LEAN AND OPERATIONAL EXCELLENCE

BST841

GROUP REPORT

DEWSBURY MEDICAL DEVICE MANUFACTURER

A Lean Transformation to Restore Alignment and Competitiveness

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Contents

Introduction

Dewsbury Medical Devices is a UK-based manufacturer specialising in hip and knee replacement components. It employs approximately 600 staff and is owned by a larger US medical device group. Despite short-lived operational improvements, Dewsbury faces growing external pressures from key customers such as the NHS, BUPA, and Nuffield Health, who demand 2-6% annual cost reductions along with continuous quality improvements. These challenges are further exacerbated by increased competition from rivals adopting advanced AI-driven technologies, undermining its current market position.

This report proposes a strategic operational transformation. Section one evaluates the current state of the company's Operational Excellence (OpEx) programme. Section two identifies key areas for improvement and recommends specific solutions. Section three discusses how these improvements can be sustained through a cultural transformation and, more importantly, provides a path for continuous improvements beyond the proposed solutions.

Current Analysis

Dewsbury's Operational Excellence (OpEx) programme initially generated localised improvements but has struggled to achieve the organisational-wide transformation. Early initiatives included a workforce educational programme on fundamental Lean knowledge, such as the seven wastes, execution of the 5s methodology, and the implementation of Standard Operating Procedures (SOPs).

Although 5s removed significant workplace clutter, subsequent audits revealed a failure to sustain these improvements. 5s was increasingly seen as a cleaning tool rather than a driver for operational flow, falling into a common implementation pitfall to sustain (Hines, 2008; Ohno, 1988). Over time, employee knowledge deteriorated, particularly among the second shift members, indicating a cultural weakness in embedding desired behaviours and retaining knowledge (Found, 2013).

The lack of leadership accountability and follow-up contributed to a loss of interest in the suggestion scheme and employees' increasingly disregard for the SOPs. Several Kaizen Blitz events were conducted to drive organisational engagement but only delivered temporary benefits. This reflects Womack's (1997) warning that isolated improvement efforts without daily management integration will fail to drive meaningful lasting change.

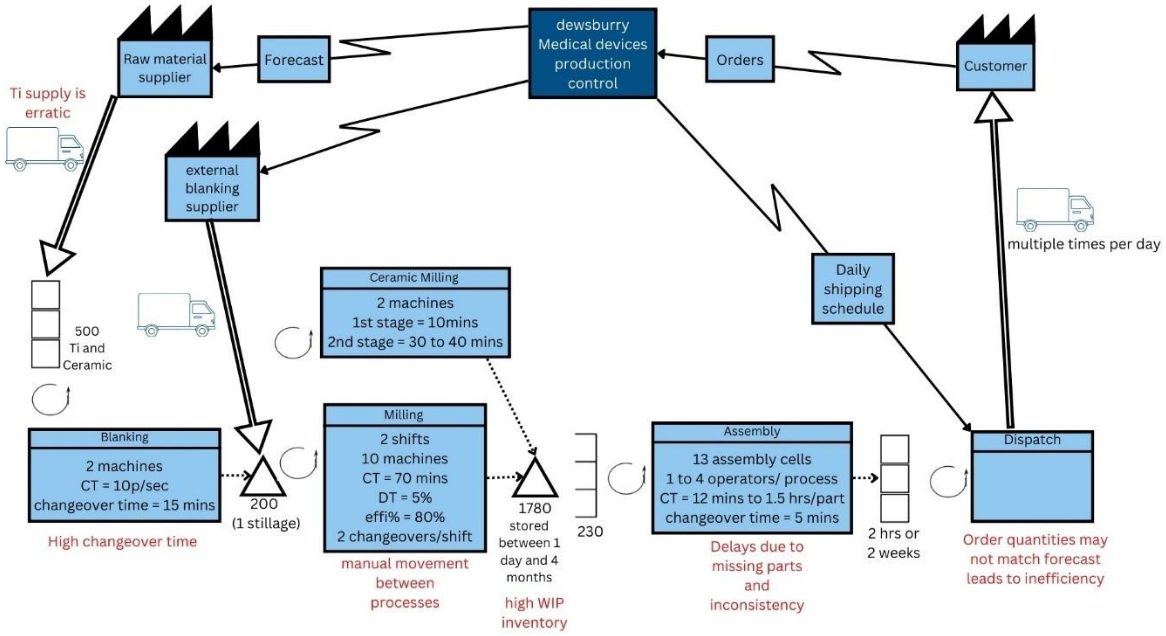

Figure 1: Current Value Stream Map

This misalignment is further evidenced by the organisation's current Value Stream Map (VSM) inefficiencies (***Figure 1***). Inbound deliveries are disrupted by erratic deliveries of external titanium and ceramic supplies, requiring a safety stock of approximately 500 units. Although blanking operations are capable of a high throughput of 10 pieces per second, they are constrained by two machines requiring lengthy changeover times of approximately 15 minutes, limiting production flexibility (Rother, 1998). Dewsbury's limited internal blanking capacity shifts reliance to external suppliers exposing the business to further external variability and risk (Slack, 2018).

