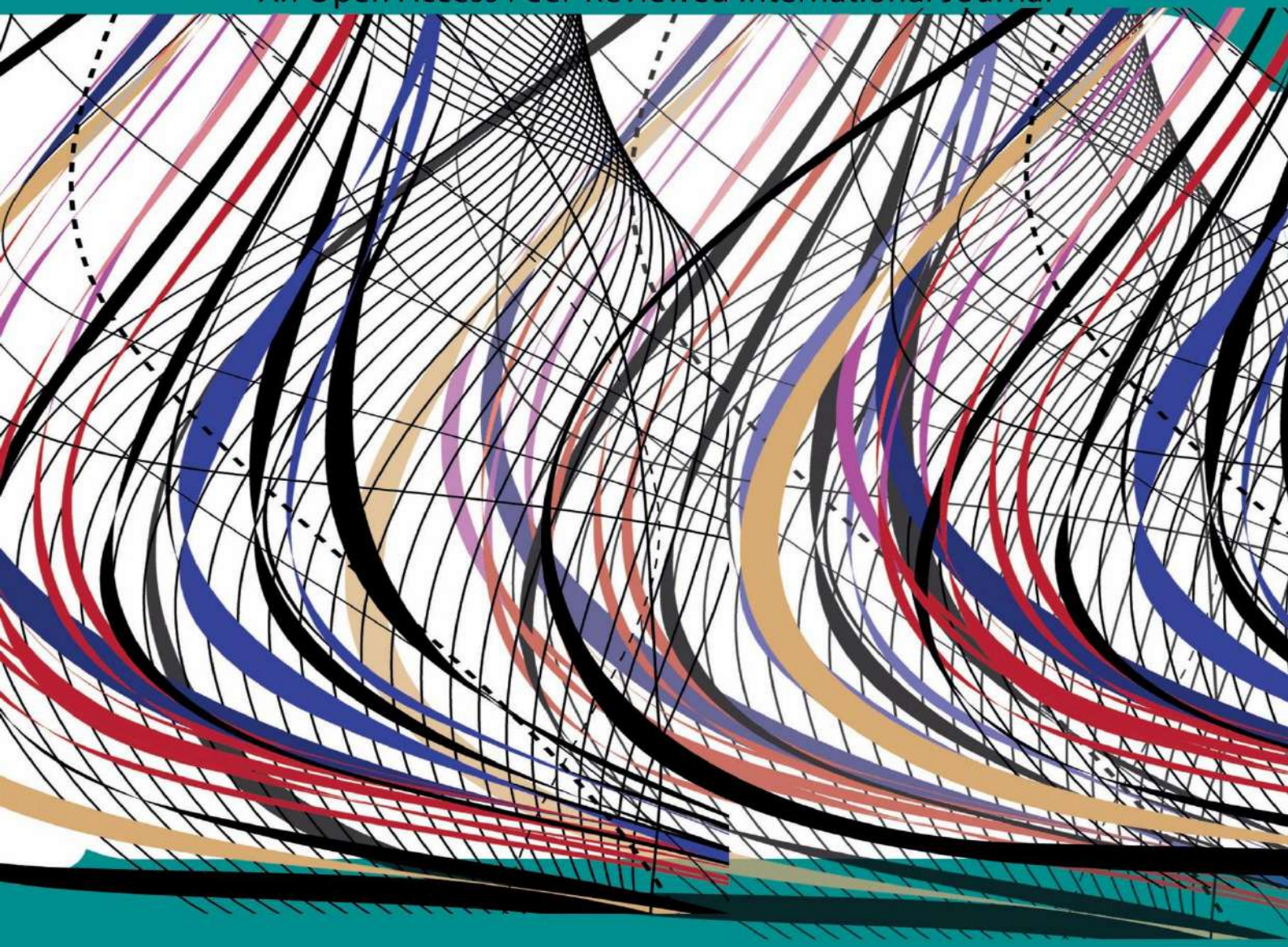
ISSN : 2454-1311

International Journal of Advanced Engineering, Management and Science

Journal CrossRef DOI: 10.22161/ijaems

(IJAEMS)

An Open Access Peer-Reviewed International Journal



Vol-9, Issue-3 | Mar 2023

Issue DOI: 10.22161/ijaems.93

INFOGAIN PUBLICATION

https://www.ijaems.com/ | editor@ijaems.com

International Journal of Advanced Engineering, Management and Science

(ISSN: 2454-1311)

DOI: 10.22161/ijaems

Vol-9, Issue-3

March, 2023

Publisher

Infogain Publication

Email: ijaems.editor@gmail.com ; editor@ijaems.com

Web: www.ijaems.com

Editorial Board/ Reviewer Board

Vol-9, Issue-3, March, 2023

(DOI: 10.22161/ijaems.93)

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-3; Mar, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.93.1

A Survey on Decentralized e-health record with health insurance synchronization

Praveenkumar P, Shre Aurobind Raam T, Vignesh Vaithialingam N, Mahavarun M

Assistant Professor, Sri Manakula Vinayagar Engineering College, Puducherry, India

Received: 03 Feb 2023; Received in revised form: 24 Feb 2023; Accepted: 03 Mar 2023; Available online: 10 Mar 2023

Abstract**—** *In the medical field, electronic health records (EHR) serve a critical function that benefits both healthcare providers and patients. Many cloud-based solutions for medical record exchange have been offered, but the credibility of a third-party cloud service is questioned due to the centralized approach. As a result, a decentralized blockchain system for sharing electronic health records has been established that does not rely on third-party services. Existing services, on the other hand, exclusively collect data from medical tests. They are ineffective at sharing data streams that are continuously created by various sorts of devices. The information gathered is shared with laboratories and medical institutions for future research. Furthermore, current techniques are too rigid to accommodate metadata modification effectively. Decenrod proposes a medical data-sharing scheme that combines blockchain, electronic health records, and a structured peer-to-peer network based on InterPlanetary File System (IPFS) techniques to address the above efficiency issues in existing medical data-sharing and storage services. A session-based healthcare data-sharing strategy has been designed, according to Decenrod, which allows for more flexibility in data sharing. According to the evaluation results, Decenrod can improve efficiency and meet security criteria in data exchange by implementing Decentralized EHR. The information gathered is shared with laboratories and medical institutions for future research.*

Keywords**— health insurance system, e-health,**

I. INTRODUCTION

Blockchain technology could rehabilitate the electronic health record (EHR) by increasing the efficiency, security, and privacy of EHR sharing platforms over a peer-to-peer network. Traditional security is centralized, whereas blockchain is a decentralized database. The limitations and complexity faced by the centralized database approach are overcome by using the decentralized database approach. By using the decentralized database approach, we are introducing the health insurance concept along with this technique.

The data stored in the decentralized blocks of the blockchain remains more secure, and no unauthorized users can access the data without the knowledge and authentication given by the client. All the data stored in the node can be used by other nodes, so if any one node of the network chain is corrupted or any error occurs in the node, that particular node alone becomes dysfunctional; hence, with the help of the remaining nodes, we can retrieve the data and make the network chain efficient. The client can access their stored medical records from anywhere at any time using this type of EHR (Electronic Health Record), and they can also grant authentication (permission) to whomever they want to see their records.

A centralized electronic health record system is a core system emanating across developed countries to help improve health systems and better deliver health care. Apparently, its introduction is somewhat limited to very few parts of the world; however, its full potential has yet to be maximized due to the reluctance of many nations to consider it. Furthermore, this article emphasizes the critical role of centralized health systems in overcoming inefficient health care systems, highlighting the challenges faced by nations with the lowest Human Development Index, and discusses why employing these systems is critical for achieving an optimized health care system that will be well-

equipped to stop any potential outbreak from spreading even before it begins.

Due to numerous data breaches caused by the centralized EHR, health data management and security have become increasingly crucial. EHR is not tamper-proof because it is centralized. This will influence patients in a variety of ways, including their trust in the organization's ability to protect their health information. Human trafficking is common these days, especially for rare blood groups and organs. This occurs as a result of a data breach in hospital patient medical records.

To prevent tampering, i.e., in order to secure the information that has already been stored, the user handles grant and revocation concepts. Key generation processes employ advanced cryptography techniques. Point-of-care genomics management is a concept used for identifying genetic diseases. So we use the InterPlanetary File System (IPFS), which is a distributed file system protocol and peer-to-peer network for storing and distributing data. Each file in IPFS is uniquely identified using content addressing in a global namespace that connects all computing devices. Medical professionals would be able to control the flow of data from a single, dependable platform with blockchain-based electronic health records. Blockchain solves the interoperability problem by allowing healthcare providers to store data in a single location that can be distributed to all network nodes.

II. LITERATURE SURVEY

Blockchain technology was designed by A. A. Mamun, S. Azam, and C. Gritti [1]. The core idea was to create a decentralized currency that was cryptographically secure and beneficial for financial transactions. This blockchain concept was eventually used in a variety of other fields, including the healthcare sector. A number of researchers have conducted research in this area; these studies focus on whether the idea of using blockchain in the healthcare sector is feasible or not. They also identify the advantages, threats, problems, and challenges associated with the usage of this technology. Some researchers have addressed the difficulties of really putting this into practice on a larger scale.

Gordon and Catalini [9] conducted a study that emphasized the ways in which blockchain technology might benefit the healthcare industry. They identified that the healthcare sector is controlled by hospitals, pharmaceutical companies, and other involved third parties. According to them, the purpose of using blockchains in healthcare is data sharing. This study also identified four factors or approaches due to which the healthcare sector needs to transform for the use of blockchain technology. These include ways for dealing with digital access rights, data availability, and faster access to clinical records and patient identity. Additionally, it involves both on-chain and off-chain data storage. The study also included the challenges or barriers faced by the usage of blockchain technology: huge volumes of clinical records, security, privacy, and patient engagement.

M. Hochman [10] conducted a study to understand possible approaches to solving the scalability problem of blockchain and to identify projects that intend to solve this problem. Blockchain is described as the combination of different computational and economic principles built on a peer-to-peer network. Finding out which data should be saved on-chain and which can be stored off-chain was the goal of this study. This study presented five patterns for off-chain storage of data and also included the basic ideas and implementation framework of these patterns. On-chain data is saved on the blockchain by carrying out transactions on it, according to the authors. In order to store data off-chain, it must be done on a different storage medium and not involve any transactions.

Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang [11] presented an overview of blockchain technology, bitcoin, and Ethereum. The authors define that the information technology landscape is constantly changing and that blockchain technology is benefiting information systems. They described bitcoin as a decentralized peer-to-peer network utilized for bitcoin transactions. They also defined the proof-of-work consensus algorithm along with the mining of the blockchain concept. The authors emphasize the fact that scalability is a severe problem faced by blockchain and that certain solutions are proposed for the solution of scalability problems, including SegWit and Lightning, Bitcoin Cash, and Bitcoin Gold. The paper also explained Ethereum and its dependencies and differentiated the Ethereum blockchain from the Bitcoin blockchain.

T.-T. Kuo, H.-E. Kim, and L. Ohno-Machado [12] conducted a study that focused on smart contracts and their application in blockchain technology. They first introduce smart contracts, their working framework, operating systems, and other important concepts attached to them. The authors also discuss how smart contracts could be used for the new concept of parallel blockchains. They identify that the reason for using smart contracts in the blockchain is due to the decentralization that is offered through the programming language code written in them. After introducing the basics of smart contracts, the author explained the various layers of blockchain that combine to keep the system functioning. These layers are the data, network, consensus, incentive, contract, and application layers. The paper not only discusses the architecture and

framework that smart contracts use, but it also discusses their applications and challenges. The paper also discusses an important future trend of parallel blockchains, which intends to create a blockchain that can optimise two different but important modules.

J. eAmer. [13] conducted a review that discussed several applications of blockchain in the biomedical and healthcare sectors. The authors identified that using blockchains for this domain offers many advantages, and some of these are decentralization, persistence of clinical or medical records, data pedigree, continuous accessibility to data, and secure information being accessible to biomedical or healthcare stakeholders. The authors identified the limitations of blockchain technology as confidentiality, speed, scalability, and the threat of malicious attack; i.e., these limitations are critical for the healthcare or biomedical sector because they are used to store sensitive medical or clinical records. The authors proposed a solution to these issues: store sensitive medical data off-chain and encrypt the data to ensure its security.

A. Azaria et al. [14] have proposed a scalable blockchain framework leveraging the Hadoop database. They suggested combining the decentralization offered by blockchain technology with the scalability offered by the underlying Hadoop database to address the scalability issue with blockchain. In order to increase the scalability of the blockchain technology, they used a mechanism to store blocks on the Hadoop database. All blockchain dependencies are included in the blockchain built on top of this framework. In order to address the scalability issue of blockchain systems, this study proposes the use of the Hadoop database system in conjunction with SHA-256 for hashing used for transactions and blocks. The results of this study helped us understand how blockchain can be utilized in conjunction with other scalable platforms to enhance or address this platform's scalability.

L. A. Linn et al. [15] presented a scalable remedy for the blockchain's use in clinical records. Designing an architecture that meets the Office of National Coordinator for Health Information Technology (ONC) criteria was the main goal of this study. This study determined the main challenges this technology faces, including worries about privacy, blockchain security, scalability issues related to the massive volume of datasets being transmitted on this platform, and lastly, the absence of a globally enforced standard for data exchange on blockchain. This study also features a demonstration of a decentralized application (DAPP) built on a design developed in accordance with the previously specified ONC specifications. The lessons learned and suggestions for enhancing the FHIR chain were also included.

Kunal Dhariwal. [16], proposed a system for the management of medical questionnaires, and therefore the aim of this system is knowledge sharing through blockchain technology. The authors justify their decision to store and share knowledge via medical questionnaires by stating that this knowledge will be used for additional medical and clinical analysis functions. They emphasized that it could be useful in developing diagnostic systems; partitioning terminologies used in EHR systems; and security issues associated with these systems were also reasons why the authors chose blockchain technology for their planned framework. This study contains two main functions, i.e., to create, store, and share the knowledge gathered by questionnaires. Another profit planned by the system is the validation of the form being submitted. The forms that are additional to this system are initially valid because they are in the right fixed format, then they are parsed to differentiate the private knowledge and specific knowledge associated with questionnaire results. This ensures that knowledge can be shared for future analysis functions. The authors also address the situation when a third party requests access to this type of knowledge; this would require the patient's permission, which is requested by the doctor, to allow the third party to read that knowledge.

A. A. Vazirani [18] conducted a review that included several uses of blockchain in the biomedical and healthcare industries. The decentralization, durability of clinical or medical records, data pedigree, ongoing access to data, and last but not least, safe information being accessible to biomedical or healthcare stakeholders, are some of the benefits the authors identified with employing blockchains for this sector. The speed, scalability, potential of malicious attacks, and threat of a 51 percent attack were mentioned as the blockchain technology's limits. These restrictions were deemed crucial by the authors for the healthcare or biomedical industries because they are being used to keep private medical or clinical records. Authors offered data encryption as a remedy to these issues, recommending off-chain storage of private medical information.

III. CONCLUSION

In conclusion, blockchain technology is advantageous in a range of social insurance scenarios, such as those involving critical attention, restorative data inquiry, and associated wellness. We discussed how maintaining a permanent, straightforward document that captures every event that occurred while using the device could enhance and motivate the management of remedial records. Medical scans offer useful information from which valuable inferences can be drawn, resulting in the provision of valuable findings. By using time-based smart contracts to manage transactions

and enforcing acceptable usage restrictions, the medical chain maintains privacy by keeping track of the calculations made on EMRs. The integrity of data is ensured by the use of hashing algorithms. Access control and security are maintained by the deployment of advanced encryption. By implementing cutting-edge encryption and authentication methods across the blockchain, security and access control are maintained. Comprehensive logging is used to enable interoperability, auditability, and accessibility. Our plan is independent of any one system, and its modifications might be able to work with other, comparable systems that allow numerous users to access electronic records. Since medical records are the patients' property rather than a coin or digital currency that can be sold, this study proposes a novel incentive mechanism in conjunction with the POA for mining. It makes use of the importance or extent to which providers are contributing to the upkeep of patient files and the construction of new blocks. Since the majority of current healthcare providers are welfare-oriented and do not intend to include any monetary value, our mechanism rewards the "block's creator" with an incentive to be added to its degree, thereby lowering the likelihood that it will create the next block instead of just producing digital money. Consequently, achieving equity and justice among providers and maintaining the system's sustainability Results show how effectively our proposal handles a big dataset with low latency.

REFERENCES

[1] A. A. Mamun, S. Azam and C. Gritti, “Blockchain-Based Electronic Health Records Management: A Comprehensive Review and Future Research Direction," in IEEE Access, vol. 10, pp. 5768-5789, 2022, doi: 10.1109/ACCESS.2022.3141079

[2] Vardhini B,Shreyas N Dass,Sahana R,R. Chinnaiyan, “A Blockchain based Electronic Medical Health Records Framework using Smart Contracts “ .Jan.2021, Gaganjeet Singh Reen , Manasi Mohanda, S.Venkatesan, "Decentralized Patient Centric e- Health Record Management System using Blockchain and IPFS," 2019 IEEE Conference on Information and Communication Technology, 2019, pp. 1-7, doi: 10.1109/CICT48419.2019.9066212.

[3] G. Jetley and H. Zhang , “Electronic health records in IS research: Quality issues, essential thresholds and remedial actions,’’ Decis. Support Syst., vol. 126, pp. 113–137, Nov. 2019.

[4] Ayesha Shahnaz , Usman Qamar, Ayesha Khalid "Using Blockchain for Electronic Health Records," in IEEE Access, vol. 7, pp. 147782-147795, 2019, doi: 10.1109/ACCESS.2019.2946373.

[5] W. W. Koczkodaj, M. Mazurek, D. Strzałka, ‘‘Electronic health record breaches as social indicators,’’ Social Indicators Res., vol. 141, no. 2, pp. 861–871, Jan. 2019.

[6] A. A. Siyal, A. Z. Junejo, M. Zawish, K. Ahmed, A. Khalil, and G. Soursou, ‘‘Applications of blockchain technology in medicine and healthcare: Challenges and future perspectives,’’Cryptography, vol. 3, no. 1, p. 3, Jan. 2019

[7] C. Pirtle and J. Ehrenfeld, ‘‘Blockchain for healthcare: The next generation of medical records?’’ J. Med. Syst., vol. 42, no. 9, p. 172, Sep. 2018.

[8] P. Zhang, J. White, D. C. Schmidt, G. Lenz, and S. T. Rosenbloom, ‘‘FHIR Chain: Applying blockchain to securely and scalably share clinical data,’’ Comput. Struct. Biotechnol. J., vol. 16, pp. 267–278, Jul. 2018.

[9] W. J. Gordon and C. Catalini, ‘‘Blockchain technology for healthcare: Facilitating the transition to patient-driven interoperability,’’ Comput. Struct. Biotechnol. J., vol. 16, pp. 224–230, Jan. 2018.

[10] M. Hochman, ‘‘Electronic health records: A ‘‘Quadruple win,’’ a ‘‘quadruple failure,’’ or simply time for a reboot?’’ J. Gen. Int. Med., vol. 33, no. 4, pp. 397–399, Apr. 2018.

[11] Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, ‘‘An overview of blockchain technology: Architecture, consensus, and future trends,’’ in Proc. IEEE Int. Congr. Big Data (BigData Congr.), Jun. 2017, pp. 557–564

[12] T.-T. Kuo, H.-E. Kim, and L. Ohno-Machado, ‘‘Blockchain distributed ledger technologies for

[13] biomedical and health care applications,’’ J. eAmer. Med. Inform. Assoc., vol. 24, no. 6, pp. 1211–1220, 2017.

[14] A. Azaria et al, ”MedRec: Using Blockchain for Medical Data Access and Permission Management,” Open and Big Data (OBD) International Conference on, pp. 25-30, 2016

[15] L. A. Linn et al, ”Blockchain for health data and its potential use in health it and health care related research”, ONC/NIST Use of Blockchain for Healthcare and Research Workshop, Gaithersburg, MD, USA:ONC/NIST, 2016

[16] Kunal Dhariwal, Blockchain Consensus Mechanisms. https://medium.com/datadriveninvestor/blockchain-consensusmechanisms-7aa0176d488a

[17] S. Nakamoto, ‘‘Bitcoin: A peer-to-peer electronic cash system,’’ Decentralized Bus. Rev., 2008, Art. no. 21260.

[18] A. A. Vazirani, O. O’Donoghue, D. Brindley, and E. Meinert, ‘‘Implementing blockchains for efficient health care: Systematic review,’’ J. Med use.

