Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AP07.20260176
Published: March 25, 2026

Optimization of Job Shop Scheduling Using Dispatching Rules and Genetic Algorithms: An Industrial Case Study at Al-Rayef Factory for Aluminum and Glass

Norah Saeed Abdullah Aseri, Hawazin Ali Dhafer Alqhtani, Dareen Ali Salem Al-Ahmari, Ghadi Abdullah Mohamed Al-Asmari and Waad Ali Talhan Al-Ahmari
Undergraduate Students, Industrial Engineering Department
King Khalid University
Abha, Saudi Arabia
norahsaeed111@gmail.com, qhhawazin0@gmail.com, Eng.dareen1@gmail.com, Engghadi2003@icloud.com, Waad1424.6@gmail.com

Abir Mouldi
Assistant Professor, Industrial Engineering Department
King Khalid University
Abha, Saudi Arabia
amouldi@kku.edu.sa

Abstract

The Job Shop Scheduling Problem (JSSP) is a complex NP-hard optimization problem in which multiple jobs, each consisting of several operations with distinct processing routes and requirements, must be scheduled on a limited set of machines. Inefficient scheduling can lead to increased makespan, tardiness, and poor resource utilization. This study addresses these challenges by integrating classical dispatching rules with a meta-heuristic Genetic Algorithm (GA) to improve scheduling performance in a practical manufacturing context. A job shop model is developed using real production data obtained from an aluminum and glass manufacturing facility and implemented in LEKIN simulation software. Several dispatching rules, including First Come First Serve (FCFS), Shortest Processing Time (SPT), Longest Processing Time (LPT), Earliest Due Date (EDD), and Critical Ratio (CR), are applied to establish baseline performance measures such as makespan, mean flow time, and tardiness. Subsequently, a GA-based optimization model is implemented to generate improved production schedules by minimizing makespan and enhancing machine utilization. Comparative simulation results demonstrate that the GA-based approach outperforms traditional dispatching rules across key performance indicators, providing a more efficient and flexible scheduling solution. The findings confirm that combining dispatching-rule-based benchmarking with GA optimization offers an effective and scalable approach for improving operational performance in job shop manufacturing environments.

Keywords
Job Shop Scheduling, LEKIN Simulation, Genetic Algorithm, Dispatching Rules, Meta-Heuristics.

1. Introduction
Job shop scheduling plays a critical role in manufacturing systems, as it directly affects production efficiency, delivery reliability, and resource utilization. The Job Shop Scheduling Problem (JSSP) involves allocating multiple jobs, each consisting of a sequence of operations, to a limited number of machines under various technological and operational

constraints. Due to its combinatorial nature, JSSP is classified as an NP-hard problem, making the identification of optimal schedules particularly challenging in real-world industrial environments.

In practice, many small and medium-sized manufacturing enterprises rely on manual scheduling or simple dispatching rules to manage production activities. While such rules are easy to implement, they often fail to provide satisfactory performance when dealing with complex routing configurations, dynamic workloads, and conflicting production priorities. As a result, manufacturing systems may experience increased makespan, high tardiness levels, and inefficient machine utilization, leading to reduced competitiveness and higher operational costs.

Numerous studies have explored different approaches to address the JSSP, including priority-based dispatching rules and meta-heuristic optimization techniques. Dispatching rules such as First Come First Serve, Shortest Processing Time, and Earliest Due Date are widely used due to their simplicity and low computational requirements. However, these rules are static in nature and do not adequately adapt to the complexity of modern job shop environments. Meta-heuristic algorithms, particularly Genetic Algorithms (GAs), have demonstrated strong potential in solving complex scheduling problems by efficiently exploring large solution spaces and generating near-optimal schedules.

Despite the extensive body of research on job shop scheduling, many existing studies focus primarily on theoretical models or benchmark datasets, with limited validation using real industrial data. Furthermore, relatively few studies provide a comprehensive comparison between traditional dispatching rules and meta-heuristic optimization approaches within a unified simulation framework. This gap highlights the need for practical, data-driven scheduling solutions that can be effectively applied in real manufacturing settings.

