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# FACTORS AFFECTING ELECTRONIC PAYMENT PERFORMANCE: A CASE STUDY ON COMMERCIAL BANK OF ETHIOPIA IN JIGJIGA

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**ABSTRACT**

*The purpose of this study is to assess whether electronic payments performances (EPP) have been addressing individuals' of quality life through providing ease of payment for online transactions. Currently the banking service is well equipped with innovations and as the application of the technology in the banking industry is becoming so significant firms have made huge investment on technology based banking and shifting from conventional (bricks and mortar) banking to such branchless mode of banking. Following such shift customers are also shifting to technology based banking service due to perceived usefulness, convenient to use, privacy and freedom of mobility. Thus, the objective of the study was to assess the status of electronic-payment performance in the case of Jigjiga CBE branches. The results of the study reveal that the effect of E-payments service dimensions on the performance of E-payments is direct and significant. More than 65% of respondents signed on positively showing that customers have interest and found out convenient to use the banking technology instead of interacting with human tellers. It also allows customers to transact their banking service quickly, it saves time, some others do not misuse their personal information, and customization is good. Hence it can be concluded that the overall application of CBE e-banking has a bright future in the Ethiopian banking industry and CBE has a chance to mobilize the potential customers and reap more profits through provision of quality service using the banking technology as an interface. In addition, the bank has to increase features and improve the facilities of the technology based banking service in such a way that customers can receive a wider range of financial services. Specifically providing simple, differentiated customer-focus services based on changing and growing customer behaviour and preferences.*

**KEYWORDS**

**Electronic Payments, ATM Service Quality, POS, Mobile Banking, Internet banking, E-banking etc.**

## *1.0 INTRODUCTION*

The recent cashless policy of the Ethiopian government has been a subject of concern to bankers (accountants) and players in commerce. The National banks of Ethiopia (NBE) strategic plan on payment system is designed to ensure that a larger proportion of currency in circulation is captured within the banking system, thereby enhancing the efficiency of monetary policy operations and economic stabilization measures. There is no doubt that electronic payment (e-payment) development will strongly contribute to improving countries' competitiveness in many ways (Kamulegeya 2010). Innovations in the payment industry have also led to greater financial inclusion, where e-payment service providers help to facilitate payment transactions into the formal financial system even in the absence of banking accounts. The World Bank has also suggested that e-payment is crucial for economic development.

### *1.1 Statement of the Problem*

The existence of empirical studies measuring combined effect of banks specific determinant variables (like bank size, card production period, distribution period, replacement period, fair distribution of e-payment materials / infrastructures, cost of human capital, intensity of branches) and four e-payment systems like Automated teller machine (ATM), Internet banking, point of sales (POS) and mobile banking on customers service delivery is major

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issues in the Jigjiga town context as at the time of this study. However, a bank that performs electronic banking must develop different methods of conducting business, methods which may discourage target consumer of the bank. It is therefore important for bankers, policymakers and other players in commerce to understand how electronic transactions in commercial banks influence customers service delivery. The combined effect of all e-payments instrument on performance of the adopting banks are measured by customers actively involved in the bank provided service is worthy of exploration.

### *1.2 Objectives of Study*

Following are the objectives of the study.

- To identify factors influence electronic payment performance in commercial bank of Ethiopia in Jigjiga.

### *1.3 Research Questions*

The study tries to show and examine the following research questions:

- What are the critical determinants/factors for the performance of e-payment in Jigjiga city CBE?

### *1.4 Justifications of Study*

Intrinsically, investigating and examining the determinants that stimulate the performance behaviour is important, especially for technologically developing countries like Ethiopia, where the opportunity for economic growth is high and the benefit of technologies like e-payment is not yet fully realized. The study is expected to suggest significant policy statements through its recommendations.

## *2.0 LITERATURE REVIEW*

### *2.1 Theoretical Literature*

Unified Theory of Acceptance and Use of technology (UTAUT), theory (Verkatesh et al 2003) This theory is in user acceptance of information technology; toward a unified view, the theory explains user intentions to use an information systems and subsequent usage behaviour, and further holds that four key constructs; **performance expectancy, effort expectancy, social influence and facilitating conditions**.

Forman & Goldfarb (2006) have proved TAM to be robust model that is frequently used to study acceptance of information communication technology (ICT). TAM is viewed as Information system theory, which helps to understand the adoption and use of internet (Gibbs et al., 2007). The theory helps to understand how performers come to accept or reject the use of ICT in their businesses. However, Manueli et al., 2007 criticized TAM as less comprehensive compared to the diffusion approach, which has more innovation characteristics including time as an essential element of the theory (Gibbs et al., 2007; Rogers, 1995).

#### *2.1.1 ATM and its Benefits*

Studies show that the technological revolution came to surface in the banking industry in the 1950s with the implementation of the automated book keeping machines at banks and the history of ATM dates back to the 1960s, the time at which John Shepherd-Barron invented the first ATM. Barclays bank implemented the machine for the first time in the banking industry in 1967, Wikimedia E-encyclopedia cited in Kumbhar (2011). The first ATM, which has been implemented in US in 1968, came out with only a cash dispenser (Zaman and Chowdhury, 2012). ATM is "an electronic device which allows a bank's customers to make cash withdrawals and check their balances at any time without the need for human teller" (Islam et al., 2005:3). They state that ATM is an innovation, which can mechanically accept deposits, transfer funds between accounts and collect bills. In addition, ATM is defined as "an

automatic teller machine which is used to save the cost and reach-ability of a bank; by satisfying customer needs" (Vasumathi and Dhanavanthan, 2010:469).

### *2.1.2 POS*

**Point-of-Sale (POS) Transfer Terminals:** The system allows consumers to pay for retail purchase with a check card, a new name for debit card. This card looks like a credit card but with a significant difference. The money for the purchase is transferred immediately from account of debit cardholder to the store's account (Malak 2007).

### *2.1.3. Internet / Extranet Banking*

Internet banking is an electronic home banking system using web technology in which Bank customers are able to conduct their business transactions with the bank through personal computers.

Alabar & Timothy (2012) cited in Sintayehu, (2015) Internet banking is conducted by completing bank transactions by directly accessing the bank through the internet. Nowadays, internet-banking customers can access many different services online, which make physical banks open even after office hours. Internet banking allows customers of a financial institution to conduct financial transactions on a secure website operated by the institution. Internet banking can be conducted either by accessing the internet with a computer or by using a phone that has internet features.

### *2.1.4. Mobile Banking*

Mobile banking is a service that enables customers to conduct some banking services such as account inquiry and funds transfer, payment to others beneficiary by using of short text message (SMS).

Tiwari & Buse, (2007) cited in Sintayehu, (2015) Mobile banking (also known as M-Banking) is a term used for performing balance checks, account transactions, payments, credit applications and other banking transactions through a mobile device such as a mobile phone or Personal Digital Assistant (PDA).

### *2.3 Empirical Literature*

### *2.3.1 Business Customers' Traits on Performing of Electronic Payment*

According to (Armstrong, 2010) Human skill is defined as „the skills the force possesses and is regarded as a source or asset". It encompasses the notion that there are investments in people (example education, training, health) and that these investment increase an individual's productivity. Smith (1776) defined human capital as „the acquisition of … talents during … education, study, or apprenticeship, costs a real expense, which is capital in a person.

According to Gerald (2011), human skill can be skill acquired and observable expertise in performing tasks. Knowledge is acquired information used in performing tasks. Competencies are skills that are more general or traits needed to perform tasks often in multiple jobs or roles. In views of the discrepancies in the definitions above the definition of human skill for this study is derived from Gerald (2011).

### *2.3.2 Ease of Use of Electronic Gadgets on Electronic Payment Adoption*

Davis (1989) cited in Ogotielijah Sokobe, (2015) defined ease of use of technology as "the degree to which a person believes that using particular payment would be free of effort ". Lee (2009) defined perceived ease of use in business and fewer complexes to increase the like hood of its adoption. These definitions agree on the degree of free of effort. However, these ignore usage as constraints to the performers, which are useful ingredient of usage (Stuart, 2011).

From the above empirical review at international level most of studies were emphasized on countries with large number of electronic payment users and the commercial banks, which provide better alternative e-payment services in the context of their countries. In general, review of empirical studies shows that understanding the factors,

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opportunities and challenges in e-payments are important for banking industries due to it would potentially help them in improving their strategic planning process.

## *3.0 RESEARCH DESIGN AND METHODOLOGIES*

### *3.1 Description of the Study Area*

The study area was on commercial banks of Ethiopia branches in Jigjiga town only. Totally, there are six CBE branches in the Town, where around five branches are found at the centre of the town, this shows that more of the different kinds of businesses are collected at the centre where majority of CBE branches found.

### *3.2. Research Design*

A descriptive survey design was used because the study requires the collection of data that were descriptive in nature. A survey was conducted on all the six branches of Commercial Banks of Ethiopia in the Jigjiga. Structured questionnaires, interview and document analysis were provided to the bank staffs including managers and certain customers are the participants.

### *3.3. Target Population*

The target population of the study would be the representative number of six branches staff (Employees), premium customers and the managers of six branches. The premium customers were the customers, which have an account with the deposit minimum balance/amount greater than one million local currencies, are considered as premium customer of the given branch.

### *3.4. Sampling Technique*

The type of sample design employed for selecting individuals in this study was based on two criterions namely the representation and element selection technique

### *3.5. Sample Size*

Total sample size is 181 where Six (6) managers, 73 staff (Employees) and 102 Premium Customers from each CBE branches formed the sample of the study. Because of different size of the population, which researcher would conduct from different representative background of population using convenience sampling and therefore all respondents (managers, bank staff and premium customers) would be covered in the study.

### *3.6 Method of Data Analysis*

A multiple linear regression analysis was used to analyze the effect of electronic payment determinants on the performance.

## *4.0 RESULTS AND DISCUSSION*

### *Regression for E-Payments Dimensions and their Performance in the Customers' Perspective*

Multiple linear regressions was used to model the value of a dependent scale variable; in relation to one or more of the independent variable which shows to what extent the dependent variable is affected by the independent variables. The dependent variable (criterion) was e-payments performance while the independent variables (predictors) were the e-payments dimensions. The coefficient of determination (R Square) and regression coefficients (Beta coefficient) for the p-value for the significance of each relationship is analyzed with respect to the CBE's premium customers (annexed).

**Table-1: Regression Analysis between e-payments Dimensions and their Performance Coefficients**

| Coefficients[a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | | Collinearity Statistics | |
| Model | B | Std. Error | Beta | | | Lower Bound | Upper Bound | Tolerance | VIF |
| (Constant) | .058 | .411 | | .141 | **.888** | -.762 | .878 | | |
| Security | .038 | .053 | **.063** | .714 | **.478** | -.068 | .143 | .700 | 1.429 |
| Accessibility | .361 | .107 | **.318** | 3.387 | **.001** | .149 | .573 | .614 | 1.630 |
| Reliability | .044 | .054 | **.073** | .817 | **.417** | -.063 | .151 | .733 | 1.364 |
| Responsiveness | .033 | .053 | **.057** | .616 | **.540** | -.073 | .139 | .622 | 1.608 |
| Convenience | .257 | .115 | **.211** | 2.246 | **.028** | .029 | .485 | .610 | 1.638 |
| Easiness | .173 | .073 | **.232** | 2.370 | **.020** | .028 | .319 | .561 | 1.781 |
| Customization | .235 | .096 | **.208** | 2.440 | **.017** | .043 | .427 | .743 | 1.346 |
| Support Service | -.045 | .063 | **-.071** | -.713 | **.478** | -.172 | .081 | .551 | 1.816 |

**Note:** a. Dependent Variable: EPP
F=13.899, Sig. =.000. Adjusted R Square=.557
**Sources:** Authors Compilation

The overall Multiple Regression models of the performance with e-payments.

Dimensions will be: y = a+b1x1+b2x2+...+bnxn+e

Y = 0.058+0.038Sec+0.361Acce+.044Rel+.033Resp+.257Conv+.173Eas+.235Cus-0.045SupSer+.411

Where:

Y = Overall Performance, Resp = Responsiveness, Conv. = Convenience, Eas = Easiness, Sec = Security, Rel = Reliability, Acce = Accessibility, Cus = Customization, Supser = Support Service, E = Error Term

The total performance is an aggregation of the eight dimensions. The result shows that the generic technology based e-payments dimensions explain about 55.7% of the variance in the overall performance. In addition, the result reveals that there is positive and significance ($p<0.05$, $F = 13.899$) relationship between the technology based e-payments dimensions and the performance. This shows that the E-service quality dimensions are significant to the CBE E-banking performance.

As illustrated in table ---- the E-Service Quality dimensions separately have different significant level. For instance there is a positive and significant ($p<0.05$, Beta value = **.318**) relationship between Accessibility and e-payment services performance. Accordingly, among the eight dimensions Accessibility is the strongest predictor of the e-payments performance and has positive and significant impact on the performance of e-payments.

Easiness ($p<0.05$, Beta value = **.232**) has also positive relation with e-payment services performance which the more the bank's technology is being accessible or customized beyond regular support of others is so suitable than interacting with employees, has the significant effect on e-payment services performance.

In addition, Convenience is in a position to predict the dependent variable, e-payment services performance ($p<0.05$, Beta value = .211). The interpretation is that the more the technology is reliable the more the positive and significant impact on the e-payment services performance.

Customization has positive and significant relationship ($p<0.05$, Beta value = .208) which is the third strongest dimension that predicts e-payment services performance. The result reveals that the faster the bank resolves the

complaints quickly, offering fair compensation for its mistakes and kept confidentiality of personal information, has positive and significant impact on e-payment services performance.

On the other hand, according to table --- the remaining four dimensions namely security with (Beta value = .063), responsiveness with (Beta value = .057), reliability (Beta value = .070) and support service with (Beta value = -.071) have no statistically significant ($p>0.05$) relationship with e-payment services performance.

## *5.0 CONCLUSION AND RECOMMENDATION*

### *5.1 Conclusion*

Accordingly, factors pertaining to convenience, security, easiness, customization, responsiveness, accessibility, support service and reliability were a central constructs of the study as they have an influence on the performance level of E-payments. Furthermore, the study supplemented with structured interview questions from the banks employees to balance the study by gaining data from both sides.

Thus from the results it can be concluded that the effect of e-service quality dimensions have significant and positive effect on the performance level of e-payments. Furthermore, it can be concluded that as the result is positive the application of CBE e-banking has a bright future in the Ethiopian banking industry. Yet CBE has to work hard to exceed and go beyond the expectations of customers in such a way that it can retain its customers and develop long lasting relationship and attract more potentials customers and thereby reduce the switching cost and takes the lead from the vigorous privately owned banks.

### *5.2 Recommendations*

The study reveals that as the major determinants are given emphasis and quality of services being delivered to consumers is enhanced, customer satisfaction and resulting performance of techno-based banking (e-banking) will be increased and willingness of customers toward electronic payments is increased. Thus, the following recommendations are forwarded:

- Enhancing E-banking service facilities (from connection problem up to immediate solution) in such a better way that to speed up the machines to save the customer time and enable customers transact banking service at ease.
- In confirming confidentiality and making the Machine stations area secure enough especially during nighttime to increase safety of customers.
- Customization should be made through promoting and fostering the culture of techno-based banking services usage, informing, and encouraging customers to use the service, which is delivered via the technology.
- Increasing **features** and improving the facilities of the technology based banking service in such a way that customers can receive a wider range of financial services. Specifically providing simple, differentiated customer-focus services based on changing and growing customer behaviour and preferences.
- Improving the customer experience in using the technology based services and facilitating awareness creation ventures in such a way that customers may learn and get aquatinted with the technology and the use of techno- based banking will be availed by the general public to have cashless society.

