



TYPIFIED FUZZY-LOGIC DECISION SUPPORT SYSTEM (FLDSS) FOR E-GOVERNANCE IN WEST NIGERIA

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ABSTRACT

Artisans are craft workers, skilled in applied art and creative jobs, manufacturing or managing commodities to render services to the society. Knowledgeable in fabricating, building, crafting, architecting products and services using hands, tools, machines and acquired intellects. They apply experiential knowledge and technology to deliver improved services. Reviewing existing system for this study, artisan operations are characterised with manual record keeping for business empowerment initiatives and subsequent disbursement of loan grants by governments. Other problems discovered include the artisans not coordinated for benefits of empowerment by either the SMEDANS (full meaning), local or state-based organisations even in the democratic setting of governance. Inherent problems of partiality and preferential treatment in sharing allocated funds subsist and most artisans have never been privileged to government subsidized business loans. Using methodology of software engineering, an information management system for artisans (IMSA) was developed, enabling artisan registration and validation for fund, loan and other artisan-related processes. A Fuzzy-logic based algorithm was implemented in ranking business viability and subsequent loan disbursement. Results from IMSA as Fuzzy Logic Decision Support System (FLDSS) shows that all bias and partiality in loan disbursements would be eliminated while enforcing an impartiality in selection processes. It is therefore recommended for e-governance to enhance economic growth.

Keywords: artisans, Fuzzy-logic, DSS, e-governance, information system, IMSA.

1.0 INTRODUCTION

With Internet-based applications, information capture, storage, processing, communication and retrieval is facilitated for running all types of businesses. This is not limited to manufacturing or information technology sectors. Other sectors of the society globally can attest to this fact especially as computer and information technology has become more proliferated in the wave of driving national economy in Nigeria as a developing nation. Government implementation of electronic-governance is desired to achieve stabilized economy and the driving force of information technology offering much benefits of performance, accuracy, development and developmental growth in all sectors is a quest.

Glen and Vanessa (2000) described an online system as a state of connectivity to the cyberspace through the medium of Internet or other computer networks. With this system, all governmental activities and services are powered via integral computer system connected to Internet (Paul, 2002). Therefore, as online management processes ensure overall information management efficiency over the wide area coverage provided by Internet, development and implementation of web-based application to manage artisan records is conceived and centred on existing numerous skilled jobs in Ondo State as one active socio-economic state in south-west geo-political zone. This research adopts the software engineering methodology to provide with an information system for artisans (IMSA), which is envisaged to facilitate e-governance and as well improve Nigerian economy.

An artisan is a skilled craft worker who makes and/or creates household items that are functional and operational using tools or mechanisms (wiki, 2018). Also, Cambridge dictionary described artisans as craft person who does skilled in applied art and works using their hands while country.com described an artisan as a skilled manual worker who makes items that are functional by hand. Products made from creativity and skill knowledge help artisan perform vital functions through invention, creation, manufacture, repair and manipulation of products and services for the society. Their products include artistic masterpiece, technological crafts or mechanical devices. Hence, it has become the desire of many people today especially the youths to undergo technical training to acquire technical skills while undergoing educational training. This is essentially to expose them to practical aspect of job careers.

Virtually everything made by man which you see and use is the work of artisans. The car, we drive, the house we live in, the television we watch, the furniture and appliances in our home and the decorations among others. Artisan jobs include hairdressing, fashion designing, barbing, shoemaking, cloth-weaving, carpentry, bricklaying, electronics technicians, gold and blacksmiths among others while artisans such as draftsmen, mechanics, home-builder, plumber technicians are needed almost in every aspect of our daily lives, therefore the need to have a computerized means of getting information about them in the society. These processes range from registration of artisans, advertisement of their product and services, information gallery and demographic reports on activities. The application captures their profile to include artisan full name, shop address, residential address, phone number, age, marital status special abilities among others.

