JURNAL MANAJEMEN DAN PROFESIONAL
E-ISSN : 2775 - 5967

Strategic Capacity Planning and Production Line Efficiency In Kilogram Based Laundry Services: A Case Study of Dr Laundry

Fadhel Muhamad Zacky[1], Mita Afasli[2], Lusiana[3]
Universitas Putra Indonesia "YPTK" Padang, Indonesia[1,2,3]

CORRESPONDING AUTHOR
Name : Fadhel Muhamad Zacky
E-mail : fmzzacky@gmail.com

ARTICLE HISTORY
Received date : 03/07/2026
Accepted date : 11/08/2026
Published date : 18/08/2026

ARTICLE IDENTITY
Vol. 7 No. 2, August 2026
Page 279-285

DOI
https://doi.org/10.32815/jpro.v7i2.3034

ABSTRACT
This case study examines capacity constraints at Dr Laundry, a small-scale service business established in 2021. Using a qualitative descriptive approach with field observations and interviews, the study reveals that despite a theoretical washing capacity of 975 kg/day and drying capacity of 325 kg/day, operational bottlenecks emerge when daily demand reaches 100 kg. The primary constraint does not arise from equipment limits or ironing speed (5–10 kg/hour/worker), but from process interruptions caused by overlapping cashier and washing responsibilities. Mitigation strategies including overtime extension, workforce allocation control, and load sequencing are evaluated. The findings demonstrate that task fragmentation and uncoordinated multi-role assignment degrade theoretical throughput in SME service lines, contributing to service operations management literature by highlighting that optimizing capacity does not necessarily require capital expansion, but rather targeted job redesign and process scheduling.

Keywords: Capacity Planning, Bottleneck, Laundry Business, Service Operations.

ABSTRAK
Studi kasus ini mengkaji hambatan kapasitas di Dr Laundry, usaha jasa skala kecil yang berdiri tahun 2021. Dengan pendekatan kualitatif deskriptif melalui observasi dan wawancara, penelitian menemukan bahwa meskipun kapasitas teoretis pencucian mencapai 975 kg/hari dan pengeringan 325 kg/hari, hambatan operasional muncul saat permintaan harian mencapai 100 kg. Hambatan utama bukan disebabkan oleh keterbatasan mesin atau kecepatan setrika (5–10 kg/jam/pekerja), melainkan oleh gangguan proses akibat tumpang tindih tugas kasir dan pencucian. Strategi mitigasi seperti lembur, pengendalian alokasi tenaga kerja, dan penjadwalan beban dievaluasi. Temuan menunjukkan bahwa fragmentasi tugas dan pembagian peran ganda yang tidak terkoordinasi menurunkan kapasitas teoretis di lini usaha kecil dan menengah, serta berkontribusi pada literatur manajemen operasi jasa dengan menekankan bahwa optimalisasi kapasitas tidak selalu memerlukan ekspansi modal, melainkan perancangan ulang tugas dan penjadwalan proses yang terarah.

Kata kunci: Perencanaan Kapasitas, Hambatan, Usaha Laundry, Operasi Jasa

INTRODUCTION

In Dynamic capacity management in service operations often encounters operational friction due to the temporal mismatch between fluctuating demand and fixed structural capacity (Chase et al., 2018; Krajewski et al., 2019). While capacity planning models have been extensively studied in high-volume manufacturing environments, empirical research on capacity constraint management in small-to-medium service enterprises (SMEs) particularly those balancing standard batch processes with high-margin express requests remains limited (Johnston & Clark, 2018). Dr Laundry has been operating since 2021, providing laundry services for 13 hours daily (09:00 a.m. to 10:00 p.m.).

To remain competitive, the business offers diverse service lines, including weight-based laundry, individual garment cleaning, ironing, and express service. In practice, daily demand fluctuates significantly, averaging 80 kg on regular days, surging to approximately 100 kg during peak periods, and dropping to 50 kg on quieter days. During demand surges, operations experience fully occupied machines, employee overload, and service delays. Prior studies suggest that service bottlenecks are primarily caused by physical equipment limits (Heizer et al., 2020); however, preliminary observations at Dr Laundry indicate that bottlenecks persist even when total daily machine capacity remains underutilized. This reveals a critical research gap regarding how internal task switching and uncoordinated multi-role allocations generate operational bottlenecks in SME service lines. Grounded in the Theory of Constraints (Goldratt, 1984), this research aims to evaluate production line capacity, identify operational bottlenecks, and assess capacity management strategies at Dr Laundry.