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# CONSUMER PERCEPTION TOWARDS THE COMPLEXITY AND RISK ASSOCIATED WITH INTERNET BANKING WITH REFERENCE TO DEWAS CITY

**Yogendra Singh Rajavat**[3]

**ABSTRACT**

*E-banking is defined as the automated delivery of new and traditional banking products and services directly to customers through electronic, interactive communication channels. E-banking includes the systems that enable financial institution customers, individuals or businesses, to access accounts, transact business, or obtain information on financial products and services through a public or private network, including the Internet. Bank provides a variety of products & the customers can utilize services to the customer, the various services offered by the banks only when they are aware of the services. This research paper is mainly focused on customer awareness about the Internet banking. It is submitted that in this qualitative exploratory research using questionnaire was applied. 72 respondents were selected for study after initial screening. They were all bank customers. The awareness of customers about the online services and their expectations from online banking activities in Indore are evaluated through a survey.*

**KEYWORDS**

**Internet Banking, E Banking, Banking Without Wall, Online Banking, Cyber Banking etc.**

## *INTRODUCTION*

Internet banking is the act of conducting financial intermediation on the Internet. It represents an electronic market place where customers can conduct their financial transactions virtually. It is different from Electronic banking (e-banking) with the latter being a higher level activity encompassing not only internet banking, but also Telephone banking, Automated Teller Machines (ATM), Wireless Application Protocol (WAP)-banking, and other electronic payment systems not operated through the Internet.

In developed countries, the popularity of internet banking as delivery channel for banking services has grown, replacing the branch-based model of banking and the manual service functions provided by employees (Cheng, Lam and Yeung, 2006). internet banking enables the users to perform various activities including: writing checks, paying bills, transferring funds, printing statements, and inquiring about account balances, from any location, provided there is Internet access (Hoppe, Newman and Mugera, 2001; Frust, Lang and Nolle, 2000).

The benefits of internet banking to banks and customers are many. To the banks, internet banking lowers operating costs since it requires less staff and fewer physical branches; it promotes customer loyalty, and builds bank reputation among others (Chau and Lai, 2003; Tan and Teo, 2000). To the customers, internet banking saves time on physically visiting a branch; it is convenient since it enables one to transact without necessarily queuing or writing cheques; is accessInternet Bankingle twenty-four hours a day, seven days a week; and it executes transactions almost immediately (Suganthi and Balachandran, 2001; Bradley and Stuart, 2002).

Because of its well documented benefits, banks are beginning to leverage the Internet as a means of providing financial services. This is crucial for long-term survival of banks in the world of electronic commerce (Burnham 1996), given that its market is projected to grow sharply in the coming years (Duclaux 1996; Liao et al. 1999).

## *LITERATURE REVIEW*

El-Sherbini et al. (2007) investigated the customers' perspectives of internet banking, their perceived importance for it, usage patterns and problems rising on its utilization. The paper discussed the strategic implications of the research

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findings. Empirical data were gathered from bank customers in Kuwait to achieve the research objectives. All bank customers in Kuwait were considered as population of research interest. The results showed the perceived importance of internet banking services by customers, current and potential use of internet banking services in Kuwait and problems perceived by bank customers in using internet banking. The researchers' main hypothesis tested that top five services considered relative important in Kuwait banks were "Review account balance", "Obtain detailed transactions histories, "Open accounts", Pay bills" and Transfer funds between own accounts".

Eriksson et al. (2005) has studied the technology of internet banking in Estonia, an emerging east European economy. A quantitative study was selected to obtain data regarding the usage of and attitudes towards the internet as a banking channel. The results suggested that internet bank use increases, as customers perceive it as useful. Hence, a well-designed and easy to use internet bank may not be used if it is not perceived as useful.

Sathye (1999) analyzed the factors affecting the adoption of Internet banking by Australian consumers. His sample was from individual residents and business firms in Australia. The findings suggest that security concerns and lack of awareness about Internet banking and its benefits stand out as being the obstacles to the adoption of Internet banking in Australia. He also suggests some of the ways to address these impediments. Further, he suggests that delivery of financial services over the Internet should be a part of overall customer service and Internet Banking strategy.

Rotchanakitumanuai and Speece (2003) investigated why corporate customers do not accept Internet banking, which can assist banks to implement this self-service technology more efficiently. Many Thai banks are currently implementing Internet banking. Banks that offer service via this channel claim that it reduces costs and makes them more competitive.

Wang et al. (2003) was interested to identify the factors that determine acceptance of Internet banking by the users. The results strongly support the extended TAM in predicting the intention of users to adopt Internet banking. It also demonstrates the significant effect of computer self-efficacy on behavioral intention through perceived ease of use, perceived usefulness of Internet Banking.

According to Kolodinsky et al. (2004), Millions of Americans are currently using a variety of e-banking technologies and millions more are expected to come "online." However, millions of others have not or will not. Their paper explores factors that affect the adoption or intention to adopt three e-banking technologies and changes in these factors over time. Using a Federal Reserve Board commissioned data set, the paper finds that relative advantage, complexity/simplicity, risk tolerance, and product involvement are associated with adoption. Income, assets, education, gender and marital status, and age also affect adoption. Adoption changed over time, but the impacts of other factors on adoption have not changed.

## *RESEARCH METHODOLOGY*

The research survey was answered by a mix group of people among the customers of the Banks. The survey was conducted through questionnaires to a group of people and only 25 respondents filled in our survey that focused on gathering information about awareness, usage of and expectations about the internet banking in Indore. In this study convenience-sampling method is used, thus the respondents were randomly selected.

### *Research Question*

This study is aimed at finding out whether the respondents are aware about internet and banking services and whether they use their knowledge of hassle free banking or they are abided by habits customs and routines.

### *Research Design*

Research design is the plan, structure and strategy of investigations conceived to obtain answers to research questions and to control variance. The research design constitutes the blue print for the collection, measurement and analysis of data. It aids the researcher in the allocation of his limited resources by posing crucial choices.

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***Sample Size***

Sample sizes of 100 respondents were selected for this study.

The respondent profile who participated in the study is given below:

**Table-1**

| | **Internet banking Users** | **Percentage** |
|---|---|---|
| **Gender** | | |
| Male | 46 | 64% |
| Female | 26 | 36% |
| **Education** | | |
| High School | 2 | 3% |
| Bachelor | 17 | 23% |
| Master | 48 | 67% |
| Ph.D. | 5 | 7% |

**Sources:** Authors Compilation

***Sampling Method***

Simple random sampling has been effective for this study purpose.

***Data Collection***

Data will be collected from both primary and secondary sources of information.

**Primary Source:** All necessary information about the study has been collected from personal contact and discussion by using Questionnaire method.

**Type of Data**: Primary
**Data Collection Method**: Questionnaire

**Secondary Sources:** Data has been collected from both internal and external sources such as personal records, annual reports, published articles, websites, web links etc.

**Data Analysis Technique**: Qualitative
**Data Analysis Tool**: Pie chart

***Hypothesis***

Ho1: There is no significant difference between male and female customers towards Complexity of using Internet Banking.
Ho2: There is no significant difference between male and female customers towards risk of using Internet Banking.
Ho3: There is no significant difference between Graduates and post graduates customers towards Complexity of using Internet Banking.
Ho4: There is no significant difference between Graduates and post graduates customers towards risk of using Internet Banking.

***Hypothesis 1***

**Hypothesis is accepted because sig. value is .268**

**Table-2: Group Statistics**

| | Gender | | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|---|
| complexity1 | dimension1 | Male | 46 | 5.6522 | 1.26522 | .26382 |
| | | Female | 26 | 6.1538 | 1.28103 | .35529 |

**Sources:** Authors Compilation

**Table-3: Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | d.f. | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| complexity1 | Equal Variances Assumed | .025 | .875 | -1.138 | 34 | .263 | -.50167 | .44096 | -1.39781 | .39447 |
| | Equal Variances not assumed | | | -1.134 | 24.773 | .268 | -.50167 | .44253 | -1.41350 | .41016 |

**Sources:** Authors Compilation

***Hypothesis 2***

**Hypothesis is accepted because sig. value is .710**

**Table-4: Group Statistics**

| | Gender | | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|---|
| PerceivedRisk | dimension1 | Male | 46 | 6.0435 | 1.87030 | .38998 |
| | | Female | 26 | 6.3077 | 2.28709 | .63432 |

**Sources:** Authors Compilation

**Table-5: Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | d.f. | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| PerceivedRisk | Equal Variances Assumed | 1.869 | .181 | -.376 | 34 | .710 | -.26421 | .70342 | -1.69373 | 1.16531 |
| | Equal Variances not assumed | | | -.355 | 21.139 | .726 | -.26421 | .74462 | -1.81211 | 1.28368 |

**Sources:** Authors Compilation

***Hypothesis 3***

**Hypothesis is accepted because sig. value is .638**

**Table-6: Group Statistics**

| | EL | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| complexity1 | Bachelor | 38 | 5.7368 | 1.14708 | .26316 |
| | Master | 34 | 5.9412 | 1.43486 | .34800 |

**Sources:** Authors Compilation

**Table-7: Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | d.f. | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| complexity1 | Equal Variances Assumed | .083 | .775 | -.474 | 34 | .638 | -.20433 | .43084 | -1.07991 | .67124 |
| | Equal Variances not assumed | | | -.468 | 30.628 | .643 | -.20433 | .43630 | -1.09462 | .68595 |

**Sources:** Authors Compilation

*Hypothesis 4*

**Hypothesis is accepted because sig. value is .824**

**Table-8: Group Statistics**

| | EL | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| PerceivedRisk | Bachelor | 38 | 6.2105 | 2.14939 | .49310 |
| | Master | 34 | 6.0588 | 1.88648 | .45754 |

**Sources:** Authors Compilation

**Table-9: Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | d.f. | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| PerceivedRisk | Equal Variances Assumed | .291 | .593 | .224 | 34 | .824 | .15170 | .67769 | -1.22552 | 1.52893 |
| | Equal Variances not assumed | | | .226 | 33.991 | .823 | .15170 | .67268 | -1.21535 | 1.51876 |

**Sources:** Authors Compilation

## *CONCLUSION*

The present study covers the analysis in respect to adoption of Internet Banking. Study suggests that there is no significance difference between male and female perception towards the security and risk associated with internet banking. Study also suggests that there is no significance difference between graduates and postgraduates perception towards the security and risk associated with internet banking.

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# DESIGN AND DEVELOP AN EXPERT SYSTEM FOR DIAGNOSIS AND TREATMENT OF DIABETES USING DATA MINING TECHNIQUES

**Kedir Eyasu Abdulkadir**[4]

**ABSTRACT**

*Diabetes is a disease that affects the body's ability to produce or use insulin. According to International diabetes Federation, Ethiopia is one of the 32 countries in African region. 425 million people have diabetes in the world and more than 16 million people in the Africa Region; by 2045, it will be around 41 million. There were 2.567.900 cases of diabetes in Ethiopia in 2015.In the incident of Ethiopia different problems are observed in health care centers. From different perspectives, these problems are the scarcity of domain experts, practitioners, domain experts' skills, health facilities etc.*

*The general objective of this study is to design and develop prototype knowledge based system using data mining techniques for diagnosis and treatment of diabetes. In this study, to develop prototype knowledge base system using data mining techniques for diagnosis and treatment of diabetes is proposed by applying experimental research design. The researcher used domain expert knowledge as supplement of data mining techniques knowledge.*

**KEYWORDS**

**Diabetes, Health Facilities, Data Mining, Algorithms etc.**

## *INTRODUCTION*

Knowledge based system (KBS) is one of the areas of artificial intelligence. KBS also known as an expert system is a computer program that contains the knowledge and analytical skills of one or more human experts in a specific problem domain. The aim of the design of the expert system is to capture the knowledge of a human expert relative to some specific domain and code this in a computer in such a way that the knowledge of the expert is available to a less experienced user. KBS is a computer program that simulates the judgment and behavior of a human that has expert knowledge and experience in a particular field. It contains a knowledge base containing accumulated experience and a set of rules. Expert system provides high quality experience, domain specific knowledge; apply heuristics, forward or backward reasoning, uncertainty and explanation capability. Rule based expert system contains knowledge base, Inference engine, knowledge acquisition, explanation facility and user interface (Tripathi, 2011).

## *STATEMENT OF THE PROBLEM*

According to IDF statistics, there are 230 millions of diabetics through the world, at present time of which 80% of them are living in the developing countries. In 2025,the number of diabetics is estimated to reach 380 million (Kulani, 2012). In 2015, the IDF also estimated that, in the Africa region, 14.2 million adults aged 20–79 years had diabetes, representing a prevalence of 3.2%. The majority (59%) of people with diabetes live in cities, even though the population is predominantly (61%) rural. This region has also the highest proportion of previously undiagnosed diabetes; over two-thirds (67%) of people with diabetes being unaware they have the disease. Currently, Ethiopia has been challenged by the growing magnitude of non-communicable diseases such as diabetes. Ethiopia is among the top four countries with the highest adult diabetic populations in sub-Saharan Africa. Patient attendance rates and medical admissions related to diabetes in major hospitals have been rising.

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## *OBJECTIVES OF STUDY*

### *General Objective*

The general objective of this study is to design and develop prototype knowledge based system using data mining techniques for diagnosis and treatment of diabetes.

### *Specific Objectives*

- To build the suitable system architecture for the prototype KBS to be developed.
- To identify and acquire appropriate knowledge, both that is explicit and tacit.
- To identify the main attributes that can properly support for rule based and decision making.

## *SIGNIFICANCE OF STUDY*

The intelligent system used for diabetes are important within the medical area because it allows doctors and nurses to quickly gather information and process it in various ways in order to assist with making diagnosis and treatment decisions. These systems could help in diverse areas from the storing and retrieval of medical records, storing and retrieval of key substances in medicines, examination of real-time data gathered from monitors, analysis of patient history for the purposes of diagnosis, analysis of family history, and in many other areas. The KBS applies intelligent reasoning to a domain to solve a problem that requires considerable human time, effort and proficiency. KBS have valuable asset to any institutions as a substantial source to support decisions making (Tripathi, 2011).

## *METHODOLOGY*

### *Research Design*

Experimental research is a study that strictly adheres to a scientific research design. The primary goal of an experimental design is to establish a causal connection between the variables. A secondary goal is to extract the maximum amount of information with the minimum expenditure of resources. It is the process of planning a study to meet specified objectives. Planning an experiment properly is very important in order to ensure that the right type of data and a sufficient sample size and influence are available to answer the research questions of interest as clearly and efficiently as possible (Morrison, 2014).

### *Study Site and Population*

Study sites for this research are Jimma University Specialized Hospital, Saint Paulos Millennium Medical Hospital and Adama Medical College Hospital. Jimma University Specialized Hospital, which is found in Oromia regional state, Jimma town in Jimma University main campus, Saint Paulos Millennium Medical Hospital which is found in Addis Abeba city administration and Adama medical college hospitals which found in Oromia regional state, Adama town. The total population interviewed was twelve. The datasets used for research was also collected from this each hospital.

