Open Source ERP Adoption-Use and Organisational Performance of Deposit-Taking Saccos in Kenya

Author's Details:
[1] James Mwikya Reuben [2] Dr. Johnmark Obura [3] Dr. Moses Oginda-
[1] [2] [3] Department of Management Science, Maseno University

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Abstract
The cost and benefits of an ERP system are arguably the reason why Deposit-Taking SACCOs are opting for adoption-use of open source ERP in an effort to achieve organisation performance. Technology adoption is only important if it truly leads to performance improvements and, as such the proper criteria by which to judge whether an ERP investment has been successful rest not simply in determining whether an organization adopts a technology, but whether the technology application or use actually improves performance. The main aim of the study was to evaluate the influence open source ERP adoption-use on the organisational performance of deposit taking SACCOs in Kenya. The study-specific objective was to determine the influence of open source ERP adoption-use on the organisational performance of Deposit-Taking SACCOs in Kenya. The target population was 168 Deposit-taking SACCOs with a sample size of 378 respondents. The questionnaire was used to collect quantitative data. PLS-SEM using smart pls was used to analyse the data. The study concludes that adoption-use of open source ERP will have a significant effect on organisational performance; learning and growth, internal process, customers, and financial indicators. Open source ERP by itself cannot contribute to significant performance improvement or sustainable competitive advantage if organizational resources and work processes are not improved or changed to enable open source ERP to promote organizational performance. The organisation management and regulatory authority should create an enabling environment and policies that will increase the adoption-use of open source ERP by deposit-taking SACCOs in Kenya.
Keywords: open source ERP, adoption-use, learning and growth, internal process, customer finance, deposit-taking SACCOs.

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1. Introduction

The Deposit-Taking SACCOs industry is part of the cooperative sector in Kenya, which has impacted the lives of many disadvantaged Kenyans over the years. The sector is categorized into financial and non-financial cooperatives. Non-financial (Non-Deposit Taking) Cooperatives deal with the marketing of members' products and services such as dairy, livestock, coffee, tea, handicrafts, and many more similar cooperatives. On the other hand, financial (Deposit Taking) cooperatives comprise of Deposit-Taking SACCOs, housing, and investment cooperatives. By the close of 2014, there were 215 deposits taking SACCOs licensed by SASRA. During the year, the total assets of the licensed deposit taking Deposit-Taking SACCOs increased by Kshs 38 billion to Kshs 242 billion representing 18.6% improvement from the 2013 figures (Supervision Annual Report, 2014).

Deposit-Taking SACCOs experience challenges characterized by poor information delivery channels, inconsistent financial records, and high operational costs due to inadequate information and communication technologies. In addition, they also face high demands for loans which they are unable to meet due to liquidity shortages hence compromising their profitability especially given that they cannot seek credit from the central bank of Kenya like other commercial banks. In 2015-2016 Deposit-Taking SACCOs experience the challenges of non-performing loans which was recorded at 5.23 percent in 2015 and 5.12 percent in 2016 representing Kshs 13.21 Billion in 2015 and Kshs 15.57 Billion in 2016 this has negatively affected their liquidity and eventually their profitability (Supervision Annual Report, 2015, 2016).

Open source enterprise resource planning is modular in a structure, which means that one can implement the solution in a phased manner module by module. It can be implemented first on a smaller scale and expanded subsequently with more users, more locations, and more modules as well. In recent past, studies have been done in the area of OSS adoption in different fields and in this regard (Ardito and Constabile, 2006) states that despite these recent advances in the adoption of OSS, there is little consolidated evaluation for its applications by Small and Medium Enterprises and in this case deposit taking savings and credit cooperatives in Kenya. The open source enterprise resource planning software offers big

opportunity to deposit taking savings and credit cooperatives societies in Kenya to achieve the desired organisational performance.

Rishab (2004), notes that Open Source (OS) ERP brings an alternative which addresses many of the key problems found on both custom and commercial enterprise software. It begins by offering the user a freely available code base as a starting point. The user can try it for free to see if it meets his needs. There is no risk of upfront licensing fees for software that may not work. If no modifications are required, Open source ERP can be implemented with the same rapid time-to-market as commercial packages. If customizations are required, the user has a head start with an existing code base. Furthermore, the user can leverage the expertise of both in-house and Open Source Software community developers. An Open Source Software project brings with it the domain knowledge and business requirements of many contributing organizations, significantly reducing the specification risk typical of custom software.