THEORETICAL BACKGROUND

Strategic capacity planning refers to the process of determining the overall capacity of an organization's capital resources—including physical facilities, equipment capability, and workforce allocation—to ensure that operational output aligns with the company's long-term competitive strategy (Krajewski et al., 2019). The primary objective of capacity management is to achieve an optimal balance that minimizes the costs of excess capacity while reducing the economic losses associated with insufficient service capacity (Chase et al., 2018).

To evaluate production flow efficiency, the Theory of Constraints (TOC), introduced by Eliyahu M. Goldratt (1984), provides a framework suggesting that every operational system is ultimately constrained by one or more bottlenecks that limit its maximum throughput. A bottleneck occurs when the actual capacity of a workstation is lower than the workload it receives or lower than the capacity of the preceding and subsequent workstations (Heizer et al., 2020). As a result, the bottleneck determines the pace of the entire production process.

In small and medium-sized service businesses, production line efficiency is frequently affected by overlapping duties or multitasking. Although workforce flexibility through cross-training can theoretically reduce employee idle time, assigning multiple responsibilities without carefully considering task transition time may instead create operational inefficiencies (Appelbaum et al., 2013). These include higher cognitive workload and increased task-switching costs (Rubinstein et al., 2001). Frequent and unstructured movement between tasks disrupts standardized processing times, interferes with queue priorities at downstream workstations, and creates fluctuating operational bottlenecks that are difficult to detect when evaluation is based solely on theoretical capacity calculations (Johnston & Clark, 2018).

RESEARCH METHODS

This research employed a qualitative descriptive approach using an in depth case study to explore the operational practices at Dr Laundry. A case study was considered the most appropriate approach because it allows operational variables to be examined within their actual setting, particularly in the dynamic environment of a micro, small, and medium sized enterprise. Primary data were collected through two main methods:

3.1 In depth Interviews: Face to face interviews were conducted with the owner, who also manages the daily operations of Dr Laundry, to collect information on historical daily order volumes, human resource management practices, task allocation, and the operational challenges experienced in day to day activities.

3.2 Structured Field Observation: Direct observations, including a time motion study, were carried out to record quantitative data from the production floor. The observations covered the actual cycle time of each machine, laundry arrival patterns, manual ironing rates across different fabric types, and employee movement between workstations.

The data analysis combined a deterministic quantitative approach to estimate the theoretical installed capacity with an inductive qualitative approach to evaluate the actual workload. The theoretical daily machine capacity was calculated using the following basic equation:

$$\boldsymbol{Daily\ Capacity} = \frac{\boldsymbol{Total\ Effective\ Operating\ Time}}{\boldsymbol{Processing\ timer\ per\ Cycle}} \boldsymbol{x} Machine\ Rated\ Load\ Capacity \quad (1)$$

The numerical calculation results were then compared with a process mapping analysis to identify the gap between the theoretical capacity estimated on paper and the actual throughput achieved in daily operations. This approach made it possible to accurately determine the root causes of production bottlenecks.

RESULT AND DISCUSSION

4.1 Production Line Configuration and Human Resources

Dr Laundry operates with a total of four employees. To reduce fixed overhead costs associated with labor, the business adopts a cross functional work structure in which employees perform overlapping duties across multiple workstations. In practice, two employees are assigned primarily to washing operations, while three work at the ironing station, including two who also handle washing tasks. One employee is responsible for laundry pickup and delivery, and another manages cashier duties, administrative work, and bookkeeping while also assisting with washing and ironing whenever the production system reaches a bottleneck or operates at maximum capacity.

This lean organizational structure provides a high degree of flexibility during periods of low demand. However, as the workload increases, the absence of clearly defined job boundaries begins to affect operational efficiency. Production staff frequently shift between sequential tasks without a structured priority, resulting in reduced focus and disruptions to the overall workflow.

4.2 Washing and Drying Machine Capacity Analysis

Dr Laundry's operations are supported by washing and drying machines with processing times that vary according to load capacity. Based on an effective operating schedule of 13 hours per day, from 9:00 a.m. to 10:00 p.m., the maximum theoretical daily capacity was calculated as follows:

Table 1. Dr Laundry Washing and Drying Machine Capacity

Machine Type	Number of Units	Capacity / Processing Time	Theoretical Daily Capacity (13 Hours)
Large Washing Machine	1 Unit	12 kg / Approximately 30 Minutes	312 kg/day
Small Washing Machine	2 Units	8.5 kg / Approximately 19 Minutes	Approximately 663 kg/day
Total Maximum Washing Capacity			975 kg/day
Large Drying Machine	1 Unit	10 kg / 40 Minutes (Rate: 15 kg/hour)	195 kg/day
Small Drying Machine	2 Units	5 kg / 60 Minutes (Rate: 5 kg/hour)	130 kg/day
Total Maximum Drying Capacity			325 kg/day

Source: Processed Observation Data (2026)

The empirical calculations confirm that the drying station represents the lowest technical capacity within the machine system, with a maximum capacity of 325 kg per day. Even so, this capacity remains more than sufficient, providing a capacity cushion of approximately 69.2% above the workload recorded on the busiest days, which averages around 100 kg.