The milling operations are constrained, with ten CNC machines operating at around 80% efficiency and a cycle time of 70 minutes per batch. In high-precision manufacturing, this level of utilisation indicates underperformance, which likely results from non-value-adding activities of manual handling between milling stages that introduce muda waste through unnecessary motion and waiting (Bicheno, 2016). Frequent changeovers per shift further amplify non-value-adding time (Shingo, 1985). The ceramic milling process complicates planning, with cycle times varying significantly from 10 to 40 minutes per part, depending on complexity.

Downstream at the assembly stage, failures within the Kanban system further disrupt flow. Parts are delivered to the general cell supermarket in stillages by forklift, where empty stillages are supposed to trigger a pull signal. However, due to warehouse congestion, forklift drivers frequently move multiple stillages to access the correct parts, leading to frequent wrong deliveries. The frequent errors not only hinder flow across the 13 assembly cells but also undermine the effectiveness of the Kanban system and contribute to the large build-up of work-in-progress inventory (1,780 units) (Ohno, 1988). The large WIP ties up capital and disrupts production, directly contradicting Lean principles of establishing flow and waste minimisation (Womack, 1997).

Finally, the dispatch stage faces inefficiencies due to persistent discrepancies between consumer forecasts and actual demand output, usually due to consumers changing orders at the last minute. Buffer stocks fluctuate from two hours to two weeks, while frequent rescheduling on Dewsburry’s end deteriorates consumer service levels and erodes trust (Christopher, 2016).

Despite implementing the quality improvement program with Statistical Process Control and Poka-yoke devices initiatives, defect rates have plateaued at 200 parts per million, well above the Six Sigma benchmark of 3.4 parts per million expected in the medical device industry.

Operational Strategy

Dimension	Current Rating (1–5)	Current Justification	Target Rating (1–5)	Target Justification
Quality	2.5	Defect rate improved to 0.16% (200 ppm) but plateaued; still high for medical devices. FTT ranges 92–99%.	4.5	Aim for <100 ppm; progress toward Six Sigma (3.4 ppm) crucial in healthcare manufacturing.
Dependability	3.0	Delivery performance in the high 90s%, but part shortages persist; unreliable scheduling from some customers affects performance.	4.5	Near-perfect OTIF (on-time, in-full) delivery across NHS, BUPA, and Nuffield, despite differing requirements.
Flexibility	2.0	Manual changeovers, multiple customer systems, and rigid schedules reduce flexibility. Operators do some rebalancing, but limited autonomy.	4.0	Ability to respond quickly to schedule changes, reduce setup times, and balance lines independently.
Cost	2.0	High WIP, rework, and non-standardized operations drive up cost. NHS demands annual 2–6% cost reductions.	4.0	Lean flow, reduced defects, better scheduling, and smarter purchasing to cut costs sustainably.
Speed	2.5	Some SMED gains (30 mins), but changeovers still lengthy. Delays from forklifts and batching slow the flow.	4.5	Achieve SMED <10 mins, continuous flow, and faster response to customer demand using lean tools and digital scheduling (e.g., SAP heijunka).

Figure 2: Operational Performance Summary (Current Vs Target)

Figure 2 summarises and compares Dewsbury's performance gaps across the five operational metrics (Slack, 2019). Our operational strategy priorities are structured around four key pillars (***Figure 3***): Enabling a lean cultural foundation, streamlining production flow, strengthening inventory management, and leveraging improved technologies. This strategy is designed to provide an immediate performance benefit while addressing the need for a cultural transformation.

