Towards high-impact community-based projects through data-driven monitoring: a case study of the Community Service Centre at Strathmore University

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Abstract

Over the year's philanthropic spirit has been on the rise across the globe. The gesture has enabled community outreach make strides in impacting and uplifting the livelihood of poor stricken nations and communities. A lot of projects have been funded and executed to completion successfully and commissioned to and opened to the public to serve the community. When a sustainability checks are conducted on whether projects are still useful to the community members you always find that their projects are under-utilized or not running at all. This study was aimed at finding an appropriate approach to come up with a community-based analytics tool that is a web-based system to help oversee and monitor project progress in order to achieve high impact community-based projects. In order to achieve that a myriad of surveys and analysis of the feedback collected along was conducted in order to see if the projects being done were on course and in line with the initial goals upheld and chances of adoption once completed were high. The Web-Based information system was developed using standard HTML5, CSS3 and JavaScript. The REST API was developed using the Go Programming Language. The PostgreSQL database management system was used to persist the data in a relational database. The community feedback provided by the community via the analytic tool helped the stakeholders converse and if necessary, the project was re-routed for optimality and usefulness to the local community hence helping the community spearhead their journey towards sustainability.

Keywords: Analytic tool; high-impact; community-based projects; surveys and analysis

Introduction

Community-based organizations have been of high significance to the lives of the local Kenyans since it tends to help them achieve at least one positive milestone in their life by just being active and collaborating with local community members.

According to the National Council of Community-based Organization which is a national Umbrella boasts of over 15000 registered Community-based Organization spread across over 59 constituencies spanning across Kenya. This pointer informed us on how Kenyan communities were trying to come up together to utilize positive synergy by starting and

implementing sustainable projects within their backyard to achieve important Sustainable Development Goals (SDG) for their families and communities.

In Kenya every year most of this community-based organizations had embarked on various projects some had been completed and successful while others were complete but failed to meet the intended success metric, others failed even before completion, Others were due to un-accountability and mismanagement of funds channeled to aide them.

In light of the above concerns suggested that there was a need for them to have a proper way on how to collect, record and analyze data related to various projects for easier monitoring and tracking. This is done in order to deduce better base points for an informed decision-making process and to find out what mistakes had been done by analyzing a graphical interface that showed a clear illustration of the progress of each project. This was adopted over the traditional way of record keeping mostly in written in books to a better approach that had visuals and analytics on the progress of the projects.

The proposed solution was to develop a web-based platform that Community-based organizations can register their projects i.e. nature of the project and funding, set important dates for the projects, Initiate the projects, monitor and track the them through a well clear and concise dashboard with visual analytics.

We propose to come up with an Information System for management of the progress of the various projects undertaken by CBOs. The information system was to be used to keep track of specific projects from those that are underway to those that are complete. Beneficiaries will be able to give responses on surveys involving the projects that affect them directly. CBOs will be able to add, edit, delete and read project data.

Records were to be presented using clear and well thought visualizations for example using a chart or a line graph. Good visual graphs were on the web dashboard that showed the progress of a particular project. This helped managers and involved stakeholders to be able to drive meaningful insights that helped make better decisions in order to end up with useful projects for the community.

The remainder of the paper is organized as follows. Section II presents the methodology applied in the research. This includes software development life cycle (SDLC) methodology, as well as a description of the research site and the sample analyzed. Section III starts by introducing the reader to the technology involved and builds up on this introduction in order to present the results of the research. Finally, Section IV presents a discussion to conclude the paper.

Research Site

The Strathmore University Outreach Program is a family of Strathmore University fraternity who have a passion for service to the society. The office works with various Community based organizations and Homes by lending a hand where possible through the University funds and donors from well-wishers such as students and staff. The office also facilitates