To address these challenges, this paper proposes a hybrid scheduling framework that integrates classical dispatching rules with a Genetic Algorithm-based optimization approach. Real production data obtained from an aluminum and glass manufacturing facility are used to model and simulate the job shop environment using LEKIN software. The proposed approach is evaluated based on key performance measures, including makespan, flow time, and tardiness. The remainder of this paper is organized as follows: Section 2 presents the related literature, Section 3 describes the data and methodology, Section 4 discusses the results and analysis, and Section 5 concludes the paper with key findings and future research directions.

2. Problem Formulation

Job shop scheduling has always been recognized as fundamental and challenging problem in operations research and industrial engineering. According to Pinedo (2016), the Job Shop Scheduling Problem (JSSP) involves assigning a set of jobs, each consisting of a sequence of operations, to a limited number of machines while satisfying technological constraints and optimizing specific performance measures. Due to its combinatorial complexity, JSSP is classified as an NP-hard problem, which renders exact solution methods for large scale and real-world applications.

Early job shop scheduling methods relied heavily on heuristic dispatching rules such as First Come First Served (FCFS), Shortest Processing Time (SPT), and Earliest Due Date (EDD). These rules provide simple and computationally efficient decision-making mechanisms and are widely used, particularly in small and medium-sized manufacturing enterprises. However, as Pinedo (2016) pointed out, dispatching rules are inherently limited, prioritizing local decision criteria without considering overall system performance. Consequently, no single dispatching rule consistently performs well across different shop configurations or performance objectives, such as makespan, flow time, and tardiness.

Exact optimization approaches, such as branch-and-bound (BB) and integer programming, were developed to overcome the shortcomings of heuristic procedures. Although these techniques can potentially generate optimal schedules, their application to small issue instances is limited due to their exponential computing complexity. The invention of meta-heuristic optimization techniques, which seek to achieve near optimal solutions within reasonable computational times.

Genetic Algorithms (GAs) have drawn a lot of interest among meta-heuristic techniques for resolving challenging scheduling issues. According to Deb (2001) and Eiben and Smith (2015), GAs are population-based search algorithms that draw inspiration from the concept of natural evolution. They are especially well suited for NP-hard problems like JSSP because of their capacity to explore spaces through selection, crossover, and mutation. GAs offer flexibility in solution representation and robustness in handling complex constraints, which has led to their widespread application in scheduling research.

Simulation has emerged as crucial tool for analyzing job shop scheduling systems in addition to optimization techniques. Law (2015) emphasizes that simulation-based approaches allow researchers to model complex and dynamic manufacturing environments, evaluate alternative scheduling policies, and measure system performance under controlled conditions. Without interfering with actual production systems, simulation offers a useful environment for comparing dispatching rules and optimizing techniques.

Despite the extensive research on dispatching rules, meta-heuristic optimization, and simulation-based analysis, a gap remains in integrating these methods within cohesive and useful framework. Many studies concentrate on heuristic benchmarking or optimization techniques in isolation, with little use of real-world industry data and full comparison analysis. Ulrich and Eppinger (2016) emphasize that the practical application of advanced analytical methodologies necessitates answers that are transparent, verifiable, and consistent with real world situations.

As a result, this study contributes to existing literature by integrating classical dispatching rules with a Genetic Algorithm-based optimization strategy in a simulation environment. Using real production data and a unified evaluation framework, the suggested approach intends to bridge the gap between traditional scheduling practices and advanced optimization techniques, contributing to both academic research and practical manufacturing applications.

3. Methods

Based on the formulated job shop scheduling problem and the defined optimization objectives, this study employs a structured and systematic methodology to evaluate and improve scheduling performance in realistic manufacturing environment. The proposed method converts conceptual and mathematical problems into executable simulation and optimization frameworks.

Figure 1 depicts the overall methodology flowchart of the proposed approach, illustrating the sequential processes taken in this work, from system modeling and data integration to performance evaluation and optimization.

