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Digital Transformation in Managing Employee Retention using Agile and C4.5 Algorithm

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Abstract

Retention of employees became a critical success factor of an organization. Human Resource Management Society revealed that businesses would spend the equivalent of six to nine times the monthly wage of an employee to locate and train a replacement. A renowned psychiatrist in the 1950s, Fredrick Herzberg, has revealed in his research the impact of attitudes on motivation is related to employee gratification and retention. The workplace environment has undoubtedly an impact on job satisfaction, and another feature attribute is linked to job dissatisfaction. This workplace condition and feature attributes were converted numerically into this research in discovering patterns in large datasets involving decision tree method, extraction of information, and digital transformation of a comprehensible business structure. The digital transformation as a fundamental approach to business strategies today by envisioning the traits and trends that will happen in the future. An efficient digital strategy that gives priority to a handful of opportunities where organizations can build a digitally-enabled business model that utilizes competitive advantages in that corporate revenues, such as enhancing the organization's retention ability through collaborative resources. The result of this study showed that an upscale workplace strategy could a basis in designing a Human Capital Intelligence System that applies ISO 25010: Software Quality Model in terms of Functional Suitability, Usability, Reliability, Performance Efficiency, and Maintainability. The use of C4.5 Algorithm and calibrated datasets transforms the manual approach of employee retention to a digital-agile approach giving 99.59% data performance using WEKA will augment the retention of employees and avoids business disruptions. The Cost and Benefit analysis component allowed the visualization and analysis of the benefits of employee retention for businesses that take a toll on organizational performance and revenues.

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I. INTRODUCTION

Digital Transformation (DT) is becoming a vital issue for companies around the globe. Business firms that remained traditional and kept manual approaches are expected to fall short and stagnant will eventually disappear in their position while those companies transitioning to the digital ecosphere are anticipated to remain competitive and resilient to technological signs of progress. "Discussion of human resource management in the twenty-first century assumes new complexity owing to the current realities surrounding the needs of the individuals, the expectations of the organizational stakeholders, the dynamics of the workplace, and other evolving issues. As in other aspects of human resource management, nearly all recognized principles and assumptions of management practice have been questioned in the latest times"[1]. The evolving nature of the job has brought fast technological developments. In today's corporate environment, the productivity issues of corporate stakeholders, more stringent government regulation, and enforcement. Expectations and pressures at the workplace

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have all rendered traditional techniques of managing the organization's human content is insufficient while many businesses are experimenting with digital transformation. "The latest success stories have shown that the improved competitive positioning of successful firms does not rely exclusively on the techniques they embrace but, more importantly, builds on the policies that their rulers deploy"[2]. Research by the Human Resource Management Society disclosed that businesses would spend the equivalent of six to nine times the monthly wage of an employee to locate and train their substitute. "The Cascio customized model referred that the average cost of changing an hourly line employee was have doubled for an employee member. An estimated study turnover in the early ' 80s cost about $2,500"[3]. Over the past 15 years, Southeast Asia has experienced impressive growth and is one of the world's most dynamic regional economies.

Highly skilled labor is becoming more and more critical for economies in the region to remain competitive and achieve their growth goals. "The I.T. industry is becoming diversified, and demanding job requirements are more complex and sophisticated skills"[4][5]. The ability to recruit the right people is vital for the success of any company. Employee selection for a type position is the necessary part of every sophisticated human capital intelligent system that focuses on the organization's "recruitment, management, employee's knowledge, skills, competences, attitudes and behaviors and guidance of people"[6][7][8]. A study conducted on the turnover of IT professionals and the antecedents of turnover identified are job satisfaction, organizational commitment, salaries, promotion, stress, burnout, and work-life balance. Application Development approach can be an alternative strategy to promote employment retention and reduce attrition. By developing a Human Capital Intelligence System can upscale the Human Resource Management practices and workplace strategies that enhance the retention of employees. It can help businesses reduce their turnaround costs, which impact businesses in several ways and have adverse effects. The digital transformation of HR activities allows organizations to determine the skills they need to achieve their strategic aspirations and goals so that they can identify critical vectors where the disturbance originates by grounding their ideas and integrating them into the system.