Studied and established in Akeem and Adedoyin (2013), vocational and technical skills enhance the relevance and functionality of individual in the society, promote their economic survival and vibrancy and thereby play a vital and indispensable role in the development of the society. Existing manual system of production used in most of the artisan centres does not commensurate with the trends used in modern society because most craft workers still engage manual processes largely due to lack of fund for expansion or diversification. Also, this problem was prevalently associated with larger percentage of the artisans. Based on findings, developing IMSA as major template and proposed

solution was informed considering the multi-variant businesses funded by fresh graduates, who could only afford minimal capital take-offs. Major objective of this study therefore, include the design of an efficient fuzzier algorithm framework to evaluate each artisan business for qualification for fund. The Fuzzy model enabled an artisan's membership of a trade and qualification for fund to be gradual rather than just being a member or not a member, and out rightly disqualifying the eligibility for fund. The model promotes accurate selections because the privacy routines and maintenance practices incorporated in IMSA is utilized efficiently.

2.0 BRIEF DESCRIPTION OF THE SITUATION

Early artisan repertoire was a mixture of traditional and contemporary songs where all performed acappella without instruments while raising apprentices. Artisan usually constitute about 30-35% of the population of most nations, creating much of the beauty, grace, fun and excitement to the rest of the people to enjoy in life. Apprenticeship plays a huge role in bringing the manufacturing companies new talents. Apprenticeship is a major part of their engineering making process. In recognition of the importance of semi-skilled job for Nigerian citizen, the government have always had it as part of her policy to structure out creation of pool of craft jobs for artisans and entrepreneurs, mostly found among the unemployed youth in the Country. This can only be achieved through skill acquisition (Federal Government of Nigeria, 2009).

In agreement with Akosile (2007), artisan development is described as a primary key in grass root empowerment and development of skill acquisition is a vital ingredient in nation building. Engaging youths in skill acquisition rescues street youths, ghetto and destitute from gangsters, drug abuse, criminal, violent and other vicious involvement in the society. Their development is crucial to both cultural and economic development of the country.

Akeem and Adedoyin (2013) presented a brief on the impact of artisan and significant role played by them. The proportion of Nigerian population and the remarkable contribution made to development was also iterated as well as the neglect and marginalization of this group of people in the on-going implementation of a democratic governance and a crusade to grow the national economy was also highlighted.

Akeem and Adedoyin (2013) discussed the impact of artisans in the society and specified that artisan generally constitute a significant proportion of the Nigerian population with a remarkable contribution to societal developments. This study is motivated by the fact that many of the artisan groups are not co-ordinated at the state level or national level and therefore they are not functional. Even at the local government levels, most town and villages in Ondo State were not covered by the manual registration implemented for managing the artisan groups as no proper co-ordination was initiated. In addition, there is redundancy and inconsistency in tracking any artisan who might have committed any offence while executing their right to customers, who are bonafide citizens of the state and country or patriots from other surrounding countries.

As generally observed in the South West region of Nigeria and other geo-political zones, most of the existing trained artisans had abandoned their professional trades for quick money in auto bike commercial transportation business popularly called "Okada". To achieve rapid economic growth, the unemployment problem among the teeming youth must be addressed. In recognition of the importance of semi-skilled job for Nigerian citizen, the government have always had it as part of her policy to structure out creation of pool of craft jobs for artisans and entrepreneurs in her annual budgets. The problem of unemployment is heightened among the numerous graduates turned out from our higher institutions, both private and public. This agenda of making the unemployed youths engaged in one skill or the other can only be achieved through skill acquisition (Federal Government of Nigeria, 2009).

Some of the problems associated with using manual registration techniques include mental labour, involving the use of strength, brain and body, haphazardous record keeping coupled with unorganised record management techniques leading to energy and brain drains; registration errors (including errors due to omission); excessive time spent on collation processes for fund allocation or disbursement for empowerment and business growth. Redundancy and inconsistency problems are eminent in the manually created files existing for the artisan groups. These disallow proper and efficient updates as existing records were not properly managed and a lack of privacy on collected data remains as major challenges on information processing. These and many other problems were addressed in the proposed IMSA and its evaluation algorithm.

3.0 IMSA FRAMEWORK

Framework for Information Management System for Artisans (IMSA) consists of various modules. The architecture database contains captured artisan profile, business records, and other controls required for processing while processing module initiate login procedure via two-level encryption of username and password. The conceptualized architecture shown in fig. 1 illustrates a logical flow within modules as shown in fig. 2.

3.1 FLOWCHART FOR INCLUDED PROCESSES

Flowchart showing registration, processing and validation of members is shown in fig. 2. The system flowchart describes the registration process in which the homepage welcomes the users to the register page and the web registration form is displayed in order for the user to register and fill the form with his/her personal data and then supply valid user name and password. If the verification is successful the applicant will click submit and entered his/her valid username and password to print the registration details and stop.

