, our content review highlights some of the salient challenges confronting e-learning adoption and diffusion in educational institutions. For instance, technological factors, such as IT infrastructure [13],[6], human factors (including IT skills, awareness among students and instructors) [9],[8],[15], institutional factors (poor state of

institutions, lack of policy alignment with e-learning activities, etc.) [14],[11], pedagogical factors [6], environmental issues associated with the political will for advancing the development of national IT policy, and related infrastructure, and challenges of systems design, affecting IT interactivity and instructional design [12],[14],[8],[9]. To advance the e-learning adoption and diffusion, policymakers must minimize the effects of these challenges in educational institutions.

The rest of the paper is organized accordingly. The first section, is the brief introduction, stated above. Section two briefly describes e-learning innovation. Section three is the research method. Section four is the findings of the study. Lastly, section five discusses the conclusions and recommendation for policy and future agenda.

II. DEFINING E-LEARNING INNOVATION

It seems there is no universal definition of e-learning. However, scholars have used different concepts to describe e-learning innovation. For instance:

Sangrà and colleagues (p.154) define e-learning "as an approach to teaching and learning, representing all or part of the educational model application that is based on the use of electronic media and devices, as tools for improving access to training, communication, and interaction, that facilitate the adoption of new ways of understanding and developing learning"[15].

Alonso and others, describe e-learning involving the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services, as well as remote exchange and collaboration [2].

According to Ellis et al. "e-learning is information and communication technologies used to support students to improve their learning [17]. This reduces the costs of learning and education, increase access to learning and knowledge resources [18].

Jereb and Mitek [19] state that e-learning in educational processes utilizes information and communications technology to mediate synchronous as well as asynchronous learning and teaching activities – a process that revolves around the four models of technology-based learning models: face-to-face learning (no e-learning), classroom support model, blended model, and online distance education (full e-learning).

Many of these studies characterize e-learning through the lens of instructional learning and education, digital communication, or systems technology infrastructure. By paraphrasing Cantoni and colleagues [6], the effectiveness and efficiency of e-learning innovation, it is necessary to choose *"just the right content, just the right person, at just the right time, on just the right device, in just the right context, and just the right way." (pg.337).* Based on these, e-learning characterizes the application of electronic-based learning, thus enabling teaching and learning, the engagement between students, instructors, and administrators, to deliver and sustain learning, teaching, assessments, and feedback.

III. METHODS

A. Systematic Literature Review (henceforth, SLR)

Following suggestions of methodological rigour of management literature reviews (e.g., [20],[21],[22]) and aiming to consolidate the literature across the domain, our methodology is that of a systematic, evidence-informed literature review (e.g., [23],[24],[25]. SLR is a common research approach used by scholars to conduct reviews of literature in a field, in an iterative, systematic way. Kraus, et al. [21], define SLR as "a review of an existing body of literature that follows a transparent and reproducible methodology in searching, assessing its quality and synthesizing it, with a high level of objectivity" (p.4). Unlike the traditional reviews, SLR ensures reproducibility and increased objectivity in the paper selection and review [26]. Paper selection criteria in SLR improves the robustness of the SLR approach and minimize the exclusion bias associated with a traditional review [25].

Scholars used various models for the different stages of an SLR process. For example, Tranfield [25] separates five stages in 10 steps. Pittaway et al. [26] use three steps for an SLR, and recently, Kraus et at., [21] use three steps of SLR: *planning the review, conducting the review* and *reporting of the findings.* Thus, we use the Kraus and colleagues' [21] methods to perform this research.

To complement SLR, we performed bibliometric techniques. Bibliometric analysis is considered as an extension of theoretical review, and recognized as an innovation in review methodologies (e.g.,[27],[22],[20]). Researchers use bibliometric analysis for identifying the leading trends in a field in terms of journal, topics, highly cited papers, authors, institutions, and countries (e.g.,[20],[28]). To perform this kind of test, we leveraged bibliometric data of papers and execute analysis using the VOSviewer software. VOSviewer has been used by scholars in social science fields to perform various forms of bibliometric techniques (e.g., [20],[28]).

B. SLR Process

I. Planning the review

The first stage of our SLR involves the identification of the selected search keywords. Because e-learning innovation is multidimensional, such that its use is characterized by educational institutions (such as universities, colleges, and schools), it is also in use by corporate organizations for in-house staff capacity building training. Several terms can be deduced from the extant literature, as synonymously used by various scholars in the social sciences, Information and communication, and engineering fields.