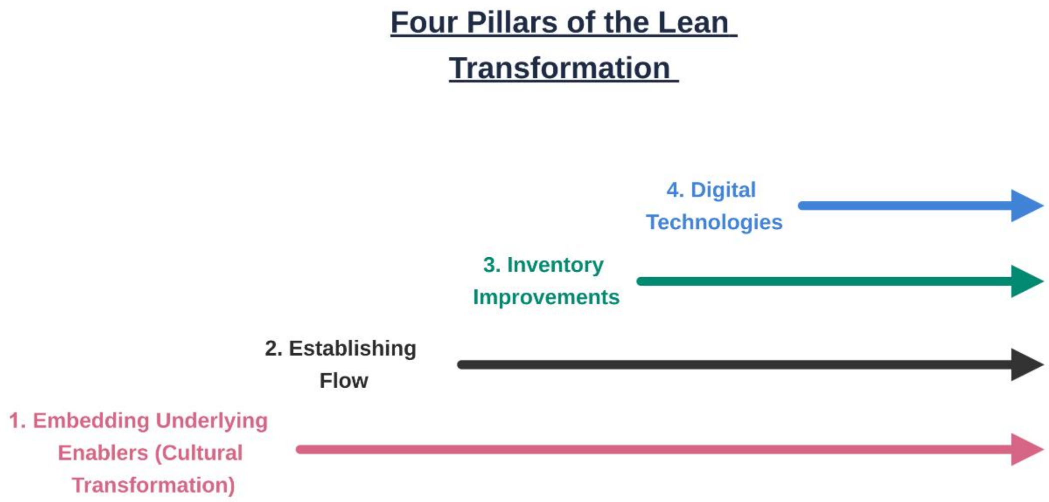

Figure 3: Four pillars of lean transformation presented in priority order and parallel execution phases

The transformation begins with addressing process inefficiencies through operational flow stability. Dewsbury's limited banking and milling equipment acts as a bottleneck, the constant need to externally purchase blanks and frequent changeovers highlight the capacity constraint (Goldratt, 2016). Investing in faster, more flexible equipment would cut cycle times and improve parts consistency, reducing reliance on volatile external suppliers (Ahmad, 2024). Although this requires considerable upfront investment and planned downtime during installation, regaining in-house production capabilities enables greater control over quality and flow stability (Slack, 2018).

However, machine upgrades alone are insufficient to establish a consistent flow. Dewsbury must redesign the layout using a spaghetti diagram to address warehouse congestion. Implementing 5s would further support this by arranging frequently used stillages closer to the point of use, significantly reducing unnecessary forklift movement and retrieval errors (Sahoo, 2021). Nevertheless, sustaining 5s improvements remains a cultural risk. It must be embedded within daily habits, and frequent audits can reinforce this behaviour (Galsworth, 2011).

Single Minute Exchange of Die (SMED) techniques will be implemented to further strengthen flow stability. By enabling employees to think critically about improvements through Toyota Kata coaching, standardising changeover procedures, and externalising the set-up tasks, changeover times can be consistently reduced to under 10 minutes (Shingo, 1985). Reducing changeover variabilities enables the use of smaller batch sizes, which would reduce work in progress and allow faster responses to shifting consumer demands (Hopp, 2011). However, technical improvements must be reinforced through disciplined standard work to sustain gains and embed continuous improvement into daily operations (Liker, 2004).

While safety stock safeguards Dewsbury against unreliable titanium and ceramic suppliers, maintaining excess inventory creates a significant cost challenge (Amirjabbari, 2013). To reduce inventory levels, upstream external variabilities must become more predictable and visible.

Blockchain-enabled smart contracts offer a targeted solution by synchronising inventory movements directly with actual demand consumption (Omar, 2021). Smart contracts between Dewsbury and its suppliers would reduce information delays by triggering an automatic replenishment order within a contractually agreed-upon limit (Seberi, 2022). However, supplier variability also includes on-time and in-full deliveries, blockchain can uphold contractually agreed-upon performance measures and hold unreliable suppliers accountable (Meng, 2018).

Complementing this, virtually simulating the production environment through a digital twin would enable Dewsbury to pinpoint operational inefficiencies and limitations without real-world resource commitments (Coandă, 2020). This would also facilitate data-driven predictive maintenance calculated through machine utilisation and throughput (Coandă, 2020). These analytical predictive capabilities increase operational visibility and allow proactive decision-making, protecting flow stability (Zonta, 2020).

Although Blockchain and digital twin technologies require upfront investment and workforce upskilling, their long-term impact is critical in confidently lowering inventory levels (Seberi, 2022). This not only improves flow-through machine reliability but also enhances the dependability and strengthens consumer trust by swiftly meeting orders even when slight changes occur.

Change Management

Sustaining Dewsbury's operational improvements requires embedding a cultural foundation focusing on underlying enablers (Hines, 2008). The initial priority is to build a strong foundation through targeted training sessions aimed at reducing the skill and confidence gaps between shift members. However, it must be approached carefully to avoid being perceived as a top-down intervention undermining operators' skill (Devine, 2016).

Daily minute meetings centred around an A3 board will embed daily continuous improvement habits. Reintroducing the suggestion scheme into these meetings will foster greater employee engagement by demonstrating that ideas are valued (Mann, 2005; Found, 2013). But, leadership is equally critical as capabilities are developed by doing (Lean Enterprise, 2025).