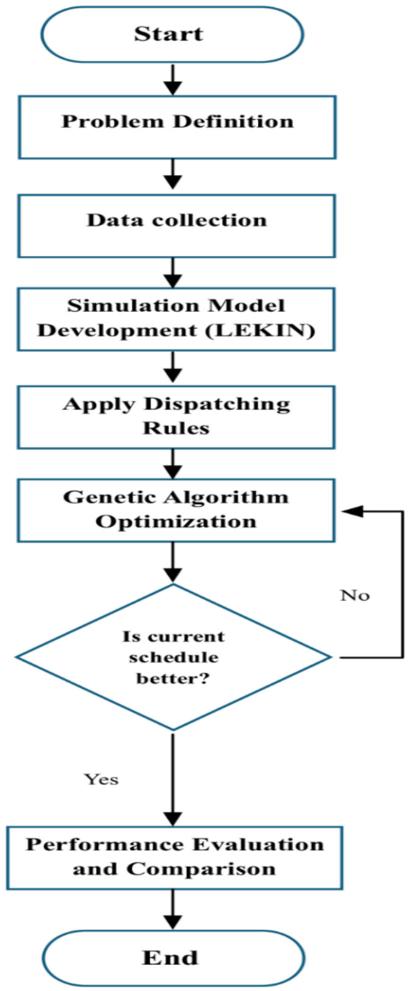

Figure 1. Proposed Methodology Flowchart

The proposed methodology consists of the following main steps:

- **Problem Definition:**
  The survey results, based on a questionnaire distributed to several companies, show that delivery delays and difficulty in rescheduling are the most common production challenges (37.5%), followed by bottlenecks and machine breakdowns (25%). These findings indicate that scheduling inefficiencies and limited flexibility are the main causes of performance issues. Accordingly, this project focuses on improving scheduling effectiveness to reduce delays, enhance rescheduling capability, and mitigate bottlenecks (Figure 2).

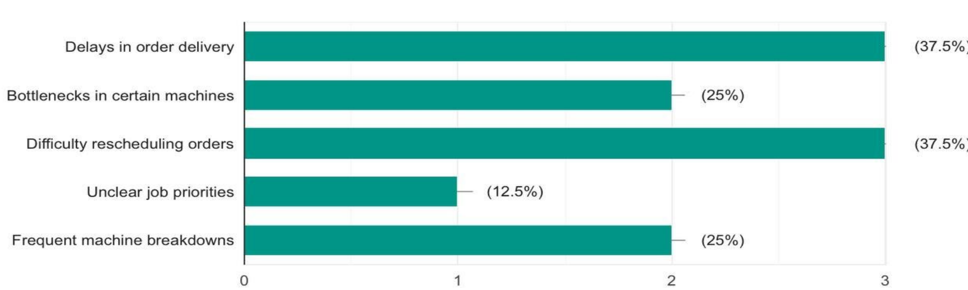

Figure 1. Survey results showing the main production challenges

Accordingly, the job shop scheduling problem is defined with the aim of minimizing makespan while reducing average flow times and tardiness under technological and resource constraints. The problem formulation takes into account job specific operations sequences and limited machine availability, capturing the complexities of real-world job shop environments. These objectives serve as the foundation for analyzing and comparing various scheduling approaches.

- **Data collection:**
  Actual production data was collected from aluminum and glass manufacturing facility, including workflows, processing times, machine assignments, and due dates. This data accurately reflects real world production conditions and ensures that the model represents practical manufacturing constraints. Before use, the data is reviewed and processed to guarantee its consistency and compatibility with simulation model.

- **Simulation Modeling:**
  A discrete-event simulation model of the job shop system was developed using LEKIN to represent the real production environment and evaluate scheduling policies. The model captures the job routings, machine constraints, and processing times as defined in the problem formulation. This simulation framework enables the consistent and repeatable evaluation of different scheduling strategies.

- **Dispatching Rules Evaluation:**
  Classical dispatching rules (FCFS, SPT, LPT, EDD, and CR), are applied to create baseline schedules within the simulation environment. These rules are executed dynamically according to machine availability, simulating real time shop floor decision making. Predefined key performance indicators (KPIs) such as makespan and tardiness are used to assess performance.

- **Genetic Algorithm Optimization:**
  A Genetic Algorithm-based optimization model is applied to create improved schedules, with makespan minimization as a primary objective. The GA iteratively evolves scheduling solutions using selection, crossover, and mutation operators. This approach allows for an effective exploration of solutions beyond the constraints of rule-based scheduling. The optimization process is iteratively executed until no further improvement in the schedule is achieved, as illustrated in the decision stage of the flowchart in Figure 1.

