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DEVELOPMENT OF POLICY RESEARCH-EVIDENCE ORGANIZER AND PUBLIC HEALTH-POLICY EVALUATION TOOL (PROPHET): A COMPUTING PARADIGM FOR PROMOTING EVIDENCE-INFORMED POLICYMAKING IN NIGERIA

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ABSTRACT

In the vast majority of low-and middle-income countries, performance of health systems continues to be abysmally poor with unacceptably low health outcomes. This is not unconnected with implementation of evidence-deficient health policies. Critical research evidence contributes to strengthening health policies to ensure clear cut targets and context specifics that adequately address identified health challenges and inequities. This study modeled a computing paradigm for brokering knowledge translation process and assisting health policymakers in promoting evidenced-informed policymaking. It strategically evaluates and assesses levels of evidence content and predicts implementation prospects of health policy documents. Its development process adopted object-oriented methodology for structural analysis and design specifications. Visual Basic.net and standard query language server were deployed at the front-end and back-end implementation processes, respectively. The study designed an algorithm based on discrete choice experiment technique in an iterative four-scaled user-defined parametric options for rating policy features and assessment of overall policy prospect. Salient policy features/attributes were assembled as assessable variable entities. It adapted machine learning linear model to classify attributes into 6-domains to reflect the WHO promoted 6-policy cycle of a health system. Aggregated scores of policy features across all domains are utilized to compute policy overall grade-point in percentage weight. PROPHET was used to assess thirty-three (33) national health policies extracted from online repository warehousing health policy documents in Nigeria known as *policy information platform*. The result shows that only 11 out of the 33 (33.3%) policies passed with at least 50% grade-point fixed in this study as minimum benchmark for implementation considerations. This system rates policy features, assesses overall implementation prospect of policies with seamless real-time data validation and referencing across modules. PROPHET is expected to aid health policymakers in amplifying evidence-informed policymaking for improved health outcomes.

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Index words: *Evidence-informed, Grade-point, knowledge translation, Object-oriented, Policy feature/attribute, Policymaking, User-defined.*

I. INTRODUCTION

Provision of appropriate policy direction especially in the health sector is critical to the realization of Sustainable Development Goals (SDGs) in health and could further be strengthened with innovative computer-aided tools. Lack of relevant computing technology aid for assessing the research evidence content and classified ways to validating prospects of policies adversely affect health outcomes. The strengthening of global health systems has been facilitated through rapid utilization of the ever-evolving computer technological processes [1-3]. Computing and information technologies (CITs) has sustained their growing trends and tremendous impacts on the global health systems in terms of improved dissemination of public health information, facilitating public discourse around policy related issues and dialogue around major public health threats [3-5].

There is an increasing global acceptance that one major way to address weak health systems and improve health outcomes in low-income settings is by the development and implementation of health policies that are evidence-informed [6-8]. Thus, the strengthening of low- and middle-income countries' (LMICs') health systems would require strong drive anchored on the use of research evidence in formulating health policies in compliance with systems' thinking perspectives [9,10]. Systems' thinking ensures equitable schedule of resources across the six health systems' building blocks, in order to maintain undisrupted balance among the various domains and forestall all forms of imbalance and inadequacies. For instance, the imbalance in cost of healthcare services negatively impacts on overall uptake especially among the poor and vulnerable groups for obvious reasons [11]. Recognizing the importance of utilizing best available research evidence in health policymaking by policymakers in Nigeria is still at a low level leading to the formulation of policies based on assumptions [9,12-13]. Implementation of such policies have in most cases resulted in an effort in the futility and waste of scarce resources as the policies never achieved their purpose.

Evidence-informed policymaking (EIP) is a critical process involving proven scientific methods that creates avenues where researchers are linked with policymakers for active collaboration [14]. This ensures integration of evidence-based interventions with community preferences to improve and balance policymaking initiatives [15,16]. Evidence-informed policy process has rationalist assumptions that health policies should ultimately be based on evidence from research [17]. A study suggests positive effect of adopting electronic technology support systems to harness and synthesize varieties of evidence for sustainable policy practice [18,19]. It leverages the use of electronic driven interventions in the government and overall management of public health data/information and health systems operations [20,21]. Such approach suffices knowledge translation process for harvesting experts' views and experience as useful resources that can cumulatively build policy support [22-24]. In other words, evidence-to-policy link can be energized more by maximizing the reach potentials of emerging pertinent technologies to pull-through policymaker's capacity.

Advances in computing techniques are rapidly creating the framework upon which almost everything works, even transforming and reforming the trends of

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health-based undertakings by creating sensitive tools for hospitals, pathology laboratories and dental clinics, etc. [3,25]. They provide strategic platforms with metric-engineered processes for real-time health information management and control [26,27]. Such systems may include the development of digital or mobile health solutions for improved knowledge dissemination, community participation in prevention programs, advocacy and policy dialogues for effective public health [28,29]. Digital health technology has provided a more efficient, accessible, and effective means to collect, analyze, store and share health data [30]. Just as computerized systems now permeate complex managerial areas in industries for evaluating proposed acquisitions, this new system models a window of applicability to ease-off problem-solving approaches associated with health policymaking [31,32]. Expert's ideas weaves solutions by creating enhanced information access and flow process, with interactive sharing and unique exchange technique [33,34]. These avails policymakers' seamless opportunities to explore and utilize unlimited evidential resources on policy-driven issues especially those of the health sector. There exist several information systems platforms such as medical transcription tool for physicians and healthcare providers to leverage on, in treatment and care for patients [35,36]. These tools facilitate interpretation of handwritten prescriptions, updates medical case histories, along with emerging trends in network technologies that connect sensors and input devices in patient home to a "home-health-care provider" made home care for even gravely ill patients a possibility [37-39].

Several action frameworks and multifaceted approaches have been developed to identify pertinent domains and guide development of organizational tools and systems that may facilitate research use by policymakers. Such action frameworks include: (a) **The SPIRIT Action Framework,** which is an Intervention Trial that is a structured approach to selecting and testing strategies to increase the use of research in policy [40]. (b) **The SAGE Framework,** which is a tool to evaluate how policymakers engage with and use research in health policymaking [41]. (c) **The ORACLe framework,** which is a comprehensive system to measure and score organizations capacity to engage with and use evidence from research in health policymaking process [42]. (d) **The SEER framework,** which is designed to determine the well validated measures to identify priorities for capacity building in engaging with research outcomes and researchers [43]. These previous action frameworks inspired the development of a computer-driven approach and conceptual framework known as the PROPHET *(Policy Research-evidence Organizer and Public Health-policy Evaluation Tool)*. The PROPHET is designed to facilitate standards, support improved precision in decision making and abate waste of scarce resource through strategic engagement of evidence informed policymaking process. The PROPHET is therefore a computer software paradigm, which is to serve as a tool to aid knowledge translation process. It was intended that the software would assist policymakers assess multiple aspects of health policy documents compliance with evidence-to-policy perspectives. The PROPHET is also intended to predict the prospects of a given policy successfully achieving its purpose prior to implementation, thereby suggesting the feasibility of the policy option addressing targeted areas of needs.