### *Data Collection Method*

For primary data collection interview was used to collect domain knowledge (tacit) from the domain experts and by documents analysis explicit knowledge was extracted from secondary sources of data. For hidden knowledge to be discovered from database by automatic data mining (KDD and Crisp model method) techniques and dataset was collected from baseline diabetic patients' medical record using secondary data collection method also known as retrospective method.

*Techniques and Algorisms*

Data mining process inputs predominantly cleaned, transformed data, searches the data using techniques and algorisms, and outputs patterns and relationships to the interpretation/ evaluation step of the KDD process (Pillay et al., 2009).

## *CLASSIFICATION TECHNIQUE*

Classic data mining technique based on machine learning maps data into predefined groups or classes. Supervised learning is a technique where by the classes are determined before examining the data. Classification algorithms require that the classes be predefined based on data attribute values. It is often describe these classes by looking at the characteristics of data already known to belong to the classes (Ambilwade, 2014). A Rule-based classification extracts a set of rules that show relationships between attributes of the data set and the class label .For this study three algorithms namely J48 pruned, PART, and JRip was used.

## *CLASSIFIER ALGORISM*

**J48:** Decision trees are mainly used in the classification and prediction. It is a simple and a powerful way of representing knowledge. Decision tree is built; many of the branches reflect anomalies in the training data due to noise or outliers. Tree pruning methods use statistical measures to remove the least reliable branches. A classifier system takes input from the cases described by values and attributes and output a classifier that can accurately predict classes of new cases. C 4.5 is a descendant of CLS and IDE creates classifier and generated decision tree. It can also make classifier in most comprehensive rule-set forms (Abuhay & Tesema, 2015).

**PART:** rule-based classifier uses a set of IF-THEN rules for classification. An IF-THEN rule is an expression of the form IF condition THEN conclusion. The IF-part (or left-hand side) of a rule is known as the rule antecedent or precondition. The THEN-part (or right-hand side) is the rule consequent. Class for generating a decision list and uses separate-and-conquer. Builds a partial C4.5 decision tree in each iteration and makes the "best" leaf into a rule. A rule induction algorithm which grabs rule from a decision tree (Abuhay & Tesema, 2015).

**JRip:** is also a rule-based classifier uses a set of IF-THEN rules for classification and this experiment conducted with default parameters of WEKA and the algorithm generates a model with rules and identify Correctly Classified Instances and Incorrectly Classified Instances (Abuhay & Tesema, 2015).

## *EXPERIMENT TOOL*

WEKA has several graphical user interfaces that enable it easy access to primary functionality. Therefore data mining techniques, algorisms and tools was applied on the patients' medical datasets for discovering rules used for develop the prototype KBS. The algorithm can either be applied directly to dataset or called from Java code. It contains tools for data pre-processing, classification, regression, clustering, association rules and visualization. A set of data items, the dataset, is a very basic concept of machine learning (Witten, 2011).

## *KBS DEVELOPING TOOL*

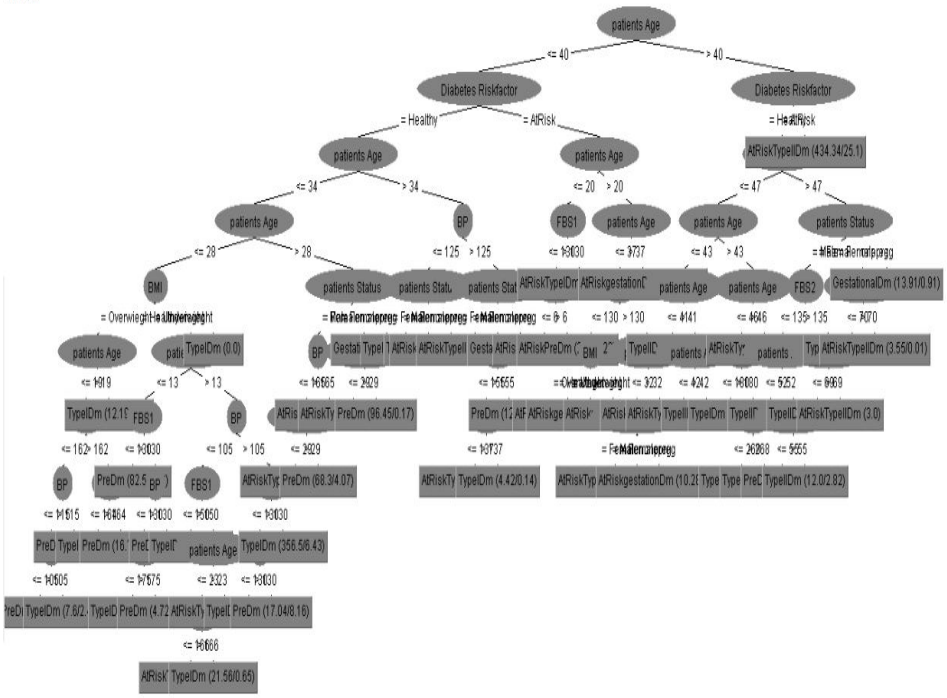
KBS shell with the ready-to-wear utilities of self-learning, explanation and inference etc. like Quincy prolog, visual prolog, and Clips rule based, Java Expert System Shell (JESS), GURU, and Vidwan are more specific and can be useful to develop KBS. KBS can be developed using programming languages like LISP and Prolog (Chala ,Million and T., 2016). Therefore, for the study tool the used to develop prototype KBS was Clisp.net.

## *DOMAIN EXPERTS KNOWLEDGE ACQUISITION*

In this work, the tradition methods (such as interview and document analysis) are used primarily for understanding the basic concepts related to diagnosis, treatment and prognosis of diabetes disease. More specifically, interviews and document analysis are used to access the general and domain-specific knowledge and to obtain comprehensive

example sets. On the other hand, data mining approach is particularly fruitful in automating the knowledge acquisition task of rule-based system. However, it is a mistake to believe that one can do data mining process without a domain expert. Because at the very least the researchers need an expert to select the training examples and to explain the domain terminology as well as to identify the features of the examples which are likely to be relevant. Therefore, the researcher used the traditional methods to supplement the automatic knowledge's acquisition of the KBS development.

**Figure-1**




**Sources**: Authors Compilation

J48 pruned decision tree Weka output

**Figure-2**

```
=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   i   j   <-- classified as
   3   0   0   0   0   0   0   0   0   0 |   a = Healthy
   0   0   3   0   1   0   0   0   0   0 |   b = Diabetes
   0   0 458   0  12   0   3   0   2   0 |   c = PreDm
   0   0   0   0   0   2   0   0   0   2 |   d = AtRiskPreDm
   0   0  15   0 656   4   0   0   0   3 |   e = TypeIDm
   0   0   4   0  10 171   0   4   0   0 |   f = AtRiskTypeIDm
   0   0   2   0   4   0 450   1   0   0 |   g = TypeIIDm
   0   0   4   1   8   0  40 616   0   1 |   h = AtRiskTypeIIDm
   0   1   0   0   0   0   0   0  60   2 |   i = GestationalDm
   0   0   0   1   3   0   0   1   2  91 |   j = AtRiskgestationDm
```

**Sources**: Authors Compilation

**Figure-3**

Confusion Matrix J48

```
patients Age <= 40
|   Diabetes Riskfactor = Healthy
|   |   patients Age <= 34
|   |   |   patients Age <= 28
|   |   |   |   BMI = Overwieght
|   |   |   |   |   patients Age <= 19
|   |   |   |   |   |   FBS1 <= 162
|   |   |   |   |   |   |   BP <= 115
|   |   |   |   |   |   |   |   BP <= 105: PreDm (46.69/1.77)
|   |   |   |   |   |   |   |   BP > 105: TypeIDm (7.54/2.45)
|   |   |   |   |   |   |   BP > 115: PreDm (90.8/3.44)
|   |   |   |   |   |   FBS1 > 162
|   |   |   |   |   |   |   FBS1 <= 164: TypeIDm (8.74/0.25)
|   |   |   |   |   |   |   FBS1 > 164: PreDm (16.3/0.98)
|   |   |   |   |   patients Age > 19: TypeIDm (12.09/1.96)
|   |   |   |   BMI = Healthywieght
|   |   |   |   |   patients Age <= 13
|   |   |   |   |   |   FBS1 <= 130: PreDm (82.09/9.72)
|   |   |   |   |   |   FBS1 > 130
|   |   |   |   |   |   |   BP <= 130
|   |   |   |   |   |   |   |   FBS2 <= 175: TypeIDm (58.99/3.54)
|   |   |   |   |   |   |   |   FBS2 > 175: PreDm (4.73/0.67)
|   |   |   |   |   |   |   BP > 130: PreDm (9.24/0.35)
|   |   |   |   |   patients Age > 13
|   |   |   |   |   |   BP <= 105
|   |   |   |   |   |   |   FBS1 <= 150: TypeIDm (9.55/1.27)
|   |   |   |   |   |   |   FBS1 > 150
|   |   |   |   |   |   |   |   patients Age <= 23
|   |   |   |   |   |   |   |   |   FBS1 <= 166: AtRiskTypeIDm (8.2/1.09)
|   |   |   |   |   |   |   |   |   FBS1 > 166: TypeIDm (21.56/0.65)
|   |   |   |   |   |   |   |   patients Age > 23: AtRiskTypeIDm (23.9/3.74)
|   |   |   |   |   |   BP > 105
```

**Sources**: Authors Compilation

***MODEL EVALUATION***

All the selected algorithms allow generating rules from the data set. The results of the algorithms are evaluated based on prediction accuracy in classifying the instances of the dataset into Healthy, Diabetes, PreDm, AtRiskPreDm, TypeIDm, AtriskTypeIDm, TypeIIDm, AtRiskTypeIIDm, GestationalDm and AtRiskgestationDm. The performance of classifier algorithms is compared and the one, which performed better, is selected as prime choice for the knowledge acquisition step.

The accuracy, precision, recall and f-measure of each of the mentioned classifiers, which are obtained from the experiment, are shown in table.

**Table-1: Performance of Classifiers**

| **Model Evaluation** | **Correctly Classified Instances** | | **Incorrectly Classified Instances** | | **Time taken to Build Model** | **Precision** | **Recall** | **F Measure** |
|---|---|---|---|---|---|---|---|---|
| Classifiers | Instances | Percentage | Instances | Percentage | Time / seconds | | | |
| J48 | 2512 | 95.1515 % | 128 | 4.8485 % | 0.31 | 0.949 | 0.952 | 0.95 |
| PART | 2495 | 94.5076 % | 145 | 5.4924% | 0.69 | 0.944 | 0.945 | 0.944 |
| JRip | 2501 | 94.7348 % | 139 | 5.2652% | 2.69 | 0.95 | 0.947 | 0.947 |

**Sources**: Authors Compilation

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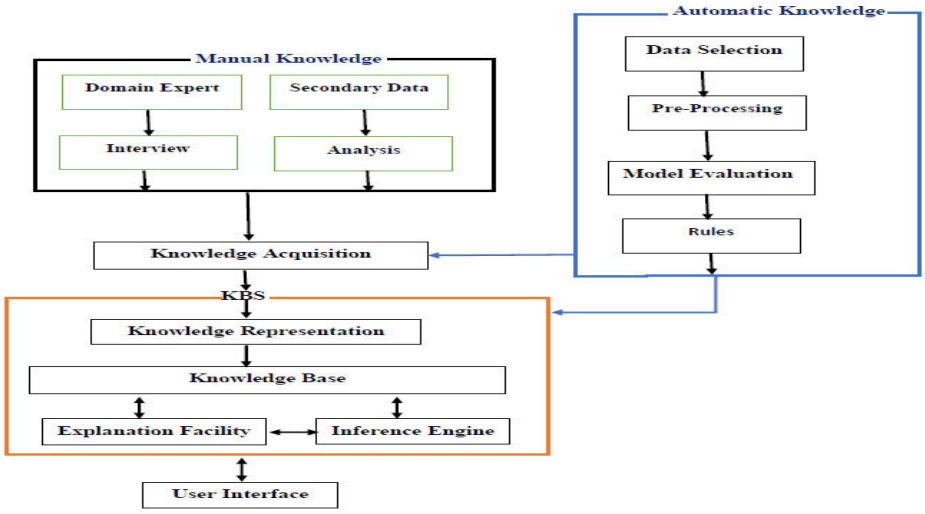
## *ARCHITECTURE OF THE PROTOTYPE SYSTEM*

An architecture is a blueprint showing how the components of the prototype self-learning knowledge-based system interacts and interrelates.

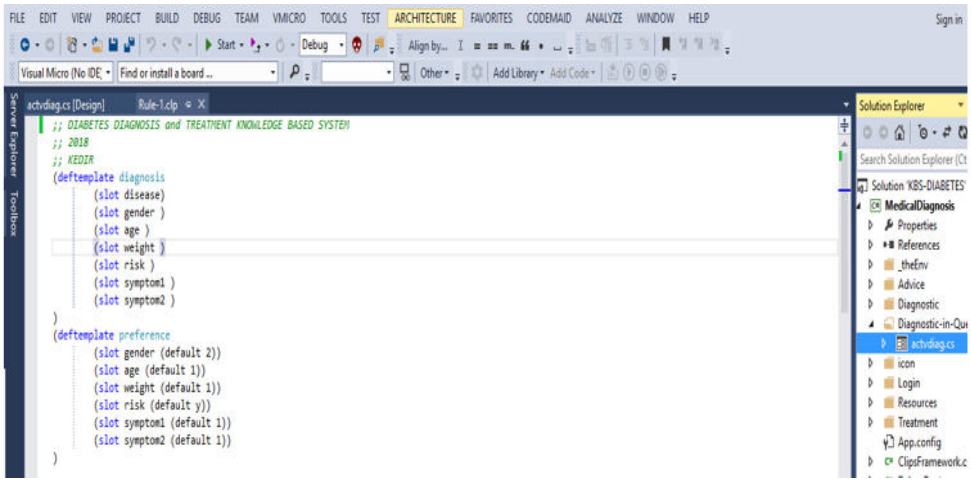
**Figure-4: Architecture of KBS**




**Sources**: Authors Compilation

## *SOFTWARE REQUIREMENT FOR DEVELOPMENT KBS*

**Figure-5: Prototype of KBS Development Environment**



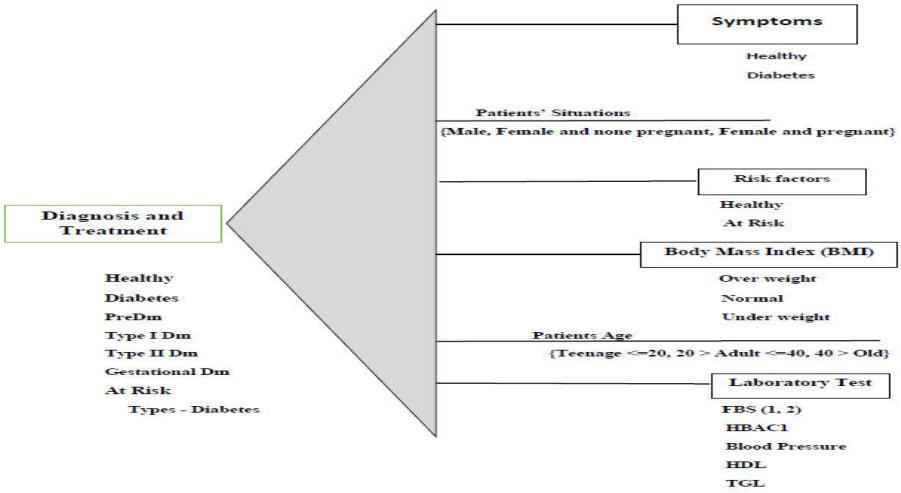

**Sources**: Authors Compilation

## *DIAGNOSIS AND TREATMENT*

Diagnosis of diabetes is based on several cases like patient's physical exam, presence or absence of symptoms, medical history, risk factors, blood test reports etc. Blood tests can be used to confirm a diagnosis of diabetes, based on the amount of glucose found. Urine test can also be used to check protein in the urine that may help diagnose diabetes. These tests also can be used to monitor the disease once the patient is on a standardized diet, physical

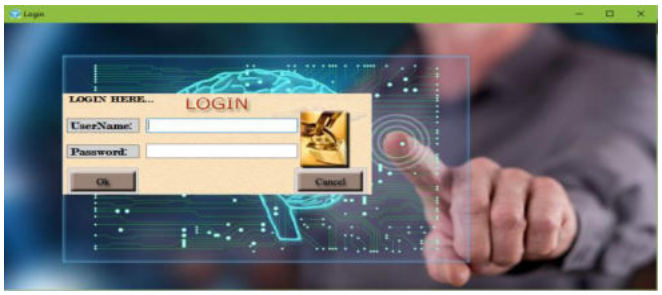
exercise, oral medications, or insulin therapy. The system can provide necessary information about the indications, diagnosis and primary treatment advices to the diabetics. Prototype KBS developed using both automatic extracted and expert based knowledge used for diagnosis and treatment of diabetes as shown below using Mockler Chart. This Mockler Chart of diagnosis and treatment has been drawn to show the relation of components tests, patient's situation, patient's age, Body Mass Index (BMI), symptoms and risk factors. The used Mockler Chart of symptoms, the questions and choices related to determining of the patient's symptoms, which concluded diabetes, or further analysis of the patients.

