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The Use of Neural Network Technology in The Strategic Human Resources Planning Internal Auditor's Perspective

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Abstract

This study primarily focused on enhancing internal audit function by identifying the most important factors that contribute to improving HRM strategic planning and studying the ability to use neural networks to assist internal auditors to review HRM strategic plans. There may be a significant gap between auditors' knowledge of strategic HRM implementation and the practical reality, so we propose an internal audit framework that seeks to ascertain the role of human resource planning in contributing to improve effectiveness of the organization. This study established a HRM strategic audit model based on the integration of deep neural network. Training data is extracted from an electronic questionnaire that was distributed to human resources staff and faculty members, and we used deep learning neural network-based predictors to help in predicting strategic human resources plans. We conclude that neural network seems promising for effective HRM strategic audit.

Introduction

Human resource planning is the process of predicting the supply and demand of the organization's workforce in the future, and it is a continuous process that begins with setting goals and ends with evaluation, feedback, and control.

The goals of human resource planning are:

Determining the objectives of HR planning - For which the process is to be carried, these goals must be precisely defined to ensure that the right number of people suitable for the jobs will be selected.

Analyzing current HR inventory - It is a process to assess current staff before hiring new employees, it is an important step to understand the organization's talent and develop skills for the current process. This can be done through employees' self-evaluation looking over past performance.

Demand and supply forecasting of HR - Once the inventory of talented manpower is maintained, the next step is determining future HR needs to meet the company's current and future needs and the current resources to meet the demands.

Gap analysis - After forecasting supply and demand, the organization needs to identify the gap between the skills that exist and what the organization needs.

Employment plan - Including translating actions into a workplace schedule, a successful workforce plan requires the commitment and leadership of everyone in the organization, especially top management.

Training and development - These are a crucial part of the HR process not only for the new

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employees but also to update the current employees' skills from time to time.

Appraisal of HR planning Once the HR plan – Has been in place the organization can evaluate its effectiveness.

The real challenge for the organization is the link between organizational strategy formulation and strategic HR formulation. This means the link between overall strategy and the decisions regarding HR policies and practices used by management to design work and select, train, develop, appraise, motivate, and control employees. HR planning is engaged in strategic planning by HR professionals working with line managers to ensure results.

The challenges facing the human resource department can be identified when building a strategic plan:

- A lack of understanding of how business strategy affects HR's program and processes.
- Inability to translate the business strategy into the HR strategy.
- The inability to prioritize the human resource plan and link it to the goals of the organization.
- Many HR professionals are not able to articulate their plans.

From our point of view, to integrate the HR plan into the overall strategic plan of the organization, the following questions must be answered:

1. Who will participate in HR planning?
2. What is the main process for integrated HR planning?
3. What are the desired outcomes of integrated HR planning?
4. What is the primary role of the internal auditor in strategic HR planning?

Literature Review

Strategic Human Resource Planning

In the contemporary business environment, the organization needs to have and retain competent employees, as they are the main source for obtaining a competitive advantage, most advanced companies are developing and implementing an integrated HR system, which is beneficial for them and their employees alike (Antoniou, 2010). HR development (Seth, 2016) plays a vital role in the career development of the resources and the maturity of any organization can be measured through the top talent retention and succession plans charted out by the HRD function. Also, organizations can utilize strategic human resource management to coordinate between diverse activities and create appropriate opportunities and prevent potential threats (Collins, 2020).

A study (Syvajarvi, 2015) indicated that HR planning could participate in achieving an organization's strategic aim. (Tara Prasad Gautan, 2018) measured human resource management planning, the process of employee selection and training by companies. The results indicated the need to conduct more studies to measure the causative factors of human resource management planning, the selection and training process, and how to increase its effectiveness to ensure better performance for companies. It also recommended the importance of improvement in human resource management practices. Also (Nameirakpam Chetana, 2017) shows a stronger relationship between career management and career development programs in an organization. Another study (Farnood Abbasi, 2021) presented the desirable human resource strategies model of project-based construction organizations through evaluation of external and internal environment.

This research (O.N.Docanscy, 2015) aims to determine the benefits, contributions, and challenges of the

human resource information system. The results indicated that the human resource information system contributes to identifying vacancies, accurate analysis of each job position and its job title in the organization, providing insight into organizational training needs, selecting the right people for training at the right time, and evaluating the effectiveness of training programs. Thus, HRIS plays a major role in human resource management. Organizations should integrate HRIS with other organizational systems to facilitate rapid information sharing and decision-making. (Wang, 2019) indicated that it is essential for success to build an organization full of good, talented, and well-trained people, which is also the center of human resource management, he used the fuzzy synthetic evaluation method to solve problems and then built the human capital network of the different departments. Also, (Khaled, 2018) concludes that HRIS is an excellent tool for HR planning, it enhances the identification of unfilled positions and analyzing each job.

Strategic HR planning predicts the future HR management needs of the organization after analyzing the organization's current HR, the external labor market, and the future HR environment that the organization will be operating in strategic human resource management (Iqbal, 2019) can serve as a starting point for creative climate and organizational performance in terms of financial, human resource and customer retention.