II. LITERATURE REVIEW

A. Digital Transformation

Digital Transformation is a fundamental change in our world due to the fast-changing technologies and multiple of modern times. The premise of digital transformation derives from converging the corporate business functions, and IT practices that sums up the transformation effect of digital technology such as the application of IOT's, Machine Learning applications, Artificial Intelligence, among others have been part of the industrial revolution of our society[2]. The phenomenon of digital transformation has extensively studied in a variety of scholarly and industry domains. The digital world provides a distinction to the company's context in terms of operations old process and the recent approach of using content that offers distribution to the businesses. In 2009, Apple managed to achieve the highest competitive advantage of digital convergence. The price of depreciation was experienced rapidly by its competitors [9]. The integration of knowledge and innovations leads to a globalized economy..

For several activities and organizational results in the 1990s, "Transformation" became a buzzword and has divided into four clusters. It starts with "Re-Engineering" or streamlining the organizational efficiency thru improving the workforce engagements partially, the "Restructuring" is the capacity of achieving productivity and efficiency the scale of opportunities and long term goals, the "Renewing" stage is promotion of innovation and empowerment towards the employees, and finally, the "Regenerating" is optimization and continuous improvement of portfolio towards the direction of organization and seeking opportunities.

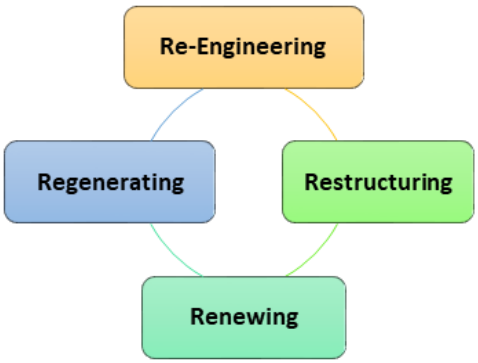

Figure 1: Digital Transformation Model

Digital innovation is perceived as new and relies on digital technology as the process and outcome of digital innovation. It is a question of combining digital technology in new ways or with physical components that enable socio-technical changes and create new value for consumers [10]. Digitalization, digital innovation, and digital transformation are closely related and connected in different ways. Digital innovation is perceived as new and relies on digital technology as the process and outcome of digital innovation. It is a question of combining digital technology in new ways or with physical components that enable socio-technical changes and create new value for consumers. Digital transformation and connections, as defined as digitalization and digital development is carried out over time to allow for substantial changes in the way business operations are carried out, leading to a significant transformation of the company or sector.

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B. *Employee Retention*

Retention of the productive labor force is one of the top priorities for organizational success in today's business environment. The lack of satisfaction of the employee may have severe consequences for the organization. The turnover of employees can have a domino effect on the quality of service, productivity, and overall success of the organization[12]. The guiding principles of Herzberg's have brought employee retention to a different convention. Many organizations globally are investing a considerable amount to the employees in building technical capabilities and competencies. Retention of trained employees is essential, and replacing them becomes more expensive. Unfortunately, many organizations do not have a retention program or a succession plan to keep the knowledge base asset within the organization.[13].

