

# A Mathematical Approach to Human Resources



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By

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This book is dedicated to my mother. ‘Nothing is better than practice,’ says my mother, Nirmala Mishra, who has always encouraged me to strive and try again in my life. And I was always one step ahead. She is no longer alive, but when I chose to publish a book about a mathematical approach to human resources, I discovered that it is a fresh method with many problems in this subject. I remembered my mother and began and eventually finished this job.

While writing this book, my father (Ashok Mishra) has always put light on the practical parts of life, which has helped me to develop knowledge.



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## PREFACE

This book, “A Mathematical Approach to Human Resources”, presented the concepts of various approaches to human resource practices. Academicians and practitioners follow human resource practices on the basis of their ideas and understanding. Currently, there is a rising debate on which human resource approach is better, i.e., human resource accounting, internal marketing approach, mathematical approach, proactive approach, reactive approach, etc.

Due to the extensive usage of human resource practices, it is difficult to determine the number of human resource practices. Due to rising employee-related concepts and various approaches that are employee-focused, it isn't easy to implement human resource practices and differentiate them from other concepts. To bring clarity to the concept and to follow the right approach toward employees, this book was developed.

There are eight chapters in this book. Chapter 1 provides an introduction to the mathematical approach to human resources, which includes the evolution of human resources, human resource digitalisation, human resources in the 21st century, and various approaches to human resource management.

Chapter 2 elaborated on the concept of human resource accounting, which encompasses the meaning of human resource accounting, the objective, the concept of HRA, the application of HRA, and the relationship between accounting and human resource management. Chapter 3 explores the mathematical modelling for human resource practice, comprising human resource planning, workforce planning, performance management, human resource allocation, company efficiency, and intellectual capital. Every feature of the organisation is changing rapidly. Since the evolution of human resource management, various ways have been followed to attain its objective.

Chapter 4 focuses on internal marketing, which is a different concept from human resource management. It works as an integrated approach between human resource management and marketing to increase the value of

internal customers. The major distinction is that internal marketing is competitive and needs to build customer focus by providing value to internal customers. Employees' value was enhanced with the introduction of internal marketing, as they called employees internal customers. Chapter 5 explains the importance of internal management measurement, measuring HR effectiveness, and HR efficiency.

Chapter 6 discusses performance measurement, the advantages of performance measurement, the performance measurement framework, the meaning of performance evaluation, benefits, employee performance reviews, KPIs, Employee performance indicators, and performance measurement and management of the workforce.

Chapter 7 highlighted internal and external marketing, internal marketing tools, internal marketing campaigns, internal marketing strategies, and their tools and mechanisms. Chapter 8 revealed various recent trends in human resource practises, including the usage of IT technology, the adoption of internal marketing practises, and emerging human resource management practices and innovations. It also discussed human resource measurement and various case studies.

Thus, these chapters are directed towards increasing knowledge of the mathematical measurement aspect of human resource practice as well as providing practical aspects of it.

## INTRODUCTORY NOTE

Employees play a crucial role in organisational performance; thus, it is vital to measure and improve their performance in the future, which is the aim of this book, 'A Mathematical Approach to Human Resources'. It is valuable to comprehend the effectiveness and efficiency of organisational initiatives, programmes, and projects in attaining organisational goals.

The management of any organisation is continuously working hard for optimal employee effectiveness. The most widespread way to define an organisation's effectiveness is to inspect its financial accounts, like inventories, account receivables, cash, etc. There is a need to measure employee investment to save costs for the organisation and attain organisational goals.

Due to considering the feelings and emotions of employees, various factors like leadership, attitude, commitment, emotional intelligence, happiness, and leader-employee interactions lead to organisational development through employee motivation and satisfaction. However, it is typical to measure these intangible aspects. But despite this, various measurement techniques are being used currently.

Conventional and modern approaches to human resource management are discussed in this book. Human resource accounting is the concept of identifying, measuring, and reporting human resource investments that need to be accounted for by typical accounting methods.