- **Performance Analysis:**
  The performance of the optimized schedules is compared against dispatching-rule-based results to evaluate the overall effectiveness of the proposed approach. The comparative analysis focuses on key performance indicators (KPIs) improvements across different scheduling scenarios. The results provide quantitative evidence of the benefits of integrating the meta-heuristic with traditional dispatching rules.

4. Data Collection

The data used in this study was collected from an actual aluminum and glass manufacturing facility that operates in a job shop production environment. The dataset reflects actual production conditions and was obtained through direct observation, production records, and collaboration with facility operations personnel. Collected data includes the number of jobs, the sequence of operations required for each job, machine assignments, processing times, and due dates.

To prepare the collected production data for simulation, operation sequences were predefined, each machine processes one job at a time, and processing times were assumed deterministic. The objective is to minimize the overall makespan.

$Minimize\ F_{n+1}(C_{max})$

Subject to:

$$F_k \leq F_j - d_j \qquad j = 1,2,\ldots.,n+1 \qquad k \in P_j$$

$$\sum_{j \in A(t)} r_{j,m} \leq 1 \qquad m \in M; t \geq 0$$

$$F_j \geq 0 \qquad j = 1,2,\ldots.,n+1$$

Where: C_{max} is the makespan, F_j the completion time of job j, d_j the due date of job j, P_j the set of predecessor operations, $A(t)$ the set of jobs processed at time *t*, and $r_{j,m}$ a binary variable indicating assignment of job *j* to machine.

Table 1 illustrates the routing structure of the job shop system, showing the sequence of operations for each job and the corresponding machines assigned to perform these operations. This routing information defines the technological constraints of the system and serves as a key input for the simulation and scheduling models.

Table 1. Job routing and machine assignment

J/M	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**
J1	1	4	8	5	9	12	13	11	14
J2	1	4	8	5	9	12	13	11	14
J3	1	5	9	12	11	13	14		
J4	2	6	10	9					
J5	3	7	11						

Table 2 presents the processing times in minutes for each operation performed on the assigned machines. These values represent actual production durations collected from the manufacturing facility and are used as primary input parameters for the simulation and Genetic Algorithm optimization process.

Table 2. Processing times of operations on assigned machines

J/O	**O1**	**O2**	**O3**	**O4**	**O5**	**O6**	**O7**	**O8**	**O9**
J1	420	150	48	210	420	192	150	270	210
J2	390	120	72	330	780	210	138	252	180
J3	480	600	390	180	300	150	288		
J4	240	300	270	252					
J5	210	180	360						

Table 3 presents the machines involved in the job shop system, including their identification numbers and corresponding functional descriptions. These machines represent the main production resources used in the manufacturing process and define the operational structure of the job shop environment considered in this study.

Table 3. Machine descriptions used in the job shop system

Machine Number	Machine Description
1	Double Head Cutting Machine
2	Vertical Saw Machine
3	CNC Glass Gutting Machine
4	Copy Router
5	Milling Machine
6	Cladding table
7	Glass Edge Polishing Machine
8	Punching Machine
9	Air Screwier Machine
10	Manual Router
11	Glass Tempering Machine
12	Glass Cutting Manual
13	Glass Cleaning Machine
14	Glass Doubling Manual

Table 4 summarizes the due dates and priority levels assigned to each job. The due dates are expressed in both hours and minutes to support scheduling and simulation analysis, while priority levels reflect job importance based on order size and production requirements. These parameters are used to evaluate scheduling performance, particularly in terms of tardiness and delivery reliability.

Table 4. Due dates and priority levels of the selected jobs

	Due Date (Hours)	Due Dates (Minutes)	Priority
Sliding Window	40.00	2400	Varies on Size
Hinge Window	48.33	2900	Varies on Size
Structural Glazing	46.67	2800	Varies on Size
ACP Cladding	21.67	1300	Varies on Size
Frameless Glass	15.00	900	Varies on Size

The collected dataset was subsequently used to build a job shop model within the LEKIN software, forming the basis for simulating distribution rules and optimization based on the Genetic Algorithm. By relying on real-world industrial data rather than reference cases, this study enhances the practical relevance and credibility of the results, ensuring their effective interpretation and transferability to similar manufacturing environments.

