# Model for Evaluating Hospital Management Performance using Artificial Neural Network

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***Abstract***
*This paper presents model for evaluating hospital management performance to establish appropriate rules for efficiency performance. Feed-forward neural network was applied. The methodology adopted the Rapid Application Development (RAD), Prototype Design Specification (PDS) and UML as design tool. The architectural design consisted of nine inputs nodes, five hidden (processing) nodes and one output node, to achieve this; back-propagation feed-forward neural network was trained. The system was implemented Java programming language. An input interactive interface was generated for evaluation parameters $X_i$ values ranging from (1-9), with a weighted value W ranging from 1-4.45. Comparison has been carried out on the outcome between public and private hospital performances. Results show in bar chart and graph, denoting poor, average, above average, Good and excellence percentage performances. The bar chart and graph as dynamically used to illustrate the behaviors of each evaluation output, poor performance 1- 48%, in some cases, 50-59%, indicates average and above average performances,60-69% shows Good and above good performance, excellent performances ranged 70-100%, the use of neural network had shown that private hospital has higher accuracy and commitment. In deduction, this study offers tools for assessing the performance of hospital activity which are useful for both hospital management and healthcare administration controlling hospital performances.*

## 1. Introduction

Artificial neural network is effectively used comprehensive in real life applications because it has scientific strong fitting that try to mimic the edifice and functions of the brain like network. ANN has the capability to solve more multifaceted mathematical related problems that cannot be solved by mere human reasoning (Andrej et al., 2011), the aim of the study is to present the use of artificial neural network for evaluating of hospital management performance. Hospital Performance evaluation is an official organizational way to afford an evaluation between individual performances based on objective or subjective elements. Performance evaluation (PE) is an adopted method improving the quality of employee work performance that encourages staffs to be more contributive in an organization growth (Adnan, 2014).World Health Report (2003),WHO reported that the establishment, arrangement and service delivery has an effect on the general health system, which present reformation strategy in the hospital setting, the significance base for evaluating hospital establishments throughout healthcare sector requires medical experts and professionals and third party to make tangible contributions improving quality service, that governments "should make sure that their country's health care system provides the best health services for its people", that Hospitals are significant branch that should afford all-around health service that rely on capability and satisfaction, also delivered emergency healthcare demands. High hospital performance should be appraised in relation to the availability of hospitals' services to all patients irrespective of physical, cultural, social, demographic and economic barriers"(Mila, et al,2003).Satisfaction and safety of

patients depend on relevant indicators for evaluation of any organisational performance should comprised profitability, productivity, marketing effectiveness, and customer satisfaction (Ying, 2012).Hospital management performance evaluation system is prevailing and is expandable platform that is proposed to bring real believable profit to healthcare (Fatemeh & Wickramasinghe, 2014). Performance management in the public sector is a rising trend worldwide design to advance public hospital sector accountability (Cristina, et al, 2017). Several models were obtainable for valuation of hospital performance. In some reviewed works, numerous indicators were applied to evaluate and compare performance in hospitals (Hamed et al, 2014). Specialty, cost, delivery, risk, quality and service pattern recognition, drug monitoring. Healthcare services thus assumes larger amount, and in the circumstance, the role played by information and communication technology has certainly a bigger contribution for its effective delivery mechanism (Pradhan, 2014).Well-organized and active hospital system is important for quality healthcare service delivery to humanity (Nagesh et al., 2017).

## 2. Related works

In recent time, cost of service in the hospital raised disparity between the poor and the rich, where a lot of poor people cannot access hospital for treatment. General speaking, it was argued that some hospital management missed their core needs that would have promoted healthcare productivity. (Medici & Murray, 2010).Performance assessment attempts to find the best, valid and cost effective way of evaluating performance and work satisfaction, that there are several indicators considered for hospital performance assessment which overlook the managerial aspect. Hence, it said that public hospital domain must originate substantial study to reduce increasing expenses in any country. That most of them ideally suggested that there should be cutting down of costs to increase healthcare productivity, that to evaluate hospital performance which is relevant way to offer quality of service in public hospitals, hospital management should gear towards given attention on the effectiveness of resource usage.(Ali et al,2017).Case-mix was a significant instrument to evaluate costs for Diagnosis Related Groups (DRGs) although there were no sufficient material facts to establish costs for radiology services. Their work evaluated radiology services' costs for each diagnostic related group based on serious sicknesses. It is observed that a handful researchers engaged other approaches in order to evaluate radiology costs, they adopted the lower-three-higher-three technique to clipped radiology costs data; and further used it for calculation of the coefficients assigned to radiology process, results shows that radiology facilities in a public hospital domain are important section that needed concurrent attention, radiology service were component diagnostic related group and non-surgical cases for public hospitals were handled. To reduce un-useful radiology procedures medical experts are advised to study about relevant findings so as to advance healthcare competence that the method can be useful in other areas. (Syed et al, 2018). Subcontracting were internal operations manually carried out within an organization templates, this is where some persons from the outside were engaged to offer certain needed services which bring into bear regulatory services by the private work force. In most cases, hospitals subcontracted their outlying doings to specific establishment to raise sustainability over management core needed actions, this safeguards upsurge in working competence and pave way for experienced know-how. ( Apurva & Ankita, 2014).Strong effort was put in to study three key functions of a public hospital, were bed occupancy rate was considered as relying element, whereas income generated and number of patients admitted in a unit was used as the illustrative elements, interest was to bring down cost of healthcare service to enhanced effectiveness. (Vitalis et al, 2018). According to the researchers that internal connections between hospitals differs base on managerial ideology or principles, the researcher opinion was that since the hospitals managers could not defined a better means to improve inter- hospital relationship that there was difficulty to build quality healthcare sector. Main targets was to