A. CONCEPTUAL FRAMEWORK OF THE PROPHET

Figure 1 describes the high-level model (HLM) architecture of the PROPHET developed to showcase the entire system immediately by specifying the basic activities and attributes associated with it. It is an architectural model configured to identify and describe data elements with basic functional components and the logics infused into the system and synchronized for efficient data communication traffic flow.

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The PROPHET's operation is designed to revolve around the central strand of the system labeled "Interface Control Valve" configured into four-fold activity modules. On the left stroll is the "Input Switch Function" that comprises Login Reset, Add Domain, Add Features and create Option-list. These are initial basic system tools exclusively engaged by an administrator (Admin) for classical operations and subject to necessary modifications whenever it is called for. From the right side of the HLM is the "Domain Classification Framework" which defines and establishes the six domains encasing all the profiled policy features/attributes. Directly underneath the interface control valve is the "Computation Paradigm" and the "Report Generation" modules. The Computation Paradigm undertakes registration of policy documents, rating of its features as appropriately specified and performing overall policy assessment, to determine its percentage weighted grade-point (PWGp). On the other hand, the Report Generation keeps track of, stores and seamlessly recalls where necessary, all the records of activities or transactions traversing the entire system. Figure 1 presents high-level model architecture for the system (PROPHET).

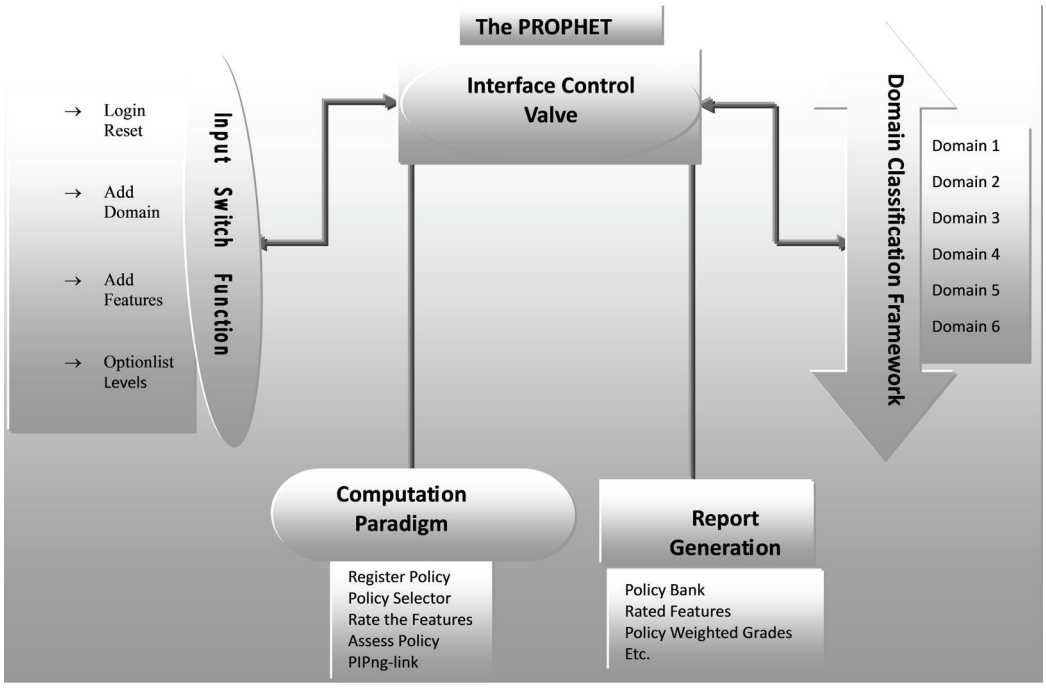

Fig. 1. High-level model architecture for the system (PROPHET)

II. MATERIALS AND METHODS

Software engineering development process broadly encompasses three major phases viz: systems analysis, design and implementation [44-46]. Undertaking these basic activities requires adoption of appropriate methodology and in the development of the PROPHET, the Object-Oriented methodology (OOM) was considered suitable and adopted. This is due to the fact that OOM ensures concise definition of the problem and ease of exploring definite concepts associated with the problem domain [47][48]. The OOM helps to model the system in a way to easily manipulate object pieces for proper interaction and generation of events among functional components, as well as ensure adequate structural data entity representation among various system components [47]. The relevant OOM tools and materials utilized for the PROPHET development analysis and design includes: flow charts, sequence diagram, use-case diagram and activity diagram. These OOM tools

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have been shown to facilitate systems analysis and design process of software development that describe the interactive flow of operations within and/or among the system components [47,48]. The PROPHET analysis and design are critical steps that involve a systematic way of x-raying the structural and logical processes that underpin the various operations. It indicated phase-by-phase and module-by-module development process [44-46].

A. DESIGN AND ANALYSIS OF PROPHET FLOWCHART OPERATION

To transform the conceptual framework of the PROPHET into an operational system, the overall system flowchart was designed as illustrated in figure 2 as an OOM generic tool for analysis and design [47,48]. The traffic flow operation was designed such that at the onset, the system access point is launched to select a definite level of usage either as "Admin" or "Ordinary policymaker". In any case, the user needs to enter a unique username and password to login and have access to the system's main user interface. In another case, to have access to the system main user interface, the system was designed such that the user has to enter a unique username and password to login. The system was also designed such that the Admin can create or modify basic functions of the system such as adding/deleting domains, policy features, rating levels etc., and can perform other sub-operations which include enrolling or profiling a policy document (A), rating its features (B) and assessing the policy document (C). On the other hand, the system was also designed such that a policymaker can view already assessed health policy document to guide in implementation decision and can pick up a registered policy, rate its features (B) and assess the policy (C) to determine its overall weighted grade-point. These operations were designed to be automatically validated from within the system, systematically and routinely ensuring error-free transmissions. Figure 2 shows system development flowchart operation.