Before integrating HR strategy into the overall strategic plan (Tim Toterhi, 2019) the organization should align the organization and HR strategy so HR managers must first analyze the overall strategy and planned strategic initiatives before establishing HR strategies, evaluate HR capabilities and compare their current capabilities to best practices, evaluate and prioritize the internal customer portfolio, Gap analysis in people, skills, systems, and processes, and measure results. So, HR planning helps the management of the organization with its human resource requirements and assists in utilizing its HR capacities (Biswas, 2019).

A study (Lauren Berk, 2018) presents a robust-optimization-based framework that models the uncertainty in hiring requests to improve HR planning to allow companies to dynamically make hiring decisions that maximize profit while remaining as flexible as possible. (D.M.Jusubaliev, 2015) examined the importance of using information technology and information indicators in digital transformation to achieve comprehensive development of human resources. (A.P.D.Hussien Waleed Hussien, 2021) suggested that the organization have to use contemporary technologies and computer systems to build databases for the content of strategic memory and to update its operations.

We conclude that:

- HRM is a core aspect of any organization so HR should be integrated into its daily work.
- HRM is not crucial to an organization's success, but it should be effective in achieving specific organizational goals.
- HRM managers should know what upcoming challenges may be faced to make plans to deal with those challenges, they should understand how technology can be used.

Human Resource Audit

Human resource management is a preferred area of activity in internal audits. HR internal audit not only involves measures for maintenance and continuous improvement of HR strategies, policies, and practices but also can demonstrate that HR policies and procedures are correct and consistent with the overall strategy. HR audit practices (Rajesh K. Yadav, 2014) enable an organization to ensure how best to use its HR to achieve outcomes and help to link the long-term purpose and goals of the HR plan with the organization. HR audit always implemented to improve the human capital as the basis of the business and its competitive ability (Sazarkova Miroslava, 2013).

An HR audit is a type of functional audit that consists of diagnosing, analyzing, evaluating, and assessing

future lines of action within the framework of HR management (Sastre, 2022). A study (Xu Xiangzhen, 2009) discuss the three main areas of HR audit and suggested how to make reasonable arrangements for HR audit procedures.

HR audit (Sharma, 2019) is an overall quality control check to evaluate how these activities support the organization's strategy. A study (Kumari, 2017) indicated that HR audits may achieve many objectives such as ensuring legal compliance, improving competitive advantage, helping maintain and establish efficient documentation and technology practices, and identifying strengths and weaknesses. Also (Muhammad, 2019) indicates that an HR audit develops a system of measurement that helps the organizational objectives by increasing individual skills and capabilities, so it is considered a logical, highly structured analysis of HR practices and policies. Therefore, customization of the HR audit will need to understand the organization strategy and priorities to determine the internal audit objectives (COBIT 5, 2014).

There are many types of HR audits such as strategic, operational, compliance, system, personal, and functional but all of them should be concerned with:

1. Risk mitigation will mainly review the entire of procuring, developing, and utilizing HR in an organization (Praveen Kumar, 2015) risk (RaO, 2012) including regulation and compliance failure, loss of business opportunities due to the failure to attract, hire and retain top talent, ineffective staff development, finally inability to control labor costs.
2. Value creation mainly looks for areas where HR processes and policies can be improved to maximize the value of the organization's employees.

The HR Internal Audit Should Ensure That

1. An effective governance structure supports in place and supports the integration of HR planning into the overall strategic plan. This is done by ensuring that the roles and responsibilities that support the strategic planning of human resources are defined and documented.
2. Clarity of the objectives of the process of integrating strategic planning for human resources into the strategic plan of the organization, as well as the expected returns and outcomes from this integration.
3. HR strategies support the implementation of the organization's strategic goals.
4. HR information used for strategic planning is factual, and timely and it complies with internal policies and legal requirements.
5. HR strategies are measured, monitored, and evaluated, to ensure their contribution to achieving strategic priorities and operational needs.
6. HR priorities and strategies are communicated widely to stakeholders, to provide them with complete information promptly.
7. Analyzing the gap between "what is the current HR function" and "what should be the best possible HR function in the organization.

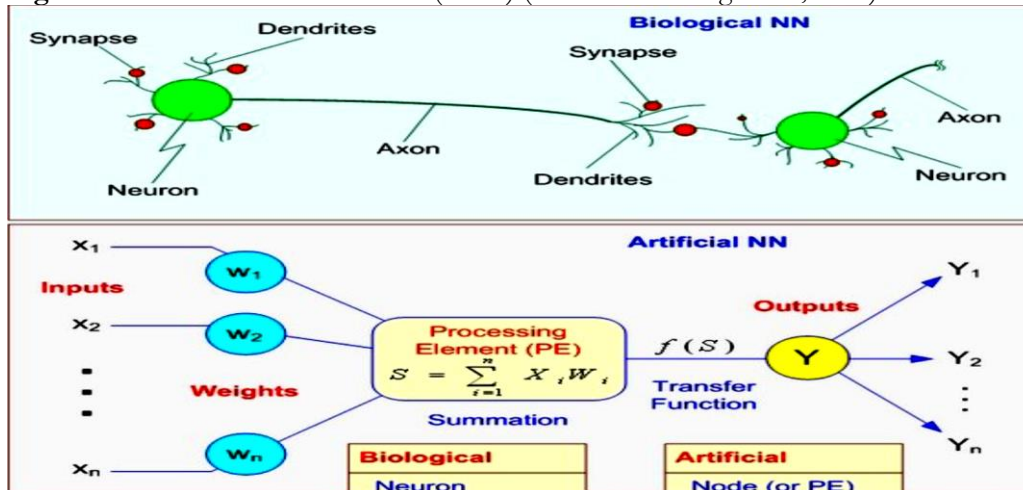
Neural Network

Neural networks are a set of algorithms designed to work just like the human brain does. It is a method of attempting to reproduce the working of the human brain in a computer to learn from experience. Artificial neural network (ANN) models have a specific architecture format that is inspired by a biological nervous system (Arash Malekian, 2021). The ANN consists of input, hidden, and output layers with connected neurons (nodes) by weighted links, the existing nodes process and transmits signals to the next node (Masoud Mohseni, 2022).

