

UNIVERSITY OF MAKATI

**DEVELOPMENT OF OPTICREW: A WORKFORCE MANAGEMENT SYSTEM FOR  
FIN-NOYS INTEGRATING RULE-BASED WITH GENETIC ALGORITHM  
OPTIMIZING TASK SCHEDULING**

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# **CHAPTER I**

## **INTRODUCTION**

Workforce Management (WFM) is an evolving process within Human Resources (HR) that streamlines business operations, specifically in employee management, analytics, and strategic initiatives. Moreover, it encompasses workforce planning, including the analysis of workforce skills, resource allocation, and goal alignment, thereby forming the basis for strategic decision-making and balancing workforce supply with operational demands. Central to this is task allocation and scheduling, which allocates work based on skills and availability to maximize productivity. Consequently, Workforce Management (WFM) ultimately drives organizational success by supporting strategic decision-making, performance monitoring, and overall management.

With the growing reliance on digital solutions, modern organizations demand management systems that emphasize convenience, adaptability, and scalability. However, the digital revolution has disrupted traditional business frameworks, exposing limitations in static workforce planning. According to Alabi (2024), traditional workforce planning and management are limited to static schedules, which have led to task allocation mismatch, reduced service quality, urgency-based task scheduling, and slower response times. From this, the lack of organizational coherence, analytics to implement strategic decision-making, employee management, customer management, task allocation, and collaboration – among the pivots of an organization – are identified as the primary challenges addressed by one of the recent digital transformations propagating through operational business management, the workforce management systems.

To streamline business operations, a hybrid approach combining Rule-based and Genetic algorithm (GA) is employed to accommodate the dynamic nature of company workflows operating upon constraints and structured in both determinism and flexibility, thereby contributing to its complexity. With the rule-based algorithm, the task allocation and scheduling function of the system is integrated with the Genetic Algorithm (GA), introducing stochastic optimization by using an initial population refined through the rule-based algorithm and further generating possible solutions, which compensates for the rule-based algorithm in optimization and flexibility. Ultimately, this hybrid approach, which combines a rule-based algorithm and Genetic Algorithm (GA), balances determinism and adaptability, ensuring constraint adherence while also facilitating adaptability and flexibility, particularly in task allocation and scheduling.

Workforce management systems are positively linked to improved productivity, collaboration, accountability, and transparency by providing platforms that support organization and coordination, ultimately leading to better time utilization and optimized team performance. In service-oriented sectors, these systems have been found to enhance service quality by offering features such as prioritization, categorization, deadline tracking, and identifying delayed tasks, directly supporting effective management. By streamlining core management functions—including planning, organization, motivation, control, and coordination—automation strengthens organizational effectiveness, adaptability, and competitiveness. Notably, labor-intensive industries such as cleaning services in Finland have already demonstrated the benefits of process management automation (Olayiwola et al., 2024).

## **Project Context**

The modern community is structured around transactions, dominated by various types of organizations operating to meet evolving demands through a systematized exchange of supply and service delivery. To remain market-competitive and efficient in output delivery, organizations that prioritize workforce management must be technology-aware and globalization-prepared, necessitating a systematic approach to maximize resources, minimize effort, and optimize time. In both white-collar and blue-collar settings, workforce management systems play a vital role—particularly in the Human Resources (HR) department, which manages onboarding, employee oversight, and client transactions through automation, service delivery, and analytics; and in labor-intensive industries such as construction, engineering, and cleaning, where they enhance resource utilization, reduce costs, and improve operational efficiency. In line with this necessity, Fin-noys, a Finland-based startup cleaning company with a currently growing workforce, expressed the relevance of adopting a digitalized workforce management system to accommodate the processes of labor-intensive cleaning operations.

Generally, organizations are increasingly replacing manual processes with workforce management systems to streamline operations and improve efficiency. Studies show that digitalization, when paired with innovation, enables optimized task allocation, data-driven decision-making, and enhanced employee engagement while reducing operational risks (Akter et al., 2024). The integration of technologies such as artificial intelligence, automation, and data analytics further strengthens workflow coherence and organizational performance. In this context, Fin-noys recognizes the necessity of adopting a digitalized workforce management system to optimize scheduling, task allocation, and client management in its labor-intensive cleaning operations.