**Figure-5: Mockler Chart Shows Relations How KBS Used for Diagnosis and Treatment of Diabetes Mellitus**




**Sources**: Authors Compilation

**Figure-6: Login Screen User Interface**




**Sources**: Authors Compilation

**Figure-7: Home Screen User Interface of the Proposed System**

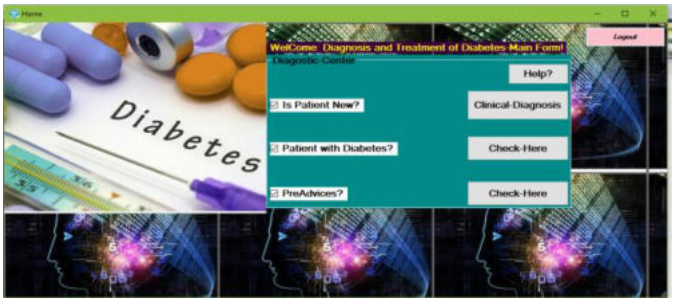



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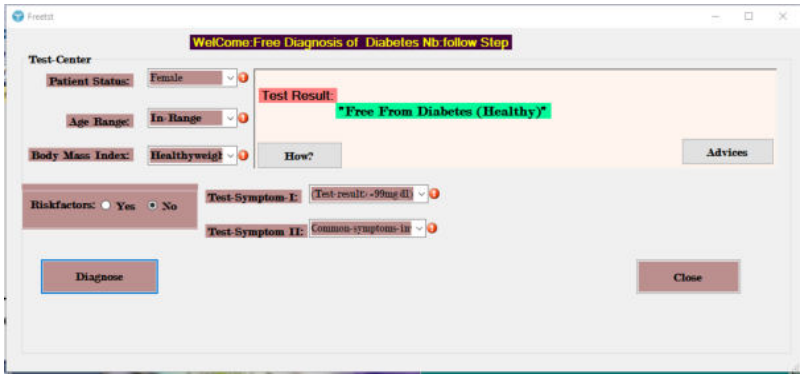
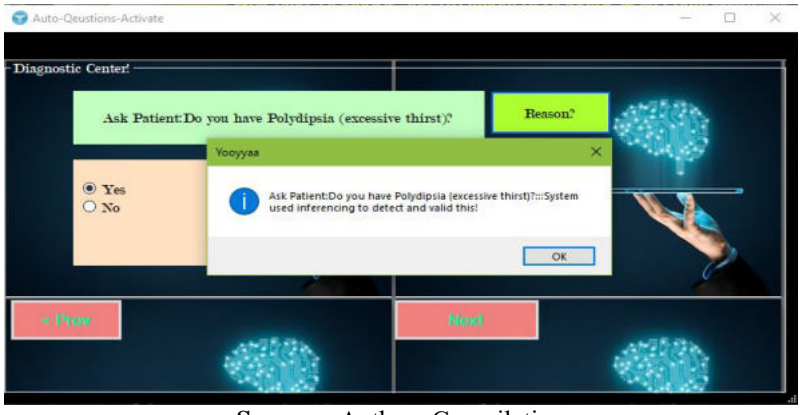
**Figure-8: User Interface Used Identify Whether Patients Healthy**




**Sources**: Authors Compilation

**Figure-9: User Interface Used to Identify Patients Diabetes using Questions**




**Sources**: Authors Compilation

**Figure-10: User Interface Detects Patients Got Diabetes Using Questions**

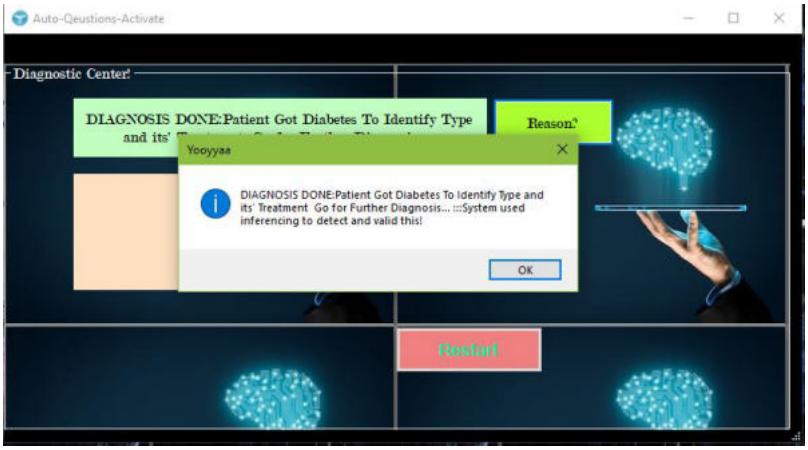



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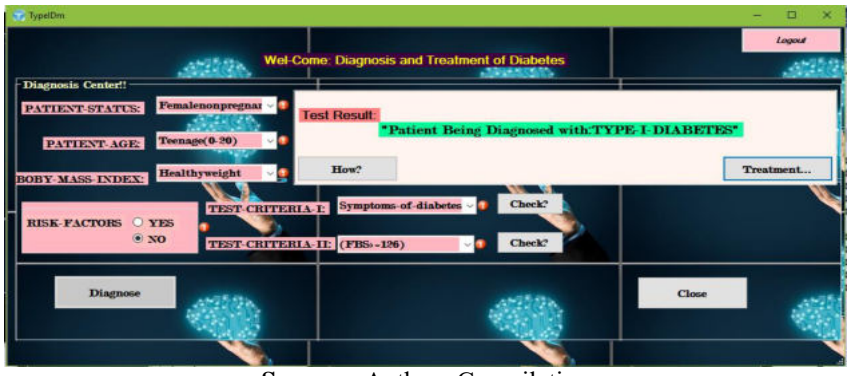
**Figure-11: Graphical User Interface for Clinical Diagnosis**




**Sources**: Authors Compilation

**Figure-12: Graphical User Interface for Clinical Treatment**


**Sources**: Authors Compilation

## *DISCUSSION*

The purpose of this research is to develop prototype KBS for diagnosis and treatment of diabetes using data mining techniques. The use of data mining techniques to build the knowledge base of the KBS can be taken as strong features of the system. The findings are discussed in this section. The main aim of data mining is classifying the attribute based on the given attribute. Decision trees achieve this even though three algorithms are selected for this purpose. Classification maps data into predefined groups. It is often referred to as supervised learning as the classes are determined prior to examining the data. Classification Algorithms usually require that the classes be defined based on the data attribute values. On this study different types of situation were conducted for the purpose of developing prototype KBS for diagnosis and treatment of diabetes, as well which rules(knowledge), which model and which algorithm would perform very well and it is approved under this study.

For this study three algorithm were selected to test on the diabetic datasets in order to generate rules i.e. J48, PART and JRip algorithms. Three of them are raised under the methodology of this study. Therefore, analyzing one by one and seeing the result that they performed during the previous experiment has been tabularized accordingly. Additionally the J48 algorithm is the most performing model more than the rest of the algorithm. In addition, the other algorithm had been resulted according to the nature and ability of evaluation based on the algorithm is set by default.

The J48 algorithm is the most accurate model from the other due the result that this algorithm demonstrated in case of performance, time, labeling, specificity and confusion Matrix. From the previous situation the J48 algorithm had scored a time of 0.31 seconds to classy the 2512 records according the class they belongs too. Beside this, the model also showed the good performance more than the other did. The ROC which this model displayed is almost

approximate to one which is 0.997 and the result of precision and recall (0.949 and 0.952) also pretty well more than the left model. This model showed the most performing one in case of diabetic datasets classifying.

## *CONCLUSION*

Diabetes is a metabolic condition that leads to high blood sugar levels. It is a kind of disease in which the body does not produce or properly use insulin. The amount of glucose in blood is too high because the body cannot use it properly. This is because pancreas does not produce any insulin, or not enough, to help glucose enter patient body's cells or the insulin that is produced does not work properly. Insulin is the hormone produced by the pancreas that allows glucose to enter the body's cells, where it is used as fuel for energy so we can work, play and generally live our lives. Due to this reason, patients need diagnosis and consistent treatment. However, in our country, there are no sufficient numbers of domain experts. This situation leads to disproportional numbers of experts and patients also available resource, urbanization and high obesity, lack of know how. As a result, diabetic patients are not getting enough diagnosis and treatment. Hence, in this study an effort has been made to design and develop a prototype of effective and efficient knowledge-based system that can provide advice for experts and patients to facilitate the diagnosis and treatment of patients living with diabetes.

## *RECOMMENDATIONS*

Data mining techniques was applied on diabetic patients' baseline datasets in order to generate rules used for developing prototype KBS for diagnosis and treatment. However, diabetic datasets are manually stored witch made preprocessing datasets difficult. For future if, such challenge solved automatically rule generating from database and integrating to knowledge base the rule generated with data mining techniques become easy. A method must be investigated on how to integrate the prototype system with the existing health information systems. This would lead to the development of standards applicable to all, enabling suitable information exchange and planning for additional improvement of functionality. Since such types of systems developed in English language, the applicability of the system is limited, so the researcher recommended that the system would have more applicability if it can be developed in local languages.

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# CLOUD BASED E-LEARNING MODEL FOR ETHIOPIAN EMPLOYEES

**Duol Kuey Deng[5] Getahun Tigistu[6] Durga Prasad Sharma[7]**

**ABSTRACT**

*Many institutions across the world have been trying to upgrade/transform their educational systems to reduce the cost of learning with high comfort. Ethiopian education system is one of them, which is has been facing critical challenges to afford the education extensions & teaching facilities. This problem becomes critical to those who are Employees, disables and females with pregnancy or the learners who cannot join the classes on regular basis with traditional teaching learning processes like regular, summer, extension and distance education. In recent years, few institutions in Ethiopia tried to encounter accessibility barriers by adopting advanced learning & teaching systems but acceptance level of such systems is still not satisfactory and popular. However, it has been observed that there is a strong and urgent need to have better and alternative educational platforms with extensive accessibility. The strategic shift from traditional classroom to e-learning and e-learning to cloud based learning can be a promising change and significant improvement for next generation teaching- learning environment. To achieve this, a Unified Cloud based E-Learning Model (UCELM) was proposed and functionally tested using Cloud Services opens source application.*

**KEYWORDS**

**UCELM, Disables, Females, Employees, Cloud Computing, E-learning.**

## *I. INTRODUCTION*

The opportunity of higher education has become a great challenge in Ethiopia due to the population growth and the shortage of educational institutions and facilities. Although the government is striving to fill the gap of teaching professionals through hiring the foreign professionals, still both the quality and quantity of education is not achievable.

The studies [1][2] [3] have also been experience that governmental organization and academics institutions have been facing critical challenges for how to upgrade their ICT and E-Learning systems and daily losing their data within on-premise IT infrastructure. Not only this, the limitation of sharing academics resource for online study especially for busier professionals still another issue that setbacks the accessibility and wide extension of education to everybody. Therefore; due to all aforementioned challenges, contextualized alternative teaching method is expected to be a better solution for improvised data storage, long term sustainability, suitability, easy upgradability, resource Sharability and extension of higher education with low cost and better comfort so that Employees and learners can learn anywhere at any time based on their comfort and need. Using cloud computing, higher institutions with voluminous data such as education system would be better beneficial because this technology provide services elastically [4] [5] [6] [7]. Many educational institutions across developed and developing world including Ethiopia have tried to implement the on-premise e-learnings systems in order to support learning to extent accessibility of education to a broad spectrum to solve learning demand of learners but unfortunately, the cost for IT infrastructures is not affordable to numerous organizations. Even though the e-learning solves the several challenges and problems of traditional education platform but still there are several problems such as software purchase, frequent system update, cost of maintenance, scalability, flexibilities, integration, and need based contextualization of educational platforms [8] [9] [10]. Today cloud computing has widely proved to be an alternative way out for educational computing, communication and collaboration with better profit margins as it reduces the cost of hardware and software and improves the efficiency of delivery of computing resources via internet. In addition, it helps for energy conservation as research identified that more different data centers have the largest power consumption [11] [12]

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[13]. The central motivation of this research study is to bring remedial solution to solve the problem that is faced by Employees, academics institutions and learners community for ease of access to education with improved facilities like anytime, anywhere over any device alongwith comfort and convenience. This is aimed to the whole country into forefront line of digital education and transformation that lead to significant change of economy and educational quantities & qualities. The main objective of this study is to analyze the current challenges in existing education delivery systems and platforms and designing an alternative cloud based model with better suitability, comfort, convenience and improved facilities for the learners' community.

### *1.1 The Problem Investigated*

The access to academics learning resources, and protecting of data in a traditional IT infrastructures now has become an unsolved problem. The stakeholder being affected mostly are Employees , people with disability, Females with pregnancy and, government officials who are not able to access education to upgrade their knowledge and credentials on regular basis. Not only upgrading the existing e-learning system, maintenance and cost of the software are another big issues that setback the prosperity of academics institutions and individual who want to resolve their learn issues. These strongly affected Employees are private/Govt employees, disables, and females with pregnancy who are not able to afford cost of self-sponsor and others living expense such as; transport cost from far distant to school centers. In related situation, physically challenged groups such as disables and pregnant women are not able to travel and get school far away from their residential places but unfortunately, the current educational systems failed to resolve such problems in Ethiopia. Another big problem is with working employees who are staying away from latest technology that can promote and develop their technical skills through available online training and certification programs [14] [6]. Aforementioned problems are declining the quantity and quality both in terms of educated or trained professionals. In recent years few universities and colleges in Ethiopia have adopted advanced teaching learning systems like e-learning over their owned and managed e-learning servers but acceptance and success level of these systems is not satisfactory and wider popular because the sector has limited research studies that can support for better educational analytics and technology supported modeling in Ethiopian context. The reasons behind such learning challenges are wider and to be investigated, examined/measured and then an alternative technology model over cloud is aimed to be designed for resolving the enlisted issues and challenges. Supplementary, it is still unknown that what are the challenging factors and what kind of systems should be needed for next generation teaching/learning in Ethiopian context that can support Employees ' development in their respective working organizations. This research study has tried to answer the following research questions:

- What are the basic learning challenges faced by Employees, disables, females with pregnancy?
- What are the challenges that could not be addressed by existing e-learning technologies?
- What kinds of educational model over cloud can be able to resolve such challenges of Employees?