The ANN model usually accepts real value sets of inputs and it should be fed into a node in the input layer (Vadapalli). The inputs for which you already know the correct outputs are called training sets.

Every ANN generates outputs as a prediction, classification, or decision about the data fed into. A standard Neural Network consists of an input layer, one or more hidden layers, and an output layer. Each layer has a certain job in a system. The input layer receives a vector of inputs and forwards it to the hidden layers. Each hidden layer contains a group of non-connected individual neurons fully connected to all neurons of the previously hidden layer. Then, the output layer has the same structure as the hidden layers (Yuanfang Zhao, 2018) Artificial Neural Networks (ANN) incorporate the two fundamental components of biological neural nets which are Neurones (nodes) and Synapses (weights) as shown below.

Figure 1: Artificial Neural Networks (ANN) (Source: Yuanfang Zhao, 2018).



There are many different types of ANNs varying in complexity, density of nodes, and how data may flow:

Perceptron neural network - is the oldest form of neural network, it consists of just one node which takes the input and applies an activation function on it to produce a binary output. It is a supervised learning algorithm, doesn't contain any hidden layers, and can only be used for binary classification tasks.

Feed-forward neural networks - are the ANNs in which the connections between units do not form a cycle. They are called feed-forward because information only travels forward in the network, first through the input nodes, then through the hidden nodes, and finally through the output nodes. The feed-forward NN divides into two main types first- single-layer feed-forward NN (SLFFNN), second- multilayer feed-forward NN (MLFFNN) (Sharkawy, 2020).

The radial basis function (RBF) - is the ANN anticipated in a different way which uses radial basis functions as activation functions. The RBF networks have the advantages of easy design, good generalization, strong tolerance to noise data, and online learning (Hossam Faris, 2017).

A recurrent neural network (RNN) - is a dynamic type of ANN that uses sequential data or time series data (Sethi, 2019). RNNs have the concept of memory that helps them to store and remember every piece of information through time.

A modular neural network - refers to an ANN that is composed of more than one neural network connected by some intermediary (YiDing, 2014). The modular neural network has the advantages of reducing model complexity, learning several tasks at the same time, and improving the speed of learning by reducing the effect of conflicting training information.

A convolution neural network - is a deep-learning neural network designed for processing structure arrays of data (Jonas Tuwen, 2020). Deep learning is one of the newest techniques of machine learning, it is comprised of a collection of advanced deep neuro listed in a distinctly layered topology which allow computers to human brain capabilities such as learning using examples (IlyasBenessahel, 2018).

In the last two decades, ANN has been successfully used in many business applications. ANN has come into practice wherever it is necessary to solve the problem of forecasting, classification, or control. (Shengqina Ma, 2022) used nonlinear characteristics of a neural network to establish a deep neural network HR which has strong adaptability, learning ability, and fault tolerance ability which can minimize identifying confused behavior and action, but the research refers that the application of neural networks in the field of human resource still need further improved. (Ting Xiang, 2022) combines BP neural network and logistic regression analysis to build an intelligent HRM system to predict and analyze HR processes. Also (Xu Liw, 2022) establish a model of HRM evaluation based on the self-organizing map. (Yangda Gong)Integrates the BP neural network into HRM to forecast employees 'salaries by analyzing their resumes to provide salary references for the HR department for the applicant, during recruitment, and the formulation standards.

Data Methodology

In collecting data for this study, we relied on the survey method. The questionnaire was sent electronically, and the questionnaires were examined after the response, excluding those that weren't compatible with the aim of our study. The study population consists of internal auditors, human resources staff, and faculty members in the faculties of business administration to benefit from scientific and academic expertise in the subject of research.

Our field study was aimed at testing the validity of the following hypotheses which are formulated based on the literature and the aim of the research:

- H1. There is a statistically significant relationship between integrating the human resources plan into the overall strategic plan of the organization and achieving the organization's goals.
- H2. There is a statistically significant relationship between the participation of the internal auditor in human resource planning and the effectiveness of the human resource plan.
- H3. There is a statistically significant relationship between the use of deep neural network and the effectiveness of the human resource strategic audit.

The study is explanatory depending on four independent variables (determine cognitive abilities and skills, assessment of the expectations gap, evaluation of the human resources plan, The internal auditor role) and dependent variable is the human resource strategic audit.

