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Leveraging Technology for Sustainable Elderly Support: Automation of Social Assistance Grants Empowerment (SAGE)

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Business Process Reengineering
Systems Development
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Social Protection

Abstract

The effect of integrating information technology in Business processes Reengineering of Social Assistance Programs in developing countries like Uganda has not been fully studied. Social Assistance programs have continued to grapple with business process challenges during service delivery. Social assistance grants empowerment is the Uganda government's social protection programme that supports the elderly with direct income. It, however, encounters several challenges that this paper addresses by leveraging technology. Using business process reengineering, design science methodologies, and Bizagi Simulation tool, the Complaints and Grievances (C&G) sub process was reengineered, new models were designed that informed the development of a mobile and web applications to automate and improve the process. Further, simulation results from two scenarios are presented to compare old and revised models. The revised model exhibited improvements where a case is resolved in eight days compared to over two months in the old case.

1. Introduction

In various sectors and disciplines, Information and Communication Technology (ICT) plays a critical role in Business Process Re-Engineering (BPR). Social Protection Assistance programs for vulnerable groups, such as children, persons with disability and the elderly in developing countries, is one of the areas in which ICT can play an important role in enabling BPR for improved service delivery and overall wellbeing of beneficiaries [1]. Information technology is an enabler of changes in the process performance [2]. However, fewer studies have been conducted to understand how the use ICT can improve business processes in the context of Social Protection Assistance programs

that target to support the elderly in developing countries [3, 4]. As a result, social protection programs are riddled with a myriad of business process challenges leading to poor service delivery and overall wellbeing of vulnerable target beneficiaries [3, 5].

Clear understanding on how to use information systems driven by model driven BPR methodologies to successfully implement business processes of social protection programs will improve social protection service delivery in developing countries, such as Uganda [6], while creating novel approaches to reach vulnerable groups. The current study aims to use a model-driven approach for successful use of information systems in business process reengineering of social protection assistance programs in developing countries. Consequently, a best practice is created that will drive subsequent efforts for serving the undeserved and underserved vulnerable communities.

Social protection is a vital national development strategy for supporting social inclusion of vulnerable people in both developed and developing countries. Uganda, through its Social Assistance Grants for Empowerment (SAGE) programme, provides monthly monetary support to elderly citizen above 85 years as direct income. It is a social protection effort by the government to reduce poverty in line with the sustainable goal 9, i.e., fight poverty, and improve the well-being of the elderly.

SAGE supports inclusive and sustainable growth by raising household incomes, fostering productivity and human development, and boosting domestic demand [7]. The programme serves the elderly whose population is close to 1.6 million (5% of Uganda's population), expected to increase to 5.5 million by 2050 [8]. However, the programme has encountered operational challenges that could constrain its success and impact in future.

Interviews with key stakeholders such as the beneficiaries and members of the SAGE implementation unit revealed several challenges: missed payments, beneficiaries missing on the payroll, delay in addressing complaints and grievances, and lack of a formal mechanism to track raised complaints or even know the status, lack of quick communication mechanism between beneficiaries and implementation team, among others. These challenges, if not addressed, threaten programme existence and deter its sustainability [9, 10].

Beyond the process-based challenges, the lack of process automation and supporting technologies creates delays, deadlocks and lack of progress during process execution. The current technology support is a Management Information System (MIS) whose support is limited to only data storage services. The database is not scalable to accommodate and support load balancing as load increases with tasks. Moreover, operational demands, such as seamless access to data, were not supported. SAGE challenges are exposed by Ugandan newspapers reports showing disabled beneficiaries carried on wheelbarrows for longer distances to disbursement centers, incurring costs nearly half of the expected benefits [4]. COVID - 19 pandemic further exposed failures in operations where benefits could not be extended due to lockdown, a weakness that could have been overcome with existence of information technology (IT) support [11].

Therefore, this paper addresses the challenges following a process reengineering approach that underpinned the review and redesign of the SAGE business process. In essence, a model is created to embrace full stack technology to push SAGE services to the last mile towards the beneficiaries through mobile and web-based systems. The design of the systems followed design science method, a well-known information systems research methodology for accomplishing research that is artifact oriented [12-14]. The paper presents a rigorous process of systems development and resultant systems

2. SAGE Business Process

Following key informer interviews in addition to the priority matrix technique, the complaints and grievances (C&G) phase was considered a priority for intervention to create more impact and low hanging fruits. The challenges of the C&G phase, if mitigated, would result in ripple effect improvements to benefit other phases.

SAGE is implemented by the programme implementation unit under the ministry of Gender, Labor and Social Development, as a business process composed of several phases (Figure 1).

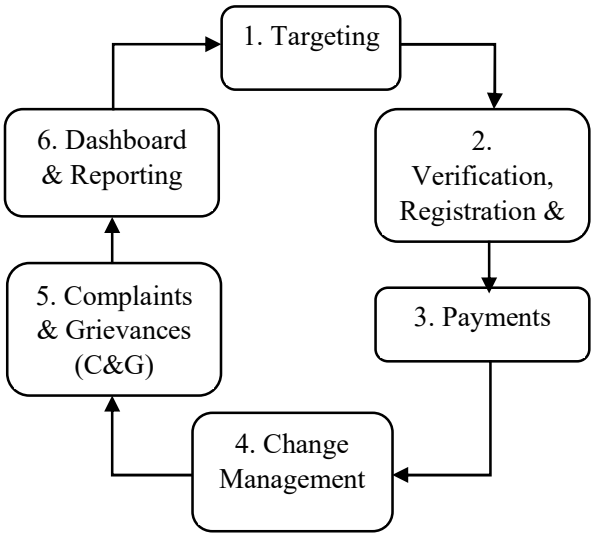

Figure 1:SAGE business process.

