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# Digitalizing Planned Production Scheduling and Control: Enhancing Visibility and Performance Tracking at Belrise Industries

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***Abstract*— This project-based On-the-Job Training study investigates Planned Production Scheduling and Control (PPC) at Belrise Industries Limited, Plant Bhamboli, addressing the critical operational challenge of bridging the gap between demand planning and shop-floor execution in the automotive component sector. Grounded in a comprehensive review of manufacturing literature surrounding Industry 4.0, digital Kanban systems, and exception management, the research evaluates how manual spreadsheet-based tracking creates significant information-flow delays. To structure the investigation, the study is guided by five core objectives: analyzing the current PPC process and monitoring gaps, evaluating planned-versus-recorded production performance for the M310/W610 and M110 lines, identifying repeated operational constraints, designing a digital monitoring framework within the proposed Integrated Manufacturing Operations Centre (IMOC) architecture, and assessing potential business benefits alongside future Digital Kanban integration requirements.**

**Methodologically, the study combines quantitative descriptive analysis of an 8-day operational dataset (18–25 May 2026) with qualitative framework evaluation. The major empirical findings reveal a combined production achievement of 73.83% and dispatch achievement of 69.68%, driven by a severe performance divergence where the M110 line achieved only 40.63% and accounted for 58.6% of the total plant gap. Furthermore, constraint mapping established that manpower shortages appeared on 100% of recorded days, while the existing manual workflow failed to surface these variances until next-day reviews. The study concludes that transitioning to a structured digital PPC framework is vital to eliminate operational blind spots, improve cross-functional visibility, and enable proactive management decision-making. Practical suggestions include replacing unstructured text logs with standardized severity tags, prioritizing digital tablet integration on lagging lines like M110, and expediting automated supplier Kanban triggers to ensure long-term manufacturing throughput and delivery reliability.**

**Keywords—Planned Production Scheduling and Control (PPC), Automotive Component Manufacturing, Digital Transformation, Industry 4.0, Production Visibility, performance Tracking, Integrated Manufacturing Operations Centre (IMOC), Exception Management, Digital Kanban, Operational Constraints**

## I. INTRODUCTION

The planned production scheduling and control (PPC) function serves as the vital operational bridge within manufacturing organizations, translating customer demand, dealer indents, and forecasted requirements into resourced, scheduled, and monitored production workflows. In component-supply sectors such as automotive manufacturing, PPC occupies a central position across the value chain, interfacing directly with sales and dispatch on one side while coordinating closely with the shop floor, stores, and suppliers on the other. This study is grounded in an On-the-Job Training (OJT) assignment undertaken by the author as a PPC Intern at Belrise Industries, Plant Bhamboli, in partial fulfilment of the Master of Business Administration (Operations) program at the School of Business, Indira University, under the academic mentorship of Dr. Sanjay Asati and industry guidance of Mr. Nilesh Thakur. Throughout the OJT period, empirical observations were drawn from routine data capture, consolidation, and review activities for two specific production lines—designated as M310/W610 and M110—which were monitored using a manually updated Daily PPC Excel working sheet.

Within this operational context, manufacturing and component supply environments face growing pressures to modernize planning and performance-tracking systems that have historically relied on manual, spreadsheet-based mechanisms. These demands stem from rising Original Equipment Manufacturer (OEM) expectations for near-real-time visibility, the broader industrial push toward Industry 4.0 practices such as sensor-based tracking and exception-based alerting, and the heavy operational costs associated with delayed end-of-day reconciliations. At Plant Bhamboli, the observed daily PPC working data for the M310/W610 and M110 lines revealed



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significant plan-versus-actual performance gaps, alongside persistent operational constraints such as manpower shortages, late shift starts, projection-welding defects, part variations, and equipment disruptions. Because the existing manual tracking process records these deviations after the fact rather than surfacing them while corrective action remains possible, plant management developed a proposal for an Integrated Manufacturing Operations Centre (IMOC)—a standalone web-based platform designed to integrate production monitoring, digital Kanban with supplier integration, and customer complaint management into a unified system.

Consequently, this research addresses a twofold operational problem: a persistent, line-specific gap between production plans and actual output operating alongside recurring, partially resolved shop floor constraints, and a manual monitoring system that delays visibility until intervention opportunities have passed. The primary scope of this study is focused specifically on the production-monitoring and PPC workflow for the M310/W610 and M110 lines during an 8-day working window, while treating broader platform capabilities such as digital Kanban, supplier portals, and quality management as future extension opportunities aligned with the IMOC phased rollout. By rigorously verifying the production and dispatch data, mapping current operational constraints, and evaluating the proposed digital monitoring framework, this study provides an evidence-based foundation for prioritizing manufacturing digitalization interventions and bridging the gap between theoretical PPC concepts and live automotive plant operations.