enumerate the inter hospital differences while providing new way of rating scale that shall improve hospital managerial practice, to make inter-hospital relationship viable, dependable and doable depends on the ideological structures, new rating scale was developed to annexed hospital target, operation ability, performance and capacity management. Data were collected through questionnaire approach, information implemented with clinic pathway with acute coronary syndrome study model, results shows that dependability has higher score r = 0.8. (Yidan et al, 2018).Again, Performance examination is a chief technique to identify hospital incompetency in healthcare delivery to patients. A viable method is adopted to ascertain the dominant and powerful pointers to progress healthcare targets. One of the strongest target was to proposed for a combinatorial decision support model that shall improve and identify better input parameters which give way for continued evaluation of hospital performance; another method that was viable is the use of evidential reasoning. To improve the proposed approach, empirical case was reviewed to attain better result. results gotten reveals "accidents/adverse events", "nosocomial infection", "incidents/errors", "number of operations/procedures" were important and powerful. However, pointers like "length of stay", "bed occupancy" and "financial measures" are key parts in hospital business (Sheng-Li et al,2017).It is well said, that evaluating infection control products and measures needs an organized, multi-disciplinary method. Infection Control Professionals (ICP) should take the lead when evaluating infection control-related products or processes that effect infection control activities (Valenti 2018).Certain scholars had argued that a lot of hospitals management team has respond adequately to face the problems that confronts health sector, thereby not performing well in their daily healthcare activities. However, in recent time hospital decision makers has drastically moved away from the traditional methods, and introduce an efficient and unique patient center hospital approach which was evidence base effort put together to ascertain hospital performance level. they explored the merit of using pseudo trial scenery**,** data were collected from hospital discharged chart, the study allows evaluation or assessment of hospital efficiency and effectiveness of hospital performance, the patient centre approach was apply in examining the disease analysis type between hospitals. The researchers have proved that increase healthcare/hospital performance deals with the introduction of an innovative framework in replace of statistical base analytical theories (quantitative calculations). Result indicate that there were increase performance with patient center approach. (Carlo et al, 2018).Hospital performance are elementary elements that depended on selected and essential indicators that relates to hospital functions, to measure and reducing patient duration or days of stay increase hospital efficiency and quality, the research further target to define or describe elements related to hospital operational gains, reduction of disease infection rate and treatment after effect,

## 3. Methodology

Rivers State University Teaching Hospital and Nuvon Hospital/Clinic (case study).We vigorously explore Questionaire and hospital rated form methods to drives formation of this research work. The methodology adopted in this research were the Rapid Application Development (RAD) UML tools. This methodology place little importance on development and more weight on an adaptive method. Prototypes design specification (PDS) was used for development of the intended model. This methodology was adopted because it is the best suited for developing software that is driven by user interface requirements. In this research work, we are not interested in the establishment of the hospital but how it functions. Rapid application development (RAD) tools help to provide a firm task improvement making it a good-looking option to developers that work in a software environment. By adapting Rapid application development methodology (RADM), this study designs tends to reduce plan period and emphasizes prototype iterations.

## 4. System Design

Proposed method is a performance evaluator. It evaluates the performance of a hospital management. The system evaluates and rates the quality of the management of the activities of a hospital system. It rates the response time of a hospital when a patient arrives in an out-patient case and in emergency case. In the two cases mentioned above, the former is cared by the family medicine department (FMD) while the later as cared for by the emergency and accident department (EAD). The proposed system evaluates critically how each department manage, its cases in terms of response time, hospitality, professionalism, skill, cost of service, infrastructural balance across the various departments, attitude toward patients, visitors, referral promptness and staff relationship. Each department is measured and evaluated with the same scale. Each parameter is divides by 360 and multiplied by 100 to ascertain the percentage score of each department when the constant 360 aggregated is chosen to make complete revolution around the hospital system. This is fitting since no unit or department will be skipped mathematically, a complete turnaround 9 system (point or state) amounts to 360 degrees. The nine parametric elements of the evaluation are acronym as RHICARPSS without subscripts and with subscripts as $R_t\ HI_b\ C_s A_p R_p P_{ssr}$ where:

$R_t$ = Response time
H = Hospitality
$I_b$ = Infrastructural balance
$C_s$ = Cost of service
$A_{pr}$ = Attitude toward patients'/visitors
$R_p$ = Referral promptness
P = Professionalism
S = Skill
$S_r$ = Staff relationship

The overall evaluation will assess the hospital activities and their management quality, so as to determine strength, and weakness of the functionality in medical practice and hospital administration. Each parameter is defined to have maximum weight of 40 points. A total of 48% score by a department in the hospital is considered average performance while 68% and above is considered excellent performance and ultimately 47% and below is considered poor performance. The hospital is judged the same in rating when department scores are aggregated.

### 4.1 Use - Case Diagram of the Proposed System

Use case diagram used to describe the functionality of the system in any manner. This implies that it symbolizes the particulars of single features of a system and its available functionality. It is a description of an actor-activity relationship.

