1 **IMPLEMENTATION EVALUATION METRICS FOR ENTERPRISE RESOURCE PLANNING**
2 **SOLUTION – A CASE OF KIBABII UNIVERSITY**

3 **ABSTRACT**

4 *Most institution of higher learning are implementing and Enterprise Resource planning (ERP) in*

5 *automating various activities. The architecture of most of the ERP is based on the Service Oriented*

6 *Architecture (SOA) where each module can be called as service. In most of the contract signed between*

7 *the vendor and the university, payment is tied to the level of implementation. The Question is how to then*

8 *measure the level of implementation? This chapter proposes a metric that could be used. The metric was*

9 *derived based on an acceptance test on each of functionality of module as per terms of reference. The*

10 *result of a test was rated as a Fail,pass, or query The result was then coded such that a fail was assigned*

11 *a zero (0), pass one (1) and query a half (½). From which a metric was derived which measures the level*

12 *implementation.*

13 **Key Words**: ERP, Metrics, Implementation, SOA, Test, Module, User, Acceptance.

14 **1.0 INTRODUCTION**

15 Kibabii University started of University College and was became a chartered
16   University in 2015 as the 23rd Public University in Kenya (Charter 2015, Webmaster 2018). On inception
17 in 2012, the University had incomplete, unfurnished classrooms; laboratories and offices. The ICT
18 infrastructure had been laid in the Administration block and University Library only. Several computers
19 were purchased for student and staff on which basic Microsoft application were installed. The Finance
20 department used Quick Books and payroll software. The University subcontracted for website
21 development that was hosted at Deep Africa.
22
23 The ICT infrastructure was later enhanced by the last mile radio link was to provide internet to the
24 organization at 10Mbs. This was enhanced to 21Mbs then 66Mbs, 82Mbs, then 110 and the present
25 speed is 400 Mbs. The University now receives internet bandwidth through a last mile fibre link. The
26 Campus network continues to be enhanced with campus fibre backbone in place. The radio link is now
27 used as backup. Several hotspots have been installed to allow the students and member of staff access
28 the net. The University has a Directorate of ICT whose mandate are to (Mbuguah SM 2018):

29   • Establish and maintain ICT infrastructure and services.
30   • To advance the intellectual and human resource capacity through use of E-resources.
31   • To publicize University programmers, activities and promote its public image.
32   • Automate University wide services

33 The Directorate has purposed continue automating most services through the use of an Enterprise
34 Resource Planning (ERP) solution.

35 **2.0   ERP CASE DESCRIPTION**

36 The University initiated the procurement by request of expression of interest (EOI) for ERP solution. In
37 EOI provided a brief overview of the University, including staff levels, student and number computers
38 available. Processes and their input and outputs were identified.
39
40 The EOI set evaluation criteria for bidders. Out of the twelve bidders who responded to the call only three
41 qualified for the next stage. In this stage, a request for proposal was submitted to successful bidders and

42   with terms of reference (TOR). After evaluation of bidders, ABNO Software international was awarded
43   tender and signed contract based on the TOR. Payment was to be staggered based on completion of
44   modules.
45
46   After signing the Contract the stakeholders agreed on a project implementation management structure.
47   The Deputy Vice Chancellor (Academic and Student affairs) (DVC (ASA)) was designated the patron of
48   project. DVC (ASA) was to chair the ERP implementation committee that was tasked the job of
49   monitoring and solving implementation issues as they did arise. DVC (ASA) was also to report to top
50   University management (Statutes 2017) on ERP implementation progress and issues arising.
51
52   The Director ICT was designated as project manager. He was to report to ERP implementation committee
53   on progress and any issues that may require resolving. After evaluation of the work done, he was to
54   report back to committee. The committee could then assess the report and use it to advice the University
55   management on amount to be paid to vendor.