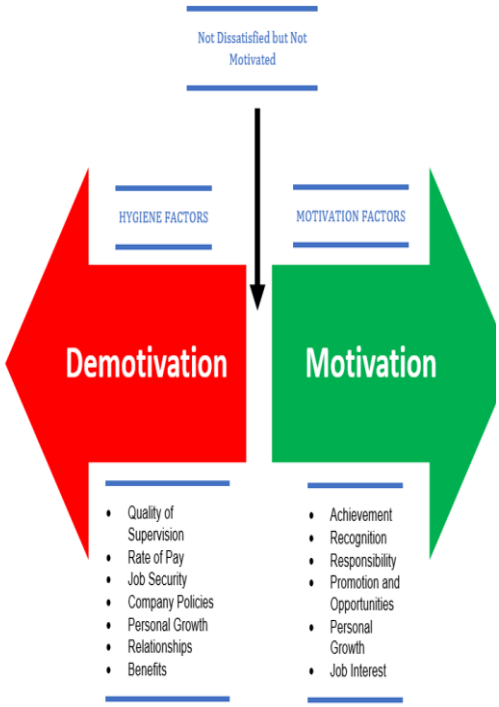

Figure 2: Frederick Herzberg Motivation Theory

Behavioral scientist Frederick Herzberg suggested a theory of two factors or motivator-hygiene in 1959. According to him, employment factors could either increase fulfillment or discourage. A "Satisfaction" has a reverse of "No Satisfaction," while the opposite of "No Dissatisfaction" is "No Dissatisfaction."[14]. It describes the factors that employee engagement find their employment satisfactory and dissatisfying and identified as hygiene factors and motivators. Hygiene factors can lead to discontent in the workplace, but when treated and nurtured can be adequate to satisfy employeesthat lead to increased motivation[15]. The theory of Herzberg has widely accepted and considered relevant across industries motivating employees to perform well.Countless strategic ideas have affected how companies treat employees to create a motivated workforce. These theories are intended to explain how people behave in the way they do, and to provide advice on the reasons and strategies that can best benefit workers as they work in terms of their willingness to work.

Hygiene considerations are also alluded to as maintenance considerations that include biological health and relationship needs. These are conditions that are not directly linked to the job but the situation surrounding the work. Motivational factor considerations rigidly adhere to the quality of the job, are innate to the job as a whole, and do not gain from' carrot and stick opportunities.'It encompasses the physiological need for development and appreciation. The lack of these factors does not prove to be particularly dissatisfactory, but they are currently building up a healthy level of motivation, which leads to excellent job performance.As a result, they are called satisfiers or motivators. Those attributes include achievement recognition, growth, jobs itself, the potential for personal growth, and openness.

C. *Agile Development and Software Quality*

Agile Methodology substitutes the traditional techniques of the software development process and recognizes the need for innovation and heavy-weight software development processes to enable rapid visibility of results and performance. The submission and documentation of a set of guidelines and requirements accompanied by high-level application design, build functionalities, and testing. Beginning in the mid-1990s, many experts found that these initial growth strategies were daunting and likely unlikely[16]. The fast-changing technology which tends industry requirement to be volatile and deviating from traditional approaches does not meet the increasing volume of customers demands and expectation from the software applications.As a result, many consultants have independently developed frameworks and procedures to adapt to the inevitable adjustments they have encountered. These Agile Methods are, in reality, a collection of distinct methods that share the same values and fundamental principles. Many of them form the basis of iterative learning, an approach adopted in 1975. The two driving factors in the life cycle of software development is emphasizing the system developmentand quality assurance practice. Agile application techniques are iterative and progressive developments in which user-centric specifications can be modified. This leads to evolutionary planning, iterative development through pacing[17].

The conceptual model emphasizes the anticipated communication all through the development phase. There is a

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range of SDLC models with distinct advantages. The actions taken out at each phase of the software development cycle is a framework that allows Planning, analysis, design, coding, testing, and maintenance as core stages[18]. The agile method adheres to the life cycle of software development with time-controlled sprints fulfillment of customer requirements. Customer satisfaction is the highest priority. [19].