Businesses are heavily dependent on creativity or research to determine methods to measure human investment. However, it is critical to measure intangible assets such as human abilities. Despite the reason that human resource accounting is practised in the organisation, they are handling their problems with this method. Still, the fact is that effectiveness can only be gained with the positive attitude and commitment of the employees. For this, internal marketing is focused on the employer as well as employee commitment to attain organisational objectives. The reason is that employees and employers are both involved in the exchange process; thus, how can human resource professionals measure employee performance

with a one-sided approach? In this regard, Internal marketing measurement is the technique to measure the functioning of its dimensions in the organisation, for example, internal communication, internal segmentation, rewards, job products, internal customer orientation, service quality, etc.

There is a requirement for mathematical modelling to measure human resource practice so that organisations can utilise it for their development. Developing consistent quantitative methods for various practices takes time and effort. However, it is possible only if there is a proper understanding of the various concepts linked to it.

This book will provide a better insight into the human resource measurement procedure and approaches and provide a basis to develop quantitative techniques in human resource practice.

## ACRONYMS

HRM	Human Resource Management
HR	Human Resource
HRM	Human Resource Management
IM	Internal Marketing
SHRM	Strategic Human Resource Management
R and D	Research and Development
AI	Artificial Intelligence
COVID 19	Coronavirus Disease
ITC limited	India Tobacco Company Limited
HRA	Human Resource Accounting
SAIL	Steel Authority of India Ltd
BHEL	Bharat Heavy Electrical Limited
SPIC	Southern Petrochemicals Industries Corporations of India
MMTC	Metals Trading Corporations of India Ltd
SMEs	Small and medium-sized firms
IT	Information Technology
CIS	Common Wealth of Independent States



AHP	Analytical Hierarchy Process
HRA	Human resource allocation
SPSS	Statistical Packages of Social Science
IC	Intellectual Capital
KPI	Key Performance Indicator
ROI	Return on investment
SMS	Short Message Service



# CHAPTER ONE

## INTRODUCTION TO HUMAN RESOURCE MANAGEMENT<sup>1</sup>

### **Abstract**

There is a drastic change in every sector of business. Due to changing technology, increasing globalisation, and competition, there is a change in the organisation's overall system. Human resource management is one of the disciplines in management that focuses on managing employees at work. However, various conceptions have developed over time regarding how to tackle human resources in the organisation. There is an increasing awareness for the betterment of human resources in the organisation; thus, currently, organisations call human resources 'internal customers'.

It is required to redefine and develop the human resource concept due to the increasing complexity and dynamic environment. To deal with human resource practices and assess the effectiveness of the human resource management process in the modern era, mathematical approaches and tools are required. In this context, the introduction to human resource management and other associated methodologies were the main topics of this chapter.

### **Introduction**

"Human resource management" describes managing human resources in a business. (Manashree 2019) With the advent of human resource management, the significance of human resources has been increasing. Employees play a vital role in the organisation, and their management brought various stages of its evolution.

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<sup>1</sup> Chapter One: Human Resource Management

Personal management, human relations approaches, human resource management approaches, strategic human resource management approaches, holistic approaches, mathematical approaches, and internal marketing approaches are some stages of its evolution.

There is a need for much work in measuring human resources. It is time to consider how to quantify human resources. Therefore, there is a need to make an effort and provide a direction for implementing it. Due to growing rivalry, organisations concentrate on strategic human resource management to acquire a competitive advantage. In 1981, internal marketing was initiated in response to the growing need to motivate and retain workers following the emergence of human resource management. Instead of treating employees as assets, internal marketing involves treating them as internal customers. Later, different authors continued to explore this idea. Identification of measurement variables is required for internal marketing implementation to be successful. (Manashree, 2019)

There is a question: Are internal marketing and human resource management similar notions? After extensive research in this field, it shows that both are distinct. (Mishra, 2022) A measurement approach needs to be identified to measure the internal marketing concept. Scandia is the first big company to concentrate on measuring knowledge assets. Intellectual capital is one of the factors present when the hidden components of human and structural capital are combined. (Edvinsson and Malone, 1997, as cited in Kucharčíková, 2011)

According to Sveiby (1997), intellectual property is an intangible asset. He proposed a framework based on three families of intangible assets: internal structure (organisation management, manual systems, legal structure, attitudes, R&D software, and individual competence), external structure (customer relations, brand knowledge, supplier relationships, and distribution relationships) and individual competence (education, skills, and experience). Sveiby presented a method for calculating intangible assets. Several authors have updated their intellectual capital because intangible assets help boost value. According to conventional accounting, these assets are costs. An argument is made that a comprehensive indication of financial success and shareholder value can be found by utilising non-financial measurements to assess intangible assets and financial measurements to assess visible equity. (Kucharčíková 2011)