INFOGAIN PUBLICATION

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-3; Mar, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.93.2

Artificial Intelligence Tutelage System

Dr. S. Balaji, Kumanan, Irfan Ahamed, Piraisanthan

Department of Information Technology, Sri Manakula Vinayagar Engineering College, Madagaidipet, Puducherry, India

Received: 16 Feb 2023; Received in revised form: 08 Mar 2023; Accepted: 15 Mar 2023; Available online: 22 Mar 2023

Abstract— *E-learning, often known as "online learning," "virtual learning," "remote learning," and other similar terms, is an alternative to traditional classroom instruction. "Distance education," "digital learning," or "mobile learning." E-learning involves using several distinct technologies, including the web, open broadcast, loop, cable, microwave, broadband lines, fibre optics, satellite, wireless communications equipment, audio/video conferencing, and others, for one-way or two-way transmission. To improve educational knowledge, e-learning makes use of interactive technology and communication infrastructure. It has the ability to change how we typically teach and learn across the board. It will improve standards and increase long-term learning involvement. Although it cannot completely replace teachers and lecturers, it will improve the quality and scope of their instruction and reduce the time spent on administration. Each learner will be changed to reach his or her full potential, and it will make it easier to give an academic force the freedom to change. It makes a very ambitious educational system for an emerging learning society feasible. As demand grows, there is a need to standardise the E-learning system and to use new technologies to raise the standard of the current system. Despite the fact that many corporations and academic institutions have previously adopted various standards, there are still certain issues with these standards' benefits and drawbacks that must be addressed by incorporating new technical standards into the current norms to improve their usability and systematicity*

Keywords— ***intelligent recommendation, online education, learning standards, technology-enhanced learning procedure, Meeting , Attedence , Presentations***

I. INTRODUCTION

Teachers can connect their students to a variety of applications and tools, enabling students to be creative in how they demonstrate their knowledge of standards. A student might react to an assignment, for instance, by uploading a video recording, snapping a photo of their original artwork, or sharing a document that they collaborated on with classmates. The cloud gives students the chance to express themselves and make choices about how to exhibit their learning, and it gives them access to a variety of technological tools for doing so. Teachers and students can tailor coursework through the cloud to each student's unique needs. The 21st-century classroom requires more flexibility in terms of design and layout, much as technology is influencing and reshaping future occupations. The education system based on AI uses technology to enhance and augment the learning experience for students. This can include using chatbots for personalized tutoring, using machine learning algorithms to personalize lesson plans and curriculum, and using virtual and augmented reality for immersive learning experiences. Additionally, AI can be used for tasks such as grading assignments, providing feedback, and tracking student progress. The goal of an AI-based education system is to provide a more efficient and personalized learning experience for students.

E-learning, also referred to as electronic learning, is one of the most important aspects of the modern world. Any learning or teaching method made possible by technology is referred to as e-learning. Knowledge and communication systems use specialised media to carry out academic activities, whether or not networked learning is utilised. The phrase is likely to be used to describe both outside-of-classroom and inside-classroom educational experiences using technology as long as curriculum and device developments continue. The use of a computer and a network to impart knowledge and skills is known as e-

learning. E-learning tools and procedures include web-based learning, computer-based learning, virtual learning possibilities, and online collaboration. Content can be found on the Internet, intranet/extranet, audio or video cassette, satellite television, and CD-ROM. It combines text, image, animation, streaming video, and audio with other content and can be taken at your own leisure or under the guidance of an instructor. The demand for e-learning has been rising daily as a result of its flexibility. Due to their independence from place and time, e-learning systems are gaining popularity among academics and students alike. This independence allows for greater learning flexibility. The Internet is used to implement the majority of e-learning systems. Due to rising need to improve the quality of current systems, the e learning system needs to be standardized . Consequently, the goal of this e-learning platform is to educate pupils by way of this website.

II. RELATED WORKS:

Author	**year**	**Technique/ Models**
Qingsong Tu, Jian Liu	2013	Adaptive recommendation-based system for online education. This system may change the tudy strategies based on the learner's learning environment It increases the efficiency of the online learning process.
Haibo Yi, Zhe Nie	2017	A learning platform for college students to learn programming stuffs
Radhika Garg(SUSIMS)	2018	Attendance module, Placement module, Alumni Association module and many more
John thuku	2019	Class presentation, group activities, topic scheduling ,online tutorials etc..
Bo-wang	2019	School information system to connect various schools world wide
Zhang yan	2020	Reviews, project Module ,project handlings ,submission report management
Rohini.S.Choudhari Pratiksha Dehanikar Priya Jumle, Ranjana Kawle and Kajal Patel	2021	Create /join meeting with setting passwords Screen sharing /whiteboard Screen recording Upload view edit Documents Present video lecutures
Dimple Patil, Siddhi Rane, Vanshika Waghela, Sandeep Mishra	2022	Learnoative button must be clicked in order to register as an instructor. The instructor can also create courses, plan lectures or lessons, and add resources for particular courses. Additionally, the choice to charge for a course is up to the instructor. Enrolled students will have access to the lectures and resources that the instructor has posted for these courses. Students will also rate instructors.

III. LITERATURE SURVEY:

The majority of the papers examined are intensely focused on the efficiency and the effect that e-learning resources are having on the brains of the current generation. While some publications even touched on additional issues, such as what precisely is killing people's interest in studying something online.

3.1 Author :HAIBO YI, ZHE NIE describe A learning management system for college students is now required as the usage of the Internet, computers, and mobile devices grows. As a result, we create a productive learning management system for learning programming that is based on cloud computing and may enhance student learning and interaction. We categorise the learning management system into three platforms: SaaS (software as a service), PaaS (platform as a service), and IaaS (in the cloud). For learning programming, a SaaS learning platform offers lesson systems, learning systems, examination systems, document systems, forum systems, and programming systems. For learning programming, the PaaS learning platform offers Visual Studio 2015 Community, C-free, Eclipse, SQL Server, Oracle, IIS, and Apache. An IaaS learning platform offers network, computation, and storage infrastructure for learning programming. Using Microsoft ASP.Net (version 4.0) and SQL Server, we implement our designs on the OpenStack cloud computing platform (version 2008). The

experimental findings demonstrate the high efficiency of the learning management system based on cloud computing for programming learning, which offers learning services on SaaS, PaaS, and IaaS platforms for students majoring in computers.

3.2 Author: QINGSONG TU, JIAN LIU said that information age has swept the globe, altered human society's way of life and thinking, and provided a strong technological foundation for the revolution and advancement of traditional education. The Internet and education work together to produce the education system of the future as two significant drivers of social economic progress. Through thousands of emails, online education links teachers and students and facilitates face-to-face interaction. This transforms education significantly and introduces new concepts for teaching and learning. Online learning thus emerges as a new trend in educational advancement that many nations have already begun to closely monitor. The current online education system's content is basically disorganised by educational materials, without taking the learner's personal character, needs, or habits into account. Instead of automatically adjusting to the student and not being developed in accordance with the learner's law, they always demand that the learner adapt themselves. As a result, issues like inefficiency and a lack of adaptation constantly exist. The AOES can track each learner's learning progress and capture pertinent data in order to create the user study file. The learner's studying effect and initiative can be greatly enhanced by the system's ability to dynamically deliver studying suggestions for them based on their study files.

3.3 Author: JOHN THUKU said that For a long time tutorials has been known to enhance student participation in learning and often learning institutions have used them to improve student's learning experience. However, in the recent past, there has been a gradual decline in use of group tutorials discussions due large classes a lecturer is expected to teach. With the advent of emerging technologies such as cloud computing there is need to rethinking about how tutorials can be conducted in order to retain its benefits. This paper reports on an online tutorial management system (Tutmas) developed to improve the management of tutorials. It is based on research conducted at Kenyatta University where respondents were identified through snowballing. Data was collected through questionnaires, interviews and observations then Agile Software Development approach was used to develop the platform. Tutmas is a platform that provides lecturers with a forum to setup classes, add tutorial questions or topics, schedule class presentations, monitor group activities and assess the performance of individual groups. On the other hand, students are able to enrol in tutorial groups, indentify questions to write on, collaborate in writing the paper, upload and share the final papers to class members.

3.4 Author: ZHANG YAN describes ,based on the theory of software engineering, this paper designs a university research project management system based on cloud platform. The system includes project application and review module, project opening management module, project progress management module, project completion management module and project research results display module, which realizes the distributed submission of project declaration, opening report, progress report and conclusion report, and network review. The system has the characteristics of electronic materials, uninterrupted service, office network, automatic results, and feedback zero distance. It effectively solves the problem of declaration review and process management of university research projects, improves project management efficiency, and saves the working hours of project management personnel, review experts and teachers, promotes the university research results and realizes the information of university research project management.

3.5 Author: BO-WANG describes that We propose a simple cloud-based School Information System to connect branches of schools round the globe including rural, remote areas branches and metropolitan area branches. The connection and communication problem arises between remote areas and metropolitan areas with the head office for sharing of resources including information. This is because of lack of IT services deployment in such areas. We have designed a cloud-based application to manage school information including branches on cloud. The information system is to be controlled and managed centrally and all branches of school can use that information. The client application will be installed in the client computers at school branches. The branches may be in remote rural areas or in more developed metropolitan areas.

3.6 Authors:Rohini. S. Choudhari Pratiksha Dehanikar Priya Jumle, Ranjana Kawle and Kajal Patel they explains the design of an online learning web application that gives teachers and students a venue for structured interaction. This app is primarily made for organisations that want to conduct their own virtual learning and engagement activities outside of the traditional classroom setting. The goal of this software is to have everything in one location, allowing professors to efficiently teach students through content management so that students can readily access the study material without having to hassle with gathering it from other platforms. It gives users access to cutting-edge technologies for evaluating their students' progress using a range of evaluation tools. As an illustration, engage students in debate via video conferencing and quizzes. Their objective is to provide 1. Better communication between

student and teachers. 2. Prevent scattered data and resources provided by faculty. 3. For providing better and well organised content management

3.7 Author: Radhika Garg, SUSIMS is the most advanced, creative, and reliable solution for a university. Many tasks are conducted manually in the college data management systems that are currently in place. These are all time- and money-consuming, paper-based tasks. Different departments tackle different tasks. Due to this, it becomes extremely difficult to link data together and prevent duplication. Therefore, getting information from management becomes a very challenging and drawn-out procedure for students. All of these tasks have a better, paperless, time- and money-saving solution described in the proposed system. With the newest technologies, the globe is going toward cloud computing in the twenty-first century. SUSIMS is a complete information management system based on cloud computing. It integrates these processes onto smartphones with an easy-to-use interface and covers all the smallest details of a university's work flow. It comprises each and every significant module, such as the modules on attendance, placement, alumni associations, and many more. Redundant data is not present because all units are interconnected.

3.8 Authors: Dimple Patil Siddhi Rane Vanshika Waghela Sandeep Mishra .They created an application where a user will choose whether to register as a student or instructor as soon as they access our site. The login button must be clicked by the user in order to register as a student, and the InvisionLearnoative button must be clicked in order to register as an instructor. The passwords are hashed for security purposes before being stored with the rest of the registration data in MongoDB. The instructor can also create courses, plan lectures or lessons, and add resources for particular courses. Additionally, the choice to charge for a course is up to the instructor. Enrolled students will have access to the lectures and resources that the instructor has posted for these courses. Students will also rate instructors. Students and instructors can get in touch with us through the contact us page if they have any questions about the website or problems accessing a particular course. The administrator may therefore see the query in MongoDB and respond to it.

IV. PROBLEM STATEMENT

The inability to continue working during the lockdown time forced many universities/schools and every other department to abruptly switch to a digital work environment. Nobody anticipated it and it was unfamiliar to everyone at first; nevertheless, now it has become the new normal in people's life. The reach of digital learning increased the difficulties for organisations and developers in creating platforms that are safe for users and easy to use. The question of how a student will experience a virtual classroom environment is raised. However, a lot of businesses are now developing a solution for this issue. Through video conferencing tools like Google Meet, Google Classroom, and Zoom, universities and schools have been attempting to arrange and organise their lessons online. Forcing pupils to compile study notes and manage them has been a burden. The issue is that we must use many platforms for various purposes, none of which can be altered to suit our needs. It gets very monotonous to listen to online classes. Additionally, searching online does not yield information that is clear. that causes the delivery of study material to students to be random. It is also challenging to administer objective assessments to differentiate between students' levels, which calls for studying, identifying flaws, and attempting to remedy them. Working parents find it challenging to keep an eye on their kids. The current educational system is unable to meet the demands of a diverse education. excessive academic pressure There isn't a system in place to track students' development or present material that is catered to their interests. inadequate teacher-to-student ratio. Ads and objectionable content for youngsters are displayed in gaming applications. Due to COVID, children's motivation in learning new things has decreased, and there is no effective way to instruct the student. The current educational system requires a lot of labour from teachers. The maintenance and management of schools become tremendous jobs. Before grading the students' tasks, the schedule will be changed, the response papers will be edited, and the students will be given the necessary books.

V. CONCLUSION

We conducted surveys and research on a range of technologies that can be used for improved interactivity and app development efficiency. used them to analyse several learning management systems and other video conferencing tools like zoom and arrived to a specific result. As a result, we were aware of the power of open source, which has grown over time as a result of strong community support. Students at universities and other educational institutions will find it simpler to avoid the difficulties mentioned in the problem statement above by using the applications designed. The major goal is to create an active learning environment rather than just a teaching environment. To do this, many IT tools, APIs, and resources are used to engage students, as well as teachers who actively participate in raising standards of instruction.

REFERENCES

[1] Author John thuku https://ieeexplore.ieee.org/document/8764858/authors#authors
[2] Author Rami Muqbel Al-Sumaty https://ieeexplore.ieee.org/doment/8538428/authors#authors
[3] Author BO-WANG https://www.academia.edu/34939401/CLOUDSIS_An_Application_of_Cloud_Computing_for_Smart_School_Management_System
[4] International Journal of Innovative Research in Science, Engineering and Technology (IJIRSET) | e-ISSN: 2319-8753, p-ISSN: 2320-6710| www.ijirset.com | Impact Factor: 7.512| || Volume 10, Issue 2, February 2021
[5] Research on Autonomous Online Education System based on Intelligent Recommendation || Qingsong Tu , Jian Liu (Hubei University of Technology) Wuhan, China https://ieeexplore.ieee.org/document/6132136
[6] Nishant Agarwal, Founder, Proctur.com, "The future of e-learning in India". May 19, 2021
[7] Gizella Dewath: "A Study of the current state of elearning in the United Kingdom" | Perspective on E-learning
[8] Implementation of Learning Management System Based on Cloud Computing || 2017 4th International Conference on Information Science and Control Engineering https://ieeexplore.ieee.org/document/8110313
[9] International Research Journal of Engineering and Technology (IRJET) || Volume: 09 Issue: 06 | Jun 2022|| E-learning Online Education App
[10] International Research Journal of Engineering and Technology (IRJET) ||Educational Website (E-Learning) ||Volume: 09 Issue: 05 | May 2022
[11] International research journal of engineering and technology (IRJET) E-learning Management Web-App with Video Conferencing || VOLUME: 08 ISSUE: 06 | JUNE 2021

INFOGAIN PUBLICATION

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-3; Mar, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.93.3

A Review: Aeronautical Components and Systems Should have their Weight Reduced throughout the Design Process

Raj Kumar*, Kedar Narayan Bairwa

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur, India
Regional College for Education Research and Technology, Jaipur, India
*Corresponding Author

Received: 18 Feb 2023; Received in revised form: 11 Mar 2023; Accepted: 17 Mar 2023; Available online: 22 Mar 2023

Abstract— *Lightweight requires cutting-edge materials and imaginative engineering to achieve the same or better technical performance with less material. This approach has been widely used in automobiles, fashion, and packaging, and the aviation sector may benefit from it. Traditional lightweight methods have used high-performance materials like composites, structural optimization using computationally-aided engineering, and cutting-edge manufacturing processes including additive manufacturing, foam metals, and hot forming. This article will examine the most prevalent lightweight technologies and their possible usage in aviation, such as power plants and airframe components. Solar-powered aircraft wings require improvement and are open to lightweight technology. High aspect ratios cause non-linear distortion, aileron reversal, flutter, and rigid-elastic coupling. Lightweight aircraft, UAVs, and rocket subsystems are all being considered. Cutting-edge optimization methods may optimize structural elements and geometrical parameters for optimum structural stiffness, least mass, and energy storage. Additive manufacturing may create composite or multi-material components that can serve several purposes.*

Keywords*— *High-Frequency Structure, Lightweight Design, Aerospace Industry

I. INTRODUCTION

Lightweight design, especially in airplanes, is connected to green aviation. Aviation's role in climate change and environmental deterioration has spurred emission reduction efforts. The World Civil Aviation Organization has set a goal to reduce emissions from aviation by half by the year 2050. Solar energy and improved energy efficiency seem to be two paths for accomplishing this objective. It may be possible to conserve fuel and cut down on pollution if an airplane's size is decreased. The Boeing 787 improved its fuel economy by 10–12% after shedding 20% of its original weight. A design that is less in weight produces fewer greenhouse gas emissions while also improving acceleration, structural rigidity, and cost. A solar-powered unmanned aerial vehicle (UAV) with its low weight-optimized to its full potential might result in the creation of environmentally friendly aircraft. Solar-powered unmanned aerial vehicles (UAVs) have lower energy densities and less rigid wings. There are several requirements that must be satisfied by ultralight aircraft, including a low specific weight (less than 115 kg) and then a restricted fuel capacity (19 L). A lightweight structure improves performance and flight time. Rocket design requires lightweight. (Miracle, 2019)

II. OBJECTIVE

The research aimed to fulfill the following objectives:

- To study the Materials selection for the aerospace industry
- A Conventional numerical and computer-aided structural optimization
- The Advanced metal forming

III. METHODOLOGY

The lightweight design assumes fewer, lighter materials may deliver the same or better technical outputs. Modern materials on quantitatively optimized structures made

utilizing acceptable manufacturing techniques are used to achieve a lightweight design in aviation components and systems. Modern lightweight materials reduce weight and increase efficiency. Composite materials compete with aluminum alloys in many innovative aviation applications, although metals, especially aluminum alloys, still dominate aerospace utilization. Structural optimization, which strategically places features to reduce material consumption and improve structural performance including strength, stiffness, and vibration damping, may help lighten a structure. Optimizing structures usually involves dimensions, forms, and topologies. Lattice structures provide multiscale optimization. Manufacturing limits material and structural optimization. Additive manufacturing, foam metal, and improved metal forming have increased multi-scale structural optimization adaptability.

IV. MATERIALS SELECTION FOR THE AEROSPACE INDUSTRY

Choosing the correct aircraft materials is critical throughout component and system development. From design through disposal, It has an effect on several aspects of an aircraft, including its structural efficiency, flying performance, capacity, energy consumption, safety and dependability, lifetime cost, recyclability, and disability. Materials used in the construction of aerospace structures are required to have specific properties, including high levels of strength, stiffness, exhaustion endurance, as well as damage tolerance; low densities; high levels of thermal stability; high levels of resistance to corrosion and oxidation; and commercial characteristics such as cost, service, and production. Aerospace architectural engineering has to find ways to boost structural efficiency in order to keep pace with the need for lighter aircraft constructions. Enhancements are made in areas such as energy efficiency, agility, payload, flight duration, and total life cycle cost, including greenhouse gas emissions. Thus, aircraft structural design must increase structural efficiency to meet basic service requirements. Studies have found that lowering a building's density improves structural efficiency the greatest. Use lightweight materials. (Williams et al., 2019)

Commercial aircraft use aluminum alloys, titanium alloys, high-strength steels, and composites for structural components. These parts comprise 90% of an airplane's bulk. From the 1920s through the late 19th century, aircraft airframes were nearly entirely composed of metal, with aluminum alloy being the most preferred owing to its strength and stiffness. Passenger safety and flying performance drove airplane design. Before 2000, most civil aircraft airframes were built of light aluminum alloys, which are still used today. High-performance composites developed in the 1960s and 1970s are used to make more aeronautical constructions.

