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The Strategic JOURNAL of Business & Change MANAGEMENT
ISSN: 2312-9492 www.strategicjournals.com
Vol. 7, Iss. 3, pp 651 – 668. August 18, 2020. www.strategicjournals.com, ©Strategic Journals

INFLUENCE OF GEOGRAPHICAL INFORMATION SYSTEMS INTEGRATION IN MONITORING AND EVALUATION ON PERFORMANCE OF COMMUNITY DEVELOPMENT PROJECTS AT WORLD VISION KENYA

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Accepted: August 16, 2020

ABSTRACT

This study sought to determine the effect of Geographical Information Systems integration in Monitoring and Evaluation, and how it influences the performance of community development projects at World Vision Kenya. The research design was descriptive, targeting a total population of 183 employees working for World Vision Kenya with a sample size of 125 respondents. Data collection was done by use of online self-administered questionnaires and quantitative data was analysed using descriptive and inferential statistics on Statistical Package for Social Sciences (SPSS). Descriptive analysis incorporated frequencies, percentages, means and standard deviations. Multiple linear regression analysis was used to test the hypothesis and results presented in tables and charts. Results showed that Geographical Information Systems (GIS) progress tracking had a positive correlation and significantly influenced performance of community development projects. GIS data integration had a positive correlation with performance of community development projects and significantly affected the performance of community development projects. GIS information sharing had a positive correlation and significantly influenced performance of community development projects. GIS data sharing positively and significantly influenced performance of community development projects and GIS data management also positively and significantly influenced performance of community development projects. The study aimed at benefiting project managers in tracking progress of community development projects by use of GIS, provide World Vision staff with the skills to monitor project progress and performance trough GIS, help donors in accessing data in online portals powered by GIS, and support national and county governments in strengthening their monitoring and evaluation systems for tracking performance of government infrastructural projects. The study recommended that GIS should be factored in project design with emphasis on GIS in progress tracking to ensure good performance of projects, there was need to decentralize GIS to local level planning and implementation of community and government projects along with the right skill set to harness the power of GIS in project implementation. As well, academic institutions needed to package basic GIS data management skills in all community development/project management courses, to enable learners collect, analyse and interpret GIS data, for proper decision making.

Key Words: *Geographical Information Systems, Progress Tracking, Data Integration, Data Sharing, Data Management, Community Development Projects*

CITATION: Atandi, E. N., & Ngugi, L. (2020). Influence of geographical information systems integration in monitoring and evaluation on performance of community development projects at World Vision Kenya. *The Strategic Journal of Business & Change Management*, 7(3), 651 – 668.

INTRODUCTION

Successful completion and implementation of any community project is dependent on its performance from the conceptual, planning, implementation and completion stages, and it's attributed to the resources adequacy and community capability to stand with and support the project, through implementation and post completion (Ngiri, 2012). Aduma and Kimutai (2018) observed that project performance is determined by contentment of stakeholders needs and is judged by the degree of meeting the standards laid down at the beginning of the project.

In Kenya, Gwayo (2014) listed seven dimensions of project performance as innovation; profitability effectiveness; productivity; quality; efficiency; and quality of work. This shows that there exist different criteria for determining projects performance. Hence, the success of any project highly depends on the completion time all the way from inception to the delivery of results (Wanjau, 2015). This often has a direct bearing on management decisions such as budgets, targets and standards.

Project performance is still a challenge in different sectors of the world. This is noted by Project Management Institute (2012) report which showed that eighty percent of projects in the Middle East were delayed and nearly half of them were behind schedule by more than six months. For instance, Ramathan, Narayanan and Idrus (2012) noted that project delays in the construction industry is a global issue and has been documented taking various forms like; poor quality, cost overruns, delays and low productivity. In Malawi, Murwira and Bekker (2017) on analysing building and infrastructure projects noted that, at North West Province, projects performed poorly regularly in budget overspends and project completion time in the Department of Public Works and Roads (NW DPWR) and failed to meet the desired functional requirements.

In South Sudan, Mogere (2017) observed that one major problem that faces project managers in the country is not aligning the project management processes with business strategies leading to cost overruns and delays. In Ethiopia, Sharew (2016) in the analysis of completed projects demonstrates that, a good number of them surpassed the planned costs and time which resulted in reduced benefits. Poor performance of projects in relation to cost and time may lead to a significant cost and time overrun which is mostly associated to delay in completion of set targets in the contract schedule (Abdul *et al*., 2012). The challenges of project performance have also been felt here in Kenya in different sectors. According to Aduma and Kimutai (2018), poor project performance has been the order of the day in the country. For instance, delays in completion of infrastructural projects have had significant cost implications for Kenyans. Gwayo (2014) noted that there has been a growing concern on why the project goals are unattained as per the client's standards that many times lead to delays and cancellation.

According to Mutua (2017) performance of community development projects mostly is determined by the commitment of the community, acceptance and the great will of the community to support the project. Well-managed community projects do outstanding value for money and abundant things with limited funds. All the community based development projects have a certain period of time in a project called gestation period or life-span. When this period comes to an end the community expected to make effort and continue running the project established and ensures that it is sustained.

Statement of the Problem

When projects are initiated they are supposed to be completed within the planned time frame, meet required quality standards and within budgeted costs. However, incidents of poor and low project performance have been evident for a while now. These projects face the challenge of delay in completion, partial achievement of set objectives; budget overspends and under-spends, and lack of community participation for project sustainability.

Kaburu (2012) noted that rather than many organisations in Kenya especially NGO's viewing M&E as a management tool, they perceive it as donor necessity. Due to this, they just implement M&E to comply with donors demands rather than to measure how the project is performing.