To verify the initial search terms, we first, conduct a pilot search, using a combination of terms, to ensure precision in paper selection. A list of initial terms was excluded, as they provide wider variability in search results: ("off-campus learning", "mobile-learning" "digital learning" and "*virtual learning")*. Our final search terms used in this research include, (*"e-learning"* OR *"distance learning"* OR *"online education*" OR *"computer-based learning*"), separated by another Boolean operator AND (*"diffusion"* OR *"adoption")*. This combination of terms ensures the scooping out of all relevant papers associated with the combination of terms.

II. Conducting the review

We conduct our paper search using the Web of Science database, which is commonly used by researchers for scholarly data collection (e.g.,[20],[22],[27]). The database allows for the use of Boolean operators "AND" "OR" to help focus on specific research to a particular search outcome. The system illustrates results in various descriptive forms according to authors, research category/fields, publication years, publication type, etc. Researchers use these choices to filter their research into a more precise search term(s). Thus, using the final search terms, we then apply search filters according to our search criteria.

Following many scholars, we perform paper selection based on a list of inclusion and exclusion criteria (e.g., [26],[21]). Inclusion criteria are those conditions that must be met for the inclusion of the paper in the research such as paper must focus on e-learning from the "education" search category of WoS database; papers published between 2015-2020 (August, 31); the paper must be available in WoS database, and papers must be in English. Our exclusion criteria, on the other hand, are characterized by conditions that if a paper meets, such paper, must be excluded from the study. These include papers other than peer-review articles (e.g., books, book chapters); papers in languages other than English, papers published before

the January 2015 and after August 2020, and all grey literature (working-papers, conference proceedings).

Our first search results generate a total of *381* papers. We then filter our search based on our selection criteria, an additional filter, based on the Web of Science categories of discipline, education field: *education research* and *education scientific discipline,* a list of *211* papers was obtained. All papers generated are organized are assigned codes, first, we read through the abstract and introduction of all papers, to minimize the inclusion error associated with poorly written abstracts and exclude papers that lack a precise focus on the search terms (e.g., papers that include "e-learning" AND "adoption" in the abstract or keywords, but have not discussed the topic in the content). After this process, a total of *41* papers were excluded, and a final list of *170* papers, was used in this study. No additional paper selection criteria were applied.

III. Reporting of the findings

We report our findings based on descriptive analysis, which comprises of (a) papers methodology, (b) publication year, (c) journal outlet, and (d) authors. The descriptive analysis brings out a clear illustration of the influential authors and journals that dominate discussions in the field. The final section of the finding is the content review of the selected papers. This provides us with great insights into the RQ: (1) what are the opportunities of e-learning innovation? and (2) what are the key challenges of e-learning adoption and diffusion? For each paper, we read the entire content and synthesize findings based on the content areas of the RQs.

IV. FINDINGS

A. Descriptive analysis

I. Most influential Journals in e-learning research

Of the total number of selected papers (170), our distribution shows 9 most dominant journal outlets in e-learning research (in table 1). Because e-learning characterizes the use of IT and communications systems, Journals related to technology in education are major outlets for publications in the field. For example, first, is *Education and Information Technologies,* which dominates publication in the field. The journal has a yearly overall rank of (0.78), with h-index 36 (meaning every 36 articles of this Journal have more than 31 number of citations (SJR, 2019). Second, *International Journal of Emerging Technologies in Learning*. This journal is ranked (0.33) with (h-index 19) (SJR, 2019). Third, is the *Interactive Learning Environments*, which is ranked (1.22) and h-index of 38 (SJR, 2019).

Other journals tend to are beginning to merge with a relatively low number of publications in e-learning during the period.