Managers will be trained using Toyota Kata principles to empower their employees by facilitating scientific thinking through coaching (Rother, 2018). They will be encouraged to apply the cathedral model, actively promoting desirable behaviours while discouraging misalignment (Schein, 2010). Nevertheless, a realistic benchmark must first be established. SOPs should be revisited to reflect actual operations and communicated visually through visual task boards, ensuring standard work becomes embedded in daily routines (Galsworth, 2017).

Although Dewsbury's purpose is clear, its vision is not articulated (Akao, 2020). Strategic alignment will be reinforced through Hoshin Kanri, establishing a true north: *"To become a trusted, high-performance medical device manufacturer by delivering defect-free products, on time, at a cost-competitive price."* This vision will be cascaded through an X-Matrix (**Figure 4**), aligning long-term goals with short-term actionable tasks that are measurable through key performance indicators (Barnabè, 2017).

However, with only three members for 600 employees, the OpEx team is overburdened. Work must be delegated through champions, or additional members should be recruited to sustain a manageable workload (Hines, 2008).

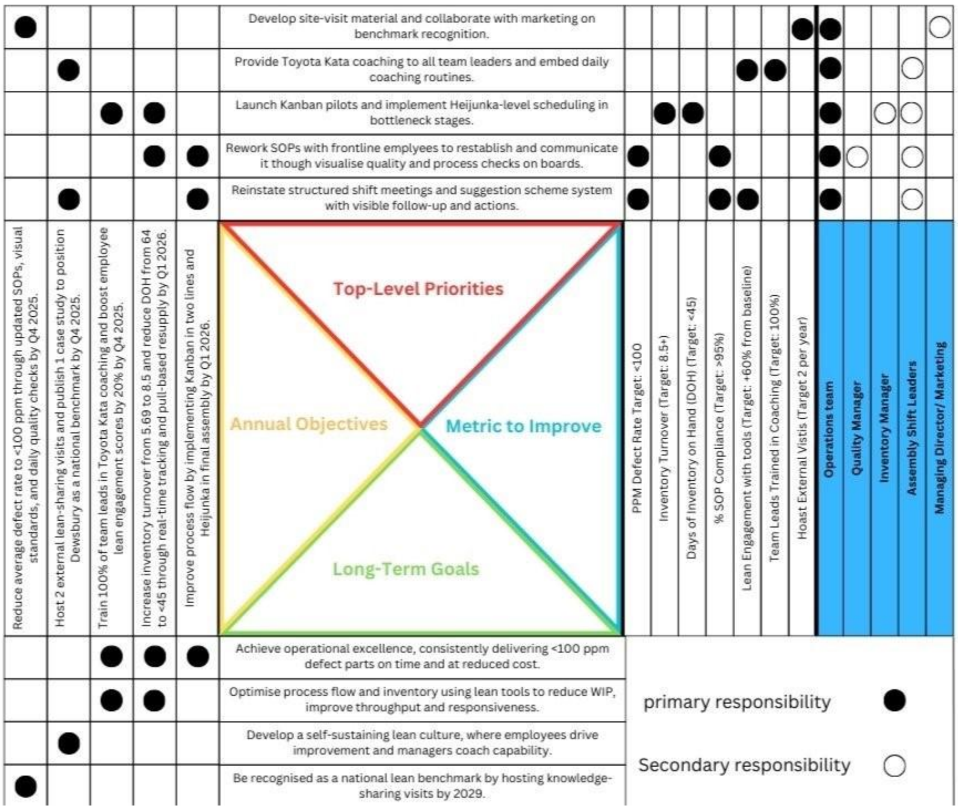

Figure 4: Top-Level X-Matrix

Conclusion

This report provides a structured path for Dewsbury to regain operational excellence. The transformation is underpinned by four key principles: Improving production flow by shifting the bottleneck to a more controlled point, reducing reliance on volatile external suppliers, and enabling greater control over material inputs. Improving inventory management by restoring Kanban discipline, applying 5s in the warehouse, and using blockchain-enabled smart contracts to improve external visibility, holding suppliers accountable. Strategic use of digital technologies through digital twins will further reduce operational uncertainty, enabling proactive decision-making. Most importantly, a focus on the underlying enablers will help establish a self-propelling, continuously improving culture.

Next steps include gathering initial investment approval from senior managers, reviewing processes through Gemba walks to accurately understand realistic operations, setting an initial benchmark through revisiting and communicating the SOPS, and creating a detailed corporate-level X-Matrix to drive organisational progress. By embedding this foundation now, Dewsbury will recover its competitiveness and build an organisation capable of thriving amongst future uncertainty.

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Appendix

Cover page, figures and graphs created by the group