- ***Aerospace-grade metals***

Examples of the distribution of different aluminum alloys used in the construction of numerous typical Boeing aircraft show that aluminum alloys are still widely used in aerospace, despite the increasing popularity of higher-performance composites like carbon fiber. Due to their cheap price, high dependability, outstanding manufacturability, strong ductility, and corrosion resistance, advanced aluminum alloys are favored for many lightweight aircraft structural applications including, but not limited to, the skin of the fuselage, the upper and the lower wing skins, and the wing stringers. Despite the rise in popularity of sophisticated composites in this aerospace industry, high-strength aluminum alloys that have been made possible by improvements in techniques of heat treatment are still viable alternatives. Aluminum alloys may offer a varied set of properties if they are chemically changed and thermally treated to fulfill the needs of a broad number of applications. This may be accomplished via the use of thermal processing. Al-Cu (2xxx sequence), Al-Zn (7xxx sequence), and Al-Li are three of the most frequent types of aluminum alloys used in aeronautical applications. (Liu et al., 2021)

- ***Titanium-rich metals***

Titanium alloys have excellent specific strength (Beta C titanium alloy has a specific strength of ca. 260 kNm/kg, which is around 3 times something like Co-Mo steel 4130 and 1.27 times that of high-strength aluminum alloy 7075-T6), stiffness, fracture toughness, fatigue resistance, as well as corrosion resistance. Titanium alloys are superior to steel and aluminum alloys in a number of ways, making them a great choice for aircraft frames as well as power plants. Titanium alloys have a broad range of potential applications, but they are seldom employed due to their high price and low manufacturability (often about seven times more than conventional Al alloys). Titanium alloys are very versatile thanks to their high strength as well as resistance to corrosion. Today, titanium alloys are primarily used in the aircraft industry for airframes as well as engine components (which account for 7% as well as 36% of the industry in terms of overall weight, respectively).

- ***Heavy-duty metal construction***

Steel's low cost compared to other commercial aerospace materials, ease of production, broad availability, steel's tremendous strength, and rigidity make it a popular structural material. While high-strength steels have been well suited for aircraft construction, they are not commonly

employed due to their restrictions. Their high density and sensitivity to corrosion as well as embrittlement are only two of these issues. Steels make up between 5 and 15 percent of a commercial jet's load capacity, and that number has been going down for quite some time. High-strength steels have drawbacks, yet they are nonetheless used in applications that need extreme strength and stiffness, such as life-saving devices. Gearing, bearings [5a], as well as undercarriage components are some of the most prevalent uses of high-strength steel in the aerospace industry.

- ***Aircraft composites***

Fiber-reinforced polymers (FRPs) and fiber metal laminates (FMLs) are two examples of high-performance composites being evaluated for use in aircraft alongside aluminum alloys and other ground-breaking lightweight aerospace materials. Aerospace composites outperform most metals in terms of specific strength and specific stiffness at moderate temperatures (about 150 to 200 °C). The mechanical properties of several commercially available carbon-reinforced polymers are compared. One of the numerous advantages of composites is that they may have their lay-ups modified to provide optimal strength and rigidity in the required directions, along with developing resistance to fatigue, corrosion, and moisture. A key barrier to the widespread use of composites is their greater price in comparison to metals. According to research (Kim & Chang, 2020)

Aside from aluminum alloys, carbon fiber-reinforced polymer (CFRP) is probably the most common structural material for aircraft. The wings, empennage, and fuselage, in addition to the control surfaces, are all constructed mostly from carbon fiber reinforced (CFRP) (e.g. rudder, elevator, and ailerons). Semi-structural parts like fairings and often make use of glass-fiber-reinforced polymer (GFRP). Aramid fiber polymers are often employed in situations calling for material with great impact resistance. Better mechanical qualities than monolithic metals make composites like glass fiber reinforced aluminum (GLARE) and fiber metal laminates (FML) popular in the aircraft industry (particularly in the Airbus A380). Typical GLARE sites include the outside skin of both the fuselage and also the tail portion, often known as the empennage.

- ***Aspects of materials used in aviation***

When designing an aircraft system, it's important to weigh a variety of factors, such as price, safety, and compliance with regulations, before settling on a final material. Loading, temperature, humidity, corrosion, and noise are all factors to think about while designing a system or component. Example stressors that wings face throughout service include fatigue, bending, strain, torsion, vibration, and vibration. For wings, the main constraints are characteristics such as elasticity, tensile strength, compressive strength, buckling strength, as well as vibration modes are all important for wing structures. Combustion chambers are very high-pressure environments that need materials with exceptional heat stability and oxidation resistance. Materials with several constituent parts that work together to form a whole, composites like carbon fiber reinforced polymers (CFRPs) as well as glass fiber reinforced epoxy resins (GLARE), offer much superior specific strength and stiffness than metals, making them a suitable candidate for lightweight design in many aircraft components and systems. However, numerous aviation applications still make use of metals due to their low price, vast availability, and ease of manufacture. (Summe, 2019)

V. CONVENTIONAL NUMERICAL AND COMPUTER-AIDED STRUCTURAL OPTIMIZATION

Optimizing the structure of a product or component is often done to improve its functionality in some way, whether it is by increasing its strength, stiffness, and vibration performance; decreasing its weight, peak stress, and displacement; or cutting its cost. Analytical optimization, the traditional method of optimization, often depends on the intuition and knowledge of the engineers based on trial findings and, as a consequence, a design may take considerable study and time to obtain the desired results.

Recent advances in computer-aided engineering and finite element analysis provide new ways to optimize structures. Every iteration of the design process involves the creation of a roughly optimized model using numerical structural optimization. When it comes time to develop the next approximate model, the design solution from the previous approximation optimization is utilized to revise the finite element model and conduct a comprehensive system analysis. Repeated iterations of the design process are used until an optimal solution is found. (Williams et al., 2019)

Conventional numerical structural optimization

Traditional numerical structural optimization techniques are often broken down into three distinct groups: size/shape optimization, shape/topology optimization, and topology optimization.

Adjusting for optimal proportions: The best dimensions of a structure may be found by several techniques, but the most basic of them is sizing optimization. Depending on the specifics of the design, the thickness, breadth, and length of the goals are all viable options. The section characteristics of a particular component are adjusted to achieve a desired stress, displacement, or other criterion value.

The term "shape optimization" refers to the process of maximizing a structure's usefulness by adjusting its external borders and internal hole shapes. By shifting the placement of grids, it may be utilized to create any desired form for the building's exterior. Connectivity within the structure is not altered in any way throughout this optimization procedure. (Kim & Chang, 2020)

To find the optimal distribution as well as arrangement of components in a given design space, engineers employ a technique called topology optimization, which is a kind of structural optimization. Topology optimization enables a wide variety of topological changes, such as modifying the shape of the structure and the density of its holes. The concept behind topology optimization is to transform the optimization issue into a material demand problem with the use of a characteristics function that takes on the values 1 and 0 in the material and void domains, respectively.

SIMP (solid isotropic material with penalization), BESO (bidirectional evolutionary structural optimization), GAs (genetic algorithms), as well as LSTs (local search techniques) are only few of the structural optimization methods available (level set methods).

Studies on Real-World Optimization Problems: Aerospace engineering, automotive, lighter weight bicycle design, engineering, etc. have all benefited greatly from the use of numerical structural optimization. Natural lightweight structures served as inspiration for the topology optimization technique used in the creation of the Alfred-Wegener-design Foundation's lightweight bionic bicycle, which reduced the weight of the bike by 60%, and the collaborate of Zhu et al., who made available Airbus with a model of even a topology-optimized engine bracket that could be cast from an optimized main wing box rib. (Liu et al., 2021)

The Advanced metal forming

Metal forming plays a critical role in the production of metal sheet components. Intricate geometries may make it difficult to develop lightweight metals like aluminum alloys and titanium alloys at ambient temperature and now after the structure has been optimized. Technologies for metal shaping have been created to render metals more malleable, allowing for the creation of complex optimized structures. (2019)

The solution high temperature, forming, and then in quenching (HFQ) technique is a modern approach to metal forming that improves the material's formability and the component's mechanical characteristics. The precipitates are dissolved into the material matrix by heating the sheet to its solution heat therapy (SHT) temperature and holding it there for an extended period of time. Here, we use a method called the HFQ® procedure. SHT is so effective because it produces a homogeneous microstructure, which greatly enhances ductility. Quenching and shaping occur simultaneously when the material is passed through a series of cold dies. After rapid cooling, a supersaturated solid solution (SSSS) forms, and its consistent microstructure is preserved. Once the material has been artificially aged, it is heated above its aging temperature and reaps the benefits of the precipitates' strengthening capabilities. In conclusion, the HFQ® technique has the potential to considerably enhance the material's formability, allowing for the formation of intricate components with much less spring back as well as distortion. It has been successfully used in high-strength steel and aluminum alloys. Using HFQ® technology, for instance, AA7075 was stamped into a complex vehicle beam all in one go. Alternate processing methods provide significant challenges when attempting to produce complex AA7075 components. (2019) A True Miracle

When traditional forming procedures are unable to provide the desired result, superplastic formation (SPF) is employed to construct the necessary components or processes. Granules must be very small and spherical, with a grain diameter of around 5 m, for superplastic deformation to occur. In addition, diffusion can only occur at temperatures higher than half the melting point. Its extreme ductility in this condition is shown by the fact that the sample length may be extended by more than 200%. Deformation may aid static dispersion processes, which dominate grain development under these circumstances. A material's sensitivity to strain rate and, by extension, its elongation at failure, are both reduced due to grain formation. In two-phase systems, such as titanium alloys (e.g. Ti6Al4V), the presence of a phase with a low diffusivity, such as the alpha phase, serves to suppress development of the beta phase, which has a greater diffusion coefficient and hence prevents excessive grain expansion. Thermoforming, blow formation, vacuum forming, and other methods are among the several that may be used to create SPF. The primary benefit of SPF is that it permits the manufacture of complex-shaped elements with little spring back and residual stresses. The primary downsides of this technology, however, are its poor processing speed and high energy requirements. (Krishnadas Nair, 2019)

VI. CONCLUSION

Lightweighting boosts efficiency and performance. Aircraft components and system design use this concept. Advanced lightweight materials and numerical structural optimization enable lightweight design with sophisticated production

processes. Over a century, metals, especially aluminum alloys, have been aircraft materials. Metals are strong, rigid, damage-tolerant, fracture-resistant, and manufactural, making them good structural materials. Metal processing and raw materials make it inexpensive. New heat treatment and metal processing methods may optimize aeronautical components and systems employing lightweight Al-Li and TiAl alloys. Aeronautical composites challenge metals. Metals are heavier than composites, yet composites are stronger and stiffer. CFRPs, the most common aerospace composites, have up to three times the stiffness and more than five times the strength of aluminum alloys. Nanocomposites excel. Composites are costlier and less manufactural than metals, restricting their application. Structural optimization optimizes material distribution to minimize weight and improve aerospace component and system strength, stiffness, and vibration. Structural optimization includes size, form, and topology. Computers optimize software. Multi-scale lattice structure optimization may optimize weight and performance. Numerous variables complicate numerical optimization. Numerical optimization requires efficient algorithms. Manufacturability limits material and structural optimization. Additive manufacturing, foam metal processing, and advanced metal forming provide both processes additional versatility by allowing them to make materials with poor manufacturability and intricate structural geometries. Additive manufacturing and foam metal methods still struggle with production time, cost, standardization, and process.

REFERENCES

[1] Enright, J., & Dzamba, T. (2014). Measurement weighting strategies for satellite attitude estimation. 2014 IEEE Aerospace Conference. https://doi.org/10.1109/aero.2014.6836411

[2] Hopkins, G. D., Ratner, J., Traille, A., & Tripp, V. (2007). Aperture efficiency of amplitude weighting distributions for array antennas. 2007 IEEE Aerospace Conference. https://doi.org/10.1109/aero.2007.352856

[3] Kim, H., & Chang, Y.-K. (2020). Optimal Mission Scheduling for hybrid synthetic aperture radar satellite constellation based on weighting factors. Aerospace Science and Technology, 107, 106287. https://doi.org/10.1016/j.ast.2020.106287

[4] Krishnadas Nair, C. (2019). Innovations in materials and engineering for lightweight aircraft. Light Weighting for Defense, Aerospace, and Transportation, 73–88. https://doi.org/10.1007/978-981-15-1263-6_6

[5] Light weighting for defense, Aerospace, and Transportation. (2019). Indian Institute of Metals Series. https://doi.org/10.1007/978-981-15-1263-6

[6] Liu, X., Yan, C., Zhou, H., Chang, Y., Xiang, X., & Tang, D. (2021). Towards flocking navigation and obstacle avoidance for Multi-UAV systems through hierarchical weighting Vicsek model. Aerospace, 8(10), 286. https://doi.org/10.3390/aerospace8100286

[7] Miracle, D. (2019). Lightweight and the future of Aerospace Metals. Light Weighting for Defense, Aerospace, and Transportation, 27–38. https://doi.org/10.1007/978-981-15-1263-6_2

[8] Summe, T. (2019). Exploring the trends, opportunities, and aluminum solutions behind Automotive Material Innovation. Light Weighting for Defense, Aerospace, and Transportation, 39–52. https://doi.org/10.1007/978-981-15-1263-6_3

[9] Williams, J., Post, B., Love, L. J., & Blue, C. (2019). Opportunities for lighter weight and lower total cost component manufacturing. Light Weighting for Defense, Aerospace, and Transportation, 1–26. https://doi.org/10.1007/978-981-15-1263-6_1

[10] Witteveen, J. (2010). Explicit and robust inverse distance weighting mesh deformation for CFD. 48th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition. https://doi.org/10.2514/6.2010-165

INFOGAIN PUBLICATION

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-3; Mar, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.93.4

Bank offered rate based on Artificial Intelligence

Lakshmi Prabha[1], Karthikeyan.T[2], Sasikumar.P[3], Mohanraj.D[4]

[1,2,3]Department of Information Technology, SMVEC, Puducherry, India
[4]Assistant Professor, Department of Information Technology, SMVEC, Puducherry, India

Received: 15 Feb 2023; Received in revised form: 10 Mar 2023; Accepted: 18 Mar 2023; Available online: 25 Mar 2023

Abstract**—** *The rise of event streaming in financial services is growing like crazy. Continuous real-time data integration and AI processing are mandatory for many use cases. Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, speech recognition and machine vision.*

Keywords**— *Artificial Intelligence, Lendo, Swedbank***

I. INTRODUCTION

As the hype around AI has accelerated, vendors have been scrambling to promote how their products and services use AI. Often what they refer to as AI is simply one component of AI, such as machine learning. AI requires a foundation of specialized hardware and software for writing and training machine learning algorithms. No one programming language is synonymous with AI, but a few, including Python, R and Java, are popular.

In general, AI systems work by ingesting large amounts of labeled training data, analyzing the data for correlations and patterns, and using these patterns to make predictions about future states. In this way, a chatbot that is fed examples of text chats can learn to produce lifelike exchanges with people, or an image recognition tool can learn to identify and describe objects in images by reviewing millions of examples.

AI programming focuses on three cognitive skills: learning, reasoning and self-correction.This aspect of AI programming focuses on acquiring data and creating rules for how to turn the data into actionable information. The rules, which are called algorithms, provide computing devices with step-by-step instructions for how to complete a specific task.AI in banking is maturing, bringing the potential for higher-complexity solutions that generate positive ROI across business segments. Adoption of AI solutions in banking has become more mainstream: A majority of financial services companies say they've implemented the technology in business domains like risk management (56%) and revenue generation through new products and processes (52%), per the Cambridge Centre for Alternative Finance and the World Economic Forum. As AI gains popularity in banking, financial institutions (FIs) are building on their existing solutions to solve increasingly complex challenges.

Most banks (80%) are highly aware of the potential benefits presented by AI and machine learing, per an OpenText survey of financial services professionals. In fact, many banks are planning to deploy solutions enabled by AI: 75% of respondents at banks with over $100 billion in assets say they're currently implementing AI strategies, compared with 46% at banks with less than $100 billion in assets, per a UBS Evidence Lab report seen by Insider Intelligence. Certain AI use cases have already gained prominence across banks' operations, with chatbots in the front office and anti-payments fraud in the middle office the most mature.

Artificial Intelligence (AI) has been around for a long time. AI was first conceptualized in 1955 as a branch of Computer Science and focused on the science of making “intelligent machines” machines that could mimic the cognitive abilities of the human mind, such as learning and problem-solving. AI is expected to have a disruptive effect on most industry sectors, many-fold compared to what the internet did over the last couple of decades. Organizations and governments around the world are diverting billions of dollars to fund research and pilot programs of applications

of AI in solving real-world problems that current technology is not capable of addressing.

Artificial Intelligence enables banks to manage record-level high-speed data to receive valuable insights. Moreover, features such as digital payments, AI bots, and biometric fraud detection systems further lead to high-quality services for a broader customer base. Artificial Intelligence comprises a broad set of technologies, including, but are not limited to, Machine Learning, Natural Language Processing, Expert Systems, Vision, Speech, Planning, Robotics, etc.

The adoption of AI in different enterprises has increased due to the COVID-19 pandemic. Since the pandemic hit the world, the potential value of AI has grown significantly. The focus of AI adoption is restricted to improving the efficiency of operations or the effectiveness of operations. However, AI is becoming increasingly important as organizations automate their day-to-day operations and understand the COVID-19 affected datasets. It can be leveraged to improve the stakeholder experience as well.

The following are 5 applications of Artificial Intelligence in banking:

Chatbots deliver a very high ROI in cost savings, making them one of the most commonly used applications of AI across industries. Chatbots can effectively tackle most commonly accessed tasks, such as balance inquiry, accessing mini statements, fund transfers, etc. This helps reduce the load from other channels such as contact centres, internet banking, etc.

Automated advice is one of the most controversial topics in the financial services space. A robo-advisor attempts to understand a customer's financial health by analyzing data shared by them, as well as their financial history. Based on this analysis and goals set by the client, the robo-advisor will be able to give appropriate investment recommendations in a particular product class, even as specific as a specific product or equity.

One of AI's most common use cases includes general-purpose semantic and natural language applications and broadly applied predictive analytics. AI can detect specific patterns and correlations in the data, which legacy technology could not previously detect. These patterns could indicate untapped sales opportunities, cross-sell opportunities, or even metrics around operational data, leading to a direct revenue impact.

AI can significantly improve the effectiveness of cybersecurity systems by leveraging data from previous threats and learning the patterns and indicators that might seem unrelated to predict and prevent attacks. In addition to preventing external threats, AI can also monitor internal threats or breaches and suggest corrective actions, resulting in the prevention of data theft or abuse.

AI is instrumental in helping alternate lenders determine the creditworthiness of clients by analyzing data from a wide range of traditional and non-traditional data sources. This helps lenders develop innovative lending systems backed by a robust credit scoring model, even for those individuals or entities with limited credit history. Notable companies include Affirm .

1.1 OBJECTIVE

Designing a prototype system which simulates a real time banking environment, which can respond and perform loan approval functionality via Event Based Microservice Architecture and Artificial Intelligence depict sample Digital transformation that's recently going on in IT industry. Event based Banking System is a real time online banking which should be able to perform all banking functionalities via internet without the need of customer to come to a physical bank.

- The primary goal is to create a prototype of real type loan approval system
- The framework provides a general banking application which can be used by customer to borrow loan for any purpose tagged to any organization something similar to Klarna in Sweden.
- To immediately to credit check and inform customer , whether he is eligible to get the loan amount or not and to give Banks to get the potential customers easily.

1.2 SCOPE

BORAI can be useful for all banks including private banks as well as public banking sectors including all countries . More than end customers or users , BORAI is useful for Banks to get their potential customers which they might lose due to very minute differences in Loan interest rate offered.

Scope is only to determine offer rate per customer , and does not include Artificial Intelligence application on determining fraud card users or any other banking business scenarios. Here we are use AI only to determine , which Interest rates can be lesser but not to find out who is fraud and who is not.

We are going to do it based on AWS AI technologies available in the market like AWS Sage Maker .

II. LITERATURE SURVEY

Less than a decade after helping the Allied forces win World War II by breaking the Nazi encryption

machine Enigma, mathematician Alan Turing changed history a second time with a simple question: "Can machines think?"

Turing's 1950 paper "Computing Machinery and Intelligence" and its subsequent Turing Test established the fundamental goal and vision of AI.

At its core, AI is the branch of computer science that aims to answer Turing's question in the affirmative. It is the endeavor to replicate or simulate human intelligence in machines. The expansive goal of AI has given rise to many questions and debates. So much so that no singular definition of the field is universally accepted.

- DBS Bank: AI-Driven Transaction Surveillance

Since the passage of the Bank Secrecy Act, also known as the Currency and Foreign Transactions Reporting Act, in the US in 1970, banks around the world have been held accountable by governments for preventing money laundering, suspicious cross- border flows of large amounts of money, and other types of financial crime.