The major problem at World Vision Kenya is that introduction of GIS technology has been embraced but not fully adopted in monitoring and evaluating of project performance, to enable reporting with evidence. This is despite the much potential that GIS has in improving M&E activities like; sharing information more effectively, strengthening randomised trials, geo-locations mapping, social monitoring and big data analysis. The value add of GPS data collected during field surveys is yet to realize its full potential, which is a factor of inadequate staff capacity and minimal GIS analysis. This has led to struggling to show evidence of interventions especially in short term projects or those that are being implemented in hard to reach areas that would require more of remote monitoring using GIS to measure performance.

A number of researches have been undertaken both internationally and locally on geographical information systems, monitoring and evaluation systems and project performance. Internationally for instance, Rogers and Luna in (2004) carried out a study on the impact of geographical information systems on geo-technical engineering, while Johansson *et al*., (2007) carried out a research on how geographical information systems affected collaborative command and control tasks, focusing more on GIS applications on automated industrial processes. More studies have been done in Kenya, with Mutiso (2011) doing a study on geographic information system and remote sensing integration in managing and monitoring floods in Budalangi. This study focused more on GIS in Disaster Management contexts compared to community development context. Micah (2014) studied how M&E Systems influenced Performance of Non-Governmental Projects, basing his study on Maternal Health Projects in Bungoma South Sub-County of Kenya. Whereas Phiri (2015) investigated how monitoring and evaluation influenced project performance in African Virtual University, Kenya. The study focused more on Management information systems compared lacking a GIS perspective. With regard to the above studies it is apparent that not many studies have focused on how GIS integration in monitoring and evaluation systems, influences project performance, at the community level.

This study therefore sought to analyse how geographical information systems integration in M&E systems, influence performance of community development, by integrating accurate up-to-the minute geographic information of projects and beneficiaries, tracking progress of implementation, and enhancing information sharing and use for decision making, in support of community based projects implemented in various counties of Kenya.

Objectives of the study

The main purpose of the study was to investigate how integration of geospatial information systems in the monitoring and evaluation affects performance of community development projects implemented by World Vision Kenya. The specific objectives included;

- To determine the influence of progress tracking on performance of Community development projects at World Vision Kenya
- To determine the influence of data integration on performance of Community development projects at World Vision Kenya
- To determine the influence of information sharing on performance of Community development projects at World Vision Kenya
- To determine the influence of' data management on performance of Community development projects at World Vision Kenya

LITERATURE REVIEW

Systems Theory

System theory was developed and advanced by Von Bertalanffy (1968) and later was advanced by De Bot, Lowie and Verspoor in 2007. It informs the

value of integration in problem solving and outlines that is not possible to solve problems if they are considered in isolation from interrelated components. This theory focuses on identifying all the possible courses of action along with the risks, costs and the benefits associated. It's closely related to cybernetics as well as system dynamics theory that is known to examine the usual mathematical models and common principles to all the complex entities, which in one way is utilized to describe them. This theory approach campaigns for wholeness that is a holistic approach which determines a system as a whole functional unit. A system may be defined as a group of many interconnected components that form whole and displays properties that are properties of the whole rather than of the distinct components (De Bot *et al.,* 2007).

According to Catherman (2013) a GIS and M&E system contains procedures, data and technology, and people. In systems' thinking, there is an interaction between the components of the 'whole' rather than the sum of individual components' properties. This means therefore, that individually, these components would not be able to function on their own to produce the intended information to project managers.

This theory is important to the study as it unpacks how GIS and Monitoring and evaluation systems integrate various components that work together to provide information to project managers for a better decision making.

The Theory of Change

It was developed in 1995 by Carol Weiss, and it provides a framework for planning, participation, and evaluation used by organizations and governments to promote social change. Long-term goals are defined and mapped backward to identify required preconditions (Carol, 1995). The theory of change outlines short term, intermediate and longer term causal linkages in an initiative. The identified changes are mapped in a logical and chronological relationship to all the others. The association between outcomes is explained by statements of ways a single result is believed to be a precedent for another outcome (Clark & Taplin, 2012). The theory of change supports to articulate the 'why' element at design, planning and monitoring stages, which offers input for the evaluation. In this regard it links to the study objective of how GIS adds value to monitoring and evaluation, and measuring of outcomes, by providing credible data for Programme decision making that in turn will lead to achievement of Programme objectives.

Empirical Review

GIS progress tracking is the capacity of a monitoring system to periodically collect geographical and attribute data and present it on a single map for users to easily see, analyse, and comprehend patterns and relationships (Esri International, 2011). Its indicators are, regular data updating in the system, real-time data validation and periodic data evaluation on how the project is reaching the right people with the right intervention (Measure Evaluation, 2016).

Prasad (2012) in his study on role of geographical (spatial) information system (GIS) in governance in India observed that geographic Information System (GIS) progress tracking affected to about 80% the outcomes of the project. The study further stated that GIS provides a better understanding of the spatial phenomenon that is complex in nature and requires a vast collection of data. This statistical data when integrated with geographic data therefore, from different sources was fundamental in understanding the project environment, and making critical decisions affecting project performance. The gap of this study was that it focused more on management information systems, compared to geographical information systems integration in M&E.

Palve (2013) carried out a study on applications of GIS in infrastructure. From the study, he observed that, a GIS availed a lot of information easily from a spatial interface. This helped to organize information that was relevant and needed, for project progress tracking. However, this study

focused more on infrastructural community development projects. Altuwaijiri (2014) studied how use of GIS affected project success, basing his study in select construction organizations. Though he focused more on construction projects, the study found out that digital tracking was beneficial due to integration of GPS technology in GIS. This significantly reduced communication provided to stakeholders, by providing online access to project data.