Abbreviation	Journal name	No. of Papers	SCImago JR (2019)
Br. J. Educ. Technol.	British Journal of Educational Technology	6	1.62
Comput. Educ.	Computers and Education	7	3.05
Educ. Inf. Technol.	Education and Information Technologies	14	0.78
Interact. Learn. Environ.	Interactive Learning Environments	9	1.23
Interact. Technol. Smart Educ.	Interactive Technology and Smart Education	7	0.45
Int. J. Emerg. Technol. Learn.	International Journal of Emerging Technologies in Learning	11	0.33
Int. J. Inf. Commun. Technol. Educ.	International Journal of Information and Communication Technology Education	6	0.25
Int. Rev. Res. Open Distrib. Learn.	International Review of Research in Open and Distributed Learning	7	-
J. Inf. Technol. Educ.-Res.	Journal of Information Technology Education-Research	6	0.79

Table 1. The list of top 9 most influential Journals in e-learning research

Because e-learning field is emerging, it is expected that that publication with specialist journals in the field will be relatively low. However, a large volume of research has been done in the field and sporadically distributed across several high indexed journals such as *British Journal of Educational Technology (h-index 87), International Journal of Information and Communication Technology Education (h-index 12), Educational Technology & Society (h-index 81),* etc.

Label	weight<Total link strength>	weight<Documents>	weight<Norm. citations>
British journal of educational technology	694	6	4
Computers & education	1146	7	7
Education and information technologies	864	14	10
Interactive learning environments	730	9	7
Interact. Technol. Smart Educ.	600	7	7
Int. J. Emerg. Technol. Learn.	385	11	11
Int. J. Inf. Commun. Technol. Educ.	102	6	6
Int. Rev. Res. Open Distrib. Learn.	451	5	5
Inf. Technol. Educ. Res.	548	6	6

Table 2. Bibliometric coupling between the most influential Journals in e-learning research (sourced: VOSviewer computations)

The bibliographic coupling between the most productive and influential journals in e-learning research (see fig 1 and Table 2) shows that *Educ. Inf. Technol* has the highest density in terms of the connection with other journals, as the journal with the highest links (14) to other papers, followed by *Int. J. Emerg. Technol. Learn* (11), then *Interactive learning environments (9)*. Despite the high score on the number of connections between *Education and information*

technologies and other Journals, the bibliometric coupling of Journals demonstrates that *Computers and education* recorded (1146) the highest links with other journals and (7) citation. *Int. J. Emerg. Technol. Learn* records the highest (11) total citations with only (385) links. Find the rest of the details of the VOSviewer computation output in table 2.
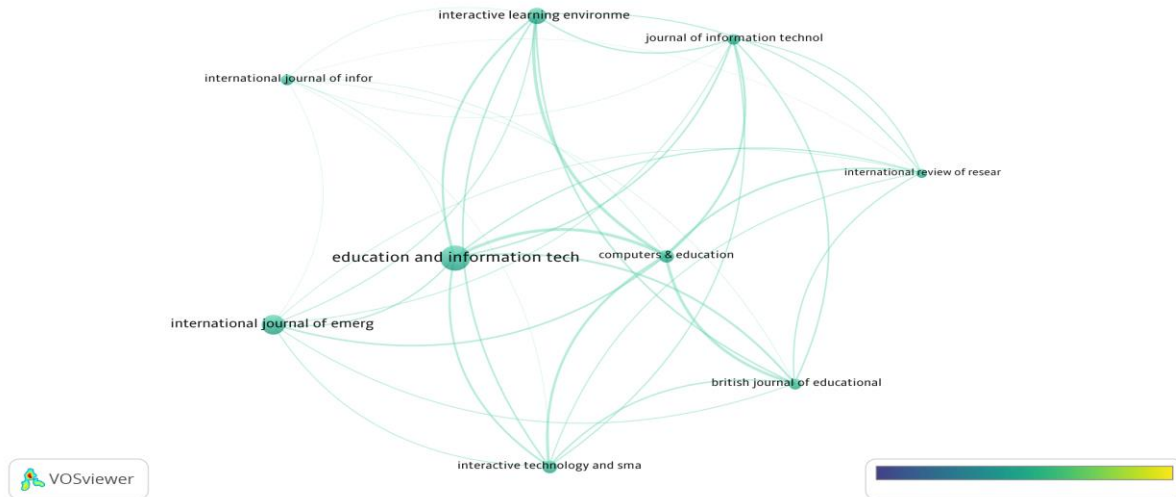

Fig. 1. Bibliographic coupling between the most influential journals in e-learning research

