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Review Article

The Cooperative Society System Framework: A Goal Oriented Approach

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Abstract

ICT has led to innovations in various sectors of the economy, including cooperative societies. As a result of innovation, several cooperative systems have been developed, but they do not adequately and effectively meet the needs of various cooperative societies. In addition, their process framework does not embed a generic approach such that the peculiarities of different cooperative can be catered for. Therefore, this paper presents a generic systems process framework for the development of cooperative system using Goal-driven Development Process (GDP). The GDP draws from the principle of an iterative and incremental model with top-down and bottom-up convergence approach for the identification of goals and implementation. HTML and CSS was used to implement the front-end while the back end was implemented using PHP and MySQL. The system was evaluated by 24 stakeholders across 4 cooperative societies. The result showed 71.67% overall reaction to the software, 73.54% screen, 68.13% terminology, and system information, 67.01% learning, and 71.5% system capability with overall evaluation of approximately 70.4% user's satisfaction. Thus, the research presents a generic process framework that adequately captures the peculiarities of cooperative societies that software engineers will find useful in the development of cooperative software irrespective of the size and the complexity.

Keywords: Goal-Driven Process, Software, Cooperative Society, Process Framework, Business.

1. INTRODUCTION

Cooperative Society can be defined simply as an association of people with common economic, social needs and aspirations that unite jointly to own an enterprise that is being governed democratically (Karakas, 2019). A Cooperative Society is formed by two or more people across the low-income group. They are formed on the principle of togetherness, that is "we can achieve goals that none of them can achieve alone." Essentially, Cooperative Society engages in capital connections and procurement, as well as storing and distribution of inputs and promotion of commodities (Adedayo *et al.*, 2020). The growing need for necessities of life and credit facilities in different trades and professions necessitated the need to form a cooperative society (Adekunle *et al.*, 2021). In Nigeria, the Cooperative Societies Act of 2004 serves as the legal framework for the practice of the cooperative society (Coop, 2019). Different forms of cooperative that exist include consumer cooperative societies, producer's cooperative society, farmers' cooperative society, labour cooperative organization, processing cooperative organization, and storage cooperative organization (Yebisi, 2014). As much as cooperative societies have assisted the people and the economy of Nigeria to grow, it cannot work in isolation without the basic building blocks of the organization that improve strategies for business support which is Information and Communication Technology (ICT) (Silveira & Reis, 2022). ICT has led to innovations in various sectors of the economy, including cooperative societies. This industrial revolution led to the modern cooperative movement that adopt the use of technological hardware and software for the management of activities of Cooperative Society. However, report has it that those that adopted the technology only have the hardware device but failed in using the appropriate tools in the management of members and daily financial transactions (Oyebanjo *et al.*, 2020). According to the report of findings in (Prudentia Africa, 2018), it was ascertained that there is need for a cooperative management solution that bridges the available universal information and data computerization gap, as

most solutions used in Africa by Cooperative Societies are accounting solutions. Also, available software specifically developed for cooperatives are somewhat hard coded to satisfy the certain needs of a specific type of cooperative society. Examples of these are (Olorunlomerue *et al*., 2017) for registration of cooperative societies to aid government data collation, (Ogochukwu & Evans, 2020) for loan management, (Sakti *et al.*, 2018) for the dissemination of information to members of cooperative, and (Ogundugbagbe Augustine Taiwo, 2015) for members' online registration, application and tracking purposes and so on. The aforementioned software only caters to a few aspects of credit and thrift cooperatives and labour cooperative organizations. Also, to the best of our knowledge, there is no established process framework that provides the basis for the entire software process and set of activities related to cooperative software that can serve as a reference for software engineers. Hence, this study aims to consider a generic approach in the design of cooperative society's processes framework that will effectively capture the day-to-day activities and processes of cooperative societies. The study of daily activities of cooperative societies allows the identification of the operations of cooperative societies, the stakeholders, obligations, and their goals, as well as processes to realize those goals. As the process to realize goals is what differentiates cooperative societies, this work gives goal identification a great priority which has a great influence on the setting of requirements in the core process principle. According to (Laoyan, 2021), a business goal is described as a predetermined objectives that an individual or business intends to accomplish in a set timeframe. The goals identification gives clear pictures of the services, goal constraints and enables the assigning of responsibilities to agents (van Lamsweerde, 2002). The top-down and bottom-up convergence approach realizes goals based on the services, goal constraints specification, and agent responsibilities (Frenkel *et al*., 2021). Goal definitions are achieved by the top-down approach and the decision on the goal feasibility are achieved by the bottom-up approach through the provision of universal, reusable, and highly flexible component. Taking cognizance of the theoretical concept of top-down and bottom-up convergence, this work proposes a goal-driven process framework that implements software that captures the peculiarities of cooperative societies. Therefore, the establishment of an extensive foundation for software process and a set of umbrella activities in cooperative societies that software engineers can use as a reference point, regardless of size and complexity, to meet the needs of stakeholders underlines the novelty of this work.

