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Original Article

A Framework for Integration of Web 3.0 and Social Media Technologies in Government Portals for Personalized Integrated Service Delivery

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Abstract**:** *The sustainable development goals (SDGs), which are at the heart of the 2030 Agenda for Sustainable Development, are closely interrelated. The integrated nature of the SDGs has shed new light on the need for integrated service delivery by various governments. An effective e-government portal needs a system with good Integration, interoperability and personalized service delivery. However, most e-government portals lack Integration, interoperability and personalized service delivery. The purpose of this study was to investigate how Web 3.0 and Social Media technologies could be integrated into existing government portals for personalized, integrated service delivery to citizens. The study employed design science research to achieve its objectives. The target population consisted of 94 experts involved in managing social media and portal services for the Kenyan government national portal (eCitizen). The study established that while most government portals had already incorporated social media, social media was being used mostly for information dissemination and not to offer other services like public participation or transactional services. The study developed a framework made of six components that would guide the Integration of web 3.0 and social media technologies within government portals to achieve personalized, integrated service delivery.*

Keywords *- Social Media based government, social media and government portal; web personalized services; e-governance and social media.*

I. INTRODUCTION

The United Nations E-Government Survey 2018 (a bi-annual survey) [1] highlights a positive global trend towards higher levels of e-government development. Countries in all regions are increasingly embracing innovation and utilizing ICTs to deliver services and engage people in decision-making processes. One of the most current trends in the advancement of people-driven services (personalized service). It addresses the growing demand for more personalized services that reflect individual needs, as well as people's aspiration to be more closely engaged in the design and delivery of services. These new demands can transform the way the public sector operates [2]. The United Nations (2016) report also emphasized the importance of having Integrated services as a key success factor of any e-government initiative. According to the report, another new trend in e-government is the evolution towards integrated public services online through one-stop platforms (web portals). The U.N. report emphasizes the need for personalized, integrated service delivery as key components of any government portal, and this formed the basis for this study.

II. STATEMENT OF THE PROBLEM

An effective e-government portal needs a system with good Integration, interoperability and personalized service delivery. However, most e-government portals lack Integration, interoperability and personalized service delivery. This problem has thus forced each government agency to have its own website. This has prevented governments from providing personalized, integrated e-services. The purpose of the study addressed was how Web 3.0 and Social Media technologies could be integrated into existing government portals to enable the delivery of personalized, integrated services to citizens.

III. METHODOLOGY

This study adopted Design Science Research (DSR). It was selected because it allows researchers to build new or invent, innovate artefacts for problem-solving or

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facilities improvement of artifacts to create a new reality, rather than the existing reality. The study was based on the Kenyan government official portal (eCitizen). The study's target population was composed of (94) experts managing the eCitizen.The expert's target and sample population for this study was composed of the teams managing social media accounts and portal servicers in all the 10 organizations which are part of eCitizen portal, Kenay's official national portal [3] and had a total of 94 members. Census sampling was used because the expert's target population of 94 was not very large, and it was possible to gather data from every member of the target population. Research instruments used in this study were questionnaires and guided interviews. Quality control of the instruments of the study was done to establish both validity and reliability. The reliability of the instruments was established through pretesting and piloting, where the Cronbach's alpha of 0.791 value was calculated for 19 items. The tool was hence deemed reliable for use in the study [4].

IV. RESULTS

The study collected and analyzed data on how the government of Kenya is using Web 3.0 and Social Media to deliver services to its citizens through the eCitizen portal (www.citizen.go.ke). The study sort first establishes the type of services that the organizations involved in this study are offering through social media.