5. Results and Discussion

5.1 Numerical Results

The initial scheduling analysis was performed using the classic dispatching rules applied in LEKIN. The results, summarized in Table 5, reveal notable differences in production duration between the different rules, highlighting the limitations inherent in rule-based scheduling in complex work environments. While some rules performed relatively better, the overall results indicate that there are still shortcomings and opportunities for improving work performance.

Table 5. LEKIN results

Dispatching Rule	**Results**
FCFS	3600
CR	3948
EDD	3450
SPT	3450
LPT	4380
Best Makespan	**3450**

Table 5 presents the makespan results obtained using classical dispatching rules in LEKIN. With certain rules EDD and SPT producing lower makespan values while others suffer from increased congestion and bottlenecks.

To address work performance limitations, a Genetic Algorithm was subsequently applied with the aim of further reducing production time through a meta-heuristic optimization approach. The numerical results of the Genetic Algorithm, shown in Table 6, show improvement compared to the distribution of rule solutions obtained from LEKIN.

Table 6. Genetic Algorithm results

Runs	**Results**
1st	3450
2nd	3450
3rd	3372
4th	3372
5th	3450
6th	3372
7th	3372
8th	3372
9th	3372
10th	3450

The observed convergence behavior confirms the algorithm's robustness and its ability to repeatedly identify the global minimum, ensuring reliable scheduling performance under varying initial conditions.

