A Validation of The Delone And Mclean Model On The Educational Information System Of The Maharashtra State (India)

SANJAY S SIRSAT
Department of Management Science
Dr. B.A.M. University
Aurangabad (M.S.)
INDIA
sanjiivv2010@gmail.com

MANISHA S SIRSAT
Information Technology, CITIUS
University of Santiago de Compostela (La Coruna)
Santiago de Compostela
SPAIN
Manisha.sahane2012@gmail.com

Abstract: - The advancement of information technology and high performance computing technology encourages every area such as in the present scenario; the public sector enterprises face huge competition at national and global level. Due to liberalization and globalization, more emphasis needs to be on quality, time line, innovation and customer orientation but it requires an accurate, fast, effective information system so that evaluation of information system is necessary with the aspect of organizational objectives. It does not only calculate the performance of hardware, software, computer network, and data but also achievement of all objectives of the enterprise. The use of information systems (IS) have been increasing in the last decade across the application architecture not only in private business enterprises, but also in public and government enterprises so that information systems success model can be considered in all contexts. This paper is focused on review of DeLone and McLean evaluation model, comparative analysis of original and updated model of DeLone and McLean and to validate information success of the Indian government UDISE system by applying the same model. In this paper the authors have successfully validated the model in the government of Maharashtra's system.

1 Introduction

During the growth of a competitive global environment, there is pressure on most organizations to make their overall process effective. The growth of information technology can increase the competitiveness and gain effective information for organizational decision making. The information system nowadays plays vital role in every stage of e-business, e-commerce operations management and strategic success of the business [17] as well as educational management information system. According to [23], there are a number of factors that can increase the importance of IS nowadays that is the intense use of internet and communication technologies, transformation of

business enterprise due to technology forces, globalization of business and huge opportunities on the international level, rise of information and knowledge economy, and the rise of the digital firm where almost all business relationships are digitally enabled. "The Measurement of Information Systems (IS) success or effectiveness is critical to our understanding of the value and efficiency of IS management actions and IS investments [10]." Many researchers spend their time to evaluate information system success factors. The effectiveness of the system depends upon many factors like organizational environment, information system [18]. Evaluation of information system success is multidimensional which can be evaluated by many researchers at various stages. In 1992,

DeLone and McLean developed and conducted wide-ranging critiques on Information Success (IS) model. This model is very popular and extensively accepted. In India accordance the constitutional assurance to ensure free and compulsory education for children up to age of 14 years and provision of universal elementary education has been a basic feature of Indian national policy since independence. A number of schemes and programmes were launched in India for successful execution of education. One of them is Sarva Shiksha Abhiyan (SSA) which is government of India's flagship program for achievement of universalization of elementary education in a time-bound manner, as mandated by 86th amendment of the Constitution of India – making free and compulsory education to the children of 6-14 years age group a fundamental right. For the successful implementation of SSA project, Management Information System i.e. UDISE is developed by National Institute of Educational Planning and Administration (NIEPA).

Unified District Information System (UDISE): Sarva Shiksha Abhiyan (SSA) is a complete and integrated flagship programme of the Government of India to achieve Universal Elementary Education (UEE), covering the entire country in a mission mode. SSA has been launched in 2001-2002 in partnership with the State Governments and Local Self Governments [38]. The programme intends to provide useful and relevant, elementary education to all children in the age group of 6 to 14 by 2010 but Central Government has given extension to this programme to accomplish the educational goal by 2017. For the successful achievement of goal of any government programme information system plays a vital role. National Institute of Educational Planning and Administration (NIEPA), New Delhi developed UDISE information system for SSA. The first version of the system, named as 'District Information System for Education' (DISE) was released by the NIEPA during the middle of 1995. The UDISE software is now operational in 581 districts in 29 States & *union territories* of the country and is providing vital information for policy formulation and preparation of district elementary education plans. In the year 2010 DISE received two national awards: E-Governance 2010 (Department of Administrative Reforms and Public Grievances, Ministry of Personnel, Public Grievances and Pensions, GoI) and eINDIA 2010 (Department of Information Technology, Ministry of Communication & IT, GoI) and also Manthan Award South Asia 2010. Data is collected by every school through Data collection Format (DCF) and it is entered on every block by data entry operator. After data entry, all inconsistencies in data are detected during the entry phase. It is then corrected by MIS coordinator at block level and district level. The preliminary reports are generated and shared at the district and lower levels. Once data has been adequately scrutinized and shared at the district level, it should be sent to the state level MIS center where the data from all districts will be merged to obtain the state level analytical reports.