Table 1. Services offered through social media

S/NO	Service s	Strongly disagree	Disagree	Not sure	Agree"	Strongly agree
1.	Information disseminatio n				5.6%	94.4%
2.	Public participation	83.3%	4.2%	4.2%	5.6%	1.4%
3.	Transactional services	80.6%		6.9%	6.9%	5.6%
4.	Address customer complains			4.2%	8.3%	87.5%
5.	Campaign/ Promotions	4.2%		6.9%	34.7%	54.2%
6.	Survey	41.7%	16.7%	13.9%	15.3%	12.5%
7.	Marketing	9.7%		6.9%	30.6%	52.8%

Table 1 above reveals that most of the respondents (94.4%) use social media for information dissemination, while (87.5%) of the respondents use social media to address customer complaints (54.2%) use social media for carrying out campaigns/ promotions and 50.2% use social media for marketing. Hence Information dissemination, addressing customer complaints carrying out campaigns/ promotions and marketing was the most popular services that were being delivered through social media. However, social media is not being fully utilized for public participation as only 1.4% of the respondents indicated that they use social media for public participation and (5.6%) use it to carry out transactional services while 41.7% use it to carry out a survey.

The study also sought to find out which measures, if implemented, would improve the way organizations offers services through social media.

Table 2. Measures that would improve service delivery through social media

S/NO	Measures	Yes	I don't Know	NO
1.	Automated monitoring and management of social media accounts	84.7%	6.9%	5.6%
2.	Dedicated team for managing social media	90.3%	1.4%	5.6%
3.	Clear social media policy	77.8%	9.7%	9.7%
4.	Store citizen's social media profile details	66.7%	18.1%	12.5%
5.	Personalization	76.4%	9.7%	11.1%

Table 2 above reveals that the respondents identified five key measures that they believed, if implemented, would improve service delivery through social media. The five measures were; automated monitoring and management of social media accounts where (84.7%) of the respondents stated this would improve service delivery through social media, automated monitoring of these accounts would help in manage the large volume of data that is usually generated from users hence a small team of employees would be able to manage the accounts. Furthermore (90.3%) of the respondents pointed out that having a dedicated team for managing social media with their organization was necessary, 77.8% identified the need to have a clear social media policy, (66.7%) of the respondents indicated that it was necessary to capture and store citizens social media profile data as this would facilitate offering better feedback to citizens based on the bio-data captures from the citizen social media profile and (76.4%) of the respondents pointed out personalized service delivery as a key factor towards improved service delivery through social media and this would be possible through the capture and storage of profile data from citizens accounts.

The study sought to further investigate which measures if implemented, would facilitate the integration of social media within government portals for improved service delivery to citizens. Table 3 below gives a summary of the response to this question.

Table 3. Measures To Facilitate Integration Of Social Media Within Government Portals

S/NO	Factors	Strongly disagree	Disagree	Not sure	Agree"	Strongly agree
1.	Training		41.7%	6.9%	51.4%	
2.	Integration of government data		15.3%	13.9%	70.8%	
3.	Device independent services			5.6%	26.4%	48.6%
4.	Tools for managing social media accounts		15.3%	2.8%	26.4%	55.6%
5.	Secure services		11.1%	2.8%	33.3%	52.8%
6.	Change in Organizational culture		15.3	11.1	29.2	43.1

Table 3 above reveals that (51.4%) of the respondents agreed that Training on how social media would be used for service delivery was necessary for the smooth Integration of social media within government portals to support delivery services. Integration of government data was also sighted by (70.8%) of the respondents as an important factor that would facilitate better Integration of social media within government portals for service delivery, (48.6%) of the respondents pointed out having device-independent service as a necessary factor for Integration while (52.8%) acknowledged that having secure services was required form integration of social media and government portals for the services delivery. Finally, (43.1%) of the respondents emphasized the need for organizational culture change to achieve enhance service delivery through social media within government portals.

Some of the key features that characterize Web 3.0 include personalized service delivery, intelligence service and ubiquitous services. Hence the study sought to find out if these key features of web 3.0 were being implemented by the organizations involved in this research when delivering services to citizens through social media.