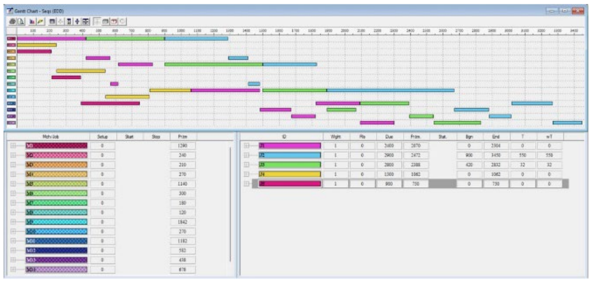

Figure 3. EDD

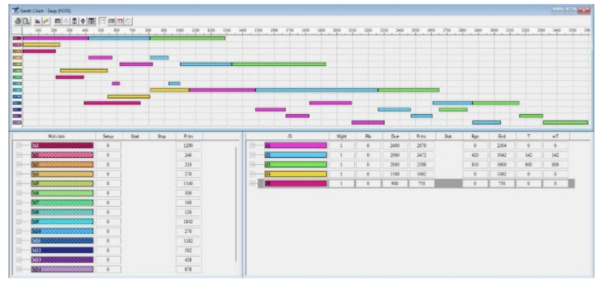

Figure 4. FCFS

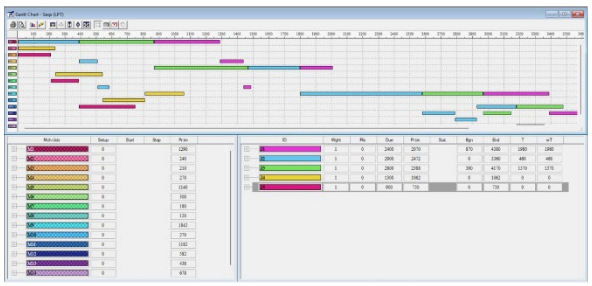

Figure 5. LPT

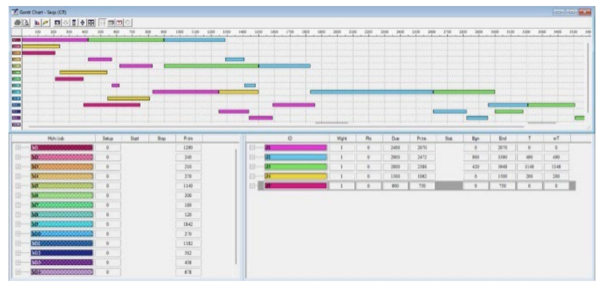

Figure 6. CR

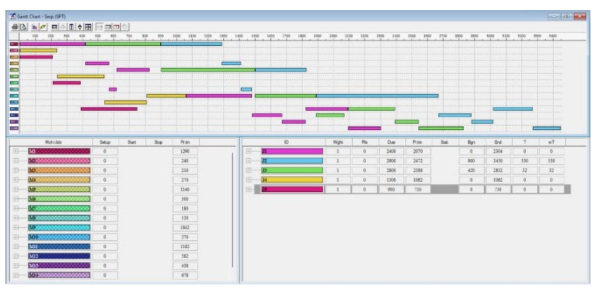

Figure 7. SPT

Schedule	Time	C_{max}	T_{max}	ΣU_j	ΣC_j	ΣT_j
EDD	1	3450	550	2	10398	582
SPT	1	3450	550	2	10398	582
FCFS	1	3600	800	2	10758	942
CR	1	3948	1148	3	11658	1838
LPT	1	4380	1980	3	13722	3810

Figure 8. Key performance measures

The LEKIN graphical results reveal machine congestion and idle time for each dispatching rule, highlighting the limitations of dispatching rules in complex job shop scheduling (Figure 3- Figure 10).

```
Running Genetic Algorithm - 10 independent runs

============================================================
Run  1: Makespan = 3450 (pop=102, gen=549, mut=0.20)
Run  2: Makespan = 3450 (pop=98, gen=467, mut=0.26)
Run  3: Makespan = 3372 (pop=117, gen=499, mut=0.25)
Run  4: Makespan = 3372 (pop=90, gen=554, mut=0.26)
Run  5: Makespan = 3450 (pop=89, gen=402, mut=0.24)
Run  6: Makespan = 3372 (pop=108, gen=584, mut=0.23)
Run  7: Makespan = 3372 (pop=114, gen=411, mut=0.45)
Run  8: Makespan = 3372 (pop=89, gen=583, mut=0.30)
Run  9: Makespan = 3372 (pop=100, gen=531, mut=0.22)
Run 10: Makespan = 3450 (pop=81, gen=578, mut=0.29)
```

Figure 9. Performance consistency across multiple stochastic runs.

The graphical representation of the schedule generated by the Genetic Algorithm shows a compact and well-organized execution of operations across machines. The visualization indicates reduced downtime and smoother process sequencing compared to rule-based schedules, supporting the numerical results, and confirming the effectiveness of the genetic algorithm in improving workshop scheduling performance.

This section presents a graphical representation of the scheduling results to provide a clearer understanding of the performance of the genetic algorithm compared with traditional dispatching rules. The visualizations summarize the GA runs and highlight the differences in makespan values among the evaluated scheduling approaches.