DBS Bank, the largest bank in Singapore and in Southeast Asia, has long had a focus on anti-money laundering (AML) and financial crime detection and prevention.

- Design of bank service products based on AI digital human technology

Based on the "Ai digital human service" technology, this paper focuses on the design of the bank network of "Ai digital human service", and tries to carry out the design practice from the aspects of man-machine, interaction mode and use mode.

- Assessing a Voice-Based Conversational AI prototype for Banking Application

This paper aims to assess a Conversational AI for a banking application in terms of usability, attractiveness, and intuitiveness. For this purpose, two different prototype versions were developed with varying dialog design and visual backgrounds.

The experiment was conducted by letting 40 participants interact with the prototype versions, exploiting the Wizard-of-Oz (WoZ) paradigm, and administering three questionnaires to measure their perception of the Conversational AI prototype.

- Redefining Banking and Financial Industry through the application of Computational Intelligence;

In recent times, AI and machine learning are perceived to be the most valuable enabler to achieve competitive advantage by enhancing the decision making capabilities and transforming the banking industry.

This paper will highlight the applications of AI and evaluate its utility in different functional areas of financial industry focusing primarily on automation of banking operations and customer engagement. It concludes with an analysis of how banking and financial organizations frame their environment and effectively use computational intelligence to improve their business.

- What Banking and Phone Data Tell us about the Socioeconomic Groups and Their Consumption Patterns?

This paper makes use of a large dataset of anonymized banking transactions and phone calls to classify individuals into socioeconomic groups (SEGs) and social networks, determine their consumption patterns, and compare the latter with equivalent information available from household surveys.

The results obtained demonstrate that classification into SEGs by aggregated bank income provides a robust breakdown of the population that is validated by a social network analysis of the phone data.

- Trust in Banking Management System using Firebase in Python using AI;

The Banking Management System (BMS) is windows based Trusted GUI application which can be used to store the data of bank account holders into a trusted real time database in Firebase which could be later used to fetch the details of account by any system using internet.

The Scope of BMS is to help the banks to allow their account holders or users to gain access onto their particular account from sitting at home itself using internet. Making their data accessible to them online. This helps the users to make their data safe in database and also leads to built trust among the banks and their customers.

- Digital Banking Transformation: Application of Artificial Intelligence and Big Data Analytics for Leveraging Customer Experience in the Indonesia Banking Sector;

This study explores the application of AI and BDA in banking for leveraging customer experience. This study used literature review and interviews to gather the data. We interview more than some persons in Indonesia banking industry to get the insight on the implementation of AI and BDA in Indonesia.

The paper reveals best practices of the global banking and Indonesian banking, in the implementation of AI & BDA. The contributions of this study are proposed enterprise architecture and recommended digital innovation in AI and BDA that enables banking institutions to leverage customer experiences.

- The Integration of AI on Workforce Performance for a South African Banking Institution

The ultimate purpose is to improve the workforce's performance in the South African banking institution and ensure successful adaptation to artificial intelligence. Descriptive statistics have been adopted with the use of frequency distribution tables to analyze and present the information on the variables of interest.

It is essential for the banking institution to adopt and integrate artificial intelligence with workforces because the next frontier for shared services may be far more interesting, incorporating greater computing power so that the differences between human perception and intelligent automation become indistinct.

- The Human Touch: Practical and Ethical Implications of Putting AI and Robotics to Work for Patients

We live in a time when science fiction can quickly become science fact. Within a generation, the Internet has matured from a technological marvel to a utility, and mobile telephones have redefined how we communicate.

Health care, as an industry, is quick to embrace technology, so it is no surprise that the application of programmable robotic systems that can carry out actions automatically and artificial intelligence (AI), e.g., machines that learn, solve problems, and respond to their environment, is being keenly explored.

- Toward Scalable Artificial Intelligence in Finance;

The goal is to support finance practitioners navigate the plethora of AI options more effectively and accelerate data monetization. While ML techniques in data analytics and forecasting apply to many scenarios, this paper focuses on selected competences in Banking, Financial Markets and Chief Finance Officer (CFO) operations.

The architecture and method introduced in this paper is a first step toward a service practice. We harvest from our work carried out in banks, asset management firms and CFO lines-of-business as well as R&D experiences in new finance technologies for over one decade.

III. EXISTING SYSTEM

A software requirements specification (SRS) is a document that captures complete description about how the system is expected to perform. It is usually signed off at the end of requirements engineering phase.

Requirement analysis is significant and essential activity after elicitation. We analyze, refine, and scrutinize the gathered requirements to make consistent and unambiguous requirements. This activity reviews all requirements and may provide a graphical view of the entire system. After the completion of the analysis, it is expected that the understandability of the project may improve significantly. Here, we may also use the interaction with the customer to clarify points of confusion and to understand which requirements are more important than others.

Some projects are developed for the general market. In such cases, the prototype should be shown to some representative sample of the population of potential purchasers. Even though a person who tries out a prototype may not buy the final system, but their feedback may allow us to make the product more attractive to others.The prototype should be built quickly and at a relatively low cost. Hence it will always have limitations and would not be acceptable in the final system. This is an optional activity.

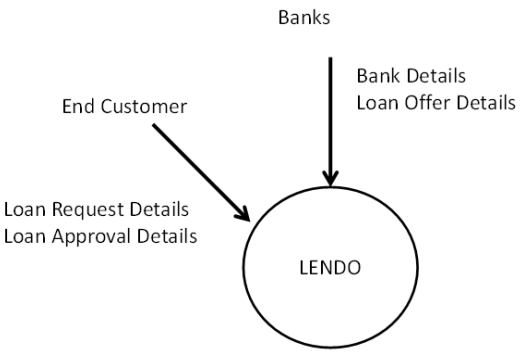


Fig 1 Context Diagram

In Existing System , All Private banks and Public banks of Sweden are subscribed to their service. As soon as a customer registers ith required details like

1) Name
2) Personal Number (Similar to Aadhar card number)
3) Loan Required
4) Salary
5) Property Details

Lendo Application , sends the application to all banking customers and once Bank responds , it sends the quotation to Customers with certain time. Whichever option , Customer likes , customer chooses and then approves from his end .Once customer approves , the bank does the hard search of all criteria before lending the loan . **Lendo** is a leader in the field of debt crowdfunding for Small and Medium Enterprises (SMEs). **Lendo** offers investing opportunities in SME financing in Saudi Arabia. Investors get attractive short-term and Sharia-compliant returns, while SMEs obtain instant cash flow. Lendo is a

marketplace for loans. This includes, among many things, a place for consumers to compare consumer loans, car loans, credit cards, business loans and mortgages. Lendo was founded in Sweden in 2007, when few players offered price comparison for consumer loans without affecting customers' credit scores.

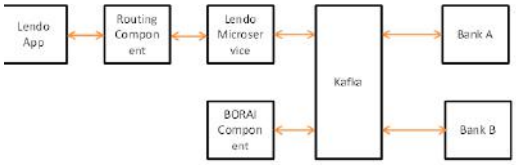
In Existing system , the application does not have intelligence to guide banks with offer percentage based on Market strategy. With minute offer rate differences , certain banks lose customer by considering only Business strategy .Hence in proposed system , we are going to make the application intelligent . We are going to guide the banks to finalize the offer rate based on Marketing strategy as well as Business Strategy by repetitive data.In Next screen , we are going to guide COOP bank to offer 5.09 % instead of 5.90 %.This 5.09 % comes out of the calculation done by business logic based on Business Strategy and Market Strategy which will be explained in next review.

Lendo Application will have the front end of registration form , where customers can register the loan request via, API routing component , once the form is registered the routing takes it to Lending Microservice , which process the loan request and send the details to Banks via event based Architecture .

The current application has a problem where different banks offer different rate but with minute differences .

- Say Example Bank 1 offers ar 5.1 % and Bank 2 offers at 6.1 % , though for Bank 2 even 5.0 % would be beneficial based on business strategy ,. So During this situation if we bring in our solution , to make Bank 2 intelligent and offer 5.0 % , then Bank 2 would win the loan contract with the customer.
- So in one line , our problem statement would be , To determine offer rate per customer , to have high probability of getting acceptance .

IV. PROPOSED SYSTEM



In Existing system , the application does not have intelligence to guide banks with offer percentage based on Market strategy. With minute offer rate differences , certain banks lose customer by considering only Business strategy .Hence in proposed system , we are going to make the application intelligent . We are going to guide the banks to finalize the offer rate based on Marketing strategy as well as Business Strategy by repetitive data.In Next screen , we are going to guide COOP bank to offer 5.09 % instead of 5.90 %.This 5.09 % comes out of the calculation done by business logic based on Business Strategy and Market Strategy which will be explained in next review.

Lendo Application will have the front end of registration form , where customers can register the loan request via, API routing component , once the form is registered the routing takes it to Lending Microservice , which process the loan request and send the details to Banks via event based Architecture .

Once the Banks receive the requests, they process the customer information and then different loan offers are given to the customers via the App.

Very minute differences are thrown so that it is easily identified by banks . Say for example Coop bank have a higher offer rate than forex bank , but given an Aritifical Intelligence, Coop can go for a lesser percentage at later point of time.

V. MODULES

We are planning to implement using 5 modules ,

Module 1 – Lendo Application – With Application Form

Module 2 – Lendo Microservice (Kafka Producer)

Module 3 – Integration Microservice (Producer and Consumer LIbraries)

Module 4 – Bank Services (Kafka Consumer)

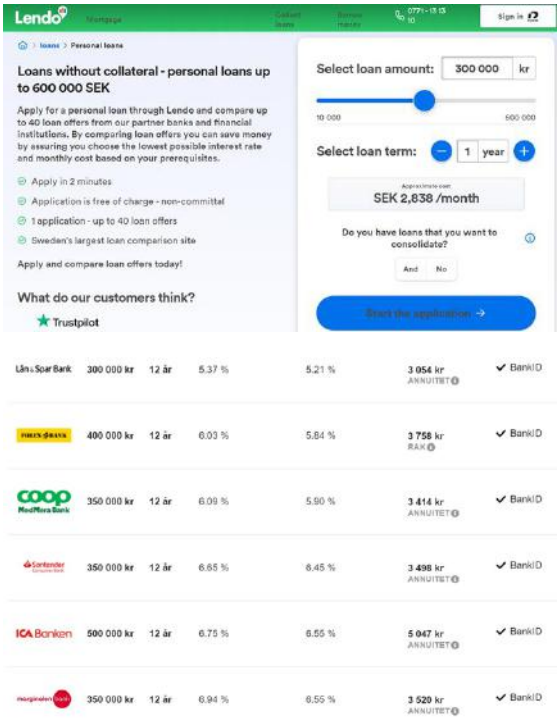
Module 5 – BORAI Microservice

MODULE 1 – LENDO APPLICATION FORM

This is the first form that the end customer needs to fill to apply loan, this form would request for salary information , loan request , duration information . Based on the collection of these details, it will be sent to multiple banks at the same time to get different offer rates.

MODULE 3 - INTEGRATION LAYER

The architecture leverages distributed processing and fault-tolerance with fast failover, no-downtime, rolling deployments, and the ability to reprocess events, so you can recalculate output when your code changes. Integration and Stream Processing are still key functionality but can be realized in real time natively instead of using additional ETL, ESB or Stream Processing tools.



A concrete example architecture shows how to build a complete streaming platform leveraging the widely-adopted open-source framework Apache Kafka to build a mission-critical, scalable, highly performant streaming platform. Messaging, integration, and stream processing are all built on top of the same strong foundation of Kafka; deployed on-premise, in the cloud, or in hybrid environments. In addition, the open source Confluent projects, based on top of Apache Kafka, add additional features like a Schema Registry, additional clients for programming languages like Go or C, or many pre-built connectors for various technologies.

MODULE 4 – BANK SERVICES

Let's start at the beginning. What, exactly, is a credit check? When most lenders and other authorities check your credit, they're looking at that three-digit FICO score mentioned above — the one that ranges from 300 (poor) to 850 (exceptional). They will likely also receive your entire credit report, which is a lengthy, detailed document listing all your open accounts, their statuses, and several years of your historical behavior around loans and credit, among other items. By historical behavior, we mean things like whether you pay your bills on time or late, how much debt you've managed, and whether any debts have been put in for collection.

Incidentally, when your credit is checked, it can be either a soft or hard credit inquiry. The former are inquiries that don't impact your precious credit score. But the latter can wind up lowering your score because these "hard pulls," as they are sometimes known, can indicate that you are shopping around for more credit, which can make you look like a risky prospect.

But back to our question about whether a bank will initiate a credit check…the answer is: not exactly. They don't typically check your credit score. Instead, they use their own kind of financial background check system. It's called ChexSystems — and it's a reporting agency similar to but distinct from the ones that record and report your credit score.

MODULE 5 BORAI MICROSERVICE

Our world is moving at a fast pace. Though banks originally built their foundations to be run solely by humans, the time has come for artificial intelligence in the banking industry. In 2020, the global AI banking market was valued at $3.88 billion, and it is projected to reach $64.03 billion by the end of the decade, with a compound annual growth rate of 32.6%. However, when it comes to implementing even the best strategies, the application of artificial intelligence in the banking industry is susceptible to weak core tech and poor data backbones.

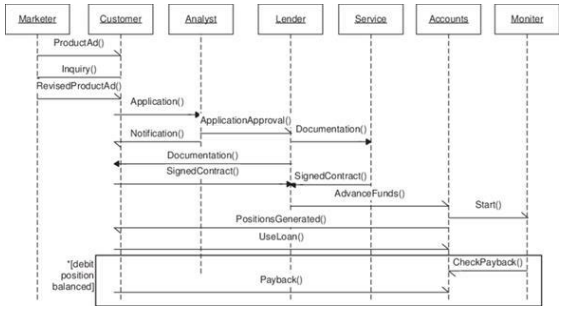
By my count, there were 20,000 new banking regulatory requirements created in 2015 alone. Chances are your business won't find a one-size-fits-all solution to dealing with this. The next-best option is to be nimble. You need to be able to break down the business process into small chunks. By doing so, you can come up with digital strategies that work with new and existing regulations.

AI can take you a long way in this process, but you must know how to harness its power. Take originating home loans, for instance. This can be an important, sometimes tedious, process for the loan seeker and bank. With an AI solution, loan origination can happen quicker and be more beneficial to both parties.

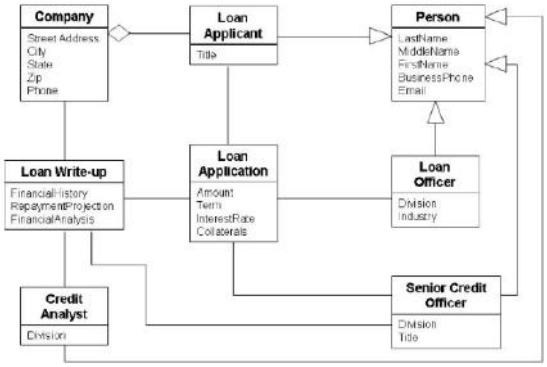
As the world of banking moves toward AI, it is integral to note that the crucial working element for AI is data. The trick to using that data is to understand how to leverage it best for your business' value. Data with no direction won't lead to progress, nor will it lead to the proper deployment of your AI. That is one of the top reasons it is so challenging to implement AI in banks — there has to be a plan.

Even if you come up with a poor strategy, those mistakes can be course-corrected over time. It takes some time and effort, but it is doable. If you home in on how customer information can be used, you can utilize AI for banking services in a way that is scalable and actionable. Once you understand how to use the data you collect, you can develop technical solutions that work with each other,

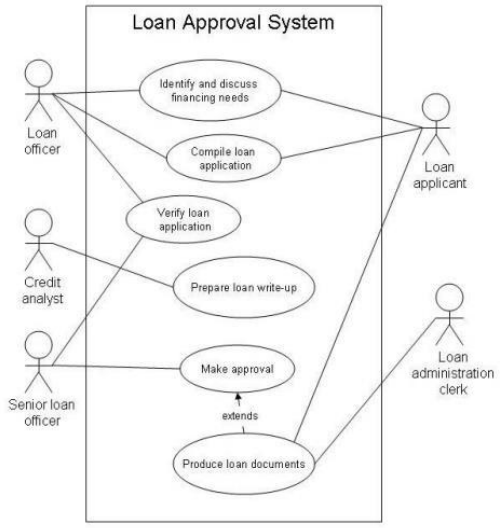
identify specific needs, and build data pipelines that will lead you down the road to AI.



Sequence Diagram



Class Diagram



Use Case Diagram

VI. CONCLUSION

Lendo application induced Aritifical intelligence to banks, so that they can identify potential customers for them without losing their business. Existing Lendo application has some issues to Bank, where they lose potential customer with minute differences in the offer rate they provide but once this Artificial intelligence is introduced , they will be able to use without losing potential customers.

.

VII. FUTURE ENHANCEMENT

All banks can take this idea and become a Digital bank, avoiding waiting time and physical spaces. The traditional integrated banking model is under tremendous stress. In its place, a diverse digital banking ecosystem of bank and non-bank players is emerging. Succeeding in a digital banking ecosystem will require a new set of capabilities, which are more common in other industries than in today's vertically integrated corporate banking market. Banks will need to develop the "muscles" by adopting new technologies like Apache Kafka to compete in the new landscape.

REFERENCES

[1] DBS Bank: AI-Driven Transaction Surveillance Thomas H. Davenport;Steven M. Miller Working with AI: Real Stories of Human-Machine CollaborationYear: 2022 | Book Chapter | Publisher: MIT Press

[2] Design of bank service products based on AI digital human technology JianJun Fang;XinXin Guo;2021 International Conference on Digital Society and Intelligent Systems (DSInS)Year: 2021 | Conference Paper | Publisher: IEEE

[3] Assessing a Voice-Based Conversational AI prototype for Banking Application;Chinmoy Deka;Shiva Sah;Abhishek Shrivastava;Mridumoni Phukon;Lipsa Routray;2021 8th NAFOSTED Conference on Information and Computer Science (NICS)Year: 2021 | Conference Paper | Publisher: IEEE

[4] Redefining Banking and Financial Industry through the application of Computational Intelligence;Princy Agarwal;2019 Advances in Science and Engineering Technology International Conferences (ASET)Year: 2019 | Conference Paper | Publisher: IEEE

[5] What Banking and Phone Data Tell us about the Socioeconomic Groups and Their Consumption Patterns?;Angel F. Agudo-Peregrina;Diego Perez;Luis C. Reyes;Martin Langberg;Martin Minnoni;2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)Year: 2018 | Conference Paper | Publisher: IEEE

[6] Trust in Banking Management System using Firebase in Python using AI;Babu Kumar;Ajay Vikram Singh;Parul Agarwal;2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)Year: 2021 | Conference Paper | Publisher: IEEE

[7] Digital Banking Transformation: Application of Artificial Intelligence and Big Data Analytics for Leveraging Customer Experience in the Indonesia Banking Sector;Elisa Indriasari;Ford Lumban Gaol;Tokuro Matsuo;2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI)Year:

2019 | Conference Paper | Publisher: IEEE

[8] The Integration of AI on Workforce Performance for a South African Banking Institution;Tebogo Lucky Mamela;Nita Sukdeo;Sambil Charles Mukwakungu;2020 International Conference on Artificial Intelligence, Big Data, Computing and Data Communication Systems (icABCD)Year: 2020 | Conference Paper | Publisher: IEEE

[9] The Human Touch: Practical and Ethical Implications of Putting AI and Robotics to Work for Patients; Jim Banks; IEEE Pulse Year: 2018 | Volume: Issue: 3 | Magazine Article | Publisher: IEEE

[10] Toward Scalable Artificial Intelligence in Finance; Jorge L. C. Sanz; Yada Zhu; 2021 IEEE International Conference on Services Computing (SCC)Year: 2021 | Conference Paper | Publisher: IEEE

International Journal of Advanced Engineering, Management and Science (IJAEMS)
Peer-Reviewed Journal
ISSN: 2454-1311 | Vol-9, Issue-3; Mar, 2023
Journal Home Page: https://ijaems.com/
Article DOI: https://dx.doi.org/10.22161/ijaems.93.5

Adoption of Digital Learning Technology: An Empirical Analysis of the Determinants in Telecom Sector

Abdul Basit

Received: 19 Feb 2023; Received in revised form: 11 Mar 2023; Accepted: 22 Mar 2023; Available online: 30 Mar 2023

Abstract— *Technology has advanced significantly from the analogue period to the digital era. Digital Learning Technology (DLT) is a learning paradigm based on the use of ubiquitous latest technologies, by using smart devices. It can be described as a learning environment that is assisted in daily life by wireless networks, mobile, and embedded computers. It aims to offer content and interaction to students wherever they are, at any time. The learning process has advanced thanks to the technology revolution, which has also fundamentally altered how knowledge is shared and learned. At present, there exist other frameworks too, but they are centered towards different paradigms, and point of view pertaining to DLT with its emphasis on Telecommunication Sector has not been taken into consideration. As, existing frameworks are centered towards different environments hence there exists a need to add dimensions of Empowered Learner, Digital Citizen, Knowledge Curator, Innovative Designer, Computational Thinker and Creator, Communicator & Global Collaborator. These have not been integrated together in existing available research. The study will ascertain level of knowledge of DLT and examined factors which affect the adoption rate, use, and role of DLT in telecoms setups. The results of this research will help create a framework that, if used in any academic or learning setting in a technology-based firm.*

Keywords— ***Artificial Intelligence, Lendo, Swedbank***

I. INTRODUCTION

The newest development in educational technology is digital learning. The widespread use of smart gadgets, which have powerful computing and communication capabilities, is responsible for this educational revolution. The major technologies that are paving the way for DLT are thought to be those relating to information, communication, and computation. "Urban learning paired with Technology Centered Learning Environment (TCLE) devices has created enormous opportunity and paradigm shift for the users." (Xianzhi Ye, 2008).