II. Publications over the years

Based on the data generated from the Web of Science database, we could find that e-learning research has been experiencing increasing research attraction during the period under observation. Although the year 2015 shows the lowest growth, 2016 on the other hand experiences a bigger jump. We continue to see such increasing trends over the year. There is an even bigger jump in the number of publications between 2018 and 2019.
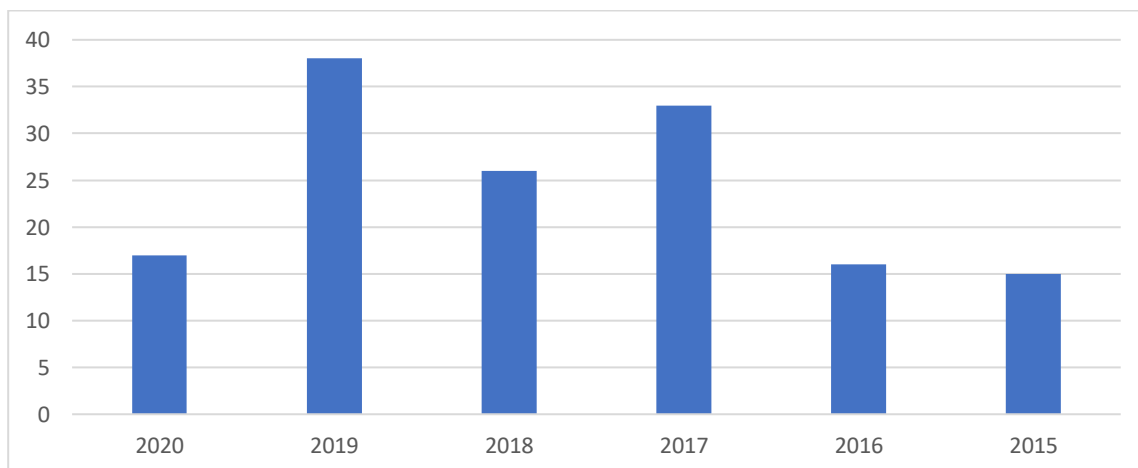

Fig. 2. Publication over the years

However, one would expect that the coronavirus crisis would increase research attention, once again, to e-learning, due to the lockdown and social distance measures adopted by education institutions around the world. This trajectory may change as we go towards the end of the year 2020 to account for the whole year, instead of January to August, as observed in this study.

III. Most influential authors (co-citation)

Fig. 3 shows the relationship between authors in e-learning research, where three clusters can be detected. This analysis shows that the two most cited authors, Venkatesh and Davis, are especially related because, they co-authored several papers, and share a common field of research: e-Services and technology adoption.
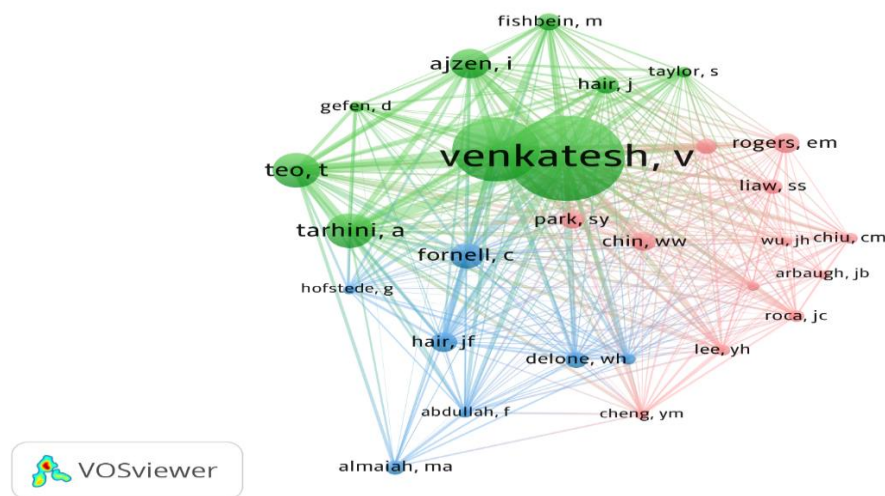

Fig.3. Co-citation of authors in e-learning research (minimum citation threshold of 20 and 100 links)