2. PROCESS PRINCIPLE

In order to capture the activities of the cooperative society, a study was carried out on the day-to-day activities of four cooperative societies with a view to having a broad understanding of their goals and peculiarities, as well as the obligations of the stakeholders, that is the cooperative societies and members. As all the stakeholders have duties, and goals cannot be achieved individually, a goal with process oriented allows the discovery activities in business processes and sharing of responsibilities to efficiently achieve the desired result. Software development is a way of formalizing such supported business processes, which includes the entire activities right from conception to the final project delivery (Adeagbo *et al*., 2021). The Fig 1 shows the chart of activities based on the obligation of cooperative societies and members. This indicates that the required application for the management of day-to-day activities of cooperative societies is still far below the standard as indicated in the (Prudentia Africa, 2018) report. This chart, however, forms the bases that the proposed software lends credence to.

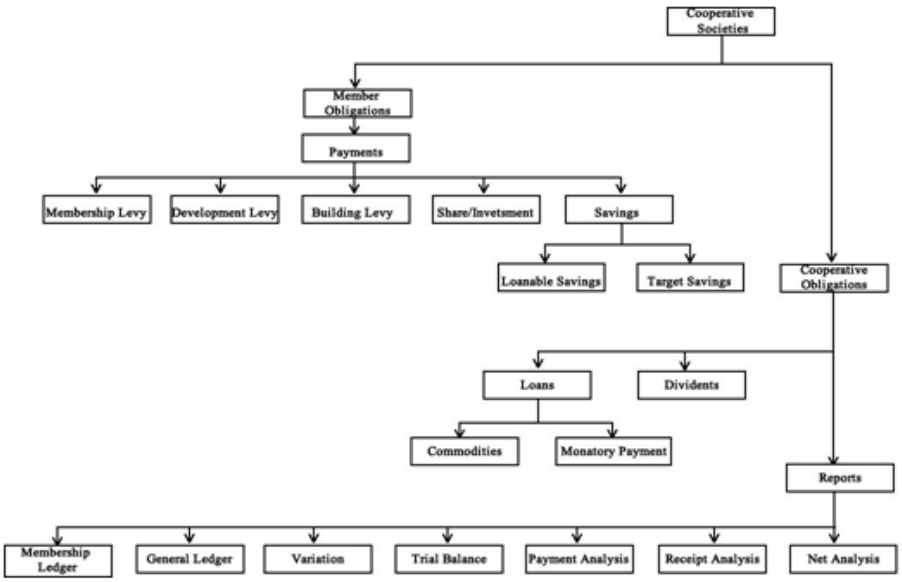

Fig 1: Cooperative and Members Obligation Charts

In the software development process, the first step is the system requirement. It contains the stakeholder's goal identification; services and constraints specification that actualize those goals; and assigning responsibilities to agents (software, human and devices) based on the drafted requirement (van Lamsweerde, 2002). The goal identification was given a great priority due to the peculiarity of the work, and the influences the core process principle will have in the setting of requirement. This is followed by the top down and bottom-up convergence that will take care of the actualization of goals based on service and constraints specification as well as agents' responsibilities.