4.3 Manual Ironing Station Efficiency (Finishing)

The finishing stage relies on manual steam ironing, and its efficiency depends largely on the operator's physical capability and the complexity of the fabrics being handled. The time and motion study revealed two distinct levels of ironing performance:

1. Low Complexity Garments (T shirts and Casual Wear): These items have relatively flat and simple surfaces, allowing an ironing rate of 5 kg every 30 minutes, equivalent to 10 kg per hour per operator.

2. High Complexity Garments (Dress Shirts, Denim Trousers, Long Dresses, and Layered Hijabs): These items require greater attention to detail and careful ironing, resulting in a processing rate of 5 kg every 60 minutes, equivalent to 5 kg per hour per operator.

Under the worst case scenario, assuming that all incoming laundry consists of high complexity garments with the lowest ironing rate of 5 kg per hour, the combined capacity of three ironing operators reaches 15 kg per hour. Over a 13 hour operating day, the finishing station has a theoretical capacity of 195 kg. This finding indicates that, under uninterrupted working conditions, the ironing station is capable of processing nearly twice the laundry volume handled on the busiest days, which averages approximately 100 kg.

4.4 Bottleneck Analysis and Production Line Inefficiency

The calculated washing capacity (975 kg), drying capacity (325 kg), and theoretical ironing capacity (195 kg) indicate that Dr Laundry has more than sufficient infrastructure to handle peak daily demand of approximately 100 kg. Despite this, the business continues to experience operational issues, with machines frequently perceived as fully occupied and employees struggling to keep up with the workload. The analysis identified that the main bottleneck does not stem from limited capacity, but from inefficiencies created by overlapping job responsibilities, particularly when express service orders are received. During busy periods, ironing staff who also perform washing duties must leave their ironing stations to weigh, sort, and load laundry into the washing machines. These interruptions create idle time at the ironing station, causing dry laundry to accumulate while waiting to be ironed. As the backlog grows, the workload becomes increasingly concentrated, creating the impression that the available operational capacity is insufficient even though the existing infrastructure is technically capable of meeting demand.

4.4 Bottleneck Analysis and Production Line Inefficiency

The calculated capacities of the washing station (975 kg), drying station (325 kg), and theoretical ironing station (195 kg) indicate that Dr Laundry has more than sufficient infrastructure to handle peak daily demand of approximately 100 kg. Despite this, operational issues such as fully occupied machines and overwhelmed employees continue to occur. The findings reveal that the primary bottleneck is not caused by limited machine capacity, but by inefficiencies arising from overlapping job responsibilities, particularly when express service orders are received.

During busy periods, ironing staff who also perform washing duties must leave their ironing stations to weigh, sort, and load laundry into the washing machines. These interruptions create idle time at the ironing station, allowing dry laundry to accumulate while waiting to be ironed. As the backlog grows, the workload becomes increasingly concentrated at the finishing stage, creating the impression that the business lacks sufficient operational capacity, even though the available capacity is technically adequate.

4.5 Capacity Management Strategies During Demand Surges

To address operational bottlenecks during peak demand periods specifically managing the observed accumulation of approximately 100 kg of dry laundry per day the management of Dr Laundry implements three primary capacity management strategies. The practical application of these strategies is evaluated against operations management theories and empirical research as follows:

1. **Extension of Working Hours Through Overtime:**
   - **Empirical Findings:** Management frequently utilizes 1.5 to 2 hours of daily overtime per operator during high-volume periods to ensure delivery schedules are met. While this strategy successfully prevents chronic delivery delays, operational observation indicates that prolonged overtime causes fatigue, leading to a noticeable decline in ironing finish quality and an increase in unit labor costs.
   - **Theoretical Analysis & Literature:** This aligns with Capacity Requirement Planning (CRP) principles, where short-term capacity adjustments rely on labor flexibility. However, as noted by Chase et al. (2018) and Soman et al. (2017), excessive reliance on overtime to mitigate capacity shortages introduces labor inefficiencies, increases variable costs, and diminishes operational quality due to human fatigue in labor-intensive tasks.