2 Objectives

(1) To review the DeLone and McLean information system success Model (1992) and updated model (2003).
(2) To test the proposed instrument empirically within the context of the UDISE.
(3) To verify the proposed model based on the findings of this research to ensure its validation and reliability.

3 Literature Review

Information system success modules: Formulation of the theories of reasoned action and planned behavior (1934) studied by [22]. Information theory in communications engineering provides a formal framework for measuring the quantity of information and communications efficiency [16].

The term information theory is concerned with encoding and decoding of message through communication channel. [33] defined the technical level as the accuracy and efficiency of the system which produces the information, the semantic level as the success of the information in conveying the intended meaning, and the effectiveness level as the effect of the information on the receiver. Based on [33] expanded Shannon & Weaver's theory by extending the 'effectiveness level' into three categories. DeLone and MacLean Model taxonomy based on Richerd Mason's modification of [34] mathematical theory of communication which based on three levels of information.

(1) An accuracy and efficiency of the system formed that is Technical Level.
(2) An ability to transfer the intended message that is Semantic Level.
(3) Finally impact on the receiver that is the Effectiveness or Influence level.

Mason (1978) expanded Shannon &Weaver's theory "Effectiveness level into another three different categories that is receipt of information,

impact on recipient and influence on system".

quality, Information quality, Use, User satisfaction,

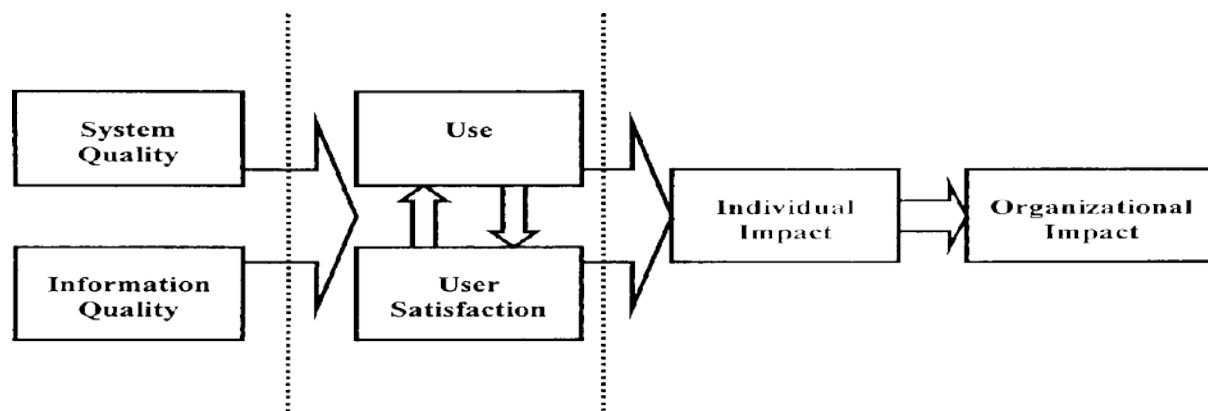| Theory Developed By	Theory	Model based on theory	New model developed by
LaPiere, R.T. (1934)	Formulation of the theories of reasoned action and planned behavior	-	-
Shannon and Weaver (1949)	Mathematical Theory of Communications	Expanded Shannon & Weaver's theory by extending the 'effectiveness level' into three categories	Mason, R.O. (1978)
Cyert and March (1963)	Behavioral Theory of the Firm Theories 'Beliefs and attitudes about the system' and 'Beliefs and attitudes about using the system	1. Development of a Tool for Measuring and Analyzing Computer User Satisfaction [4] 2. The Measurement of End-User Computing Satisfaction [11] 3. Technology Acceptance Model	Bailey, J.E. Pearson, S.W (1983) Doll, W.J. Torkzadeh, G (1988) Wixom, B.H. Todd, P.A. (2005)
Fishbein and Ajzen (1975)	Theory of Reasoned Action, Theory of Planned Behavior	1. Technology Acceptance Model (TAM) 2. Technology Acceptance Model 2 (TAM-2) 3. Unified Theory of Acceptance and Use of Technology(UTAUT) 4. Technology Acceptance Model 3 (TAM-3) 5. Task Technology Fit Model (TTF) 6. TAM/TTF Model with Computer Self-Efficacy (TAM/TTF)	Davis F.D., Bagozzi R.P. Warshaw P.R.(1989) Venkatesh, V. Davis, F.D. (2000) Venkatesh, V., Morris, M.G., Davis, F.D. Davis, G.B. (2003) Venkatesh, V. Bala, H. (2008) Goodhue, D.L. Thompson, R.L. (1995) Dishaw, M.T., Strong, D.M., Bandy, D.B. (2002)
Mason (1978)	Expanded Mathematical Theory of Communications	1. DeLone and McLean IS Success Model 2. Extension of the DeLone and McLean IS Success Model combined with the Technology Acceptance Model 3. Re-specification and extension of the DeLone and McLean Model of IS Success 4. Updated DeLone and McLean IS Success Model	DeLone, W.H. McLean, E.R (1992) Seddon, P.B. Kiew, M. Y (1996) Seddon, P. B. (1997) DeLone, W.H. McLean, E.R (2003)