Table 4. Web 3.0 features

S/NO	Web 3.0 Feature	Yes	Not sure	NO
1.	Personalization		13.9%	84.7%
2.	Predict services		16.7%	81.9%
3.	User identification		20.8%	77.8%
4.	Select Service delivery platform	5.6	25.0%	68.1%

Table 4 reveals that the organizations involved in this study were not taking advantage of Web 3.0 features. This is evident from the results illustrated in table 4 as (84.7%)of the respondents indicated that the services they offer lack personalization, while (81.9%) indicated that they were not able to offer predictive services, (77.8%) that they were not able to automatically identify users who engage with them through social media, and (68.1%) pointed out that the services they offer were not platform-independent.

Portals are evolving towards integrated public services online through one-stop platforms (web portals). Hence the study sort of finds out if the Kenyan national portal eCitizen is offering a one-stop-shop to citizens requesting services. Further, are these services integrated since for the one-stop-shop for government service to existing the government data and systems should be integrated. Lastly, the study also sought to find out if the service being offered were intelligent such that they incorporated the use of artificial intelligence for effective personalized service delivery. Figure 1 below summarizes the results

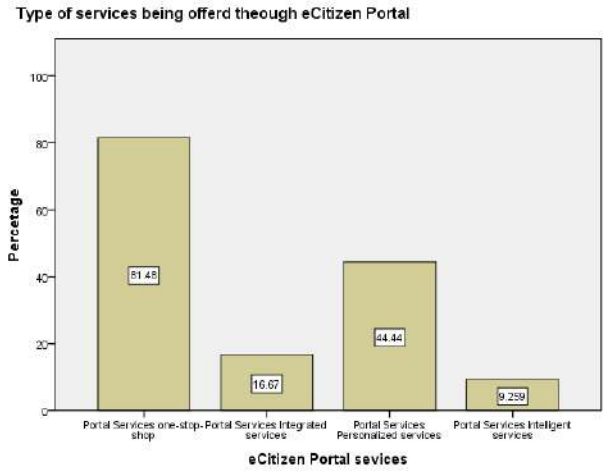

Fig.1 Types of services offered through the eCitizen portal

Figure 1 reveals that 81.48% of the respondents agreed that the eCitizen portal does offer a one-stop-shop for government services. However, the chart further reveals that the portal scores poorly on the other three aspects that the respondents were requested to rate the portal on. Only 16.67% of the respondents indicated that the portal was able to offer integrated services,

while 44.44% indicated that the portal was able to offer personalized services, and 9.25% indicated that the portal was able to offer intelligent services.

V. FRAMEWORK FOR INTEGRATING WEB 3.0 AND SOCIAL MEDIA TECHNOLOGIES FOR PERSONALIZED, INTEGRATED SERVICE DELIVERY

From the findings of the study, factor analysis was used to identify the factors that were relevant to the development of a framework for integrating web 3.0 and social media technologies for personalized, integrated service delivery. This was done through Principal component analysis. Tale 5 below summarizes the results of the Principal component analysis.

Table 5. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.590	28.112	28.112	7.590	28.112	28.112	4.726	17.503	17.503
2	3.310	12.261	40.372	3.310	12.261	40.372	4.149	15.365	32.868
3	2.597	9.620	49.993	2.597	9.620	49.993	3.791	14.042	46.910
4	1.673	6.197	56.190	1.673	6.197	56.190	1.863	6.901	53.811
5	1.620	5.999	62.189	1.620	5.999	62.189	1.724	6.384	60.195
6	1.445	5.352	67.541	1.445	5.352	67.541	1.692	6.265	66.460
7	1.070	3.964	71.505	1.070	3.964	71.505	1.362	5.045	71.505
8	.993	3.677	75.181						
9	.855	3.167	78.348						
10	.811	3.004	81.353						
11	.728	2.698	84.051						
12	.707	2.618	86.669						
13	.638	2.365	89.034						
14	.551	2.039	91.073						
15	.469	1.736	92.809						
16	.393	1.456	94.265						
17	.290	1.075	95.340						
18	.267	.989	96.329						
19	.220	.814	97.142						
20	.195	.723	97.865						
21	.168	.621	98.486						
22	.125	.462	98.948						
23	.084	.310	99.258						
24	.078	.290	99.549						
25	.069	.256	99.805						
26	.036	.132	99.936						
27	.017	.064	100.000						

Extraction Method: Principal Component Analysis.