community projects in various marginalized communities around Kenya for example by facilitating construction of a needed library for a school or a dormitory.
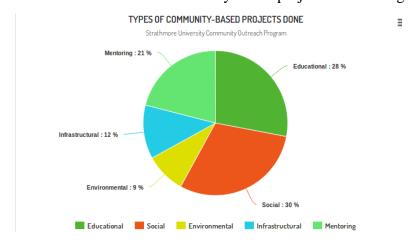
The intention was to liaise with the coordinators of Community Outreach Programme for useful insights on refining the ways of measuring metrics by getting valuable information. The provided information was tested within web-based monitoring tool and it will be refined over time by reengineering the requirements and iterating the development of the application to enhance usability and increase usefulness in a real working environment once it is in production.
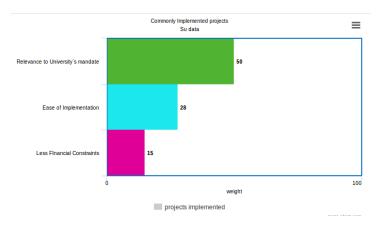
B. Sample

We interviewed coordinator at the Strathmore University community service center and this is a sample of data about how they deal with community-based projects. The objective of collecting this data was to identify the key data needed to be analyzed to inform better decision making and developing the information system.
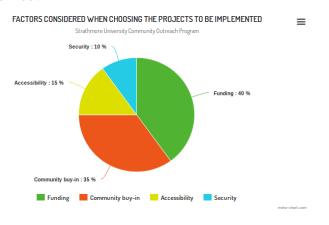
I. SAMPLE INTERVIEW GUIDE

What are Some of the community-based projects that the organization is engaged in?

TYPES OF COMMUNITY-BASED PROJECTS DONE
Strathmore University Community Outreach Program

Mentoring : 21 %
Educational : 28 %
Infrastructural : 12 %
Environmental : 9 %
Social : 30 %

Educational   Social   Environmental   Infrastructural   Mentoring

What are the most common projects highly likely to be implemented by the community service center?

Commonly Implemented projects
Su data

Relevance to University's mandate — 50
Ease of Implementation — 28
Less Financial Constraints — 15

weight

projects implemented

What are the factors that you consider when deciding which projects to implement as an office?

FACTORS CONSIDERED WHEN CHOOSING THE PROJECTS TO BE IMPLEMENTED
Strathmore University Community Outreach Program

Security : 10 %
Accessibility : 15 %
Funding : 40 %
Community buy-in : 35 %

Funding   Community buy-in   Accessibility   Security

meta-chart.com

The above chart shows the factors considered as weighted in percentages out 100%.

How do you measure the success rate of community-based projects?

The success rate of community-based projects is measured based on the following factors

1. Having base-line surveys
2. Frequent project monitoring and evaluation.

How do you guarantee the sustainability of community-based projects?

By ensuring that the community participate and own the projects

Ensuring accountability and transparency while undertaking the projects and proper governance.

Through close monitoring and evaluation of the projects progress to ensure that they are in line with the community goals.

How do you receive feedback from the beneficiaries of the projects you implemented?

1. By oral interview to the community.
2. By documenting reports and questionnaires filled.

Do you conduct follow up meetings with the beneficiaries of the projects?

Yes, normally the projects are adopted for a period of 3 years.

If yes how often do you conduct these follow-up meetings?

For social activities, minimum of 3 times a year. For mentoring projects it's a bit difficult to measure but mostly annually.

What challenges do you face as an organization with regards to implementing high impact projects?

Project Funding

Ensuring and sustaining community participation.

Embezzlement of funds.

Results

Challenges that Cause Low Success Rate of Community-Based Projects

Governance Efficiency in CBO Operations

Governance relates to processes and decisions that seek to define actions grant power and verify performance [8]. Poor governance has been experienced all round not only CBOs but also big NGOs. Lack of knowledge of what is expected from each member of the committee is a substantial drawback that indicates they lack full mastery of what good governance is.

Funding of Community-Based Projects

Nowadays one of the main challenges that CBOs are facing tends to deal with financing of various projects. As norm Community-based organizations rely on resource mobilization to fund its daily operations. Finding access to donors sometimes becomes challenging, if they do find donors finances might be constrained. In addition, the project being funded might be long term and continuous funding may become a challenge also.

External Interference on Running of CBO Activities

Lack of smart resource mobilization at times becomes a challenge. Most of the time the CBOs fail to acknowledge donor opportunities locally available for funding and pursue national or international donors [10].

Also, CBOs strive to suit donor's preference with the fear of losing the funding which in turn makes them loose track of the priorities of a particular project leading to completion of projects that are different from the initial proposed projects thus not sustainable to the local communities.