1.1. Background

The development of digital learning is supported by improvements in computing technology combined with a "always connected" digital world. The process of learning from the environment has become considerably simpler as a result. The ubiquitous world is encouraging knowledge sharing to happen naturally, methodically, consistently, and continuously. According to (Yano, 2003), based on (Chen Y.S, 2002), the main characteristics of ubiquitous digital learning are Empowered Learner, Digital Citizen, Knowledge Curator, Innovative Designer, situating of instructional activities and Creator, Communicator & Global Collaborator.

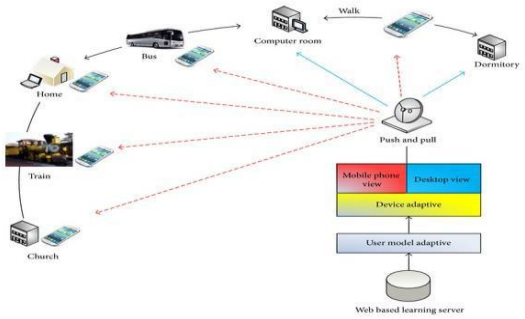


Fig 1.1-1: The conceptual design for a ubiquitous learning system

Source: (Chen Y.S, 2002)

The design above shows a digital learning environment where the user has the liberty to move from one place to another while always being connected to the web based learning server installed at telecommunication services

providers. With the advancements in telecom technology, the location of the web based server can be on the cloud. Cloud computing is a new concept which allows the servers available for computing in the cyber space.

Fig 1.1-2: The cloud computing model

Source: (Xorlogics, 2017)

The above model shows the complete cloud structure. The services have following categories.

- IaaS - Infrastructure as a service
- PaS - Platform as a service
- SaS - Software as a service

IaaS outsources virtualization, storage networking and load balancers.

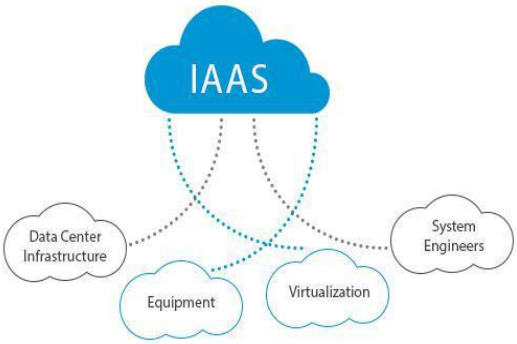


Fig 1.1-3: Infrastructure as a Service

Source: (Wilson, 2019)

PaaS consists of hosting operating system and services that allow the user to run his/her applications.

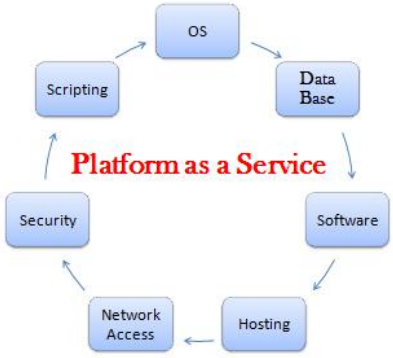


Fig 1.1-4: Platform as a service

Source: (IndiaMART, 2019)

And finally the Software as a service is used only for the needed applications. The cloud has public, private and hybrid space for the specific users.

Fig 1.1-5: Infrastructure as a service

Source: (Solutions, 2019)

DLT is a fresh, dynamic approach to learning that builds on traditional teaching strategies. Because consumers can now afford to use digital media, it is now conceivable. The emergence of ubiquitous learning has altered the roles and responsibilities of educators, trainers, educators, and trainees/students. The core of this strategy is new ways of creating, storing, delivering, and accessing knowledge, not the logic or technical requirements of smart devices employing telecommunication infrastructures. A new digital learning paradigm is starting to take shape, and it is guiding us to take the lead in technological innovation.

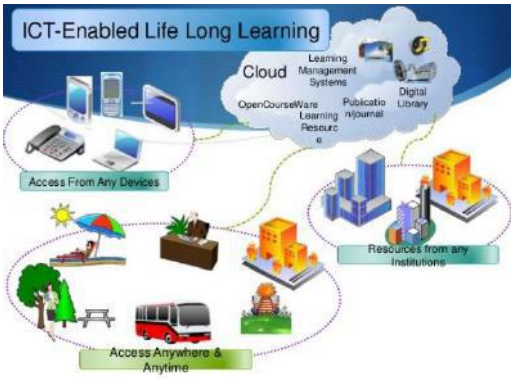


Fig 1.1-6: Information and Communication Technology Enabled Life Long Learning

Source: (Hasibuan, 2013)

The information and communication (ICT) enabled lifelong learning model depicts the overall learning environment integrated with cloud computing infrastructure.

DLT environment offers an interoperable, pervasive, and seamless learning architecture (Saadiah Yahya, 2010). It offers appropriate learning partners, appropriate learning materials, and appropriate learning services at the appropriate location and time. Because the context in which learners are learning has a significant impact on the effectiveness and efficiency of digital learning, context models and contextual acquisition methods are needed (Stephen J.H. Yang. Yang, 2006).

DLT also incorporates learning analytics, a method created very recently to make use of the vast amount of knowledge. It has proven to be a very effective technique to promote initiatives for advanced learning. The learner's mobility and the potential benefit of employing learning analytics to improve the digital learning experience are significant features.

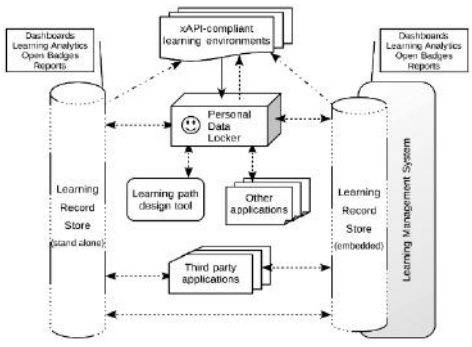


Fig 1.1-7: Ubiquitous Learning Analytics

Source: (Magoulas, 2016)

As boundary-crossing tools, mobile devices, and particularly mobile social media, help learners create multimodal representations that reflect their experiences and identities and share them with their non-digital / digital social networks. (Pimmer, 2016).

Fig 1.1-8: Ubiquitous Learning Smart Mobile Devices

Source: (Lentini, 2019)

Keeping digital records is another aspect of digital learning. They can share their expertise and log their activity on social media. One can focus on targeted quizzes and discover solutions to the targeted questions by making use of specific tools. Interest in digital learning is growing significantly, especially in light of its potential applications in academic contexts.

Although there are now few widespread implementations of DLT, empirical evidence suggests that this will change in the near future thanks to access to digital platforms and telecommunications infrastructures. A paradigm shifts from conventional learning methods to high technology based learning methods will occur in the future when various types of learning technologies are adopted. By the use of communication networks, this will allow us to access any information from anywhere at any time.

1.2. Research Problem

The actual issue is how to develop a conceptual framework for digital learning that can transform current learning approaches into cutting-edge virtual domains in a telecom setting. With the implementation of new DLT mechanisms and technologies, conventional digital learning techniques will become ineffective in the future. The solution to this issue is to provide a conceptual framework for sustained learning that is integrated into the pervasive digital learning echo system.

1.3. Research Objectives

- Analyzing and evaluating existing technologies relating to DLT.
- To come up with a Digital Learning Technology framework in order to find out relationships between dependent and independent variables which are affecting adoption of Digital Learning Technology in the Telecommunication Sector.

- Analyzing through the use of statistical method collected questionnaires and subsequently validating the research hypothesis.
- Coming up with DLT framework.

1.4. Research Motivation

The motivation behind the selection of this area is based on developing a guideline for the telecommunication sector learners where digital learning frameworks are non-existent. This is a completely new domain/area of research in which not much work has been done and there is a dire need to come up with some sustainable framework, which can eventually lead to learning transformations in the futuristic digital world.

II. LITERATURE REVIEW

This section starts with a discussion of the existing theories based on which this research work is ingrained, and then follows a review of literature explaining relationships between the various variables and the existing gaps in the knowledge.

2.1 Literature Review

The implementation of digital learning is a good opportunity to address the affordability, Digital Citizen, and quality issues of the higher education sector that are present in many countries (A'ang Subiyakto, 2019). Mobile learning solutions improve engagement among students, communication, time management, and information delivery according to their needs. Mobile technology elements that allow for time and location independence as well as personalization opportunities capture students' attention more. (Ayse Gunay, 2014).

A digital learning query/answer System developed by (Lei Jing, 2017) makes use of digital artifacts in the ubiquitous environment and have provided ability to learner to learn from more extensive learning contents. They discussed architecture of ubiquitous query/answer system with the ability of searching and providing real/virtual learning content. To implement the suggested method, they developed a matching algorithm. To meet the needs of today, learner-centered approaches and possibilities are required, broadening the application of mobile learning (Travis L. Irby, 2015).

Digital Learning Technology (DLT) is a learning method in which the learner can effectively start learning process at anytime and anywhere (Keengwe, 2015). It is structured by Technology Centered Learning Environment (TCLE) Technology and is the integration of physical, such as humans, physical devices, places, info-space etc. DLT environment is a mechanism that anyone can access from anywhere at any time and by any device.

Digital learning analytics in Telecommunication Networks Support (TNS)s by (Naif Radi Aljohani, 2012) describes the advantages of using learning analytical techniques to enhance learning in mobile and Telecommunication Networks Support (TNS)s from a theoretical perspective.

Contextual data can be used to improve interactions between students, gadgets, and learning environments. The interaction between mobile devices and students is improved by the DLT apps' retrieval of contextual data about the students. Learning resources are made available that are based on gathered contextual data. To make mobile device interaction easier, the precise contextual information is gathered (Naif Radi Aljohani, 2012). Contextual data gathering is helpful in increasing student focus on critical activities and enabling time savings. The most recent technical tools that have affected social norms of society in many sectors of life are regarded as mobile equipment (Norbert Pachler, 2011). (Ogata, 2011) investigated computer supported digital learning and came up with ubiquitous learning log system called SCROLL (system for capturing and reminding of learning log). It helps the learners to log their understanding experiences by the use of photos, audios (mp3), videos, location, codes, tags and sensor set.

Similarly, mobile technology has penetrated at an unprecedented rate in the last few years. (Sung Youl Park, 2011) Argued that m-learning is rather a new research topic and the effectiveness of m-learning has not been fully explored. "Evolution of Technology Centered Learning Environment (TCLE) has been catalyzed because of the improvement in wireless telecommunications and led to DLT that allows the embedding of individual learning activities in daily lives.

(Alhassan, 2016) says that greatest added value of m-learning is dependent on the features that encompass classroom interactions to other settings by using the communication networks; Mobile and U-learning in higher educational institutes, a proper review of empirical studies by (Pimmer, 2016) talks about harnessing the increasing access to digital mobile media for the enrichment of traditional forms of higher education.

An article by (Saadiah Yahya, 2010) describes new learning paradigm that is supported by digital computing technologies. It describes information regarding to u learning. Observation of u-learning features are discussed in order to propose a conclusive definition of u-learning together (O.K. Boyinbode, May 2009).

According to (Gwo-Jen Hwang, 2008), the fast changes occurring in the learning contexts, DLT lacks a precise definition. As a result, the academics have developed many meanings for the term DLT. A learning mechanism that

includes collaborators, contents, and services is offered by the DLT environment. DLT is concerned with giving strategies to find the best learning partners and having the appropriate content. We should pay special attention to the consequences of the Technology Centered Learning Environment (TCLE) as we examine its affordance. The digital divide, where individuals cannot afford to purchase the most modern and advanced products despite prices lowering, needs to be closed. (Bill Cope, New Media, New Learning, 2007). The proponents of Technology Centered Learning Environment (TCLE) in the academic world are working hard to lower the cost of technology for the general public (Yang, 2006). (Stephen J.H. Yang. Yang, 2006) Researched upon context aware Telecommunication Networks Support (TNS)s.

An Agenda for Educational Transformation by (Bill Cope, 2006) explores the dimensions of this proposition by using new technologies to learn old things. "Emergence of Technology Centered Learning Environment (TCLE) creates new conditions for professionals".

From an evolutionary standpoint, the transition is significant because it has enabled people to engage without being constrained by physical contact (Hans, 2004). (Scholtz, 2004) gives framework which was developed through discussion of the computing applications with a view to developing a framework for the evaluation of Technology Centered Learning Environment (TCLE) applications.

Looking at the learners' perspective, context is defined in terms of the surrounding environment affecting the learners. From a services viewpoint, it is described as the environment, which has an impact on how learning services are delivered and carried out. Additionally, as sensing technologies have advanced, it is now possible to collect contextual data, such as time and location, by utilizing tools like Wi-Fi, GPS, and other technologies. The DLT environment can be distinguished from the mobile learning (ML) environment (Kalle Lyytinen, 2002).

2.2 Research Direction

Shift from e-learning to digital learning is shown below (Boyinbode O. K., 2008).

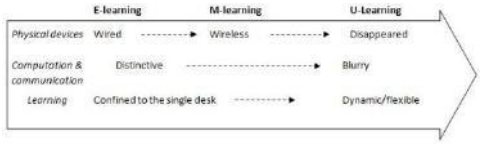


Fig 2.2-1: Comparison and flow of Digital E-learning, M-learning, and U-learning

Source: (Moreiraa, 2017)

Following are some of the important characteristics/variables of UL (Chen Y.S, 2002) and (Mohd Khairul Ikhwan, 2015).

2.2.1 Empowered Learner

By Empowered Learner it is meant that the learner has access to all the tools needed for the digital learning purposes.

2.2.2 Digital Citizen

By Digital Citizen, we mean that all the information, data, documentations, audio-visual data or videos can be accessed from anywhere by any individual. The availability of the information is based on the digital learner's requirements, hence the learning being self-directed.

2.2.3 Knowledge Curator

The knowledge curator is able to save and hold the information safely for digital access at any time.

2.2.4 Innovative Designer

Through Innovative Designer, the learners can come up with innovative solutions.

2.2.5 Computational Thinker

It means having computational capabilities while thinking out of the box.

2.2.6 Creator, Communicator & Global Collaborator

By Creator, Communicator & Global Collaborator, we mean that the learner has the drive to get hold of the digital learning materials through interactions and collaborations. On the basis of these variables, researchers developed research framework that guarantee proper execution of ubiquitous learning in a high-knowledge environment (Mohd Khairul Ikhwan, 2015).

III. RESEARCH METHODOLOGY AND DESIGN

In this section, we look at the concept of framework for futuristic digital learning environment. Based on these understandings, a conceptual framework is developed, and research hypothesis established.

3.1 Research Framework

These factors led us to develop a research framework based on types of interactions that take place in a digital learning scene (Mohd Khairul Ikhwan, 2015)

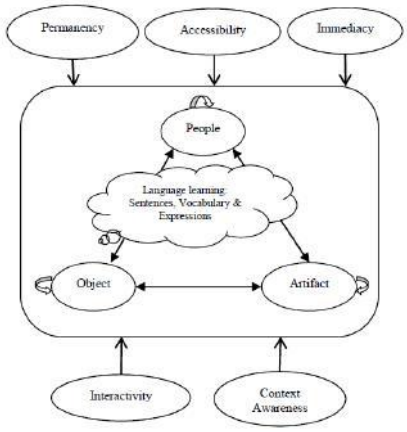


Fig 3.1-1: Type of Interaction in Digital Language Learning Environment

Source: (Mohd Khairul Ikhwan, 2015)

Based on the above model, the variables identified for this research contribution are Empowered Learner, Digital Citizen, Knowledge Curator, Innovative Designer and Computational Thinker. In the Perceived model, Creator, Communicator & Global Collaborator has been added. The model with Creator, Communicator & Global Collaborator.

The six independent variables are:

- Empowered Learner (EL)
- Digital Citizen (DC)
- Knowledge Curator (KC)
- Innovative Designer (ID)
- Computational Thinker (CT)
- Creator, Communicator & Global Collaborator (CCGC)

Dependent variables are selected to be:

- Telecommunication Networks Support (TNS)
- Technology Centered Learning Environment (TCLE)
- Technology Adaptation Mind-Set (TAMS)

The study will evaluate the level of knowledge about DLT and examine the contributions of various factors influencing how quickly it is being adopted in the telecommunications industry. The results of the research will help create a framework that, when used in any technology configuration, will enable the delivery of cutting-edge telecommunication networks support in an efficient manner (TNS).

3.2 Research Model

Based on the extensive literature review, the following research model is proposed.

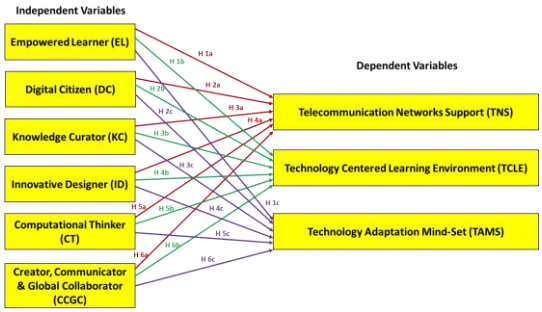


Fig 3.2-1: Research Model

The relationship between IV and DV needs to be looked into. There are many approaches to data analysis. First of all, validity/reliability of the method is essential in research. Reliable measuring method gives the same measurements when one repeatedly measures the same unchanged objects or the events.

Similarly, Cronbach's alpha is defined as the measure of internal consistency i.e. as a group, how closely related a set of items are. It is a measure of the scale reliability. If we look at the frequency distribution of a particular observation, it is the number of times the observation occurs in the data.

In statistics, Pearson correlation coefficient measures linear correlation between two variables. Regression will find relationships between variables. It comprises of many techniques for modeling & analyzing variables i.e. dependent and independent variables.

3.3 Research Hypotheses

Following are the research hypothesis.

H1a: In the learning environment, Empowered Learner (EL) needs Telecommunication Networks Support (TNS).

H1b: In the learning environment, Empowered Learner (EL) needs Technology Centered Learning Environment (TCLE).

H1c: In the learning environment, Empowered Learner (EL) needs Technology Adaptation Mind-Set (TAMS).

H2a: In the learning environment, Digital Citizen (DC) needs Telecommunication Networks Support (TNS).

H2b: In the learning environment, Digital Citizen (DC) needs Technology Centered Learning Environment (TCLE).

H2c: In the learning environment, Digital Citizen (DC) needs Technology Adaptation Mind-Set (TAMS).

H3a: In the learning environment, Knowledge Curator (KC) needs Telecommunication Networks Support (TNS).

H3b: In the learning environment, Knowledge Curator (KC) needs Technology Centered Learning Environment (TCLE).

H3c: In the learning environment, Knowledge Curator (KC) needs Technology Adaptation Mind-Set (TAMS).

H4a: In the learning environment, Innovative Designer (ID) Needs Telecommunication Networks Support (TNS).

H4b: In the learning environment, Innovative Designer (ID) needs Technology Centered Learning Environment (TCLE)

H4c: In the learning environment, Innovative Designer (ID) needs Technology Adaptation Mind-Set (TAMS).

H5a: In the learning environment, Computational Thinker (CT) needs Telecommunication Networks Support (TNS).