56   2.1   Challenges encountered in implementation of the ERP

57   The ERP implementation is largely complete, and now in the support phase. Three of the major
58   challenges experienced were:
59   (a)   Attitude change. The ERP forces people to adopt a certain workflow. The acceptance
60   that there is a system is in place, that it is not business as usual, has been constant
61   source of friction.
62   (b) Training of users. Initially users took training   casually and hence took too long to adopt
63   the system and continue making errors as they use the system. Also because there are
64   many concurrent activities happening at the University, then training within campus has
65   not been very effective.
66   (c) Lack of metrics for measuring the level of implementations. There is need to assess the
67   degree of implementation for modules. There were no metrics in place to solve this
68   problem, looking at available Service oriented metrics (Mbuguah& Wabwoba, 2014). Yet
69   the University management required an absolute figure to enable them determine the
70   payment.

71   4.0 PROPOSED SOLUTIONS TO THE CHALLENGES

72
73   4.1 Attitude
74   Change of altitude will take time to be realized but as staff continue to use the system they will gradually
75   buy into the system and their attitude will gradually changes. Also continues enforcement of the workflow
76   by the senior management will force those who are reluctant to adopt to do so.
77
78   It has also been recommended that most the services be automated and integrated within the ERP. Top
79   management has discouraged any process being undertaken outside the ERP that involves service
80   already included in the modules.
81
82   4.2 Training of Users
83   Most of the errors being experienced in the system are user based, and this could be tied up to
84   effectiveness of the training. Generally most of the users are demanding for more training. This should be
85   done either formally or informally by the vendor and ICT staff. It has also been recommended by users
86   that future training been done away from campus to allow the participants to fully concentrate.
87
88
89   4.3   Lack Metrics
90   To determine the level implementation Directorate of ICT (DICT), the ABNO team and the internal auditor,
91   visited the various users in the various departments for user acceptance tests.   The question then was

92 how to evaluate the level implementation in face of nonexistent metrics. The solution then was to come
93 up implementation metrics.
94
4.3.1 ERP Implementation Metrics
96 The metric has to be sufficiently objective to satisfy both the vendor and the client. The vendor had
97 prepared a questionnaire on user acceptance. But had not provided an objective transformation of the
98 questionnaire into a metric.
99
100 The team carried out an acceptance test based on each of functionality of module as per terms of
101 reference (TOR) which informed the contract. The result of the test was then rated as Fail, Query or
102 Pass. Fail if it failed outright, query if the user was fully satisfied and Pass if a given functionality
103 performed as required.
104
105 The result was then coded such that a fail is assigned a zero (0), a query (½) and pass one (1). The ½
106 assigned to query which the arithmetic mean of 0, and 1.
107
108 The concept was borrowed from the Tristate logic in Digital logic where we have high (1), low (0) and
109 high impedance (Z) states (Kurt W.2017).
110
111 The metric for implementation was then defined as
112 Implementation % = {((no pass +½ (no of queries))/ (total number of tests))*100}
113
4.3.2 Validation of metrics
115 Validation of metrics can be done both theoretically and empirically. Muketha et al., (2011) posits that
116 main goal of theoretical validation is to establish the theoretical soundness of the metrics. Several
117 researches such Fenton et al., (1998), Weyuker (1988) and Briand et al., (1998) have studied the metrics
118 for quite some time.
119 The proposed metric is a size metric because the level implementation increases from 0% when there is
120 no implementation to 100% for full implementation. Theoretical validation shows that it may not be
121 possible for implementation to be below zero (0) % or above 100%.
122
123 Considering zero case then
124 Implementation % = {((no pass +½ (no of queries))/ (total number of tests))*100}
125   No of passes = 0
126 No of queries = 0
127 Substituting into the equation
128 Implementation % = {((0 +½ (0))/ (total number of tests))*100}
129   = 0
130
131 Considering the case of complete successful implementation
132   No of passes = total number of tests
133 No of queries = zero (0)
134 Substituting into equation
135 Implementation % = {((no pass +½ (no of queries))/ (total number of tests))*100}
136
137 Implementation % = {((total number of tests +½ (0))/ (total number of tests))*100}
138   = total number of tests/total number of tests *100
139   = 1*100 = 100%
140
141 Empirical tests can also be based on Weyukker criteria and /or the Lionel Briand criteria.
142
143 But as has been, argued by Muketha (2011) and others Weyukker criteria is best for complexity metrics.
144 Since the proposed metrics are size then Weyukker criteria may not apply here.