DeLone and MacLean (1992) reviewed 180 conceptual and empirical studies which were published during the period of 1981-1987 and extracted 100 measures, used for evaluation of IS success model on the basis of the study used to create IS Success Model [12]. The model [27] has also been found to be useful framework and widely used by organization and researcher for understanding and measuring the dimensions of IS success with six variables of IS success: System Individual impact, and Organizational impact. These six variables are not independent success measures, but are interdependent variables [9].

System quality: According to [29] the term quality means excellence, value, conformity to specification, and quality meeting customer expectation. The value of information system can be realized by improving profit margins for the

organization, providing easy-to-use and useful applications, and designing easily maintainable system [14]. Thus system quality is an important aspect in IS success. Measures of the system quality

which have been used in the literature are flexibility, stability, reliability,

Figure 1: Information System Success Model [9]

usefulness, user-friendly interface, ease of use and response time ([4], [11], [28], [35]. Access and retrieval of information when needed, to meet work demands and to return requests quickly have been noted to be inherent to system quality [26].

Information quality: Information system quality concept is related to system output that is useful for business users. [1] States: ''The most important informational insufficiency the managers suffer from is plenty of irrelevant information''. Information quality problems, such as incorrect information due to program or data errors and irrelevant information arise due to changed user requirements [34]. Some important dimensions studied under Information quality like relevance, understandability, accuracy, conciseness, completeness, up to date, timeliness, and usability. According to [29] information quality refers to the ability to acquire information that is sufficient, that meets end-user needs, and is comprehensive in nature. [10] found in his empirical study that Emery (1971) suggested measuring system characteristics like the content of database, aggregation of details, human factors, response time, and system accuracy. Many researchers in different studies have measured information quality and the most common measures were of timeliness, completeness, ease of understanding, relevance, security [10],consistency, accuracy and personalization, importance, usefulness, readability etc[4][11][31].

Use: A term 'Use' is defined as the recipient's consumption of the output of an information system. Use of Information system and information is very important dimension in IS success. The success

dimension use represents the degree and manner in which an IS is utilized by its users [37]. Use of Information is closely related with consumption of the output of an information system. This measured in terms of amount of use, nature of use [10], appropriateness of use, extent of use, actual use [8], daily use and frequency of use [2], [21] etc.

User Satisfaction: User satisfaction defined as the recipient's response to the use of the output of an information system. [13] found that user satisfaction is dependent variable. [18] and [24] found that user satisfaction closely related with user attitude; therefore, studies which include user satisfaction as a success measure should ideally also include measures of user attitudes. [28] States that user satisfaction can be measured indirectly through information quality, system quality, and other variables.

Individual Impact: Individual impact is the effect of information on the behavior of the recipient [10] and it is closely related to the performance or the individual performance. Individual impact is an ability to understand the decision context and improvement individual decision making productivity. [25] States the hierarchy of impact to the recipient information through the understanding of information and the application of the information to a specific problem and it changes in decision behavior and finally organizational performance. Some of the indicator of individual impact learning, decision effectiveness, decision quality, improved decision analysis, correctiveness, decision making time, improved individual productivity, Task performance, and problem identification etc.