Koko *et al*., (2014) in their study on real-time geospatial data collection and visualization using smart-phone observed that, while the pen and paper method has been the traditional way to collect monitoring data in the field, with the expanding availability and functionality of powerful hand held computers, GPS, and mobile GIS, researchers are increasingly integrating and replacing conventional field methods with more efficient mobile methods. The study found out that a distributed GIS has seen recent GIS technologies dramatically depart from the traditional two-tier client-server model, to mobile to web technologies that has in turn improved project performance, by strengthening monitoring and evaluation system (Peng & Tsou, 2003). Both of these studies were focused on data collection, as compared to information use for decision making.

GIS data integration is the ability to utilize the underlying geography so as to link data from several sources. It involves participatory data collection, linking data from multiple sources and data centralization in one central geo-database that is accessible by everyone. This results in a better- off comprehension of the story which the data can communicate and often, it leads to a corresponding rise in demand of data and use of it (Prasad, 2012).

In Ethiopia, Tefere (2010) investigated how GIS was used in implementation of a sanitation project funded by a Finnish organisation through construction of group toilets. Through use of survey, it intended to establish the location and conditions of existing latrines. The main purpose was to find out how GIS can be used in making decisions on the above mentioned projects. Though limited in scope and context, Research findings revealed that GIS can be integrated into sanitation projects where funds are limited since it aids in decision making and prudent utilisation of resources in areas of budget constraints.

Graham *et al.,* (2011), studied the Benefits of Using GIS. He illustrated a case where students used Trimble Recon GPS devices full with customized data dictionaries to make collection of the spatial data points. For every GIS data, points which were collected were keyed into the GPS devices under one of the following categories: Transportation & advertising, education, health & safety, food security, community asset & others. Data collection points comprised of hospitals, small businesses, transportation, restaurants, and advertisements. The study aimed at finding out how GPS technology supported data collection. The data was analysed and visualised and used to create a community asset inventory shared to the community. The study found out that inclusive GIS the process promoted confidence, strengthened the partnership between the community and the implementing agencies, and informed key decisions between the university and the community. It however focused more on GIS community needs assessment, as compared to M&E processes key in the project implementation cycle.

In his study on Applications of GIS in infrastructure, Palve (2013), observes that Modern GIS and ICT technologies offer the opportunity to computerize records like land records, base maps, land registers plans, deeds, and index maps (Prasad, 2012). The study found out that, a central data system provided by Modern GIS and ICT technologies in constructing and developing infrastructure, provides engineers with a common way to communicate geospatial information, retaining the present data, without mixing up data files of different versions, format and content. The study further stated that, GIS technology was gradually becoming key in implementation of many projects in infrastructure due to its superior spatial data

handling capabilities, though it had a gap on how GIS would be implemented in the case of non-infrastructural projects.

Lai, Hancock and Muller-Praefcke (2012), observed that in South East Asia, projects established by NGO's established MIS systems that were web-based, to demonstrate feasibility and utility of ICT technology in enabling data collection and communication across several project locations and levels. This incorporated integration of GIS and remote sensing tools. The study found out that, GIS MIS was able to provide valuable information for decision support, in project implementation and progress tracking. They further noted that, unavailability of modernized telecommunication infrastructure lack of access to qualified professionals to provide technical and support restricted adoption of ICT in MIS for several projects. The project however lacked on how, those running with small budgets could adopt advanced M&E systems because of high financial costs