When designing the survey questions, we used the following five-point Likert Scale to determine the importance of factors related to human resource planning, as well as factors related to the internal auditor:

Very low	Low	Neutral	High	Very high
1	2	3	4	5

We used a descriptive statistical method to describe the data and show the degree to which our sample responded to the survey questions. After taking the weighted average of the responses, this range was divided into degrees of approval, as the overall range (5-1 = 4) was divided into five categories, each category had a width of $4/5 = 0.80$, as follows:

Very low	Low	Neutral	High	Very high
1 to 1,79	1.80 to 2,59	2.60 to 3,39	3.40 to 4,19	4.20 to 5

Following statistical methods were used: Cronbach's Alpha Coefficient to measure the stability coefficient of the responses, Internal Consistency Test measured by the correlation coefficient between each of the questionnaire statements, and the dimension or axis to which that statement belongs, Simple Correlation Analysis based on Pearson's linear correlation coefficient to determine the degree, direction, and significance of the simple correlation between the study variables, Measures of central tendency such as arithmetic mean, frequencies, and percentages, to describe the opinions of the study sample, and to determine the importance of the statements in the survey questionnaire, as well as the standard deviation to indicate the degree to which the answers were dispersed about their arithmetic mean, T-test on the medium value requires determining the test value, which was represented by the average value of the Likert scale, which was 3.

Considering this, the null hypothesis and the alternative hypothesis were formulated as follows:

Null hypothesis:	$H_0 : \mu \leq 3$
Alternative hypothesis:	$H_1 : \mu > 3$

Finally, we used the Man-Whitney test to compare the responses of two sub-samples (Practitioners and academics).

The validity and reliability of the survey questionnaire: as a data collection tool, were validated using the Cronbach alpha test. The internal consistency of the survey questionnaire statements was tested by calculating the correlation coefficient between each and the global average. The following table shows the values obtained for internal consistency and the values of the reliability and validity coefficient of the survey questionnaire responses.

Table 1: Internal Consistency, Reliability, And Validity of The Survey Questionnaire Responses.

Statements	Internal Consistency Test (Correlation Coefficient)	Validity Coefficient ⁽¹⁾
Determine cognitive abilities and skills		
X1_01 The main objectives of the organization to be achieved	**0.845	0.916
X1_02 Strengths factors that help achieve the goals of the organization	**0.893	0.943
X1_03 The tasks and actions required to achieve the goals of the organization	**0.835	0.910
X1_04 The skills required to achieve the goals of the organization	**0.871	0.931
X1_05 Organization growth trends	**0.891	0.942
X1_06 Projects and future expansions in the organization	**0.700	0.824
X1_07 The competitive position in the organization	**0.860	0.925
X1_08 Linking the number of employees with the goals of the organization to be achieved next year	**0.868	0.929
X1_09 Characteristics and skills that affect employee productivity	**0.876	0.934
Test Cronbach Alpha	0.944	
Reliability Coefficient	0.972	

Assessment of the expectations gap		
X2_10 Possibilities of training current employees	**904.0	0.950
X2_11 The need for new employees	**0.610	0.758
X2_12 The extent to which new employees need training	**0.887	0.940
X2_13 The extent to which the facility plans to retain current competencies	**0.882	0.937
X2_14 Compare individual skills of workers to job descriptions	**0.493	0.660
Test Cronbach Alpha	0.816	
Reliability Coefficient	0.903	
Evaluation of the human resources plan		
X3_15 The extent to which the human resources plan depends on the strategic plan of the organization	**925.0	0.961
X3_16 The number of employees is determined considering the strategic objectives	**0.911	0.953
X3_17 The number of employees is determined considering operational needs	**0.856	0.922
X3_18 The expected gap between supply and demand for the required skills is analyzed	**0.881	0.937
X3_19 A long-term HR time plan is drawn up	**0.946	0.972
X3_20 The human resources plan is presented to the executive departments	**0.861	0.925
X3_21 The HR plan has the support of the senior management	**0.891	0.942
X3_22 There is a strategy to update the human resource plan	**0.926	0.962
X3_23 There is a framework for documenting the responsibilities and roles of the human resources department	**0.915	0.956
X3_24 There is a system for controlling the outputs of the human resources plan	**0.858	0.924
X3_25 The results of the cost-benefit analysis	**0.564	0.721
Test Cronbach Alpha	0.966	
Reliability Coefficient	0.983	
The internal auditor role		
X4_28 The participation of the internal auditor in human resource planning affects the effectiveness of the human resource plan	**0.851	0.920
X4_29 The role of the internal auditor is limited to reviewing the human resources plan	**0.762	0.865
Test Cronbach Alpha	0.664	
Reliability Coefficient	0.815	

** Significant at the 0.01 level - Validity Coefficient = $2R / (1+R)$

Descriptive analysis of the factors affecting HR strategic planning aims to describe these factors in terms of central tendency and dispersion, and to compare responses of human resources staff and faculty members, and to test the extent to which there are significant differences.

Table 2: Descriptive Analysis of The Factors Affecting HR Strategic Planning.