2. Content analysis

A. Opportunities for e-learning adoption (RQ.1)

Fig. 4 illustrates a word map associated with the benefits of e-learning innovation research. VOSviewer depicts the commonly used terms by researchers in e-learning studies according to four clusters: individual-user-related benefits (cultural integration, influence, performance, self-efficacy, and value); institutional level benefits (assessment purposes, blended learning, e-exam, service delivery quality), and general benefits (communication medium, innovation source, strategy, teaching, and trendy) are observed. We synthesized these findings, and summarized below:
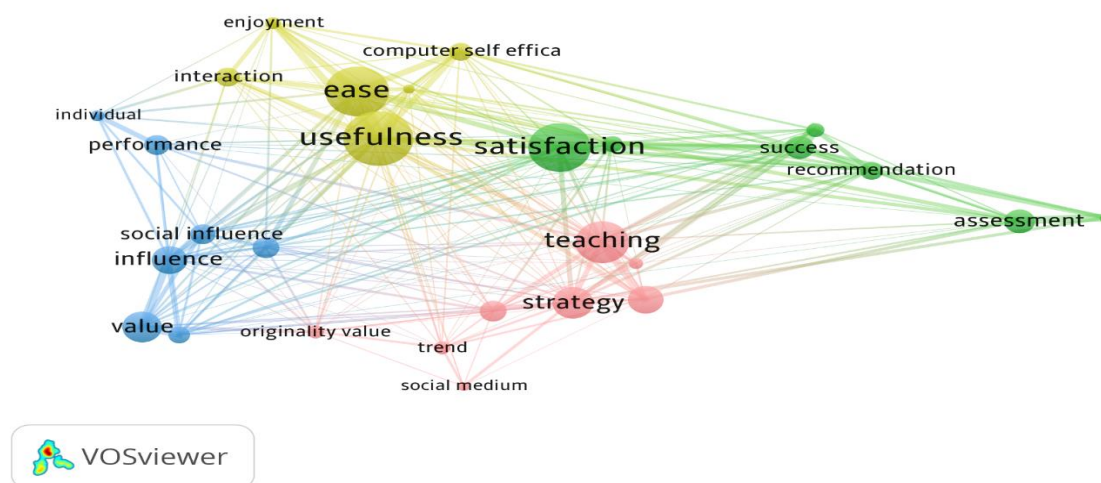
Fig.4. Keyword mapping associated with e-learning opportunities research
(minimum links threshold of 20 and 100 links).

I. Instructional design

Scholars found that e-learning facilitates pedagogical or curriculum design and delivery, in a manner most efficient than the traditional methods [29]. This practice allows instructors to easily design, modify, deliver, and share instructional contents with diverse stakeholders [13], [11], irrespective of their geographical location. Cantoni et al. [6] suggest that unlike the traditional classrooms, content design for e-learning classrooms must be explicit in the selection, sequencing and creation of learning experiences (pg. 337). Such practices could reinforce not only rational and analytic know-how but also engages students' creative abilities of the experience [6].

IT systems (e.g., Google Art Project, Software, Microsoft package) and sharing platforms (GoogleDrive, Dropbox, etc.) make curriculum planning and delivery easier. These facilities increase the quality, transparency of the learning process for students, instructors, administrators, and parents. Video, audio, and pictorial capabilities of e-learning allow for the creation of instructional materials, curriculum planning, and lesson deliver [1],[2],[13],[14]. Scholars find that these features of digital-based instructional design and teaching, encourage e-learning adoptions, and use among instructors and students (e.g., [1],[14],[30]).

II. Assessment and reports

The interactivity between instructors and students conducted via virtual learning is fundamental to feedback generation in e-learning environment [31],[32], [29]. According to Aldosemani [31], tests and general examinations can

be undertaken through e-learning, thus enabling a larger number of students than a traditional classroom. This opportunity makes exam and test supervision much more convenient, less crowded than the in-class method. E-learning ensures high flexibility of conducting tests for students and instructors [33]. However, Phutela and Dwivedi [32] and Sarrab [13], argue that the e-learning is an enabler of students' dishonesty and cheating in tests and examinations. The authors argue, that because e-learning assessments are often supervised by digital proxies, it is often difficult to control or regulate activities such as cheating behaviour such as piracy, plagiarism.

In many European universities, authorities leverage the capabilities of online learning management (Moodle), to generate students' performance reports (especially by parents) [6]. Students and parents can easily log in to the e-learning platform to monitor student's performance [29], thus reducing the high demand for physical report making, which is often tedious and cumbersome for instructors/administrators.

