OPERATIONS MANAGEMENT ASSIGNMENT

Quality Control, Project Scheduling, and Operational Performance Management

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Executive Summary

This assignment assesses the concepts of quality control, project scheduling and operational performance management, using a case study of DHL Group's Post & Parcel Germany division with a focus on Germany. Uses Total Quality Management (TQM), Six Sigma, Statistical Process Control (SPC), capacity planning and PERT/CPM scheduling for a proposed parcel-center improvement project. According to DHL's published results, the company's parcel volume in 2025 was 2,024 million, a 11.7% rise from 2024, and parcel revenue rose 11.2% to €8,157 million (DHL Group, 2026a). The expansion allows for new opportunities, but also requires a need for consistent sorting, adaptable capacity and staffing plans for the seasons.

For the practical analysis, a simulated data set is used that includes 25 baseline samples (of 500 parcels each) and 1 signal-day sample. The percentage of the baseline defect is 3.856, the upper control limit for the p-chart is 6.439. The simulated signal-day defect rate is 8.6% which exceeds the upper control limit, suggesting that management should be concerned that there is a possible special cause and should not assume it is a stable process. The separate capacity scenario indicates that 84.6% of the capacity would be used during normal periods, but 115.4% would be used during peak periods with a daily capacity gap of 10 000 parcels. The PERT/CPM schedule estimates the project will take 22.83 weeks with A–B–C–F–G–H–I–J on the critical path.

The assignment suggests implementing the culture of continuous improvement as part of TQM across the entire organisation, combined with specific Six Sigma projects; keeping a live SPC dashboard; having flexibility with peak capacity; and applying quality gates prior to scaling automation. All Centre level data and project estimates are academic assumptions and are not DHL information. Introduction | Theoretical Framework & Operational Models

Introduction | Theoretical Framework & Operational Models

Operations management transforms resources, such as people, equipment, technology, information and materials, into products and services. The service level in parcel logistics is felt by the customer, but is dependent on the inbound collection, the barcode capture, sorting, linehaul, the depot handling and the last-mile delivery. If a failure occurs early, it can lead to misrouting and rework, delivery windows missed, customer complaints, and extra transport costs. Operations management involves coordinating capacity, designing processes, supplier performance, quality assurance and employee capability.

The German company DHL Group is suitable as a case study because the company Subsidiary Post & Parcel Germany has a nationwide transport, sorting and delivery network. The Annual Report 2025 shows revenue of €17.874 billion for the division (+3.0%) and €8.157 billion for Parcel Germany (+11.2%). The German volumes of parcels reached 2.024 billion (+11.7% YoY), (DHL Group, 2026a). The company also says there is a distinct fourth quarter parcel peak – indicative of seasonal demand. Parcel revenue amounted to €4.077 billion (6.8% higher than the first half of 2025) and parcel volume to 994 million pieces (3.9% higher than the first half of 2025) during the first half of 2026. Post & Parcel Germany EBIT, however, declined by 10.6% to €399 million in H1 2026, leaving increased transport and staff costs as some of the pressures noted by DHL (DHL Group, 2026b). Capacity and process efficiency is strategically important due to the combination of volume growth and cost pressure.

TQM is a customer-focused management approach in which employees across the organisation participate in continuous improvement. It relies on leadership commitment, employee involvement, process discipline and the use of evidence to improve products and services (American Society for Quality [ASQ], n.d.-c). Six Sigma is more project-focused and uses structured analysis to reduce defects and process variation. Its DMAIC sequence is Define, Measure, Analyse, Improve and Control

(ASQ, n.d.-b). TQM creates the culture and governance for quality, while Six Sigma provides a disciplined method for solving specific recurring problems. They should be integrated rather than treated as competing alternatives.

SPC uses data collected in time order to distinguish common-cause variation from unusual special-cause variation. A control chart displays the process statistic, Centre line, upper control limit (UCL) and lower control limit (LCL) (ASQ, n.d.-a). A p-chart is appropriate when the quality outcome is a proportion of defective units, such as parcels with an incorrect destination label or unreadable barcode. According to the National Institute of Standards and Technology (NIST, n.d.), the p-chart limits are based on the binomial model and the estimated defective proportion.

Project scheduling brings improvement activities into alignment and exposes the dependencies. The expected time of PERT is calculated as: $(O + 4M + P)/6$, where O is optimistic duration, M is expected duration and P is pessimistic duration. CPM is used for determining the longest sequence of dependent activities. It is true that activities on the critical path have no total float – any delay on one of these will cause the project completion date to be delayed (Kramer & Jenkins, 2006). The following methods are applicable where automation and software integration are required to occur in a sequential manner because training and operational validation needs to be done in sequence.

