

## ABSTRACT

Determining an optimal facility placement in a production layout plays a crucial role in terms of improving productivity. However, the scope of facility layout problem (FLP) have developed a complex configuration based on its objective and placement. Facility layout problem with unequal area (UA-FLP) poses its own challenge due to its diverse department dimension, uncertain bay and computational complexity. In addition to the complex nature of UA-FLP model, real-world FLP encourages many-objective model to represent facility layout purposes other than material movement aspect. Therefore, this study proposes a metaheuristic algorithm to solve many-objective UA-FLP by considering three objective functions (flow/distance measurement, adjacency rating, and hazard movement).

The proposed algorithm uses a matrix slicing mechanism, by utilizing array elements as a discrete representation of layout grid. Each department is represented as smaller sub-array to be placed at larger array grid as its production floor. This discrete approach employs a chromosome that consist of department placement sequence that will be used in the multi-objective metaheuristics. The proposed evolutionary algorithms are non-dominated sorting genetic algorithm-II (NSGA-II) and multi-objective particle swarm optimization (MOPSO) with the optimal solution contains a set of solution candidates that does not have any priorities on each objective function. Duplicate removal mechanism is added in the algorithm in order to preserve solution diversity and prevent early convergence.

Based on the computational result, the proposed algorithm is able to solve multi-objective UA-FLP on small, medium, and large data instances. The NSGA-II algorithm provide a better solution compared to MOPSO, especially with two-point crossover mechanism because the fitness value dominates the other algorithm. By dominating the other algorithm's solution, the NSGA-II with two-point crossover also yields a better performance evaluation.

**Keywords:** *UA-FLP, NSGA-II, MOPSO, non-dominated sorting, many-objective optimization, , matrix slicing*