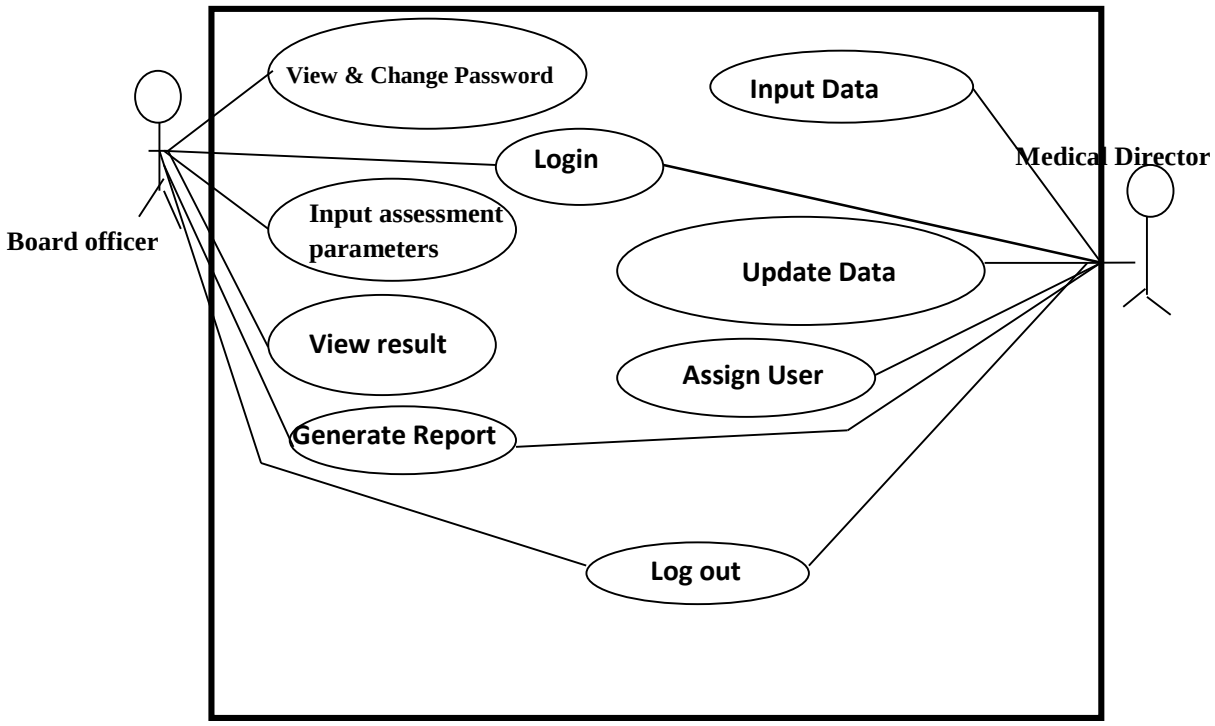


**Figure 4.1: Use-Case Diagram of the Proposed System**

## 4.2 Output Design of the Proposed System

Output design is reports of what is processed by the system. They play a huge role in system design in terms of the user needs and design specifications.

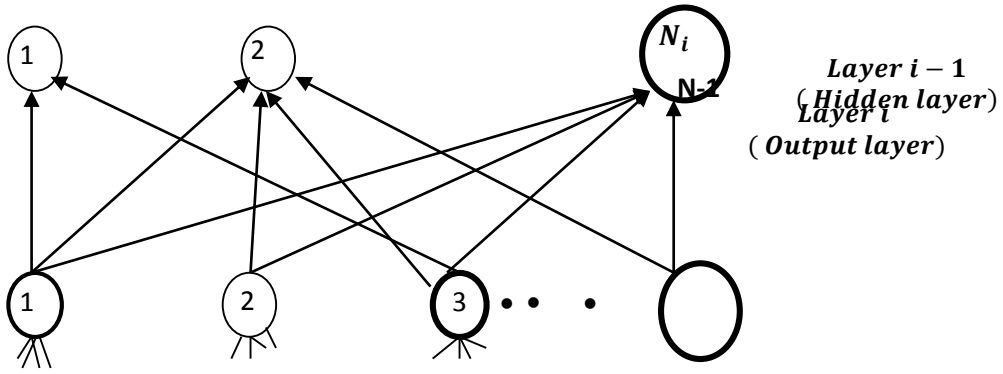


**Figure 4.2: Multilayer Structure of Output of the proposed system**

## 4.3 User- based of Output display of the proposed system

The above describes the artificial neural network (ANN) structure of the output. This is a technical profile of the system output. The $y_1,\ y_2,\ y_3 \ldots\ldots\ldots\ y_n$ represent the outputs of the process occasioned by their respective $x_1,\ x_2,\ x_3, \ldots\ldots\ldots\ x_n$ values. We can describe the model output in a user-based structured where it is conveniently appreciated. The figure 3.3 below shows what happens when the supplied inputs are eventually processed.

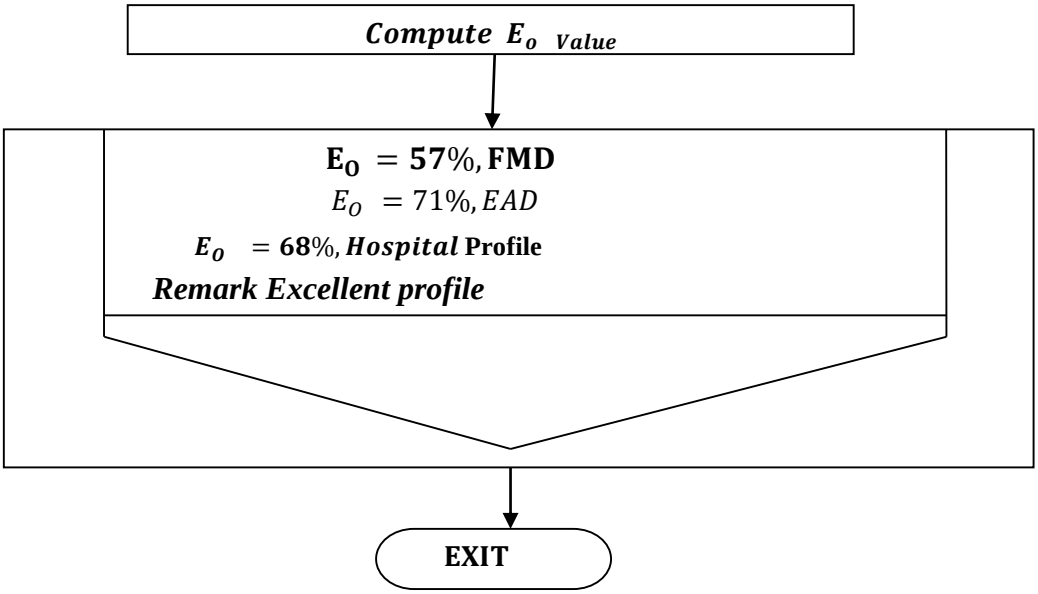


**Figure 4.3: User- based of Output display of the proposed system**

## 4.4 Database Design of the Proposed System

Database design figure 3.4 is the art of creating a thorough data model of the system database. Database design outlines the logical design of the data structures and it is used to store data.