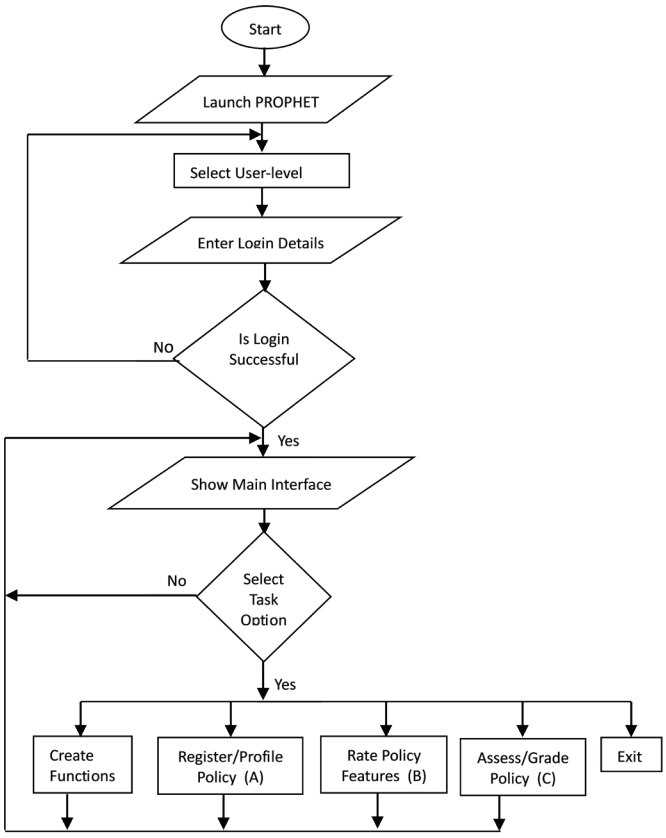

Fig. 2. System development flowchart operation

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B. DESIGN AND ANALYSIS OF PROPHET SEQUENCE DIAGRAM OPERATION

The PROPHET was designed such that there are sequential interactions between and amongst actors and objects in the system. In figure 3, sequence diagram as a pertinent OOM tool was designed to depict and analyze interactive operations in the PROPHET where an admin or a policymaker could trigger-off an action within the system via "Select Policy" item at the instance of policy information object class, which supplies the policy identifier (PID) item. The PROPHET was further designed with "Activate System" command to extract and return required information of selected policy document in the "Policy Bank" and enables activation order "Activate RF" for a user to commence a definite rating task. If a policy document is not validly selected, activation order would fail and fresh request is retransmitted. Once the transmission service is upheld and an activation order is validated, the PROPHET was designed to load the domain selection Form for commencement of a domain-by-domain rating of the features/attributes with the "Activate RF" command enabled. The next action stage is where the PROPHET was designed to display a status update on a message box indicating the cumulative value accruing from rate features "RF" operation, and this value was used at the next action stage to compute overall policy weighted grade-point with details from update file tool. In assessing a policy's weighted grade-point (PWGp), the PROPHET was designed to call-up detailed updated value from "Authorize RF" through the "summarize policy identifier (PID)" command tools. With a click event of grade-point command button "Grdp summary", the PROPHET was designed to automatically activate PWGp computation order and display the overall result on the message box. Thereafter, the PROPHET was designed to allow user perform an end-to-end validation action by selecting submit/update database activation order and click exit to quit that round of operation. Figure 3 shows the sequence diagram operation for the system (PROPHET).

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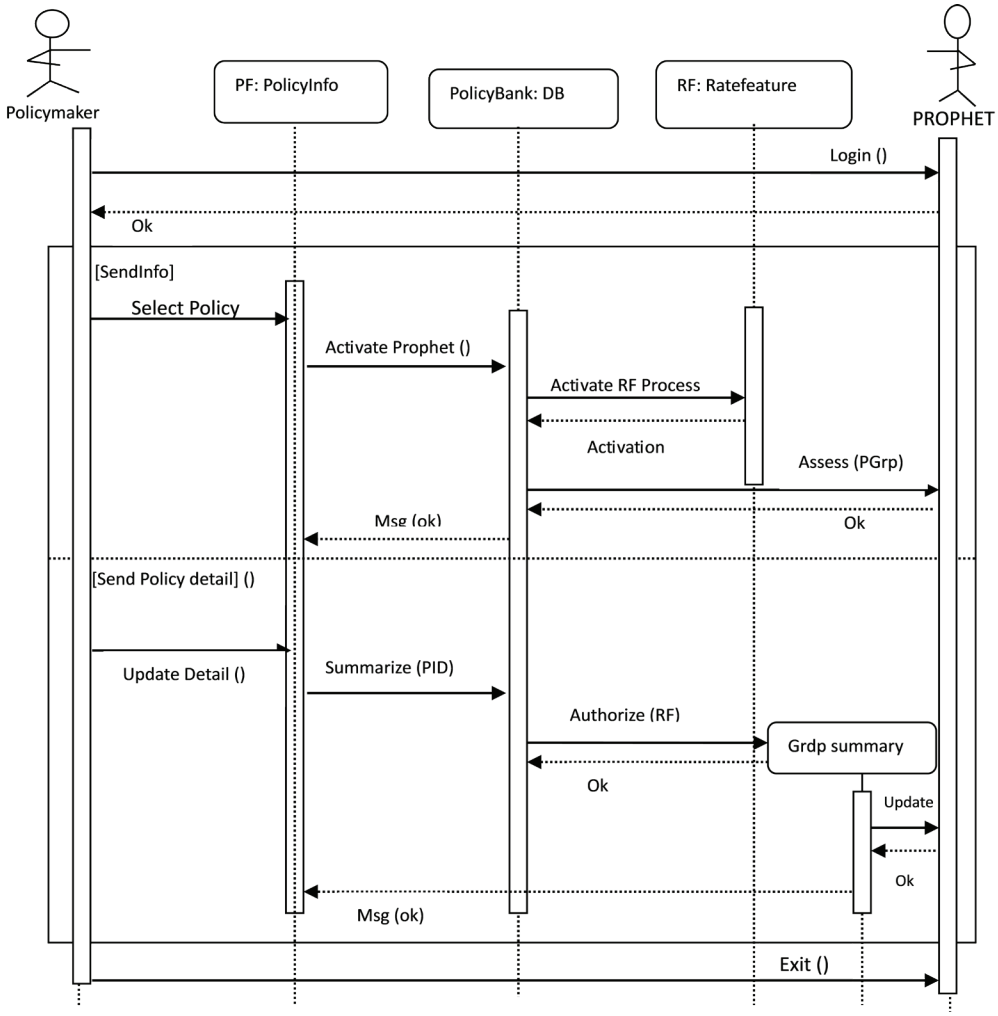

Fig. 3. Sequence diagram operation for the system (PROPHET)

C. DESIGN OF PROPHET DOMAIN CLASSIFICATION

This is the PROPHET development phase that saw to the design and formulation of the six (6) operational domains of the system. In developing the PROPHET, the researchers designed a six-domain framework and classification model adapted in reflection of the health policy cycle development process of the World Health Organization [13,49-51]. This was used to facilitate a systematic classification of all the identified salient policy features/attributes into suitable domain as assessable variable entities according to their functional relevance. All these policy features/ attributes represent the input functions designated in PROPHET as active data traversing across its various related data fields. In other words, the PROPHET was designed to adapt the structured six policy cycle development process as a classified ordered framework of six (6) key domains encasing all salient policy features/attributes [13,49-51]. Each domain encases an array of relatively peculiar policy features or attributes with requisite information metric critical to policymaking process. Overall, the PROPHET was designed to enumerate thirty-six (36) default policy features/attributes which form the basis for assessing profiled health policy documents. The PROPHET was designed with a dynamic nature that allows for modifications in both ratable features and the rating option-list levels. These domains with their various policy features or attributes, are represented and explicitly defined in table I. This table indicates the content adequacy consideration

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of each domain, which can be modified as future research findings provides more useful evidence per subject matter.