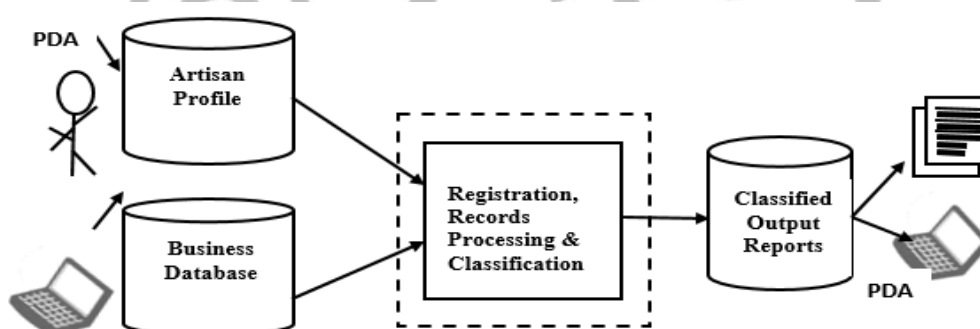


Fig. 1 Conceptualized framework for IMSA

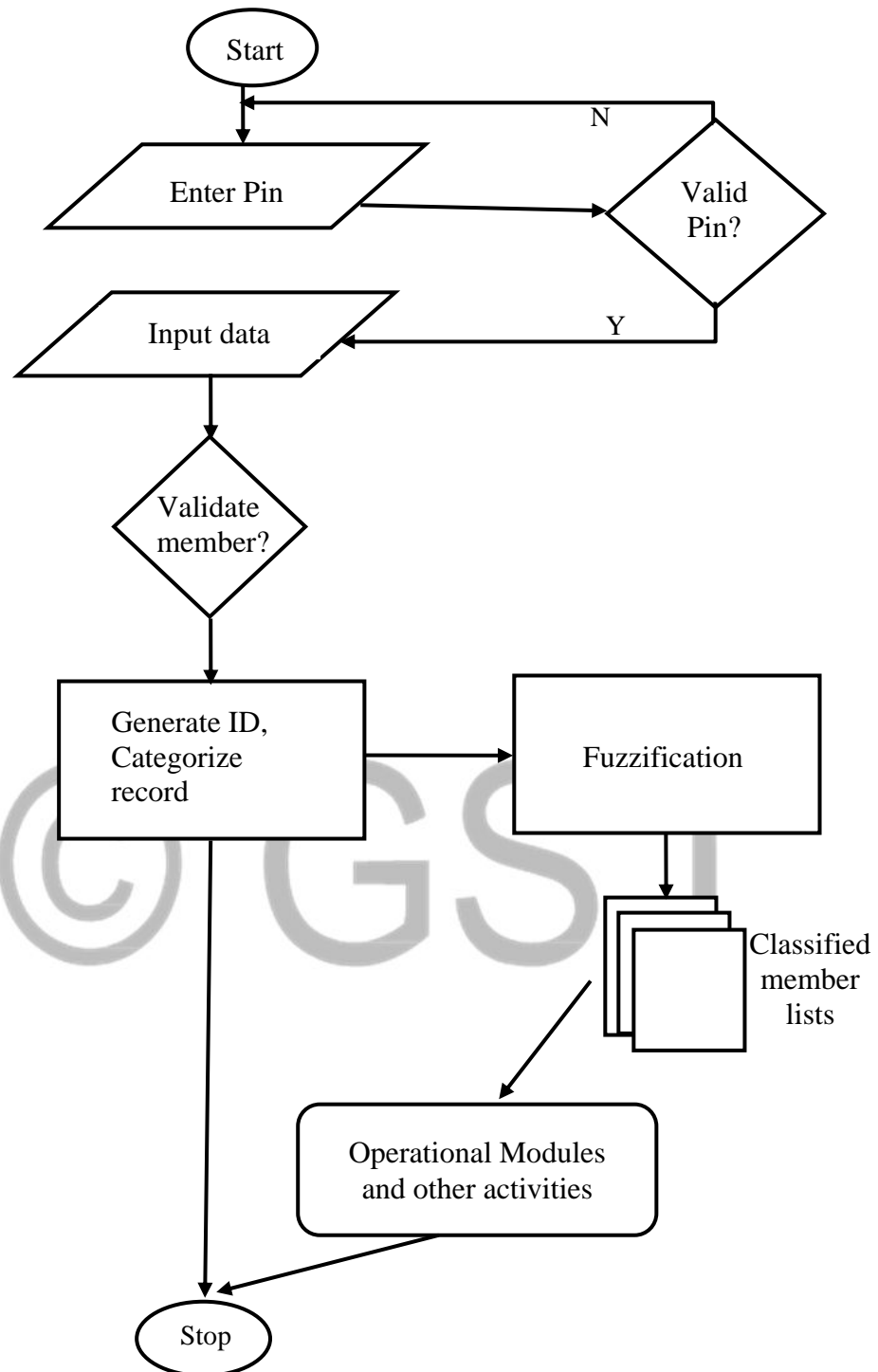


Fig. 2 Flowchart for registration, classification and evaluation

3.2 DEVELOPMENT TECHNIQUES USED IN IMSA

A 3-tiered architecture was adopted for the development of (IMSA). The architecture is a client-server solution deployed running as a web-based application. Developer tools used consist of PHP front-end engine, MySQL database engine, Macromedia Flash tool and Cascading Styling Sheet (CSS)-formatted graphical user interface, enabling artisans' registration, update and other processes via a friendly GUI.

PHP was used for the front-end to provide interface functions, which enable artisans' interaction via the user-friendly graphical interface provided. The tool creates dynamic web pages while MYSQL tool used in designing the database serves as the backend. The use of index tables and other groupings enables flexibility to be built into the developed system. These were all modelled and developed on WAMP Server solution.

3.3 COMPUTATIONAL MODEL FOR CLASSIFIER

Neuro-Fuzzy classification model was adopted for classifying registered artisans and the associated business degrees. The artisans were classified as sole-trader (0) or empowered (1) by the neural classifier while the business capital base categorization was fuzzified. Using neural network model classifier, registered businesses were classified for fitness into the empowerment scheme. The capital_base was evaluated using a fuzzified scale for refinement.

Artisan categorization into 0 and 1 where category 0 represents group I and II and category 1 represents group III and IV. Following variables are represented at the input layer as determinants to place registering artisan in business group: (registration pin-code, Business-name, Business-size, Business/Address, Local Government Area, State of Origin, Director's name, Director's phone number). U is taken to represent the universal group of a set of artisan group captured into the database.

$$y_j = \left\{ \sum_{i=1}^n x_i w_{ij} - U \right\} \dots\dots\dots (1)$$