III. Communication and collaboration

Interaction between students and instructors and administrators is one of the salient contributions of e-learning systems. With little consideration for locations and time, students interact and collaborate on class projects, communicate with faculty members, and professors can collaborate on research activities [29], [7], [6], [34]. Tan [33] reports, that in Vietnam, e-learning adoption favours interaction between students and instructors, as an important source of learning and problem-solving. Kulshrestha and Kant [29] suggest that dissemination of classroom and college announcements are easy via e-learning systems. In Saudi, Aldosemani et al. [31] and Khlood [7] find that e-learning reduces face-to-face interaction between male and female students and instructors, thus reinforces virtual communication.

However, Cantoni et al. [6], argue that related technology may be intimidating, confusing or simply frustrating, lacking part of the informal social interaction and face-to-face contact of traditional classroom training. Scarab et al. [13] argue that m-learning environments breed a feeling of isolation, separation or of being out-of-the-loop among students, especially the younger students.

IV. Future Career Opportunities for instructors and students

Several scholars found that e-learning adoption in educational institutions provides enormous opportunities to students, instructors, and administrators (e.g., [6],[9], [7]). It reduces the trouble of distance travel for learning and education [32], [35], empower students to the knowledge of global issues and trends, increasing access to tertiary educations for students who are denied due to reasons such as

health, financial, cultural, etc. [7], [36], improve innovativeness [3], and global cultural immersion of students and instructors [2]. Such learning environments make it easier for instructors draw inspirations and examples from around the world.

Moreover, in Indian universities, Phutela and Dwivedi [32] report that e-learning carves students' career prospects in ICT, and help enhance computer skills and knowledge thus employing after graduation. For instructors/Professors, it stimulates teaching and research activities of instructors, especially where incentives are available for e-learning adoption (such as certificates, stipends, and acknowledgement of their accomplishments during the tenure and promotion process) [31], [6], [5].

V. Quality education

e-learning innovation enriches the learning experience of students, such that it allows for special demonstrations (e.g. a video tutorial, special training before the course), provide supplementary material (e.g. a digitized copy of the lecture) and customize learning modules [3], [31], [6]. It allows for easy and affordable access to an online library, e-books, journal articles, which are often difficult to access in traditional mode [11]. These facilities minimized the physical and cost barriers to traditional education [3], [8].

According to scholars (e.g., [30], [6]), e-learning modes orientate the instructional design and delivery of certain pedagogical courses, including STEM programs, enabling learning and teaching through the illustration of materials in varied forms, shapes, colours, dimensions, etc. Because e-learning mode enables the creation of different contents (e.g., images, sounds and text work together), it engages and stimulates students' learning process (games, quizzes, etc.) [6]. Due to these reasons, Universities adopt a blended learning approach, involving a mixture of both traditional and e-learning mode [2],[33],[31].

B. Challenges of adopting an e-learning innovation (RQ.2)

We focus on reviewing the key challenges of adopting and implementing e-learning innovation for academic and educational purposes, particularly from the literature on developing countries. Based on our review of the rich literature in the field, we categorized these challenges according to four basic dimensions (institutional, technology, environmental, and attitudinal, pedagogy, and interactive experience) that characterizes the challenges of e-learning success.

I. Technological factors

Technological factors are characterized by IT technology, its infrastructure, systems, and its components, that support the implementation of e-learning

systems [14],[37]. In our case, the IT technology includes both the actual software and hardware features that support the operation of an efficient e-learning project and ensure teaching and learning. Researchers have discussed some of the challenges of IT technologies in the adoption e-learning: for instance, organizational IT infrastructure [13],[6] and usability of application [14],[12],[8],[6]. In Ghana, researchers found that IT infrastructure, and ICT usability, inhibit the progress of e-library and e-learning performance [14], [11]. These technology dimensions of e-learning adoption enable the operationalization, without which the e-learning systems.

However, IT and its components are manufactured and imported to several countries in the developing continent. This may affect the systems requirement and usability of most e-learning projects in many developing countries.

II. Human resource factors

IT skills and experiences are fundamental enablers of digital-based e-learning innovation in education institutions. IT skills ranges from the E-learning expert [9],[8],[15] and IT awareness, and attitude of administrators and instructors, basic issues affecting e-learning success [8],[14],[11]. In Zambia and Ghana, researchers found that IT training activities for trainer Nurses and tutors, enable the integration of e-learning innovation success [38].

Bhuasiri and colleagues, examine the ICT expert and faculty readiness for e-learning success in several developing countries [9]. The authors report some basic issues affecting e-learning success: low technology awareness, uncooperative attitude towards e-learning, lack of basic knowledge and skills information technology, and institutional unwillingness for digitization [9].