The complete SAGE cycle involves the following:

1. Targeting where beneficiaries are recruited to into the programme. Beneficiaries are elderly citizens above 85 years of age.
2. Verification, Registration and Enrollment: The qualifying beneficiaries are registered and enrolled to officially receive benefits.
3. Payments: monitory benefits are disbursed through a third-party service provider. The payment service provider (PSP) disperses workforce to the parish level where beneficiaries assemble to receive.
4. Change management: the phase caters for adjustments undertaken for registered beneficiaries. Changes are, for instance, beneficiary death, voluntary exit from the programme etc.
5. Complaints and grievances: the phase is used to manage beneficiaries' complaints from collection to resolution. Common complaints relate to payments.
6. Dashboards and Reporting: support monitoring and reporting to the government and other funders.

2.1 Traditional C&G Phase

This phase deals with collection, management and resolution of complaints and grievances raised by beneficiaries. Figure 2 illustrates the traditional C&G workflow, where a raised complaint/ grievance is received at the local level by a community officer. Complaints are raised by beneficiaries who fill out forms. Complaint forms are forwarded to the programme officer at the district where they are registered into the MIS database, verified and forwarded for resolution to the implementation unit head office or to payment service provider (PSP). A complaint may be sent back to the parish level if it is not clear or where it can be easily resolved. A complaint is payment related while a grievance is programme related in terms membership to SAGE. The process ends when resolved cases are archived.

2.1.1 C&G Operational Challenges

Conventional methods of pen and paper are used to collect complaints/grievances. These create delays in transmission and processing of complaints and consequently result into higher process turnaround time. Ordinarily, addressing a complaint required a period between three to four months from reporting to resolution.

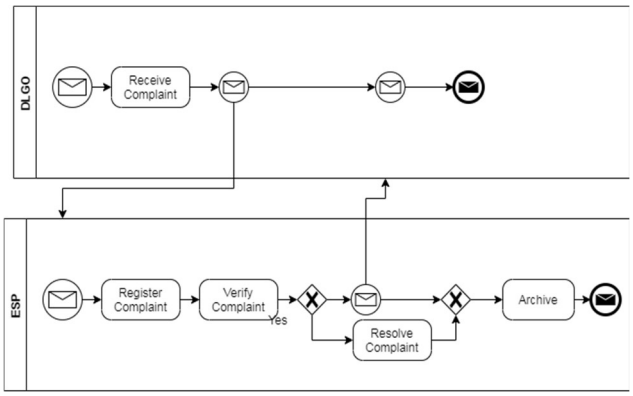

Figure 2: The As-Is C&G business process model.

With the enormous volume of complaints, it is evident that fewer cases would be resolved. Beneficiaries would remain disgruntled and affected. For example, if a complaint related to missed payment, the beneficiary would remain deprived until when the complaint is successfully resolved. Additionally, the phase lacked effective coordination structure which obstructed information required to track complaint progress or a mechanism to provide quick feedback. An intervention to subject the phase to process review and reengineering was necessary.

2.1.2 C&G Phase Intervention Propositions

Propositions at the C&G phase required application of reengineering techniques to facilitate technological integration. The intervention intended to reduce the cycle time taken to resolve a complaint/grievance to one week. This was to be achieved through phase automation through online/ offline mobile and web applications to support seamless complaints registration to resolution with speed, agility and flexibility.

Further, the intervention aimed at enhancing support to beneficiaries to track progress and status of raised complaints. Above all, the automated C&G phase integrated with workflow management tools to benefit phase optimization and permit efficient complaints management process through automated tasks like registration of new complaints, managing existing complaints, automatic escalation of unresolved complaints, tracking complaints progress, and supporting beneficiaries inquires, as well as enabling support for on-demand visualization, analysis and reporting of complaints/grievances for respective persons/departments.

To achieve the objectives of the study, both design science and BPR methodologies were adopted for the study [14, 15].

BPR describes the fundamental rethinking and radical redesign of core business processes to achieve dramatic improvements in quality, cost, and cycle time [16, 17]. Application of BPR methodology and integration of ICT to the C&G subprocess aimed to;

- Lower operational costs in the C&G phase
- Reduce cycle time
- Improve the quality of C&G resolution service and service competitiveness
- Achieve customer satisfaction
- Attain service competitiveness

The application of the design science (DS) methodology, on the other hand, supported the design, development and validation of mobile and web application tools for C&G automation. DS is a methodology well applied in information systems research, leading to development of artifacts relevant to community [14], [18-20].

Furthermore, After the redesign, both new and revised C&G process models were simulated using the Bizagi Simulation tool. Simulation enables use of models to replicate and represent actual systems, rendering an inexpensive way to test or predict expected behavior before actual implementation [21]–[23]. Simulation enabled a comparison of the outcomes from the two simulation scenarios, revealing more significant improvements in the number of C&G cases that can be resolved within a specific time [23, 24].

3. Method

Business process reengineering (BPR) methodology was adopted to analyze the C&G

phase. Hammer and Champy (1993) comprehensive model of reengineering was followed with four steps: mobilization, diagnosis, redesign and evaluation. This way, C&G phase was redesigned to create a new process model (Appendix A, Figure A.1).

Design science supported the design and implementation of the artifact [12, 14, 15, 25, 26] (Figure 3).

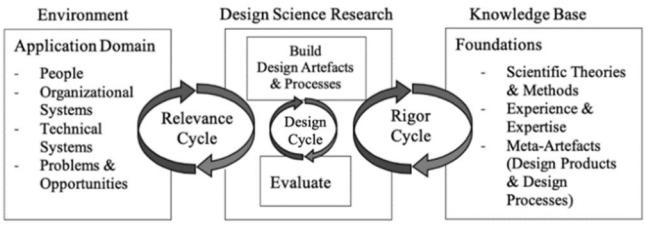

Figure 3: Design science research cycles [12]

The desire to improve the environment in which the SAGE programme is implemented motivated the need to solve the existent challenges related to C&G phase. Thus, the *relevancy cycle* of DS. The cycle too provided opportunity for evaluating the developed C&G model and resultant systems. The *rigor cycle* supported the link between the scientific theories with the knowledge of the industry experts. The research was conducted with a supportive team from the line government body, i.e., the Ministry of Gender, Labor and Social Development, SAGE implementation unit. The *design* cycle supported the actual construction of the artifact in form of the mobile and web tools for automation of the C&G phase. This cycle will further support the evaluation of the developed tools against design requirements.