Practical Calculations & Scenario Analysis

Any published operating facts are set apart from any calculated figures. The number of DHL Parcel Germany delivered items increased from 1,812 million in 2024 to 2,024 million in 2025. Over the same period, the revenues of parcels Germany increased from €7,339 million to €8,157 million. The volume of the division's mails went in the other direction: there was a decrease in traditional letter and an increase in digital substitution (DHL Group, 2026a). This implies that the capacity of parcels needs to be increased and timetabled assuming that not all postal work has the same demand characteristics. DHL also says that in 2025, it expects that about 97% of domestic letters will be

delivered within three working days and 99% within four working days. These are letter-service measures, and should not be incorrectly used as indicators for parcel delivery rates.

In SPC exercise 25 preliminary samples of 500 parcels are drawn from every day. The number of defective parcels in the baseline samples totals 482 out of 12,500 inspected, so p-bar = 482 / 12,500 = 0.03856, or 3.856%. With equal sample size n = 500, the standard error is sqrt[p-bar(1 − p-bar)/n] = 0.00861. The three-sigma limits are UCL = 0.03856 + 3(0.00861) = 0.06439 (6.439%) and LCL = 0.03856 − 3(0.00861) = 0.01273 (1.273%). The simulated day 26 sample of 500 parcels includes 43 that are defective, or 8.6% defective, which is above the UCL. This is an indicator that needs to be investigated if the scanner alignment is incorrect, the print quality on the labels is poor, there is an induction congestion, or the operator hand over is incorrect. The cause cannot be determined from the chart alone, and must be determined with the aid of a check sheet and root cause analysis.

Control limits for the chart are not customer specifications or management targets. The p-chart is used to determine if the process is statistically stable, while a target (2% defect) asks if the performance is good enough. Even if the process is stable, it may not be able to achieve the demanding target. This is a simulated 25-day baseline therefore, a real implementation should collect representative data across shifts, parcel types and during peak periods; be transparent in removing confirmed special causes and then recalculate limits when the process is stable.

The capacity planning is based on a hypothetical parcel Centre with a normal daily demand of 55,000 parcels, designed capacity of 65,000 parcels and peak demand of 75,000 parcels. Normal utilization = 55,000 / 65,000 = 84.6%. Peak utilization = 75,000 / 65,000 = 115.4%, meaning demand exceeds rated capacity by 10,000 parcels per day. The center should not be based on an excess capacity for a short season. Instead, management will mobilize temporary work crews and shift hours, and approve excess facilities and line haul contingencies — while keeping safety and quality standards intact.

There is an example to learn: Consumables. If the labels are used at the rate of 2,400 per day, the supplier lead time is five days, and the safety stock is two days of use, then the safety stock is 4,800 labels. Reorder point = daily usage × lead time + safety stock = (2,400 × 5) + 4,800 = 16,800 labels. The reorder point must be calculated based on inventory position, not just physical stock, in order to take into account open purchase orders.

A proposed upgrade of the quality control is to be implemented with the help of PERT/CPM. This involves the project charter, process mapping, procurement of scanners, development of the dashboard, redesign of the SOPs, installation, pilot, audit and validation, shift training, and acceptance audit and closure. The three-point estimates are used to get expected activity durations. This gives an expected project duration of 22.83 weeks. The critical path is A–B–C–F–G–H–I–J, the float on the dashboard branch (D) is ~1.33 weeks and the float on the SOP redesign (E) is ~5.33 weeks. The critical path procurement and installation milestones should be tracked weekly by management, and all work not on the critical path should be given float to ensure the final date.

Discussion & Managerial Implications

Production quality and speed are inextricably linked as can be seen in the DHL case. An increase in parcel volumes may help to optimize network utilization, but if demand increases, so too may the risk of queues, mis-sorts, overtime and late dispatch. The results of the H1 2026 are based on the distribution of parcels and the volume of parcels delivered, as well as the EBIT generated by Post & Parcel Germany, which is lower than in H1 2025 (DHL Group, 2026b). So, the primary goal of operational improvement should not be throughput per volume, but rather throughput per labor hour, first-time sorting accuracy, equipment availability and equipment cost per parcel.

Toyota does offer a manufacturing comparison. It is based on Just in Time and jidoka in its Production System. Just-in-Time optimizes the flow of the necessary materials, and jidoka allows for any abnormalities to be identified, and the process stopped so that defects aren't propagated.