In the broader domain of workforce management systems, optimizing task allocation, scheduling, monitoring, and operational management remains a persistent and critical challenge, particularly to service-based companies. Traditional systems often struggle to support dynamic and efficient processes because they lack automated tools capable of assigning tasks while simultaneously considering key factors such as availability, workload duration, completion rate, and attendance behavior (Azhar, 2024). According to Olayiwola et.al (2024), the absence of employee and communication management within the organization negatively impacts organizational performance, customer satisfaction, productivity, and employee performance, thereby underscoring the need for coherence and a streamlined platform that enhances collaboration between employers and employees. Moreover, existing scheduling systems rarely consider employee performance and availability in task allocation and cannot adjust in real time to changes in attendance, workload, or urgent tasks. As highlighted by Fin-noys, such limitations directly impact operational costs, employee morale, and overall organizational effectiveness. This results in inefficiencies, especially when urgent, unscheduled tasks arise, and the lack of a system providing coherence of business processes, which particularly impacts operational costs, employee morale, and overall organizational effectiveness.

To address the inefficiencies in workforce management, the development of OptiCrew aims to address this by employing a hybrid approach of Rule-Based Algorithm and Genetic Algorithm (GA), to bridge the gap of existing workforce management systems by utilizing a dynamic task allocation and scheduling engine based on employee availability, room status, and workload, as the fundamental process in a workforce management system. With the Rule-based algorithm ensuring simple constraint application as a preprocessing layer to generate a static schedule in accordance with a set of rules defined in the system, and the Genetic Algorithm for

optimization and generation of schedules throughout its evolutionary process, it hence, promotes an appropriate and optimal solution. This study will investigate the impact of OptiCrew as a Workforce Management System (WMS) for Fin-noys and aims to answer the following research questions: How does OptiCrew impact team coordination and employee productivity, How does it affect customer satisfaction and the operational efficiency of service delivery, To what extent does it influence employee response times, and in what ways does it enhance an employer's ability to monitor and track operations? Guided by these questions, OptiCrew, a Workforce Management System (WFMS) that incorporates dynamic scheduling, task allocation, and real-time attendance tracking to optimize employee, service, and client management, was developed for Fin-noys as a cleaning company.

### **Purpose and Description of the Study**

Widespread challenges in workforce, project, and quality management across various industries made process management an increasingly in-demand solution. In the service sector, inefficient workforce management operations, particularly in task management, result in overburdened staff, prolonged response times, missed deadlines, and decreased productivity due to inefficient task allocation and limited availability. One of the industries that finds process management automation beneficial is a labor-intensive industry—cleaning businesses (Olayiwola, 2024). From this, Fin-noys, a cleaning company, experiences similar struggles related particularly to task allocation, workload distribution, and scheduling. To address these issues, OptiCrew was conceptualized as a company-based workforce management system designed to optimize task and service management, ensuring a high-quality service delivery and increased productivity. By automating and streamlining core processes, Opticrew aims to reduce occupational burnout,

improve workload distribution through an optimized task allocation and scheduling feature, and ensure efficient task allocation and scheduling to boost overall service satisfaction, quality monitoring, and employee productivity.

The primary purpose of this study is to develop OptiCrew, a company-based workforce management system in an effort to optimize task and service management for task allocation, employee management, and service management, as a website for the users. The system employs a hybrid of Rule-Based Algorithm and Genetic Algorithm (GA) for efficient task allocation and scheduling, and real-time GPS tracking via Google's Fused Location Provider (FLP) with geofencing for attendance monitoring. The hybrid approach of Rule-Based Algorithm and Genetic Algorithm (GA) ensures operational efficiency, reduces scheduling conflicts, improves response times, maximizes resources while ensuring equitable workload distribution in a service-based organizations such as Fin-noys.

The system comprises three (3) primary modules: the Employer Module, the Employee Module, and the Client Module. The Employer Modules oversee the resource management and process automation, such as task allocation, scheduling, and team assignment, where the Rule-based Algorithm and Genetic Algorithm (GA) will be employed. On the other hand, the Employee Module serves as the interface where employees can view assigned tasks, updates, and employment-related processes and requests. Lastly, the Client Module provides clients with a platform to book cleaning services, track their orders, and provide feedback. By utilizing the Rule-Based and Genetic Algorithm (GA) in task allocation and scheduling, OptiCrew ensures fair

workload distribution, enhances responsiveness and efficiency, and improves service satisfaction, quality monitoring, and employee productivity.

## **Objectives of the Study**

The general objective of this study is the Development of OptiCrew: Workforce Management System for Fin-noys, employing a Rule-Based Algorithm with Genetic Algorithm (GA), to optimize task allocation and enhance employee scheduling.