The design involved specification and analysis of requirements for the systems design. The process involved interviews with stakeholders of the SAGE eco-system such as the beneficiaries, the implementation unit members, SAGE staff at the head office and field. Some of the key requirements were specified;

Functional Requirements: These composed the basic functionalities expected from the automated system during operations. Various features and functions necessary for the system to operate as intended are described with use cases and stories.

a. Permit entry of complaints or grievances from the various sources such as suggestion boxes, SMS or web-based forms.
   - Use case – raise a complaint
   - User story - as a beneficiary I want a convenient mechanism where I can register a complaint.
b. Restrict submission of incomplete and invalid forms.
   - Use case – submit a complete complaint form easily.
   - User story – as a beneficiary I want to submit a complete complaint that cannot be rejected.
c. Enable email/SMS notifications upon case submissions to the officer in line of next action as well as the beneficiary.
   - Use case – get notifications for raised complaints
   - User story – as a beneficiary, I want to be assured that my complaint has been received / registered.
d. Provide input areas to write down complaint or grievance narration
   - Use case – provide a narrative of each C&G case
   - User story – as a beneficiary, I want to be able to provide detailed description of the complaint while I register it.
e. Notifications to SAGE operations Officer (SPO) whenever there is delay to take action or when an action has taken place for each case.
   - Use case – track case progress
   - User story – the SPO would like to be notified of the progress of the case being handled.
f. Permit automated categorisation of complaints /grievances to overcome wrong categories.

- Use case – categorise complaint cases with ease.
- User story – as SPO I want cases automatically categorised to avoid confusion.

g. Enable use of time stamps for workflow tracking and reminders for actions. by responsible officers
- Use case – Register complaint cases with automated time.
- User story – As a user I want to have all cases automatically time stamped.

h. Enable system generated serial numbers composed of beneficiary ID and other random numbers.
- Use case – For each registered complaint case, there is an automated reference number.
- User story – As a user I want to have a system-based reference number to track my complaint.

i. Capacity to support document scanning where documents need to be attached for evidence.
- Use case – Support scanning for any documents that may be required
- User story – As a user I want to directly scan required documents.

j. Integrate Ms. Excel to import and export data.
- Use case – capacity to import and export data to Ms. Excel.
- User story – As a user I want to be able to import data and export it to Ms Excel.

k. Support data analysis and visualisation
- Use case – Dashboards for data analysis and visualisation.
- User story – As a user I want to generate required data summaries and graphs and other visualisations.

l. Standardise complaint progress and status for tracking and reporting i.e., Open, Closed, Escalated, Resolved.
- Use case – standard compliant case status.
- User story – As a beneficiary I want to be able to check how my complaint is progressing.
- User story – As SPO I want to be able to check and report about the status of all cases.

m. Reports generated and or exported must include beneficiary details such as beneficiary ID and bank account.
- Use case – Each case should bear all beneficiary information/ data.
- User story – As SPO I want to generate and report on complete beneficiary data.

n. Role definitions and assignments to process complaint cases must be based on administrative and functional hierarchy but with permission to delegate authority.
- Use case – Limit full scale access to case date.
- User story – As SPO, I want to assign access to data by role and function.

o. Enable email notifications upon completion of case resolution to concerned parties like CDOs and beneficiaries.
- Use case – Inform complainant when a case is resolved.
- User story – As a beneficiary I want to be updated and informed when my case is resolved.

p. The source of collection of the complaint should be identified during complaint registration, e.g., walk in, RTSU or complaints box
- Use case – Indicate source of complaint during its registration.
- User story – As SPO I want to be able to categorise complaints according to their sources.

q. Include National ID and beneficiary serial Number in bio data section during the collection.
   - Use case – all beneficiary personal data should be corrected during complaint registration.
   - User story – As SPO I want to generate all legal data about beneficiary.

There are also non-functional requirements which included those other requirements that did not qualify to be the basic necessary functional requirements. However, they were deemed important for system operations. They were also deemed to determine the quality of service provided by the system. They included the following.

- Support for cloud operations where data is centrally store and accessed.

- Application should support both versions of offline and online. End users with in network coverage register complaints directly into the system while those in areas of no network or limited bandwidth can register complaints in the offline version and sync them while in an area of network coverage.

- User identity management to control access to data and system. The details should define user access provision and or restriction based on defined role hierarchy.

- Enable end user to check case progress status online using the C&G case serial number.

- Provide documentation for each section within the system as user guide and tutorials.

- End-user profile management for both beneficiaries and staff detailing a record of information such as bio-data.

- Enable complaint probing question checklist to be used by the complaint collector when investigating the complaint details from the beneficiary.

- The system should be compliant of the data privacy and protection regulations, both local and international.

- System should provide support feature for scalability and growth since the population of the beneficiaries increase at a more rate than its decreasing rate.

- The system should be easy to learn and use given the digital literacy levels of end users.

- System flexibility to permit future changes and maintenance.

- The system should be light weight and portable to accommodate low bandwidth levels, low-capacity phones and computers.

4. Results and Discussion

4.1 This Simulation Experiments

After the redesign, both new and revised C&G process models were simulated using the Bizagi Simulation tool.

Procedurally, two simulation scenarios were conducted. Scenario 1 was based on the old C&G subprocess while Scenario 2 was based on the revised C&G subprocess. The outcomes of the simulation process are presented in the results section.

4.2 Results

The simulation analysis conducted for the C&G phase provided comparative outcome. Scenario 1 analysis was based on real data from the currently running C&G business process. Several *what if* scenarios were used by varying temporal elements of the process such as time to reveal current performance levels. Based on each scenario, the simulation projections provide data that enables analysis and validation of the modelled 'as to be' C&G business process. The current C&G sub process upon which simulation is conducted is illustrated by the process model given in Figure 2.