2.1. *Goal Identification/Top-Down and Bottom-Up Convergence*

In Goal Driven Process, both collaborative goals identification and top-down with bottom-up works hand in hand (Schnabel & Pizka, 2006). The informal definition of stakeholder that intends to improve or change in the business environment is regarded as goal at the top-level. While top-down concern itself with the goal definition, the feasibility of the goal is decided by the bottom-up by providing generalized, highly flexible and reusable component. This involves collaborative work of both stakeholders and developer on the goals such that the feasibility will be known to the stakeholder and project developer having a grip understanding of the business processes. Therefore, collaborative identification of goals glues together the users' knowledge and the developers.

2.2. Goal-Driven Activities

In goal-driven activities, the first iteration processes are business goals identification and their priorities. It subsequently ends with running of the corresponding software version of the specified goals. The scope of the iteration process is extended in other software incremental development to include a memorandum of business objectives after each iteration. This is with a view that business objectives mature with the availability of usable implementation.

2.3. System Process Framework

In the process framework, the common business activities in terms of financial obligation and the processes related to each of the obligations are itemized. The financial obligation is regarded as the common business activities while the processes are seen as the peculiarities of different cooperative society. Examples of the financial obligations are membership levies, development levy, savings, loans, and investments. Also, the processes are agreed levy for membership/development, conditions for obtaining loan, numbers of surety, conditions for being a surety, the repayment period to mention but a few. These financial obligations are what go into the system design and development process while the processes go into the system configuration. Framework or architecture in software development helps to depict the techniques, modules, and how they interrelate (Adeagbo M. A *et al.*, 2019). The framework presented in Fig 2 depict succinctly the type of captured process in specific modules based on the entire structure, logical components, and how they interrelate, as well as other perceptions. It also shows that the activities can further be expanded in the future if the need arises to accommodate more business activities and processes.

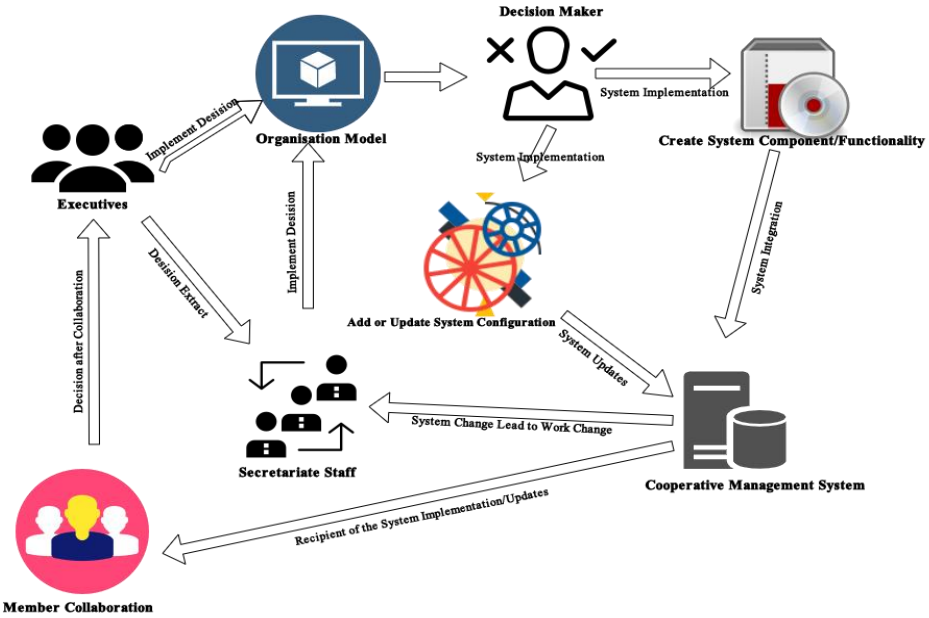

Fig 2: System Process Framework

This lay credence on the fact that the uniqueness and volatility of contemporary software requires modification of standard process development and making of adjustments as the need arise (Lee *et al*., 2020). This will help stakeholders in saving time, cost, and other resources when brainstorming on the development of cooperative software.