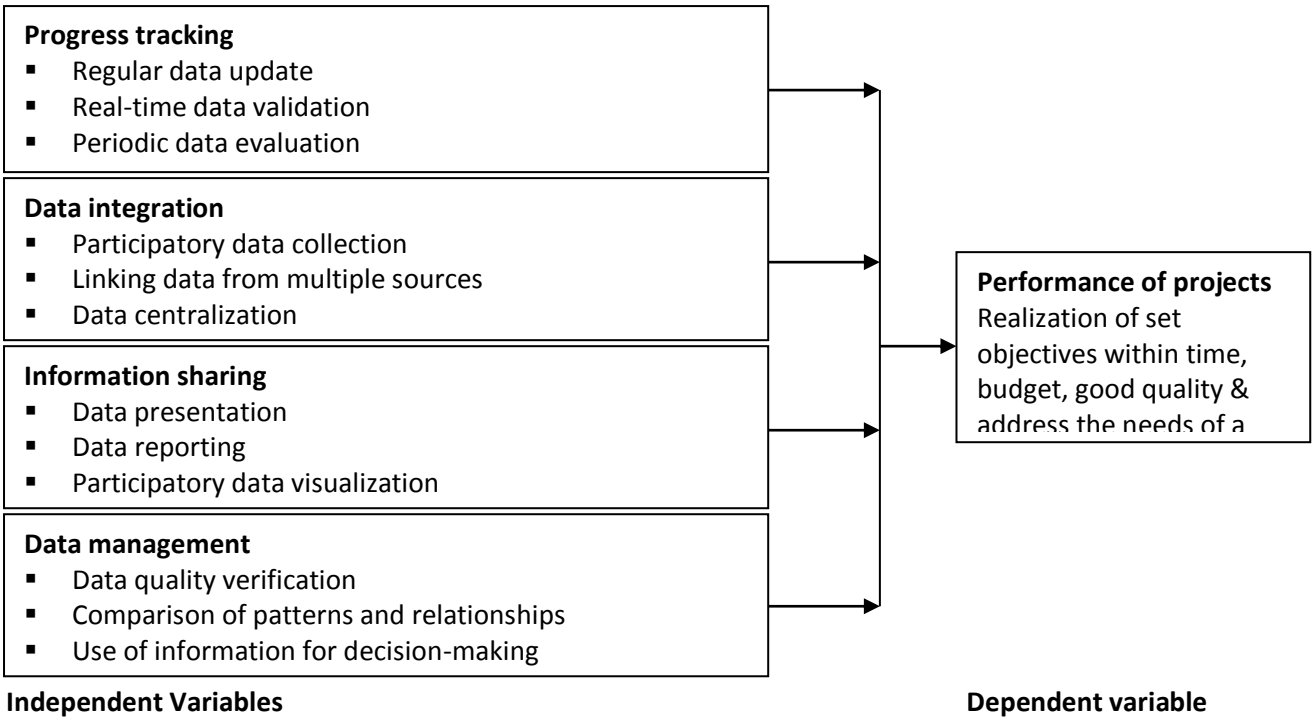

Figure 1: Conceptual Framework
Source; Researcher (2018)

METHODOLOGY

The study adopted a descriptive research design. This was preferred because it gave the researcher the ability to designate the features of the variables of interest. The target population for the study constituted 183 staff from 41 Area programs and National office charged with direct implementation of community based projects. They comprised of; Regional managers, Area program cluster managers, system operators, Project officers/co-ordinators, Regional monitoring and evaluation co-ordinators, technical specialists and technical program leads, working for World Vision Kenya. Stratified simple random sampling method was used for sampling the study respondents. The following formula proposed by Miller and Brewer (2003) was used to determine the sample size.

$$n = \frac{N}{1 + N(a)^2}$$

Where:

n= Sample size
N=Population
a =Level of significance (0.05)

To have a fair representative sample size, it was determined at a 95% confidence interval (0.05

The Strategic Journal of Business & Change Management. ISSN 2312-9492 (Online) 2414-8970 (Print). www.strategicjournals.com

significance level), which resulted in 125 respondents as below.

$$n = \frac{183}{1 + 183\ (0.05)^2}$$

n=125 Respondents

The researcher used semi-structured, self-administered online questionnaires for the data collection which were self-administered through online platform. Digital data was collected by logging into the web server and filling the questionnaire, and taking GPS points of the respondent's exact location. Once the respondent was done, they saved and synced the GIS mobile device that relayed the data to a web server for retrieval and analysis. The data collected by mobile GIS devices was downloaded in excel sheets, and loaded to SPSS Version 23.0. Quantitative data went through preliminary data analysis to check for completeness. Descriptive analysis was run on the data for all the variables to give frequencies, percentages, means and standard deviation. The multiple regression model was used to establish and measure the strength of the relationship between the dependent variable and each of the independent variables.

FINDINGS AND DISCUSSION

A total of 125 respondents were expected to fill the online questionnaires. Out of these 125, only 98 staff responses were received which translated to 78.4% response rate. The response rate was considered desirable as Kothari (2005), notes that, the recommended response rates to verify consistency of measurements required for analysis should be above 60%.

Performance of Community Development Projects

This variable sought to examine the overall performance of projects at World vision Kenya in terms of completion within the specified time, addressing the specific needs of a community, implementation within the specific budgets, the overall quality completed, projects and lastly if the projects achieved its set objectives. Table 1 showed that this variable had an aggregate mean of 1.92 and a standard deviation of 0.485 implying that a majority of respondents strongly agreed that the performance of community development projects in World vision Kenya was within the specified time, addressed the specific needs of a community, was within the planned timelines, with good quality and achieved their set objectives.

Table 1: performance of community development projects

	Valid						N	Mean	Std. Dev.
Projects are completed within the specified time	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Total	Valid		
	8.2	70.4	4.1	16.3	1.0	100.0	98	2.32	.880
Projects address the specific needs of a community	32.7	61.2	1.0	5.1	0.0	100.0	98	1.79	.707
Projects are implemented within the planned budgets	38.8	53.1	1.0	6.1	1.0	100.0	98	1.78	.831
The overall quality of projects is good	23.5	74.5	2.0	0.0	0.0	100.0	98	1.81	.531
Projects achieve their set objectives	23.5	74.5	2.0	0.0	0.0	100.0	98	1.96	.731
Aggregate Value for performance of community development projects	-	-	-	-	-	-	98	1.92	0.485

Source; Survey data (2019)

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The results indicated that, 8.2% of staff strongly agreed that all projects in WVK were implemented within the specified timelines, 70.4% 'agreed', 4.1% were not sure, 16.3% disagreed, while 1% strongly disagreed. The mean was 2.32 while the standard deviation from the mean was 0.880, indicating that the data points were very close to the mean. This is presented in Table 1 above. This makes a cumulative percent of 78.6 who agreed that projects in WVK were completed within planned timelines. It's in line with Owulabi (2014) who states that, the items determining project performance are; time, quality, safety, environment and performance.

Further, 32.7% of staff strongly agreed that all projects implemented in WVK addressed the specific needs of a community. A 61.2 % majority agreed, 1.0% were not sure, while 5.1% disagreed. The mean was 1.79, depicting that a majority of respondents either strongly agreed or agreed. The standard deviation was 0.707 indicating that the data points were very close to the mean. Shihemi (2016) states that successful project performance as the sum of quality of a project in terms addressing needs of the beneficiaries and whether the interventions are sustainable in the long run.