1.1 Problem Statement
The cost and benefits of an ERP system are arguably the reason why Deposit-Taking SACCOs are opting for adoption-use of open source ERP in an effort to achieve organisation performance. Nonetheless, despite the adoption-use of open source ERP by the Deposit-Taking SACCOs in Kenya, little academic attention has gone to the assessment of the impacts of ERP adoption in the industry. This certainly impedes the understanding of the field among practitioners in a manner that can precipitate information for the improvement of the systems. The lack of academic attention on the effect of open source ERP on the performance of Deposit-Taking SACCOs further impedes scholarly understanding of the relationship between open source ERP adoption-use and the performance of Deposit-Taking SACCOs.

1.2 Objective of the Study
The objective of the study was to determine the influence of open source ERP adoption-use on organisational performance of Deposit-Taking SACCOs in Kenya.

1.3 Research Hypothesis
Ho_1: Adoption-Use of open source ERP has no significant effect on organisational performance of Deposit-Taking SACCOs in Kenya.
The null hypothesis **Ho_1** was further subdivided into four null hypotheses for ease of analysis; the four are:
$Ho_{1.1}$: There is no influence of open source ERP adoption-use on the Learning and Growth organisational performance of Deposit-Taking SACCOs in Kenya.
$Ho_{1.2}$: There is no influence of open source ERP adoption-use on the Internal Process organisational performance of Deposit-Taking SACCOs in Kenya.
$Ho_{1.3}$: There is no influence of open source ERP adoption-use on the Customer organisational performance of Deposit-Taking SACCOs in Kenya.
$Ho_{1.4}$: There is no influence of open source ERP adoption-use on the financial, organisational performance of Deposit-Taking SACCOs in Kenya.

1.4 Conceptual Framework
To implement the study independent variable (Adoption-use) was defined and its relationship with dependent variables (organisational performance) based on the Balance scorecard indicators as shown on the conceptual framework (see figure 1). Usage is the ante in the information technology transition game while adoption is all about behaviors' which are inherent and subjective (William, 2014). Usage and adoption are duality, and both are essential in that neither alone can lead to success.
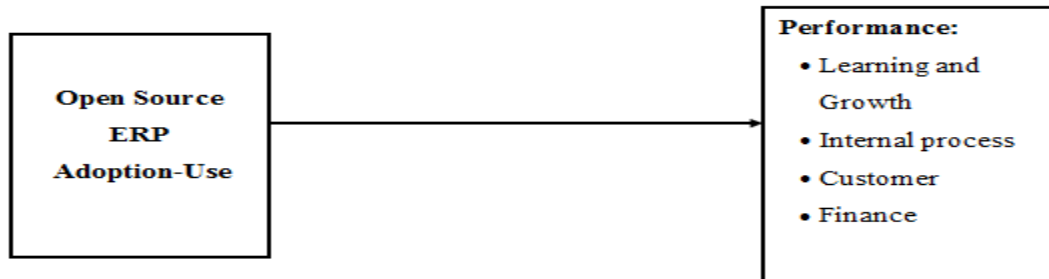
Figure 1: Influence of open source ERP adoption-use on the organisational performance of Deposit-taking SACCOs in Kenya.