Table 1. Scenario 1 scenario simulation outcome

Name	*Instances completed*	*Instances started*	*Min time (d)*	*Max time (d)*
C&G Sub process.	9	100	102.17	102.17
Submit to RTSU.	119	148	30	30
MIS DB entry.	62	62	2	2
Analyze, report & escalate.	53	62	10	10
Resolve Grievance.	10	15	15	15
Resolve Payment.	30	38	15	15
Feedback.	9	31	30	30
Follow Up.	31	40	10	10
Fill Form.	148	148	0.12	0.12
Assess & categorize.	100	100	0.04	0.04
Verify.	110	119	5	5

Table 2. Scenario two outcomes.

Name	*Instances completed*	*Instances started*	*Min. time(d)*	*Max. time(d)*
G&G Subprocess	52	61	8.21	8.38
Assess & categorize	60	61	0.04	0.04
Register C/G on the System	63	63	0.08	0.08
Verify C/G	63	63	0.08	0.08
Analyze. Report & escalate	59	60	1	1
Resolve Grievance	15	15	3	3
Resolve Payment	41	44	3	3
Give Feedback	52	54	2	2
Follow Up	54	56	2	2

Simulation scenario one was based on a period of 120 days, approximately 4 months. Outcomes show that it is not possible to address a single complaint or grievance within a period of one-two months. It further shows that within the 120 days, up to only nine (9) C&G cases would be addressed, and it requires a minimum period of 102 days to address a single case of C&G. Summarily, for every 100 C&G cases, only 9% of them are addressed. This percentage is very low compared to the volume of cases registered in the same period.

The SAGE implementation unit targeted to resolve all C&G cases within a single payment window of two months. The target formed the basis for simulation scenario two.

The C&G revised model in Figure 3 was subjected to time variations and constrained to approximately 2 months. Scenario one assumptions are maintained besides the period which was adjusted from 120 to 60 days. Scenario two outcomes are presented in Table 2. Outcomes show improvements in cycle time while optimizing resource usage. It further shows that within 60 days, 52 C&G cases out of 61 registered cases can be successfully resolved. Due to time constraints of the simulation, only 61 of the 100 cases can be *registered* while 52 complaint cases *resolved* to closure. Technically, for each C&G case, it requires a minimum of 8 days from collection to closure.

A comparative analysis of outcomes from scenario 1 and 2 reveals the value and justifies the rationale of subjecting the C&G subprocess to reengineering. It further shows that tremendous turn around shall be achieved when the entire SAGE business process is reengineered and supported through subprocess automation.

4.3 Discussions

The simulation outcomes indicate the role of business process management and its techniques towards business process improvement. The output from scenario 2 simulation indicate that the reengineered C&G sub process is more productive, realizing significant increase in the number of complaint cases resolved (52 out of 61) compared to scenario 1. On average, each case is resolved in 8 days. The improvement indicates that 85% cases

can be resolved in 2 months (60 days), compared with the old C&G process where only 9 out of 100 cases could be successfully resolved in over 100 days. The improvement is achieved through integration of information technology [27] and automation [28, 29] of some tasks of the sub process to facilitate quick decision making, fast information transfer, and easy adaptation to changes [16, 30].

Application of simulation provided low hanging fruits in terms of indicative value addition to the C&G sub process before actual service automation. It provided flexibility to develop variant models that were subjected to what-if scenarios while seeking to achieve specific targets from the sub process. Variant models arose from the redesign as alternatives that were compared against performance indicators. The resultant business process model informed the design and development of the C&G mobile application and web system. Figure A.2 under Appendix A is the system architecture upon which the development of the tools was based. System views and development tools for the system are appended as Appendix B (Figures B.1–B.7) and Appendix C, respectively.

The systems support collection, processing and reporting of the various cases. It further supports case categorization and progress tracking by both beneficiaries as well as programme implementers.

However, the study was phased where the entire SAGE business process was not reviewed due to time constraints. The future outlook of the study points in the direction of reengineering the complete SAGE business process and verifying its compliance to required regulations. Moreover, the developed tools are still subject to evaluation through subject matter expert workshops

5. Conclusion

Business process management and business process reengineering provide bigger lenses through which an organization can understand and assess its performance against key performance indicators. Moreover, BPR provides an opportunity for business process improvement through the use of ICT. The paper sought to improve service provision by leveraging ICT systems to extend services to the last mile of the underserved and underserved vulnerable groups.

The application of BPR to C&G subprocess supported its redesign for value addition to the entire SAGE business process. The value is demonstrated in terms of shorter process cycle time, automated tasks, quicker collection and access to data, and faster decision making among others. The study contributed to the national goals of IT integration into service delivery as per the national development plan III [34], fighting poverty in all its forms and Zero hunger as per the sustainable development goals 1 and 2, respectively [35]. The entire SAGE value chain is yet to be reengineered, while the developed tools will in the future be fully evaluated and deployed.

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CONTRIBUTIONS OF CO-AUTHORS

John Paul Kasse	ORCID: 0000-0001-9728-3817	Conceived the idea and wrote the paper
Charles Olupot		Supported the technical development
Edward Kabaale		Participated in the study
Claire Kaijaabwango		Provided subject matter information.
Samson Akol		Supported in systems production and development.

Appendix A

A.1. C&G Process Model.