## *II. REVIEW OF RELATED WORKS*

To understand the domain; the technical concepts used in this this research study are reviewed. A rigorous review of related and previously research works done on this domain was done. The reviewed papers were evaluated as presented in the table 1 and prioritized based on their three parameters; Relevancy to the research domain, Quality of Journal, the year of their publication (latest).

**Table-1: Review of Related Literature with Critical Remarks**

| No. | Author & Year | Title & Journal Names | Major Findings, Contribution and Conclusion | Critical Remarks & Research Gap |
|---|---|---|---|---|
| 1 | Rumana Javali, 2016 [15] | Cloud Computing in Education System (*International Journal of* | The researcher find that Cloud based can reduce infrastructure costs, increase ease of access, make possible collaboration, and enhance flexibility and customization of software based on | The research showed great contribution by introducing the core advantageous of cloud computing in education but failed to design a model that can be used in education systems |

| | | | | |
|---|---|---|---|---|
| | | *Advanced Research in Computer Science and Software Engineering)* | the need of organization and modernization learning by introducing technology to classroom can increase student's learning opportunities while improving students' skill. Researcher quantified the advantage & drawback of cloud computing. | transformation with contextual need of Employees, disables and females with pregnancy. |
| 2 | Kiran Yadav 2014 [16] | Role of Cloud Computing in Education<br><br>*International Journal of Innovative Research in Computer and Communication Engineering* | The research presents how cloud could be a better alternative in higher education and benefit to learners' community, educators & institutes. | But research failed to address the way forward especially for how to implement this technology by using both functional & theoretical model over cloud. |
| 3 | Alemseged & Prof DP Sharma, 2016 [13] | Suitability analytics and cloud computing adoption modeling For educational institutions<br><br>*Pezzottaite journals* | In this research study, researchers tried to develop a cloud adoption model for higher educational institution in Ethiopian context with study of Arba Minch university as case analytics. And model was developed for Arbaminch university with shallow scope. | This study is relevant to the proposed research but it does not cover the opportunities and challenges in higher education delivery for Employees, disables and females with pregnancy in convenient and cost effective manners in Ethiopian context. But our study made survey for the challenges that prevent Employees to learn and developing the model. |

**Sources:** Authors Compilation

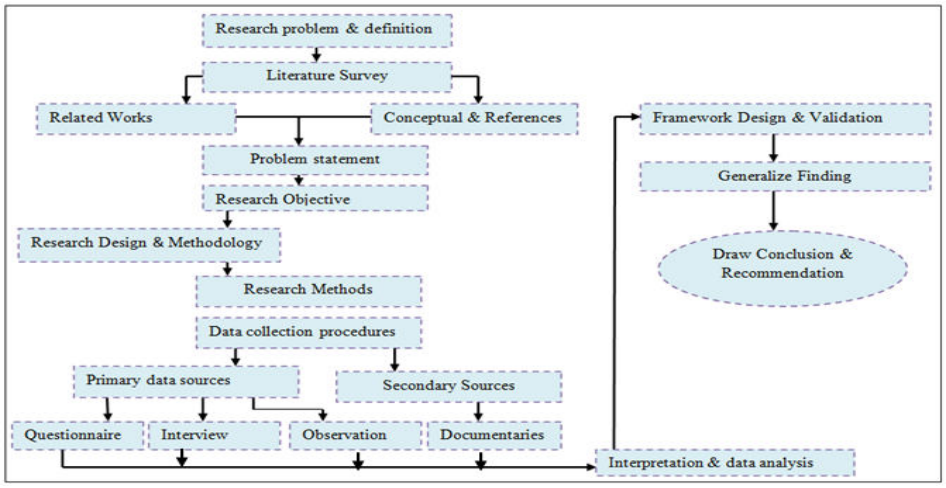
## *III. RESEARCH DESIGN AND METHODOLOGY*

### *Research Design & Approach*

The design of the study is mixed of i.e. exploratory and applied research because the study problem is in preliminary stage as only few researches are conducted the research in this domain with contextualized parameters. A mixed design is the best approach if the study requires both quantitative and qualitative designs to analyze the problem attributes. An exploratory applied design gives a clear view of the problem, familiarity of idea, develop a model and test.

In order to answer the research questions and achieve the research objectives, the study followed general research approach using chosen methods & tools for statistical analysis of stakeholders' inputs qualitatively and quantitatively using questionnaire, document analysis and technical observation. In order to find out the critical gape, from the previous work done, several related works published in journals, research reports, thesis project were critically reviewed and summarized. To synthesize what researcher has proposed to do through the study, the researcher summarized the flow of works as presented in the figure 1 of how this research study was done.

**Figure-1: Research Process Flow and Methodology**

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## *IV. DATA ANALYSIS AND DISCUSSION*

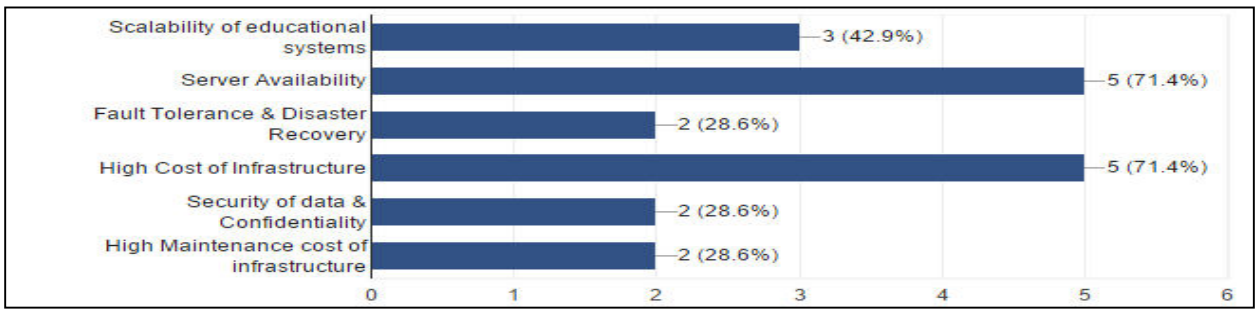
This research study conducted 1) Interview of education and ICT experts, 2) Technical observation by researcher self and 1) survey for investigation, for collecting views and need input of salient stakeholders (Employees) like teachers, managers, secretariats official and others employees about the learning challenges in existing learning delivery systems and their learning perception over cloud to support their learning accessibility as primary data input of the study.

### *A. Existing Technical Challenges in Traditional & in On-premise E-learning*

**1. The major challenges faced in the current traditional / conventional or existing e-learning environment (You may select/tick one or more options).**

According to the responses as presented in the figure 2, on major challenges in both traditional classroom & e-learning platform, it is observed that the high cost of infrastructures and server availability with 57.4% are the biggest challenges facing the usability of traditional e-learning delivery methods. Furthermore, another challenge is scalability with 42% of both traditional systems, 28.6% are lack of fault tolerant & disaster recovery, cost of maintaining and security of data confidentiality. This has also verified as the highest correlation with the research findings in the review of the literatures. In addition, it was revealed that the on-premise e-learning & traditional learning platform have highest cost of infrastructures i.e. 71.4%.

**Figure-2: Challenges faced in the Current Traditional Education System**

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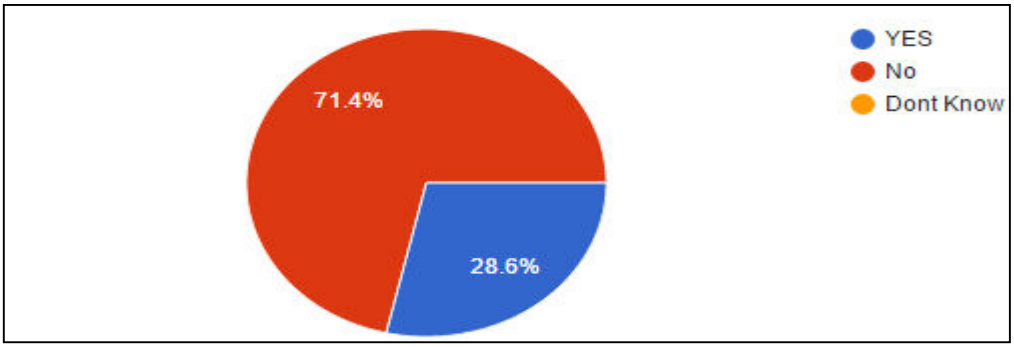
***B. Responses of Respondents on Current E-learning Satisfaction in Educational Delivery***

**Are you a working professional and satisfied with current education delivery systems in traditional/conventional or e-learning systems?**

Based on the responses of the respondents (as in the figure 3) on how these traditional delivery methods impact their learning experiences? It was identified and observed that the highest 71.4% strongly expressed their dissatisfaction with the current learning platforms. In addition, 28.6% expressed good concern in these traditional deliveries. This proved that different learners have different learning preferences. May be learning in this system satisfied their learning need and demand. This clearly reveals that two third majority of the target stakeholders need an alternative education and training delivery systems for their convenience and comfort

**Figure-3: Employees Satisfaction Level**

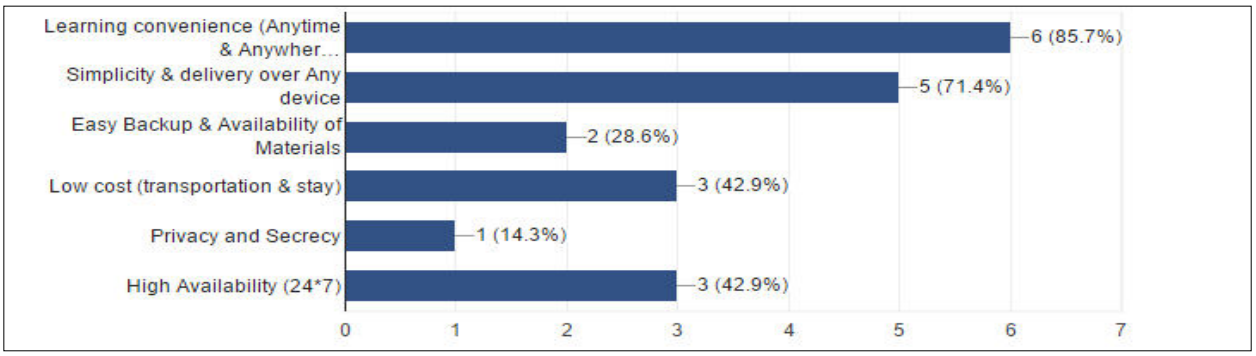



**Sources**: Authors Compilation

**3. Which amongst the following do you believe to be expected benefit of learning over the cloud than traditional e-learning for higher education by Employees? (You may select/tick one or more options)**

According to the responses of the respondents as presented in the figure 4, it has been observed that Employees like and prefer to move towards the learning platform over the cloud for their learning convenience that have highest degree of 85.7% which is not available in others learning platforms and this is strongly supported by the research [17], Cloud computing have high interoperability for the salient types of access devices. Furthermore, high availability also ranks third with 42.9%. In addition, devices interoperability with 71.4% is the second significant use of e-learning over the cloud. All these were the keys motivations too much company as the study [8] revealed about the availability, devices interoperability & cost cutting which are the main factors for migrating data/information/ systems like learning systems over the clouds infrastructures.

**Figure-4: Expected Benefit of Cloud Computing in Higher Education**

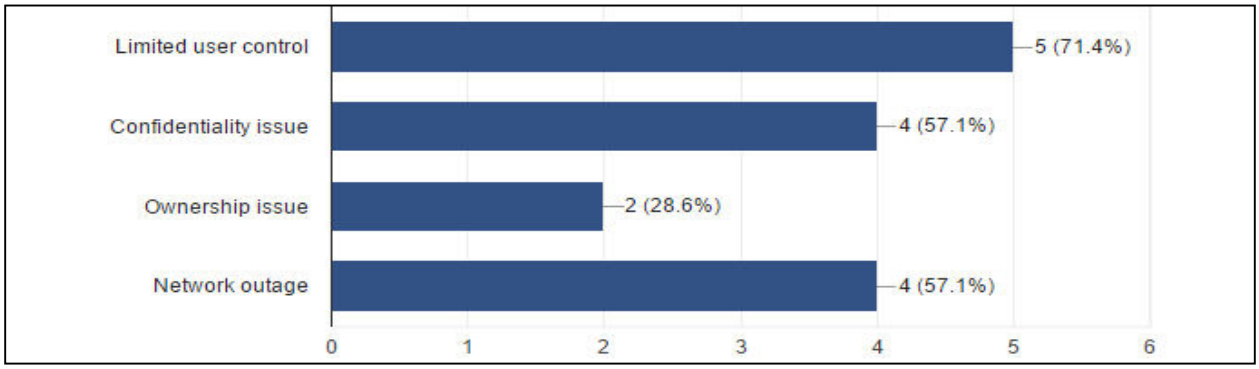



**Sources**: Authors Compilation

**4. Which amongst the following you believe to be a main challenge for the implementation of cloud based learning in higher education for Employees? (You may select/tick one or more options)**

The users' negative reactions over cloud based e-learning implementation are found limited to user control over the system with 71.4% and presented in the figure 5. The confidentiality issues & network outage 57.1% respectively and are significantly not important. The ownership issue with 28.6%, which is most likely because owners always like to own their data in their own hands but they also accepted during fact findings that maintenance and owning security is not only costly but challenging these days in connected world. These issues can be resolved by implementing hybrid cloud and with appropriate Serve Level Agreement (SLA) as research finding recommended.

**Figure-5: Main Challenges for Cloud Computing Implementation**




**Sources**: Authors Compilation

***Critical Analysis***

In the table 2, the features based critical analysis was done by researchers using observation and facts collection and finally supported by secondary sources.