Kaiser's criteria [5] recommends that all constructs of eigenvalue greater than one (eigenvalue > 1) be retained for interpretation. Hence based on Kaiser rule (1960), only factors of eigenvalue >1 would contribute adequately to the PISD framework. Therefore the study retained factors 1 to 7 from Table 5. This study employed the orthogonal rotation procedure and the Varimax method for factor rotation. Table 6 illustrates the rotated component matrix provided a matrix of the factor loadings for each variable onto each factor.

Table 6. Rotated Component Matrix

	Component						
	1	2	3	4	5	6	7
campaign/promotion	.883						
Marketing	.871						
Address customer complaints	.822						
Survey	.749						
Information dissemination	.740						
Predict a Service		.888					
Intelligent services		.852					
Integrated services		.761					
Select Delivery platform		.726					
Recognize users		.588					
Automated services		.555					
Personalization		.527					
Respond or act upon issues			.915				
Store social media profile data			.895				
Reject /remove inappropriate content			.845				
Collect and store S.M. data			.806				
Dedicated team			.504				
Public participation				.718			
Transactional services				.525			
Secure services					.525		
Integration of government data						.621	
device-independent services						.666	
one-stop-shop for services						.588	
Social Media Policy							.570
Training							.528
Institutional culture							.694

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 11 iterations.

A. Interpretation

In factor analysis, interpretation is the process of examination to select variables that are attributable to a construct (factor) and allocating a name for that factor [6]. From the analysis, the variables offering campaign/promotion services with a factor of (.883), marketing services (.871), Address customer complaints (.822), survey (.749), and Information dissemination services (.740) all load together on factor one (1) and the variables social media is used to carry out public participation with the loading of (.718) and offer transactional services (.525) both load together under factor number four (4). All the variables loading on the factor (1) and those loading on factor (4) have a common theme around the type of services offered. Hence they were also collectively named services.

The variables predict a Service with a loading factor of (.888) Intelligent services (.852), Integrated Services (.761), Select Delivery platform (.726), automatically recognize users (.588), Automated services (.555), Personalization (527) all load together under factor two (2). The researcher notes that the variables under this factor describe the nature of service to be provided and that it is a service that is integrated, intelligent automated and predictive all these are key features of web 3.0 services. Therefore these factors were collectively named Web 3.0 features.

The variables respond or act upon issues with loading of (.915), store social media profile data (.895), reject /remove inappropriate content (.845), Collect and store S.M. data (.806), dedicated team (.504); all these variables load together to form factor three (3). The study notes that these variables have a common theme revolving around collecting, storing and responding to issues raised on social media. This points towards social media management. Hence the variables were collectively named social media management.

The variable secure services with the loading of (.525) load on to factor five (5) this variable recommend a secure platform for services delivery, and since it is the only one loading on to factor five and points a very significant requirement for any service delivery platform, it was not combined with any other factor. Therefore factor five was named secure services.

The variable Integration of government data with a loading of (.621), device-independent services (.666), and one-stop-shop for government services (.588) load together under factor six (6). The three variables relate to a one-stop shop for government service. Hence they were collected named One stop shop for government services.

Finally, the variables Social media Policy with the loading of (.570), Training (.528) and Institutional culture (.694) are all variables that affect service delivery although they are not part of the actual platform delivering the services. Since these variables are not part of the actual system delivering the services but can affect how services are being delivered, they were collectively called external factors

VI. PERSONALIZED, INTEGRATED SERVICE DELIVERY FRAMEWORK

From the Principal component analysis, six sub-constructs (Factors) were identified that would make up the Personalized, integrated service delivery (PISD) framework. The contributions of these sub-constructs to the PISD framework were calculated using the sum score by factor method. The First step based on the sum score by factor method was to sum the individual loadings of all variables that load onto each factor and then compute the average to get the Construct Average Loading (CAL) as illustrated in figure 2 below.