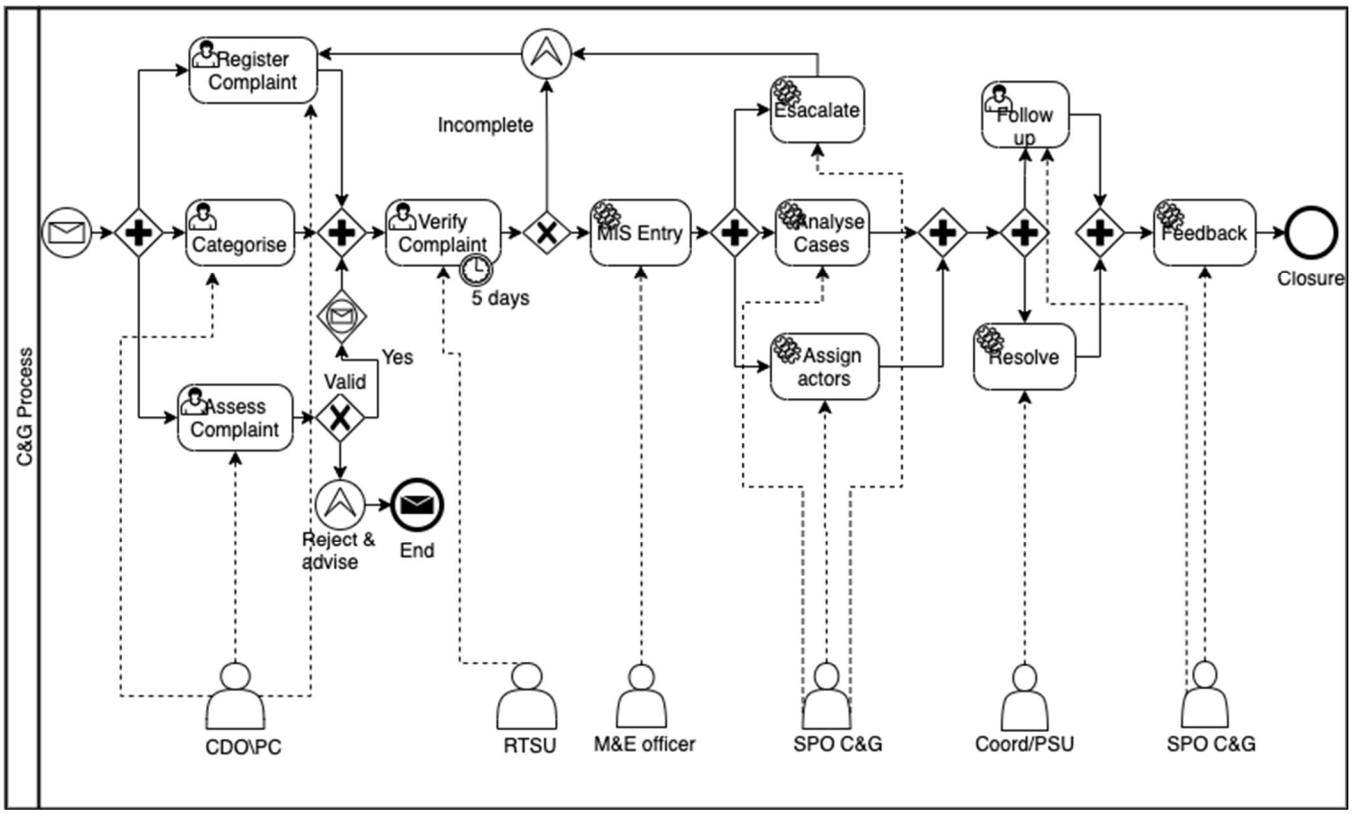

Figure A.1. C&G process model.

A.2. System Architecture

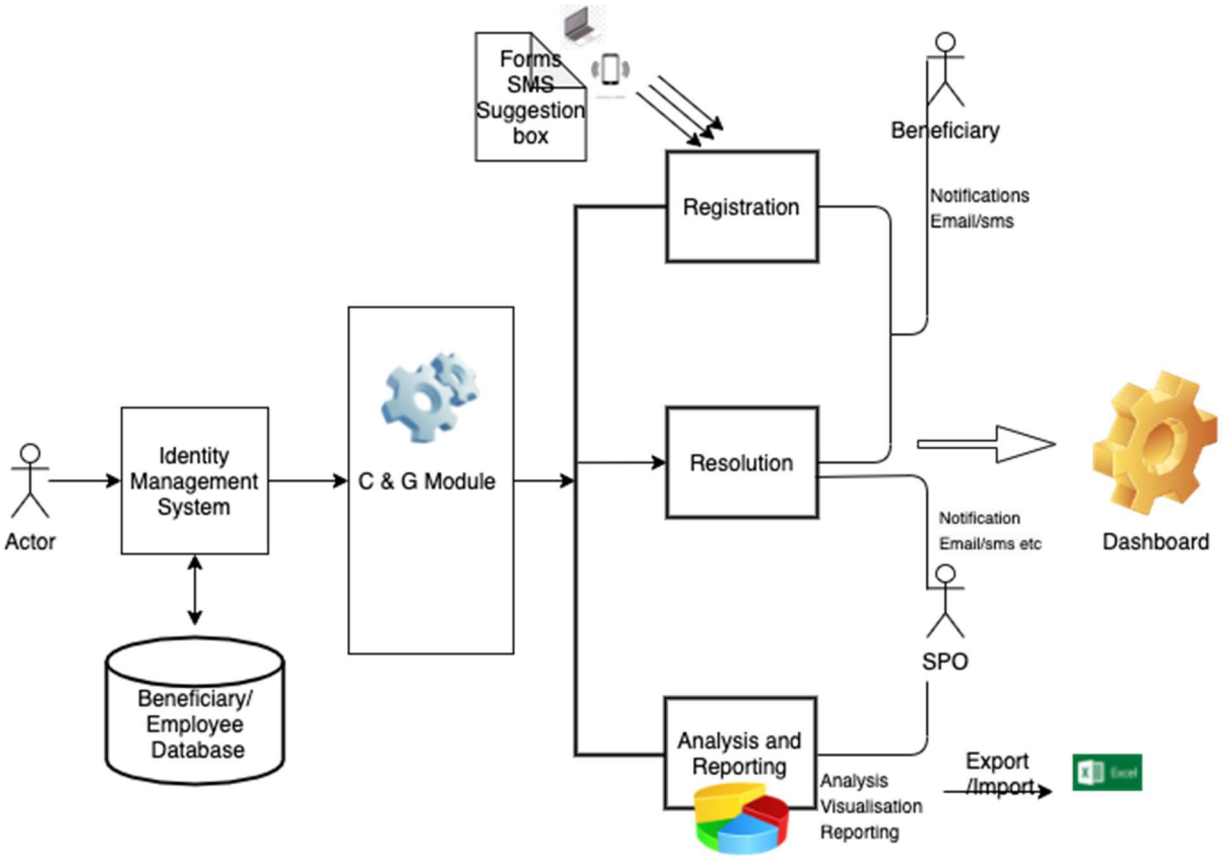

Figure A.2. System architecture.