2.   Literature Review
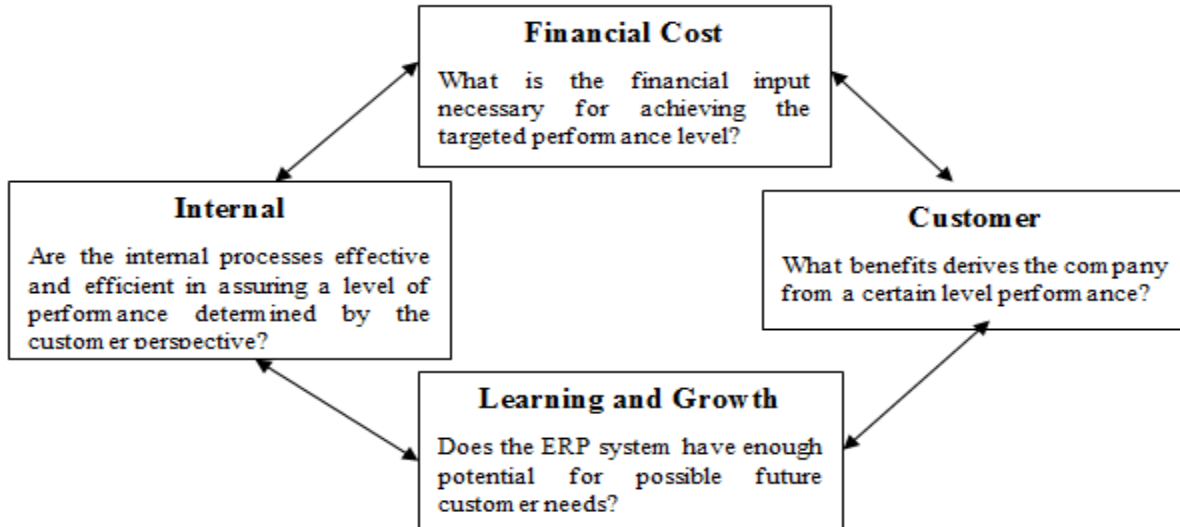### 2.1   Information System Success Model

Delone and McLean (1992), in their famous IS success model, suggested that system quality and information quality jointly and severally affect the use and user satisfaction, which, in turn, result in individual impact and subsequent organisational impacts. Further research into this model, however, had led to the addition of dimensions such as service quality, intention to use, and Net benefits (replacing organisation impact construct) (Delone and McLean 2003). In this study, Delone and McLean's model was adopted to measure the open source ERP success through use (adoption-use) and the net benefits (organisation performance) measured through balances scorecard framework indicators.

2.2   Balanced Score Card (BSC) framework

The management of ERP software consists of two main tasks, the implementation and the use of the comprehensive software afterward (Rosemann and Wiese, 1999). The intention of the Balanced Score Card (BSC) is the supplementation of traditional financial measures with three additional perspectives – the customer perspective, the internal business process perspective and the learning and growth perspective (Kaplan and Norton, 1997). BSC approach of Rosemann and Wiese, the operational BSC, is more relevant to this research for measuring the firm performance before the implementation of open source ERP and can be used for continuous customization and perfection of the open source ERP system.The most cited models for success and performance measurement in the field of enterprise resource planning (ERP) system are the DeLone and McLean, and Gable *et al.* (2003) models. The DeLone and McLean (DeLone and McLean 1992, DeLone and McLean, 2003) model, uses and is a user-centered approach when trying to judge overall enterprise resource planning success. Gable *et al.* (2003) did an exploratory inventory survey which was used for model building. They built a model which was used for enterprise resource planning (ERP) system success measurement approach called the "A Priori Model." These two most commonly used models, that is; DeLone and McLean, and Gable *et al.* (2003) information system success models, mainly focuses on ERP system measurement in an ex-post evaluation which concentrates on an evaluation of an already existing system. According to Stefanou (2011), an ex-ante evaluation is necessary because of the fact that selecting an ERP is a long time commitment and which is very costly too. It's, therefore, important to understand how ERP adoption-use influences organisational performance through analysis of the anticipated impacts of the planned ERP system prior to adoption. Balanced Score Card is an ex-ante evaluation model with four ERP measurement dimensions of financial cost, internal process, customer aspect, learning, and growth aspect, as shown in figure 2.5 by Rosemann and Wiese. On this study, Balanced Score Card (BSC) model will be adopted for an ex-ante evaluation of open source ERP performance on Deposit-Taking SACCOs in Kenya.

Figure 2.7: Balanced Score Card Model

Financial Cost

What is the financial input necessary for achieving the targeted performance level?

Internal

Are the internal processes effective and efficient in assuring a level of performance determined by the customer perspective?

Customer

What benefits derives the company from a certain level performance?

Learning and Growth

Does the ERP system have enough potential for possible future customer needs?

2.3 Adoption-use and organisational performance

Organisational performance is positively affected by the adoption of new technologies is a well-known fact. Fang (2001) and Fang *et al.* (2003) empirically established that corporate performance is influenced by the adoption of e-business. In addition, a study by Yunis *et al.* (2017) focuses on ICT adoption has become a major driver of enhanced organizational performance. In this research reveal an important explanation of the relationship between open source ERP adoption-use and performance.