H5b: In the learning environment, Computational Thinker (CT) needs Technology Centered Learning Environment (TCLE).

H5c: In the learning environment, Computational Thinker (CT) needs Technology Adaptation Mind-Set (TAMS).

H6a: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Telecommunication Networks Support (TNS).

H6b: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Technology Centered Learning Environment (TCLE).

H6c: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Technology Adaptation Mind-Set (TAMS).

Due to the fact that it is grounded in the corpus of existing knowledge, this research project is oriented towards positivistic research philosophy.

Following a study of the relevant literature from earlier investigations, a conceptual framework is being created using accepted scientific procedures. For establishing if the presented hypotheses are true or false, basic laws of hypothesis are applied to the observations. Propositions were tested empirically as part of the research project. To generalize the results, the entire population was analyzed. Research Methodology and Design

In this research work, the following tests were performed:

Validity Test	Cronbach's Alpha	Frequency Distribution
Descriptive Statistics	Pearson Correlation	Regression Analysis

For the analysis of this study, the researcher will use the package of SPSS. SPSS is used to find Cronbach's Alpha Coefficient aiming to find how much reliable is the method for the collected data (questionnaire's). However, before we apply Cronbach's Alpha Reliability, it should be ensured that all independent variables, measuring the dependent variables are in the same direction; i.e., there exists no negatively items in the developed questionnaire. Research design in this study is descriptive and is based on cross sectional design. Furthermore cross-sectional research studies are undertaken that represents a snapshot at that point in time (Cooper, 2008).

Using the information gathered from the pilot study, questionnaires are tested to determine the validity of the procedure. The purpose of the pilot test is to make the questionnaires better so that respondents will have no trouble responding them, the questions will be clear, and there won't be any issues with the data being recorded accurately. This result in the assessment of the validity of data which will be collected (Mark Saunders, 2007).

Comparable to external validity, internal validity is defined as the capacity of the study methodology to measure what it is intended to assess. The degree to which the approach adequately covers the research issues is known as content validity. The success of the measurements employed for the predictions or the estimations is explained by the criterion associated validity. Finally, the construct validity considers both the theory and the chosen measurement technique (Cooper, 2008).

Cronbach's Alpha is calculated to test the reliability. Alpha can take any value from zero (no internal consistency) to one (complete internal consistency) whereas 0.7 is defined as an acceptable limit. As per (George, 2003), the following rules apply (as shown in the table);

Table 3.3-1: Cronbach Alpha (Reliability Limits)

Reliability	Assessment
>0.9	Excellent
>0.8	Good
>0.6	Questionable
>0.5	Poor
<0.5	Unacceptable

3.4 Target Population

The samples will be collected from the following three telecommunication Companies;

1. PTCL (100 questionnaires)
2. Worldcall (100 questionnaires)
3. Nayatel (100 questionnaires)

3.5 Data Collection

The research study makes use of primary data collection procedures.

3.6 Data Analysis & Presentation

Regression-analysis & Pearson's Product Moment Correlation-analysis are used. Mean scores were calculated for the Likert scale type of questions.

IV. DATA ANALYSIS, FINDINGS AND DISCUSSION

The findings are described in depth in the chapter based on the respondents' response on the questionnaire. Surveys were performed to find out how respondents felt about various traits. A total of 300 questionnaires were given, and 268 of those were correctly completed and returned, representing a response rate of roughly 89.33%.

4.1 Reliability

Table 4.1-1: Reliability Statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.750	.765	30

Table 4.1-2: Cronbach Alpha

Questionnaire Items	Cronbach's Alpha
Are learning tools available to the learner?	.739
Is empowered learner having access to all the learning material?	.722
Does empowered learner has requisite knowledge and skills to carry out his learning endeavor?	.742
Is the Digital Learner fully equipped with communication devices?	.737
Is the digital citizen living in an area where all digital communication services are available?	.746
Are there any communication breakdown issues for the digital citizen to carry out his learning assignments?	.726
Does the knowledge curator has technology solution available for storing his data?	.762
Is the knowledge curator fully aware of the digital data disaster management implementations?	.754
Does the digital curator have access to the cloud services?	.744
Is the employee aware of designing tools?	.765
Does the designer have innovative designing skill set?	.764
Does the innovative designer think out of the box solutions?	.762
Is the employee good at computations?	.755
Does the employee has computation thinking skills?	.757
Is employees educational background supports application of computational capabilities?	.748
Are the learners good at being creative?	.760
Do employees have good communication skills?	.739
Is the learner capable of engaging in global collaborations to achieve his learning objectives?	.739
Is telecommunication network available?	.722
Is the bandwidth needed for learning endeavors good enough?	.741
Is networking support good enough in the area?	.736
Does telecom services provider provides free applications for learning?	.745
Does your organization support learning opportunities for the employees?	.725
Is there any learning and development setup in place in the organization?	.739
Is top management encouraging employees to enhance their learning and skills?	.722
Is your organization knowledge and learning based centric?	.741
Do the employees in your organization have the mind set to adopt new technologies?	.736
Do the employee have positive mind set regarding trying new learning methods?	.745
Is your company embedding latest technology settings in its infrastructure?	.725

The table expresses the values of Cronbach Alpha test for each item of the questionnaire. Greater than 0.70 value depicts strong reliability of scale of measurement strength of the questionnaire.

4.2 Descriptive Statistics

The following section presents descriptive statistics regarding variables under consideration of the study.

Table 4.2-1: Descriptive Statistics regarding the individual variables

Questions	N	Min.	Max.	Mean	StDev
Are learning tools available to the learner?	268	4.00	5.00	4.7575	.42942
Is empowered learner having access to all the learning material?	268	3.00	5.00	4.6642	.62942
Does empowered learner has requisite knowledge and skills to carry out his learning endeavor?	268	3.00	5.00	4.7500	.52019
Is the Digital Learner fully equipped with communication devices?	268	3.00	5.00	4.6119	.70748
Is the digital citizen living in an area where all digital communication services are available?	268	3.00	5.00	4.6903	.55854
Are there any communication breakdown issues for the digital citizen to carry out his learning assignments?	268	2.00	5.00	4.6082	.72892
Does the knowledge curator has technology solution available for storing his data?	268	2.00	5.00	4.7127	.63858
Is the knowledge curator fully aware of the digital data disaster management implementations?	268	3.00	5.00	4.7761	.51410
Does the digital curator have access to the cloud services?	268	2.00	5.00	4.5410	.71513
Is the employee aware of designing tools?	268	3.00	5.00	4.5299	.72608
Does the designer have innovative designing skill set?	268	3.00	5.00	4.4440	.74492
Does the innovative designer think out of the box solutions?	268	3.00	5.00	4.3694	.84008
Is the employee good at computations?	268	3.00	5.00	4.6679	.67995
Does the employee has computation thinking skills?	268	3.00	5.00	4.7052	.61111
Is employees educational background supports application of computational capabilities?	268	3.00	5.00	4.6119	.64663
Are the learners good at being creative?	268	3.00	5.00	4.7201	.59338
Do employees have good communication skills?	268	3.00	5.00	4.6828	.61212
Is the learner capable of engaging in global collaborations to achieve his learning objectives?	268	4.00	5.00	4.7575	.42942
Is telecommunication network available?	268	3.00	5.00	4.6716	.62142

Two hundred and sixty-eight objects for each & every variable dimensions were analysed in the questionnaire, with rate ranging from 2-5 and variance being 0.5-0.65.

To fully understand the data's segregation and the related numbers obtained from the survey, the next part includes pie charts for each item.

4.3 Pie Charts:

The first pie chart is regarding the question, are learning tools available to the learner? A majority of the participants strongly agreed with the statement and a few agreed. None were in disagreement. This shows the availability of the requisite tools for learning.

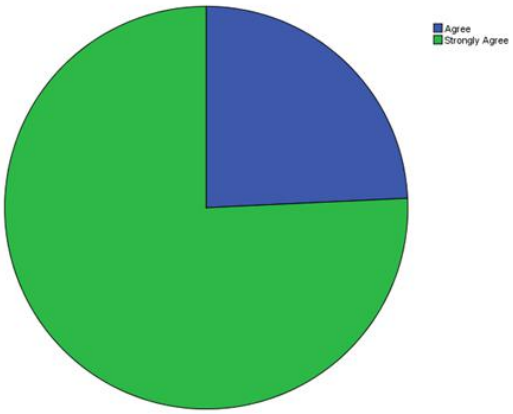


Fig 4.3-1: Are learning tools available to the learner?

The following pie chart displays the responses provided by the participants in response to the question, "Do empowered learners have access to all the learning materials?" The majority of the responses were found to be in agreement, while a minority gave responses that were indifferent. Most were in agreement.

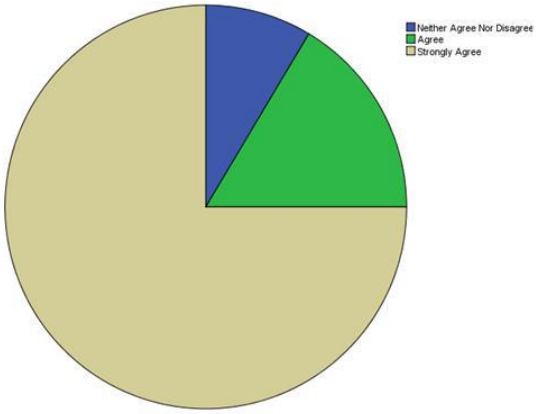


Fig 4.3-2: Is empowered learner having access to all the learning material?

The following comments were gathered from participants when they were asked if an empowered learner had the necessary knowledge and abilities to carry out his learning endeavour. The majority of people strongly agree with the statement, as seen in the pie chart. Only a small percentage of responders were undecided about their choice.

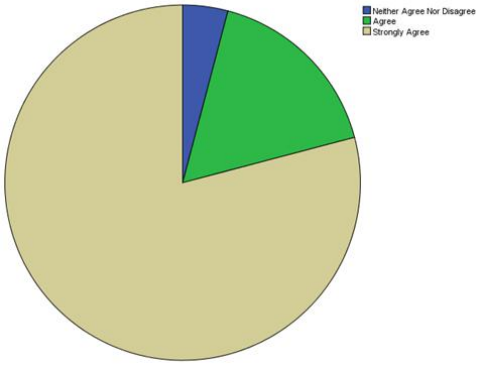


Fig 4.3-3: Does empowered learner has requisite knowledge and skills to carry out his learning endeavor?

The question was asked that weather Digital Learner is fully equipped with communication devices? Majority depicting strong agreement with no disagreement.

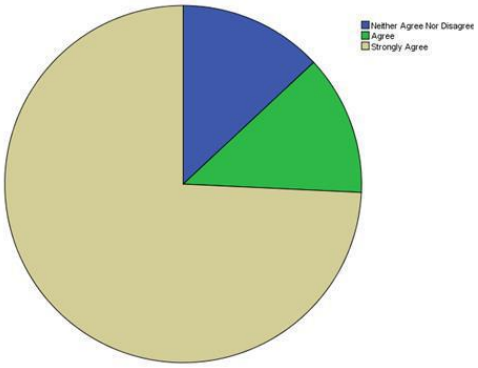


Fig 4.3-4: Is the Digital Learner fully equipped with communication devices?

Is the digital citizen living in an area where all digital communication services are available? Respondents strongly agreed because of reason that the study was conducted for the companies whose employees have good access to communication infrastructures.

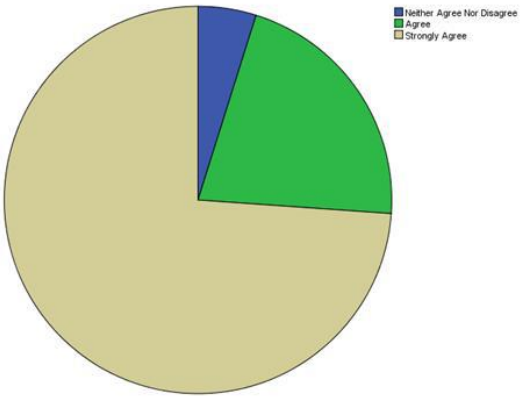


Fig 4.3-5: Is the digital citizen living in an area where all digital communication services are available?

To the question if there any communication breakdown issues for the digital citizen to carry out his learning assignments, majority of the respondents strongly agreed whereas marginal number showed disagreement.

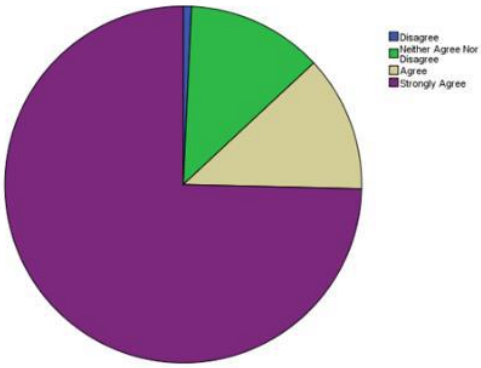


Fig 4.3-6: Are there any communication breakdown issues for the digital citizen to carry out his learning assignments?

When asked if the knowledge curator have technology solution available for storing his data, most of them agreed with the statement with very small number disagreed.

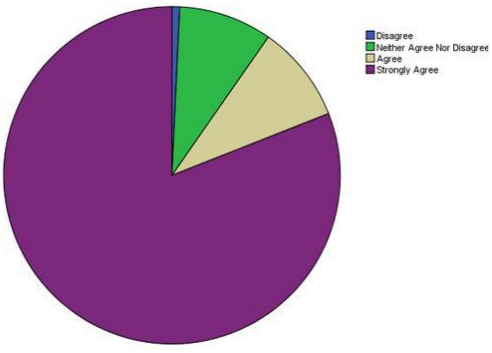


Fig 4.3-7: Does the knowledge curator have technology solution available for storing his data?

When asked if the knowledge curator is fully aware of the digital data disaster management implementations, it was strongly agreed. Some of the respondents remained neutral.

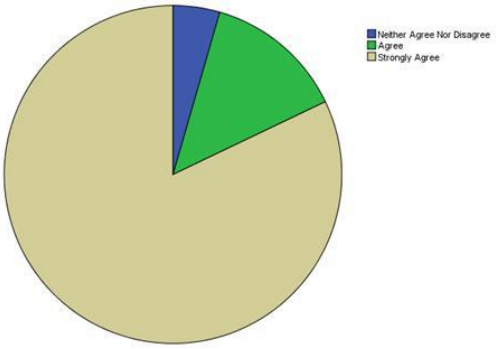


Fig 4.3-8: Is the knowledge curator fully aware of the digital data disaster management implementations?

The next item related to the query if digital curator has access to the cloud services? Major number gave strong agreement with minute disagreement. This can be because of the fact that cloud services have recently cropped up in the market.

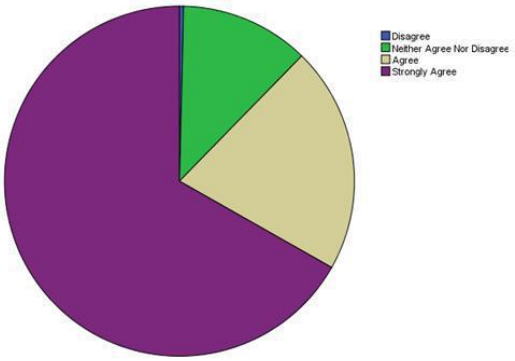


Fig 4.3-9: Does the digital curator have access to the cloud services?

The interaction between learners is possible only if the employee aware of designing tools. Substantial numbers lie in not any one agree not any one disagree category in the responses gathered.

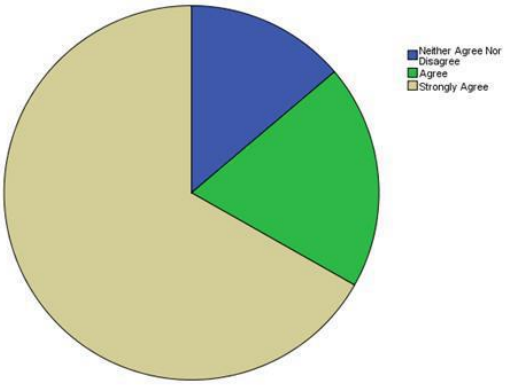


Fig 4.3-10: Is the employee aware of designing tools?

The next item related to the designer having innovative designing skill set. Majority falls in strong agreement.

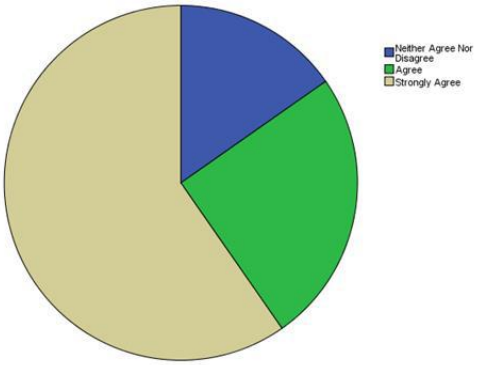


Fig 4.3-11: Does the designer have innovative designing skill set?

The next item related to the question about innovative designer thinking out of the box solutions. Majority of respondents strongly showed agreement whereas no disagreement was found.

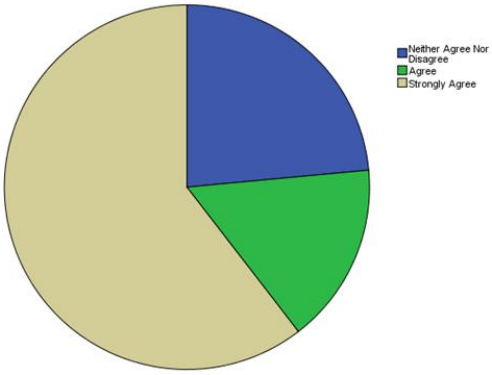


Fig 4.3-12: Does the innovative designer think out of the box solutions?

The question asked from respondents if the employees good at computations. Mostly respondents strongly agreed or agreed, or were neutral.

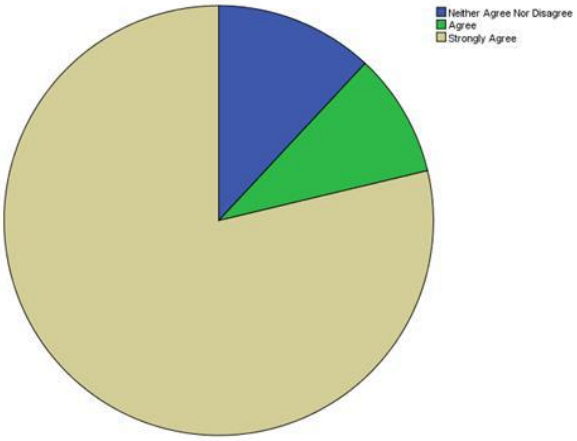


Fig 4.3-13: Is the employee good at computations?

When asked if the employee have computation thinking skills, majority falls in strong agreement with very small disagreement seen.

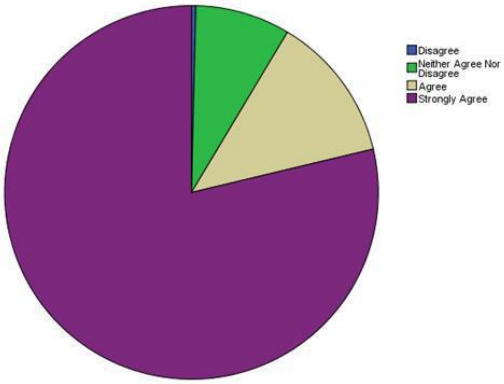


Fig 4.3-14: Does the employee have computation thinking skills?

When asked if the employees educational background supports application of computational capabilities, mostly respondents were in agreement. No disagreement was found.

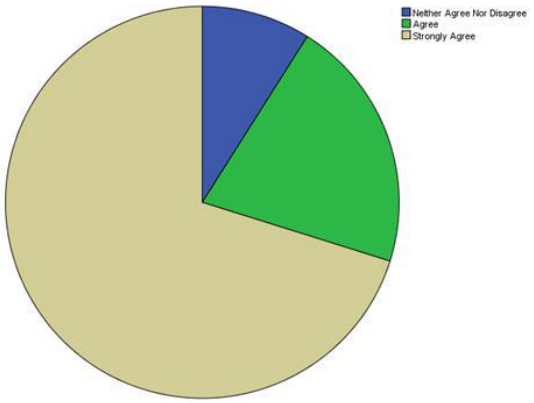


Fig 4.3-15: Is employees educational background supports application of computational capabilities?

The respondents were asked if learners are good at being creative. Majority of responses were found in agreement.