**Table-2: Feature Based Critical Analysis of Existing Learning Platforms vs. Learning over Cloud Based**

| S/N | Parameters | Traditional Learning | E-Learning | Cloud Based Learning | Critical Remarks |
|---|---|---|---|---|---|
| 1. | Security | Low | Medium | High | However Cloud based learning platform ensures promising security under SLAs. |
| 2. | Accessibility | Low | Medium | Medium | Every one having mobile or any hand held device can access e-resources over cloud via the internet. |
| 3. | Scalability | Low | Low | Very High | Cloud based learning systems promise high scalability (vertical / horizontal) with no geographical limitations. |
| 4 | Flexibility | Low | Medium | Very High | The contents of cloud-based management are very dynamic. Anyone can customize but this feature does not exist in existing learning platforms. |
| 5 | Storage | Low | Medium | Very High | Both traditional learning and e-learning systems have limited storage capacities but in case of cloud it's unlimited and 24/7 scalable with fast upgradability. |
| 6 | Blending | Low | Medium | High | Only one or two style of learning existing in both traditional teaching methods but over cloud variety is available. |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Collaboration | Low | Medium | High | Class based & on-premise eLearning teaching methods have limited interaction in 24/7 model for learners but cloud based is 24/7 anywhere over any device. |
| 9 | Compatibility | Low | Low | High | The cloud based learning platform has better compatibility because it supports all accessible devices. It supports cross platform. |
| 10 | Infrastructure Cost | High | High | Very Low | Both traditional platforms need high capacity infrastructures and the cost of maintenance, and installation are very high but over cloud based only internet connection needed and rests are very low or almost negligible. |
| 11 | Fault Tolerant | Low | Low | Very High | Cloud based education systems have better fault tolerance and reliability because the cloud service providers promises 99.99 percent uptime. The on-premise eLearning & traditional class room method are not high fault tolerance and all time available. |
| 12 | Disaster Recovery | Low | Medium | Very High | In traditional or on premise eLearning methods, there is limited provisions of disaster recovery but over the cloud, the offsite replication and redundancy of servers ensure high disaster recovery and promised under SLAs. |

**Sources**: Authors Compilation

## *V. PROPOSED MODEL*

Technologies have been changing with fast speed. The existing systems, Models in educational domains are required to be reviewed, restructured and redesigned in align with evolving technologies so that they can survive for a longer time in highly competitive global environments. The International Society for Technology in Education (ISTE) based standards clearly revealed a new idea that education delivery systems should transform from traditional to technology-enabled environment for learners and educators. Currently the COVID-19 pandemic has also proved that we must have alternative teaching learning systems to alleviate the emergencies and disasters. The proposed model fits to solve problems of learning challenges is Unified Learning method and it can be deployed over the cloud platform as a Unified Cloud based E-Learning Model. The Unified-learning platform is defined as:

$$\textbf{Unified Learning} = \frac{f(time, space, path, place, teacher, resources)}{individual\ learning\ objective} + f(Mobile\ Technology)$$

### *Implementation of Unified E-Learning Model*

In the literatures review, it has been clearly observed that the existing eLearning systems of both traditional and on premise have a lot of limitations/short comings and challenges that are faced by higher education systems and their stakeholders. However, the proposed Unified-learning model over cloud in Ethiopian context can be better and alternative learning platforms that can be the best fit in localized system attributes. Also existing or pre adopted Ethiopian curriculums can easily adopt and install over the cloud platform to achieve the flexibility in Hardware/Software/Communication (HW/SW/COM) services, high accessibility, and cost effectiveness with high security and high scalability of learning system without any disparity. Here the entire teaching-learning process is required to be migrated from either traditional or e–learning to cloud based teaching-learning environments/platforms. All the Advanced features and add on services can be easily availed when needed in education delivery when it is migrated over cloud. The figure 6 presents the proposed i.e. cloud based unified e learning model.

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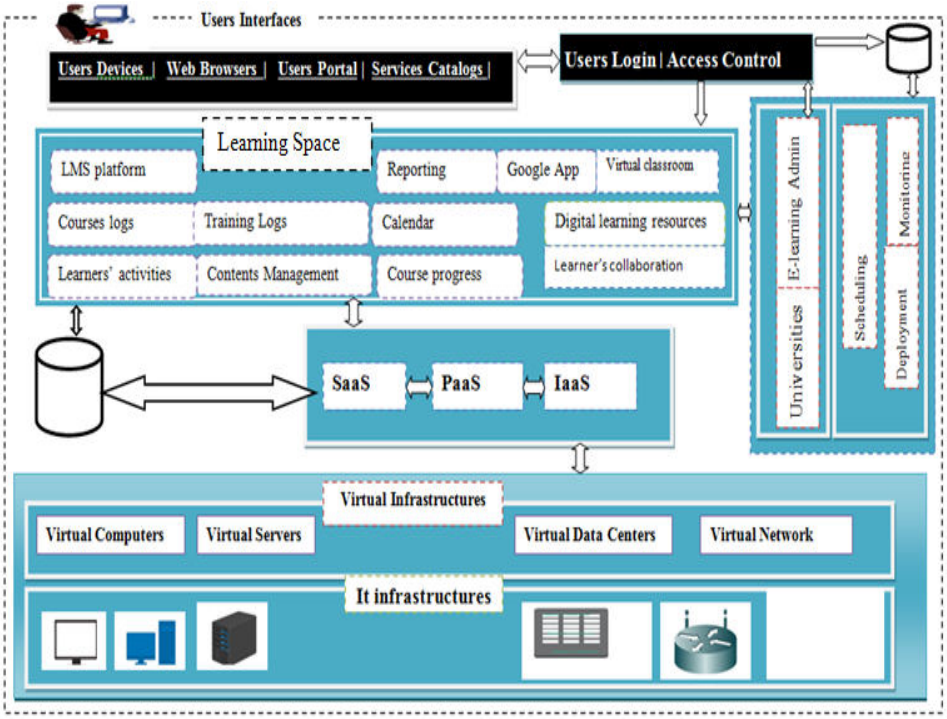
**Figure-6: Unified Cloud based E-learning Model (UCELM)**

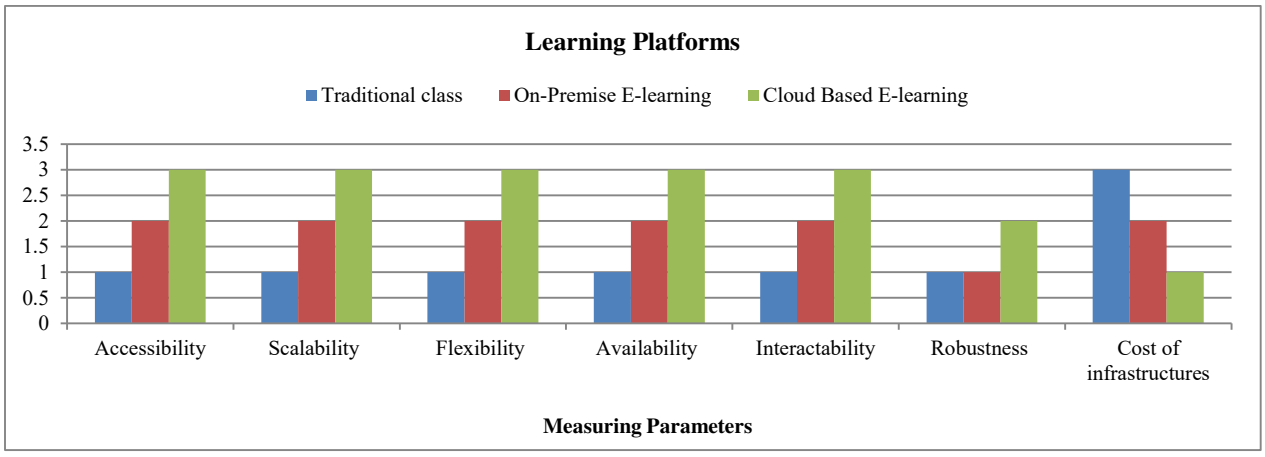



**Sources**: Authors Compilation

***Processes of Unified Learning Model***

The proposed model does not change or alter the features of the existing learning platforms (i.e. Traditional Class Room Learning, E-Learning over localized Intranets/servers) rather, it just promises to enhance and integrate all the best features together so that Employees can have sufficient choice to choose among different learning styles /platforms they want. In addition, cloud is advised to be the best amongst all. The figure 7 clearly compares the three specified learning platform features with quantitative measures and justifications.

**Figure-7: Comparision of Learning Platform Features**




**Sources**: Authors Compilation

The proposed model has several components which are described in the table 3.

**Table-3: Description of the Model**

| No. | Layers | Description |
|---|---|---|
| 1 | User Interface & Access control | This layer of the model (as presented in the figure 6) is the first entry layer of the proposed model. Here the users can use to access the education service or resources over the cloud infrastructure. It includes the browsers platform, different website links, users' portals, and services catalogs. In this design users can uses any access devices using any browsers. In addition, before accessing any services, the users should pass through services catalogs. This services catalog contains services that are available within the Unified learning system. Afterwards users can choose their services or program preference based on their interest and after users choose their preference program, the users can create his/her course portal site. The admin within the university can provide limited access control to users through cloud infrastructure interface. After the user created course portal, they can access the Unified learning spaces layers that rely over the Software as services platform. The authentication and authorization will be done using the Users Login and access control sub-layer to verify the entered users' credentials. Afterwards the system forwards the users' request to the appropriate component in the same layer or may be in the different layers as well. Furthermore, this layer has full access to the Services layers, which comprises of the following components: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and SaaS (Software as a Service). The users can use; different access devices like, thin client, user portals and services catalogs to access different services and offers within the cloud model. The Users devices can be any device that can support web-browsers, Users portal are gateway or entrance that users can use to access cloud services via their users accounts. Services catalogs when the users successfully login to the system. The users can be directed to which service that the best suit to his/her needs. In this design, the users include Employees (students/learners), faculty, administrator, or others who can be created by the system's administrator and managed by several types of users like Admin & Student themselves. This system is proposed be controlled by the universities and ministry of education as policy negotiators with cloud vendors under the hybrid Cloud governance provisions. |
| 2 | Unified Learning Space | After the users successfully registered, the system directs them to a layer where the users can use the different SaaS applications and other cloud based educational tools that are integrated for learning support to the Employees. In this layer (as presented in the figure 6), the Unified learning resources are populated so that learners' communities can access them using any device through their registered web portals. The experienced users such as developer, Lecturers and professionals can develop, design and deploy their applications over the cloud services and can indirectly access public cloud services and some advanced services such as Platform as Services & Infrastructures as Service based on their demand. |
| 3 | Service Layers | In this layer (as presented in the figure 6), the users can get everything/anything as services. These services are Software as Services **(SaaS)** that Unified different resources to enhance the learning environment. SaaS gives clients to access over different application gadget through system interfaces. Over the Platform as Services **(PaaS)** platform users can have control over their application development and deployment. In this regard, advance users can place advanced program. Virtual Infrastructure i.e. Infrastructure as a Service **(IaaS)**, level provides better flexibility that includes; the Hardware layer through the virtualization of ICT infrastructure such as servers, computation, Network and Data Centers. The notion of implementing IaaS is the utilizing ICT Infrastructure to overcome the resources boundaries. In this model, public Cloud is embedded with Infrastructures so that the users can access virtualized service in the |

| | | |
|---|---|---|
| | | Unified learning space within the public or virtualized with in hybrid cloud. |
| 4 | Cloud Management | The proposed cloud model's e-resources are designed to be managed by higher education in collaboration with the ministry of education. In this platform layer (as presented in the figure 6), ministry can work as negotiator that can agree with cloud vendors for liability and policy of the service based on the service level agreements (SLAs). Within this management layer there are cloud build in management service. These services are; performance and scheduling service that report cloud model performance to its adopter's different tasks and activities scheduling and cloud deployment management policy. |
| 5 | Database | This layer (as presented in the figure 6) is the place where the user log, courses, training, contents and all others service data are stored as a centralized repository but distributed over replicas and used and managed by the hosting institution. |

**Sources**: Authors Compilation

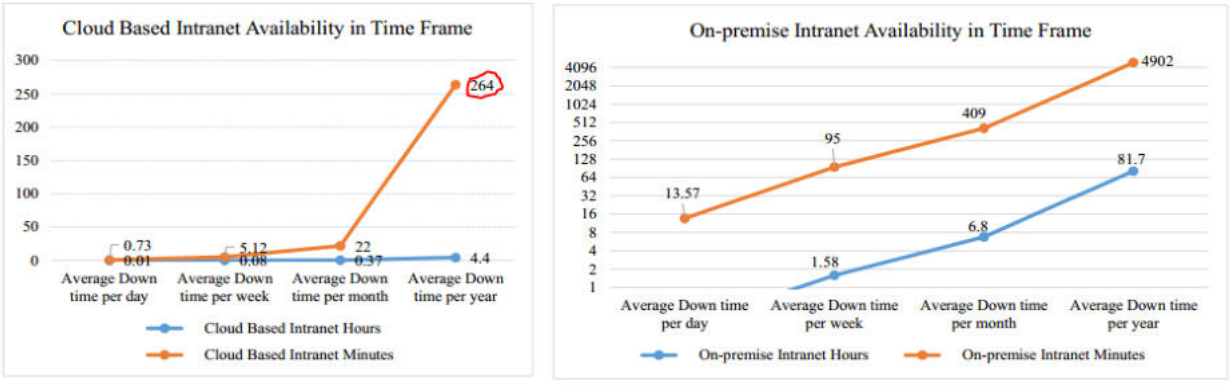
## *VI. EVALUATION OF THE MODEL*

In this model, the existing educational delivery in both traditional & on-premise eLearning platform verse education over Cloud has been evaluated for their performance in terms of high uptime (*availability), On demand needs fulfilment (scalability), On demand provision and provision of products and services (flexibility), Promising reliability with Least downtime (reliability), Cross boundary usage over any electronic device (accessibility) and Promising optimized performance under SLA (performance)* in the real world computing and communication scenarios of higher education environment.

### *User's acceptance & Availability of System*

Available of educational e-resources over the server is the most critical challenges in many academics' institutions. The 99.99% of On-premise/traditional eLearning is not guaranteed while 99.99% from the cloud counterpart is guaranteed. Due to these challenges there is no or poorly guaranteed availability for e-learning over existing platforms. There is no such SLA provided by existing e-Learning service providers as on date in Ethiopia. Hence cloud based eLearning platform can definitely promise 99.99% uptime availability. The figure 8 shows the output comparison of On-premise E-Learning over localized intranet vs. Cloud Based Intranet Availability based on 24/7 requirement. This challenge has already been investigated and proved for high uptime assurance services over cloud.

**Figure-8: Comparison of availability of On-premise vs. Cloud Based Intranet Services like E Learning**



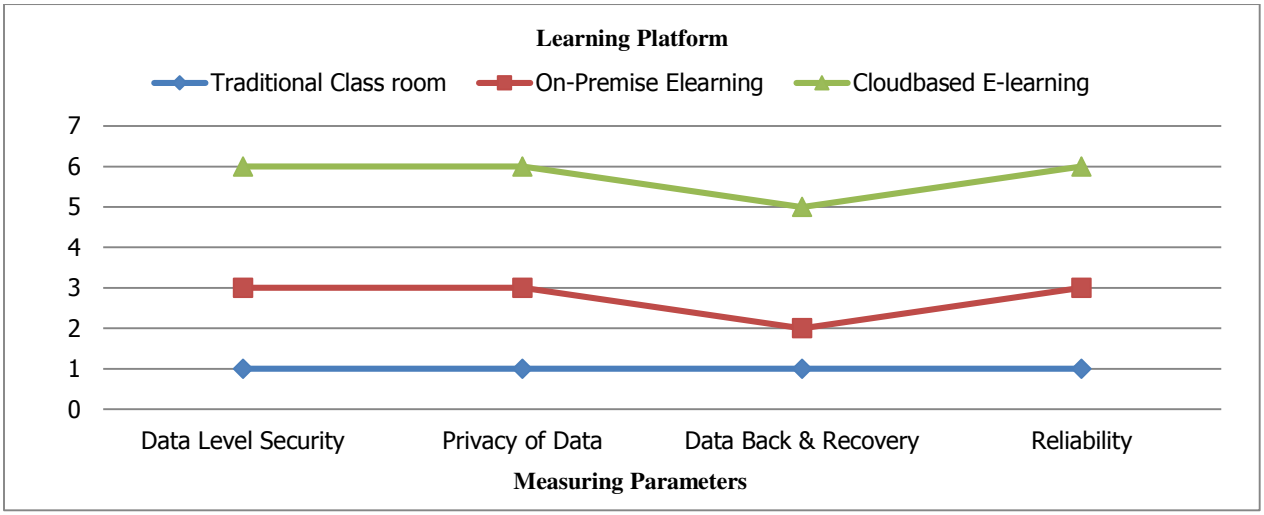

**Sources**: Authors Compilation

### *Security, Reliability and Privacy*

During the survey, security, privacy and reliability of the data over the cloud platform were criticized. Apart from this; there is another angle, where different stakeholders also understand and feel that these challenges are also associated with both the traditional education system like; Traditional class method and On-premise E-learning methods. Researcher decided to compare these challenges against three learning platforms with special reference and

focus of learning objectives of Employees. The critical observations with argumentations of the results are presented in the figure 9 (plotting point graph). As a final note, security, privacy and reliability perspectives conclude that cloud based education system have better and promising data security, privacy and reliability with recovery commitment and guarantees under SLA however traditional system or e-educational system over local intranets or web servers are missing such provisions under SLA, even no SLA exists in their practices.