TABLE I
CLASSIFICATION OF DOMAINS AND CONTENT DEFINITIONS

Domain Code	Domain Title	Domain Features/Attributes
D1	Preliminary Concepts	comprises all standardized preliminary components of a standard policy document which includes: policy title, source of policy, date of production, preface, foreword, acknowledgement, contributors/ stakeholders, acronyms/glossary, policy lifespan, abstract/executive summary, roles/responsibilities, annexure and reference/ bibliography
D2	Introductory & Issue Raising	comprises all the introductory factors that shades light on the cause(s) of study and benefits. They include background concepts, policy statement/problem definition, policy goals and objectives, policy scope and policy justification/rationale
D3	Scientific Process & Policy Design	It comprises all scientific process and technical approach considerations adopted to guide policy production decisions. This includes methodology, policy framework, priorities/priority areas, policy guideline, research evidence, analyzing roles of actors/institutions ideologies, **policy situation analysis and policy institutional context analysis**
D4	Public Support	this entails the rigorous efforts made to sell the policy to the people (people-oriented and driven) – ensures it does not impede on their norms and values. These are: policy dialogue/consensus building, advocacy drive and policy recommendation
D5	Legislative Decision & Policy Support	it comprises all the necessary steps taken to bring a policy into legitimate force – making it binding on all the target population and coverage areas. They include policy legislation, legal and regulatory framework
D6	Policy Implementation	this refers to the critical step-by-step process followed to appropriately provide and deploy adequate resources needed to enforce realization of overall policy goals and objectives. These includes budgeting issues, policy implementation strategies/planning/guidance, policy monitoring and evaluation, supervision mechanism, policy dissemination strategies, and communication/social mobilization.

D. DESIGN OF RATING OPTION-LIST LEVELS

In developing PROPHET, the rating option-list levels was designed as a parameter for rating policy features by exploring the dynamics of discrete choice experiment technique to formulate an iterative user-defined algorithm in a four-scaled option list [52-54]. This framework was designed to evaluate the level of availability or content adequacy of designated input variable in each domain so as to duly assign appropriate scale value indicated in table II. Due to possible changes in the input variables, PROPHET designed a mathematical and regression model wherein output values would be expressed as the linear combination of a set of input variables [55,56]. This implies that:

$$y = w1x1 + w2x2 + w3x3 \quad (1)$$

where y describes a residual function, w1...w3 is the weight value assigned to the input variables and x1...x2 is the probable error function.

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The user-defined parametric discrete variable weighs policy features/attributes over the four scaling levels for purposes of rating each variable into a definite value. This logical and iterative structural process systematically rates these variables and records their scores on domain-by-domain basis. Precisely, table II illustrates the four-scale rating option lists designed for this system development with their corresponding discrete values are specified thus: not included "0", unsure "1", partially included "2" and fully included "3".

TABLE II
THE PROPHET OPTION-LIST LEVELS DEFINITION

Option-List	Rating Value	Level Definition
Not Included	"0"	It means a feature/attribute is inadvertently unavailable and was not represented or considered in any form in a policy document
Unsure	"1"	A feature is not categorically stated or included, instead it has a grossly inadequate description relative or similar to it captured as part of a policy document
Partially Included	"2"	Some information about an attribute or a feature is included in a policy document but not concisely described (content inadequacy)
Fully Included	"3"	An attribute or feature is both available, concisely described and all relevant details are exclusively represented in the policy (content adequately)

E. DESIGN OF POLICY RATING AND ASSESSMENT ALGORITHM

The system (PROPHET) algorithm was designed to collate cumulative scores or values of rated features (RF) within domains and all summarized into a domain weighted aggregate score. Policy rating process is designed to valuate both item availability and content adequacy in line with established discrete option levels. The values allotted to rating options duly selected will linearly add up to generate total score for that domain. In other words, the summative score accruable from a selected domain was designed to be calculated through equation 2, as the linear combination of the input variables (rated features) within that domain as expressed thus:

$$DWV = \Sigma (RF_1 + RF_2 \ldots + RF_{n-6}) \quad (2)$$

Where;
DWV: represents domain weighted value, which is meant to hold the total result of sum of all the values arising from the individual rated features of a policy.
RF = this stands for rated feature and it represents each of the features in a domain which is selected (activating) before clicking an option-list suitable for its availability or level of adequacy in the policy being assessed. The numeric value of the option chosen is recorded in favor of that feature and used to calculate total domain score (DWV).

On the other hand, the PROPHET was designed to calculate cumulative policy weighted grade-point (PWGp) in percentage terms. This is done by collating the outcome of domain weighted value (equation 2) across all six domains using the algorithm in equation 3, expressed as the linear combination of all domain weighted values contained in equation (2) above and derived thus:

$$PWG_p = \Sigma (DWV_{n1} + DWV_{n2} \ldots + DWV_{n-6}) / MAS * 100 \quad (3)$$

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PWGp = it stands for Policy Weighted Grade-point in percentage. This is the PROPHET final policy assessment process carried out to determine potential or prospective implementation strength of a policy measured in percentage (%) weight factor.
DWV = this represents Domain Weighted Value, as collated from across the six (6) domains in equation (2) after rating the policy features.
MAS = stands for Maximum Accruable Score across all domains. It is obtained by calculating the total number of registered policy features and multiplying same with the highest possible numeric option-list value established in the system (i.e. "3"). It implies that MAS is the total number of registered policy features multiplied by highest possible value "3". Aggregated score from policy features across all domains is utilized to compute policy overall grade-point in percentage weighting.

III. RESULTS

In the developed system called PROPHET, the input and output objects that were designed in PROPHET were implemented and tested to ascertain their functionalities following software engineering development routine. The implementation routine was as provided in the integrated development environment (IDE) of Visual Basic. net at the front end, the standard query language (SQL) Server at the back end and a relational database called "PolicyMakingDB". The inherent logics resulted in the development of this novel piece called PROPHET, technically configured with main-menu interface that integrated and activated various modules of the PROPHET for seamless real-time functionality.

A. MAIN MENU INTERFACE MODULE

The PROPHET activities were implemented on a well-developed window-based and highly interactive graphical user-interface, which serves as the main menu for access. Figure 4 presents the PROPHET main menu interface made up of robust controls that insulates users from underlying technological tendencies which ensures operational flexibility. It provides simplified and easy independent access to all the controls/menus for initiating and undertaking a policy assessment task with timely response to errors. There are four menu items that characterized the main interface as follows: Admin, Task, Report and About. These menu items and other submenus were meant to handle all operation beginning with policy profiling to the overall policy assessment exercise. Figure 4 illustrates the screenshot of main menu interface window.

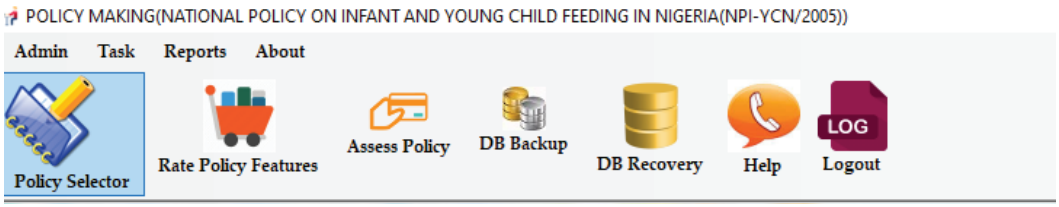

Fig. 4. Screenshot of main menu interface window

B. MODULE FOR RATING POLICY FEATURES

The PROPHET implemented policy rating activity through the development of the model of four-scale option-list level shown in figure 5. The model comprised of the following rating levels: "not included", "unsure", "partially included" and "fully included" respectively assigned with numerical values "0", "1", "2" and "3" for each

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level. The ratable policy features of policy documents were designed into a set of number knobs (1, 2, 3, ...n) lined chronologically at the base of the rating window underneath the option-list levels. Each feature or attribute is comparatively weighed and pined with a commensurate numerical value, akin to the extent or its availability strength in the policy being assessed. The PROPHET undertakes the rating activity procedurally with the aid of pre-determined logical activations leading to domain-after-domain and attribute-after-attribute operations. Figure 5 show the screenshot of dialog window for rating policy features/attributes.