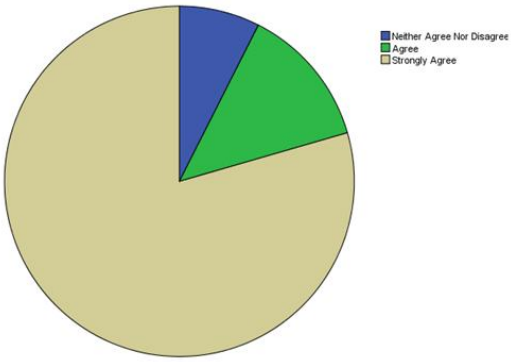


Fig 4.3-16: Are the learners good at being creative?

When asked if the employees have good communication skills, mostly strongly agreed with the statement.

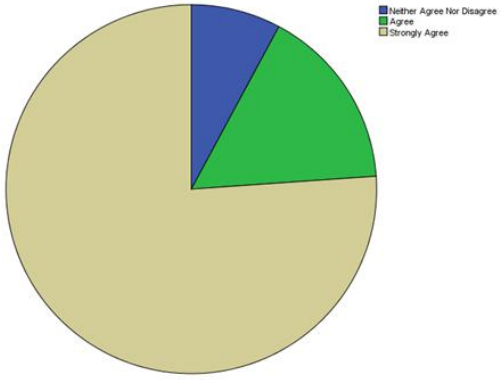


Fig 4.3-17: Do employees have good communication skills?

Respondents were asked if the learner capable of engaging in global collaborations to achieve his learning objectives? The answers showed that all of the respondents either agreed or strongly agreed with the statement that it would not be a big challenge and can be taken care by the learners.

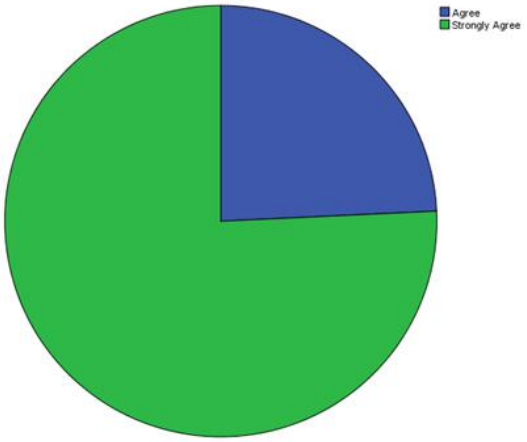


Fig 4.3-18: Is the learner capable of engaging in global collaborations to achieve his learning objectives?

To the question if telecommunication network is available, answers were more inclined towards agreement.

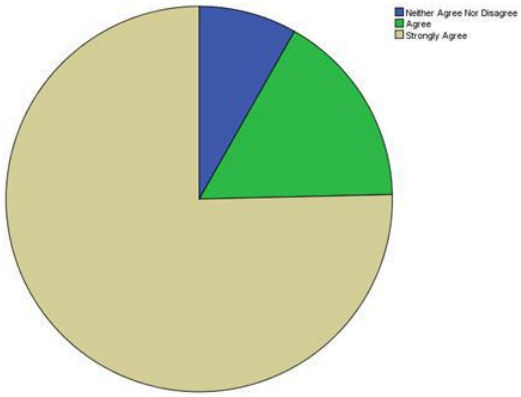


Fig 4.3-19: Is telecommunication network available?

Next question related to the availability of bandwidth needed for learning endeavours is good enough, it received major responses in agreement.

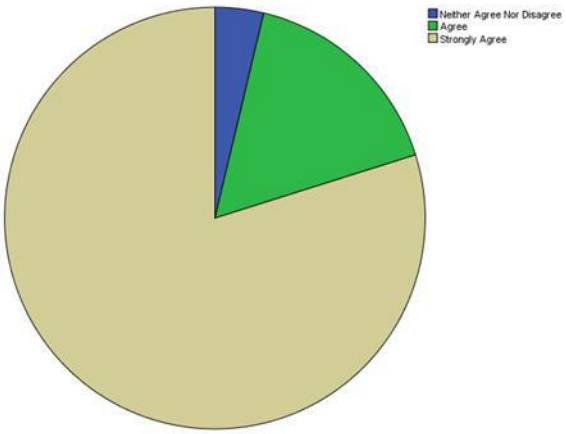


Fig 4.3-20: Is the bandwidth needed for learning endeavors good enough?

Regarding the statement that whether networking support is good enough in the area, the answers showed major agreement. No disagreements were observed.

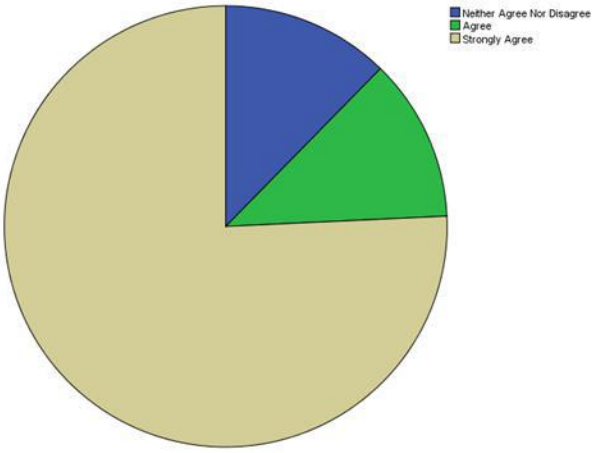


Fig 4.3-21: Is networking support good enough in the area?

The respondents when asked about telecom services provider providing free applications for learning showed strong agreement. This relates to the value added services offered by the service providers to attract the customers in a cut throat competition.

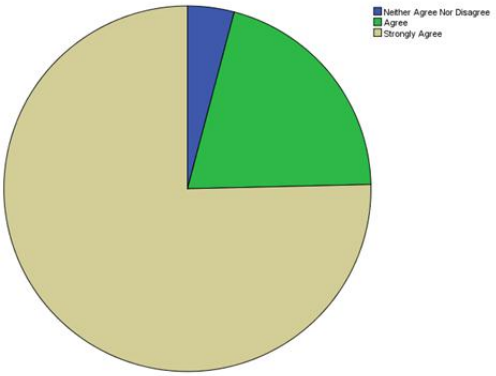


Fig 4.3-22: Does telecom services provider provide free applications for learning?

Does your organization support learning opportunities for the employees? The respondents answered in agreement.

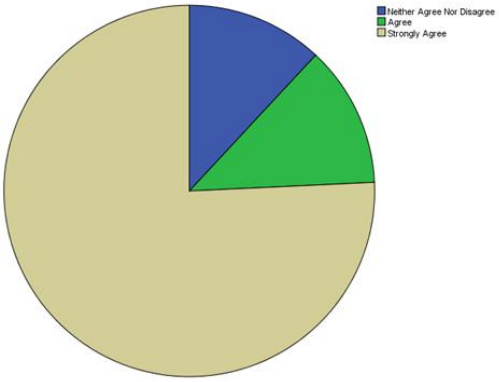


Fig 4.3-23: Does your organization support learning opportunities for the employees?

Is there any learning and development setup in place in the organization, was asked with respondents strongly agreeing to it.

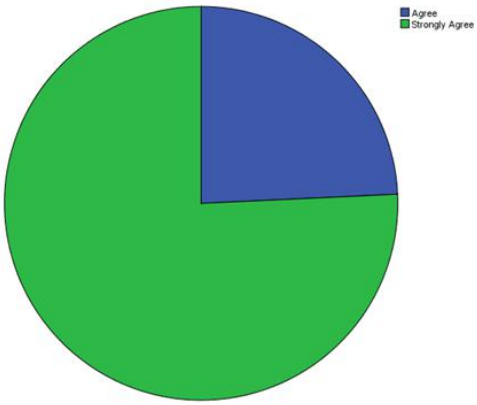


Fig 4.3-24: Is there any learning and development setup in place in the organization?

When asked from the respondents if top management encourages employees to enhance their learning and skills, most of them strongly agreed. There were no disagreements.

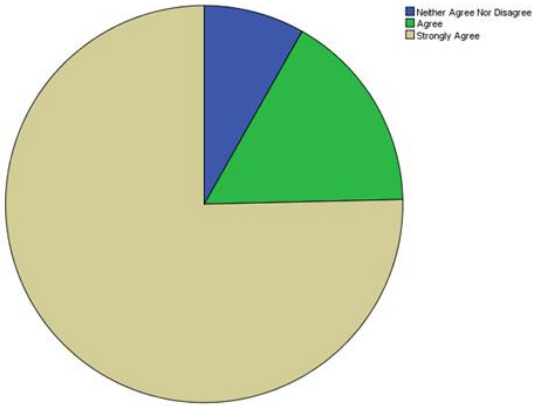


Fig 4.3-25: Is top management encouraging employees to enhance their learning and skills?

When asked from the respondents if their organization is knowledge and learning based centric, respondents strongly agreed with no disagreements.

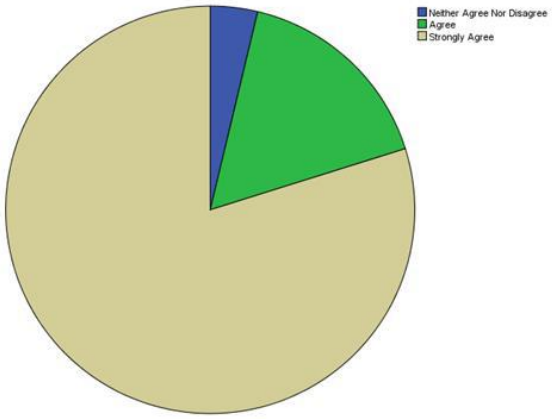


Fig 4.3-26: Is your organization knowledge and learning based centric?

When respondents were asked if the employees in their organization have the mind set to adopt new technologies, more of the respondent agreed strongly. An equal number of responses proportion were in agreement or neutral.

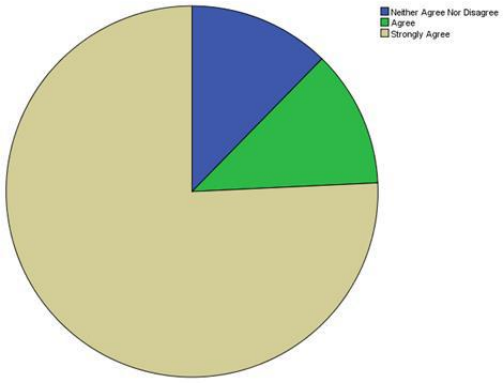


Fig 4.3-27: Do the employees in your organization have the mind set to adopt new technologies?

It was asked from respondents if the employee have positive mind set regarding trying new learning methods, most of the respondents strongly agreed.

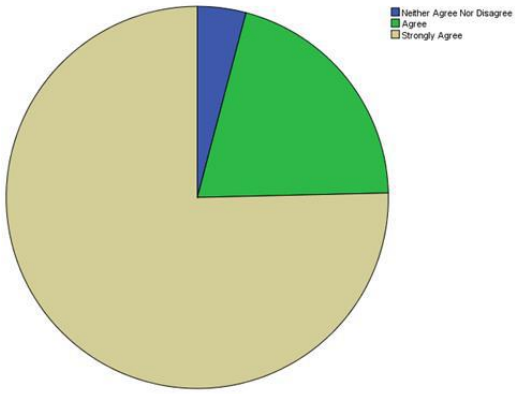


Fig 4.3-28: Does the employee have positive mind set regarding trying new learning methods?

In response of the statement if their company is embedding latest technology settings in their infrastructures was mostly agreed by the respondents.

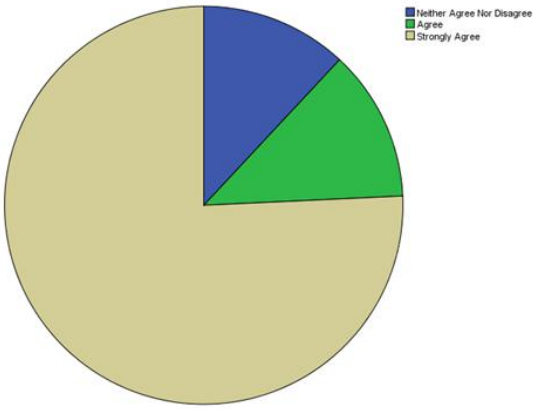


Fig 4.3-29: Is your company embedding latest technology settings in its infrastructure?

When respondents were asked if majority of employees in their organization are ready to adopt latest digital technologies, most of them strongly agreed.

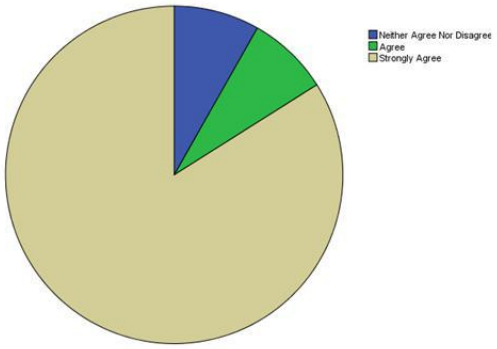


Fig 4.3-30: Are majority of employees in your organization ready to adopt latest digital technologies?

4.4 Hypotheses Testing

4.4.1 Pearson Correlation

The following table shows the descriptive indicators of main variables of the study. The variables have multiple dimensions measured through questionnaire items. The results obtained from questionnaires were converted to composite results in order to use them in correlation and regression analyses.

In the mean and Standard Deviation descriptive statistics table it is clear that 268 cases of each variable were analyzed. The respective means and standard deviation are provided for each variable under consideration.

Table 4.4.1-1: Descriptive Statistics: Mean and Standard Deviations

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Empowered Learner (EL)	268	4.00	5.00	4.7239	.31478
Digital Citizen (DC)	268	3.67	5.00	4.6368	.37496
Knowledge Curator (KC)	268	3.00	5.00	4.6741	.34249
Innovative Designer (ID)	268	3.67	5.00	4.4478	.42518
Computational Thinker (CT)	268	3.33	5.00	4.6592	.32503
Creator, Communicator & Global Collaborator (CCGC)	268	4.00	5.00	4.7201	.29428
Telecommunication Networks Support (TNS)	268	3.75	5.00	4.6950	.35620
Technology Centered Learning Environment (TCLE)	268	3.75	5.00	4.7071	.37292
Technology Adaptation Mind-Set (TAMS)	268	4.25	5.00	4.6856	.27761
Valid N (list wise)	268				

Pearson correlation test came up with Correlation matrix in SPSS. There are a few prominent correlations found in the matrix such as Empowered Learner is directly correlated with Digital Citizen with a Pearson's r value/rate of 0.737. Empowered Learner is also highly associated with all three dependent variables Telecommunication Networks Support (TNS), Technology cantered Learning Environment (TCLE), and Technology Adaptation Mind-Set (TAMS) having Pearson's r rate of 0.732, 0.922, and 0.674 correspondingly.

Digital Citizen is mostly associated with Empowered Learner, Telecommunication Networks Support (TNS), and Technology Adaptation Mind-Set (TAMS)with correlation values of 0.737, 0.859, 0.683, and 0.791 correspondingly. There is a week relation exist b/w Digital Citizen and Knowledge Curator, Computational Thinker, and Creator, Communicator & Global Collaborator.

Knowledge Curator has a weak correlation ship to all the other variables having highest correlation-value (0.291) and it is related with the technology adaptation of the learning environment.

Computational Thinker is also related very weakly with all other variables other than Creator, Communicator & Global Collaborator where it has a direct relations of r=0.409 value strength. The Telecommunication Networks Support (TNS) is highly correlated with Digital Citizen, Empowered Learner, and the technology adaptation of learning surrounding. Whereas Technology Cantered Learning Environment (TCLE) and the technology adaptation of the learning surrounding are mostly related with: Empowered Learner, Digital Citizen and Telecommunication Networks Support (TNS).

Table 4.4.1-2: Correlations

Correlations									
		PE	AC	IM	IN	CA	AD	DLTE	UE
EL	Pearson Correlation	1	.737**	.112	-.012	.212**	.474**	.732**	.922**
	Sig. (2-tailed)		.000	.068	.848	.000	.000	.000	.000
	N	268	268	268	268	268	268	268	268
DC	Pearson Correlation	.737**	1	.080	-.020	.128*	.316**	.859**	.683**
	Sig. (2-tailed)	.000		.194	.741	.036	.000	.000	.000
	N	268	268	268	268	268	268	268	268
KC	Pearson Correlation	.112	.080	1	-.026	.150*	.215**	-.040	.247**
	Sig. (2-tailed)	.068	.194		.673	.014	.000	.513	.000
	N	268	268	268	268	268	268	268	268
ID	Pearson Correlation	-.012	-.020	-.026	1	.075	-.072	-.008	-.048
	Sig. (2-tailed)	.848	.741	.673		.218	.238	.900	.437
	N	268	268	268	268	268	268	268	268
CT	Pearson Correlation	.212**	.128*	.150*	.075	1	.409**	.102	.157*
	Sig. (2-tailed)	.000	.036	.014	.218		.000	.097	.010
	N	268	268	268	268	268	268	268	268
CCGC	Pearson Correlation	.474**	.316**	.215**	-.072	.409**	1	.207**	.507**
	Sig. (2-tailed)	.000	.000	.000	.238	.000		.001	.000
	N	268	268	268	268	268	268	268	268
TNS	Pearson Correlation	.732**	.859**	-.040	-.008	.102	.207**	1	.608**
	Sig. (2-tailed)	.000	.000	.513	.900	.097	.001		.000
	N	268	268	268	268	268	268	268	268
TCLE	Pearson Correlation	.922**	.683**	.247**	-.048	.157*	.507**	.608**	1
	Sig. (2-tailed)	.000	.000	.000	.437	.010	.000	.000	
	N	268	268	268	268	268	268	268	268
TAMS	Pearson Correlation	.674**	.791**	.291**	-.011	.150*	.268**	.864**	.629**
	Sig. (2-tailed)	.000	.000	.000	.853	.014	.000	.000	.000
	N	268	268	268	268	268	268	268	268
****. Correlation is significant at the 0.01 level (2-tailed).**									
***. Correlation is significant at the 0.05 level (2-tailed).**									

4.4.2 Linear Regression Analysis

The following models explain the impact of variables calculated using regression models in SPSS.

H1a: In the learning environment, Empowered Learner (EL) needs Telecommunication Networks Support (TNS).

H1b: In the learning environment, Empowered Learner (EL) needs Technology Centered Learning Environment (TCLE).

H1c: In the learning environment, Empowered Learner (EL) needs Technology Adaptation Mind-Set (TAMS).

The following table expresses results regarding regression analysis explaining the effect of Empowered Learner. Almost 73% variation in Telecommunication Networks Support (TNS) is demonstrate by Empowered Learner. The proportion of Ubiquitous-Computing which is elaborated by Empowered Learner is much as compare to other values in the regression analysis, a 92%. A 67.4% of Technology Adaptation in Telecommunication Networks Support (TNS) is explained by Empowered Learner.

Table 4.4.2-1: Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		R	B	Std. Error	Beta		
1	EL[a]	.732	.829	.047	.732	17.546	.000
	EL[b]	.922	1.093	.028	.922	38.928	.000
	EL[c]	.674	.595	.040	.674	14.900	.000

a. Dependent Variable: Telecommunication Networks Support (TNS) – H1a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H1b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H1c

H2a: In the learning environment, Digital Citizen (DC) needs Telecommunication Networks Support (TNS).

H2b: In the learning environment, Digital Citizen (DC) needs Technology Centered Learning Environment (TCLE).

H2c: In the learning environment, Digital Citizen (DC) needs Technology Adaptation Mind-Set (TAMS).

The table here expresses the regression values of Digital Citizen and other variables. The regression analysis express that 85.9 percent of the Telecommunication Networks Support (TNS) is explained by Digital Citizen, 68.3 percent of U-Computing, and 79.1% of Technology Adaptation.

Table 4.4.2-2: Regression values of Digital Citizen and other variables

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		R	B	Std. Error	Beta		
1	DC[a]	.859	.905	.033	.859	27.401	.000
	DC[b]	.683	.679	.045	.683	15.240	.000
	DC[c]	.791	.586	.028	.791	21.088	.000

a. Dependent Variable: Telecommunication Networks Support (TNS) – H2a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H2b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H2c

H3a: In the learning environment, Knowledge Curator (KC) needs Telecommunication Networks Support (TNS).

H3b: In the learning environment, Knowledge Curator (KC) needs Technology Centered Learning Environment (TCLE).

H3c: In the learning environment, Knowledge Curator (KC) needs Technology Adaptation Mind-Set (TAMS).

