**Table 1** Summary of single and multi-objective studies on HFSP problem

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Authors | Objective Types | | Objective Function | Problem Characteristics | | | |  | Solution Approaches | |
| Single | Multi | Lot Streaming | Lot Spliting | Limited Waiting Time | Other Constraint |  | Exact Methods | Heuristic/ Meta-Heuristic Methods |
| Ying (2009) | ✓ |  | Cmax |  |  |  | ✓ |  |  | ✓ |
| Nishi et al. (2010) | ✓ |  | TWT |  |  |  | ✓ |  | ✓ |  |
| Behnamian and Ghomi (2011) |  | ✓ | Cmax ; TRAC |  |  |  | ✓ |  |  | ✓ |
| Defersha and Chen (2012) | ✓ |  | Cmax | ✓ |  |  |  |  | ✓ | ✓ |
| Cheng and Sarin (2013) |  | ✓ | Cmax ; SCT | ✓ |  |  |  |  | ✓ | ✓ |
| Pan et al. (2014) | ✓ |  | Cmax |  |  |  | ✓ |  |  | ✓ |
| Pan et al. (2017) | ✓ |  | TWET |  |  |  | ✓ |  |  | ✓ |
| Ying and Lin (2018) | ✓ |  | Cmax |  |  |  | ✓ |  | ✓ | ✓ |
| Khare and Agrawal (2019) | ✓ |  | TWET |  |  |  | ✓ |  | ✓ | ✓ |
| Zhang et al. (2019) |  | ✓ | Cmax; TEC |  |  |  | ✓ |  |  | ✓ |
| Meng et al. (2019) | ✓ |  | TEC |  |  |  | ✓ |  | ✓ | ✓ |
| Zohali et al. (2019) | ✓ |  | TC | ✓ | ✓ |  |  |  | ✓ | ✓ |
| Wei et al. (2019) | ✓ |  | Cmax |  |  |  | ✓ |  |  | ✓ |
| Li et al. (2020) |  | ✓ | AST; EC; E; T | ✓ |  |  |  |  |  | ✓ |
| Chen et al. (2020) |  | ✓ | Cmax; EPC | ✓ |  |  | ✓ |  |  | ✓ |
| Marichelvam et al. (2020) |  | ✓ | Cmax; TFT |  |  |  | ✓ |  |  | ✓ |
| Ünal et al. (2020) | ✓ |  | TT |  |  |  | ✓ |  | ✓ | ✓ |
| Zhang et al. (2021) | ✓ |  | Cmax | ✓ | ✓ |  |  |  |  | ✓ |
| Cao et al. (2021) | ✓ |  | Cmax |  |  |  | ✓ |  |  | ✓ |
| Han et al. (2021) |  | ✓ | Cmax; TT |  |  |  | ✓ |  | ✓ | ✓ |
| Yılmaz and Yılmaz (2022) | ✓ |  | Cmax | ✓ | ✓ | ✓ |  |  | ✓ | ✓ |
| Zhang et al. (2022a) |  | ✓ | Cmax; TNS | ✓ | ✓ |  |  |  |  | ✓ |
| Lu et al. (2022a) |  | ✓ | Cmax; TEC |  |  |  | ✓ |  |  | ✓ |
| Tao et al. (2022) | ✓ |  | Cmax |  |  |  | ✓ |  |  | ✓ |
| Meng et al. (2022) | ✓ |  | Cmax |  |  |  | ✓ |  | ✓ |  |
| Chen et al. (2023) |  | ✓ | Cmax; TFT; TPC | ✓ |  |  | ✓ |  |  | ✓ |
| Wang and Zhang (2023) | ✓ |  | Cmax |  |  |  | ✓ |  | ✓ | ✓ |
| Goli et al. (2023) |  | ✓ | Cmax; TEC | ✓ |  |  | ✓ |  | ✓ | ✓ |
| Shao et al. (2023) | ✓ |  | Cmax | ✓ |  |  |  |  | ✓ | ✓ |
| Zhu et al. (2024) |  | ✓ | Cmax; DTD | ✓ |  |  | ✓ |  |  | ✓ |
| Zhang et al. (2024) |  | ✓ | Cmax; TEC |  |  |  | ✓ |  |  | ✓ |
| Yu et al. (2024) |  | ✓ | AST; TE; TT |  |  |  | ✓ |  |  | ✓ |
| **This Study** |  | **✓** | **Cmax; λ; γ** | **✓** | **✓** | **✓** |  |  | **✓** | **✓** |
| MCT: Mean Completion Time, E:Earliness, T: Tardiness, TWT: Total Weigthed Tardiness, TRAC: Total Resource Allocation Cost, SCT: Sum of the Completion Time, TT: Total Tardiness, SWCT: Sum of Weighted Completion Time, STD: Starting Time Deviation, TWET:Total Weighted Earliness and Tardiness, AT: Average Tardiness, TPC: Total Production Cost, TFT: Total Flow Time, TEC: Total Energy Consumption, TC: Total Cost, AASZ: Average Adjustment of Sublot Size, AST: Average Sojourn Time, EC: Energy Consumption, EPC: Electric Power Consumption, TNS: Total Number of Sublot, λ: Average Flow Time, γ: Total Workload Imbalance | | | | | | | | | | |