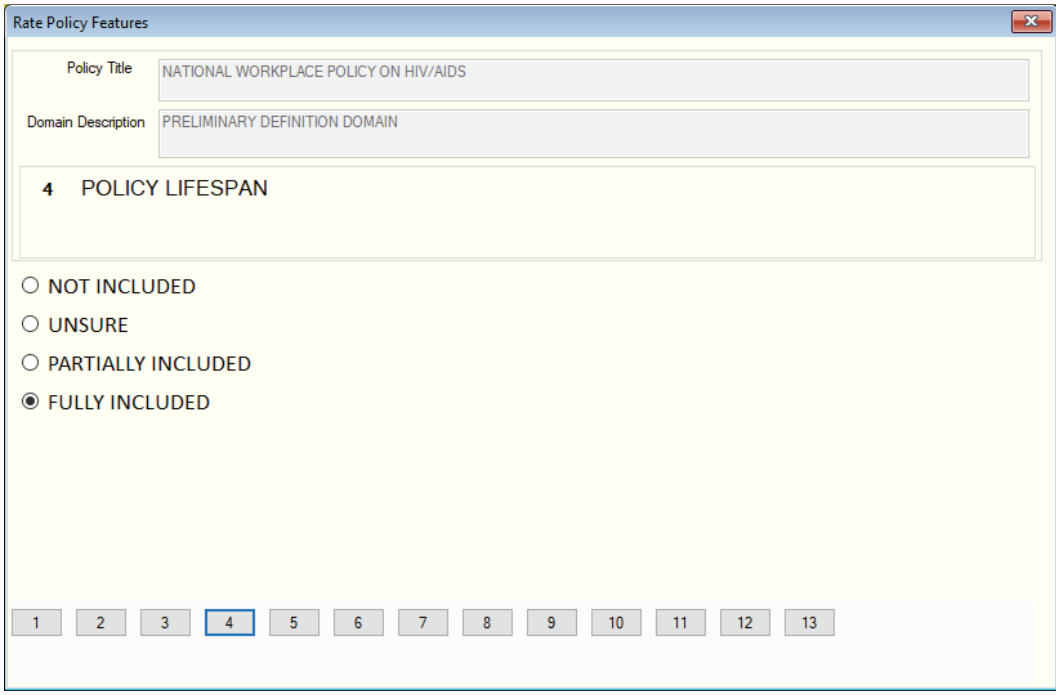

Fig. 5. Screenshot of dialog window for rating policy features/attributes

C. MODULE FOR COMPUTING POLICY GRADE-POINT

At this module, figure 6 was a dialog window for the PROPHET used to initiate and coordinate the processes of computing and determining overall policy weighted grade-point (PWGp) in percentage scale. This operation is carried out by selecting/clicking the assess policy menu item to load the "Compute Policy" window. Next step is to select/click "All Domain" option button to activate the rated values of the six (6) domains in readiness for next operation. This action displays cumulative summary value in the Total Domain Score box. Thereafter, select/click the command button bearing "Process Gradepoint" to get the policy weighted gradepoint (PWGp) and then tick the "I Agree" option-box before finally clicking the "Submit" command button to transmit into the database and conclude the operation. Figure 6 presents the screenshot of dialog window for policy grade-point assessment.

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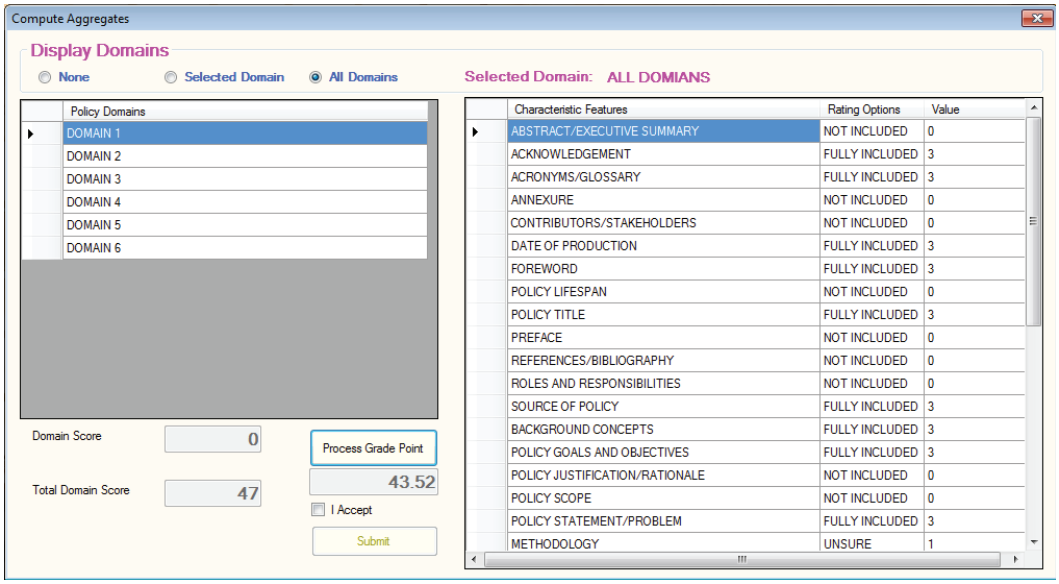

Fig.6. Screenshot of dialog window for policy grade-point assessment

D. SUMMARIZED RESULT OF HEALTH POLICY DOCUMENTS ASSESSED WITH PROPHET TOOL

Table III captures the results of the thirty-three (33) policy documents that were assessed with their corresponding weighted grade-point using the PROPHET software tool. From the results, only eleven (11) policies marked with green color out of a total of thirty-three (33) policies scored up to the minimum benchmark of fifty (50) percent grade-point and above. That is for serial numbers 1, 4, 7, 13, 14, 20, 22, 24, 27, 28 and 29. Whereas the other twenty-two failed short of the designated fifty percent study minimum benchmark.