Most of the CBOs lack basic resources such as furnished offices and Computers. This may make the community they are representing not take them seriously [2]. They lack a decent

meeting place and proper equipment for keeping project progress records. Thus, compromises proper report documentation, correspondence and project proposals [12].

Importance of Data

The essence of a particular project is to be successful in the long run. During the execution of a particular project there is lump sum amount of data generated along the way from the project specifics and details to task and activities data, also milestones and important dates data, community feedback on the quality and impact data.

In today's world data is an important asset that when studied carefully by the management can unearth meaningful insights that might greatly influence the decision-making process of the management for a better service delivery in the future.

In this research project we decided to develop a robust application which will be able to capture all the important data relating to community-based projects, also be able to expose the data to external and specialized business intelligence and analytics tools for further data processing and customization of visuals in order to come up with descriptive and meaningful insights that can inform decision making for both present and future projects.

Data Processing Technologies Used for Analytic Visualizations

There exists a numerous number of tools that can be used for visualizations and analytics such as Microsoft BI is an analytics tool that is widely used for analysis and visualization of data [6]. Others include Tableau which has an open-source version of the tool which is free for use [2]. Highcharts is a JavaScript tool that is used for creating powerful visualizations that are real-time and embeddable in web pages. This makes the dashboard interactive and real-time and therefore it becomes easier to make sense of the existing data and once data is fetched from the store changes are instant and can be presented in numerous graphical shapes such as Bar Graphs, Histograms Line Graphs and Pie Charts. Highcharts library is easily customizable to suit the developers need based on what he needs the tool to do in relation to the data provided [7]. With a robust application programming interface that conforms with representational state transfer of data one can be able to feed the various analytics and visualization tools for further business intelligence-oriented ways.

Also, Matplotlib is also an open-source visualization library. The library is written with the python programming language [4]. It has a lot of similar functionalities to those of the Highcharts library.

Data Used to Measure the Success Rate of Community Projects

For the likelihood of projects to be considered successful there are a number of success metrics laid out. The metrics vary from project to project since there are different number of variables involved in each project. During this research the following key metrics we observed.

(i) Beneficiary Involvement

It's quite a wise approach to involve the community that the project is intended to serve for a couple of reasons. First of all, only the beneficiaries clearly understand the priorities more than any other party. It is therefore necessary to involve the beneficiaries of the project within the community at every stage of the project life cycle. For example, during evaluation stage a survey may be carried out by the management to gather meaningful requirements from the beneficiaries themselves. In doing so many of the beneficiaries will be more willing to give honest feedback and actively participate in every stage of the project lifecycle since they feel a sense of ownership since the project is part of their ventures they are involved. Lack of beneficiary participation in the projects affect project sustainability in the long run [12]. Data collected on the various aspects of beneficiary involvement throughout the project lifecycle recorded as survey may be beneficial in decision making to whether the project was impactful and likely to be sustainable to the community in the long run. It is ideal to consider a methodology to capture the beneficiary opinions and sentiments and also involve them in the whole process since it will guide the community-based organizations on a more optimal way to deliver projects that are sustainable to the livelihoods of the immediate beneficiaries.

(ii)Proper Funding

Funds availability are at the core of the project's minimum requirements. Local CBOs prefer to wait for national and international donors since they lack resource mobilization skill set. Most projects need a lot of raw materials which vary over a period of time [8]. Many CBOs also require monetary resources to acquire or train the proper skill set for proper capacity building within the communities. A well laid out financial request plan and all the materials to be used attached to a particular price tag is vital data needed that can be beneficial for analytics.

(iii)Strategic Planning

Failing to plan is planning to fail. The CBOs ought to come up with a detailed plan on what is needed for each phase of the project. A proper breakdown of the timelines of a particular project and the needed deliverables for each milestone of a specific phase in the project lifecycle. This data will be beneficial when conducting analytics.

(iv)Leadership and Organizational Structure

Leadership is a vital role within the CBOs. It is important to have dedicated personnel who are the drivers of change and are conversant and passionate with working on community projects. Skills and knowledge are vital specific areas that affect CBO operations thus influencing the sustainability of the projects [9]. If there is a proper management team they will be able to acquire the right skill set for a particular team required for each project. With

data of the availability of skilled personnel per team assigned to a particular project will likely influence the success of a particular project.