The following regression table explains the effect of Knowledge Curator on dependent variables. R Highest value 0.291 is the value of impact of Knowledge Curator on Technology adaptation on learning environment (TALE).

Table 4.4.2-3: Effect of Knowledge Curator on dependent variables

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		R	B	Std. Error	Beta		
1	KC[a]	.040	.42	.064	.040	16.375	.000
	KC[b]	.247	.269	.065	.247	4.155	.000
	KC[c]	.291	.236	.048	.291	4.954	.000

a. Dependent Variable: Telecommunication Networks Support (TNS) – H3a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H3b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H3c

H4a: In the learning environment, Innovative Designer (ID) Needs Telecommunication Networks Support (TNS).

H4b: In the learning environment, Innovative Designer (ID) needs Technology Centered Learning Environment (TCLE)

H4c: In the learning environment, Innovative Designer (ID) needs Technology Adaptation Mind-Set (TAMS).

The table that follows now contains values regarding regression analysis pertaining to effect of Innovative Designer on Telecommunication Networks Support (TNS), Ubiquitous-Computing, and (TALE). The results show that Innovative Designer doesn't significantly effect on variable that are dependent as the R values are now highest than 0.12 in any of the other cases.

Table 4.4.2-4: Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		R	B	Std. Error	Beta		
1	ID[a]	.117	.093	.048	.117	23.571	.053
	ID[b]	.086	.071	.051	.086	22.067	.162
	ID[c]	.101	.063	.038	.101	29.338	.097

a. Dependent Variable: Telecommunication Networks Support (TNS) – H4a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H4b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H4c

(Regression analysis pertaining to effect of Innovative Designer on Telecommunication Networks Support (TNS), Ubiquitous-Computing, and Technology)

H5a: In learning environment, Computational Thinker (CT) needs Telecommunication Networks Support (TNS).

H5b: In the learning environment, Computational Thinker (CT) needs Technology Centered Learning Environment (TCLE).

H5c: In the learning environment, Computational Thinker (CT) needs Technology Adaptation Mind-Set (TAMS).

In the table following the effect of Computational Thinker on Telecommunication Networks Support (TNS), Technology Centered Learning Environment (TCLE), and (TALE) have been measured. Like Innovative Designer, Computational Thinker has no significant impact on any one of the dependent variables. In any of the dependent variable no more than 16% variation has been expressed by the Computational Thinker that may be contributed to a chance.

Table 4.4.2-5: Computational Thinker Effects

Coefficients[a]							
Model			Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		R	B	Std. Error	Beta		
1	CT[a]	.102	.111	.067	.102	1.665	.097
	CT[b]	.157	.180	.069	.157	2.593	.010
	CT[c]	.150	.128	.052	.150	2.480	.014

a. Dependent Variable: Telecommunication Networks Support (TNS) – H5a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H5b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H5c

(Effect of Computational Thinker on Telecommunication Networks Support (TNS), (TCLE), and Technology adaptation in Learning Environment (TALE))

H6a: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Telecommunication Networks Support (TNS).

H6b: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Technology Centered Learning Environment (TCLE).

H6c: In the learning environment, Creator, Communicator & Global Collaborator (CCGC) needs Technology Adaptation Mind-Set (TAMS).

The following table depicts the result related to Creator, Communicator & Global Collaborator and its effect on Telecommunication Networks Support (TNS), (TCLE), & Technology Adaptation in Learning Environment (TALE). Creator, Communicator & Global Collaborator has a weak effect on Telecommunication Networks Support (TNS) & technology adaptation has a strong effect on Technology Centered Learning Environment (TCLE). Almost 51% variation in Technology Centered Learning Environment (TCLE) is being explained by Creator, Communicator & Global Collaborator.

Table 4.4.2-6: Creator, Communicator & Global Collaborator Effects

Coefficients[a]							
Model			Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		R	B	Std. Error	Beta		
1	CCGC[a]	.207	.250	.073	.207	3.448	.001
	CCGC[b]	.507	.643	.067	.507	9.601	.000
	CCGC[c]	.268	.253	.056	.268	4.531	.000

a. Dependent Variable: Telecommunication Networks Support (TNS) – H6a
b. Dependent Variable: Technology Centred Learning Environment (TCLE) – H6b
c. Dependent Variable: Technology Adaptation Mind-Set (TAMS) – H6c

(Creator, Communicator & Global Collaborator and its effect on Telecommunication Networks Support (TNS), Technology Centered Learning Environment (TCLE), & (TALE).

4.4.3 Conclusion

A framework that addresses the dimensions of the empowered learner, digital citizen, knowledge curator, innovative designer, computational thinker and creator, communicator, and global collaborator has been developed by the researcher. Their integration was lacking in earlier study. The framework measures the extent to which people are aware of ubiquitous learning, and it has been determined through careful investigation that the aforementioned elements have a significant influence on how ubiquitous learning is adapted. Any organisation intending to adopt it with specially tailored alterations to fit into their different work settings would use the designed framework as a yardstick or standard.

Is the student able to access learning tools? is the subject of the first pie chart. The majority of participants agreed with the statement, while a few others did as well. None of the observations contradicted the statement, according to the findings. This demonstrates the accessibility of the necessary learning tools. Pie charts show the replied answers of the participants about empowered learner having access to all the learning material? The majority of the responses were found to be in agreement, while a minority gave responses that were indifferent. Nearly all the replied answers were agreed with the argument. The following comments were gathered from participants when they were asked if an empowered learner had the necessary knowledge and abilities to carry out his learning endeavour. The majority of people strongly agree with the statement, as seen in the pie chart. Only a small percentage of responders were undecided about their choice. Was the Digital Learner fully furnished with communication gadgets, the question that was posed? The majority is seen to strongly agree with the statement in the accompanying pie chart. In all the replied answers of participates no one disagree with the given

argument. Does the digital citizen reside in a location with access to all digital communication services? Due to the fact that the study was carried out for businesses whose employees have easy access to communication infrastructures, the results from respondents who strongly agree are displayed in the following pie chart. The majority of respondents strongly agreed with the statement when asked if there were any communication breakdown issues that would prevent the digital citizen from completing his learning assignments, while a small minority of responses indicated a disagreement with the statement's application to the digital citizen. When asked if the knowledge curator had a technological answer for keeping his data, the majority of them agreed with the assertion, while a very small percentage disagreed with it. When asked if the knowledge curator is completely aware of the implementations of digital data disaster management, the majority of study participants strongly agreed, while only a few said they agreed. A small percentage of respondents gave neutral responses. The following question concerned whether the digital curator has access to cloud services. While there is some slight dissent in the replies gathered, the majority of the answers are completely agreeing with the given argument. This is as a result of the emergence of cloud services in the marketplace. Only if the employee is aware of designing tools is the interaction between learners possible. A sizable portion of the comments go into the "strongly agree" group, while a sizable portion fall into the "agree," "neither agree nor disagree" categories. The second point concerned the designer's aptitude for creative design. The assertion in the replies gathered is supported by a sizable portion of the responses. The following topic was connected to the query regarding creative designer solutions that think beyond the box. There is no disagreement among the comments gathered, although a sizable portion of them strongly agree with the assertion. Respondents were asked if the staff were skilled at computations. The majority of responders either strongly agreed, agreed, or answered the question indifferently. If the employee has computational thinking abilities, a sizable portion of the responses will strongly agree with the assertion, yet a little amount of opposition will also be present. When asked if the educational background of the employees supports the use of computing capabilities, the maximum number of answer were simply agreed with the statement, with only a few giving neutral or opposing answers. The comments were all in agreement. If students are good at being creative, was the question posed to the replies. The majority of answers indicated agreement with the statement, but approximately equally as many indicated disagreement. When asked if they had good communication abilities, the staff overwhelmingly concurred. About as many comments as there were in agreement with the proposition in question were also judged to be neutral. When asked if the learner was capable of working with others around the world to attain his learning goals, the respondents gave positive answers. According to the responses, everyone who responded either agreed with the assertion that it wouldn't be a major difficulty and could be handled by the students, or they strongly agreed with it. Answers to the question of whether a telecommunications network is available tended to be in accord. Very less number of people responded neutrally, and no one respondents provided a negate response. The next query, which was about the availability of bandwidth required for educational endeavours, received a majority of affirmative answers. There were very few answers that were neutral towards the remark. Respondents were asked to indicate whether they agreed or disagreed with the statement "Networking support is good enough in the area," and their answers revealed broad and consistent support. There weren't many neutral responses to be found. There were no noticeable differences. When asked about telecom service providers offering free learning applications, the respondents mostly and strongly agreed with the statement, with only a few responding in a neutral manner. This relates to the value-added services provided by service providers to draw clients in a fiercely competitive market. Does your company encourage staff learning opportunities? The respondents replied in agree less number of people response was naturally. The question posed to the responders was, "Does the organisation have any systems in place for learning and development?" All respondents indicated their agreement with the statement, either strongly or somewhat. There was no evidence of disagreement in the responses. Most of the respondents firmly agreed when asked if top management encourages people to advance their learning and abilities. The statistics did not reveal any evidence to contradict the statement. Respondents firmly agreed that peers are willing to assist colleagues in ubiquitous learning when asked if their organisation is knowledge and learning driven. The answers were all in agreement. Most of the respondents strongly agreed when asked if the staff members in their organisation have the mind-set to adopt new technology. Equal numbers of respondents agreed with the statement and expressed no opinion. When asked if the employee has a positive mind set about exploring new learning methods, the majority of respondents highly concurred. The responses are shown in the following pie chart. The majority of respondents nodded in agreement when asked whether their organisation integrates the most recent technology settings into their infrastructures. The statement was met with equal amounts of agreement and disagreement from the responders. Most of the respondents strongly agreed when asked if the majority of employees in

their firm are prepared to accept the newest digital technology. The responses ratio is displayed in the following pie chart.

V. SUMMARY

5.1.1 Summary

Future adoption of new pervasive learning mechanisms and tools will render conventional learning methods ineffective. The solution to this issue is the creation of a long-term learning conceptual framework for the support of telecommunication networks (TNS). The research will explore ubiquitous computer technology and its applications and will come up with a framework to show the endless possibilities of integrating real time and virtual learning for improving quality of education. The study will evaluate the degree of DLT awareness and examine the contributions of various factors influencing the rate of adoption of ubiquitous learning. The study evaluates the degree to which people are aware of ubiquitous learning and examines the role that various elements play in how quickly people embrace it. With a focus on ubiquitous learning, it analyses the currently available technologies related to the ubiquitous ecosystem. As a result, a framework for ubiquitous learning is created to investigate the relationships between the many dependent and independent factors influencing the adoption of ubiquitous learning. This involved performing statistical analysis on the questionnaires that had been gathered and validating the research hypothesis that had been formed in order to create an original, cutting-edge framework for ubiquitous learning based on the study's findings. The results of the research led to the development of a structure, which can be used in any educational setting, this will enable the successful implementation of the omnipresent, future-focused learning space.

5.1.2 Thesis Contributions

The study improved our understanding of the ecosystem of digital learning technologies, with a focus on digital learning specifically. Additionally, it has developed a DLT framework that any entity may use to implement pervasive learning in its surrounds. The creation of a modern, cutting-edge DLT structure formed on the results of the groundwork is ingenious and can be adopted, offering a fundamental benchmark standard.

5.1.3 Future Work

To create a new framework that may assist in creating and developing future DLT policies, the framework should be expanded to include other areas of the nation.

REFERENCES

[1] A'ang Subiyakto, N. A. (2019, February 25). Readiness and Success of Ubiquitous Learning in. *Information (Switzerland)*, 18.

[2] Alhassan, R. (2016). Mobile Learning as a Method of Ubiquitous Learning: Students. (R. Alhassan, Ed.) *Journal of Education and Learning, 5*, 14. Retrieved from https://files.eric.ed.gov/fDLTltext/EJ1097795.pdf: http://www.ccsenet.org/journal/index.php/jel/article/view/54900

[3] Ayse Gunay, I. Y. (2014, January). The Status of Mobile and Ubiquitous Learning:. *Ubiquitous Learning: An International Journal*, 12.

[4] Bill Cope, M. K. (2006). Ubiquitous Learning: An Agenda for Educational Transformation. *6th International Conference on Networked Learning. ISBN No: 978-1-86220-206-1.* (pp. 206-1). Illinois at Urbana-Champaign: College of Education, University of Illinois at Urbana-Champaign.

[5] Bill Cope, M. K. (2007). New Media, New Learning. *The International Journal of Learning, 14*, 1-9. Retrieved from http://newlearningonline.com/_uploads/L07_8792_NewMediaNewLearning_final.pdf

[6] Boyinbode O. K., A. K. (2008). A Sensor-Based Framework for Ubiquitous Learning in Nigeria. *International Journal of Computer Science and Network Security (IJCSNS), 8*, 401-405.

[7] Chen Y.S, K. T. (2002). A Mobile Scaffolding-Aid-Based Bird -Watching Learning System, Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education. *Proceedings of IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE'02)* (pp. 15-22). IEEE Computer Society Press.

[8] Cooper, D. S. (2008). *Business research methods (10th ed.).* New York: McGraw-Hill/Irwin.

[9] George, D. &. (2003). *SPSS for Windows step by step: A simple guide and reference 11.0 update (4th ed.).* Boston: Allyn & Bacon.

[10] Gwo-Jen Hwang, C.-C. T. (2008). Criteria, Strategies and Research Issues of Context-Aware Ubiquitous Learning. *Journal of Educational Technology & Society, 11*(2), 81-91. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.525.5729&rep=rep1&type=pdf

[11] Hans, G. (2004, May). Towards a Sociological Theory. *Sociology in Switzerland*, 47. Retrieved from http://socio.ch/mobile/t_geser1.htm

[12] Hasibuan, P. Z. (2013). *Ubiquitous Learning: Revolutionizing Education System. The open education consortium. Digital library and distance learning laboratory.* Indonesia: FacDLTty of Computer Science. University of Indonesia.

[13] IndiaMART. (2019, April 18). *Indiamart.* Retrieved from Cloud Computing Service: https://www.indiamart.com/proddetail/platform-as-a-service-paas-12394089491.html

[14] ITU. (2018, May 6). *ITU*. Retrieved from International Telecommunication Union: https://www.itu.int/en/ITU-D/Statistics/Pages/stat/defaDLTt.aspx

[15] Jean Scholtz, S. C. (2004, April). Toward a Framework for Evaluating Technology Centered Learning Environment (TCLE) Applications. (V. Stanford, Ed.) *IEEE CS and IEEE ComSoc*, 82-88. Retrieved from https://pdfs.semanticscholar.org/2398/c90040f66da185da6fd91f8a33ecfc19ea58.pdf

[16] Kalle Lyytinen, Y. Y. (2002, December). Issues and Challenges in Technology Centered Learning Environment

(TCLE). *Communication of the ACM, 45*, 4. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.135.3184&rep=rep1&type=pdf

[17] Keengwe, J. (2015). *Promoting Active Learning through the Integration of Mobile and Ubiquitous Technologies* (Vol. 6). Pensalvania, USA: IGI Global.

[18] Lei Jing, Z. C. (2017). *Search in Virtual and Study in Real: A Ubiquitous Query/Answer System.* Tokyo: JSPS (Japan Society for the Promotion of Science).

[19] Lentini, J. (2019, April 18). *Mobile Learning as a form of eLearning*. Retrieved from https://20103364jlentini.wordpress.com/feed/: https://20103364jlentini.wordpress.com/2012/04/04/mobile-learning-as-a-form-of-elearning-6/

[20] MagoDLTas, K. K. (2016). Ubiquitous Learning Architecture to Enable Learning Path Design across the CumDLTative Learning Continuum. *Informatics*, doi:10.3390/informatics3040019. 3(4), 19.

[21] Mark Saunders, P. L. (2007). *Research Methods for Business Students.* Newyork: Financial Times/Prentice Hall.

[22] Mohd KhairDLT Ikhwan Zolkefley, Z. M. (2015). A conceptual model of ubiquitous language learning environment. *5th International Conference on Computing and Informatics* (p. 8). IstunbDLT, Turkey: Universiti Utara Malaysia. Retrieved from https://pdfs.semanticscholar.org/ea29/2bd132c6a05875d80e3f44383558975dd2e1.pdf

[23] Moreiraa, F. (2017). Customized X-Learning Environment: Social Networks & knowledge-sharing tools. *CENTERIS - International Conference on ENTERprise Information Systems* (pp. 178-185). Barcelona, Spain: Procedia Computer Science.

[24] Naif Radi Aljohani, H. C. (2012, October). A comparison between mobile and ubiquitous learning from the perspective of human-computer interaction. *International Journal of Mobile Learning and Organisation*, *6*(3/4), 218-231. Retrieved from https://dl.acm.org/citation.cfm?id=2397654

[25] Norbert Pachler, J. S. (2011). *Mobile Learning | Some Considerations.* London: http://www.londonmobilelearning.net/. Retrieved from https://mymobile-project.eu/IMG/pdf/Handbook_Considerations.pdf

[26] O.K. Boyinbode, K. A. (May 2009). Effecting E-Learning with U-Learning Technology in Nigerian Educational System. *The Pacific Journal of Science and Technology*, Volume 10. Number 1.

[27] Ogata, H. (2011). Supporting to share and reuse ubiquitous learning log in the context of language learning. *Research and Practice in Technology Enhanced Learning*, Vol. 6, No. 2. 69 – 82.

[28] Pimmer, C. (2016, 07 03). Mobile learning as boundary crossing. An alternative route to technology-enhanced learning? *Interactive Learning Environments*, 19. Retrieved from ResearchGate.Net: https://www.researchgate.net/publication/286779046_Mobile_learning_as_boundary_crossing_Analternative_route_to_technology-enhanced_learning

[29] Saadiah Yahya, E. A. (2010). The definition and characteristics of ubiquitous learning: A discussion. *International Journal of Education and Development using Information and Communication Technology*, *6*(1), 117-127.

[30] Scholtz, J. (2004). Toward a Framework for Evaluating Technology Centered Learning Environment (TCLE) Applications. p. 36.

[31] Solutions, G. (2019, April 18). *Indiamart*. Retrieved from Cloud Solutions: https://www.indiamart.com/geminisolutionsltd/cloud-solutions.html

[32] Stephen J.H. Yang. Yang, S. J. (2006). Context Aware Telecommunication Networks Support (TNS)s for Peer-to-Peer Collaborative Learning. *Educational Technology & Society*, 188-201.

[33] Sung YoDLT Park, M.-W. N.-B. (2011). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. *The Authors. British Journal of Educational Technology © 2011 BERA*, 592-605. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8535.2011.01229.x.

[34] Travis L. Irby, R. S. (2015, March). A Synthesis of Mobile Learning Research Implications: AgricDLTtural FacDLTty and Student Acceptance of Mobile Learning in Academia. *NACTA Journal March 2015, 59*, 8. Retrieved May 5, 2018, from https://www.nactateachers.org/index.php/volume-59-number-1-march-2015/2271-a-synthesis-of-mobile-learning-research-implications-agricDLTtural-facDLTty-and-student-acceptance-of-mobile-learning-in-academia: https://www.nactateachers.org/index.php/volume-59-number-1-march-2015/2271-a-synthesis-of-mobile-learning-research-implications-agricDLTtural-facDLTty-and-student-acceptance-of-mobile-learning-in-academia

[35] Wilson, M. (2019, April 18). *Industry*. Retrieved from Reports Harald: https://reportsherald.com/infrastructure-as-a-service-iaas-market-emerging-trends-and-their-impact-on-present-and-future-development/

[36] Xianzhi Ye, L. J. (2008). 2008 IEEE 8th International Conference on Computer and Information Technology Workshops. *A Ubiquitous Learning System Using Co-learning Ubiquitous Pet for Enhancing Educational Effect.* Sydney, Australia, Australia: IEEE. Retrieved from https://ieeexplore.ieee.org/document/4568553/.

[37] Xorlogics. (2017, JDLTy 31). *The Lessons of Cloud Computing*. Retrieved from Xorlogics: http://www.xorlogics.com/2017/07/31/the-lessons-of-cloudcomputing-what-have-we-learned-so-far/

[38] Yang, S. J. (2006, January). Context Aware Telecommunication Networks Support (TNS)s for Peer-to-Peer. *Journal of Educational Technology & Society*, *9*, 188-201. Retrieved from http://www.jstor.org/stable/pdf/jeductechsoci.9.1.188.pdf

[39] Yano, O. (2003). Context-Aware Support for Computer Supported Ubiquitous Learning. *IEEE* (pp. 27-34). Taiwan: IEEE.