		Determine cognitive abilities and skills					Mann-Whitney U Test	Sig. Level
		Arithmetic mean	relative weight %	Standard deviation	Impact	Rank		
X1_01 The main objectives of the organization to be achieved	1	4.58	91.6	0.57	Very High	1	1.160	0.246
	2	4.71	94.2	0.54	Very High	1		
	3	4.63	92.6	0.56	Very High	1		
X1_02 Strengths factors that help achieve the goals of the organization	1	4.33	86.6	0.55	Very High	3	2.238	0.025
	2	4.61	92.2	0.57	Very High	3		
	3	4.43	88.6	0.57	Very High	3		
X1_03 The tasks and actions required to achieve the goals of the organization	1	4.25	85.0	0.65	Very High	4	2.287	0.022
	2	4.57	91.4	0.69	Very High	4		
	3	4.36	87.2	0.68	Very High	4		
X1_04 The skills required to achieve the goals of the organization	1	4.33	86.6	0.62	Very High	2	2.387	0.017
	2	4.64	92.8	0.62	Very High	2		
	3	4.44	88.8	0.63	Very High	2		
X1_05 Organization growth trends	1	4.19	83.8	0.77	High	6	2.008	0.045
	2	4.54	90.8	0.69	Very High	6		
	3	4.31	86.2	0.76	Very High	6		
X1_06 Projects and future expansions in the organization	1	4.15	83.0	0.85	High	7	1.977	0.048
	2	4.50	90.0	0.79	Very High	7		
	3	4.28	85.6	0.84	Very High	7		
X1_07 The competitive position in the organization	1	4.13	82.6	0.82	High	8	2.050	0.040
	2	4.43	88.6	0.88	Very High	8		
	3	4.24	84.8	0.85	Very High	8		
X1_08 Linking the number of employees with the goals of the organization to be achieved next year	1	4.25	85.0	0.88	Very High	5	1.143	0.146
	2	4.54	90.8	0.74	Very High	5		
	3	4.35	87.0	0.84	Very High	5		
X1_09 Characteristics and Skills that affect employee productivity	1	4.08	81.6	1.05	High	9	1.548	0.122
	2	4.43	88.6	0.96	Very High	9		
	3	4.20	84.0	1.02	Very High	9		
Overall average = 4.36								
Assessment of the expectations gap								
X2_10 Possibilities of training current employees	1	3.92	78.4	0.90	High	4	2.218	0.027
	2	4.37	87.4	0.96	Very High	2		
	3	4.09	81.8	0.95	High	4		
X2_11 The need for new employees	1	3.90	78.0	0.85	High	5	0.868	0.385
	2	4.03	80.6	1.00	High	5		
	3	3.95	79.0	0.90	High	5		
X2_12 The extent to which new employees need training	1	4.13	82.6	0.77	High	2	1.664	0.096
	2	4.37	87.4	0.93	Very High	1		

	3	4.22	84.4	0.83	Very High	1		
X2_13 The extent to which the facility plans to retain current competencies.	1	4.02	80.4	0.80	High	3	1.562	0.118
	2	4.27	85.4	0.98	Very High	3		
	3	4.11	82.2	0.88	High	3		
X2_14 Compare individual skills of workers to job descriptions	1	4.19	83.8	0.66	High	1	0.988	0.323
	2	4.23	84.6	1.01	Very High	4		
	3	4.21	84.2	0.80	Very High	2		
Overall average =4.11								
Evaluation of the human resources plan								
X3_15 The extent to which the human resources plan depends on the strategic plan of the organization	1	4.29	85.8	0.75	Very High	1	0.600	0.549
	2	4.30	86.0	0.99	Very High	2		
	3	4.29	85.8	0.84	Very High	1		
X3_16 The number of employees is determined considering the strategic objectives	1	4.27	85.4	0.74	Very High	3	0.958	0.338
	2	4.33	86.6	0.99	Very High	1		
	3	4.29	85.8	0.84	Very High	2		
X3_17 The number of employees is determined considering operational needs	1	4.29	85.8	0.80	Very High	2	0.089	0.929
	2	4.23	84.6	1.01	Very High	3		
	3	4.27	85.4	0.88	Very High	3		
X3_18 The expected gap between supply and demand for the required skills is analyzed	1	4.06	81.2	0.83	High	10	0.520	0.603
	2	4.10	82.0	1.03	High	11		
	3	4.07	81.4	0.90	High	11		
X3_19 A long-term HR time plan is drawn up	1	4.15	83.0	0.80	High	6	0.660	0.509
	2	4.20	84.0	1.03	Very High	6		
	3	4.17	83.4	0.89	High	5		
X3_20 The human resources plan is presented to the executive departments	1	4.06	81.2	0.87	High	11	0.765	0.444
	2	4.17	83.4	1.02	High	7		
	3	4.10	82.0	0.92	High	9		
X3_21 The HR plan has the support of the senior management	1	4.17	83.4	0.76	High	5	0.196	0.845
	2	4.13	82.6	0.97	High	8		
	3	4.16	83.2	0.84	High	6		
X3_22 There is a strategy to update the human resource plan	1	4.08	81.6	0.76	High	9	0.509	0.611
	2	4.10	82.0	0.96	High	10		
	3	4.09	81.8	0.83	High	10		
X3_23 There is a framework for documenting the responsibilities and roles of the human resources department	1	4.13	82.6	0.79	High	7	0.741	0.459
	2	4.20	84.0	1.00	Very High	5		
	3	4.16	83.2	0.87	High	7		
X3_24 There is a system for controlling the outputs of the human resources plan	1	4.21	84.2	0.96	Very High	4	0.180	0.857
	2	4.13	82.6	1.11	High	9		
	3	4.18	83.6	1.01	High	4		
X3_25 The results of the cost-benefit analysis	1	4.10	82.0	0.96	High	8	0.324	0.746
	2	4.20	84.0	0.81	Very High			
	3	4.13	82.6	0.90	High			
Overall average = 4.17								