## II. LITERATURE REVIEW AND THEORATICAL BACKGROUND

### A. *Literature Review*

The academic and industrial literature on manufacturing digitalization highlights a clear structural shift away from traditional, manual production control toward smart, data-driven frameworks. Alexopoulos et al. (2022) and Nwasuka and Uchechukwu (2023) emphasize that the core efficacy of Production Planning and Control (PPC) historically depended on static, periodic spreadsheet reconciliation. However, empirical studies by Du et al. (2018) and Khajavi and Holmström (2015) demonstrate that spreadsheet-based tracking induces severe information-flow delays, causing plan-versus-actual deviations to surface only after proactive intervention opportunities have passed. Addressing these systemic vulnerabilities, Bueno et al. (2020) and Tripathi et al. (2022) conducted extensive reviews showing that Industry 4.0 adoption in component manufacturing is driven by mounting Original Equipment Manufacturer (OEM) demands for near-real-time visibility.

Further building on this technological transition, Mourtzis (2022) and Tariq et al. (2024) document how Manufacturing Execution Systems (MES) and Cyber-Physical Production Systems (CPPS) automate shift-wise data capture and eliminate retrospective reporting lags. In the specific context of automotive supply chains, Lang et al. (2024) and Mathew et al. (2023) explore the deployment of digital Kanban and automated replenishment portals, proving that digital synchronization significantly reduces material-driven line stoppages. Additionally, research by Smith et al. (2024) and Piedade et al. (2020) underscores the high operational cost of manual exception tracking, validating that automated dashboards and structured constraint categorization are vital for minimizing downtime. Finally, broader sector analyses by Mourtzis et al. (2017), Pimentel et al. (2018), and Souza et al. (2023) confirm that integrating real-time visualization tools directly strengthens operational resilience, traceability, and competitive delivery performance among Tier-1 component suppliers.

### B. *Thereotical Background*

The theoretical framework underpinning this study integrates Production Planning and Control (PPC) theory, Lean Manufacturing, Visual Management, and Exception-Management Theory. Classical PPC theory establishes that manufacturing plants operate as value chains converting market demand into resourced production schedules, requiring a rapid, accurate feedback loop to align shop-floor reality with managerial planning. When this feedback loop breaks down, lean manufacturing principles—as articulated by Garcia et al. (2023) and Joppen et al. (2019)—dictate that operational transparency and visual management become indispensable for eliminating waste and stabilizing workflows.

Complementing lean theory, Exception-Management Theory provides the conceptual foundation for handling operational variances. It posits that managerial attention should not be wasted on routine performance, but must be systematically channeled toward unexpected deviations from standard operating plans, such as manpower shortages, equipment breakdowns, and material variations. In traditional manufacturing settings, these exceptions remain obscured within unstructured text logs or delayed shift reports. Digital transformation frameworks—such as the Integrated Manufacturing Operations Centre (IMOC) architecture evaluated in this study—operationalize these theories by introducing automated exception-flagging mechanisms, role-based visualization layers, and structured ownership tracking. By anchoring the research in these complementary theories, the study demonstrates how replacing manual oversight with automated exception visibility transforms passive data collection into proactive, data-driven decision-making.

## III. MATERIALS AND METHODS

This study adopts a project-based descriptive and analytical research design to evaluate Production Planning and Control (PPC) mechanisms at Belrise Industries Limited, Plant Bhamboli. The methodological approach combines quantitative empirical analysis of operational performance data with qualitative framework evaluation. Primary data was extracted from daily PPC tracking workbooks spanning an 8-day observation window from 18 to 25 May 2026, covering production schedules, actual outputs, dispatch logs, and free-text constraint notes. Secondary data sources included internal plant proposals for the Integrated Manufacturing Operations Centre (IMOC) and relevant academic literature on manufacturing digitalization. Data processing involved rigorous cleaning, formula verification, and descriptive metric computation—such as plan-versus-actual variance, percentage achievement, and constraint frequency—to isolate operational bottlenecks and evaluate the feasibility of digital intervention strategies.



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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 12, UCBO - 2026

### A. *Research Objectives*

This study is guided by five core objectives designed to systematically evaluate production planning and control practices and digital intervention strategies at Belrise Industries Limited, Plant Bhamboli: (1) focuses on analyzing the current PPC process and identifying existing gaps in production and dispatch monitoring; (2) evaluates the planned-versus-recorded production performance of the M310/W610 and M110 lines using available operational data; (3) identifies repeated operational constraints and information-flow gaps that negatively affect PPC visibility; (4) involves designing a proposed Digital PPC and monitoring of production framework within the Integrated Manufacturing Operations Centre (IMOC) architecture; (5) assesses the potential operational and business benefits of the recommended process digitalization framework while identifying the specific requirements necessary for future Digital Kanban integration.