There are various changes that have occurred in the development of human resource management. The most significant change is the way

employees deal within the organisation. There is an exchange between the organisation and employees for mutual benefits. The organisation's ultimate aim is to improve employees' performance and lead to organisational growth and development. The problem for the organisation is how to measure their performance and accountability. Human behaviour is typical; therefore, it is vital to understand it and do proper planning and implementation to improve performance. If we look at organisations today, there is no need to manage employees rather than empower them. The human resource management concept remains, but there is a need for a new vision to see it.

## **Evolution of Human Resource Management**

Human resource management is a crucial component of every organisational management system. Human resource policies significantly affect individuals, as is well known. Firms have begun to focus on human resource strategies and applications to establish a sustainable competitive advantage and high performance in company operations. The concept of human resource management evolved from using human capital wisely and effectively. (Vardarlier, 2016)

Following 1980, there was a noticeable increase in the use of human resource management. Craftsmen and skilled artisans played a significant role in product creation in the ancient world and for a substantial chunk of the mediaeval era. In addition to owning the tools and equipment, they produced and sold the products on the market. They handled their own business with assistance from their family members. Nevertheless, many artisans also employ apprentices and a specific class of labourers. Strong bonds existed between the master artisans and the apprentices, and they directly dealt with any problems that the family members and apprentices encountered.

Some apprentices started their businesses after prolonged training, while others remained financially obligated to their master artisans. Throughout the mediaeval era, experienced craftsmen formed guilds primarily to defend the interests of their respective industries. These guilds also determine the price of the items, the salary of labourers and journeymen recruited to do the work, and the terms and conditions of their employment. The ancient and significant section of the mediaeval era saw many different labourers. Serfs, slaves, and indentured workers are among them. (Manashree 2019)

Managing people, serfs, and indentured labour is one of the stages of human resource management. Other phases include managing the Industrial Revolution, the trade union movement, the beginning of the 20th century's era of social responsibility, the scientific management era from 1900 to 1920, the era of human relations, the era of behavioural science, the system and contingency approach, and the era of human resource management from 1980 onward. (Manashree 2019)

The trade union developed in the 1920s, just before India gained independence. According to various authors, the First World War and trade unions were responsible for developing the human resource management concept. The Royal Commission recommended hiring a labour welfare officer in 1930 to investigate worker complaints. According to the Factory Act of 1942, if a factory employed 500 or more people, it was required to hire a labour welfare officer.

The Second World War raised awareness of workers' rights, and from the 1940s to the 1960s, new technology was introduced to assist workers and expand human resources' application beyond welfare. Personnel management now refers to a combination of welfare, labour relations, and administration. Heavy industries began to take off with the second five-year plan, and professional management gained significance. In the 1970s, the emphasis was on labour productivity, whereas in the 1980s, it was on new technology, necessitating new norms and regulations. Human values and human development were prioritised in the 1990s. As workplaces got more liberalised and different types of workers began to dominate, this trend gave rise to human resources management (HRM) and the development of personnel management. ("Evolution of Human Resource Management", n.d.)

Western Europe and the United States sowed the seeds of HRM during the industrial revolution in the 1850s. The wind gradually affected India at the turn of the 20th Century. ("Evolution and Development of Human Resource Management (HRM)" 2014)

The evolution of HRM since then can be divided into three categories:

**Trade Union Movement Era:** Trade union efforts led to the establishment of personnel procedures, including collective bargaining, grievance handling systems, arbitration, disciplinary practices, employee benefit programs, and sensible and logical compensation structures.

**Social Responsibility Era:** The era gives importance to social welfare and the perspective of British industrialist Robert Owen on labour. He thought the fundamentals of social and economic environments and people face an impact on their physical, mental, and psychic development. Hence, improving employees' working and living environments is necessary to boost productivity. It can be done by removing them from an unfavourable setting or changing it to incorporate better living and working conditions.