## **Specific Objectives**

In order to fulfill the main objective of this project, the researchers constructed the following specific objectives:

### **Specifically, the study aims to:**

1. Examine and analyze the Fin-noys' workflow and procedures in task allocation and employee scheduling.
2. Explore existing systems or applications relevant to the development of a workforce management system:
  - a. Review the existing workforce management systems to validate relevant features and evaluate their task allocation and scheduling processes for improved functionalities.
3. Analyze, understand, and perform data preprocessing on the data gathered relevant to the processes of Fin-noys' existing task allocation and scheduling.



4. Train and evaluate automation models for task allocation and scheduling with Rule-Based and Genetic Algorithm, according to the following evaluation metrics:
  - a. Use a rule-based algorithm as a preprocessing layer of data filtration to apply simple constraints on task allocation and scheduling
  - b. Integrate the Genetic Algorithm for the filtered inputs to generate an optimal solution for:
    - i. Task allocation
    - ii. Team assignment
    - iii. Employee scheduling
5. Simulate and evaluate the algorithms employed in task allocation and scheduling based on the following metrics:
  - a. Rule-Based Algorithm
    - i. Accuracy
    - ii. Correctness
    - iii. Completeness
    - iv. Robustness
  - b. Genetic Algorithm (GA)
    - i. Fitness Value
    - ii. Population Diversity Over Time
6. Design the system with the following components:

The system consists of three modules divided by the system's targeted users. The major modules include:

- a. **Client Module**

This module will be utilized by the clients seeking the cleaning services of Fin-noys. It is further divided into submodules.

- **Automated Assistant Chat Bot** - This feature includes a chatbot integrated into the system to answer frequently asked questions of the customers regarding the services Fin-noys offers.
- **Service Feedback** - This lets the clients give their ratings and feedback in the system, on the service they ordered
- **Provisional Billing** - This feature lets the clients view a quotation of the service, including the computation and breakdown overview of the requested service
- **Service Status Tracker** - This feature lets the clients view the status of their appointment based on the service they have availed.
- **Service Schedule** - This feature lets the client view the available and unavailable dates and time slots upon booking a service. Also, view their calendar, where they can view the schedules of the services they booked
- **Service Booking** - This lets the client book a service, which will be received by the admin as a task.
- **Account Registration** - This enables clients to create a personal account, allowing them to receive updates, notifications, and access service booking features.
- **Client Notifications** - This feature sends alerts to clients regarding system updates, service schedules, and any changes related to their service requests or orders.

- **User Authentication (*Three-Factor Authentication*)** - This secures client accounts using a three-step verification process to ensure only authorized users can access their profiles, based on their roles.
- **Password Change Request** - This allows clients to reset or update their passwords by verifying their identity through predefined security questions, especially in cases of forgotten credentials.
- **Account Details Management** - This feature provides clients with the ability to update key account information such as their business ID, billing address, contact details, and registered company name.

#### **b. Employee Module**

This module contains tools and functionalities specifically designed for employees to manage their tasks, schedules, attendance, performance, and personal account information.

- **Task Assignment** - This feature allows employees to view the tasks assigned to them by the system, as reviewed and approved by the admin.
- **Task Scheduling** - This feature provides employees with a calendar view of their approved work schedules, aligned with their required working hours (e.g., 8 hours per day or 90 hours per month).
- **Task Status Tracker** - This feature enables employees to update the progress and completion status of the tasks they are currently handling or have been assigned to.

- **Rescheduling Request** - This feature allows employees to submit a request to reschedule their tasks in cases of personal emergencies or valid schedule conflicts.
- **Attendance Tracking** - This feature enables employees to check in and check out of their shifts, with logs visible to the admin. These records contribute to the employee's performance evaluation.
- **Leave Request** - This feature allows employees to formally request time off from work, subject to admin review and approval.
- **Performance Tracker and Analytics** - This feature provides employees with insights into their performance, based on metrics such as task completion rates, attendance consistency, and client feedback (when available).
- **Account Registration** - This feature enables employees to register their accounts on the system in order to access work-related tools and updates. Employees are given credentials by the system, which they will customize once logged in.
- **Account Authentication (Three-Factor Authentication)** - This feature secures employee accounts through a three-layer authentication process, enhancing data privacy and login protection.