2.4. Implementation Strategies

In the actualization of the objective of the GDP in the implementation of the system process framework, the characteristics features of each obligation are identified and classified. These are embedded in the implementation process as presented in Fig. 3. This is with a view to converging on a workable solution such that the request and perceptions of users are met. Thus, the following steps are taken;

i. Itemizing the obligations of members and cooperative societies
ii. Understanding the characteristics features of all the obligations
iii. Classifying the obligation based on types, features, and process (increasing or decreasing) pattern. For instance, development levy and building are classified as fixed payment, target savings and loanable savings are classified as savings to mention but a few.
iv. Implementing the obligation that allows individual cooperatives to add or customize names of obligations, enables or disables obligations, and dynamically adds sub obligation. For instance, some cooperative further sub divided their loans into Emergency Loan and Big Loans. Some also categorized selling or buying goods for members as a form loan which is regarded as Commodity Loan.
v. Implement characteristics features that enable individual cooperative to add settings and adjust manipulated variables such as charges on loan, duration of payment, number of referees and so on.

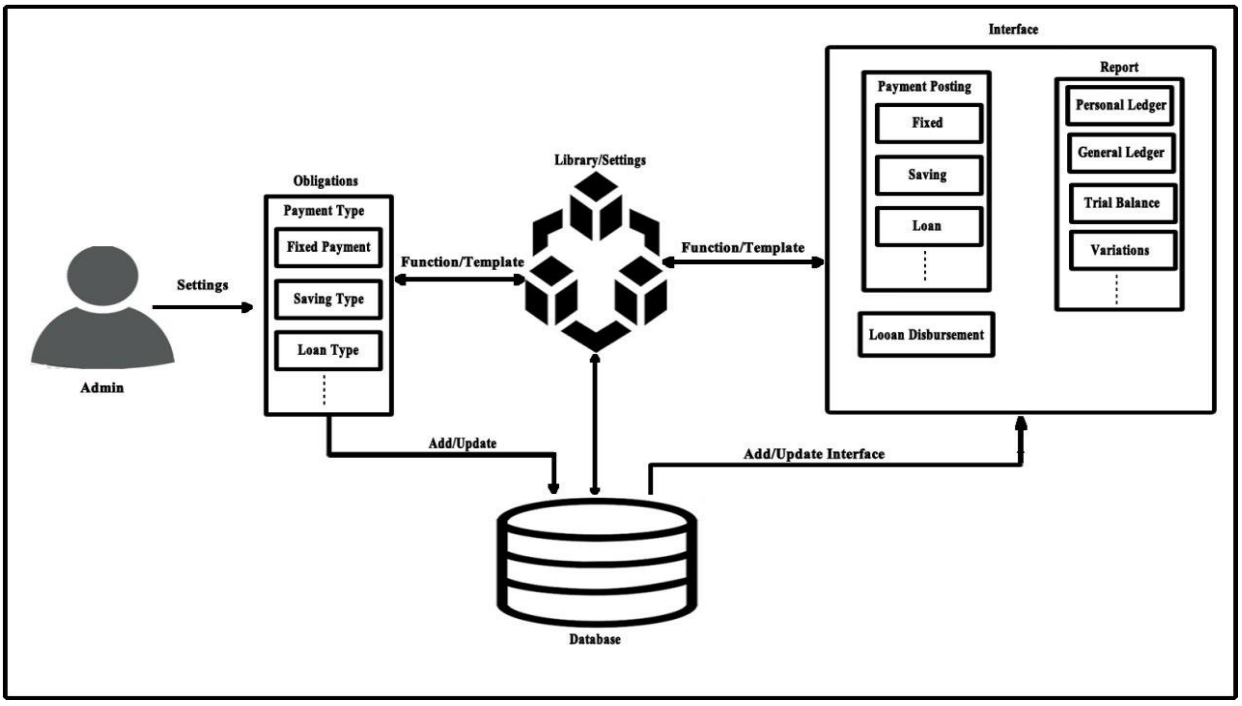

Fig 3: Implementation Strategies

3. RESULT AND DISCUSSION

All the steps in implementation strategies are fused into the development of software that automates the business processes of cooperative societies. HTML and CSS was used to implement the frontend while the back end was implemented using PHP with MySQL serving as the database storage. The administration menu provides the interface where admin can do some settings based on the policies that govern some cooperative activities such as requirement for loan application, withdrawal, fixed payment, application fee, number of guarantors, accounting year, parameters for loan repayment and so on. This is regarded as the peculiarities of the cooperative society. The result of some implementation of the obligation's classification that allows dynamic adding and editing of obligation name and sub obligations, and settings of some manipulated variables such as configuration of obligation types, setting of fixed payment, setting of loan schedule and personal ledger is as shown in Figs 4, 5, 6 and 7 respectively.