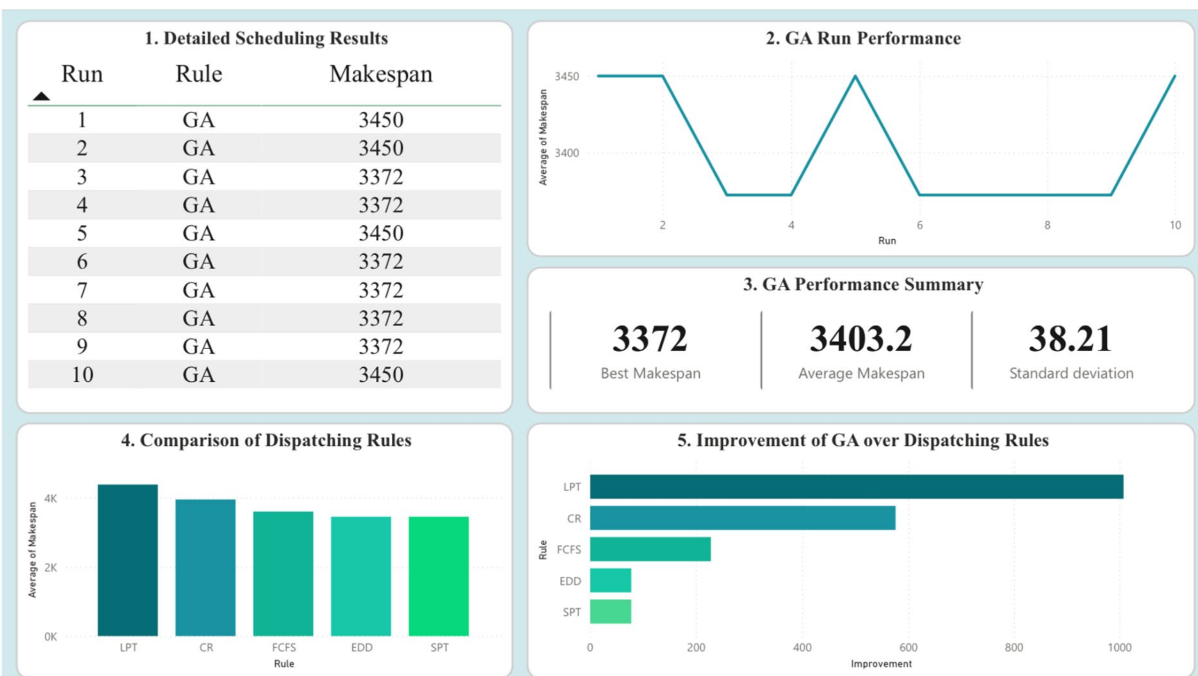

Figure 10. Scheduling Performance Dashboard

As shown in Figure 10, the dashboard summarizes the results of ten GA runs, where the makespan values range between 3372 and 3450. The performance summary indicates a best makespan of 3372, an average of 3403.2, and a standard deviation of 38.21, reflecting the stability of the algorithm. The comparison chart also illustrates the performance differences between the genetic algorithm and traditional dispatching rules, highlighting the effectiveness of the proposed optimization approach.

5.3 Proposed Improvements

Based on the findings of this study, a framework is proposed for improving production job shop scheduling. This framework replaces reliance on traditional, fixed dispatching rules with a simulation-supported Genetic Algorithm–based approach. The proposed framework integrates dispatching rule evaluation using LEKIN software with a Genetic Algorithm model, enabling a systematic and efficient search for high-quality scheduling solutions.

The results demonstrate that the proposed approach achieves significant improvements in scheduling performance, particularly in reducing the overall makespan compared to traditional rule-based methods. By applying evolutionary mechanisms such as selection, crossover, and mutation, the Genetic Algorithm enables adaptive exploration of the solution space, contributing to improved schedule quality and increased robustness.

This improvement helps optimize machine utilization, reduce production delays, and enhance system flexibility. Moreover, the proposed framework can be implemented in real-world manufacturing environments as an effective decision-support tool, assisting planners in selecting optimized production schedules under varying operating conditions.

5.4 Validation

The proposed scheduling approach was validated by evaluating the consistency of the obtained results and examining the reliability of the genetic algorithm in solving the job shop scheduling problem. The validation process aimed to ensure that the optimization method produces stable and dependable scheduling solutions.

The experimental analysis indicates that the genetic algorithm consistently generates similar makespan values across multiple runs, demonstrating stable convergence behavior. This consistency reflects the robustness of the algorithm and its capability to effectively explore the solution space while maintaining reliable performance.

Furthermore, the comparison with traditional dispatching rules supports the validity of the proposed approach, as the obtained schedules remain competitive in terms of makespan performance. These findings confirm that the proposed optimization framework is suitable for addressing job shop scheduling problems in industrial environments.

6. Conclusion

This paper presented a comprehensive investigation of the Job Shop Scheduling Problem (JSSP), encompassing problem formulation, modeling, simulation, and optimization. Several dispatching rules were modeled and evaluated using the LEKIN simulation software, enabling a systematic comparison based on key performance measures.

Furthermore, a Genetic Algorithm was developed and implemented in Python to enhance the scheduling process. The comparative results clearly indicate that the Genetic Algorithm consistently outperforms traditional dispatching rules, particularly in terms of makespan reduction. These findings confirm the capability of metaheuristic approaches to effectively address the complexity and combinatorial nature of job shop scheduling problems.

Overall, the study demonstrates that integrating simulation-based analysis with evolutionary optimization techniques can significantly improve scheduling performance. The proposed approach provides a practical and scalable framework that can be extended to more complex manufacturing environments. Future research may focus on incorporating additional performance objectives, such as tardiness and machine utilization, as well as exploring hybrid metaheuristic methods and real-time dynamic scheduling scenarios.