- **Account Details Management** - This feature allows employees to update personal and professional information such as contact details, address, and work credentials.
- **Password Change Request** - This feature enables employees to reset or change their passwords, especially in cases of forgotten credentials, by answering pre-set security questions.
- **Account Notifications** - This feature provides employees with timely updates and alerts related to their schedules, tasks, and system-related announcements.

#### c. **Employer Module**

This module consists of the system's submodules to be used by the admin.

- **Task Manager (Request-To-Task Approvals)** - This feature handles the review and approval of client service requests before converting them into active tasks.
- **Service Booking Management** - This feature lets the admin manage client appointment bookings, including reviewing service details, confirming availability, approving or rescheduling appointments, and assigning them to staff.
- **Appointment Calendar View** - Visual calendar interface for viewing all upcoming, pending, and completed service appointments, helping admins avoid overlaps or overbooking.

- **Service Quotation Configuration** - This feature allows admins to define or adjust pricing rates for various cleaning services offered.
- **Performance Metrics Dashboard** - This feature displays key indicators such as task completion rates, staff productivity, and average response time.
- **Data Export Tools** - This feature allows exporting reports for auditing, compliance, or internal review purposes.
- **Client Feedback Summary** - This feature lets the admin view aggregated insights from client reviews and satisfaction ratings.
- **Staff Scheduling and Team Assignment** - This feature sets staff work schedules and assigns employees to teams based on availability or workload.
- **Task Allocation and Workload Balancing** - This feature facilitates fair and efficient distribution of service tasks among employees.
- **Task Progress Tracker** - This feature monitors the status and progress of all ongoing and completed tasks in real time.
- **Attendance Tracker** - With geofencing, the employees' attendance should be logged and tracked by the system between check-in and check-out times, strictly within their scheduled working hours.
- **Employee Request Handling** - This feature manages requests for rescheduling, leave, or task reassignments submitted by staff.
- **Salary Rate Configuration** - This feature enables the admin to set salary computation rules based on hours worked, task type, or other variables.

- **Account Registration** - This feature allows the creation of new user accounts for employees and lets clients access the system by logging in.
- **Account Authentication (Three-Factor Authentication)** - This feature ensures secure user login through password, verification steps, and identity confirmation.
- **Account Details Management** - This feature enables updates to user profile details such as business information, billing address, and contact details.
- **Account Notifications** - This feature lets the admin receive and send out notifications to the clients and employees on the system content updates.
- **Account Activity and Audit Logs** - This feature lets the admin track and log account-related actions for monitoring and security purposes.

7. Create the system as designed using the following software technologies:

- PHP (8.2 to 8.4):** This tool is a server-side scripting language used to handle backend logic, such as processing employee data, running the Rule-Based Algorithm with the Genetic Algorithm in managing task allocations, and managing workflows such as requests, updates, and notifications.
- MySQL:** This tool is a relational database management system for storing and managing employee, clients, and employers' details, activities, task information, and scheduling data. MySQL will support CRUD (Create, Read, Update, Delete) operations to ensure smooth data management throughout the system.

- c. **HTML/CSS/JavaScript:** This tool is a front-end technology to build and design OptiCrew's user interface, ensuring an intuitive and responsive experience for employers and employees. HTML structures the pages, CSS styles the layout for visual appeal, and JavaScript enhances interactivity for a responsive and user-friendly experience for employers, employees, and clients.
  - d. **Tailwind CSS:** This tool is a front-end framework to enhance the design consistency and responsiveness of OptiCrew. It aims to streamline UI development when creating layouts for features, per module.
  - e. **AJAX:** This tool enables OptiCrew to update specific parts of the web application in real time without requiring full page reloads
  - f. **LiveWire:** This tool is a full-stack framework for Laravel that makes it easy to build dynamic, reactive interfaces using Blade templates and PHP only, without writing custom JavaScript. In OptiCrew, LiveWire will be used to create dynamic, interactive features such as task assignment panels, schedule management dashboards, and live data updates
  - g. **BrowserStack:** This tool is a front-end testing platform that ensures the responsive compatibility of OptiCrew's mobile and website interfaces on other browsers, operating systems, and real mobile devices.
  - h. **GitHub:** This tool is a version control and collaboration platform that will manage OptiCrew's development process to ensure proper versioning and documentation of updates throughout OptiCrew's lifecycle.
8. Test the functionality, performance efficiency, scalability, and security of the system