Sandra (2008) conducted a study on the performance effects of latent factors on the assimilation of commercial open-source ERP software (COSES) on small-medium enterprises (SMEs) in the United States of America. The study explains how the top management teams (TMT"s) information technology (IT) knowledge and experience impact both assimilation and firm performance. The hypotheses were tested using survey data from SMEs that have implemented COSES and analyzed using structural equation modeling. The results suggest that SMEs benefit, through higher levels of assimilation and performance, from adopting innovative enterprise resource planning (ERP) systems such as COSES when they have a TMT that has experience with and is knowledgeable about technology.

Arya (2015) on the study evaluating the impacts of enterprise resource planning on organizational performance for small to medium enterprises in manufacturing based on Micro Depot, Inc. (MDI), located in Georgia USA. The researcher employed the delphi process, key performance indicators (KPIs) including time, quality, cost, and flexibility, and corresponding performance measurement metrics, investigations were conducted between traditional manufacturing processes in SMEs and processed enhanced through ERP adoption. In this longitudinal case study, continuous improvement of organizational performance is evident in operational measures related to quality and on-time delivery. Through the study, ERP adoption enhances organizational performance through quality and on-time delivery of products.

Elragal and Al-Serafi (2011) investigated the effect of ERP system implementation on business performance. The authors used a case study to help identify the important contributing factors for the relationship between ERP and business performance of an Egyptian SME branch of a multinational company. The results indicate that in general many benefits in business performance were achieved after implementing the ERP as reported by the business users but have also shown that a few benefits previously linked to ERP were not fully achieved. This indicates the positive contribution of ERP on business performance but also suggests the limited applicability of this positive relationship according to specific factors to be researched.

Jepng'eno *et al.*, (2016), on reviewing the effects of post implementation of ERP System on organizational performance in Kitale Technical Training Institute, Kenya. The study evidently found out a lot of benefits had been realized after the adoption and use of ERP within the institution which was; Real time generation of reports, Increased accessibility of records, Improved decision making, Accountability, and Transparency, Quick retrieval of information, Minimized duplication and Accurate financial reports. Ouma and Mwangangi (2015) carried out a descriptive study titled influence of ERP system on distribution performance in Kenya, a case of Kenya medical supplies authority (KEMSA). The study

revealed that ERP adoption influenced KEMSA's medical distribution performance in Kenya, and this was as a result of having compatible ICT infrastructure within the organization.

3. Methodology

The study adopted correlational research design as it is designed to investigate factors influencing open source enterprise resource planning software adoption-use by of deposit taking savings and credit cooperatives in Kenya. The target population was the 164 deposit taking SACCOs licensed by SASRA as at 31st December 2016 and the target respondent group is senior managers for example General Manager, Chief Accounting Officer, Procurement Officer, Human Resource Manager, Customer Service Manager, and ICT Manager with dedicated involvement in the adoption and implementation of ERP in their respective organisations. To obtain a representative sample size of the population, multi-stage sampling consisting of stratified, proportionate, and convenience sampling was applied. To arrive at the appropriate sample size, Creative Research Systems (2003) formula will be used.

$$SS = \frac{Z^2 *(p)*(1-p)}{C^2} = SS = \frac{1.96^2 *(.5)*(1-.5)}{.04^2} = 600.25$$

where:

SS=Sample size

Z=Z-value (e.g., 1.96 for a 95% confidence level)

P= Percentage of population picking a choice, expressed as decimal 0.5 (50%) used for sample size needed.

C= Confidence interval, expressed as decimal (e.g., .04=+/- 4 percentage points)

From the total target population of 984, the required sample size for an infinite population is 601; the sample size was reduced using correction formula:

$$New\ SS = \frac{SS}{1+\frac{SS-1}{POP}} == \frac{601}{1+\frac{601-1}{984}} = 373.35 \text{ respondents.}$$

A total of 378 questionnaires were self-administered to the respondents accompanied. The semi structured questionnaires were constructed using the 1-5 Likert scale type of statements, where the respondents were required to either to indicate strongly agree (5), agree (4), not sure (3), disagree (2) and strongly disagree (1). Using 8% of the sample size, a pilot test was conducted to determine the questionnaire's validity and reliability. Reliability was tested using questionnaire duly completed by thirty (30) randomly selected respondents.

4. Results

Partial least square structural equation modeling (PLS-SEM) is a nonparametric statistical method that does not require the data to be normally distributed, but it is important to verify and address instances of missing data as well as non-normal data. The data was first assessed for the missing values and outliers. Outliers should first be identified before running PLS-SEM (Hair *et.al,* 2014). The data collected per item in this study was within the acceptable margins of skewness of -1 and + 1 and kurtosis -2 and + 2 and satisfied (Kline, 2005).