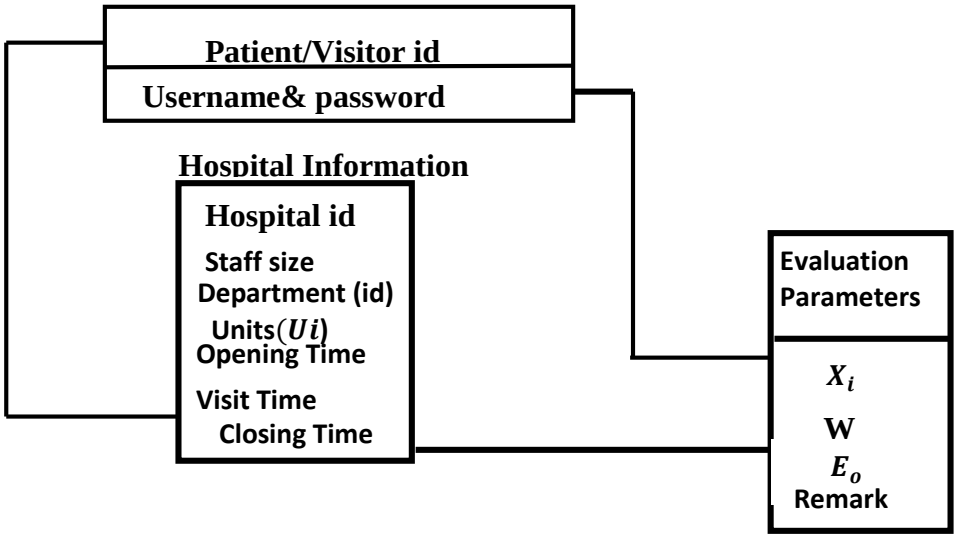


**Figure 4.4: Database model of the proposed system**

## 4.5 Artificial Neural Network Architecture of the Proposed System

Proposed artificial neural network based (ANN-B) architectures designed and is used in various fields. A feed-forward neural network with back-propagation learning algorithm is proposed in this study. Elementary component of back-propagation neural network architecture is the processing node. Each processing node behaves like a biological neuron and does two functions. First, it sums the values of its inputs multiplied by the weight associated with each interconnection. Sum total is then passed through an activation function to generate an output. All processing nodes are organized into layers, each fully connected to other layers; there is no

interconnection between the nodes of the same layer. In a back-propagation neural network, generally there is an inputs layer that acts as a distribution structure for the data being presented to the network. After this layer, one or more processing layers, called the hidden layer, follow, the final processing layer is called the output layer.The architecture above describes the nine parametric elements of the proposed system. Each of the nodes represents a parameter. The architecture clearly explores the basic layers of the artificial neural network (ANN).Figure 3.5below demonstrated a dynamic feed forward neural network with a back-propagation model that described the nine input nodes, five hidden processing and a single output n

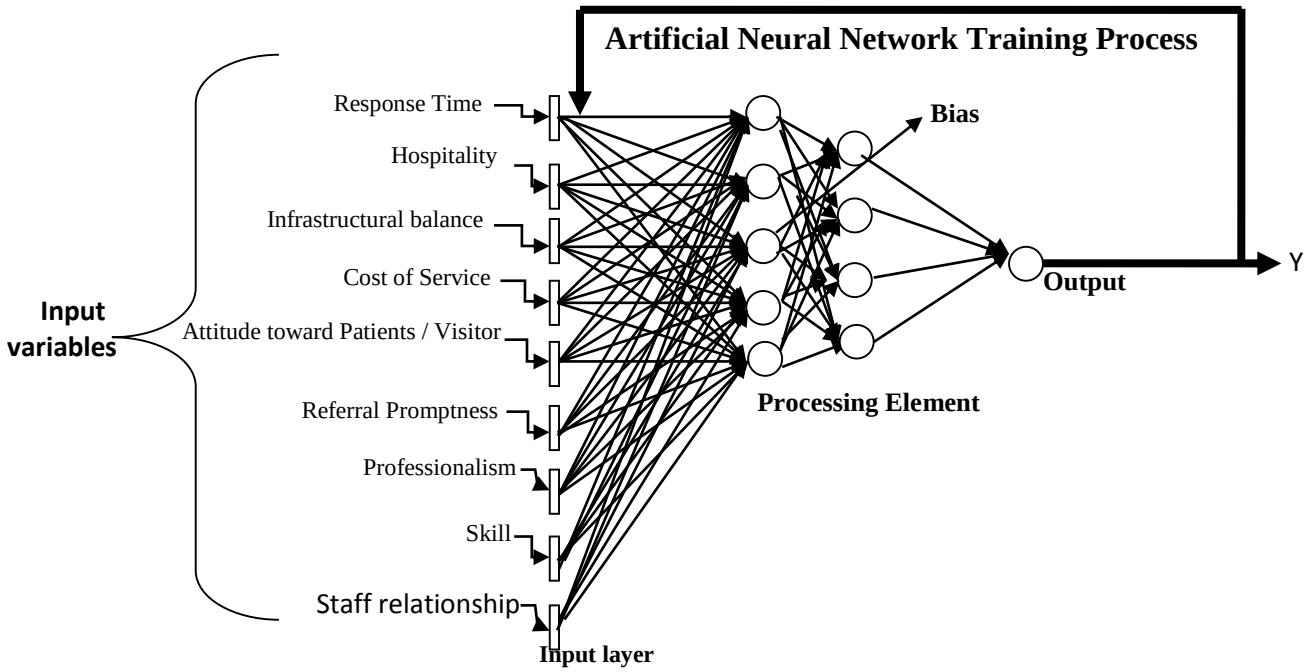


**Figure 4.5: Feed-forward Back- Propagation proposed system**

### 4.6 How the artificial neural network evaluate hospital management performance

The architecture of figure 3.7-3.9 labels the nine parametric elements of the proposed system. Each of the nodes represents a parameter. The architecture obviously explores the basic layers of the artificial neural network (ANN) where the assessment input parametric elements are presented by $X_i$ parameters into the feed-forward back-propagation artificial neural network; each input element weighted with a value ranged from 1-4.45 in the architectures which represents the strength of the connection. Back-propagation learning algorithm was used in architecture.