**Scientific Management Era:** At the start of the 20th century, Frederick Winslow Taylor popularised the idea of scientific management in the USA as an alternative to the dominant system of administration by initiative and incentive to improve the worker's efficiency. Based on his experience on the shop floor, Taylor developed the following four scientific management concepts: development and use of the scientific technique; provision for training and development; management and staff clearly defined; and harmonious relationships with employees.

**Human Relations Era:** Since they failed to recognise workers as actual, aware people with their own needs, attitudes, and feelings, earlier approaches to human resource management were deemed inadequate by 1920. Between 1925 and 1935, many specialists expressed their opinions on the human facets of organisational action. ("Evolution and Development of Human Resource Management (HRM)," 2014)

## **Human Resource Digitalisation**

The Human Resource Management System (HRMS) underwent numerous modifications over the following two decades, and many new features were added, including a different human resource information system (HRIS) for managing personnel, sophisticated employee performance management software, learning management, and talent features.

After 2010, the introduction of artificial intelligence was the next significant turning point in developing human resource (HR) technology. The introduction of artificial intelligence gave HR product architects a significant opportunity to address complicated issues in the human resources area.

Artificial intelligence (AI) in the human resource system looks appropriate in numerous areas. One of the crucial areas where artificial intelligence may offer the finest solution is recruiting personnel. Studies have been

performed to better understand this unusual phenomenon as the millennial age has begun to assume leadership roles in organisations worldwide.

The new generation was characterised as impatient and a highly motivated group impacted by business culture and the workplace. It gave rise to the idea of putting the needs of employees first, and various influential people like Richard Branson, Vineet Nanayar, and others enthusiastically supported it. (Ahmer 2018)

## Human Resources in the 21<sup>st</sup> Century

Companies will rely on human resources professionals to serve as capable leaders who help employers and employees deal with the problems of the 21st-century workplace. People will perceive human resources specialists as strategic and business decision-makers who advance the organisation. By selecting the best candidates, training personnel, and adapting to the shifting environment, the human resource department contributes to the firm's success Fig 1-1.

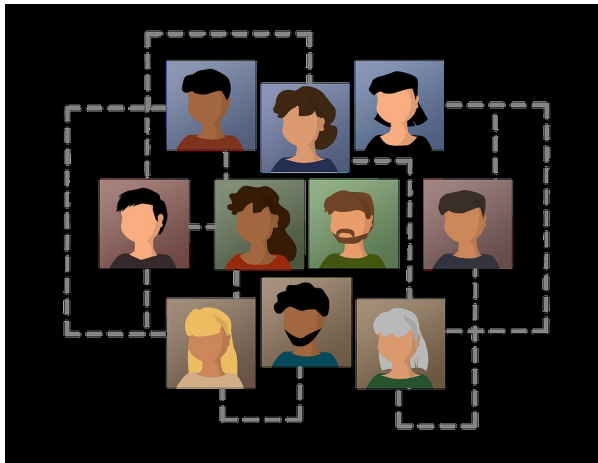


Fig. 1-1: Human Resource Network, source  
[https://cdn.pixabay.com/photo/2020/04/12/11/59/human-resources-5033959\\_960\\_720.png](https://cdn.pixabay.com/photo/2020/04/12/11/59/human-resources-5033959_960_720.png)

They will view human resources specialists as strategic thinkers and business partners who make decisions that advance the organisation. By selecting the best candidates and offering staff training to help them adapt



to the changing environment, the human resources department contributes to the firm's success. ("Major Trends in Human Resources in the 21st Century", n.d.)

**Societal changes:** The COVID-19 epidemic, according to global professional services company Deloitte, has altered the development of employee-employer interactions, possibly forever. Although it is impossible to predict where future trends in human resources will go, Deloitte offers the following four possibilities:

**Fashion in the workplace:** Companies respond to worker demands and rival actions.

**Talent wars:** A skill shortage causes workers to battle for positions.

**Employment is work.** Workers anticipate finding significance and purpose outside of their employment, as opposed to in their professional capacities.

**Unleashed purpose:** The employer and the employee have a sense of unity.

**Technology training:** The move for businesses from using local servers to adopting cloud services with unlimited storage will be led by human resources. Human resources will employ cloud computing specialists to combine cloud apps, mobile devices, and social media during the transition. The experts will train workers on cloud operations and integrate the cloud into a company's daily operations. Developing policies regarding personal technology and employee data usage will also involve human resources.