Regarding whether the respondents felt that projects in WVK were implemented within the planned budgets, a majority of respondents at a cumulative percent of 91.8% either strongly agreed or agreed. 1.0% of respondents were not sure, 6.1% disagreed, while 1.0% strongly disagreed. The mean was 1.79, while the standard deviation was 0.831, indicating closeness to the mean. Further, cost and time variables are the fundamental criteria for success of any project (Abdul, *et al.*, 2012).

On rating the overall quality of projects completed at WVK, a cumulative majority at 98% observed that all projects implemented by WVK, were of good quality, and only 2% disagreed. Out of 98% percent, 23% strongly agreed, while 73% agreed. This question had a mean of 1.81 and a standard deviation of 0.531 showing that all data points were very close to the mean. A majority of staff indicated that projects at WVK are of good quality, with Gwayo (2014) noting that there has been a growing concern on why the project goals are unattained as per the client's standards that many times lead to project delays and cancellation.

Regarding WVK achievement of objectives set for each project, 27.4% disagreed, 72.6% agreed, while 2% were not sure. The analysed data depicted a mean of 1.96 and a standard deviation of 0.449. This emphasizes the need to complete projects within the planned budgets, duration, and costs while making sure that all its objectives are met.

The results are in line with Mulandi (2013) who observed that investing in an effective M&E system is a deliberate effort that involves assembling the empirical evidence to assess the degree of achievement of projected results to make adjustments to the design of the project and implement activities that can improve accountability in attaining the projected outcomes.

GIS Progress Tracking

The aim of this variable was to investigate if regular updating of data in the monitoring system, activity monitoring to track progress towards achievement of objectives, community involvement in progress tracking of projects, and updated project data in the system at all levels of project implementation supported achievement of project objectives. 63 responses were received from project officers in the field, directly implementing and monitoring the projects.

The aggregate mean was 2.54 and the standard deviation was 0.787.A summary of the questions in this variable has been presented in table 2.

Table 2: GIS progress tracking

	Valid						N	Mean	Std. Dev.
Regular data updating in the monitoring system	**Always**	**Often**	**Sometimes**	**Rarely**	**Never**	**Total**	**Valid**		
	12.7	42.9	31.7	9.5	3.2	100.0	63	2.48	0.948
Real-time progress tracking of projects Activity monitoring with GIS	9.5	38.1	38.1	7.9	6.3	100.0	63	2.63	0.989
Community involvement in GIS progress tracking and reporting	4.8	27.0	39.7	14.3	14.3	100.0	63	3.06	1.091
GIS mapping and data update in the system at all levels of project implementation	15.9	36.5	38.1	7.9	1.6	100.0	63	2.43	0.911
Aggregate Value for GIS progress tracking	-	-	-	-	-	-	63	2.54	0.787

Source; Survey data (2019)

The first question was aimed at establishing how regular data updating in the system, contributed towards achievement of project objectives. 12.7% of respondents said it always did, 42.9% selected often, 31.7% selected sometimes, 9.5% and 3.2% selected rarely and never respectively. The responses had a cumulative percentage of 55.6 feeling that regular data updating in the system improved project performance always or often. The mean was 2.48 showing that a majority of responses were around 2 (often), while the standard deviation was 0.948 depicting data points that were very close to the mean.

To establish how real time progress tracking and activity monitoring with GIS contributed to achievement of project objectives, 63 Project officers doing activity monitoring in the field responded. As presented 9.5% of the respondents felt that activity monitoring always helped in achievement of project objectives, while 38.1% responded often. A similar percentage of 38.1% felt that it did sometimes, while 7.9% and 6.3% felt that it rarely or never did. The analyzed data had a mean of 2.63 showing that a majority of responses were at 2 (always), with a standard deviation of 0.989.

On establishing if community involvement in GIS progress tracking and reporting affected achievement of project objectives a cumulative percent of 31.8% felt that community involvement always or often did, 39.7% selected sometimes, while 28.6% felt that it rarely, or never influenced achievement of project objectives. The mean for the data was 3.06 showing that most responses lay in option 3 (sometimes), while the standard deviation was 1.091, the highest so fat in this category of questions, showing that the data was not centered around the mean. Graham *et al.,* (2011) stipulated that inclusive GIS mapping process promoted confidence, strengthened partnerships between the community and the implementing agencies, and informed key decisions between the implementing agencies and the community.

Lastly, the researcher sought to establish the frequency to which GIS mapping and data update in the system at all levels of Project implementation affected achievement of project objectives. It was observed that, a cumulative percentage of 52.4 observed that it always or often did. 38.1% of respondents felt that it sometimes did, while 7.9%

and 1.6% felt that it rarely or never did. The mean was 2.43 showing that responses were concentrated around 'often', while the standard deviation from the mean was 0.911, showing that the data was concentrated around the mean.

Table 3: Correlation between project performance and GIS progress tracking

		Project performance	GIS Progress tracking
Project performance	Pearson Correlation	1	.271**
	Sig. (2-tailed)		.051
	N	98	63
GIS Progress tracking	Pearson Correlation	.271**	1
	Sig. (2-tailed)	.581	
	N	63	63

**. Correlation is significant at the 0.01 level (2-tailed).

Source; Survey data (2019)

Table 3 presented a correlation between GIS progress tracking and project performance. The Pearson's correlation coefficient was 0.271, a positive value indicating that as GIS progress tracking increased, so did project performance. The p value was 0.051, depicting a statistically significant relationship between GIS progress tracking and performance of community development projects.

Table 4: Frequency of data update in the system * Possession GIS mapping devices.