A Web-Based Predictive Analytics Tool for Monitoring Community-Based Projects

The research was to come up with a web-based platform for CBOs management and stakeholders. The platform will be an interactive dashboard which will contain web pages that have graphical summary of various aspect of a project for instance the project specifics which encompasses tasks of a particular project, activities breakdown of a particular task, assignment of various employees to conduct various activities.

Also, availability of team and role management of various stakeholders involved in a project. In a specific web page of a particular project there was information relating to the project and also an indicator of the status of the project of the project whether ongoing or finished or stalled.

If finished there will be a summary of various success metrics such as number of milestones met in time, timeline completion of activities and various tasks on a dashboard showing the state of the project in relation to the metrics outlined. There will also be a web pages for data collection i.e. Project module, Task Module, User module and a Team and Role Management module and also employee module.

Discussion

Test Cases

We conducted unit and integration test via a Circle CI a test, integration and build tool that was triggered to run once I pushed my codebase to my online GitHub repository.

We used a tool called codacy available on GitHub. It performed code quality checks such as commenting and naming of variables, functions, Interfaces and Struct. It also warned me of unused import packages.

The following functionality tests were conducted based on various use cases in the information system. For each particular use case testing we used either success or failure as an indicator of the status of the tests.

Table 1 Authentication Test Case

Identifier	1
Test Case	Authentication
Description	User performs login using email and password
Utilized Use Case	Login interface

Results	Successful login and session set up
Verdict	success

Table 2 Project Setup Test Case

Identifier	2
Test Case	Project Setup
Description	Adds a project, assign tasks to a project, assign activities to various task and assign employee and project managers to a particular project.
Utilized Use Case	Project, Task, Activities and Employee Dashboards
Results	Successful login and session set up
Verdict	success

Table 3 Role Management Test Case

Identifier	3
Test Case	Role Management and Team setup
Description	Adds a user, an employee, various roles and also the add Project Teams.
Utilized Use Case	User, Role and Team Management Dashboards
Results	Successful login and session set up
Verdict	Partial success

Table 4 REST API Test Case

Identifier	4

Test Case	REST API
Description	Authenticate API request via json web tokens, perform CRUD via http request on the API endpoints.
Utilized Use Case	API
Results	Successful REST API http request test
Verdict	success

Findings

The research was done with the aim of finding out how to manage and monitor community-based projects better for maximum impact to the various stakeholders involved or affected.

There are various issues that arose as the research project was being conducted. The information system codebase evolved over time. Initially I had designed the API alone then the User interfaces alone, but we encountered challenges when trying to compile the codebase for testing, integration and then deployment to the server. A lot of dependencies were needed to accomplish a successful software shipping to production, some of these dependencies broke along the build process and it was really had to debug the codebase.

We decided to remodel the information system to support native html package templating engine on top of the REST API so that the data could be exposed to analytics tool via the API endpoints and also support CRUD and monitoring the community projects within one unified HTML interface dashboard. In doing so it helped us reduce the need for much dependencies when building and compiling the application. The outcome was immensely positive since it was easier to run unit tests, integration and code quality checks since the codebase compiled to a single binary with no need of external dependencies thus improving the build time due to faster compilation time.

We were able to deliver a well-designed Business logic backend for the web application. Also, usable user interfaces for the end users of the information system. Some of the proposed solution was met is that the users were able to track the projects and all the required components to manage a project efficiently with the help of modules such as Task Management, Activity management, Milestone Management and also Team and Role Management.

Having setup, a robust Web Application Programming Interface with the best REST Standards and also providing the needed endpoints. The next phase would involve designing of client application that has proper tooling for visualizing the data stored in the database management server. Also, we are considering adding a visualization module dashboard using the support vector graphics embedded on the dashboards` webpages. Another future plan is to

reuse third party survey platforms to run the survey campaigns among the community members, thus we will just need to tap into the API and fetch the data into our visualization dashboard instead of reinventing the wheel by recreating the survey module thus practicing software reuse.

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