## IV. DATA ANALYSIS AND DISCUSSION

TABLE I. CURRENT PPC PROCESS AND MONITORING GAPS

| **Parameter/Operational Metric** | ***Value/ Status in Current Process*** | ***Digital Monitoring Requirement*** |
|---|---|---|
| Production Plan (Combined) | 2,480 units (8-day total) | Real-time plan-vs-actual entry by line and shift |
| Production Gap | Next-day manual review (no intra-shift alerts) | Same-day exception alerting mechanism |
| Review Cadence | Next-day manual review (no intra-shift alerts) | Same-day exception alerting mechanism |
| Constraint Logging | Free-text 'Issues' column (no severity/owner) | Structured categorization with status fields |
| **Data Aggregation** | Manual aggregation via Summary Sheet | Live, automated dashboard visualization |

This table establishes the foundational baseline of Plant Bhamboli's existing production planning and control workflow by comparing manual spreadsheet metrics against required digital monitoring capabilities. Structurally, it details the 8-day combined totals for production plans (2,480 units), actual output (1,831 units), and resulting shortfalls, while explicitly evaluating the operational gaps inherent in a next-day review cadence and free-text constraint logging. By contrasting these manual practices with automated shift-wise accumulation and real-time exception alerting, the table provides a clear structural justification for why the current spreadsheet-based setup fails to support proactive shop-floor management.

TABLE II. PLANNED-VERSUS-RECORDED PRODUCTION PERFORMANCE

| **Parameter/Operational Metric** | ***M310/610 Line*** | ***M110 Line*** | ***Combined Plant Total*** |
|---|---|---|---|
| Total Production Plan | 1,840 units | 640 units | 2,480 units |
| Total Production Actual | 1,571 units | 260 units | 1,831 units |
| Production Achievement % | 85.38% | 40.63% | 73.83% |
| Remaining Production Gap | **269** units | 380 units | 649 units |
| Total Dispatch Plan | 1,610 units | 560 units | 2,170 units |
| Total Dispatch Actual | 1,320 units | 192 units | 1,512 units |
| Dispatch Achievement % | 81.99% | 34.29% | 69.68% |
| Total Returns (Rejections/Ret.) | 48 units | 40 units | 88 units |
| Total Transportation Cost | ₹137,610 | ₹45,870 | ₹183,480 |

This table provides a granular, comparative breakdown of manufacturing and dispatch performance across the two observed production lines, M310/W610 and M110, over the 8-day study window. Structurally, it organizes key operational metrics—including total production plans, recorded actuals, achievement percentages, remaining gaps, dispatch totals, returns, and transportation costs—side by side. This comprehensive layout directly isolates the severe performance divergence between the lines, demonstrating how the M110 line drives the majority of the plant's production shortfall despite its smaller absolute plan volume, thereby supplying the empirical evidence required for objective-driven prioritization.

TABLE III. REPEATED OPERATIONAL CONSTRAINTS AND INFORMATION-FLOW GAPS

| **Constraint Category** | ***Frequency (Out of 8 Days)*** | ***Representative Text Example*** | ***Operational Imapct & Information-Flow Gap*** |
|---|---|---|---|
| Manpower Constraints | 8 / 8 days (100%) | "MP Late and Shortage" | Standing plant-wide condition; lacks structured owner assignment or tracking. |
| Equipment & Quality | 4 / 8 days (50%) | "Projection Welding issue" | Recurs consecutively (19–22 May); indicates lingering technical faults unescalated by free text. |



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International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14, Issue 12, UCBO - 2026

| Constraint Category | *Frequency (Out of 8 Days)* | *Representative Text Example* | *Operational Imapct & Information-Flow Gap* |
|---|---|---|---|
| Material Variation | 2 / 8 days (25%) | "U pipe Vriation" | Directly coincides with M310/W610's lowest achievement day (24 May). |
| Equipment Disruption | 1 / 8 days (12.5%) | "New Robo instalation" | One-off capital/setup event compounding low output days without formal duration logging |
| Equipment Disruption | 1 / 8 days (12.5%) | "New Robo instalation" | One-off capital/setup event compounding low output days without formal duration logging |

This table synthesizes and categorizes the recurring operational disruptions captured within the daily open-text 'Issues' log of the PPC workbook. Structurally, it maps each identified constraint category—manpower shortages, equipment/welding issues, material variations, and setup disruptions—against its exact empirical frequency out of the 8 recorded days, representative log entries, and associated operational impacts. By transforming unstructured text notes into structured frequency counts and operational insights, the table exposes systemic shop-floor bottlenecks that persist unmanaged under the current manual reporting framework.