Count		**Possession of relevant GIS enabled mobile devices for mapping**		Total
		Yes	No	
Frequency of data update in the system	Always	11.0	0	11.0
	Most of the time	25.4	4.8	30.2
	Some of the time	28.6	15.9	44.5
	Seldom	6.3	3.2	9.5
	Never	0	4.8	4.8
Total		71.4	28.6	100

Source; Survey data (2019)

A cross tabulation between availability of GIS mapping mobile devices, and frequency of data updated in the system revealed that 71.4% project officers had mobile phones, where 41.2% always or most of the time updated data in the monitoring system. 44.5% of those with mapping devices updated data in the system some of the time or seldom. Whereas none of those with mapping devices never updated data in the system. Of the 28.6% who did not have GIS mapping devices, 23.9% at least updated data in the system most of the time, some of the time and seldom. This was been presented in table 4 above.

GIS Data Integration

This variable aimed at establishing the extent to which GIS mapping and data integration for community development projects at World Vision Kenya, affected achievement of project objectives. The aggregate mean from table 5 was 1.49 and the standard deviation was 0.445.

Table 5: GIS data integration

	Valid					N		
Integration of GIS data in a single database accessible by everyone	To a great extent	Some what	Very little	Not at all	Total	Valid	Mean	Std. Dev.
	59.2	35.7	4.1	1.0	100.0	98	1.38	0.487
Involvement of community members and CDFs in community asset mapping	61.2	28.6	9.2	1.0	100.0	98	1.5	0.707
Participatory GIS beneficiary mapping	51.0	42.9	6.1	0.0	100.0	98	1.55	0.611
Linking data from multiple sources e.g. log frame budget and detailed implementation plan	55.1	34.7	7.1	3.1	100.0	98	1.58	0.759
Planning by use of integrated monitoring data	66.3	28.6	5.1	0.0	100.0	98	1.39	0.586
Aggregate Value for GIS data integration	-	-	-	-	-	98	1.49	0.445

Source; Survey data 2019

To establish the extent GIS data integration in a single database for community development projects at WVK, affected realization of project objectives, results showed that 59.2% of the respondents felt it did to a great extent, 35.7% felt it somewhat did, 5% observed that it did very little or not at all. The mean was 1.47 while the standard deviation was 0.629 depicting a small distribution of data from the mean. In line with this, Palve (2013) observes that, a central data system provided by Modern GIS and ICT technologies provides a common way to communicate geospatial information, retaining the present data, without mixing up data files of different versions, format and content. He further states that, GIS technology is gradually becoming key in implementation of many projects in infrastructure due to its superior spatial data handling capabilities.

There was need to establish if involvement of community members and Community development facilitators in GIS data integration supported achievement of project objectives. Its observed that a cumulative percent of 89.8% observed that it did to a great extent and somewhat, while a cumulative percent of 10.2% observed that it did very little or not at all. The data had a mean of 1.50, while the standard deviation was 0.707, indicating that data was distributed around the mean. Involving communities in mapping the GPS co-ordinates of every household/facility, and developing a map that represents the extent of spatial coverage, the distribution of beneficiaries and possible spatial distribution inequality is the easiest mode of communication to the project management team. (Coverage Monitoring Network, 2016).

Regarding participatory GIS beneficiary mapping and its contribution to achievement of project objectives, 51% of the respondents said that it did to a great extent, 42.9% observed that it somewhat did. This makes a cumulative percentage of 93.9%, while 6.1% observed that it did but very little. The mean was 1.55 while the standard deviation was 0.611. Laura *et al*., (2013) observes that, assigning households a geographical reference to enable neighbourhood deficiencies analysis could be used for prioritization of needs by the project team.

Results showed that 55.1% of respondents agreed that to a great extent, linking data from multiple

sources contributed to achievement of project objectives,34.7 percent observed that it somewhat did, while 7.1% and 3.1% observed that it did to a very little extent, and not at all respectively. The mean was 1.58, whereas the standard deviation was 0.586. Lai, Hancock and Muller-Praefcke (2012), observed that in South East Asia, projects established by NGO's established a web based MIS system, to demonstrate feasibility and utility of ICT technology in enabling data collection and communication across several project locations and levels. Respondents were asked if they possessed the relevant skills for GIS mapping, the response has been presented in figure 2 below.

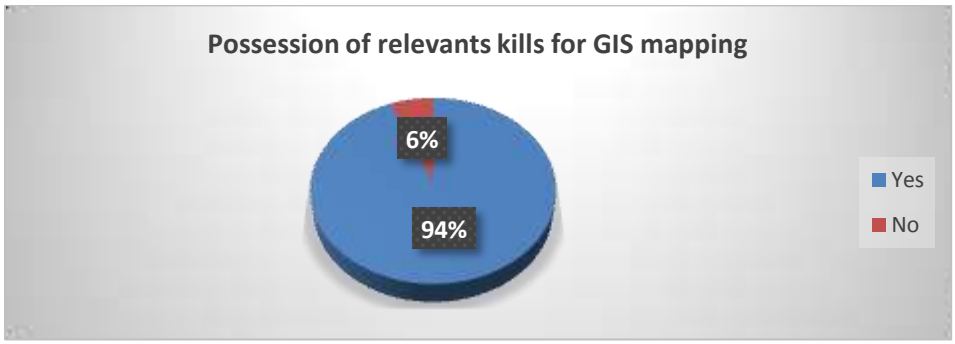

Figure 2: Possession of GIS mapping skills
Source; Survey data (2019)

94% of the respondents admitted to having skills for GIS data collection. Only 6% did not have the requisite skills for mapping. In this regard, the study findings reveal that a majority of WVK staff had been trained in GIS mapping, which is in line with Yang (2005), who asserts that, a small dedicated mapping team may be useful to update new information in the GIS database.