Appendix B

B.1. System Views

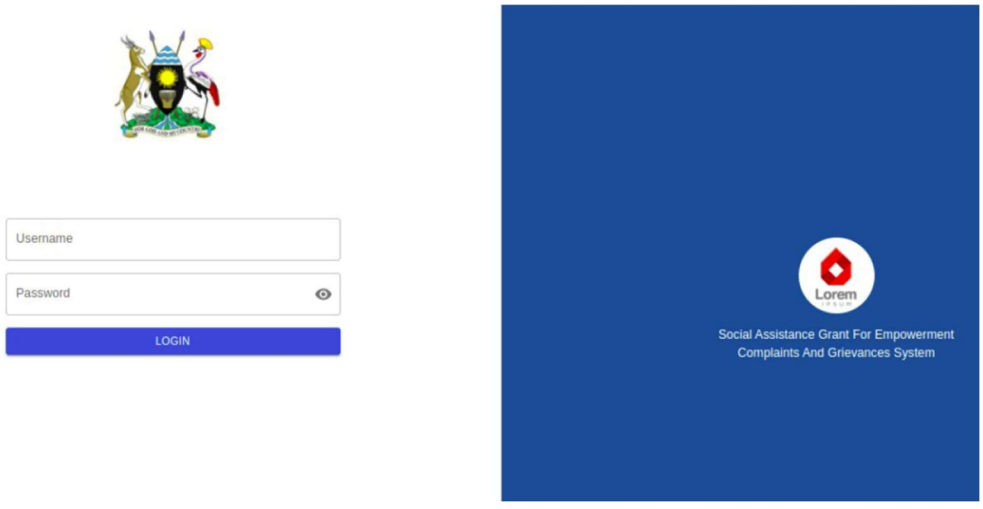

Figure B.1. Login screen.