To advance relevant IT skills necessary for effective e-learning success, educational institutions must provide more professional development training [5], enabling high familiarity of IT systems application of e-learning projects, to the instructors, students, and administrators. Such training must be done periodically to enable them to understand the emerging applications in the field.

III. Institutional factors

The institutional readiness for effective e-learning adoption has a strategic impact on the success of e-learning project [5]. Institutional readiness for e-learning adoption characterizes the strategic leadership, design of sustainable e-learning policy and incentive for ongoing capacity building for internal users.

Scholars found that in Ghana, the incongruency between e-learning activities with the institutional policy, inhibit the progress of e-library and e-learning performance [14], [11]. In similar studies, researchers found that institutional

readiness of an educational institution towards e-learning innovation, bolster the success of e-learning in various universities in Nigerian [12],[8], New Zealand [5], and Palestine [35].

Nicola [5] conceptualize the institutional perspective of e-learning diffusion, arguing that basic institutional alignment with the e-learning project is critical to the success of e-learning diffusion: aligning the activities of the department and the entire educational institutions, adoption of additional quality assurance criteria, for e-learning innovation, reducing a misfit between decision-makers' and academics' lack of ignorance, through continuous training. Under such an environment, a nation's e-learning policy could help to orientate the educational institution's e-learning programme and activities [35].

IV. Environmental factors

Environmental factors such as the availability of the nation's power/electricity supply, sound national e-learning policy, and the economic advantage of the nation, influence the degree of e-learning diffusion and success in many countries around the world. For example, the instability and crisis in several parts of the world such as Palestine, influence the supplies and use of IT systems for e-learning secondary schools [35]. The shortages of electricity in Nigeria, Uganda, and Ghana, and national internet connectivity, were reported to have negatively affected the success of many e-learning projects (e.g., [12],[14],[8],[9].

Other scholars reported the availability of educational partners, such as Charity and Non-governmental organizations, supporting the education programme in many countries [14],[39]. In that way, they finance educational IT projects, thereby increasing e-learning adoption in many schools and universities.

As a result, the cost of IT and its related systems, are found to be beyond the budget of many nations, thus limited the success of e-learning innovation. Due to the high cost of quality gadgets and IT systems, our markets are saturated with low quality IT and systems, thus inhibiting the quality of e-learning service delivery.

Many researchers that basic support to a nation's e-learning success is the presence of national IT policy for education and training [12], [35], [10], enabling the supply of power and thus attracting investment in the sector.

V. Pedagogical factors and Students' e-learning experience

The form and level of education and training determine the popularity of e-learning success. For example, most universities implement e-learning for subjects/courses in various fields of linguistics, social sciences, and creative and

performing Arts. These pedagogical areas rely on visuals and sounds which are conveniently conducted via e-learning [6].

However, the fields of Science, Technology, Engineering and Mathematics (STEM), are often limited in the e-learning practice, as supported by researchers [40]. The authors found that a significant number of students in the medical field did not adopt e-learning. Moreover, Cantone and colleagues found that instructional design for STEM field relies on not only the teacher's methodology, but also on the "creative abilities, and psychological sensitivity," which are also essential for creating an engaging e-learning course (p.337).

Aside from the strategic level, learners and students are important drivers of e-learning success [9],[35]. Thus, their perception, attitude, willingness to adapt, and IT skills set, of students are fundamental to the institution's e-learning innovation performance [6],[8],[41]. The study of Kasse and colleague suggest that IT and other digital technology skills, of students and instructors, account for the critical challenges of e-learning success in Ugandan Universities [8].

Bhuasiri and colleagues discussed learners' IT attitude challenges affecting the implementation of e-learning in many developing countries: low technology awareness and an attitude toward e-learning, and the absence of basic technology knowledge and skills [9].

VI. Design and interactivity of the e-learning system

Aside from the system usability, design of e-learning interface must advance user satisfaction [33]. Most e-platforms from the developing countries are less desirable, often non-responsive, and lacking relevant information content [37]. These challenges generate lack of trust among users, and dissatisfaction experience, particularly for students [35].