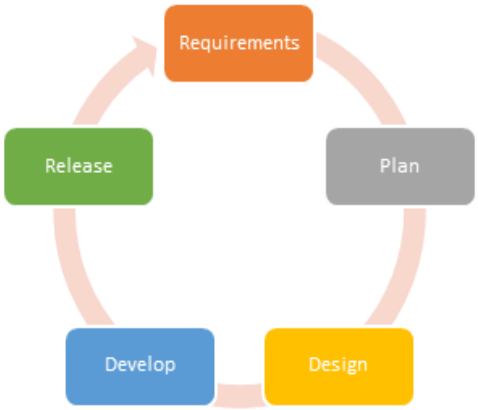

Figure 3: Agile Software Development Process

Agile methodology is a process that takes an iterative approach, open communication or collaboration with stakeholders, and a framework adaptable throughout the project engagement. The strategy minimizes the risk and adapts to changes quickly[20]. Agile methodology deviates from the traditional waterfall method that manages the volatility of requirements through sprints and iterative approach in building software.

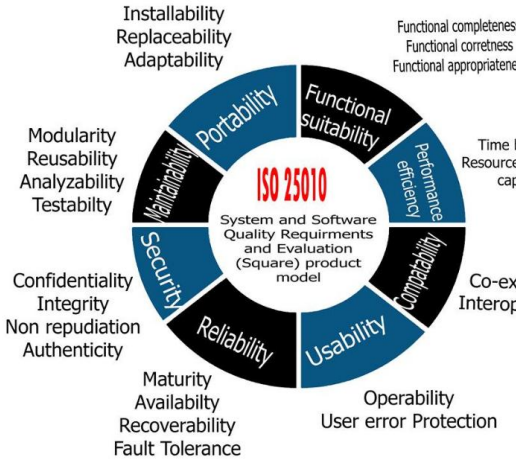

Figure 4: ISO 25010 Software Quality Requirements and Evaluation Model

The ISO 25010 is a Software Quality Assurance principle that provides checklist guidelines in developing a robust and sustainable system. The ISO/IEC 9126-1:2001 standard is amended.The eight quality features the functional suitability that provides fulfillment of requirements; performance effectiveness relates to availability and robustness of the system; Compatibility that refers to other system element; usability defines the achievement of the requirement; Reliability is the degree of a system or component to perform specified functions based on function and timing; Security refers to the protection of information and data; Maintainability refers to effectiveness of the product to be modified, and portability refers to the productivity and efficiency when component to is transferred to another environment[21].The "ISO 25010 (2011)" offers an important starting point for the implementation of software engineering standards. "ISO 25010" defines a dynamic design with the performance of the product/system (also known as internal and external quality (EQ)) and the reliability of the service in use.

D. C4.5 Algorithm

Algorithms and variants have been the subject of several research papers since Quinlan implemented ID3. A vast amount of data is available within a company to help build an efficient retention management plan[22]. Human Resources (HR) management systems have records of all changes in employment status, including voluntary termination, employee history of work-action, length of time in a position, and salary history. This extensive collection of employee data within the organization held by Human Resources (HR) can analyze the effective prediction of employee attrition. Data mining can be useful to human resources in defining the features of their most productive staff, particularly in helping to identify high attrition potential workers[23], [24].

The C4.5 algorithm is constructing a"decision trees" using the knowledge entropy principle. The training dataset $S = S_1, S_2 \ldots$,is identified and classified as samples. Each sample S_1comprises of a p-dimensional vector$(x_{1,i}, x_{2,i} \ldots x_{p,i})$, where the $x_j$denotes the attributes o=to which every sample belongs [23].C4.5 selects one of the information attributes of each tree node that most efficiently divides the collection of samples into subsets that are enriched by either category. Its criterion is the standardized gain of information or the so-called difference in entropy resulting from the selection of an attribute for data division.The most significant standardized information gain attribute is selected then reduces the data to smaller sub-lists[23].