TABLE III
SUMMERY OF RESULTS OF POLICIES ASSESSED USING THE PROPHET

SN	YR. CODE	TITLE OF POLICY	ORIGIN	SCORE	PWGp
1	DEN-PF/2010	A GENDER POLICY FOR THE NIGERIA POLICE FORCE	NPF	60	55.56
2	MAL-FIL/2013	GUIDELINES FOR MALARIA-LYMPHATIC FILARIASIS CO-IMPLEMENTATION IN NIGERIA	FMoH	46	42.59
3	IPH-G/2013	INTEGRATING PRIMARY HEALTH CARE GOVERNANCE IN NIGERIA	NPHCDA	39	36.11
4	MS-PHC/NON	MINIMUM STANDARDS FOR PRIMARY HEALTH CARE IN NIGERIA	NPHCDA	62	57.41
5	MAL-T/2005	NATIONAL ANTIMALARIAL TREATMENT POLICY	FMoH	47	43.52
6	NCH-P/2006	NATIONAL CHILD HEALTH POLICY	FMoH	53	49.07
7	NDC-MP/2015	NATIONAL DRUG CONTROL MASTER PLAN	NDLEA	71	65.74
8	ND-P/2005	NATIONAL DRUG POLICY	FMoH	34	31.48
9	NFP-RHSP/2009	NATIONAL FAMILY PLANNING/REPRODUCTIVE HEALTH - SERVICE PROTOCOLS	FMoH	35	32.41
10	NGP-SF/2008-2013	NATIONAL GENDER POLICY STRATEGIC FRAMEWORK (IMPLEMENTATION PLAN)	FMoH	49	45.37

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11	MAL-T/2011	NATIONAL GUIDELINES FOR DIAGNOSIS AND TREATMENT OF MALARIA	FMoH	39	36.11
12	HIV-TR/2010	NATIONAL GUIDELINES FOR HIV AND AIDS TREATMENT AND CARE IN ADOLESCENTS AND ADULTS	FMoH	38	35.19
13	NG-PAE/2007	NATIONAL GUIDELINES FOR PAEDIATRIC HIV AND AIDS TREATMENT AND CARE	FMoH	54	50
14	NG-PMT/2010	NATIONAL GUIDELINES FOR PREVENTION OF MOTHER-TO-CHILD TRANSMISSION OF HIV	FMoH	56	51.85
15	NH-PP/	NATIONAL HEALTH PROMOTION POLICY	FMoH	46	42.59
16	NIP/2009	NATIONAL IMMUNIZATION POLICY	NPHCDA	45	41.67
17	NNG-NCD/2014	NATIONAL NUTRITIONAL GUIDELINE ON NON-COMMUNICABLE DISEASE PREVENTION, CONTROL AND MANAGEMENT	FMoH	42	38.89
18	NPA-FN/2002	NATIONAL PLAN OF ACTION ON FOOD AND NUTRUITION IN NIGERIA	NPC	50	46.3
19	NP-FNN/2001	NATIONAL POLICY ON FOOD AND NUTRUITION IN NIGERIA	NPC	38	35.19
20	NP-HIV/2003	NATIONAL POLICY ON HIV/AIDS	FMoH	55	50.93
21	NP-IYC/2005	NATIONAL POLICY ON INFANT AND YOUNG CHILD FEEDING IN NIGERIA	FMoH	52	48.15
22	NPM-DT/2011	NATIONAL POLICY ON MALARIA DIAGNOSIS AND TREATMENT	FMoH	56	51.85
23	NP-PPH/2005	NATIONAL POLICY ON PUBLIC PRIVATE PARTNERSHIP FOR HEALTH IN NIGERIA	FMoH	45	41.67
24	NP-HDAY/2007	NATIONAL POLICY ON THE HEALTH & DEVELOPMENT OF ADOLESCENTS & YOUNG PEOPLE IN NIGERIA	FMoH	57	52.78
25	NRH-PS/2001	NATIONAL REPRODUCTIVE HEALTH POLICY AND STRATEGY	FMoH	53	49.07
26	NRH-SF/2002	NATIONAL REPRODUCTIVE HEALTH STRATEGIC FRAMEWORK AND PLAN	FMoH	49	45.37
27	NSH-P/2006	NATIONAL SCHOOL HEALTH POLICY	FMoE	56	51.85
28	NS-GHC/2005	NATIONAL STRATEGIES AND GUIDELINES FOR HOME AND COMMUNITY MANAGEMENT OF MALARIA	FMoH	63	58.33
29	NN-BF/2005	NIGERIA NATIONAL BIOSAFETY FRAMEWORKS	FMoEnv.	64	59.26
30	POLIO/2012	NIGERIA POLIO ERADICATION EMERGENCY PLAN	NPHCDA	39	36.11
31	TASK/2014	TASK-SHIFTING AND TASK-SHARING POLICY FOR ESSENTIAL HEALTH CARE SERVICES IN NIGERIA	FMoH	43	39.81
32	NBP/2006	NATIONAL BLOOD POLICY	NBTS	38	35.19
33	NG-TB/2008	NATIONAL GUIDELINES FOR TB INFECTION CONTROL	FMoH	41	37.96

NBTS national blood transfusion service, NPC national population commission

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IV. DISCUSSION

The study described an iterative technical process for strategically assessing quality of research evidence utilization and content validation in a policy document. PROPHET software was developed and used to establish the fact that computer-driven activities apply in virtually all fields of human endeavor, both to facilitate standards, support improved precision in decision making and abate waste of scarce resource through strategic conceptual approaches [38,57-59]. The policy assessment result in table III has only eleven (11) policies scoring up to fifty percent, which clearly suggests that there are very few policy documents that were made with sufficient research evidence content. This underscores the need for policymakers to adopt technology driven approaches such as the PROPHET capable of facilitating processes in compliance with evidence-to-policy perspective.

The outcome of the assessment of the thirty-three (33) policy documents that was done using the PROPHET showed its critical role in advancing evidence informed policymaking and implementation. Two-third of the policy documents assessed were shown to have low weighted grade-points, signifying that they were formulated without adequate use of research evidence and as such would be difficult to implement and would not yield intended benefits. One can deduce from this outcome, that if as much as two-third of the national policy showed this outcome, then many of the suggested policies would fall into this category and therefore need urgent reviews. Such poor outcome is in keeping with a recent report of suboptimal use of research evidence in policymaking [60]. This can be explained by the existence of weak and sometimes lack of researcher-policymaker linkages and platforms [61,62]. Understandably, with such gaps, policymakers would tend to use routinely collected data rather than research evidence from external academic institutions, as reported in a study [60].

V. CONCLUSIONS

The development of Policy Research-evidence Organizer and Public Health-policy Evaluation Tool (PROPHET) was successful, and it represents a new trend in evidence-informed policymaking (EIP) perspectives. It is a flexible, efficient and user-friendly interactive piece of software that allows for relevant context-specific modifications in conformity with any definite health issue. PROPHET has been tested for functional effectiveness with health policy document extracted from an online repository warehousing all health policy documents in Nigeria known as *policy information platform*. The test result shows that only 11 out of the 33 policies passed with at least 50% grade-point reputed in this study as minimum benchmark for implementation or be referred for necessary review. It rates policy features, assesses overall implementation prospect of policies with seamless real-time data validation and referencing across modules. PROPHET is expected to aid public health policymakers in amplifying *evidence-informed policymaking* for improved health outcomes. The researchers recommend government agencies adoption of this novel tool in facilitating compliance with the ideals of systems' thinking (evidence-to-policy perspectives) encased in the 6-building blocks of the health systems.

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FOOTNOTES

CONFLICT OF INTEREST: The authors declare that they have no competing interest.