**Globalisation Effects:** Business is expanding internationally, and there is cutthroat competition. Globalisation is accelerating at a faster rate and also making changes in the business market.

The human resources department of a corporation is in charge of hiring and educating local employees in foreign nations where the company has offices, as well as newly hired international employees in local offices. Human resources also teach work ethics to every staff member and how to comprehend cultural variations in addition to operational training.

**Internal changes:** The obligation to modernise their technological ways is one of the developments in human resources. For instance, they will alter their recruiting strategy to use social media to discover qualified individuals for open positions. They will boost shared apps between

employers and employees and update technology policies to incorporate conduct and safeguards for an IT property. They will also be able to evaluate an employee's value to the organisation by connecting their performance with its business objectives.

The diversity of the workforce will continue to increase in the 21st century due to the growth of ethnic groupings. The public sees an organisation with variety as peaceful, stable, and forward-thinking. For employees' skills to operate in diverse teams, human resources professionals will be taught to understand, support, and achieve diversity efforts. Human resources experts will collaborate with business leaders to ensure the organisation embraces different cultures to preserve a competitive advantage. (Aslam et al. 2014)

Although many firms were unprepared for the scope of the pandemic, human resource management was compelled to adjust to COVID-19 quickly. As everyone worked from home, they aimed to alter their procedures to increase production and employee performance. "Human resource management" describes managing an organisation's culture and human resources.

The management of human resources was compelled to adjust quickly. Following are the ways in which HRM changed with COVID-19:

**Widespread adoption of remote work:** There is a widespread adoption of remote work during pandemics, which makes the work easy and simple.

**Human resources and core onboarding:** Online onboarding and a digitalised hiring process initiated. Human resource management departments use task management software and qualitative and quantitative data to manage employee performance.

**Engagement:** As organisations maximise employees' well-being electronically and promote a healthy work-life balance, diversity and inclusion are essential to a human resource management job.

**Development and training:** HR experts provide online training and tools to ensure employees have the necessary skills for remote work.

HR will adjust to flexible and hybrid working after the lockdown. (Evans 2021)

Human resource departments manage human capital, which includes people, their abilities, and their skills. Since employees are an organisation's most valuable asset, HR professionals must balance their needs with the bottom line. (Evans 2021)

Organisational psychology is where the human resource management profession gets its inspiration, and it is a crucial technique for managing organisations. With time, this practice's strategic role started to take shape. The position of human resource management departments has evolved into one essential for modern business in the twenty-first century. (Aslam et al. 2014)

In the twenty-first Century, organisations must compete for HR talent because of worldwide competition. High-achieving adolescents discovering enormous advantages and financial rewards for satisfying their materialistic needs are future talents. According to Taylor (2001), a new generation of highly skilled workers is emerging in this Century. These individuals are younger, educated, knowledgeable, and highly self-assured. They are also less concerned with what they can do for the company than with what the company can do for them. (Aslam et al., 2014)

The expansion of service firms throughout developed and emerging nations shifts management attention to employee empowerment. In the global 21st century, when service companies are expanding quickly and intellectual capital is the most valuable asset, there are few examples of using the human asset accounting system. Financial reporting needs to recognise several intangibles, potentially decreasing the usefulness of the financial statements. (Gupta 2013)

## **Challenges of Human Resource Management**

**Demographic shift:** The demographic transition is challenging because of the dynamic environment. Demographic categories include physical handicap, gender, age, nation, and religion. By 2008, the proportion of female employees rose to 48% as their turnout ratio rose. As urbanisation has advanced, opportunities for women to find employment have increased.

The choices for where and how employees might work have been significantly increased by contemporary technology that combines mobile communication and high-speed internet. For instance, software engineers

work from home rather than in offices, receiving their projects over web connections. Employment preferences are another factor in the diversity of the workforce.

**Knowledge-based economy:** Due to the knowledge-based economy, it is necessary to diversify HRM tactics to compete with existing rivals and gain a competitive advantage. To simultaneously provide value to customers and employees, the trend switched from an industry-based economy to a knowledge-based economy.

Managers in industry-based economies place equal emphasis on effectiveness and efficiency. Expertise, entrepreneurial skills, innovation, and a varied workforce are in excellent demand today. (Aslam et al., 2014)

**Improve creativity and innovation:** To compete in the dynamic environment, well-known firms emphasise the workforce's abilities and synergistic power.