**Figure-9:1 Data Reliability, Security & Privacy Comparison**




**Sources**: Authors Compilation

## *VII. CONCLUSION*

In this research work, status of education access for Employees, benefits of shifting e-learning over cloud platform and its limitations have been carefully studied and analyzed with different perspectives and parameters. During information gathering & analysis, researcher grouped the questionnaire under four different categories based on the stakeholders' responses to research questions and associated problems. Demographically the participants in the survey were managers, technocrats, secretarial staff and officials. The respondents clearly responded the education challenges in traditional classroom delivery systems and eLearning over web or intranets i.e. 87.7% limited time to attend the schools, poor technical feasibility of On-premise e-learning i.e. 71.1% for Employees , 85.7% respondents perceived that the cloud platform can be better option for learning convenience to the Employees and the 71.1% Employees agreed to move education system over the cloud to harness the cloud's potential features like *high uptime* (*availability), On demand needs fulfilment (scalability), On demand provision and provision of products and services (flexibility), Promising reliability with Least downtime (reliability), Cross boundary usage over any electronic device (accessibility) and Promising optimized performance under SLA (performance), better security, privacy and robustness of the system at low cost*. Different inputs from different stakeholders pointed out that both traditional education delivery system and non-contextualized cloud platform might not improve the Ethiopian education system for Employees. Therefore the proposed Unified Cloud based Education Model (UCELM) can be an important instrumental and guideline to reduce the existing challenges faced by Ethiopian Employees. Also this model can reduce the complexity of the previously adopted cloud based models that lack contextualization of Ethiopian learning systems. For the deployment of the model, Amazon & Azure were selected to be the best for the model deployment based on the suitable functionalities to support Software as Services (SaaS). Here the cloud based Learning Management Systems (LMSs) were compared and Talents was selected to demonstrate the learning collaboration of the model's users. The Unified structure of designed model, the researcher concluded that this model can significantly reduce many of the aforementioned issues and challenges that hinders extension of higher education to the door of learners especially Employees , disable and females with pregnancy.

## *VIII. RECOMMENDATION*

During the research survey and data analysis, it has been found that the higher education needs an alternative learning platform that can support Employees. In this regards the researcher likely to recommend that; the proposed Unified Cloud Based Education Model (UCELM) need full implementation over real sites so that's its full potential benefits can be explored and recommended. And it should be checked for all the stakeholders like academicians, institutions and government to invest on most suitable platforms of education to serve better as the future generation of educational systems

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# APPLICATION OF ARTIFICIAL NEURAL NETWORKS FOR DETECTING MALICIOUS EMBEDDED CODES IN WORD PROCESSING DOCUMENTS

**Sisay Tumsa**[8]

**ABSTRACT**

*Artificial Neural Networks have been widely used in security and privacy domains for alleviating the issues of malicious attacks. Several embedded codes like Visual Basic for Application Macros are reasonably powerful scripts that can help to automate iterative processes in word processing documents. It has been observed that, unethical hackers exploit these embedded scripts for their malicious intents. Since most of the Microsoft Word, users are unaware of such malicious attacks because they are layman end users and mistakenly considers less suspicious contents. Therefore, these hackers prefer to use Microsoft Office documents as most vulnerable items for or Attack vectors. As a general approach, non-executable files are assumed less vulnerable than executable files. This implies that these document files could provide an easy and convenient exploitable pathway that can allow hackers to execute their intended malicious actions on the victim's machine. This research paper presents an automatic detection of malicious embedded codes in general and Microsoft Office documents as a specific case for experimental analysis. This research paper considered only malicious behavior of the embedded codes i.e. checks the status of inclusion or exclusion of the executable code. The malicious datasets are developed to create a knowledgebase where documents are pre-processed. Thereafter the data sets are disassembled using reverse engineering and then malicious features are extracted from the documents. In this research paper, nineteen different malicious keys were extracted. Later, feature reduction technique were applied. Based upon actions; these malicious keys were reduced to eight behaviors. Finally, a machine is trained using artificial neural network with eight input features; extracted from individual disassembled scripts. Afterwards, output nodes that represent malicious or benign behavior classify the existence of attack i.e. exists or does not exists. Based on the training model, seven hundred ninety-two samples of documents were tested. Finally, the research has achieved an average accuracy of 92.2% in the identification of maliciousness of embedded codes in Microsoft Office documents as a case. This result shows that the proposed system has high accuracy in detecting malicious Embedded in word processing documents.*

**KEYWORDS**

**Non-Executable, Malicious, Behavior, Suspicious, Knowledge Base.**

## *I. INTRODUCTION*

Most computer users are familiar with Microsoft office package tools such as MS word, MS excel, MS power point and MS Access etc. As a general functionality, the Microsoft office documents use macro scripts to automate repetitive tasks. Today the recent nature of attack vector has also changed from system level to application level. It has been observed in several studies that the application level attack uses mostly used application software's such as PDF files and Microsoft office Documents. Several recent studies revealed that attackers embed the malicious code in this application software's [1] [2]

As a matter of facts, the Microsoft office products have their own default security mechanism that prevent the executions of macros by themselves up to a certain level. However, on several cases, attackers can forcefully bypass those security mechanisms. Nowadays attackers have changed their attack vector from operating system level to the application level. Particularly, they concentrate their efforts on finding vulnerabilities in application software's such as Microsoft office documents and Portable Document Format (PDF) files. This is because of its complex data structure, which allow the embedding of code, such as JavaScript and Visual Basic for Application (VBA) macro and

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provide different kinds of Application Programming Interfaces (APIs) to control the way documents are displayed. These complex data structures and rich functionality make such applications prone to vulnerabilities [1]. According to the report [2] most popular file types for targeted attacks were Portable Document Format (PDF) and Microsoft office files. In addition, the report of Kaspersky labs stated that, in 2013, 91% of organizations were hit by the cyber-attacks and 9% were the victim of targeted attacks. Since most of the official documents in government and private organizations having confidential information are stored in Microsoft Office Documents. In addition, the most user are unaware of such kinds of attacks. Today Microsoft Office Documents have become a popular avenue for exploitation of such kinds of attacks. In order to overcome such challenges, the installation of antivirus software is not sufficiently effective in capturing embedded executable. This encouraged this research paper to develop an additional detection mechanism that can enhance the protection of the aforementioned confidential and precious documents [14].

Macro viruses make up the majority of mobile code attacks in the world. Macro viruses account for over half the infections reported each month. The U.S Department of Energy, which maintains the virus response team for the government, claims macro viruses represent 85% of their tract infections [3]. In addition a study [4]exposes the weakness identified in both Microsoft Office and OpenOffice documents and how one can bypass that security setting and execute embedded scripts. This paper covers three main aspects; including macro security level, trusted locations and digital signature of document. The other paper focuses on only detecting embedded malicious executable code an apparatus includes: an office document extension name searching module for, when the office document is opened, checking whether or not the corresponding office document has an office document extension name; a macro detecting module for detecting whether or not the office document having the extension name has a macro function; and an execution code checking/parsing module for checking whether or not the office document having the macro function has an execution code, and checking whether or not the execution code is executable [5,6]. The structure of Microsoft office 2007 and higher versions have the security features and techniques to bypass this security mechanism discussed [7,8,9]. Discusses structure of Microsoft office 2007, techniques that reveal how data are concealed and how to bypass the security mechanism set to Microsoft Office files. This clearly shows that there are different advanced techniques that allow attackers to use Microsoft office files as a weapon to attack organizations and individuals. Thus, the prime goal set for this research is to identify malicious behaviors of Macro scripts and propose a system that automatically detect malicious behavior of macros in Microsoft office documents.

## *II. RELATE WORK*

Jonathan Dechaux and Jean-Paul Fizaine in their paper "Office Documents: New Weapons of Cyber warfare" explores different weakness identified both in Microsoft Office and OpenOffice to bypass those security setting and execute automatically malicious macros. The paper covers three main aspects: macro security level, trusted locations and digital signature of documents [5].

In macro security level, the paper discloses the vulnerability of macro security and how to bypass this security level simply by changing the values set under the registry. The paper presents the different security issues with respect to macros. By default, in office security policy the macros are not allowed to be run unless they are in a "trusted location". However, it is possible to modify this default security setting according to the need and wish of every user. Macro security level is handled in the windows registry base. Indeed, the registry key involved in the security is located in the HKEY_CURRENT_USER section of the registry base [7].

When installing the Microsoft Office suite, various trusted locations are set up, as defined in the Office security policy, any macro in those trusted locations will be executed by default, and whatever may be the level of security chosen by the user. Some of these trusted locations offer the possibility that the subfolders are also considered and managed as trusted ones. Trusted locations are managed at the registry base level, in the registry section. [17] HKEY_CURRENT_USER

Finally, in digital signature of document the paper presents the vulnerability of documents and how one can bypass the security under digital signature. Creating and adding digital signatures in Microsoft Office 2007are extremely easy. The user has just to click on the "office" button and then choose the prepare option and then the "Add a signature" one. Whenever no certificate is present, Microsoft Office asks the user to create one and to select a

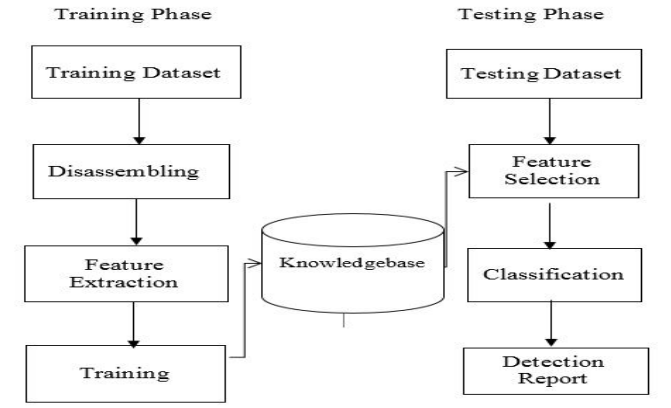
certificate type Microsoft Office we mainly use the RegOpenKeyEx, RegSetValueEx, RegCreateKeyEx and RegCloseKey function to manipulate the registry key in a suitable way for our attacks [16, 13].

This paper did not provide absolute solution for the mentioned vulnerability instead it discloses the vulnerability to the attackers. Another analysis made by "Philippe Lagadec" entitled with" OpenDocument and Open XML security (OpenOffice.org and MS Office 2007)" focused on security issues linked to native features of the file formats and applications. In this analysis, most interesting features for security concern, such as VBA Macros, are not covered in the open XML specifications. Microsoft and ECMA consider these features as proprietary technologies that are outside the scope of the open XML standards [6].

## *III. PROPOSED SYSTEM ARCHITECTURE*

Today, identification of an object and classifying it into its appropriate classes become a wide area of research. In the architecture proposed by this research paper (i.e. figure 1) the identification of an object passes through a series of steps/procedures that is proposed to be applied to differentiated items, in which each new item must be categorized in to one of a predefined class based on the basis of observed attribute or features. This section discusses the design and architecture of the proposed system for the detection of malicious macros in Microsoft office documents.

**Figure-1: Architecture of Proposed System**




**Sources:** Authors Compilation

Most frameworks for the detection of malware bearing documents are almost the same. Figure 1 shows the proposed system architecture for detection of malicious macros in Microsoft office documents and each component will be discussed hereafter.

## *IV. EXPERIMENT*

In this research, malicious features of Macro Scripts were identified and a machine is trained by their behavior to detect later those behaviors later. A knowledgebase was created because of the training process. The knowledgebase is later used during the identification of unknown samples of the given dataset. Figure-1 shows the proposed system architecture.

The research expected to have:

### *A. Feature Exraction*

In this research study, nineteen suspicious keys were extracted from these eight features selected by a method called feature reduction. The selected eight features are discussed as follows:

**Auto-execute:** suspicious keys that were included in this behavior executes when a new excel workbook or an office document is opened.

**Bind Malicious Action with Keys:** This class of suspicious behavior binds an action with frequently used keys.

**Connect to remote server:** this class of suspicious behaviors connects to remote server.

**Create Object:** May create an Object Link Embedded (OLE) objects.

**Manipulate Registry Value:** This class of suspicious behavior manipulates the registry value so that the default settings may be changed forcefully.

**Obfuscation:** This class of suspicious behavior attempt to obfuscate strings.

**Open Port:** This class of suspicious behavior open windows port.

**Run Executable File:** This class of suspicious behavior may run an executable file or a system command.

***B. Maintaining the Integrity of the Specifications***

First features were extracted from the collected datasets and the malicious features were defined. The system was trained with the extracted features and knowledgebase was created by the system through which the system would check the features for the next level i.e. for the testing phase. Since labelled data were used for the system, a supervised machine learning method were used to identify the class of the document. In this paper, an Artificial Neural Network with feed forward multilayer perceptron architecture was used for training because of its favorable properties that make it an excellent choice for object classification.

In feed forward multi-layer perceptron architecture, the neural networks have distinct input, output and hidden layers where the output from one layer of neurons feed forward into the next layer of neurons. There are never any backward connections, and connections never skip a layer. Typically, the layers were fully connected, meaning that all units at one layer are connected with all units at the next layer. A feed forward multilayer neural network consists of a layer of input units, one or more of hidden units, and one output layer of units.

For this experiment, the eight measures of central tendency and dispersions representing malicious features of macros were used as input values (nodes) and two were used as output values (nodes), which leads to have two nodes (benign and malicious) in the output layer. The number of hidden layers is determined to be four. Using this the system classifies the given input datasets as it shows in table 1.

**Table-1: Summary of the Identification**

| Target Class / Output Class | 1 | 2 |
|---|---|---|
| 1 | 51 | 8 |
| 2 | 0 | 43 |
| Total | 51 | 51 |
| Percent corrected | 100% | 92.2% |

**Sources:** Authors Compilation

The summary result of the identification showed that from the total test set of 102 samples, 94 (92.2%) were identified correctly and 8 (7.8%) were not identified in its correct classification. Numbers 1 and 2 represents benign and malicious classification. The training process finally generates a knowledgebase, which contain the complex relationship between various feature values malicious data. The knowledgebase become the primary input for the decision-making process in this research study.

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## *V. DATASET IDENTIFICATION*

Identification of dataset is made by making use of the knowledgebase created during the training phase. The procedure used in this phase was similar to that of the training phase except that the dataset was not labelled. Unknown dataset samples pass through pre-processing processes. Then, the features discussed above were computed where the system matches against the knowledgebase to predict the maliciousness of the dataset.