The results show the importance of:

- Determine cognitive abilities and skills as one of the factors associated with human resource planning, Where the average of the study sample responses according to the Mann-Whitney test corresponds between the two study groups (human resources staff and faculty members) on the importance of phrases numbers 1, 8, and 9, while significant differences were found between the two classes on the importance of the rest of the phrases.
- Assessment of the expectations gap as one of the factors associated with human resource planning, there are no significant differences between the average responses of the two categories, except for the first phase "No. 10", where significant differences were found between the two categories.
- Evaluating the human resource plan is one of the factors associated with human resource planning, and there is no significant difference between the average responses of the two categories.

Table 3: The Internal Auditor Role.

Is the internal auditor participate in HR plan											
Total		Academic Staff				internal auditor - human resource staff					
No		Yes		No		Yes		No		Yes	
%	number	%	number	%	number	%	number	%	number	%	number
69.5	57	30.5	25	70.0	21	30.0	9	69.2	36	30.8	16
Chi square = 0.005						Sig.=0.94					
Who participates in HR planning											
Total		Academic Staff		internal auditor - human resource staff							
%	number	%	number	%	number						
7.3	6	3.8	4	3.8	2	Top management					
26.8	22	32.7	5	32.7	17	HR management					
4.9	4	3.8	2	3.8	2	Executive management					
1.2	1	0	1	0	0	Internal auditor					
59.8	49	59.6	18	59.6	31	All of them					
Chi square = 6.205						Sig. = 0.184					
The consistency of the answers											
Does internal audit participate in the HR plan?				Who participates in developing the HR plan?							
%	number	%	number								
8.0	2	7.0	4	Top management							
52.8	13	15.8	9	HR management							
0	0	7.0	4	Executive management							
0	0	1.8	1	Internal auditor							
40.0	10	68.4	39	all the above							
100	25	100	57	total							

The results show that 69.5% of the total sample reported that the internal auditor participated in developing the human resources plan, and this percentage was close between the employees of the organizations and members of the teaching staff, and the Chi-square test did not show any significant differences between the two categories.

Testing The Validity of Hypotheses

To test the validity of our hypotheses, first, we performed a 1-Sample Test, and the results were as

follows:

Table 4. 1: -Sample T-Test Results.

<i>Factor</i>	<i>Arithmetic Mean</i>	<i>Standard Deviation</i>	<i>T Value</i>	<i>Significance Level</i>	<i>Average Difference</i>	<i>Min.</i>	<i>Max.</i>
Determine cognitive abilities and skills	4.36	0.64	19.1	0.000	1.36	1.22	1.50
Assessment of the expectations gap	4.11	0.66	15.3	0.000	1.11	0.97	1.26
Evaluation of the human resources plan	4.17	0.76	13.9	0.000	1.17	1.01	1.34
The internal auditor role	3.82	0.995	7.43	0.000	0.817	0.60	1.04

This indicates the significance of determining cognitive and abilities and skills, Assessment of the expectations gap, Evaluation of the human resources plan. This supports hypothesis H1.

Second, we performed a simple regression analysis to test the hypothesis (H2), and the results were as follows:

Dependent variable X3 - effectiveness of the HR plan							
Independent variable X28 - the participation of the internal auditor in human resource planning							
Independent variable	B	T-test	Significance Level	R	R ²	F test	Significance Level
Constant	1.894	8.99	0.000	0.794	0.630	163.4	0.000
X2	0.609	11.68	0.000				

The results of the regression show that there is a significant direct relationship between variable X28 “internal auditor’s participation in HR plan” and variable X3 “effectiveness of the HR plan.”

After estimating the model parameters, the regression equation took the following form:

$$X3 = 1.894 + 0.609 * X28 + \epsilon \quad \text{whereas } (\epsilon \text{ random error limit})$$

It appears from the equation that there is a positive relationship between the internal auditor's involvement in human resource planning on the effectiveness of the human resources plan, and this is evident from the value of B, which indicates the amount of effect, as increasing the internal auditor's participation in human resource planning by a degree leads to an improvement in the effectiveness of the human resources plan by an amount 0.609 degrees. Also, the explanatory power of the model reached 63% through the value of R², meaning that 63% of the changes that occur in the effectiveness of the human resources plan are explained by the internal auditor's involvement in human resource planning.

We conclude this to accept the second hypothesis: the involvement of the internal auditor in human resource planning affects the effectiveness of the human resources plan.

Applying Neural Network

A common method used for training deep neural networks is the Back Propagation (BP) algorithm devised by Hinton et al. in 1986, which is the foundation of neural network optimization. An artificial neural network is trained with back-propagation in conjunction with an optimization method, such as Adam. The algorithm repeats a two-phase cycle comprised of forward propagation and weights update (David E. Rumelhart, 1988). An input is presented to the network and is propagated forward through the network layers, until it reaches the output layer. The output layer is then compared; using a cost, objective, or loss function; to the desired output, and, for each of the neurons in the output layer, an error value is calculated. This is followed by a backward propagation of the error values from the output to the input layer. An associated error value, which approximately represents the neuron’s contribution

to the original output, is received by each neuron. The DNN model is of a linear function and an activation function.

$$Y = F(\sum_{i=1}^n ((WiXi) - B) \quad \text{Where: } X: \text{input value, } b: \text{bias, } w: \text{weight value,}$$

F: activation function, and y: output value.