The Data Mining classification tasks and knowledge acquisition process are categorized to perform the analysis process in the related databases. This method was intended to use talent databases to conduct the process of acquiring talent

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expertise in Human Resource (HR). The decision tree family C4.5 classifier algorithm suggests an appropriate dataset classifier. The classification model is used in the management of talent, in particular for the classification or prediction of expertise [25][26]. C4.5 embraces a greedy strategy in which decision trees are built and conquered in a top-down recursive way. Most decision tree induction algorithms adopt a top-down approach starting by tuple training set and related class labels. As the tree constructs, the training set is repetitively dividing into smaller subsets.

III. METHODOLOGY

Combining Applied and Experimental research utilizing the evaluative approach applies in this study. It allows the researcher to weigh the outcome in distinguishing the algorithm's performance in achieving the desired output. According to Baimyrzaeva, " Applied research seeks to find solutions to the underlying problem encountered by corporate entities, whereas fundamental research focuses primarily on blanket statements"[27].

A. Knowledge Discovery in Database (KDD)

The procedure in finding the appropriate retention model is through knowledge discovery in large databases. The creation and appreciation of the application domain and baseline information is the necessary knowledge objective of the end-user.

The dimensional reduction or transformation recognizes data outliers and determines an appropriate template for the KDD process.KDD discovers useful knowledge from essential datasets. The process requires analysis and explanation of observations to determine what we are identifying as knowledge. These involve the option of data entry methods and techniques. Data mining uses algorithms to derive data information patterns without new stages of the KDD process. The Data Collection phase allows the researcher to collect essential data to achieve the primary objective of developing a decision support system that utilizes computational modeling using decision trees algorithm for strategic calibration of I.T. Job practitioners. The testing and evaluation metrics using the Confusion Matrix shall be applied to determine its model performance and robustness of data sets.

$$CV = \frac{1}{k}\sum_{i=1}^{k} PM_i \qquad (1)$$

The industry-proven way to illustrate the standard structure is using the "Cross-Industry Standard Process" (CRISP-DM). The phases and the interpretation of the interaction between the tasks identified.

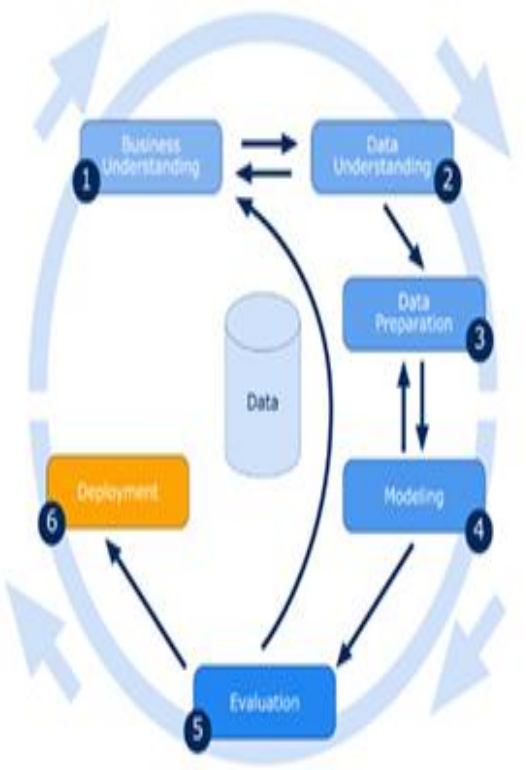

Figure 5: Cross-Industry Standard Process Model

The Business Understanding addresses what the business use case is, and, with the help of a domain expert, what attributes of the use case should include in the model such as income amount, job title, education level. The data input used in this study is from a Global company that makes the transition to digital technology by modernizing and incorporating its mainstream IT and deploying digital alternatives on a scale for a prosperous digital future to generate better company results. In compliance with the Philippine Data Privacy act, 10173 [28], and Information Security Management System policy [29], The company name and data details cannot be publicly disclosed by the researcher unless a non-disclosure agreement is serving by the interested party. Most organizations or firms have a formal calibration guide that grades performance. A useful calibration framework can benefit an organization prominently by enabling the prospective candidate to manage the expectations once they employ, and it provides information for making employment decisions, such as pay raises, promotions, or releases.