A recent study proposed that, in addition to text-based forms of interaction, designers of an e-learning project, should integrate graphical elements of e-learning interaction. This makes e-learning more interesting, and its adoption more rapid among students [32]. Applications placed in 2 or 3 dimensional (2D or 3D) contents offer students more interesting shapes, colours, dimension, and position [6]. These are in fact, very relevant in such fields of STEM, arts and architectural designs. Cantoni, and colleagues, explore the potentials of instructional design (ID) for e-learning, and the authors suggest ID should include visual learning aids, enabling learning through visual interactions (employing graphic representations, animation, and videos), and promote system design for other fields (such as linguistic, mathematics, musical) that may invoke students visual learning (e-learning designs to ensure those who learn best by seeing) auditory (for those that learn best by hearing) and kinesthetics (for those who learn

best by doing)[6]. Such facilities endear students' continuance intention to use, and spend the their time on e-learning systems [42].

V. CONCLUSION AND RECOMMENDATION

This study confirms the growing research attraction of e-learning innovation. Our results show that the field is emerging fast, as anticipated, due to the increasing proliferation of information and communication technologies. Our study contributes to the literature in e-learning by explicating some of the salient issues in e-learning research. The year 2019 shows the largest number of publications over the period. However, half a year into 2020 (August) shows that e-learning research has gained immense popularity, and this reason could be associated with the recent Coronavirus pandemic. The pandemic has intensified the adoption and diffusion of e-learning across educational institutions due to the social distancing and lockdown, as popular means of curbing the spread of the virus. Schools have resort to e-learning innovation for learning, teaching, and research collaboration.

Our results show three most influential journals in e-learning research during the period under review include, *Education and Information Technologies*, *International Journal of Emerging Technologies in Learning*, and *Interactive Learning Environments*. This result has been confirmed by the bibliometric coupling of most influential journals in the field of education research.

Moreover, the results of the co-citation by authors show that *Venkatesh* and *Davis* are the most influential scholars in the field of e-learning research. The authors have published numerous papers in the field. The two authors have collaborated in several research projects in e-services, IT and e-learning.

Results of the content analysis report that e-learning innovation offers enormous opportunities in educational institutions. Some of these opportunities include institutional design, involving the use of various IT systems (e.g., Google Art project, Google classroom) and sharing platforms (Google Drive, Dropbox, etc.). Students and instructors harness e-learning innovation for various purposes such as writing students' assessments and reports; quality education through a large variety of learning materials, communication and feedback purpose, and opportunities for skills development. Leveraging these benefits of e-learning innovation will advance the educational quality of traditional brick and mortar educational institutions towards more sustainable learning, teaching and research activities.

Despite the numerous benefits, our content review highlights some of the salient challenges confronting e-learning adoption and diffusion in educational institutions. For instance, technological factors, such as IT infrastructure; human factors (including IT skills, awareness among students and instructors),

institutional factors (poor state of institutions, lack of policy alignment with e-learning activities, etc.), environmental issues associated with political will for advancing the development of national IT policy, and related infrastructure, and challenges of systems design, affecting IT interactivity and instructional design. To advance the e-learning diffusion, policymakers must minimize the effects of these challenges in educational institutions.

However, we have discovered that there is a high paucity of studies in several areas that require future research attention: the e-learning curriculum design or instructional development, as suggested by others (e.g., [9],[6]). Moreover, Cha and others found that instructor characteristic influences students' intention to adopt e-learning in South Korea [43]. Thus, we are concern that incentive for instructors' use, and e-learning skills, should be examined in future research. Also, a theme that requires future research is managing students' digital interaction, as suggested by others (e.g.,[13]). To further advance research in the field of e-learning, we proposed that integrated criteria for measuring e-learning performance would be an interesting research finding in the field.

We have proposed some managerial implications for managing e-learning projects: Just like in many parts of Europe, which are following more robust paths, educational institutions must engage relevant stakeholders, involving regional, and central government, student parents/guardians, and investors. These partnerships will reinforce the growth and development of e-learning projects. Second, institutions and ministries responsible for training and curriculum quality must design integrated national e-learning ID, thus enabling a more unified approach in integrating and adopting e-learning, as a mandatory requirement in schools. This would also ensure that special emphasis is made on "creative and immersive approaches to learning"[6]. At the institutional levels of universities and schools, strategic policy alignment with e-learning activities, periodic professional training of instructors, students and administrators, would inspire the e-learning intention and use.

Based on the nature of the review papers, our findings are mainly limited, and thus more robust empirical studies, are required to substantiate our claims.

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