145
146 Briand et al.(1998) postulates that a size metric can be assessed based on ,non-negative, null and
147 additive properties. For non negativity it means that the size of metric should > 0, and this applies to the
148 proposed metrics. The metric null value for an empty set and the metrics from the modules can be
149 additive. Hence we may conclude that the metrics are theoretically sound.
150
151
152 **4.4   An application of metrics on instances of the Implementation**
153 Table 1 gives the results for result of application of the metrics where serial no 8 -18 represents the sub-
154 modules in the integrated finance module.
155 Table 1: ERP USER ACCEPTANCE RESULTS

S/NO	Module name	Fail	Query	Pass	Total no Functionalities
1	Student Management	2	0	13	15
2	Student academics	2	0	20	22
3	Student Portal	2	3	6	11
4	Hostel And Accommodations	3	0	14	17
5	Human Resource	0	5	30	35
6	Procurement and Inventory	14	3	31	48
7	Time tabling	1	0	15	16
8	Finance -student finance	0	1	24	25
9	IGA	12	0	0	12
10	Account payable	0	1	17	18
11	Imprest management	2	0	10	12
12	Cash management	3	2	10	15
13	Bank Reconciliation	2	3	1	6
14	Projects	4	0	0	4
15	Budgeting modules	3	0	7	10
16	Fixed assets	24	0	0	24
17	Payroll	31	0	0	31
18	Finance -Reports	1	7	2	10
19	Total	106	25	200	331

156
157 From table 1 the total number of tests were 331 of which 200 were passes while 25 were queries and 106
158 were fails.
159 From the above data the percentage user acceptance = ((25*1/2) +200)/331)*100 = 64.2 %
160 However it should be noted that the following modules were not tested because they were not in use:
161 Project, IGA, Fixed asset, and scored zero.
162 Payroll module was scored zero but the user had requested for two days before the tests would be done.
163 **4.5 Application of the Metrics to Specific Modules**
164 **4.5.1 Student Management**
165 In this module 15 functionalities were tested out of which 2 failed. The tests that failed were:
166 generating of admission/registration reports and forms and generation of admission /regrets
167 letters. The users acceptance from module was **(13/15)*100 =86.7 %**

168   Users of module should upload students' photos and other details.
169   **4.5.2 Student Academics**
170   In this module 22 functionalities were tested out of which 2 failed. The tests that failed were
171   -   Capture class attendance by lecturers
172   -   Generating departmental mark sheets
173   -   The users acceptance from module was **(20/22)*100 =90.9 %**

174   Should enhance control on the student unit registration so that units to be registered once.
175   **4.5.3 Student portal**
176   In this module 11 functionalities were tested out of which 2 failed. The tests that failed were
177   -   Students can view their attendance records on line
178   -   Students can view......
179   -   The users acceptance from module was **(7.5/11)*100 =68.2 %**

180   In this module, the following had not been utilized
181   - Viewing exam results on line and printing of unofficial transcript online
182   - View class and exam time tables online
183   Review functionalities that are not clear.
184   **4.5.4 Hostel and Accommodations**
185   A total of 17 functionalities were tested of which three failed. These were:
186   -   Capture damages caused by students and invoice appropriately
187   -   Occupancy rate
188   -   Accommodations fees collected per hostel/campus/school etc.

189   Online booking and room rates had not been used.
190   The users acceptance for this module was **(14/17)*100 =82.4 %**
191   **4.5.5 Human Resource**
192   A total of 35 functionalities were tested out which 5 had queries.
193   -   Employee service history
194   -   Monitoring employee suspension, discharge and disciplinary actions
195   -   Keep record of employee training awards and appraisals
196   -   Track employees performance reviews
197   -   List of employees due for appraisal