Organizational Impact: Organizational impact represents the firm-level benefits received by an organization because of Information System applications [14]. Measure of organizational performance which might be appropriate for measuring the contribution of MIS is return on investment [9]. Several authors have developed constructs to measure IS impacts on organizations. Effective Management Information System contributed to meeting organizational goals. The success of information systems impacts not only on firm performance but also on industry structure [7]. Operating cost reduction, staff reduction, productivity gain, increased revenues, sales, market share, profits and increased work volume.

After the D&M Model was completed, many researchers did claim that D&M model was incomplete; they suggested more dimensions should have been included in the model [5], [30], [32]. DeLone & McLean did not claim that their model was completely reliable, but needed further upgradation and validation. In 'Information Systems Success: The Quest for the Dependent Variable' they argued that the success model clearly needed further development and validation before it could serve as a basis for the selection of appropriate IS measures [9].

The major differences between the original and updated DeLone and McLean model are:

Addition of service quality that reflect the importance of service and support in success of information system.

The addition of intention to measure user attitude as an alternative measure of use.

To construct an alternative for Individual Impact

and Organizational Impact into a more parsimonious net benefit.

The updated model consists of six interrelated dimensions of IS success: information, system, and service quality; use; user satisfaction; and net benefits.

Service Quality: The success dimension, service quality represents the quality of the support that the users receive from the IS department and IT support personnel. Organizational success is delivered by the service provider. On time and error free performance by IS unit improves organizational efficiency. IS services will become better aligned with organizational goals, resulting in improved quality of decision making and improved profitability, better expectancy of customer demands and more accurate sales forecasting [14]. Some of the dimensions are measured by most of the researchers in their work like Assurance, Empathy Flexibility, Interpersonal quality, intrinsic quality, IS training, Reliability, Responsiveness.

Intension to use/Use: - This represents the degree and manner in which this system is utilized by the user. For Example amount of use, frequency of use, nature of use, appropriateness of use, extent of use, and purpose of use

Net benefits: Effective use of information system contributes to the success of individuals, groups or organizational profits. [10] says that net benefits is the most important construct since it captures the balance of positive and negative impacts of the e-commerce on customers, suppliers, employees, organizations, markets, industries, economies, and even societies. [31] Measured net benefits
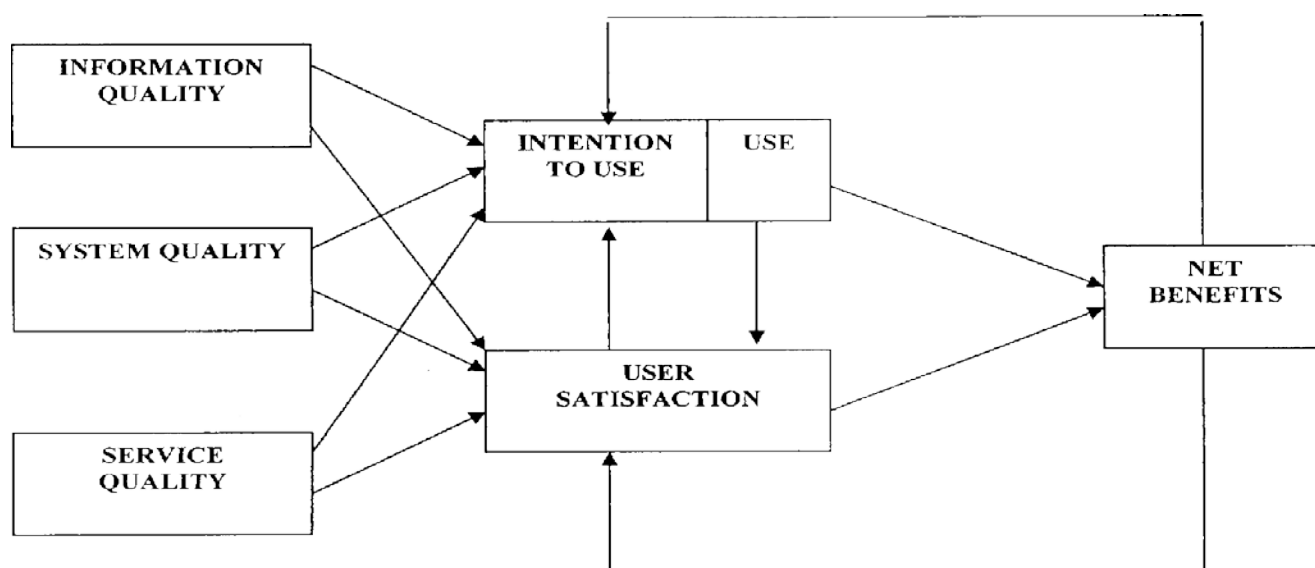