As an illustration, Apple and other businesses place their research labs worldwide to learn about consumer trends and preferences. By learning about changes, they produce novel and creative products.

**Gaining maximum market share:** Owing to diversity, manufacturers must concentrate on the market and market knowledge to understand the needs and wishes of their customers and produce goods that will capture the largest possible market share. Teamwork and abilities have improved through sketching experiences, making it easier to respond quickly to opportunities in a new market.

**Relation between employees and employers:** There are changes in the employee-employer relationship in the twenty-first century as well. Organisations operate in a fluid environment without centralised control. Workers work in a welcoming environment and continuously gain motivation and commitment. Relationships between employees and employees boost organisational performance as well as create a good work environment. Employees are devoted to their employers and give their best in today's highly competitive global environment. They may readily discuss cutting-edge market trends and strategies with the top management. Through exchanging ideas, they arrive at new, creative solutions that are highly beneficial for achieving organisational objectives.

Reward and compensation system: Employees worked in a concentrated setting throughout the Industrial Age. No one was compromised in the decision-making process because top management was responsible. Managers gave orders to the workforce, and there was no adequate employee remuneration system. They were paid daily and based on the number of units produced. Employees are adequately compensated, and organisations also provide them with awards for their achievements in finishing tasks given to them and also receive bonuses every month. Employees work well and help the firm reach its goal thanks to the reward system.

Managing the cost: The cost of running an organisation has decreased because of flexible working practices and the usage of technical equipment. It helps to produce goods quickly and effectively.

Automation offers environmental flexibility, which helps keep costs in check. The likelihood of errors throughout the production process is likewise reduced. In the twenty-first century, the concept of employee staffing and employees as assets, or human capital, is known as human capital management. Interaction between two people is called counselling, and it is a process that involves building relationships with other people. It is helpful for businesses in the twenty-first century regarding employee training.

The effects of globalisation vary depending on whether a business needs foreign labour or has a variety of cultural needs. In the twenty-first century, HRM is necessary for the growth of mindsets, capacities, and competencies needed for competitive advantage on a global scale. HR thus provides firms with the success criteria needed for a local and global competitive advantage. (Aslam et al. 2014)

Employee commitment and engagement: Human resource management reinvented the notion of internal marketing practice, in which there is a focus on increasing employee commitment and engagement to improve organisational performance and lead to profitability. (Mishra, 2022)

The human resource department of a company employs many tactics to accomplish various objectives, including utilising technological advancements, managing international business, adhering to current regulations, confirming ethical issues, monitoring union activities, and determining the best practice versus best fit. (Loji, Krabi, & Risti, 2012) Human resource management aims to make the best use of the resources at

hand to boost both the business's and its employees' success. Moreover, it should consider competitive advantage, effectiveness, legal compliance, work-life balance, and workforce compliance. (Vardarlier 2016)

## **Human Resource Philosophy**

Policy refers to the art of governing a country, the course of action that a country's leaders take with a given issue, particularly concerning other countries, and the principles on which any course of action is based. (New Webster Dictionary, cited in Ramaraju A, 2019)

It is a somewhat enduring characteristic of a company and provides parameters for managerial decisions because it is a standing plan. Therefore, it needs to be carefully developed. There are varied approaches among organisations; thus, there is no universal procedure for creating and implementing policies.

The organisational framework may state how the business will interact with stakeholders. Employees, distributors, clients, vendors, and other key group members work continuously on critical topics. (Ramaraju A, 2019)

Any policy has two goals: general goals and specific goals. The overall objectives should reflect the organisation's strategy for the particular area or function of human resources, underscoring their importance and contribution to the long-term achievement of organisational goals.

The specific goals are linked to the specific activities in that field, such as hiring, reviewing, developing, moving around human resources, industrial relations, incentive systems, etc. This framework must be used to evaluate various human resource policies, which should centre on the following:

- To make it possible for the organisation to have adequate, competent, and trained employees.
- To create working conditions that enable employees to grow a genuine sense of unity with the organisation and do their jobs as effectively and willingly as possible.
- To instil and strengthen accountability in those who directly manage human resources, encouraging them to adopt a humanistic philosophy that protects the employees' fundamental rights and dignity.