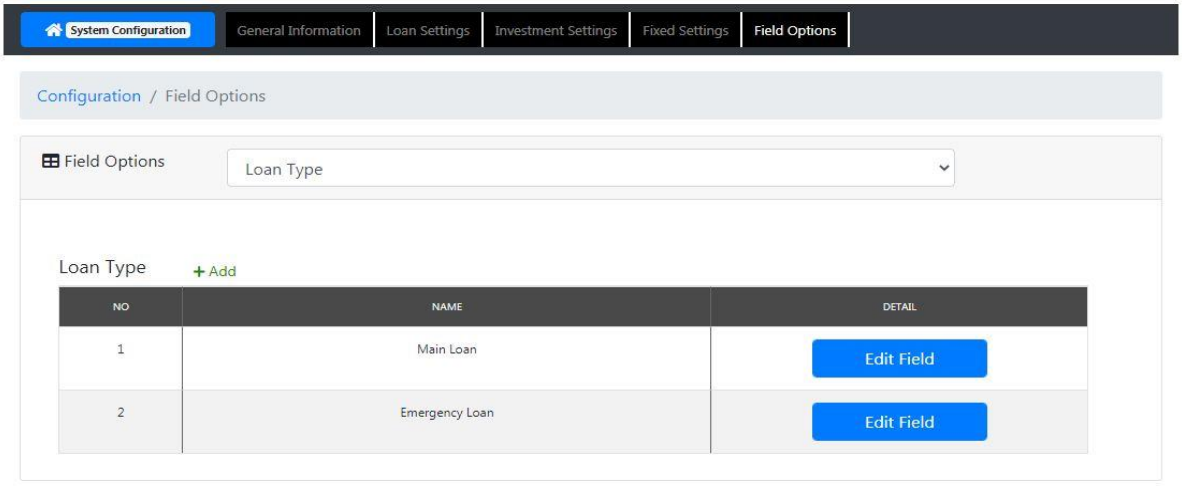

Fig 4: Configure Obligation Types

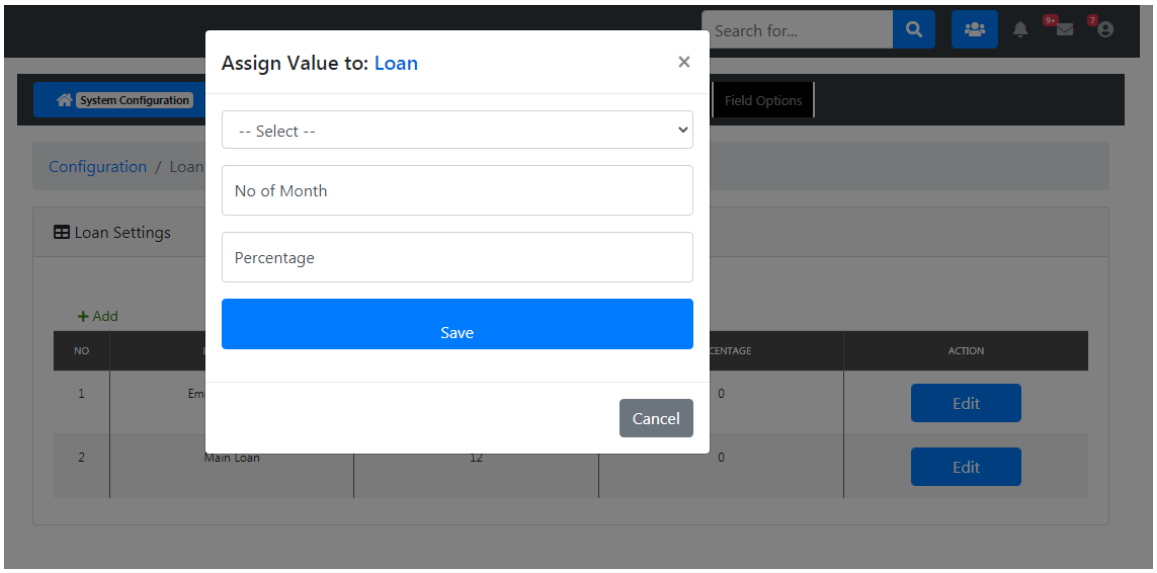

Fig 5: Setting of Loan Schedule

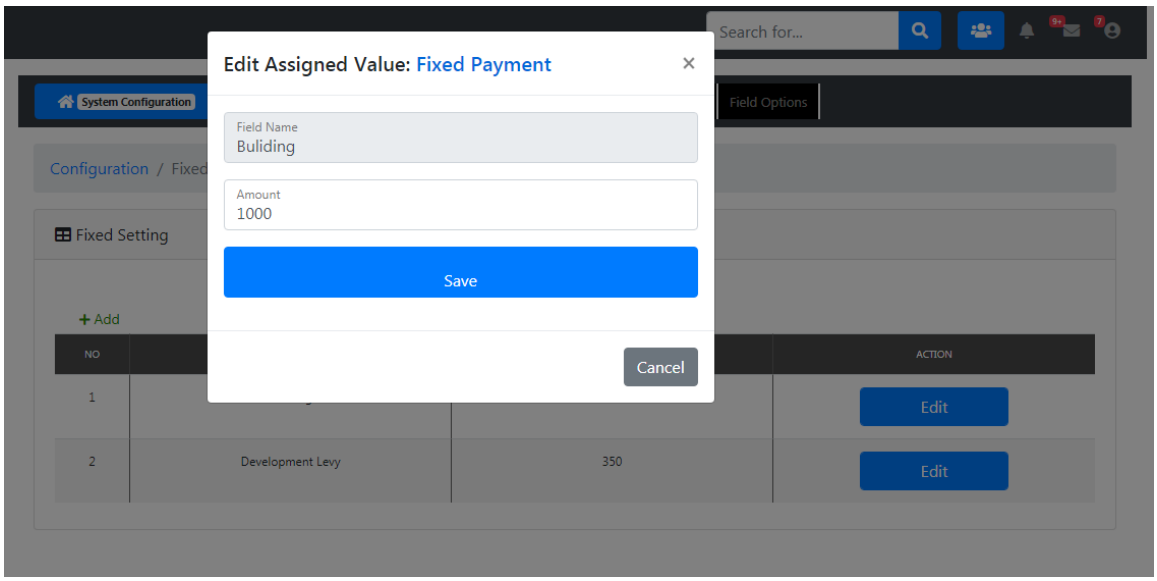

Fig 6: Setting of Fixed Payment Types

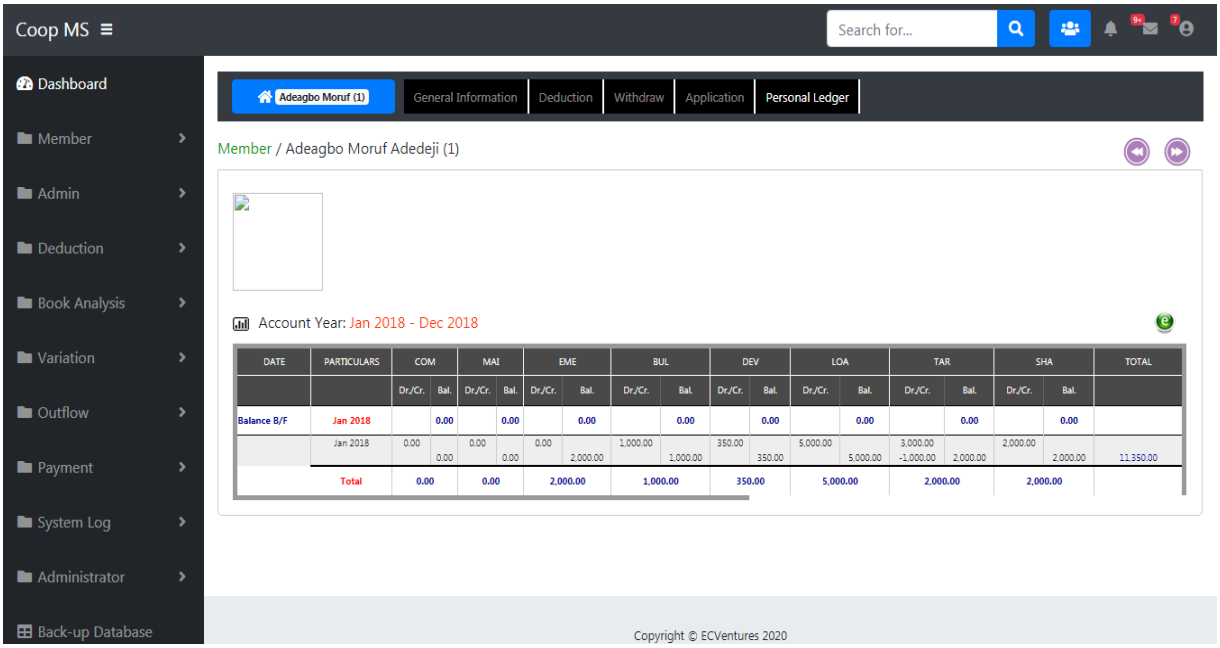

Fig 7: Personal Ledger

The System Testing and Evaluation

The test was carried out at the end of every iteration. Subsequently, the comparison of implementation and the formulated question during the goal identification was carried out. In the testing process, the possibilities of lack of accordance were taken into consideration; the defects that might arise in the implementation in conventional testing and the weakness in the definition of goals.