Figure 2: DeLone& McLean Updated Model [10]

Variables	Raw_alpha	Std. Alpha	G6(smc)	Average_r	Mean	SD	Item
Sys_Q	0.74	0.73	0.71	0.35	4	0.49	5
Info_Q	0.88	0.88	0.9	0.59	3.9	0.63	5
Serv_Q	0.8	0.81	0.8	0.46	3.7	0.74	5
US	0.77	0.74	0.79	0.41	3.7	0.74	4
USE	0.93	0.93	0.93	0.72	3.9	0.73	5
NB	0.92	0.93	0.93	0.72	4	0.7	5

Table 3: Results of cronbanch's alpha test

individual level that is Learning, Awareness, Decision effectiveness, Individual productivity and organizational level Organizational costs, Staff requirements, e-Government, Business process change, improved outcomes/outputs, increased capacity, Cost reduction, Overall productivity. Net Benefits means enhanced decision-making, improved productivity, increased sales, cost reductions, improved profits, market efficiency, consumer welfare, creation of jobs, and economic development.

4 Hypothesis of study

1. System quality is positively associated with intention to use of UDISE system
2. Information quality is positively associated with intention to use.
3. Service quality is positively associated with intention to use.
4. System quality is positively associated with intention to user satisfaction.
5. Information quality is positively associated with intention to user satisfaction.
6. Service quality is positively associated with intention to user satisfaction.
7. User satisfaction is positively associated with organizational impact or net benefit.

5 Methodology and data collection

The current study had collected qualitative data through questionnaire and converted it to quantitative data by using 5-Likert scale method. Data was collected based on relevant criteria and measurements developed from literature review. In order to establish the relationship between the various model variables and to validate the research model, Pearson's product-moment correlation has been used as numerical method of R programming for data analysis. Yearly data collected from the government schools of the Maharashtra at block level by the data entry operator in to the UDISE. It was not possible to cover all districts for data collection so samples were taken from selected district from technical and non-technical users of UDISE system. 117 questionnaires in the Google

form was distributed across Aurangabad, Jalna, Latur and Parbhani district of the Maharashtra state,

Table 3: Results of cronbanch's alpha test

to those who are working on UDISE and got 105 responses. The survey requested the respondents to answer all the variables of DeLone& McLean model about UDISE system based on their use of experience. 30 questioners are developed with the help of literature where six component that is system quality, information quality, service quality, intention to use and net benefit consist 5 questions each except user satisfaction consists of 4 questions [Appendix A]. Questions were based on 5-Likert rating scale from strongly disagree to strongly agree.

6 Result and discussion

Index of reliability is calculated by alpha (α) found by Lee J. Cronbach in 1951. According to Cronbach's alpha is a better estimate of objective measure of internal consistency. It has to follow the suppositions [36] of the essentially 'tau-equivalent model' [15]. Reliability of variables is calculated by Cronbach's alpha test as it depends on interrelatedness of sample of test items and inter-item homogeneity. According to [6] acceptable value of alpha ranges from 0.70 to 0.95. The Cronbach's alpha values are described as if value >= 0.9, reliability is 'excellent', between 0.8 to 0,9 it is 'good', between 0.7 to 0.8 it is 'acceptable', between 0.6 to 0.7 it is 'questionable', between 0.5 to 0.6 it is 'poor' and < 0.5 it is simply 'unacceptable' [12]. Package 'psych' in R contains alpha function which has been used to report two estimates: Cronbach's coefficient and Guttman's λ6 [20].

In Table 3, Cronbach's alpha values are calculated using R language show system quality with 0.74 and user satisfaction with 0.77 which are quite acceptable internal reliability of questions. Information quality 0.88 and service quality 0.8 values are having good internal consistency. Use of intension 0.93 and net benefits 0.92 are majored in excellent internal consistency quality. These two constructs are highly reliable than others.

Raw_alpha represents alpha based upon the covariances, Std.Alpha represents the standarized alpha based upon the correlations, G6(smc) represents Guttman's Lambda 6 reliability, Average_r represents the average inter item correlation. Cronbach's coefficient alpha and Guttman's lambda_6 estimates internal consistency of measures of readability [20].