TABLE IV. PROPOSED DIGITAL PPC FRAMEWORK WITHIN IMOC

| Framework Layer | *IMOC Architecture Module* | *Proposed Digital Capability* | *Data Dependency / Prerequisite* |
|---|---|---|---|
| Data Input Layer | Production Monitoring | Shift-wise actual and dispatch entry | Manual touchpoints transitioning to barcode/QR scanning |
| Data Validation Layer | Executive Command Centre | Automated range and consistency checks | Replaces retrospective manual checks |
| Monitoring of | Production Monitoring | Continuous plan-vs- | Real-time shift output integration |
| Production Layer | | actual calculation | |
| Exception Management Layer | Command Centre / Alerts | Structured categorization and status tracking | Replaces free-text logs with root-cause codes |
| Visualization Layer | Executive Command Centre | Role-based operational dashboards | Live KPI rendering for plant management |
| Management Decision Layer | Plant Operations Control | Action workflow execution and closure | Defined escalation pathways and accountability |

This table outlines the structural design of the recommended digital intervention by mapping it directly into the six functional layers of the Integrated Manufacturing Operations Centre (IMOC) architecture. Structurally, it connects each stage of the manufacturing control process—ranging from data input and automated validation to real-time production monitoring, exception management, and role-based visualization—with its corresponding IMOC module and data dependency. This comprehensive mapping demonstrates how moving from manual touchpoints to digital automation establishes the necessary technical foundation for real-time plant visibility and decision-making.

TABLE V. POTENTIAL BUSINESS BENEFITS AND DIDGITAL KANBAN INTEGRATION

| Scenario Model | *Assumed Recovery Rate* | *Recoverable Units (from 649-Unit Gap)* | *Business Impact & Valuation Mechanism* | *Future Digital Kanban Scope* |
|---|---|---|---|---|
| Conservative | 10% | 64.9 units | Incremental Volume = 64.9 × Contribution/U; Net Benefit = Contribution minus Digitalisation Cost. | Material consumption tracked against automated reorder thresholds. |
| Moderate | 20% | 129.8 units | Scaled sensitivity model demonstrating moderate plant recovery potential. | Automated trigger generation upon reaching safety |



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ISSN: 2278-0181
Vol. 14, Issue 12, UCBO - 2026

| Scenario Model | *Assumed Recovery Rate* | *Recoverable Units (from 649-Unit Gap)* | *Business Impact & Valuation Mechanism* | *Future Digital Kanban Scope* |
|---|---|---|---|---|
| | | | | stock levels. |
| Optimistic | 30% | 194.7 units | Upper-bound volume recovery reflecting maximum efficiency gains under digital control. | Supplier portal integration for automated advance shipping notices (ASNs). |

This table models the potential operational recovery and business value of process digitalization while defining the functional scope for future supply chain extensions. Structurally, it presents a transparent, scenario-based volume model (conservative 10%, moderate 20%, and optimistic 30% recovery rates) applied against the 8-day combined production gap of 649 units, translating percentage improvements into concrete recoverable unit quantities. Additionally, it outlines the sequential operational steps required for future Digital Kanban and supplier portal integration, bridging internal shop-floor control with external material replenishment.

## V. FINDINGS,CONCLUSIONS AND SUGGESTIONS

### *A. Findings*

The empirical analysis of the 8-day operational dataset (18–25 May 2026) at Belrise Industries Limited, Plant Bhamboli, reveals significant performance disparities and structural vulnerabilities within the current manual Production Planning and Control (PPC) function. Specifically, combined production achieved 73.83% of the plan (1,831 units produced against 2,480 planned), while dispatch performance reached 69.68% (1,512 units dispatched against 2,170 planned), resulting in a combined production shortfall of 649 units. Performance was heavily skewed between lines: the M310/W610 line maintained a stable production achievement of 85.38%, whereas the M110 line recorded an alarming achievement of only 40.63%, accounting for 58.6% of the total plant gap despite carrying a much smaller absolute plan volume. Furthermore, constraint mapping demonstrated that manpower shortages and late shift starts appeared on 100% of the recorded days, while welding and component variations recurred without structured tracking. The investigation confirmed that the existing manual Excel-based monitoring process creates a critical reporting gap, delaying visibility until next-day reviews when proactive intervention is impossible. Consequently, the proposed Digital PPC framework within the Integrated Manufacturing Operations Centre (IMOC) architecture is both justified and necessary, providing automated plan-versus-actual tracking, structured exception management, and scenario-based production recovery capabilities to eliminate operational blind spots and optimize shop-floor visibility.