The day-to-day activities of cooperative societies are the same in terms of obligations but considerably varied in terms of their peculiarities. A Software evaluation establishes the degree to which a specified number of peculiarities are met (Punter *et al*., 2004). These activities result in the acceptability of software product. Base on the foregoing, the system was deployed and configured for four co-operative societies and six key stakeholders were selected from each cooperative society. Questionnaires were also distributed to the stakeholders to provide feedback on user experience and the information gathered was used to evaluate the system. The metrics used for the evaluation of the software are Software Overall Reaction, Screen, Terminology and System Information, Learning, and System Capabilities. The representation of the result of 27 sub-variables that made-up each variable and the equivalent score from 24 respondents with test score ranging from 0 to 9 are presented in Fig 8.

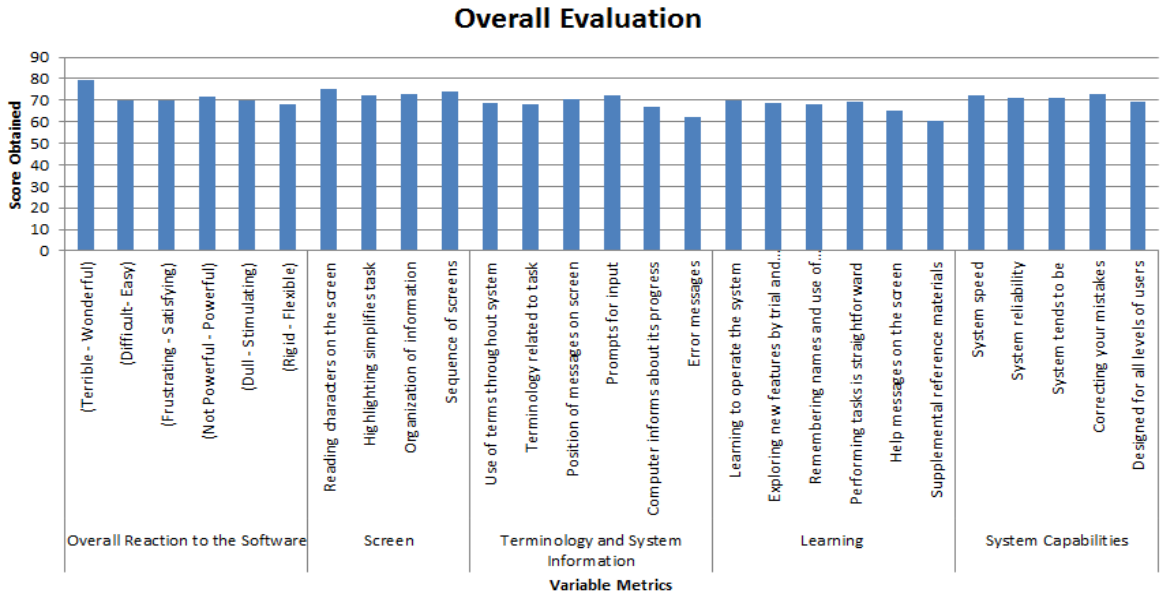

Fig 8: Result of the Evaluation

The table 1 shows that the maximum expected obtainable score for each tested variable are 1440, 960, 1440, 1440 and 1200 respectively. The total score obtained from the respondents for the five variables are 1032, 706, 981, 965 and 858 respectively. Therefore, the total maximum expected score and the obtained score are 6480 and 4,542 respectively.