The researcher sought to know if utilization of integrated monitoring data for project planning supported achievement of overall project objectives. Out of the 98 who responded to this question, 66.3% said that it did to a great extent, 28.6% said it somewhat did, while only 5.1% observed that it did to a little extent. The mean was 1.39 showing that a majority of responses were around choice number one, while the standard deviation was 0.586, indicating that the data was centered on the mean. Lai, Hancock and Muller-Praefcke (2012) found out that, GIS MIS was able to provide valuable information for decision support, in project implementation and progress tracking.

Respondents were asked if they accessed data in the centralised monitoring system for decision making. The results have been presented in figure 3 below.

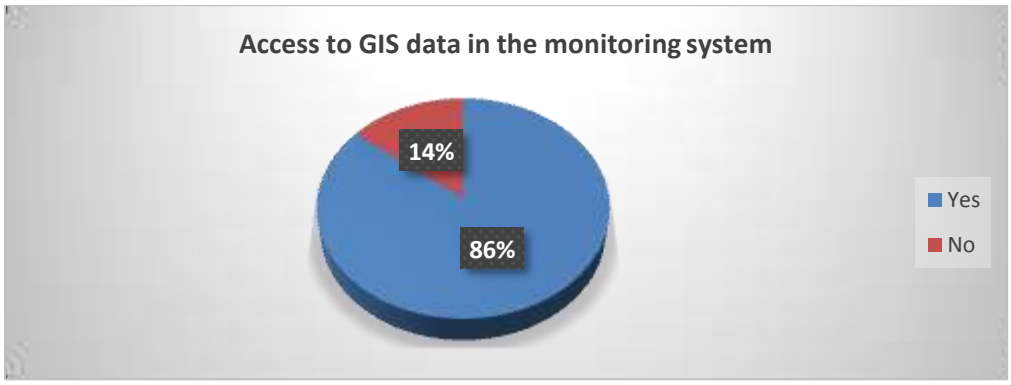

Figure 3: Access to GIS data in the monitoring system
Source; Survey data (2019)

It was observed that 86 % of staff were able to access data in the GIS system, compared to only 14% who were not able to. This in in line with the observation of Yang (2005) who says that the data collected and stored in a central database in relational tables, enable access as and when needed, to support key decisions in the project implementation cycle.

Table 6: Correlation between GIS data integration and project performance

		Project performance	GIS data integration
Project performance	Pearson Correlation	1	.435**
	Sig. (2-tailed)		.000
	N	98	98
GIS data integration	Pearson Correlation	.435**	1
	Sig. (2-tailed)	.000	
	N	98	98

**. Correlation is significant at the 0.01 level (2-tailed).

Source; Survey data (2019)

Table 6 presented a correlation between GIS data integration and project performance. The Pearson's correlation coefficient was 0.435, which was positive indicating that as GIS data integration increased, so did project performance. The p value was 0.000, depicting a statistically significant relationship between GIS data integration and performance of community development projects. This variable had the highest correlation coefficient, showing the strongest relationship to performance of community development projects.

Multiple Regression Analysis Results

The multiple regression analysis was used to present empirical evidence of the influence of GIS integration in monitoring and evaluation systems, on the performance of community development projects. The effect of each independent variable on the dependent variable was determined by computing composite variables from the data collected from the indicators for each variable under study. The multiple regression model was used to determine the effect of GIS progress tracking, GIS data integration, GIS data sharing, and GIS data management on performance of community development projects at World Vision Kenya. Table 7 provided the model summary.

Model Summary

Table 7: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.785[a]	.616	.514	.47929

a. Predictors: (Constant), GIS data management, GIS Progress tracking, GIS data integration, GIS information sharing

Source; Survey data (2019)

The adjusted R square was 0.514. The implication of this was that, 51.4 percent could be explained progress tracking, data integration, data management and data sharing. The remaining 49.6 of the variations could be accounted for by other variables outside this study.

ANOVA

Table 8: ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.107	7	1.027	4.470	.003[b]
	Residual	13.324	91	.230		
	Total	17.431	98			

a. Dependent Variable: Project performance

b. Predictors: (Constant), GIS data management, GIS Progress tracking, GIS data integration, GIS information sharing

Source; Survey data (2019)

The analysis of variance was used to test the overall significance of the model. Results yielded an F statistic of 4.470, and p-value of 0.003, with degree of freedom 4. This was <0.05, and statistically significant, hence the model was well suited for this data.

Regression Coefficients

Table 9: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.983	.298		3.297	.002
GIS Progress tracking	.234	.080	.297	2.925	.039
GIS data integration	.337	.098	.319	3.439	.006
GIS information sharing	.249	.101	.272	2.465	.013
GIS data management	.226	.097	.250	2.330	.016

a. Dependent Variable: Project performance

Source; Survey data (2019)

Table 9 showed the regression coefficients of each independent variable on performance of community development projects. The multiple regression model was presented below;

$Y= 0.983+ 0.234X_1+ 0.337X_2+ 0.249X_3+ 0.226X_4+e_1$

Where,

Y= performance of community development projects,

X_1= GIS progress tracking

X_2= GIS data integration

X_3= GIS data sharing

X_4= GIS data management

e_1= Error term

From Table 9, the co-efficient for GIS progress tracking had a p-value of 0.039 which was less than 0.05 implying a statistically significant effect on performance of community development projects. The regression coefficient was 0.234, indicating that it positively affected performance of community development projects. This therefore means that, an increase in GIS progress tracking by 1 unit, increased performance of community development projects by 0.234 units. These findings were in line with Jia *et al.*, (2007) who carried out a study on field survey system based on GPS and noted that the fundamental principle of GIS in progress tracking and reporting was leveraging on the locational and navigational abilities of the GPS device, to support regular progress tracking of the project.