The error values are used by the backpropagation [58] to calculate the gradient of the loss function about the weights in the network. During the second phase, the gradient is fed to the optimization method, which in turn uses it to update the weights, thus attempting to minimize the loss function. This process is important because while the network is trained, the neurons in the intermediate layers organize themselves in a manner that leads different neurons to recognize different characteristics or patterns of the total input space. During neural network training, there are two passes forward and backward:

1. Forward

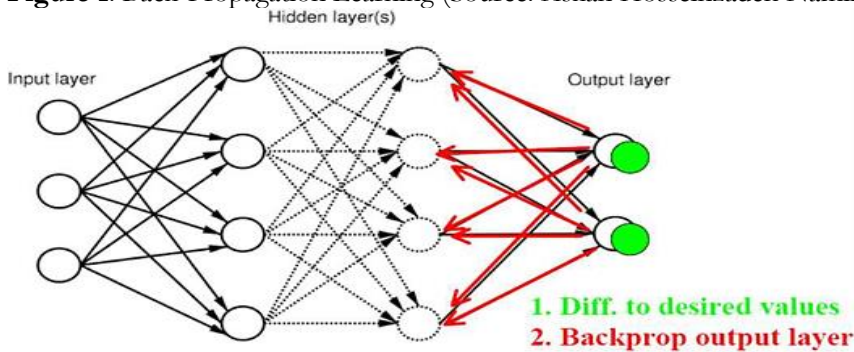


2. Backward



Back-Propagation Learning

Figure 1: Back-Propagation Learning (Source: Askan Hosseinzadeh Namin, 2009).



The Activation functions are very important to the neural network (Askan Hosseinzadeh Namin, 2009). They bound the value produced by neurons because it can range between $-\infty$ to $+\infty$. In every node of the neural network, the activation function is used for taking the action of firing (active) or not firing the node. Without using the activation function, a linear function will be produced from the output mapping function and leading to less effectiveness in learning complex input data. ReLU activation function which is 0 in the negative half and the input equals the output in the positive half is very popular because it prevents the vanishing gradient problem.

We propose a deep neural network-based predictor to help in predicting strategic human resources plans. The employee’s feature is represented by a vector with predefined dimensions.

System Implementation Details

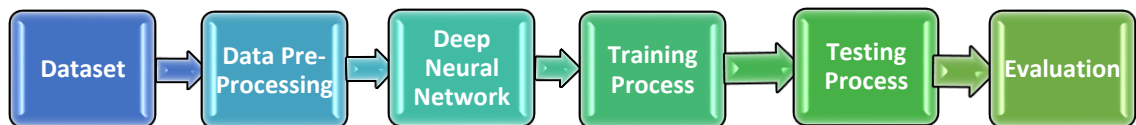
The framework described in this paper is developed in Python using Kaggle website by a desktop computer with specifications of: -

- Processor: Intel ® Core™ I7-5500U CPU @ 2.40GHZ 2.40 GHZ.
- RAM: 8 GB.
- System Type: 64-bit Operating System, x64-based processor.
- Operating System: Windows 10.
- NVIDIA: GeForce 820M.
- CUDA Cores: 96.
- NVIDIA memory bandwidth: 16.02GB/s

The Steps for Executing The Proposed System Are As Follow

1. Preparing the environment by installing the required libraries.
2. Preparing the Human Resource Strategic Planning database.
3. Pre-processing the database.
4. Dividing the dataset into 60% train, 20% validation, and 20% test.
5. Building the deep neural network using Python.
6. Training, validating, and testing the proposed deep neural network.
7. Optimization using Adam Optimizer.

All these steps can be summarized by the following figure:



Code Implementation Description

- Importing all packages that will be used in the code such as Pandas for data frame manipulation as it is mainly used for reading the "dataset.csv" file and storing it in a data frame called df.
- In our code implementation, we used the df. shape command to depict the size of the data frame which depicts that the data frame consists of a matrix with 14999 x 8.
- Data has been shown using the command df. ad() command.
- Dataset Pre-processing was done using Label Encoder, OneHotEncoder, and StandardScaler.
- Splitting the dataset into 60% train, 20% validation, and 20% test using Scikit-learn Library as it is a simple and efficient tool for predictive data analysis.
- Initiating the neural network using `dnn = tf.keras.models.Sequential()` command.
- Building the Deep neural Network and summary of it is depicted in the following figure:

```
Model: "sequential_3"
```

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 17)	136
dense_1 (Dense)	(None, 17)	306
dense_2 (Dense)	(None, 15)	270
dense_3 (Dense)	(None, 15)	240
dense_4 (Dense)	(None, 1)	16
Total params: 968		
Trainable params: 968		
Non-trainable params: 0		

- To display the number of neurons, the command `X.shape[1]` is used and it gives 28 neurons in the input layer.
- Best hyperparameter used are `dropout = 0.1`, `epochs = 200`, and `batch_size = 20`
- Training and validating using `batch=32`, `epocas = 1000`, and `dnn.fit(X_train,y_train, batch_size=batch, epochs=epocas)`.
- Optimization using `optimizer = 'adam'`.