### 4.7 Architectural Design of the Proposed System

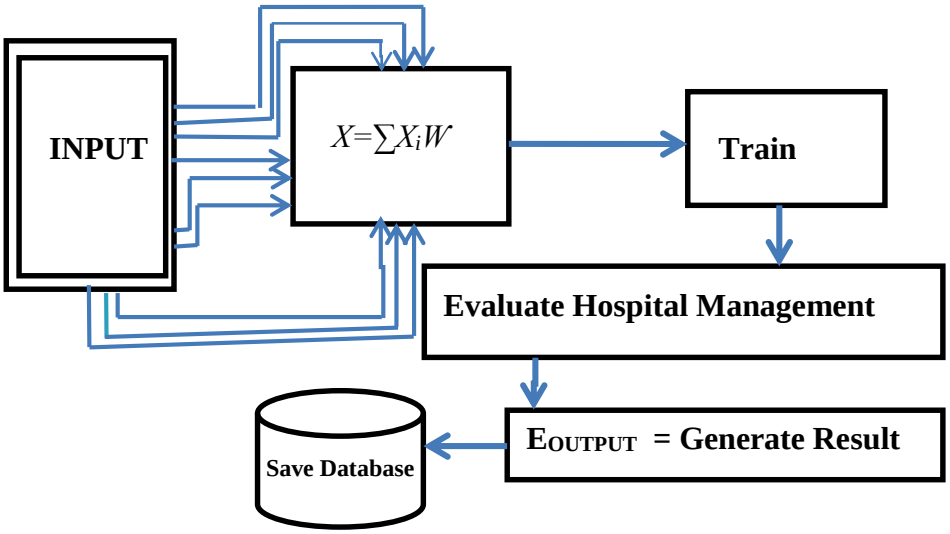


**Figure 4.6: Architectural Design of the proposed system**

### 4.8 Process Design of the Proposed System

The process design figure 3.11 shows how the information are profiled and analysed for effective evaluation, the inputs when supplied are weighted in the range of 1-9 for the $X_i$ and1-4.45 for $W$ such that for the nine parameters, we generate the mathematical algorithm below;

$X_i = x_1, x_2, x_3, x_4, \ldots x_9$ 3.1

$W = w_1, w_2, w_3, w_4, \ldots w_9$ 3.2

The weighted situation of the $x_i$ and $w_i$ will therefore become;

$X_i W = x_1 w_1 + x_2 w_2 + \cdots x_9$ 3.3

Equation (3.3) can be re-expressed as

$$WF = \sum_{i=1}^{n} x_i w \quad 3.4$$

Where **WF** = Weighted-function, if we substitute $x$ with its real parameter in

We have

$x_i = (R_t + \mathrm{H} + I_b + C_s + A_{pr} + R_P + p + S + S_r)w$ 3.5

$x_i w = \mathrm{R_{tw}} + \mathrm{H_w} + \mathrm{I_{bw}} + \mathrm{C_{sw}} + \mathrm{A_{prw}} + \mathrm{R_{pw}} + \mathrm{P_w} + \mathrm{S_w} + \mathrm{S_{rw}}$ 3.6

$\sum^{n}(R + H + I + C + A + R + P + S + S)W$ 3.7

Equations $(\mathbf{3.6})$ and$(\mathbf{3.7})$are without subscripts. Applying subscripts equation$(\mathbf{3.7})$, We have

$$\boldsymbol{X_i w = \sum_{i=0}^{n}\left[(R_t + H + I_b + C_s + A_{pr} + R_p + P + S + S_r)\right]} \quad \mathbf{3.8}$$

Hence we can write equation (3.8) as;

$$\boldsymbol{E_O = \sum_{I=0}^{n} w\left[R_t + H + I_b + C_s + Ap_r + R_p + P + S + S_r\right]} \quad \mathbf{3.9}$$

The processes of equation **[3.1-3.9]** can be described using the artificial neural network (ANN) as shown below.

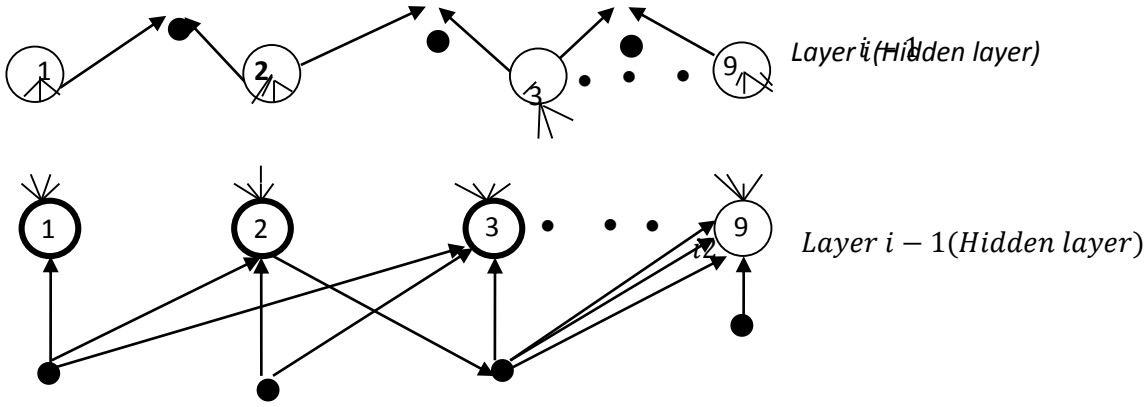


**Figure 4.7: Multilayer Figure 3.12: Multi-layer structure of the process**

### 4.9 Test Data for various modules

The test data for this system is the discrete numerical dataset. This dataset is input into the system using the keyboard, Table 4.1 contains two set of data values used. The first set contains $X_i$ values (input values) and its values range from 1-9, the second set is weighted value which range from 1-4.45.