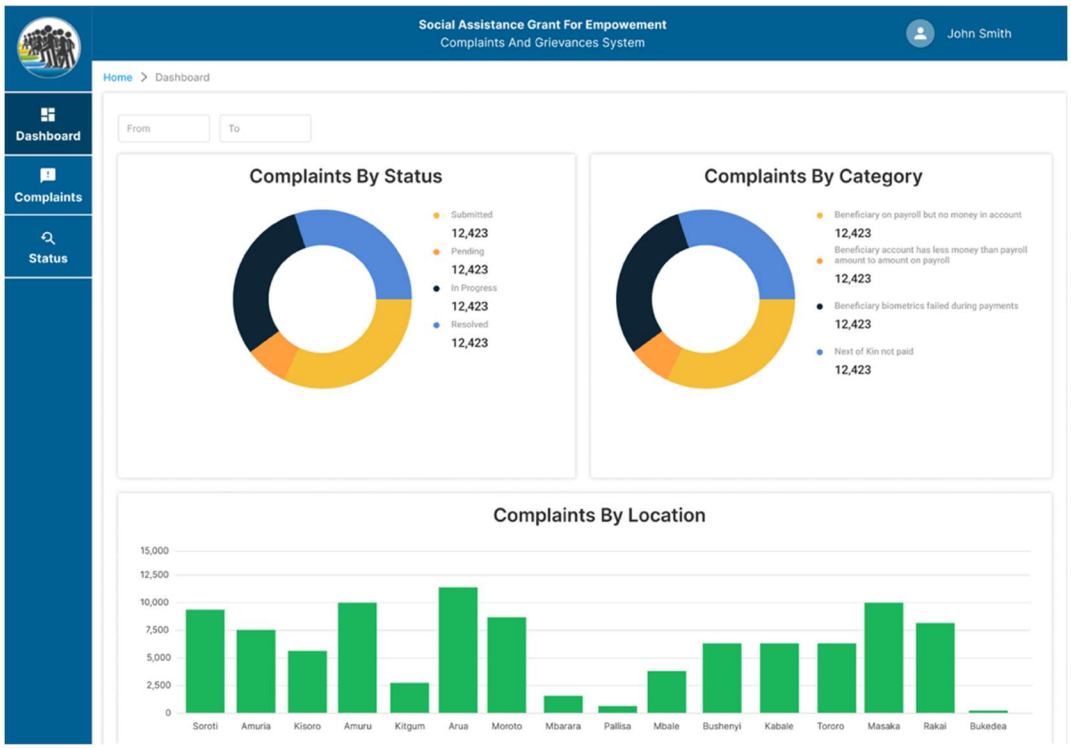

Figure B.2. Complaints Dashboard

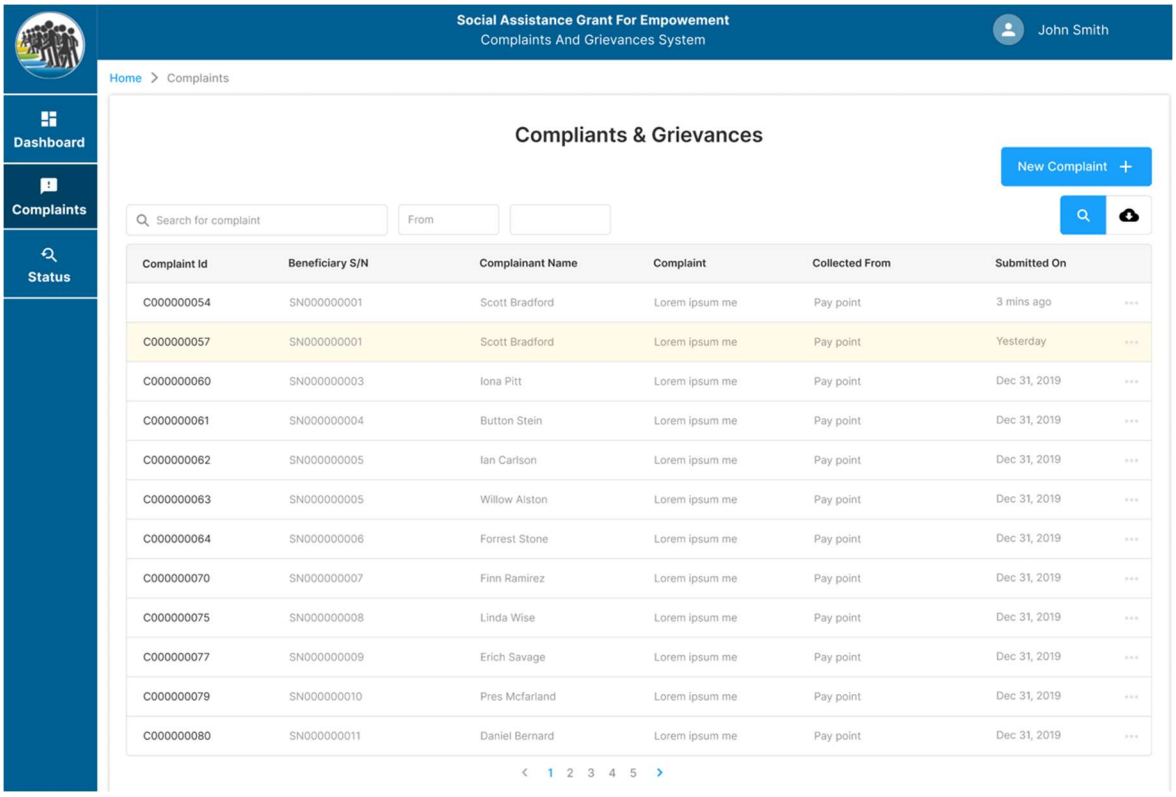

Figure B.3. Case List

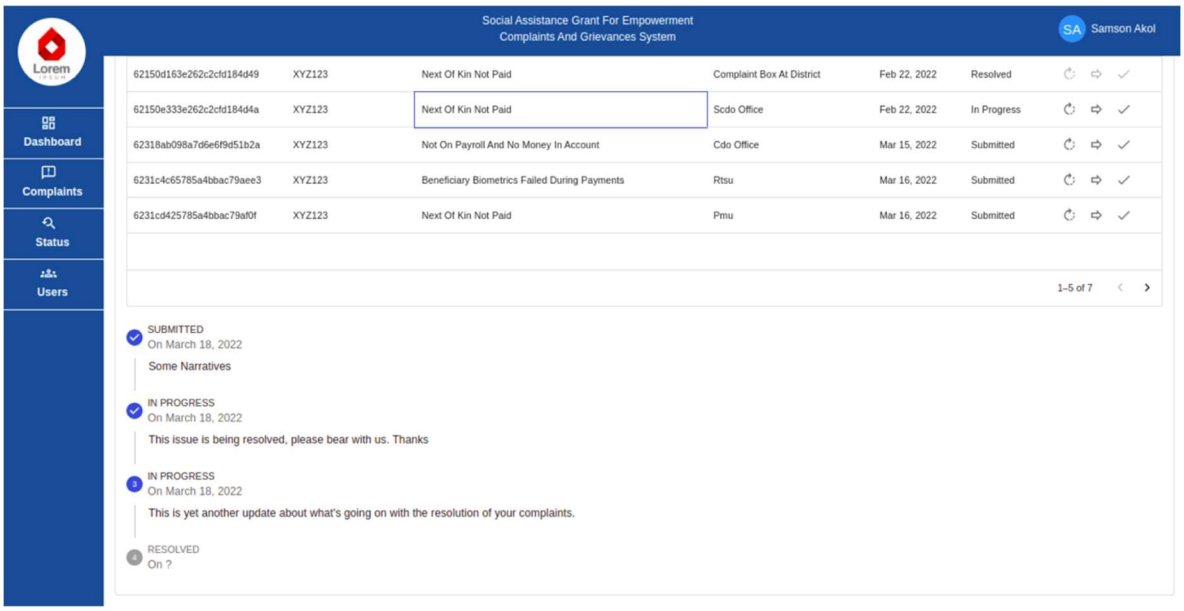

Figure B.4. Case status checking.