Therefore, the users' satisfaction for the overall evaluation is formulated as f(x) as shown in equation (1).

Table 1: The Outcome of Stakeholders Evaluation

Variables	**SV**	**TS**	**OS**	**SO**	**X**
			(SV * TS * 24)		**(SO/OS)*100**
Overall Reaction	6	10	1440	1032	71.67
Screen	4	10	960	706	73.54
Terminology and System Information	6	10	1440	981	68.13
Learning	6	10	1440	965	67.01
System Capabilities	5	10	1200	858	71.5

SV= Sub Variables, TS = Test Score, OS = Obtainable Score; SO= Score Obtained, x = Evaluation Result

$$f(x) = \left(\frac{\sum_{i=1}^{n} x}{n}\right) * 100 \quad \text{..... (1)}$$

Where
$f(x) = user\ satisfaction;$
$n = number\ of\ variable\ and;$
x
$= score\ of\ variable\ metrics\ used\ for\ the\ evaluation\ of\ the\ software$

The summarized representation of the variables and their equivalent scored obtained is shown in figure 8 with 71.67% overall reaction, 73.54% screen, 68.13% terminology and system information, 67.01% learning and 71.5% system capability respectively.

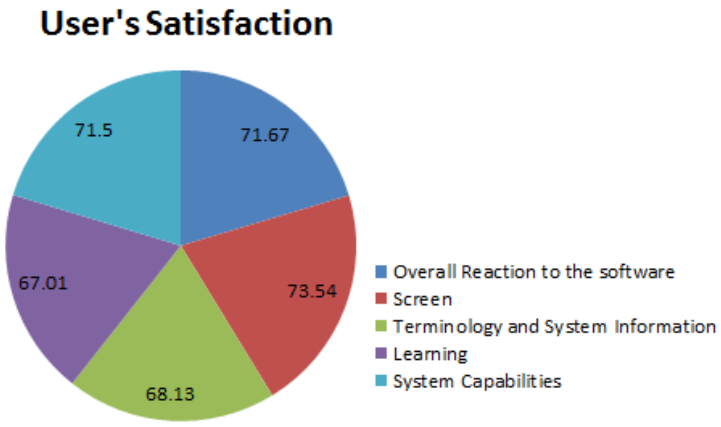

Fig 9: User Satisfaction

Drawing from the metric shown in Fig 9 and application of equation (1), the overall result was further calculated to get users satisfaction. The result of the evaluation shows that the software developed has approximately 70.4% user's satisfaction.

4. CONCLUSION AND FUTURE SCOPE

This paper showed how the application of Goal Driven Process (GDP) in software development process can be formalized in supporting business processes. The system process framework presented in this paper was drawn from the iterative and incremental principle of Goal-driven Development Process (GDP). This gives the system process framework the capability to be flexible and adaptable to a domain with similar objectives. This can further be used as a reference archetype for the development of software as it is robust and adaptable to relevant techniques that will meet the quest of software engineers. Thus, it affirms the capability of GDP in delivering high quality software at a low cost (Schnabel & Pizka, 2006).

In our experience, the system was able to adapt well to both interest free and non-interest free cooperative organizations, which is an indication that the system satisfies service-oriented principles (Queiroz *et al.*, 2014). The functionality that allows the peculiarities of each cooperative organization configurable underscores its ability to integrate well with any types of cooperative organization. All these strengths make it plausible to highlight the fact that the system developed is robust and adaptable to any cooperative organization. However, the system can be further worked on to incorporate machine learning and

artificial intelligence in the acceptance of loan application. Authorization of payment directly from the system to member account can also be integrated.

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Conflict of Interest: There is nothing like conflict of interest throughout this research activity.

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