## *VI. EXPERIMENT*

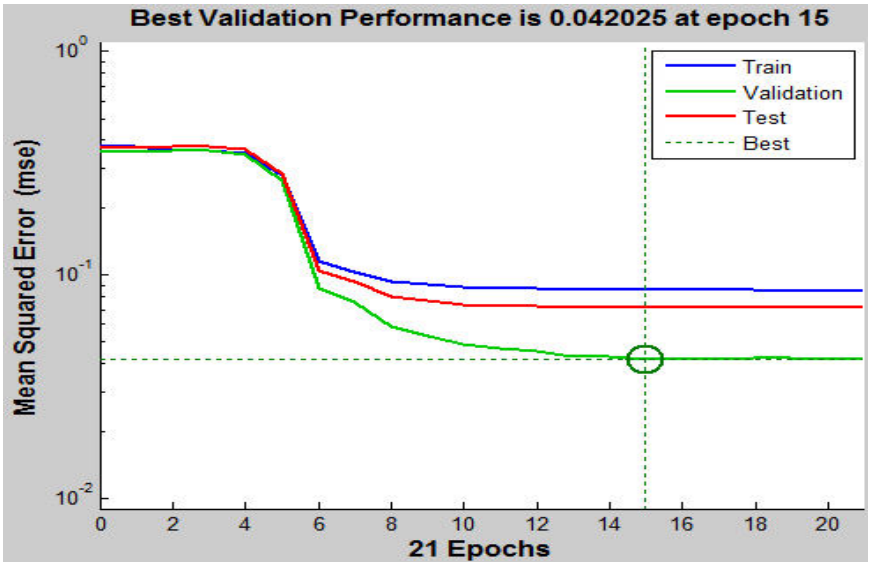
### *A. Dataset Collection*

792 data are collected from the VXheaven machine-learning repository. For this experiment, eight features were selected that identified the maliciousness behavior of Visual Basic for Application (VBA) macro scripts.

### *B. Training*

Identification of an object using a machine learning approach has two basic phases: training and testing. In the training phase, data is repeatedly presented to the pattern recognizer, while weights are updated to obtain a desired response. Thus, we design the identifier by partitioning the dataset into training, validation and testing dataset. From the total dataset 70% was used for training, 15% for validation and the remaining 15% was used for testing. Since the expected output is a sequence of binary digits, a sigmoid transfer function was used to output 1 in the correct class of the output vector and to fill the rest of the output vector with 0. During the training, the connection weight of the neural network was initialized with some random values. The training samples were input to the neural network in random order and the connection weight were modified according to the error. This process was repeated until the mean squared error (MSE) fell below a predefined tolerance level or the maximum number of iterations is achieved. The validation set was used for improving generalization of the results. During the training process, the error in the validation set is monitored. The validation error normally decreased during the initial phase of training, as does the training set error. However, when the network begins to over-fit the data, the error on the validation set typically begins to rise. When the validation error increases for a specified number of iterations, the training is stopped, and the weights and biases at the minimum of the validation performance as mentioned in the figure-2 was measured at 16 iteration and the validation error was 0.042025.

**Figure-2: Best Validation Performance**




**Sources:** Authors Compilation

### *C. Test Result*

From the collected malicious dataset, 24% of the total, which was not included in the training set, was used to test the performance of the system. Among this 92.2% of documents are correctly classified and 7.8% of misclassified by the machine after training.

From the result, it was observed that the proposed system architecture performance found very high. From the obtained result, we can conclude that the developed architecture, which performs sound on classifying new documents to benign or malicious, based on the trained behaviors.

## *VII. CONCLUSION AND FUTURE WORKS*

In this research paper, the experimental analysis process has extracted features that uniquely identifies malicious behavior of macros in Microsoft office documents. This research is a unique and new knowledge contribution to the researchers and malware analysts.

Antivirus companies may be the exclusive beneficiary as a new dimension for detecting malicious actions in Microsoft documents in offline and real-time modes. Selected features to be incorporated to their database signatures can do this. In addition, this research uses machine-learning approach in order to train the machine to identify malicious behavior of macros in word processing documents.

As an extension and recommendation, better results may be achieved by using hybrid approach for both static and dynamic machine learning approach and changing the learning algorithms.

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# NOURISHING CYBER SECURITY MEASURES AMONG PROCREATOR IN ARBA MINCH, ETHIOPIA

**Azath M.[9] Balakumar S[10]**

**ABSTRACT**

*This research is used for analyzing the awareness among the cyber security parental to safeguards their children. Nowadays young people are often called digital natives since they live in a time with digital gadgets. Just because they seem to be techno-savvy, they are not following safe practices.*

*The challenge for parents is that it can be hard to coach their children if they do not fully understand today's online threats and safeguards. Our aim is to aid parents on their security and good cyber ethics to safeguards their children.*

*The result of this study should have enlarged scrutiny via hinted through cyber security safeguard in order to organize the aspects that impinge protection toward their family. Being cautious about cyber security at early stage could help parents to defend their children.*

**KEYWORDS**

**Safeguards, Monitoring, Digital, Techno-Savy etc.**

## *I. INTRODUCTION*

At Present in Ethiopia, Information Network Security Agency (INSA) a national-level safety awareness campaign is deploying immediate administrative organizations, to implement the country's information security laws and policies [1].

Here the moral intermediate considering support nearby the administrative agencies do eminently vital in order to accretion proficiency famously together with the ambition society, specifically pupil and guardian. Elegant Internet of Things (IoT), most end user activities are dependent on internet communication in several sorts. There are various merits and demerits of using internet. Therefore, one should be aware of it by understanding its demerits properly. People who do not have good intentions they only intend to harass, harm, and engage themselves in cyber bullying activities also utilize internet.

By using Internet, guardians must remain conscious about fine cyber ethics directed toward look after their minors and others. Internet users have the appropriate rights to utilize Internet securely and to set their own limits. Every individual must be smart, liable and safeguard themselves and their children by monitoring them both online and in real life. Getting slight knowledge about their children what they endure accomplishment on the Internet frame warning since the proficiency around cyber security risks is hushed lesser among guardians. Meanwhile lure shows that, 1 among 25 Ethiopian guardians maybe familiar with their children are seeking from the Online. Elegant countless process, guardians are illiterate of their youths baseless connection as well as expose toward incorrect on the Internet [5], supervise their children towards the risk of Internet.

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Due to educational pressure amid youths, online grants how the appearance like harmful items definite along disgusting contented, cyber bullying, habit, online frauds, along with secret knowledge outflow along youth's journey in online community. The above-mentioned safeguard risks endure forenamed towards more and more complicated along with significantly worsen against lifetime [6].

Technical knowledge as well as the uncertainty related upon persistently enlarges, although a small amount of holdings call the identical. During incredible enormous move onwards, plenty of citizens remain progressive towards the need of usage also a limited figure of society remain moving towards detecting practice of exploitation. Meanwhile the exploitation resolves the dealings also found in their removal, rather community or scientific. Although safeguard authority conspire toward the society to control securing their expertness, execute the culprits. In this real world, safeguard risks desire to remain a lifetime.

## *II. METHODOLOGY*

### *a. General Approach*

This research uses quantitative approaches adapted from the investigation of 202 Ethiopian families. This investigation was conducted among the quantity of respondents consisting of parents throughout Arba Minch, Ethiopia.

**Table-A: Research Phases**

| S. No. | Phases | Motion | Result |
|---|---|---|---|
| 1 | Preliminary Study | To diagnose the obstacles of Cyber Security | Problem Statement |
| | | To identify the purpose of this study | Research Objectives |
| | | To identify the scope of this study | Scope of the investigation |
| | | To study different research papers | Literature review of existing systems |
| | | Designing System | Aim to study the tools |
| 2 | Research Feasibility | Verify the research tools | Reliable tools |
| 3 | Research Study | Survey conducted through offline | Data collection from respondents |
| 4 | Conclusion | Final Thesis | Final Results |

**Sources**: Authors Compilation

### *b. Preparation of Questionnaires*

This study consists of seven elementary closed-ended questioning around caring armor on online safety measures bullying with adults. The researchers delivered a brief explanation regarding the research to the Ethiopian parents/guardian about the objectives and threats of digital gadgets.

Few questions from this same section have been used in Scale method, where the answers are obtained as: a = Strong Disagree, b = Disagree, c = Neutral, d = Agree and e = Strongly Agree. A single questioning here bring their desire towards answering 0 = Yes or 1 = Not Ok, since addition of items are required by accused toward choose through design the lean of agreeing responses.

### *c. Sampling*

202 Ethiopian parents/guardians combine the simple samplings of a suitable investigation proceeds towards, and express the right equal of correctness and strength in place of the benefit of the study.

## *III. KEY FINDINGS AND DISCUSSION*

The ultimate aim of here exercise stays towards study the smooth of caring readiness regarding online safety fear towards their adults through Arba Minch, Ethiopia. Nearly 500 questionnaires were circulated near the defendants;

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among them merely 202 questionnaires remained completed and handover to the concerned investigators. Here measureable facts composed, stayed examined from side to side by Statistical Package for the Social Sciences statistical software.

***a. Awareness Program***

When the Awareness Program was conducted in Arba Minch, Almost 202 respondents were attended. Those respondents are the parents and guarding of the children. They were so curious with our program, which was hosted by our research team members. Those guardians were raised many questions regarding internet and online threats.

Guardians feel so normalcy by our program. During that program, we collected secondary data through questionnaires almost 202 respondents responds accurately about their children's mentality and their own interest with online threats and mechanisms.

In Africa, especially peoples from Ethiopia are indulging themselves with e-gadgets and government of Ethiopia also creates awareness among the youths and their citizens.

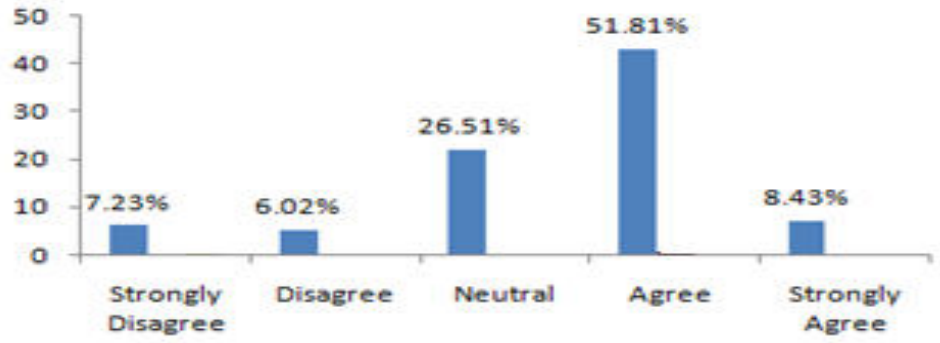
In Ethiopia, INSA organization plays an important role to their citizens to create a massive growth in the aspects of Internet and their usages. Also the researchers demonstrate several impacts of internet and usages of Internet to the respondents.

During that period the researchers circulate the questionnaires to each defendants who ever participated on that occasion. From that the following results shows the results of the defendants, only 83 (41.09%) retain as a guest in training program in the domain of internet risks and the resting of 119 (58.91%) were not as a guest in any internet related training programs.

Amid 83 participants, 50 (60.24%) respondents were fulfilled through the training program on online risks programs. The remaining 22 (26.51%) respondents were recorded as lesser fulfilled through the program results. During this time 11 (13.25%) recorded as entire displeasure.

It is clear that even though several programs were conducted by Government of Ethiopia, private organizations and by our team researchers its astound that only few parents were aware of online threats and impacts. Almost 60% respondents agree that their children may face online threats.

**Figure-A: Response of Gratification Facing Online Risks Training Program**




**Sources**: Authors Compilation

***b. Situational Alertness Level on Cyber Security***

**Table-B: Cyber Security Safeguard Alertness**

| | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| | % | % | % | % | % |
| Are you not familiar of internet risks. | 5.94 | 8.91 | 9.90 | 55.94 | 19.31 |
| Are you not familiar of your children is watching through online. | 1.49 | 2.48 | 17.33 | 67.31 | 11.39 |
| Did you notice your children aware of your internet. | 0.99 | 2.48 | 15.84 | 62.87 | 17.82 |
| I don't realize the complications in using internet. | 2.48 | 3.96 | 12.38 | 57.43 | 23.75 |
| I am a mentor for my children to use their digital gadgets. | 35.64 | 30.20 | 9.41 | 15.84 | 8.91 |

**Sources**: Authors Compilation

A detailed study was conducted in the aspect of Arba Minch, Ethiopia as a concern with their children perspectives. It is evident from the respondents statement stated that from the above Table B, 75.25% respondents have reported that they are not aware of their online threats'. Here, it is a huge gap between the parents and internet usages.

Almost 75% of guardians/parents stated that they are aware of internet, it means that most of the parents had never used internet in their daily routines. This circumstance will create a huge loss for the development of nations and upcoming generations might get more loss. Among them, only few 24.75% respondents are aware of cyber threats.

Gradually 78.7% of respondents are not familiar with their children's are accessing though internet. Here attend of why few Ethiopian guardians are not able to audit the child's action on internet, as well as advising supports, explaining towards the internet usage and let them access in society. The remaining of 21.3% of respondents who have limited information about cyber security challenges, hardly monitor their pupil.

80.69% of respondents are very aware of their child's use of Internet. 81.18% concerned peoples are acknowledged with the troublesome interest to restrict the youths towards online usage, because parents assumed internet is complicated. However, 18.84% respondents disagree with the face that they are not aware of the complications in using internet.

A total of 24.75% of parents have reported to be habituated during the e-gadgets usage though online, specifically towards the togetherness of children. Even though there is some awareness among parents in provisions about online usages in their family. Still parents lack with technology, so it becomes hard for parents and children to go hand in hand. Therefore, the researchers found that there is a gap with internet and users.

## *IV. LIMITATIONS OF THE RESEARCH*

Data gathered for inspecting is applicable only to few parents in Arba Minch, Ethiopia. This study does not consider all the Ethiopian parents, but only very few.

## *V. CONCLUSION*

From the above survey, it is clear that matching of online risks training programs in the midst of guardians remained very less. Significance rest against towards the loss of governmental or non-governmental agencies particularized awareness training meetings, finite reports are inadequate training programs around Ethiopia towards online risks. It is the duty of the authorities and NGOs to provide inspiring awareness to parents regarding Cyber threats. Several study offer valuable insights about cyber security into the existing knowledge of parents in Ethiopia. It is expected that by applying this study be used to analyze the safety measure of cyber security towards the promotion of training

programs for guardian's alertness. The researchers concluded that several training or awareness programs have to be conducted for the guardian's alertness, so that they could be excellent mentors for their children. It is clear that special care has to be care by the mentors since internet is sometimes acting as a threat for younger generations in many aspects.

## *VI. RECOMMENDATIONS*

In the case of Ethiopia, there is a substantial initiation towards the proceeding of safeguarding cyber security amid institution children and parents. Few guidance considering towards the domestic strategy upgrade cyber security in the society are:

- Organize domestic institution plans, which inspects to what degree the cyber security being consigning towards the upgrading measures of safeguard trainings to every children, teachers and parents.
- Safeguard every national IT strategies should be enforced with regular monitoring and assessment.
- Cater schools with a clear cybersecurity protocol through Ethiopia Information Network Security Agency (INSA).
- Contribute awareness program to every supervisors and parents about cybersecurity awareness and Protocols.
- Assure and aware the domestic peoples about the awareness of cyber security.

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