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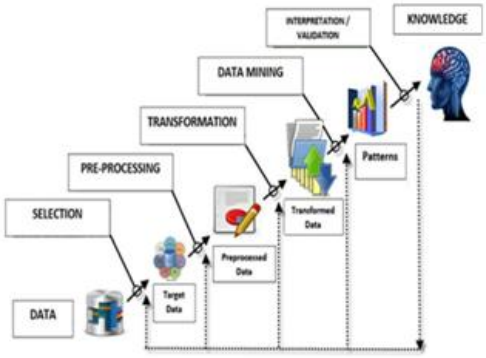
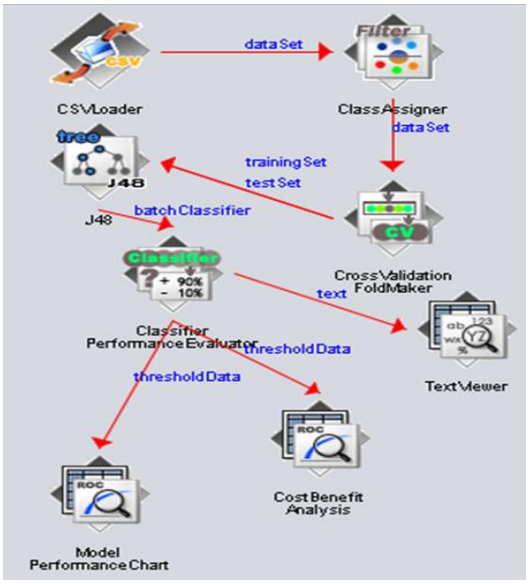


Figure 6: Knowledge Discovery in Database Model

The Data Understanding involves analyzing and exploring the data. Every independent variable and the combination of two or more variables use statistics. The two main processes involve the listing of suitable candidates and determining who among the candidates is reliable, efficient, and successful. [31]. The decisionmaking entails attributing the selection criteria with predictors confirmed through candidates 'strengths, and potential. Data Preparation phase covers all activities from the initial raw data to build the final dataset. The data category converts into analytical datasets via a reconsideration of criteria for data selection, determining of which dataset to use, collection of appropriate additional internal or external data, consideration of sample techniques, and explanation of why specific data should include or exclude.

The Modeling phase of this study is deriving from the software engineering best practices in "Decision Analysis Resolution." The DAR is one of the process areas (PAs) in the CMMI [30]. The purpose of this PA is to ensure that critical decisions are made systematically [24]. The DAR process is a formal method for evaluating essential decisions of the program and proposed program solutions. It provides a decision-making process that is controlled rather than reactionary[31].

The Evaluation Phase prepares and cleans the provided data. The preprocessing commences immediately after the model creation, testing, and evaluation using the tool "WEKA."[32]. It is designed to allow us to test existing methods flexibly on new datasets rapidly. It offers extensive support for the entire experimental data mining process, including the preparation of input data, quantitative evaluation of learning schemes, and analysis of input data and learning outcomes.This contains a broad variety of pre-processing methods as well as a wide range of learning algorithms. Classification of the "Raw" in the calibration class for workers without a dimensional reduction technique.



The Deployment Phase gathers recommendations as knowledge gained that will be organized and presented in a way that can be processed by the user. During the deployment phase of this research, a report is generated that the organization can use the calibrate employee performance assessment.