9. Evaluate the system using a set of metrics based on ISO 25010 Software Product Model:

- a. **Functional Suitability:** This metric measures the functional completeness, correctness, and appropriateness of the system, referring to the degree of function coverage, accurate output, and alignment with the specified objectives of each feature.
- b. **Maintainability:** This metric measures the degree to which the system can be modified for improvement, update, and adaptation to environmental and requirement changes. It includes modularity, reusability, analysability, modifiability, and testability.
- c. **Interaction Capability:** This metric measures the extent to which users can effectively interact with the system, treating the software as a platform for exchanging information. It encompasses several usability factors. It includes appropriateness, recognizability, learnability, operability, user error protection, user engagement, inclusivity, user assistance, and self-descriptiveness
- d. **Security:** This metric measures the degree to which the system is secured against security attacks and is relevant to information protection, confidentiality, integrity, non-repudiation, accountability, authenticity, and resistance from a malicious actor.

## Scope and Limitations

The study focuses on the development of OptiCrew—a web application for Fin-noys, a cleaning company based in Finland, utilizing a Rule-Based Algorithm with a Genetic Algorithm

(GA). This integration enables optimized task allocation with workload balancing and scheduling, which serve as the core components of OptiCrew as a Workforce Management System (WFMS). The system is designed to streamline task allocation, scheduling, attendance tracking, and service management for service-based businesses, particularly Fin-noys.

OptiCrew consists of a comprehensive list of system features that constitute the website's functional framework. These features are categorized into three (3) modules: the Employee Module, the Employer Module, and the Client Module. Each module encompasses functionalities specifically tailored to the roles and responsibilities of its respective user. The Employer Module is designed for the Fin-noys management team and provides monitoring and oversight through a centralized dashboard that contains an overview of attendance, tasks, and schedules. Moreover, it includes features for employee and client management, attendance monitoring, task management, team assignment, service scheduling, and analytics reports with data exportation tools. The Employee Module allows employees to access and track their assigned tasks, monitor their schedule, log attendance, and view performance reports. It also serves as an interface where updates and adjustments, such as rescheduling, task additions, or schedule changes made from the Employer Module, are reflected in real time. Finally, the Client Module provides clients with an accessible platform to view, avail, and track cleaning services while being able to receive updates on price changes, available discounts, and company announcements, with an automated chatbot for concerns and queries.

The geographical scope of this research encompasses two primary locations: West Rembo, Taguig City, Philippines, and Finland. The initial phases of planning, conceptualization, design,

development, prototyping, and pilot testing, in collaboration with the owner of Fin-noys, are conducted in Taguig City, initially in the academic and research environment of the University of Makati. Conversely, Finland is the target implementation environment for the final deployment, as intended for the company Fin-noys, where the system will be evaluated and adapted in accordance with the standards and protocols of workforce management, in parallel with those of the Philippines. The study encompasses data collection and system development activities conducted during the period from August 2025 to August 2026, including the planning, development, deployment, and evaluation of the proposed workforce management system, OptiCrew, for Fin-noys.

This research employs a range of tools and technologies for the design and development of the application. These tools include:

- a. Visual Studio Code – to be utilized for developing the web-based modules of the system, specifically the Employer, Employee, and Client Modules.
- b. PHP 8.2 - 8.4 – a server-side scripting language used to handle backend logic, such as processing employee data, running the Hungarian Algorithm, and managing task assignments.
- c. MySQL – a relational database management system for storing and managing employee details, task information, and scheduling data.
- d. HTML/CSS/JavaScript – front-end technologies used to design the user interface, ensuring an intuitive and responsive experience for employers and employees.
- e. Laravel: a modern, open-source PHP framework designed for building scalable,

secure, and maintainable back-end feature development

- f. Herd – a native Laravel development environment for Windows that provides an optimized, fast, and reliable setup for running Laravel applications locally.
- g. Tailwind CSS – a front-end framework to enhance the design and responsiveness of the web application.
- h. AJAX – used to enable real-time updates and notifications without requiring page reloads.
- i. BrowserStack – this front-end testing platform ensures the responsive compatibility of OptiCrew and mobile interfaces on other browsers, operating systems, and real mobile devices.
- j. Github – a resource-sharing platform for managing the creation, modification, and sharing of changes, updates, and code files throughout the system's lifecycle

## **Limitations**

Despite the study's objectives in developing a company-based workforce management system through dynamic task allocation and scheduling, using Rule-Based with Genetic Algorithm (GA), certain limitations should be acknowledged:

The validity of Rule-Based Algorithm and Genetic Algorithm (GA) relies on the quality and fineness of the input information, which serves as constraints and rules to guide the system, as well as the potential for suboptimal scheduling in cases of incomplete or inaccurate data. Although the application was originally based on the business processes of Finnoys as a cleaning company in Finland, scaling the application to large-scale data and process management may require further optimization and infrastructure.