Toyota also stresses on daily kaizen (Toyota Motor Corporation, n.d.). In parcel operations, the same principles apply: Make sure that the appropriate parcels and information are moving to the appropriate process stages at the right time, and if the label is illegible or doesn't match, send it to an exception process instead. But a lean system that has few buffers can be susceptible to equipment or supplier disruptions. Critical scanner parts and parts consumed, then, require risk-based safety stock.

TQM is best suited for establishing a shared responsibility, standard work and continuous employee involvement. Six Sigma is more suitable when the defect occurs regularly, is expensive, or occurs as a statistical trend. For instance, the simulated signal-day event needs to be contained, analyzed through DMAIC - define the defect, measure the baseline, analyse causes, improve the scanner or label controls, and maintain the gains via control charts and audits. Launching the entire network on a rush could reduce implementation time, but result in more rework and service failures. A limited pilot provides a better trade-off between speed-to-market and quality assurance - and has a clear go/no-go criteria.

Operational Control Scheme & Performance Dashboard

The suggested control scheme provides ownership at each level. Unreadable labelling and damaged parcels/misroutes are recorded at induction. Exception rates and capacity are checked by shift supervisors. P-chart and corrective action review is done daily by the quality manager. Engineering reviews availability of equipment and calibration of scanners. Seasonal demand reviews are done in the weekly network planning review, staffing and overflow capacity reviews are done on a weekly basis, and cost per parcel, customer complaints, safety and project benefits are reviewed monthly by senior management.

On-time delivery, sorting accuracy, defective parcel rate, normal and peak capacity utilisation, equipment availability, first-attempt delivery, complaints per 10,000 parcels and cost per parcel are among the metrics included on the proposed dashboard. Example baseline and target values in the

workbook are simulated and/or proposed values, not DHL-reported. Red or amber exceptions should result in a named owner, due date and documented corrective action. The data collected must come from scan events, maintenance logs, staffing information, cases recorded in the Customer service system and inventory systems, and must be reconciled daily to avoid mis-scanned items from skewing performance results.

There is a need for Quality Gates to control the speed to market as follows: (1) Up to Design Approval & Risk Assessment; (2) Equipment & Data Integration Tests; (3) Pilot Acceptance to ensure up to sorting accuracy, safety and uptime thresholds; (4) Training and competency checks during shift; (5) Scale-up and post implementation review. No just because the schedule is on can it be approved by the project sponsor for rollout. It also must be demonstrated that the process has good quality stability and that the work is safe.

Conclusion & Recommendations

The parcel business of DHL Group in Germany is being put to a direct test with regard to operations: the number of parcels is rising; demand is peaking seasonally and pressures on costs demand productivity and quality. It demonstrates how an unusual defect signal can be detected by the analysis, how a shortfall in capacity is identified during the capacity calculations and how the PERT/CPM identifies activities that are critical for the implementation date. The quantitative outputs listed are only illustrative teaching models and not an indication of the performance of DHL's internal Centre.

A recommended strategy is to develop a TQM culture, use Six Sigma for high impact defects that occur repeatedly, maintain a p-chart for monitoring the quality of parcels, and use flexible peak capacity—rather than permanent overcapacity—capacity. Management should ensure that the critical path is protected; Risk-based safety stocks for critical consumables; balanced dashboard linking quality, speed, cost, safety, customer outcomes. To start the rollout faster without compromising the

service reliability, a staged pilot and verified quality gates can help to improve operational performance.

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Appendix A – Published DHL Operational Facts

Published facts from DHL Group's 2025 Annual Report and 2026 Half-year Report. Letter delivery performance is not parcel on-time performance.