2. **Workforce Capacity Control:**
   - **Empirical Findings:** Dr Laundry restricts the recruitment of temporary daily workers during routine operations, reserving temporary expansion strictly for extreme seasonal spikes such as the Eid al-Fitr holiday period (where demand surges up to 150–200%). Under normal operating fluctuations, fixed headcount is maintained to stabilize labor overhead.
   - **Theoretical Analysis & Literature:** This approach reflects a Level Capacity Strategy aimed at maintaining a steady workforce and controlling fixed/overhead costs (Krajewski et al., 2019). By absorbing normal demand variations through internal task re-allocation rather than continuous hiring, the business avoids training friction and maintains predictable operating margins, consistent with empirical findings on small-service-enterprise workforce stability (Fitriani & Hidayat, 2021).

3. **Load Order Flow Management Without Rejecting Express Orders:**
   - **Empirical Findings:** The business continues to accept high-margin express service orders alongside regular laundry queues. While express pricing yields higher profit margins and optimizes short-term cash flow, empirical workflow tracking reveals that processing unscheduled express orders on the main production line disrupts regular batching, introducing operational variability that accounts for the peak 100 kg backlog at the ironing station.
   - **Theoretical Analysis & Literature:** According to Queuing Theory and Operations Strategy (Heizer et al., 2020), introducing high-priority jobs into a shared facility without dedicated fast-track routing increases process variance and extends total cycle times for standard orders. In line with findings by Johnston and Clark (2018), capturing premium-margin demand without dedicated capacity allocation inevitably degrades baseline process stability.

CONCLUSION AND SUGGESTIONS

This case study demonstrates that while Dr Laundry possesses a solid physical infrastructure—evidenced by a theoretical washing capacity of 975 kg/day and a drying capacity of 325 kg/day—its operational performance is fundamentally constrained by capacity planning and resource allocation rather than equipment limits. From an operations management perspective, the accumulation of approximately 100 kg of dry laundry during peak periods represents an operational bottleneck driven by task fragmentation and uncoordinated labor allocation. This contributes to the broader operations management literature by illustrating how flexible, multi-role assignment models in small-to-medium service enterprises can unintendedly degrade theoretical throughput.

From a practical standpoint, the study highlights that optimizing operational throughput does not necessarily require capital expansion, but rather targeted job redesign and process scheduling. Specifically, the frequent interruptions experienced by manual ironing operators caused by overlapping cashier duties and unscheduled express service requests can be mitigated by strictly decoupling front-line service functions from back-end finishing operations. Implementing formal time-blocking for express orders and establishing dedicated workstation policies directly optimize effective working hours, demonstrating how procedural adjustments and task separation restore operational balance without additional capital expenditure.

5.2 Suggestions

To eliminate these operational constraints without increasing capital investment costs, Dr Laundry is recommended to implement the following strategic measures:

1. **Workstation Isolation Policy:** During peak hours on busy days, at least one ironing operator should be completely isolated from cashier and washing responsibilities. This measure is essential for maintaining the continuity of the finishing station's throughput rate.
2. **Time Blocking System:** Management should establish dedicated time windows for processing regular and express orders. Express service items should be grouped and loaded into the washing machines at scheduled intervals, for example every two hours, to minimize unexpected interruptions that reduce ironing productivity.
3. **Visual Management:** Introduce a simple visual control board, such as a physical *Kanban* card system, to provide employees with clear information about the status of laundry queues. This approach enables workforce allocation across workstations to be based on actual operational needs rather than individual assumptions.

REFERENCES

Assauri, S. (2013). Marketing Management. Jakarta: PT Raja Grafindo Persada.

Chase, R. B., Jacobs, F. R., & Aquilano, N. J. (2006). Operations Management for Competitive Advantage. McGraw-Hill Irwin.

Coulter, M., & Robbins, S. P. (2010). Management. Jakarta: Erlangga.

David, F. R. (2011). Strategic Management: Concepts (12th ed.). Jakarta: Salemba Empat.

Glueck, W. F., & Jauch, L. R. (2000). Strategic Management and Business Policy (3rd ed.). Jakarta: Erlangga.

Goldratt, E. M., & Cox, J. (2016). The Goal: A Process of Ongoing Improvement (4th ed.). Routledge.

Heizer, J., & Render, B. (2014). Principles of Operations Management: Sustainability and Supply Chain Management (9th ed.). Pearson.

Kotler, P. (2003). Marketing Management: Analysis, Planning, Implementation, and Control. Jakarta: Erlangga.

Krajewski, L. J., Malhotra, M. K., & Ritzman, L. P. (2016). Operations Management: Processes and Supply Chains (11th ed.). Pearson.

Stevenson, W. J. (2018). Operations Management (13th ed.). McGraw-Hill Education.

Yin, R. K. (2018). Case Study Research and Applications: Design and Methods (6th ed.). SAGE Publications.