B. Agile Development

The Agile Model of HR referenced to the Agile Manifesto represents the new emerging way defining the missionof Human Resource Management. Data governance and management is rapidly gaining its ground. Organizations are motivated to have a strategic, proactive HRM with valuable high-level knowledge. Moreover, in terms of flexibility and scalability, it should impact on generating high business value [33]. In summary, the Agile Manifesto uncovers communications over processes and tools, job technology over extensive documentation, client cooperation over contract negotiation, and project change response worked together are among the essential activities in the Agile approach[34]. Following the twelve principles of Agile are: (1) Highest priority in satisfying the customer through delivery of working modules, (2) Allows changing requirements regardless in the late stage of development. (4) Shorter timescale and frequent software delivery. (5) Daily collaboration between the business group and technical staff throughout the project timeline. (6) Building projects utilizing highly engaged members. (7)Effective communication process (8) Working modules as the measurement of progress (9) Agility to design and technical excellence (10) Simplicity (11) Technical specification created by the self-organizing team (12) Continuous improvement and adjusting behavior accordingly.

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C. C4.5 System Implementation

The augmented training data given is with a vector

$C = c_1, c_2, ...,$ denotesc_1, c_2representsto which each sample belongsthe class.

The "C4.5" picks a data attribute from each tree node that most accurately partitions the sample set into subsections enriched in either group. The parameter is the structured gain of information or the difference in entropy stemming from the choice of the data split attribute to make the decision.There are severalcritical instances of this algorithm. All samples in the collection belong to the same group. When this happens, the options tree produces a leaf node to choose the group. Any data is extracting from any of the characteristics.The expected value of the class to establish a decision node has achieved previously unseen. C4.5 again gives rise to a more critical decision node. The pseudocode for constructing decision trees algorithm is as follows[31]:

(1) checking baseline instances.

(2) Find and identify the standardized information gain by dividing on

(3) Creationand splitting decision node.

(5) Reoccur and establish sub-nodes.

IV. RESULTS AND DISCUSSION

Theuse of the data mining method via algorithms is a technique to extract and identify the deemed knowledge according to the specifications of measures and thresholds.Focus on a specific subset of data samples to be discovered.

For this research, the dataset performance garnered is99.59%, as shown in Table 1. "Software cleaning and pre-processing eliminate outliers and the collection of the information needed to model for handling missing fields and accounting for time sequence information and known changes.".

Table 1: Classification and Performance Result

```
=== Summary ===

Correctly Classified Instances        5856               99.5918 %
Incorrectly Classified Instances        24                0.4082 %
Kappa statistic                          0.9848
Mean absolute error                      0.0045
Root mean squared error                  0.063
Relative absolute error                  1.6605 %
Root relative squared error             17.1356 %
Total Number of Instances             5880
```

The preprocessing allowed the input data file system to browse the information file by choosing and alteration of the information that was processing the relationship of attributes towards retention. Figure 7 shows that 4929 individuals retained. Classification performs regression in allowing training and testing of learning schemes to classify.

The Percentage split was chosen by the classifier to evaluate prediction by sample percentage of the data held for testing. For this study, we use 10-fold cross-validation. After setting the classifier, test choices, and class, the learning method starts. The result list contains several entries.

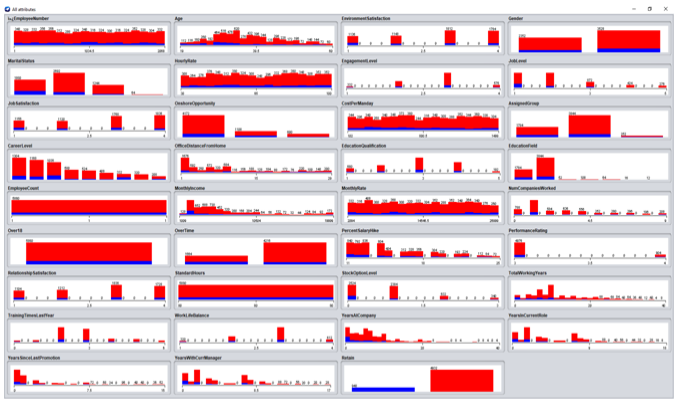

Figure 7: Performance Data Visualization

The findingsof the research showed that jobs that are very complex and with specialized skills need more considerable attention for retention to achieve, as reflected in Figure 7. Typically, this is the highly paid staff who are at the senior-level, such as Advisor Developer and Senior Actuarial. These positions tend to have disproportionately high turnover costs as a share of salaryrises.