**Table 4.1: An input sample field data for the hospital management evaluation**

| Hospital Depts | Response time | Hospitality | Infrastructural balance | Cost of service | Attitude towards patients | Referral promptness | Professionalism | Skills | Staff relationship |
|---|---|---|---|---|---|---|---|---|---|
| O&G | 6.00 | 9.00 | 7.00 | 8.00 | 9.00 | 4.00 | 5.00 | 3.00 | 6.00 |
| A&E | 3.00 | 9.00 | 6.00 | 2.00 | 1.00 | 7.00 | 5.00 | 8.00 | 4.00 |
| Radiology | 3.00 | 9.00 | 6.00 | 2.00 | 1.00 | 7.00 | 5.00 | 8.00 | 4.00 |
| Med.lab | 9.00 | 8.00 | 6.00 | 7.00 | 6.00 | 7.00 | 5.00 | 8.00 | 4.00 |
| Surgical | 7.00 | 7.00 | 8.00 | 8.00 | 6.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| Pharmacy | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| Med.record | 5.00 | 4.00 | 4.00 | 3.00 | 4.00 | 2.00 | 7.00 | 5.00 | 5.00 |
| Peadiatrics | 6.00 | 9.00 | 7.00 | 8.00 | 9.00 | 4.00 | 5.00 | 3.00 | 6.00 |
| Orthopedic | 9.00 | 8.00 | 7.00 | 7.00 | 6.00 | 7.00 | 5.00 | 8.00 | 7.00 |
| Dermatology | 4.00 | 1.00 | 4.00 | 8.00 | 8.00 | 7.00 | 3.00 | 2.00 | 4.00 |
| Cardiology | 6.00 | 1.00 | 5.00 | 8.00 | 9.00 | 7.00 | 3.00 | 2.00 | 4.00 |
| Aneasteria | 4.00 | 6.00 | 4.00 | 3.00 | 7.00 | 7.00 | 7.00 | 7.00 | 5.00 |
| Urinalogy | 1.00 | 2.00 | 3.00 | 4.00 | 6.00 | 5.00 | 7.00 | 8.00 | 9.00 |
| Family Med | 8.00 | 8.00 | 8.00 | 7.00 | 8.00 | 6.00 | 7.00 | 7.00 | 8.00 |
| Hiv/Aids | 1.00 | 2.00 | 9.00 | 9.00 | 3.00 | 2.00 | 9.00 | 6.00 | 3.00 |
| Labourward | 4.00 | 6.00 | 9.00 | 2.00 | 1.00 | 3.00 | 9.00 | 9.00 | 4.00 |
| ENT | 5.00 | 6.00 | 4.00 | 3.00 | 2.00 | 2.00 | 4.00 | 6.00 | 2.00 |
| Equipment | 8.00 | 8.00 | 9.00 | 9.00 | 8.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| Maintenance | 5.00 | 7.00 | 8.00 | 4.00 | 4.00 | 4.00 | 4.00 | 2.00 | 2.00 |

**Source: Rivers State University Teaching Hospital (RSUTH)**

**Table 4.2: An input sample field data for the hospital management evaluation**

| Hospital Depts | Response time | Hospita -lity | Infrastr -ucture balance | Cost of service | Attitude toward patients | Referr -al promp tness | Professi- onalism | Skills | Staff relationsh -ip |
|---|---|---|---|---|---|---|---|---|---|
| A & E | 8.00 | 3.00 | 2.00 | 4.00 | 1.00 | 8.00 | 9.00 | 2.00 | 4.00 |
| Orthopedic | 9.00 | 3.00 | 2.00 | 4.00 | 1.00 | 5.00 | 7.00 | 6.00 | 8.00 |
| Pediatrics | 7.00 | 5.00 | 9.00 | 4.00 | 7.00 | 4.00 | 6.00 | 8.00 | 9.00 |
| General surgery | 6.00 | 8.00 | 2.00 | 9.00 | 9.00 | 9.00 | 9.00 | 8.00 | 6.00 |
| Labor ward | 2.00 | 6.00 | 2.00 | 9.00 | 8.00 | 4.00 | 6.00 | 4.00 | 9.00 |
| Lab. Service | 8.00 | 6.00 | 2.00 | 9.00 | 6.00 | 4.00 | 6.00 | 4.00 | 9.00 |
| Cosmetic surgery | 4.00 | 8.00 | 2.00 | 9.00 | 9.00 | 4.00 | 6.00 | 3.00 | 9.00 |
| Dermatology | 1.00 | 2.00 | 2.00 | 3.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Obstetrics/ Gynecology | 3.00 | 1.00 | 1.00 | 4.00 | 7.00 | 4.00 | 2.00 | 1.00 | 3.00 |
| Immunization | 9.00 | 8.00 | 2.00 | 9.00 | 9.00 | 9.00 | 4.00 | 4.00 | 9.00 |
| Equipment | 2.00 | 4.00 | 2.00 | 9.00 | 3.00 | 4.00 | 7.00 | 7.00 | 8.00 |
| Maintenance | 4.00 | 3.00 | 1.00 | 9.00 | 4.00 | 3.00 | 5.00 | 7.00 | 7.00 |

**Source:** Nuvon Hospital /Clinic

## 5. Results and Discussion

### 5.1 Results

Nine parameters were used to developed the evaluation system for hospital management performance, which includes the response time, hospitality, infrastructure, cost of service, attitude towards patients/visitors, Referral promptness, Professionalism, Skill and Staff relationship, in which case, discrete numerical dataset was collected from the field of this research, Rivers State University Teaching Hospital and the Nuvon hospital /Clinic ( case study), various data collection approaches was exploit, which include interviewing of clients, questionnaire, generating a hospital rating form shown as Appendix C, other approaches used was scenarios and observation.