Even though real-time notifications are provided, external factors like network availability can cause delays in receiving emails or SMS, affecting the timely aspect of communication. The Rule-Based Algorithm to ensure constraints are initially applied to the initially generated schedule based solely on simple constraints (*e.g., availability, non-overlaps, workload capacity*), while Genetic Algorithm to optimize the constraint-based schedule as was generated by the Rule-based Algorithm by integrating dynamic constraints (*e.g., efficiency, workload balance, minimizing idle time*) throughout the evolutionary process (*fitness scoring, crossover, mutation*). Additionally, compliance and acceptance by users from both employers and employees will also ride on the performance of the system.

Lastly, although PHP and MySQL work well for the size of the project, they can become performance bottlenecks for extremely high-usage or high-performance applications in comparison to other technologies. These limitations emphasize the essence of continuous enhancement in the future to ensure the evolution of OptiCrew as a sustainable workforce management system for more than a single workflow.

## **Definition of Terms**

This specific section of the paper defines significant terminologies that were utilized to provide clarity and comprehension to the concepts and processes of OptiCrew as a Workforce Management System (WMS).

***Workforce Management*** – A systematic process of planning, allocating, monitoring, and managing tasks and activities within an organization for an efficient resource utilization while successfully completing organizational objectives.

***Human Resources (HR)*** – An organizational department/function consisting a set of people responsible for managing workforce-related activities such as recruitment, onboarding, compensation and benefits, performance management, administration, and the overall employee lifecycle

***Business Operations*** – The core activities of a business involved in planning, organizing, controlling, and overseeing functions and resources to boost efficiency, effectiveness, and the achievement of organizational goals.

***Workforce Planning*** – The process of planning, assigning, monitoring, and completing specific activities or tasks within a project or organizational workflow.

***Operational Demands*** – The workload and requirements within an organization that must be met across all branches to ensure seamless business operations. These demands involve resource allocation, task scheduling, and workforce utilization, all of which contribute to smooth and efficient service delivery.

***Task Allocation*** – The process of delegating tasks among employees based on factors such as availability, skills, performance, and workload capacity to ensure efficiency and fairness in operations.

***Scheduling*** – The systematic arrangement of tasks, services, or employee shifts within a defined time frame to optimize resource utilization and prevent overlaps or delays.

***Organizational Success*** – The achievement of a company's strategic goals, measured through improved efficiency, productivity, service quality, and overall business performance.

***Task Scheduling*** – A specific category of scheduling, task scheduling is related to the activity of scheduling when and how to assign tasks to employees while matching workload as best as possible and minimizing idle time.

***Organizational Coherence*** – The degree of alignment and integration of processes, resources, and processes throughout an organization to achieve alignment, teamwork, and smooth workflow across employees.

***Employee Management*** – The management of anything employee-related, such as attendance, performance, information, task assignment, and employee involvement, serves to enhance productivity and engagement.

***Customer Management*** – The management of customer relations, order requests, and responding to customer inquiries ensures effective communication or service delivery that builds trust, improves satisfaction, and creates lasting relationships.

***Hybrid Approach*** – A type of approach fusing two (2) or more algorithms to solve a complex problem efficiently and achieve optimal result/s.

***Rule-based Algorithm*** – An algorithm regulated and guided by a set of rules being iteratively applied to data for filtering, with the set constraints and limitations that data should abide by in order to be classified, processed, or considered valid.

***Genetic Algorithm (GA)*** – An optimization algorithm inspired by the process of natural selection, consisting of the processes of population selection, crossover, and mutation. Ultimately, it successively generates a population of solutions with a fitness score for each to classify the optimality of each candidate, and iteratively generates candidates by combining the candidates with the highest fitness score as reproduction. Through iterative refinement, the algorithm converges toward an optimal or near-optimal solution.

***Workflow*** – The framework of workforce processes, consisting of a structured sequence of tasks, activities, and interactions—whether automated or manual—within an organization, guided by universal and distinct policies and procedures that ensure business operations are carried out effectively from initiation to output delivery.



***Labor-Intensive*** – A type of work or process that relies heavily on human labor and physical effort rather than automation or machine-based processes.

## References