References

Baker, K. R. and Trietsch, D., *Principles of Sequencing and Scheduling,* John Wiley & Sons, New York, 2009.
Deb, K., *Multi-objective optimization using evolutionary algorithms,* John Wiley & Sons, New York, 2001.
Eiben, A. E. and Smith, J. E., *Introduction to evolutionary computing,* 2nd Edition, Springer, Berlin, 2015.
Law, A. M., *Simulation modeling and analysis,* 5th Edition, McGraw-Hill Education, New York, 2015.
Pinedo, M., *Scheduling: Theory, algorithms, and systems,* 5th Edition, Springer, New York, 2016.
Ulrich, K. T. and Eppinger, S. D., *Product design and development,* 6th Edition, McGraw-Hill Education, New York, 2016.

Biographies

Norah Aseri is a senior Industrial Engineering student at King Khalid University in Abha, Saudi Arabia. She has a strong academic record and holds the Certified Associate in Project Management (CAPM)® credential. She completed her training at the Saudi Electricity Company (SEC) in the Safety and Loss Prevention section, where she gained practical experience in industrial safety and operational efficiency. Norah participated in a research program at Colorado State University (CSU), where she enhanced her analytical and research skills. She is also a member of the technical team at IEOM KKU. Her interests include supply chain optimization, quality improvement, and production scheduling, reflecting her passion for improving efficiency and sustainability in industrial systems.

Hawazin Ali is a senior industrial engineering student at King Khalid University in Abha, Saudi Arabia, she trained at the Asir Region Municipality, where she was attended to apply industrial engineering methods in the civil sector by reducing delays and improving workflow across different departments. She has extensive knowledge of data analysis and how to effectively be leveraging industrial engineering skills in various fields of work.

Dareen Al-Ahmari is a senior Industrial Engineering student at King Khalid University in Abha, Saudi Arabia, she has a strong academic record and practical experience in energy, manufacturing, and industrial safety. She completed her cooperative training at Southern Province Cement Company (SPCC) under the Ministry of Industry and Mineral Resources Program. Dareen has participated in Supply Chain Camps by Supply Chain and Procurement Society, also she holds a license in Safety and Health in General Industry from International Academy for Safety Professionals (IASP) In accordance with OSHA 29 CFR 1910 standards, in addition to having specialized courses in occupational health and safety in accordance with NEBOSH standards and certification of ISO 45001 systems. She has also completed international courses in innovation for entrepreneurs and developing innovative ideas from the University of Maryland. She seeks to integrate the principles of design thinking and product design to develop innovative and effective solutions in industrial engineering.

Ghadi Abdullah is a senior industrial engineering student at King Khalid University in Abha, Saudi Arabia, with a strong passion for improving supply chains and developing operational systems in diverse work environments. She possesses the ability to analyze data, understand the roots of problems, and make informed decisions. During her internship at SABIC, Ghadi gained significant practical experience that enabled her to apply engineering knowledge to real-world development projects and collaborate with multidisciplinary teams to achieve operational goals that contribute to increased efficiency and quality. Ghadi is proficient in the use of advanced Excel and Power BI to prepare reports, dashboards, and analyze data to support decision-making. She also possesses strong teamwork and communication skills. Her professional ambition is to delve deeper into the field of supply chains and contribute to creating innovative solutions that enhance operational efficiency and add value to the organizations she joins.

Waad Ali is an industrial engineering student at King Khalid University in Abha, Saudi Arabia. She is interested in quality management, supply chain systems, production, manufacturing, and logistics. She has practical training experience at the Southern Cement Company, where she worked in several departments, including quality, safety, and energy. She is also interested in academic projects related to production scheduling, simulation, process improvement, and product design, reflecting her interest in developing and improving industrial systems. She excels in data analysis, problem-solving, team leadership, and teamwork, and in the use of engineering software (TORA, Mini-tab, and LEKIN). She also has a strong background in programming tools, and artificial intelligence.

Abir Khamis Mouldi is an Assistant Professor at King Khalid University in the Industrial Engineering Department. She received a Ph.D. degree in Industrial Engineering from National Engineering School of Tunis, M.S. degree in Industrial Engineering from National Engineering School of Tunis and a B.S. degree in Industrial Engineering from National Engineering School of Tunis. Abir practiced as an industrial engineer during three years in several international companies such as Baxter, UHD Carrefour and International Financial Company of the World Bank. She taught during ten years in Tunisian universities and seven years in King Khaled University in Saudi Arabia. She published more than thirty publications in the best rank journals.