7 Testing of Hypothesis

The car package and scatter plot Matrix function is used which enhanced scatterplot matrices with univariate displays down the diagonal in R [19]. The graph has been represented correlation matrix i.e. scatterplot matrix with lowness,

by cor() and cor.test() with df=103 and 95% confident interval. Table 4 depicts that there is significant relationship between system quality with intention to use i.e. r= .449, p=1.57e-06 and of DISE system. As the relation between system quality and use has a strong significance result then the user of UDISE system, satisfactorily integrate with flexibility, stability, interface to handle. Complete flexibility is provided to users to add, state and district-specific supplementary variables in the data-capture format and to generate reports at all desired levels. Thus the relation between System quality and user satisfaction shows as r=.514, p=2.042e-08. Here, p is low to assure that the correction is real. There is good association between information quality and intention to use with r=.380 and p=6.467e-05 and information quality with user satisfaction r=.726 and p<2.2e-16 values as an effect UDISE system produces 1.29 million school report
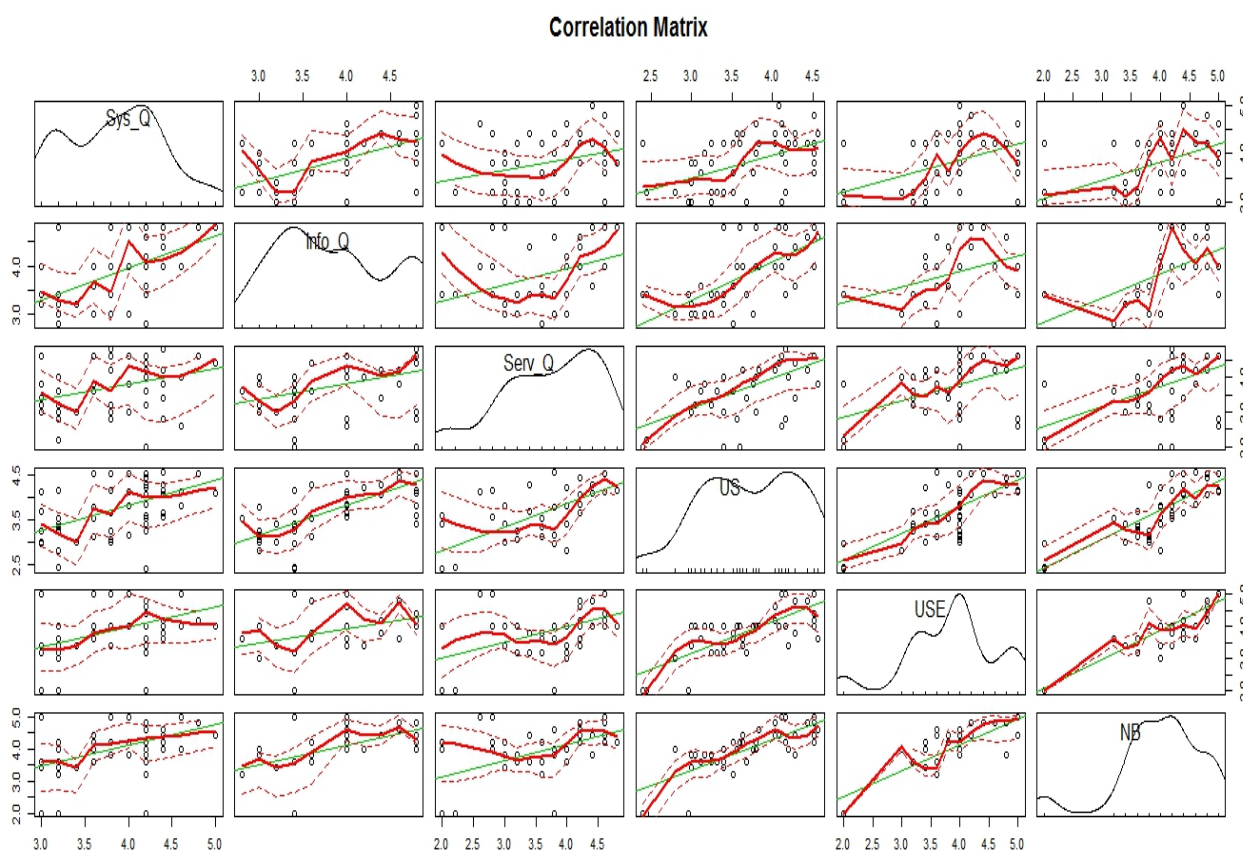