ETHICAL STATEMENT: The authors are accountable for all aspects of this study in ensuring that all questions relating to the accuracy or integrity of any part of the study are appropriately investigated and resolved.

VI. REFERENCES

[1] Mbam BCE, "Information Technology and Management Information System," *Our Saviour Press LTD, Enugu*, pp. 132–133, 2002.

[2] S. Pokhrel, "Scaling up health interventions in resource-poor countries: What role does research in stated-preference framework play?," 2006. doi: 10.1186/1478-4505-4-4.

[3] D. S. M. A. Burney, N. Mahmood, and Z. Abbas, "Information and Communication Technology in Healthcare Management Systems: Prospects for Developing Countries," *Int J Comput Appl*, vol. 4, no. 2, 2010, doi: 10.5120/801-1138.

[4] A. Chetley *et al.*, "Improving health, connecting people: the role of ICTs in the health sector of developing countries A framework paper," *Infodev*, no. 7, 2006.

[5] K. C. Laudon and J. P. Laudon, *Management information systems – Managing the digital firm*, Eleventh Edition. New Jersey: Pearson Education Inc, 2010.

[6] Z. Shroff, B. Aulakh, L. Gilson, I. A. Agyepong, F. El-Jardali, and A. Ghaffar, "Incorporating research evidence into decision-making processes: Researcher and decision-maker perceptions from five low- and middle-income countries," *Health Res Policy Syst*, vol. 13, no. 1, 2015, doi: 10.1186/s12961-015-0059-y.

[7] C. J. Uneke, A. E. Ezeoha, H. C. Uro-Chukwu, C. T. Ezeonu, and J. Igboji, "Promoting researchers and policy-makers collaboration in evidence-informed policy-making in Nigeria: Outcome of a two-way secondment model between university and health ministry," *Int J Health Policy Manag*, vol. 7, no. 6, 2018, doi: 10.15171/ijhpm.2017.123.

[8] V. Tudisca *et al.*, "Development of measurable indicators to enhance public health evidence-informed policy-making," *Health Res Policy Syst*, vol. 16, no. 1, 2018, doi: 10.1186/s12961-018-0323-z.

[9] C. J. Uneke, A. E. Ezeoha, C. D. Ndukwe, P. G. Oyibo, and F. Onwe, "Enhancing health policymakers' capacity to use information and communication technology in Nigeria," *J Health Inform Dev Ctries*, 2011.

[10] Sherri Rose, "Machine Learning in Biostatistics & Health Policy," PhD dissertation, Harvard Medical School, 2016.

http://dx.doi.org/10.21622/ACE.2024.04.2.1076

[11] I. S. Fall *et al.*, "Integrated Disease Surveillance and Response (IDSR) strategy: Current status, challenges and perspectives for the future in Africa," 2019. doi: 10.1136/bmjgh-2019-001427.

[12] "Supporting Policy In health with Research: an Intervention Trial (SPIRIT)—protocol for a stepped wedge trial," *BMJ Open*, vol. 4, no. 7, p. e005293, Jul. 2014, doi: 10.1136/bmjopen-2014-005293.

[13] J.-P. Rodrigue, C. Comtois, and B. Slack, *The Geography of Transport Systems*. Routledge, 2016. doi: 10.4324/9781315618159.

[14] B. W. Head, "Toward More 'Evidence-Informed' Policy Making," *Public Adm Rev*, vol. 74, no. 4, pp. 72–84, May 2019, doi: 10.1111/puar.12475.

[15] R. Larocca, J. Yost, M. Dobbins, D. Ciliska, and M. Butt, "The effectiveness of knowledge translation strategies used in public health: A systematic review," 2012. doi: 10.1186/1471-2458-12-751.

[16] F. El-Jardali, J. Lavis, K. Moat, T. Pantoja, and N. Ataya, "Capturing lessons learned from evidence-to-policy initiatives through structured reflection," *Health Res Policy Syst*, vol. 12, no. 1, 2014, doi: 10.1186/1478-4505-12-2.

[17] S. Ettelt, B. Hawkins, and A. Alvarez-Rosete, "Working Paper # 3 Analysing evidence use in national health policy-making – an institutional approach," *London School of Hygiene and Tropical Medicine GRIP-Health Programme*, 2013.

[18] I. Ajah and H. C. Inyama, "A Model of DNS-Based Bank Credit Risk Management," *ARPN Journal of Systems and Software*, vol. 3, no. 6, pp. 106–128, 2013.

[19] S. A. Abdulrahman and K. Ganasegeran, "M-health in public health practice: A constellation of current evidence," in *Telemedicine Technologies: Big Data, Deep Learning, Robotics, Mobile and Remote Applications for Global Healthcare*, 2019. doi: 10.1016/B978-0-12-816948-3.00011-8.

[20] N. Kasoju *et al.*, "Digital health: trends, opportunities and challenges in medical devices, pharma and bio-technology," *CSI Transactions on ICT*, vol. 11, no. 1, 2023, doi: 10.1007/s40012-023-00380-3.

[21] B. Ebenso *et al.*, "Impact of using eHealth tools to extend health services to rural areas of Nigeria: Protocol for a mixed-method, non-randomised cluster trial," *BMJ Open*, vol. 8, no. 10, 2018, doi: 10.1136/bmjopen-2018-022174.

[22] C. J. Uneke, I. Sombie, H. C. Uro-Chukwu, Y. G. Mohammed, and E. Johnson, "Promoting evidence informed policymaking for maternal and child health in Nigeria: Lessons from a knowledge translation workshop," *Health Promot Perspect*, vol. 8, no. 1, 2018, doi: 10.15171/hpp.2018.08.

[23] J. Sumankuuro, J. Crockett, and S. Wang, "Perceived barriers to maternal and newborn health services delivery: A qualitative study of health workers and community members in low and middle-income settings," *BMJ Open*, vol. 8, no. 11, 2018, doi: 10.1136/bmjopen-2017-021223.

[24] S. Ibeneme, N. Ukor, M. Ongom, T. Dasa, D. Muneene, and J. Okeibunor, "Strengthening capacities among digital health leaders for the development and implementation of national digital health programs in Nigeria," in *BMC Proceedings*, 2020. doi: 10.1186/s12919-020-00193-1.

http://dx.doi.org/10.21622/ACE.2024.04.2.1076

[25] Scott-Clark Medicals, "Computer uses and advances in medicine," *A Company Blog*, 2022.

[26] P. Shachaf, "Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study," *Information and Management*, vol. 45, no. 2, 2008, doi: 10.1016/j.im.2007.12.003.

[27] Sheila K., "How to Use Basic Computer Skills Tests to Hire Better Healthcare Support Staff," *eSkill blog: talent assessment platform*, 2021.

[28] S. A. Abdulrahman and K. Ganasegeran, "m-Health in Public Health Practice," in *Telemedicine Technologies*, Elsevier, 2019, pp. 171–182. doi: 10.1016/B978-0-12-816948-3.00011-8.

[29] A. Azimi, R. Fattahi, and M. Asadi-Lari, "Knowledge translation status and barriers," 2015. doi: 10.3163/1536-5050.103.2.008.