198   The users acceptance for this module was **(32.5/35)*100 =92.9 %**
199   **4.5.6 Procurement**
200   A total of 48 functionalities were tested out of which 14 failed. These were:
201   -   Ability to consolidate departmental procurement plans and link it university budget
202   -   System should allow different types of costing methods for inventory
203   -   They system should be able to show rejected or good returned records
204   -   Produce report on price list and price updates per supplier
205   -   Produce reports on cancelled PRNs
206   -   Produce reports on cancelled LPOs
207   -   Produce reports on rejected or goods returned
208   -   Rating of appraisals of suppliers
209   -   Have full audit trail of all stock movements
210   -   Expiry dates tracking in case of perishable goods
211   -   Generate report inventory movement

212   -   Generate stock taking reports

213   -   Generate report on inventory evaluation summary's

214   The users acceptance for this module was **(32.5/48)*100 =67.7 %**

215   **4.5.7 Time Tabling**

216   A total of 16 functionalities were tested out of which 1 failed. It was not possible to produce time

217   table reports based on lecturer.

218   The users acceptance for this module was **(15/16)*100 =93.8 %**

219   **4.5.8 Student finance**

220   A total of 25 functionalities were tested with one query. The query was ability to generate

221   invoices to eligible students only**.**

222   The users acceptance for this module was **(24.5/25)*100 =98 %**

223   It takes time to generate reports

224   Configuration of emailing demand notices to student not configured

225   **4.5.9 Finance IGA**

226   In this module none of the 12 functionalities were tested.

227   The users acceptance for this module was **(0/12)*100 =0 %**

228   **4.5.10 Accounts Payable**

229   A total of 18 functionalities were tested with only one query and no fail. The query was ability to

230   vote and stop payment of cheques especially where there exists:

231   -   Double entries on suppliers names

232   -   List of suppliers contact is not complete e.g. pin no's

233   -   No separation of capital and recurrent creditors

234   The users acceptance for this module was **(17.5/18)*100 =97.2 %**

235

236   **4.5.11 Imprest Management**

237   A total of 12 functionalities were tested with 2 fails. The fails were

238   -   Automatic alerts for overdue unaccounted for imprest

239   -   Online approval. The users acceptance for this module was **(10/12)*100 =83.3 %**

240   **4.5.12 Cash Managements**

241   A total of 15 functionalities were tested with 3 fails. These were

242   -   Create alarm features for a predetermined amount payable at time in each bank account

243   -   Ability to keep cheque disbursement register

244   -   Uncollected cheques list

245

246   The users acceptance for this module was **(11/15)*100 =73.4 %**

247   **4.5.13 Bank Reconciliation**

248   A total of 6 functionalities were tested with 2 fails and 3 queries. These were

249   -   Full bank and cash reconciliations including deposits disbursement   and adjustments.

250   -   Flexibility to import transaction from various banks systems

251   The users acceptance for this module was **(2.5/6)*100 =41.7 %**

252   **4.5.14 Projects**

253   In this module none of the 4 functionalities were tested. There was no user**.**

254   The users acceptance for this module was **(0/4)*100 =0 %**

255   **4.5.15 Budget**

256   A total of 10 functionalities were tested with 3 fails. These were

257   - Send alerts to vote holders whose balances are significantly low
258   - Print a vote holder 's statement
259   - Vote expenditure summary

260   The users acceptance for this module was **(7/10)*100 =70 %**
261   **4.5.16 Fixed assets**
262   In this module none of the2 4 functionalities were tested. There was no user**.**
263   The users acceptance for this module was **(0/24)*100 =0 %**
264   **4.5.17 Payroll**
265   In this module none of the 31 functionalities were tested because the user requested for more
266   time before assessment of module could be done.
267   The users acceptance for this module was **(0/31)*100 =0 %**
268   **4.5.18 Finance reports**
269   A total 10 functionalities were tested with one fail and seven queries. The fail was notes to the
270   financial statement with comparative figures
271   The users acceptance for this module was **(5.5/10)*100 =55 %**
272
273   **5.0 CONCLUSION**
274   In conclusion we set out to identify the key challenges that are experience during ERP
275   implementation were mainly altitude, training of the users and lack of implementation metrics.
276   The proposed metrics have been validated and believe the can go a long way in ensuring an
277   objective metrics are available.

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