4.1 Measurement Model

Before evaluating causal relationship between constructs in PLS-SEM, measurement model was conducted using smartPLS 3.2.8.

4.2.1 Internal Consistency and Convergent Validity

Table 1.0 show that the measures are strong in terms of their internal consistency reliability as indexed by the composite reliability (CR[c]). All CR[c] values are above the recommended value of 0.70. Table 1.0 also shows that all the outer loadings were above 0.70. According to Bagozzi and Yi (1988), the average variance extracted (AVE) for each measure should exceed 0.5.

Table 1.0 Measurement model

	Items	Loadings[a]	AVE[b]	CR[c]	Rho_A[d]	α[e]
Adoption-Use Factor	ExtUSG1	0.9378	0.8925	0.9803	0.9759	0.9759
(AUF)	ExtUSG2	0.9358				
	ExtUSG3	0.936				
	ExtUSG4	0.9559				
	ExtUSG5	0.9592				

	ExtUSG6	0.9434				
Learning Growth Factor **(LGF)**	OPerLW1	0.926	0.8635	0.9499	0.9242	0.921
	OperLW2	0.9305				
	OperLW3	0.9314				
Internal Process Factor **(IPF)**	OPerIP1	0.9612	0.9046	0.966	0.9499	0.9473
	OPerIP2	0.9358				
	OPerIP3	0.9561				
Customer Factor **(CF)**	OPCu1	0.9056	0.7247	0.8867	0.8149	0.8047
	OPCu2	0.8985				
	OPCu3	0.7392				
Finance Factor **(FF)**	OPFi1	0.9258	0.8612	0.938	0.9195	0.9194
	OPFi2	0.9172				
	OPFi3	0.9409				

a. All Item Loading >0.5 indicates indicator Reliability (Hulland,1999,p.198)
b. All Average Variance Extracted(AVE)>0.5 as indicates convergent Reliability (Bagozzi and Yi (1988); Fornell and Larcker (1981))
c. All Composite reliability (CR) >0.7 indicates internal Consistency (Gefen, et al, 2000)
d. rho_A - coefficient Dijkstra-Hensele
e. All Cronbach's alpha >0.7 indicates indicator reliability (Nunnally, 1978)

4.2.2 Discriminant Validity
The study employed the Fornell and Larcker (see table 2.0) to test discriminant validity. The results indicate that the values are not above 1.0 as recommended by Fornell and Larcker and therefore no discriminant validity.
Table 2.0 Forenell and Larcker Criterion

	CF	FF	IPF	LWF	AUF
CF	**0.851**				
FF	0.661	**0.928**			
IPF	0.889	0.467	**0.951**		
LWF	0.578	0.569	0.468	**0.929**	
AUF	0.681	0.576	0.602	0.594	**0.945**

*The diagonal are the square root of the AVE of the latent variables and indicates the highest in any column or row thus this shows there is discriminant validity.

4.2.4 Structural Model Path Coefficients and Coefficient of Determination (R^2)
Table 3.0 shows that the R^2 value for the endogenous construct was above the 25% accepted level set as the threshold, while table 4.0 shows the bootstrapping results for hypotheses testing.
Table 3.0: R^2

Construct	R Square	R Square Adjusted
CF	0.465	0.463
FF	0.332	0.329
IPF	0.363	0.360
LWF	0.352	0.349

Note: LWF-Learning and Growth factor, IPF- Internal Process factor, CF- Customer factor, FF-Finance factor.

Table 4.0: Direct hypothesis testing by bootstrapping

	Hypothesis Relationship	β	SD	|t-value|∧	P Values	Sig. Level	Decision	95% CI LL	95% CI UL	f^2
$Ho_{1.1}$	AUF->LWF	0.385	0.068	5.563	0	****	Rejected	0.271	0.493	0.130
$Ho_{1.2}$	AUF -> IPF	0.316	0.071	4.419	0	****	Rejected	0.199	0.434	0.093
$Ho_{1.3}$	AUF -> CF	0.444	0.067	6.637	0	****	Rejected	0.335	0.550	0.221
$Ho_{1.4}$	AUF -> FF	0.356	0.072	4.975	0	****	Rejected	0.237	0.474	0.106

Note: β- beta coefficient, SD- Standard deviation, ** $p \leq 0.05$, *** $p \leq 0.01$, **** $p \leq 0.001$, CILL-confidence interval Lower Limit, CIUL-confidence interval Upper Limit, f^2-effect size, AUF- Adoption-Use Factor, LWF-Learning and Growth factor, IPF- Internal Process factor, CF- Customer factor, FF-Finance factor.