[30] N. Kasoju *et al.*, "Digital health: trends, opportunities and challenges in medical devices, pharma and bio-technology," *CSI Transactions on ICT*, vol. 11, no. 1, pp. 11–30, Apr. 2023, doi: 10.1007/s40012-023-00380-3.

[31] Jain KC and Jain S., *Principles of Automation and Advanced Manufacturing Systems*, First Edition. Delhi: Khanna Publishers, 2004.

[32] Inyiama HC and Alo UR, "Practical Approach to Corporate Data Processing, the Dynamic Informer," *Enugu*, vol. 34, pp. 18–19, 2008.

[33] S. Haag, M. Cummings, and J. Dawkins, *Management Information Systems for the Information Age*, 2nd ed. New York: McGraw Hill Companies, 2000.

[34] Rajaraman V, *Introduction to Information Technology*, 2nd edition. New Delhi: Prentice Hall India, 2010.

[35] Adams J., Bateman B., and Becker F., "Health Technology Assessment," *NIHR Journals Library Southampton (UK).*, vol. 19, no. 94, 2015.

[36] Billie P, "Using Computers to Advance Health Care," *Agency for Healthcare Research and Quality*, 2014, [Online]. Available: http://www.unc.edu/~kmonsalv/comp101/project1/

[37] C. S. Kruse, K. Williams, J. Bohls, and W. Shamsi, "Telemedicine and health policy: A systematic review," *Health Policy Technol*, vol. 10, no. 1, pp. 209–229, Mar. 2021, doi: 10.1016/j.hlpt.2020.10.006.

[38] Wasfi Dhahir Abid Ali, lauy abdulwahid shihab, Taiba Mahdi, Ahoud Muhammed, and Hiba Jassim, "Assessment study of the importance of computer technology in nursing health care," *World Journal of Advanced Research and Reviews*, vol. 18, no. 2, pp. 567–571, May 2023, doi: 10.30574/wjarr.2023.18.2.0744.

[39] Megan R., Helena W, and Monita B.D., "Leadership, Management, and Governance Evidence Compendium ," *USA: Management Sciences for Health, International*, pp. 2–51, 2018.

[40] S. Redman *et al.*, "The SPIRIT Action Framework: A structured approach to selecting and testing strategies to increase the use of research in policy," *Soc Sci Med*, vol. 136–137, 2015, doi: 10.1016/j.socscimed.2015.05.009.

http://dx.doi.org/10.21622/ACE.2024.04.2.1076

[41] S. R. Makkar, S. Brennan, T. Turner, A. Williamson, S. Redman, and S. Green, "The development of SAGE: A tool to evaluate how policymakers' engage with and use research in health policymaking," *Res Eval*, vol. 25, no. 3, 2016, doi: 10.1093/reseval/rvv044.

[42] S. R. Makkar *et al.*, "The Development of ORACLe: a Measure of an Organization's Capacity to Engage in Evidence-Informed Health Policy," *Health Res Policy Syst*, vol. 14, no. 4, pp. 1–18, 2016.

[43] S. E. Brennan *et al.*, "Development and validation of SEER (Seeking, Engaging with and Evaluating Research): a measure of policymakers' capacity to engage with and use research," *Health Res Policy Syst*, vol. 15, no. 1, pp. 1–19, Dec. 2017, doi: 10.1186/s12961-016-0162-8.

[44] Schach SR, *Practical Software Engineering*, vol. 115. R.R. Donnelley and Sons Publications USA, 1992.

[45] Pressman SR, *Software Engineering, A practitioner's Approach.* New York: McGraw-Hill Companies Inc, 1999.

[46] Inyiama HC and Alo UR, "Software Design and Development: A Practical Approach," *WillyRose and Appleseed Abakaliki*, pp. 31–35, 2009.

[47] Osuagwu OE, *Software Engineering: A Pragmatic and Technical Perspective.* Owerri: Oliverson Puplishing House, 2008.

[48] Sommerville I., *Software Engineering*, 9 ed. Boston: Pearson Education Inc, 2011.

[49] "Mastering Machine Learning: A Step-by-Step Guide with MATLAB," 2018. [Online]. Available: https://www.mathworks.com/campaigns/offers/mastering-machine-learning-with-matlab.html

[50] S. Ray, "Essentials of Machine Learning Algorithms (with Python and R Codes)," Dec. 2018. [Online]. Available: https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

[51] "World Health Organization. A Practical Guide for Health Researchers," *WHO Regional Publications Eastern Mediterranean Series 30*, pp. 28–38, 2004.

[52] M. Ryan, A. Bate, C. J. Eastmond, and A. Ludbrook, "Use of discrete choice experiments to elicit preferences," *Quality in Health Care*, vol. 10, no. SUPPL. 1, 2001, doi: 10.1136/qhc.0100055.

[53] M. D. Clark, D. Determann, S. Petrou, D. Moro, and E. W. de Bekker-Grob, "Discrete Choice Experiments in Health Economics: A Review of the Literature," 2014. doi: 10.1007/s40273-014-0170-x.

[54] J. Coast and S. Horrocks, "Developing attributes and levels for discrete choice experiments using qualitative methods," *J Health Serv Res Policy*, vol. 12, no. 1, 2007, doi: 10.1258/135581907779497602.

[55] P. K. Sahoo and K. Charlapally, "Stock Price Prediction Using Regression Analysis," *Int J Sci Eng Res*, vol. 6, no. 3, 2015.

http://dx.doi.org/10.21622/ACE.2024.04.2.1076

[56] F. S. Gharehchopogh, T. H. Bonab, and S. R. Khaze, "A Linear Regression Approach to Prediction of Stock Market Trading Volume: A Case Study," *International Journal of Managing Value and Supply Chains*, vol. 4, no. 3, pp. 25–31, Sep. 2013, doi: 10.5121/ijmvsc.2013.4303.

[57] Efraim T, *Decision Support and Business Intelligence Systems.* New Jersey: Pearson Prentice Hall, 2007.

[58] V. Zwass, *Information System.* 2022. [Online]. Available: https://www.britannica.com/topic/information-system

[59] C. S. Kruse, K. Williams, J. Bohls, and W. Shamsi, "Telemedicine and health policy: A systematic review," *Health Policy Technol*, vol. 10, no. 1, pp. 209–229, Mar. 2021, doi: 10.1016/j.hlpt.2020.10.006.

[60] C. J. Uneke *et al.*, "Institutional roles, structures, funding and research partnerships towards evidence-informed policy-making: a multisector survey among policy-makers in Nigeria," *Health Res Policy Syst*, vol. 21, no. 1, p. 36, May 2023, doi: 10.1186/s12961-023-00971-1.

[61] B. Uzochukwu *et al.*, "Health policy and systems research and analysis in Nigeria: Examining health policymakers' and researchers' capacity assets, needs and perspectives in south-east Nigeria," *Health Res Policy Syst*, vol. 14, no. 1, 2016, doi: 10.1186/s12961-016-0083-6.

[62] F. U. Damba, N. G. Mtshali, and M. J. Chimbari, "Barriers and facilitators of translating health research findings into policy in sub-Saharan Africa: A Scoping Review," 2022. doi: 10.1057/s41599-022-01070-2.