Next the Construct Average Loading (CAL) for the six sub-constructs were summed up (0.7583+ 0.6996 + 0.793 +0 .525 + 0.625 + 0.5973) this gave a Total Average Construct Loading (TACL) of 3.9982. This TACL (3.9982) was then used to calculate the effective contribution of each sub-construct towards the PISD framework.

When the effective weights of the sub-construct are summed up, they should add up to one (1). To achieve this, the following computations (CAL / TACL) were carried out;

- Services sub construct =(0.7583 / 3.9982) = 0.1900
- Web 3.0 features = (0.6996/ 3.9982) = 0.1750
- Social media management = (0.793 /3.9982) = 0.1983
- Secure services = (0 .525 / 3.9982) = 0.1313
- One stop shop for government services = (0.625 / 3.9982) = 0.1563
- External services (0.5973 / 3.9982)= 0.1494

After calculating the individual contributions for the six sub-constructs of the PISD framework and ensuring that they added up (1.00), the computed weights were then fed into the framework. These computed weights were services (0.1900), web 3.0 features (0.1750) social media management (0.1983), secure service (0.1313), one-stop-shop for government services (0.1563) and external factors (0.1494). Figure 2 below illustrate the Personalized Integrated Service Deliver (PISD) framework.

Construct	Construct Average Loading (CAL)	Construct Weight (CAL / TCAL)
Services	**0.7583**	**0.1900**
Campaign/promotion		
Marketing		
Address customer complaints		
Survey		
Information dissemination		
Public participation		
Transactional services		
Web 3.0 features	**0.6996**	**0.1750**
Predict a Service		
Intelligent services		
Integrated services		
Select Delivery platform		
Automatically recognize users		
Automated services		
Personalization		
Social media management	**0.793**	**0.1983**
Respond or act upon issues		
Store social media profile data		
Reject /remove inappropriate content		
Collect and store S.M. data		
Dedicated team		
Secure service	**0 .525**	**0.1313**
Secure service		
One-stop-shop for government services	**0.625**	**0.1563**
Integration of government data		
Device-independent services		
One-stop-shop for services		
External factors	**0.5973**	**0.1494**
Institutional culture		
Social Media Policy		
Training		
Total Construct Average Weight (TCAW)	**3.9982**	

1.00

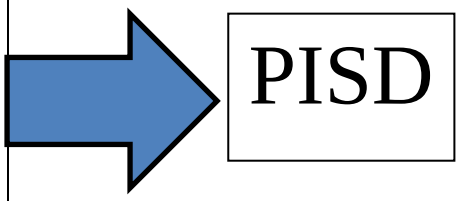

Fig. 2 Personalized Integrated Service Deliver (PISD) framework

Based on the above computations, it is clear that social media management contributes a higher value towards the Integration of social media and web 3.0 technologies in government portals for service delivery with a weight of (0.1983) followed by services sub-construct with a weight of (0.1900) then web 3.0 features (.0.1750), followed by the one-stop shop for government services with and weight of (.0.1563), then external factors with a weight (.0.1494), and finally secure service with a weight of (0.1313).

VII. CONCLUSION

The study concludes that Web portal plays an important role in service delivery to citizens. Web 3.0 and Social Media technologies have the potential to transform the way government interacts and delivery's services to its citizens if only the government/s takes advantage of their numerous features.

This paper has considered how web 3.0 and Social Media technologies can be incorporated within government portals for personalized, integrated service delivery. The study was guided by the response from a team of experts that are involved in developing, integrating and maintaining the portal and social media services for the Kenyan government portal (eCitizen). The personalized, integrated service delivery (PISD) framework developed in Figure 2 can be used to guide how web 3.0 and social media technologies can be integrated within government portals. The framework is made up of six components: services, web 3.0 features, social media management, security, a one-stop shop for government service, and external factors which are necessary for personalized, integrated service delivery through government portals to be achieved. This framework is expected to act as a guide for governments to be able to fully utilize web 3.0 and social media technologies in services delivery.

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