**Evaluation results table**

| S/N | RSUTH Unit | % | NUVON Unit | % | Decision |
|---|---|---|---|---|---|
| 1 | O&G | 67% | O&G | 23% | 67>23% |
| 2 | A&E | 51% | A&E | 40% | 51>40% |
| 3 | Orthopedic | 54% | Orthopedic | 51% | 54>51% |
| 4 | Pediatric | 56% | Pediatric | 70% | 56<70% |
| 5 | Surgery | 49% | Surgery | 80% | 49<80% |
| 6 | Labor ward | 52% | Labor ward | 57% | 52<57% |
| 7 | Lab. service | 73% | Lab. service | 63% | 73>63% |
| 8 | Dermatology | 43% | Dermatology | 12% | 43>12% |
| 9 | Equipment | 46% | Equipment | 54% | 46<54% |
| 10 | Maintenance | 42% | Maintenance | 42% | 42=42 |
| 11 | Family medicine | 51% | Family medicine (Immunization) | 74% | 51<74% |
| 12 | Pharmacy | 69% | Pharmacy | 33% | 67>33% |
| 13 | Medical record | 41% | Medical record | 25% | 41>25% |
| 14 | Radiology | 51% | - | | 51% |
| 15 | HIV/Aids | 40% | - | | 40% |
| 16 | ENT | 34% | ENT | 53% | 34<53% |
| 17 | Urinalogy | 51% | - | | 51% |
| 18 | Anaesthesia | 60% | - | 54% | 60>54% |
| 19 | Cardiology | 51% | - | | 51% |
| 20 | | | Cosmetic surgery | 61% | 61% |
| 21 | RSUTH overall % | 284% | Nuvon overall % | 218% | 284>218% |

In view of the above, hospital units was independently investigated and rated by prospective clients with the above nine evaluative parameters through which discrete numerical dataset was generated and which was directly fed into the system via keyboard, each of the indicators was assigned $X_i$ value with a weighted $W$ value ranged from 1-4.45

## 5.2 Discussion

First evaluation attempt, weighted W value ranged from 1to 4.45 was varied across the rated score assigned for ENT department of RSUTH. Where result shows that $E_O$=123.00 and percentage performance generated 34% denoting poor performance. 34<50% average performance. The HIV/ Aids special unit of the RSUTH was assigned constant weighted W value across the rated sample field data table 4.1 was supplied to the system, it reveals that the total number of $E_O$=145.00, and 40%percentage performance, RSUTH Medical record department generated 41% poor performance with a constant weighted W value varies across the rated score derived from table 4.1$E_O$=149.00, where 41%< 50%, RSUTH Maintenance unit also raised poor performance with a constant Weighted $W$ value was randomly assigned to each of the parameter, about 42%, and $E_O$=151.00 was generated. Dermatology unit of the RSUTH generated poor performance as result reveals that $E_O$ =155, and 43%, 43<50%. Equipment department of the RSUTH raised poor performance, as constant weighted W value were assigned against each of the rated values, where a total of $E_O$ = 167.00 and 46% was obtain, where 46<50% average performance. 49% was obtained as an average performance score with an $E_O$=175.00, 49% is slightly below average performance, but in this case it is captured as average performance, the 49<50%.

RSUTH, Radiology, Accident & Emergency, Cardiology, Urinalogy and Family medicine units uniquely generated an accurate performance of 51% and $E_O$=180, where 51% is slightly

above average. RSUTH, labor ward 52%, $E_O$=186, Orthopedic 54%, $E_O$=196, and Pediatric 56%, $E_O$=203 were processed and obtained above average performances, the results has shown that 52>50%, 52<53-100%, 54>50%, 54<55-100%, 56>50%, 56<57-100%. RSUTH, Anesthesia 60%, $E_O$=216, O&G 67%, $E_O$=242, and Pharmacy 69%, $E_O$=248, performed better, results indicated that Anesthesia, O&G and Pharmacy generated Good performances, where 60>1-59%, 60<61-100%, 67>1-66%, 67<68-100%, and 69>1-68%, 69<70-100%, there is stable accuracy.

RSUTH, Medical laboratory unit maintain a higher percentage performance of 73% and $E_O$=262. The result shows that this department is viable and effective and there is high level of efficiency.

Further trials NUVON hospital department, evaluations using the same weighted W values to achieve corresponding accuracies. NUVON O&G, 23%, $E_O$=82 generated in the evaluation, 23<50% thereby indicating poor performance. NUVON Dermatology has the lowest poor performance of 12%, and $E_O$=42, where 12<50% which is far below average performance. NUVON, Both Accident & emergency, and Maintenance units generated lower performance, where the A&E 40%, $E_O$=144, and the Maintenance, 42%, $E_O$=152, 40<50%, 42<50%. NUVON Orthopedic, attained a little above average performance, the assessment of 51%, and $E_O$=182 was processed, where there is slight improvement above average. NUVON Equipment and Labor ward improve better, where equipment 54%, $E_O$=193, Labor ward 57%, $E_O$=205. Both departments respectfully have a better accurate performance. NUVON Cosmetic surgery and Laboratory service departments were evaluated, where cosmetic surgery 61%, $E_O$=221, and Laboratory service 63%, $E_O$=227 were processed; both departments attain a good performance. NUVON Family medicine (Immunization) 74%, $E_O$=267, Pediatric 70%, $E_O$=253, and Surgical unit 80%, $E_O$=289 were assessed; these departments are efficient and effective respectively. The surgical maintain the highest performance, while family medicine and the pediatrics obtained higher performances. From the foregoing. An accurate results were generated in respect to hospital management performance, the system was tested for it efficiency (Strength and Weakness) using local generated dataset. The zenith of the hospital evaluation revolves within 360°of the hospital operations, and this targeted at various departments in the Hospital Life Cycle (HLC). In the proposed system, results were demonstrated with an input interfaces and with dynamic bar chart features and a graph, wherein hospital management performance $X_i$ input value range from 1-48% Poor performance scenario, the bar chart shows a drop according to each department parameters evaluated, and the graph curve depreciated below 50% average performance. And average performance taken as 49-50% which was denoted by the chart and graph, showing the result line, this is where the graph curve lies on the average degree line, Hence,51-59% assumed above average good performance, this is where the bar chart and graph curve degree of effect moved little above average as shown in the appendices. For 60-69% good performances show a degree of effect though with a fantastic drop between70-90% .60-69%>1-59%, 60-69<70-100% of hospital management performances.