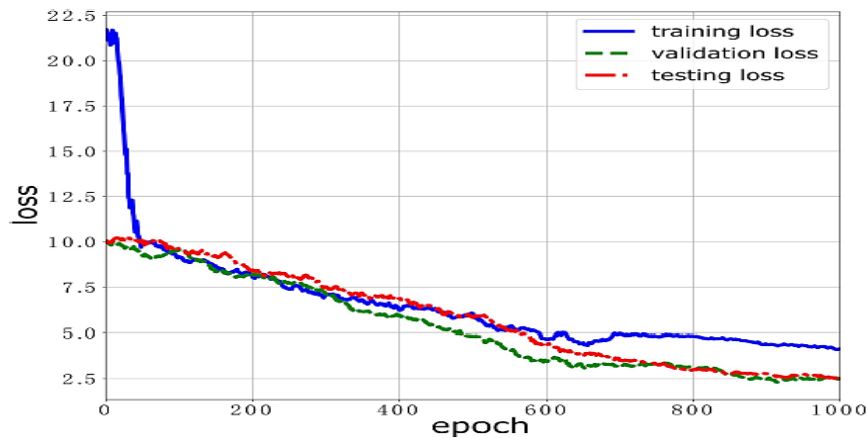
Result and Discussion

All experiments were run on Kaggle website and using Paython language. We set up 4 hidden layers in our Deep Neural Network Model. The number of input layer neurons is 28 neurons. The number of hidden layers is 4:

- The first hidden layer contains 17 neurons, so the connections are between the 28 neurons from the input layer to the 17 neurons in the first hidden layer.
- The Second hidden layer contains 17 neurons, so the connections are between the 17 neurons from the first hidden layer to the 17 neurons in the second hidden layer.
- The Third hidden layer contains 15 neurons, so the connections are between the 17 neurons from the second hidden layer to the 15 neurons in the third hidden layer.
- The Fourth hidden layer contains 15 neurons, so the connections are between the 15 neurons from the third hidden layer to the 15 neurons in the fourth hidden layer.

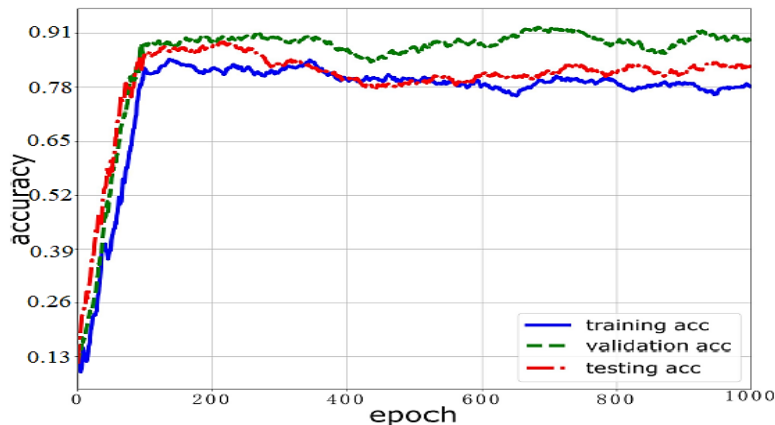
The output layer has a neuron with 16 parameters. The total parameters are 968. The whole dataset was split into training, validating, and testing with a ratio of 60%: 20%: 20%. The maximum training steps are set to 500 by default. We train the model up to 1000 epochs and evaluate the model loss and accuracy in the training stage, validation stage, and testing stage, respectively. The test results can be depicted in the following two figures:

Figure 3: Our Deep Neural Network Model Loss Performance.



We can see that the model losses in the training stage, validation stage, and testing stage decrease with the training step. When the training step is close to 600, the loss function gradually converges. This means that the model can learn to predict the Strategic Human Resources Planning from the training dataset if enough training steps are taken.

Figure 5: Our Deep Neural Network Accuracy Performance.



We can also see that the model accuracies in the training stage, validation stage, and testing stage increase with the training step. After 200 epochs, the model accuracy of the 3 curves for the training stage, validation stage, and the testing stage becomes stable and reaches the peak value. The maximum accuracy our Deep Neural Network model achieves in the testing stage is 89.54%. This also validates that the used Deep Neural Network (DNN) model can predict accurately HRM strategic planning.

Conclusion

The current study highlights the importance of the internal auditor participating in HRM strategic planning. We have divided the factors affecting the strategic planning of human resources into three main groups as follows: Determine cognitive and abilities and skills, Assessment of the expectations gap, Evaluation of the human resources plan, Also, a question was asked about who participates in the strategic planning of human resources to assess the status of the role of the internal auditor. Data was collected by distributing an electronic questionnaire to human resources staff departments as well as faculty members. The results

of the field study indicated the importance of the sub-factors included in the three groups, and the results indicated that most of the answers were agreed between human resources staff and faculty members. As for the role of the internal auditor, the results indicated that 69.5% of the total sample reported that the internal auditor participated in developing the HRM strategic plan, and this percentage was close between the employees of the organizations and members of the teaching staff.

In this study we examine the predictive ability of ANN by building a model using data collected from a questionnaire the result indicates that the neural network seems promising for effective HRM strategic audit.

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