The co-efficient for GIS data integration had a p-value of 0.006. This was less than 0.05, leading to the conclusion that, GIS data integration had a

The Strategic Journal of Business & Change Management. ISSN 2312-9492 (Online) 2414-8970 (Print). www.strategicjournals.com

statistically significant effect on performance of community development projects. The regression co efficient was 0.337 depicting a positive relationship with performance of community development projects. The results imply that increase in GIS data integration by 1 unit increased performance of community development projects by 0.337 units. These results were consistent with Esri (2011), who observed that, GIS technology gives practitioners, researchers, policy makers and decision makers the ability to bring together and link statistical data from different sources with locational properties to allow for in-depth analysis, visualization, exploration, and modelling results and trends, to reach the most vulnerable in the community, which is a key step towards achieving the objectives of a particular community development project.

The co-efficient for GIS information sharing had a *p-value of 0.013*. This is less than 0.05 hence the conclusion that GIS information sharing had a statistically significant effect on performance of community development projects. The regression co-efficient was positive at 0.249 indicating a positive relationship between GIS information sharing and performance of community development projects. The implication of this is that, for every 1 unit increase in GIS information sharing, there was increased project performance by 0.249 units. The findings alluded to Landicho (2018) who observed that, the consistency, visual clarity and efficiency of the GIS data applications were found to be excellent in achieving project execution.

Lastly, results for GIS data management had a *p-value of 0.013* which is less than 0.05 leading to the conclusion that GIS data management has a statistically significant effect on performance of community development projects the regression coefficient was 0.226 depicting a positive relationship between GIS data management, and performance of community development projects. Therefore, for every 1 unit increase in GIS data management, there was an increase in performance of community development projects by 0.226 units. This conforms with the findings of Baral (2004) which showed that GIS had high potential for utilisation in community forest management through assimilation of participatory action research design and GIS assisted community needs identification for information.

CONCLUSION AND RECOMMENDATIONS

The study found out that GIS progress tracking to a great extent influenced performance of community development projects. A correlation between GIS progress tracking and project performance yielded a positive Pearson's coefficient of 0.271 with a statistically significant p value of 0.051. The regression analysis yielded a beta coefficient of 0.234 with a p value of 0.039. This indicated that regular data updating in the system, real time activity monitoring with GIS, community involvement in GIS progress tracking and reporting, and GIS mapping and data updating in the system at all levels of project implementation were some of the key activities that improved performance of community development projects. It was observed that all those staff with the relevant mapping mobile devices always updated data in the system. Nevertheless a percentage of those without the relevant devices still managed to update data in the system by sharing mobile devices with their colleagues. A majority of staff involved community members in GIS progress tracking and reporting, making sure that they updated data in the system at all levels of implementation.

The study found out that GIS progress integration to a great extent influenced performance of community development projects. A correlation between GIS data integration and project performance yielded a positive Pearson's coefficient of 0.435 with a statistically significant p value of 0.000. The regression analysis yielded a beta coefficient of 0.337 with a p value of 0.006. This shows that staff appreciated the data integration capability of GIS mapping. Analysis of data from this this variable established that integration of data in a single database accessible

by everyone to a great extent influenced performance of community development projects. Consequently, involvement of community members in community asset mapping, participatory GIS beneficiary mapping, linking of data from multiple sources also led to better project performance. It's noted that staff agreed to a great extent that GIS data integration supports planning by use for integrated monitoring data. Almost all staff agreed that they had GIS mapping skills, while only a small percent didn't possess GIS mapping skills, a majority being new staff that hadn't gone through the training.

Based on the findings, the following conclusions were made;

GIS progress tracking significantly influenced project performance the most. Factors of progress tracking like real time data updating in the system, regular progress tracking with GIS, involving communities in project progress tracking, and mapping and updating data in the system at all levels of project implementation, had a great impact in ensuring that the projects achieved their project goals.

It was worth noting that factors of GIS data integration like having a single database accessible by everyone, involvement of community members in community asset mapping, participatory GIS beneficiary mapping, linking of data form multiple sources, and planning by use if integrated monitoring data, all significantly affected the performance of community development projects.

It was recommended that during project design phase, GIS progress tracking should be factored in as one of the key activities to be implemented with emphasis to ensure good performance of projects. There is need to organizations to be agile in GIS technological advancements and adopt real time progress tracking of projects by use of GIS technology for proper tracking of progress in terms of impact, cost and addressing any challenges. Also, GIS needs to be fully integrated in conducting data quality assessments and supporting data monitoring and clean up to verify information periodically.

GIS data integration should be adopted for all community development projects to ensure that all data is centralized for ease of access to the project implementation team and stakeholders. The government and development institutions to continue integrating GIS data to online platforms such as Google Map for ease of sharing with other partners, and the community on the state of implementation of projects.

Recommendations for further study

This study focused on how GIS progress tracking, data integration, information sharing, and data management affected performance of community development projects with emphasis on projects implemented by a non-governmental institution. Future studies can be done on how GIS integration in M&E can improve performance of projects implemented by the national government and GIS integration in sustainability and transition planning for community development projects.

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