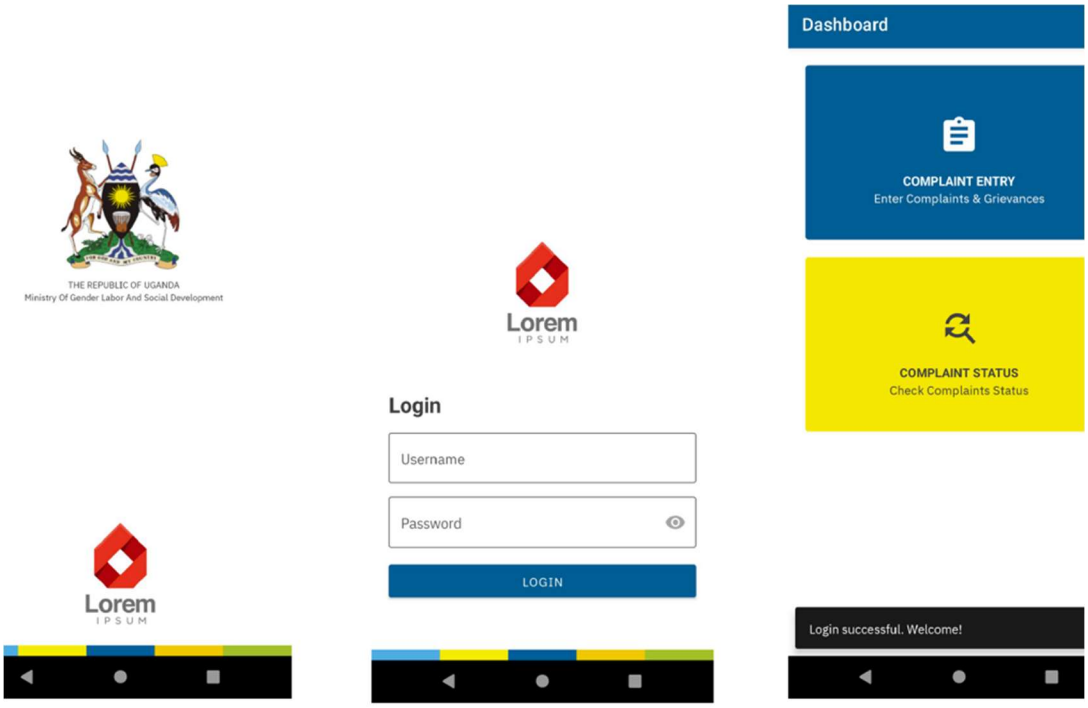

Figure B.5. Mobile App screenshots.

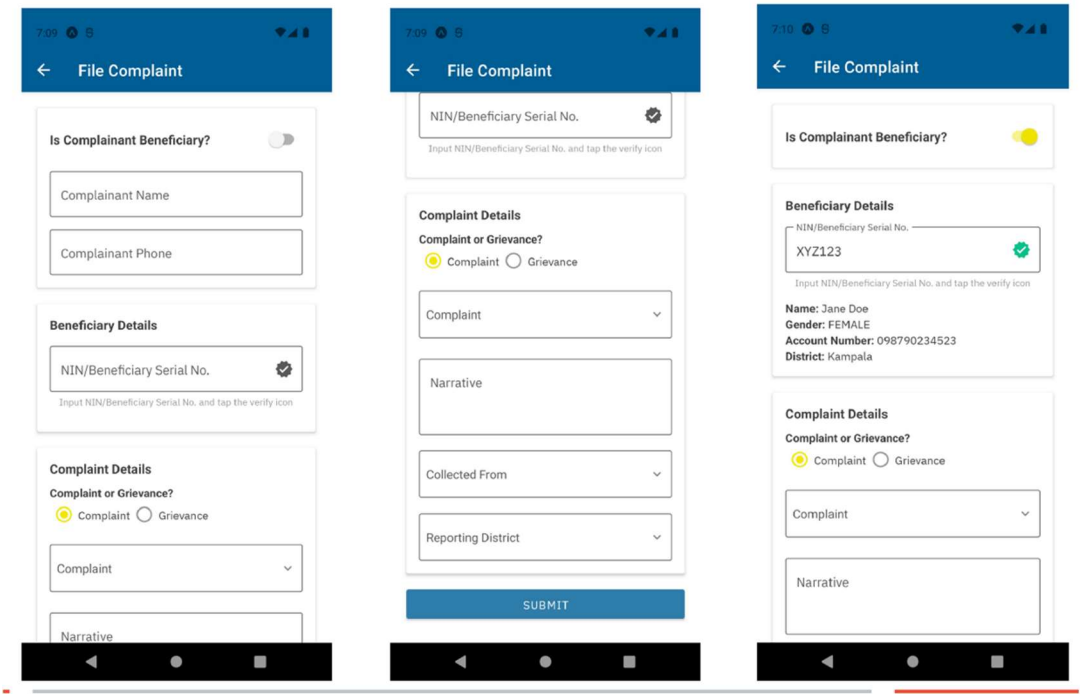

Figure B.6. Filing a complaint via mobile app.

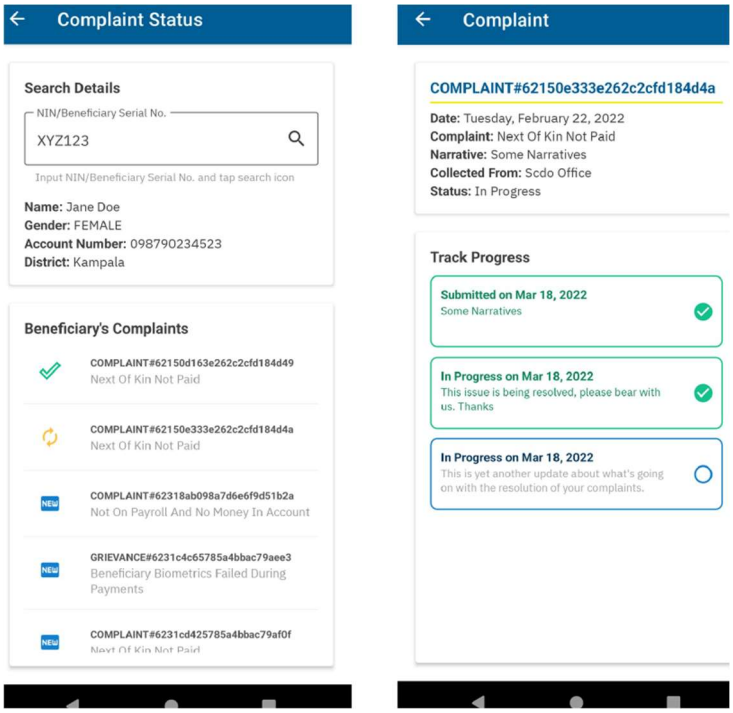

Figure B.7. Mobile App complaint status checking.

Appendix C

Tools Used in Production and Development of the System

1. User Interface Design
    - Figma
2. Web Server
    - Mongo Db - Non-Relational Db
    - Express Js - Server for web frameworks
    - Node Js - Framework used to build server-side applications
3. Web
    - React - Js framework for building web applications
    - CoreUI - React component library
4. Mobile
    - Native Android (with Kotlin and Jetpack Compose)

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