4.3 Effects of open source ERP Adoption-Usage on the organisational performance of Deposit-Taking SACCOs in Kenya

The study also set to test the following null hypothesis:

Ho_1: Adoption-use of open source ERP has no significant effect on organisational performance of Deposit-Taking SACCOs in Kenya.

Given the finding of the study the null hypothesis changes to alternate hypotheses:

$H_{1.1}$: There is significant effect of open source ERP adoption-use on the Learning and Growth performance of Deposit-Taking SACCOS in Kenya.

$H_{1.2}$: There is significant effect of open source ERP adoption-use on the Internal Process performance of Deposit-Taking SACCOS in Kenya.

$H_{1.3}$: There is significant effect of open source ERP adoption-use on the Customer performance of Deposit-Taking SACCOS in Kenya.

$H_{1.4}$: There is significant effect of open source ERP adoption-use on the financial performance of Deposit-Taking SACCOS in Kenya.

The results indicate that the adoption-use of open source ERP had significant influence on the four balance score card performance indicator set for study and therefore all the null hypotheses were rejected. The results show that the use of open source ERP had significant impact on the learning and growth of the Deposit-Taking SACCOs (β = 0.385, t= 5.563, p =0.00, confidence interval = [0.271, 0.493). The use of open source ERP had significant effect on the internal process performance of the Deposit-Taking SACCOs (β = 0.316, t= 54.419, p =0.00, confidence interval = [0.199, 0.434]). The use of open source ERP had significant impact on the customers of Deposit-Taking SACCOs s (β = 0.444, t= 6.637, p =0.00, confidence interval = [0.335, 0.550]) and finally the adoption-use of open source ERP had significant impact on the financial performance of the Deposit-Taking SACCOs (β = 0.356, t= 4.975, p =0.00, confidence interval = [0.237, 0.474]). Table 4.0 further shows that the exogenous construct adoption-use factor (AUF) had varied effect on the endogenous construct with small effect (f^2 = 0.130) on learning and growth, small effect (f^2 = 0.093) on internal process, moderate effect (f^2 = 0.221) on customers and small effect (f^2 = 0.106) on financial performance of the Deposit-Taking SACCOs. This means that of the 46.5% of the variance in customer factor was explained by the adoption-use factor, 35.2% of the variance in learning and growth was explained by adoption-use factor, 36.3% of the variance in internal process was explained by adoption-use factor while 33.2% of the variance of financial performance is explained by adoption-use factor. The results shows that there is significant adoption-use factor of open source ERP had the highest impact on the customers of the Deposit-Taking SACCOs. This is because customers form the corner stone in any business enterprise and with customers satisfaction the business is made for growth. Sandra (2008), confirmed that the use commercial open source ERP software by small and medium enterprises improved the firm performance significantly. It further corroborates the studies by Jepng'eno *et al.*, (2016), Ouma and Mwangangi (2015), Elragal and Al-Serafi (2011), Arya (2015) and Sandra (2008) who found that the use of enterprise resource planning system, significantly improved organisations performance. The study results indicate that if appropriately utilised, open source ERP will significantly increase the learning and growth, internal process, customers and financial performance of Deposit-Taking SACCOs.

5. Conclusions and Recommendations

The paper examines the relationship among ERP adoption-use on organisational performance indicators measured using the balanced score card components. Model testing indicates that open source ERP adoption-use is capable to extend organizational performances significantly and have positive impact on learning and growth, internal process, customer and finance performance of the deposit-taking SACCOs.

The Deposit-Taking SACCOs regulatory authority SASRA should come up with atleast three open source ERPs, customize the ERP to meet the user and the regulatory requirements then redistribute the ERP free of charge to deposit-taking SACCOs. The regulatory authority can charge a fee for both technical and user training. This will encourage adoption-use of open source ERP and at the same time improve the organisation performance of their clients which are the deposit-taking SACCOs in Kenya.

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