Employee turnover costs are comparatively high for companies, regardless of the value of salaries paid to depart or incoming staff, as shown in Figure 8. The model presented after data processing and analysis that high engagement and retention came from employees who have been given economic growth in terms of monetary and career advancement.

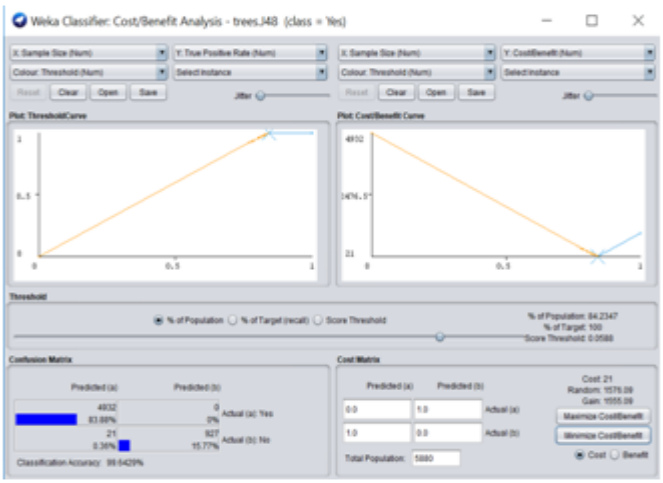

Figure 8: Cost Savings on Retention

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Effective and manageable retention policies for employees in any organization are essential and unavoidable. The implementation of strategies includes a strong commitment on the part of management and, in particular, corporate stakeholders that would undoubtedly generate rich productivity dividends [35]. The importance of employee Retention programs cannot be appreciated unless a calculation of operations cost savings and turnover cost to galvanize as a business issue.

Developing a Human Capital Intelligence System using the C4.5 Algorithm and calibrated datasets transforms the manual approach of employee retention to the digital-agile environment. The design implementation of the system covers the following features and modules:

1. The workplace engagement module is allowing collaboration between HR and Project Managers with a goal of continuous learning and an upscaling organizational culture.

2. Recruitment Module that emphasizes attracting the right talent and skill set. The decision to hire is basing on the metrics generated by the intelligence system.

3. The ongoing training is affiliating with leadership objectives and agile framework operation at planning module.

4. A guide module that is accessible to all and will strengthen confidence and develop programs that promote integrity for employees.

5. The regular interaction and transparent flow of information among the members are available in the communication module.

6. Performance assessment module to encourage employee self-improvement and performance culture and to meet personal and organizational objectives.

7. A reward and recognition module that merits distinguished achievement and continuous social recognition in the areas of development.

8. The Analytics module is quantifying employee performance for decision making.

Figure 9: Performance Module

V. CONCLUSION

The absolute finding of this study is consistent with the applied mathematical data mining approach to the motivation-hygiene theory of Frederick Herzberg. He asserted that the absence of job satisfaction is a precursor to either retention or attrition among employees. The unprecedented level of resignations among employees has become a global issue and a significant challenge for business organizations. The direct effect and indirect costs of turnover among staff are costly to maintain and affect the revenue of the organization.The classification of data using decision trees and the C4.5 algorithm resulted in the conclusion that job satisfaction is essential for the retention of an employee. Knowledge data in the database found out that by increasing the Monthly rate of an employee is not the sole basis of retention. The other considerations are rewards and recognition, a good relationship with superiors and co-worker, promotions, training, travel opportunity, and office distance from the work location.The result of this study showed that an upscale workplace strategy could augment the retention of employees which avoid business disruptions. The management team is going to drive employee retention initiatives. Consequently, Designated leaders must be engaging across other groups. The presentation of cost of turnover must come into the amount to get noticed into the boardroom the retention discussion and other essential decision-making arenas.

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