where x represents the artisans, which is quantified by the determinants listed while w is the occurrence of artisan participation within association and in group activities. On activation, the neural model computes a weighted sum of all registered members i 's of a particular group j at the input layer, enabling a sensitization at the hidden layer to categorize the particular artisan in the considered group from the list of $j=1, \dots, m$ within U . The computation generates an **output of 1** if the sum is above a certain threshold U (activation function) set as a limit for the function by the artisan group or a **0** if the sum is below the threshold U . Result of member's participation in group activities is quantified to produce output result as indicated in (2).

$$y_j = \{0\} \dots\dots\dots (2)$$

where $y = 0$ depicts classification into category 0, which is further split into groups I and II) while $y = 1$ depicts classification into category 1 split into groups III and IV.

After registration, business is verified for ranking using algorithm on defined parameters (trade_make, initial_capital and employee_size). For validation of membership category, members weight and membership status is accommodated and fuzzified over a scale of $j = 1, 2, \dots, 4$ capture four differently nominated groups I-IV, which represents National_Executive (NE), State_Executive (SE), Full_Member (FM), Associate_Member (AM) as depicted in (3).

$$w = \begin{cases} I, NE \\ II, SE \\ III, FM \\ IV, AM \end{cases} \dots\dots\dots (3)$$

Categories I-III members are the candidates eligible for 100% of funds requested for after being validated to have met all conditions specified while category IV are only eligible to access only 50% of requested fund.

4.0 IMPLEMENTATING IMSA

IMSA web-based application homepage was implemented on a local host to exploit query processing in user-friendly manner using designed GUI for interactions. Users are logged in with username and password. Pin-number generated by the system upon the payment of registration fee serves as the created password to enable members assigned with it to capture and store his or her record details. Payments for the generated pin numbers is also a source of revenue for the organisation. The system is presented from unauthorised usage by the two-level security code of username and password. Screen shots of the implementation are as shown in fig. 4.1 – 4.4.