Figure 3: Visual correlation representation of DeLone and McLean model factors on UDISE dataset

liner best fit line, boxplot, histogram on the principle diagonal and rug plots on the margins of the cells. Table 4 shows measurement of strength of two variables. Given results are obtained by applying R programming statistical functions. Pearson's product-moment correlation is calculated

cards yearly and facilitates more than 500 hundred different types of report from system. UDISE Users can also download raw data as per their requirement for further use. All the UDISE publications, such as 'District and State Report Cards', 'Elementary Education in Rural and Urban India', 'UDISE Flash Statistics including Educational Development

	USE	US
Sys_Q	r-value=0.448831; p-value=1.57e-06	r-value= 0.5140292; p-value=2.042e-08
Info_Q	r-value=0.3797176; p-value=6.467e-05	r-value=0.7259681; p-value <2.2e-16
Serv_Q	r-value=0.4821027; p-value=1.916e-07	r-value=0.6763704; p-value=2.442e-15
NB	r-value=0.8479972; p-value<2.2e-16	-

Table 4: Results of Pearson's product-moment correlation and Correlation is significant at the 0.01 level (2-tailed).

Index', and 'Elementary Education in India: Progress towards UEE, Analytical Reports', are available at [38]. The DISE software also checks for many internal inconsistencies in the data and generates reports for verification by the district project office [3]. It is seen that service quality is positively associated with intention to use having r= .676, p=2.442e-15 and Service quality with user satisfaction r=.482, p=1.916e-07. It proves that service provides through online supports to user and yearly updates of UDISE upload on websites [38]. UDISE having different modules of reports and user interface which uploaded by NIEPA time to time and training arranges state level as well as district level. Useful & final result of model is net benefit results shows significant level of intention to use r= .848, p<2.2e-16. It indicates that UDISE system is very useful to user and decision maker for planning and analysis as educational index (EDI) develops, all state of the India using UDISE data.

reliability, usefulness, user-friendly interface, ease of use. This system developed using technology such as a power builder and oracle has easy user

8 Conclusions

This study reviewed Delone and Mclean basic model (1992) and updated model (2003) and final result calculated using updated model. It seems that UDISE system is successful about system quality, information quality, and service quality based on the analysis. Results of the study is satisfactory with concern of Delone and Mclean model and respondents as they feel system quality and information generated through UDISE is useful and easy to understand. Among all constructs they feel, service quality supports well and system meets the user's need. The research model helps to understand the influence of UDISE on both individual and organizational benefits. Each district prepares perspective annual plan based on yearly data using UDISE. Hypothesized relationships between the six success variables are significantly or marginally supported to the information system. Limitation of this study is geographical area as there is variation in administration and implementation of information system of all States.

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Appendix

Questions
System Quality
1. UDISE is very easy and user friendly to handle
2. Udise is up to date and error free
3 UDISE usually fulfills the requirement of management
4 UDISE is a secure
5 I always feel that the UDISE is user friendly.
Information Quality
6 The information provided by the UDISE is accurate and is free from errors.
7 UDISE provides the precise information I need.
8 It was easy to find what you were looking for in UDISE
9 UDISE provides a coplete information
10 The output information of the UDISE is easy to understand
Service Quality
11 UDISE is easy to install
12 Updates available of UDISE time to time.
13 Supports and help provide by authority
14 UDISE can flexibly adjust to new work demands.
15 We can add supplementary variable
User Satisfaction
16 UDISE meets the Management requirements of your area of responsibility
17 I am satisfied with UDISE efficiency
18 I am satisfied with UDISE accuracy
19 UDISE has met your expectations.
Intention to Use
20 UDISE enables me to accomplish job's tasks
21 UDISE enables to perform work's requirements more quickly
22 UDISE improves my job performance.
23 UDISE increases my productivity.
24 UDISE enhances my effectiveness in the job.
Net Benefit
25 Enhances Planning of project
26 Enhance the decision making
27 UDISE improve the accuracy in work
28 Increase the productivity of project (SSA)
29 Using UDISE SSA achieved objective,