Critically speaking, the Rivers State University Teaching Hospital and the Nuvon hospital/ clinic healthcare units, the level of performance are comparable taking into account certain aspect where the healthcare institutions need to improve on their hospital services to patient. In the above, the Rivers State university teaching hospital (public) performs better in certain health service demand, while the Nuvon hospital/clinics (private) show more commitment in critical patient demands, the Nuvon private hospital higher efficiencies and effectiveness in surgery, family medicine and pediatric units considering table 4.5. The system is consistent,

dependable, efficient, holistic and devoid of subjective evaluation biasness in all evaluation targets.

## 6. Conclusion

The study provided the beauty of using neural network as an efficient model for evaluating hospital management performance. The pivot interest here is to introduce a computer model that could efficiently evaluate hospital management performance instead of traditional approach, the optimal solution of computer model is to display an accurate evaluations for hospital management performance results with an input and output interfaces displayed, results are in descriptions with a bar chart and graph curves in percentages at each time of evaluation.

## References

Adnan, S., & Mohammed, K.Y. (2014), Performance Evaluation - Methods and Techniques Survey. *International Journal for Computer and Information Technology*, 3(5), 966-979.

Ali.J., Elham, D., Jafar, S.T., Masoumeh, G., & Neda, K. (2017). Developing a hospital managerial performance assessment tool in Iran. *Evidence Based Health Policy, Management & Economics, EBHPME 2017; 1(4): 198-204.*

Andrej, K., Janez, B., & Andrej, K. (2011).Introduction to the artificial neural networks, artificial neural networks - methodological advances and biomedical applications, *Prof. Kenji Suzuki (Ed.), In Tech, Available from: http://www.intechopen.com/books/artificial-neural-networksmethodological-advances-and-biomedical-applications/introduction-to-the-artificial-neural-networks.*

Carlo, V. F., Mara, G., & Stefano, V. (2018). Evaluating organizational change in health care: the patient-centered hospital model. *Health Services Research, 18*(95*),2-15. https://doi.org/10.1186/s12913-018-2877-4*

Cristina, S. N., Cristina, A. S., Mara, A. S., & Andrei-Răzvan, C. (2017). Performance through efficiency in the public healthcare system- *A Dea Approach Inan Emergent Country*Romanian: *Studia Universitatis Babeş-Bolyai Oeconomica, 62(3),Pp 31-49,DOI: 10.1515/subboec-2017-0003,*

Apurva, T., Ankita, T. (2014) Performance evaluation of outsourced medical equipment maintenance service in a tertiary care hospital. *International Journal of Scientific and Research Publications,4*( 9).*ISSN 2250-3153, www.ijsrp.org*

Fatemeh, H.M., & Nilmini, W. (2014). Artifi cial neural network excellence to facilitate lean thinking adoption in healthcare *contexts*(xxxii).*http://www.springer.com/978-1-4614-8035-8.DOI 10.1007/978-1-4614-8036-5_2,*

Hamed, R., Mohammad, K., Zahra, K., & Marzieh, E. (2014,). Indicators of hospital performance evaluation: *Indicators of Hospital Performance Evaluation: A Literature Review. International Journal of Hospital Research, 3(4):199-208.*

Hyunyoung, B., *Minsu, C., Seok, K., Hee, H., Minseok, S.,*&*Sooyoung, Y.* 2018).Analysis of length of hospital stay using electronic health records: *A statistical and data mining approach.Plos one, 13(4),*1-16. Doi:10.1371/Journal.Pone.0195901

Medici, A., & Murray, R. (2010). Hospital performance and health quality improvements in são paulo (Brazil) And Maryland *(USA),(156).Retrieved From www.worldbank.org/enbreve*

Mila, G.B., Isuf, K. J., Johann, K. V. & Svend J. (2003). Measuring hospital performance to improve the quality of care in europe*: A need for clarifying the concepts and defining the main dimensions* . WHO, WHO Regional Office For Europe. Barcelona, Spain,: Http://Www.Euro.Who.Int.

Nagesh, S., Pascal, P., Manoj, K. T., Ceglarek, D., & Dias, J. M. (2017). Modelling and simulation in health care systems. *International Journal Of Systems Science: Operations*

& *Logistics,4*(1),1-3.Doi:10.1080/00207721.2016.1222772:https://doi.org/10.1080/00207721.2016.1222772

Pradhan, M. (2014). Data mining & health care: techniques of application. *International Journal of Innovative Research in Computer and Communication Engineering, 2,(12), 7445-7455,10.15680/ijircce.2014.0212029,www.ijircce.com*

Sheng-LiSi., Xiao-Yue, Y., Hu-Chen, L. &Jia, H. (2017). Identifying key performance indicators for holistic hospital management with a modified dematel approach. *International Journal for Environmental Research and Public health, 14(934);2-17. doi:10.3390/ijerph14080934,www.mdpi.com/journal/ijerph.*

Syed, A., Roszita, I., Amrizal,M.N., NorHaty, H., Siti, A.Z. (2018,). Abstracts from the patient classification systems international (pcsi) conference 2015, 2016 and 2017. *International Conference.18,(1):156.Malaysia:BMC Health Services Research.https://doi.org/10.1186/s12913-018-2940-1*

Valenti, W. M. (2018). Infection control and product infectious disease advisor evaluation.retrieved from https://www.infectiousdiseaseadvisor.com/hospital-infection-control/infection-control-and-product-evaluation/article/598791/[8/29/2018

Vitalis, C. N., Rajah, R., Md, M. A., & Adesina., A. (2018). An approach toward public hospital performance assessment. *Medicine (Baltimore) USA National Library Of Medicine Advanced Journal List National Institutes Of Health, 95*(36),1-2. Doi:10.109/Md.00000000004688

Yidan, Z. Ruya, G. L. D., Yifei, Z. Shenshen, L. Y., Yang, F. W. (2018). Development and evaluation of a hospital management. J*ournal of Hospital Administration, 7*(1), *9-17. Published by Sciedu Press, DOI: 10.5430/jha.v7n1p9*

ying, Z. Y. (2012). The Impact of Performance Management System on Employee performance. *master thesis*.