IMSA home page shown in fig. 4.1 has pin-number generating command and display box on launching onto the application. Pin generated is copied and entered accordingly to activate creation of new user menu options.



Fig. 4.1 Home page

From the home page, access is enabled to the gallery where products and services are on display as shown in fig. 4.2. Users are hereby allowed to log in to the system using the interface of fig. 4.3



Fig. 4.2 Artisan gallery page



Fig. 4.3 Login page

Selecting displayed 'register' menu option on the menu tab enable artisans enter their data on IMSA portal via fig. 4.4. Captured data is stored in the database as soon as registration is completed.

Fig. 4.4 Registration form

4.1 ANALYSIS AND DISCUSSION

Implementing developed IMSA, adopting scratch card formulation via encrypted database enable *registration status* confirmation. This is embedded in member's identity (ID) card generation coding, which further established system reliability as unique ID is generated by each artisan. Registered artisans are analyzed to reveal the distribution shown in fig. 4.5.

SAMPLED ARTISAN DISTRIBUTION IN OWO

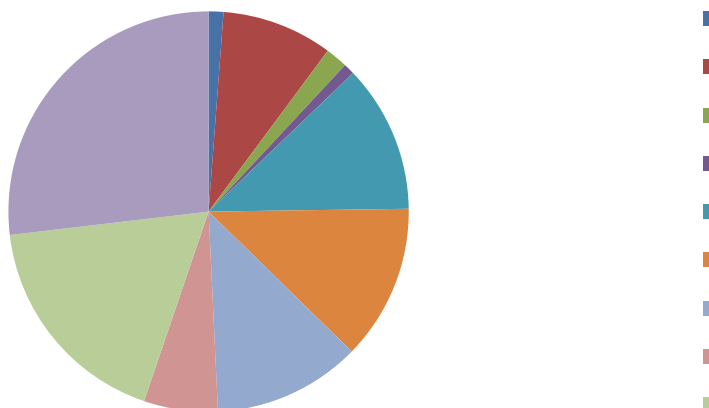


Fig 4.5 Pie Chart of Artisan Distribution in Owo, Ondo State, South-West Nigeria

4.2 DISCUSSION AND EVALUATION

Developed IMSA was implemented for selected artisan groups in Owo Local Government area of Ondo State Nigeria. The system enabled a survey of selected groups and their distribution and types as categorized by classifier model incorporated within the system. The application is usable in other states of the South-West Geo-political zones of the country as a computational model to enable those who participate in artistic jobs register and formulate business groups, classifiable as small-scale or large-scale categories represented by class 0 or class 1 respectively.

Reports of categorization guided the government in selecting business groups for empowerment programme in the operation year. Various reports on business size, membership list, products and services were generated. Registered artisan groups were

offered suggestions and recommendations on how to apply for government empowerment using feedback from users as provisioned on the platform. The model enables a customized member-administrator view all artisan details with a stronger view of monitoring while the database is maintained in an efficient manner to foster effective organization and formation for other types of businesses. Operations enabled on IMSA are ability to view and update details/content of group/scheme, comment/discussions and view of group members. Access to membership profiles; published advertisements; announced services; discussion board; group contents; work schedulers and feedback channel options among others were enabled.

Specifically, IMSA enable members' registration, viewing and update of personal details, effected by placing randomly generated pin-number key to participate in discussion groups. Queries and instant feedbacks (responses) from administrator or other registered member offer much intelligence and interaction. Modifications maintained by inference engine contained within MySQL database enabled sensitization on newly created products. A gallery collection of all products and services included in the design enable registered artisans advertise their products and services and with online management techniques, IMSA website allows prospective clients patronize their services using displayed contacts. Particularly, **the fuzzification model for selection enables** funds to be allocated using IMSA as DSS equipped with fuzzy reasoning rather than exact. Membership of an artisan set is gradual rather than just being classified as member or not a member and be disqualified for fund request. Meanwhile other learning algorithms were not applied to validate the result and accuracy of Fuzzy-logic used. Future research is encouraged in this direction and other relevant areas such as scalability, network availability model and artisans' usability metrics.



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