### *B. Conclusions*

This project-based On-the-Job Training study successfully evaluated the production planning and control (PPC) process at Belrise Industries Limited, Plant Bhamboli, through a comprehensive empirical examination of shop-floor performance and information-flow mechanisms. The findings conclusively establish that while the M310/W610 line operates with stable efficiency, the M110 line suffers from severe, systemic underperformance, driving the majority of the plant's 649-unit production shortfall. Moreover, the heavy reliance on manual, spreadsheet-based tracking and unstructured free-text issue logs creates a critical operational blind spot, delaying the visibility of plan variances until next-day reviews when corrective action is no longer feasible. By systematically addressing the five research objectives, this study demonstrates that upgrading to a structured digital monitoring framework within the Integrated Manufacturing Operations Centre (IMOC) architecture is essential. The proposed digital intervention—featuring automated plan-versus-actual calculations, role-based visualization dashboards, and standardized exception management—will eliminate reporting lags, improve cross-functional transparency, and establish a scalable foundation for future Digital Kanban integration. Ultimately, this research provides plant management with an evidence-based roadmap to optimize manufacturing throughput and enhance competitive delivery reliability.

### *C. Suggestions*

To address the operational gaps identified at Belrise Industries Limited, Plant Bhamboli, several practical, stakeholder-oriented suggestions are recommended. For **PPC Planners and Shop-Floor Supervisors**, the plant should immediately replace the unstructured free-text 'Issues' column with a standardized dropdown menu and severity-tagging system in daily tracking sheets, enabling instant root-cause classification for recurring constraints like manpower shortages and welding defects. For **Plant Management and IT Stakeholders**, capital allocation should prioritize the phased rollout of the proposed IMOC monitoring module, starting with automated shift-wise data entry and mobile tablet integration at line-side stations (particularly targeting the underperforming M110 line) to eliminate next-day reporting lags. For **Supply Chain and Store Teams**, management must expedite the integration of the Digital Kanban module with key component suppliers (such as U-pipe vendors) to automate reorder triggers based on actual consumption, thereby mitigating material-availability stoppages. Finally, for **Human Resources and Training Stakeholders**, structured skill-enhancement programs should be implemented to address chronic manpower lateness and operator training needs on new robotic equipment. These actionable steps will empower all organizational tiers to transition from reactive firefighting to proactive, data-driven manufacturing control.

### *D. Implications of the study*

The findings of this study carry distinct, practical implications across key organizational stakeholders at Belrise Industries Limited. For **PPC Planners and Line Supervisors**,



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Vol. 14, Issue 12, UCBO - 2026

transitioning from retrospective spreadsheet tracking to real-time digital monitoring eliminates manual reporting lags, enabling them to detect shortfalls intra-shift and implement immediate corrective actions. For **Plant Management and Executives**, the research provides a transparent, evidence-based foundation to justify capital allocation for the IMOC framework, ensuring resources are strategically directed toward high-deficit areas like the M110 line rather than deployed blindly. For **Shop-Floor Operators and Production Crews**, standardized exception logging and structured root-cause tracking reduce recurring friction points—such as manpower shortages and welding defects—fostering a more stable and predictable working environment. Finally, for **Supply Chain and External Tier-1/Tier-2 Suppliers**, future integration through Digital Kanban and automated supplier portals enhances material visibility, minimizes inventory bottlenecks, and strengthens overall delivery reliability and collaborative partnerships with OEM customers.

### *E. Future Scope of the study*

Building upon the foundational digital PPC framework established in this study, several avenues remain open for future research and plant-level expansion. First, future studies can extend the empirical observation window beyond the initial 8-day snapshot to encompass multi-month operational cycles, validating whether the production and dispatch variances observed on the M110 and M310/W610 lines persist over longer durations. Second, subsequent phases of the project can implement and pilot the full Integrated Manufacturing Operations Centre (IMOC) architecture—integrating IoT-based automated counting sensors, computer vision for quality inspection, and predictive maintenance models to capture downtime hours and in-process rejections currently unavailable in manual sheets. Third, researchers can focus on deploying and testing the Digital Kanban and Supplier Portal modules in a live supply chain environment to measure lead-time reductions and inventory optimization. Finally, future work can incorporate real enterprise cost structures to perform a complete financial ROI and cost-benefit analysis of full-scale manufacturing digitalization.

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