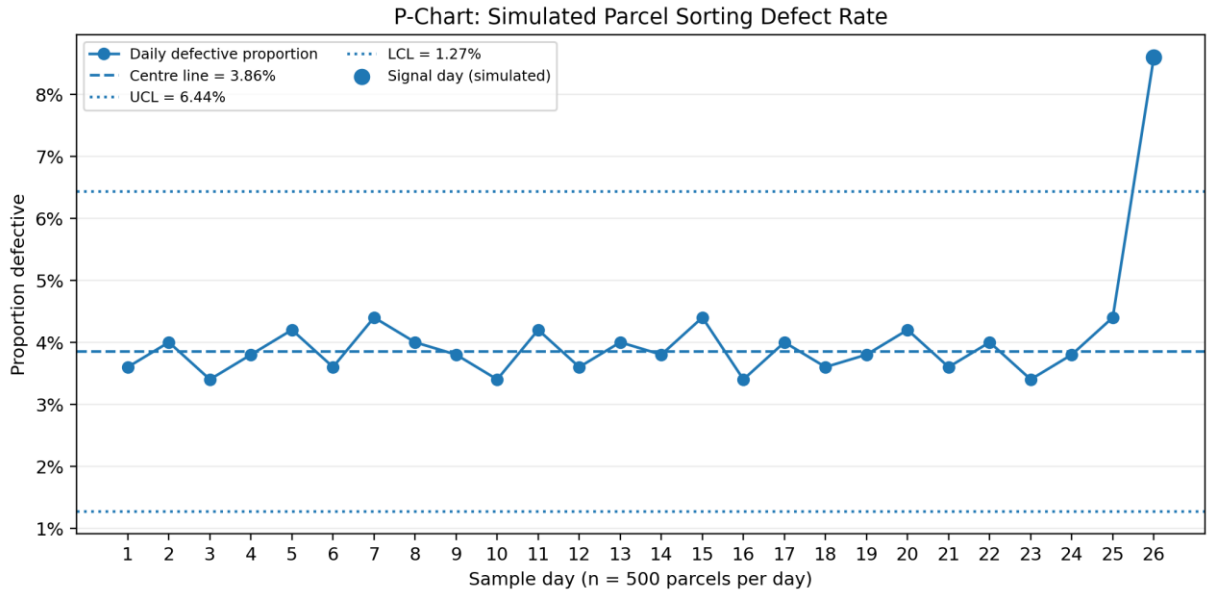
DHL Group – Published German Operations Facts

Published indicator	2024	2025	Change / note
Post & Parcel Germany revenue (€m)	17,347	17,874	+3.0%
Parcel Germany revenue (€m)	7,339	8,157	+11.2%
Parcel Germany volume (million items)	1,812	2,024	+11.7%
H1 2026 Parcel Germany revenue (€m)	—	4,077	+6.8% vs H1 2025
H1 2026 Parcel Germany volume (million items)	—	994	+3.9% vs H1 2025
H1 2026 Post & Parcel Germany EBIT (€m)	—	399	−10.6% vs H1 2025

Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Appendix B – SPC P-Chart Data and Control Chart

The 25 baseline samples and the simulated signal day demonstrate p-chart limits. All observations are hypothetical.



Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

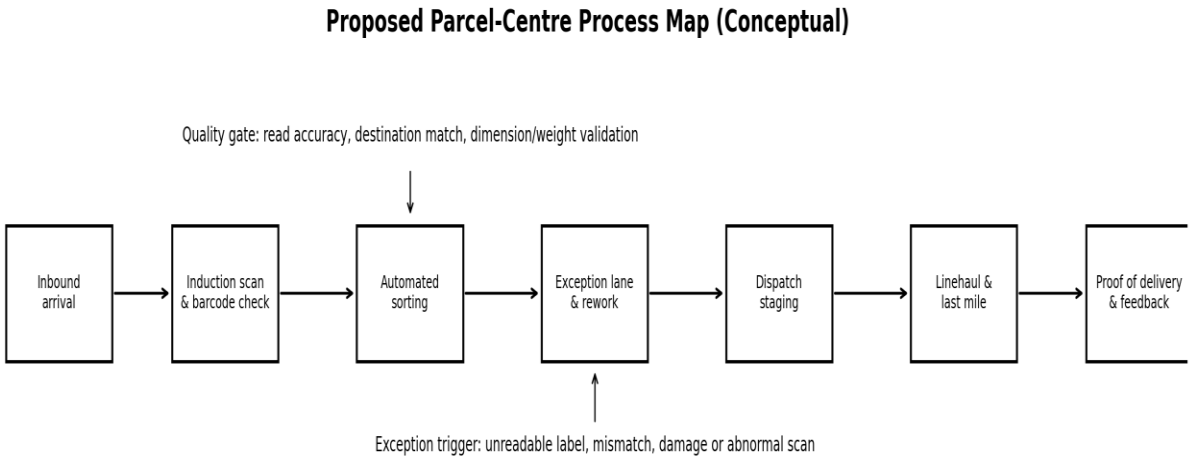
Excel Output – P-Chart Baseline and Signal Assessment

Measure	Result	Interpretation
Baseline sample days	25	Each subgroup contains 500 parcels
Total baseline defects	482	12,500 parcels inspected
Centre line (p-bar)	3.856%	Average defective proportion in baseline
Upper control limit	6.439%	Three-sigma upper control limit
Lower control limit	1.273%	Three-sigma lower control limit
Signal day proportion	8.6%	43 / 500; above UCL

Excel-generated output 2. Source: assignment workbook; simulated inputs are labelled.

Appendix C – Parcel-Centre Process Map

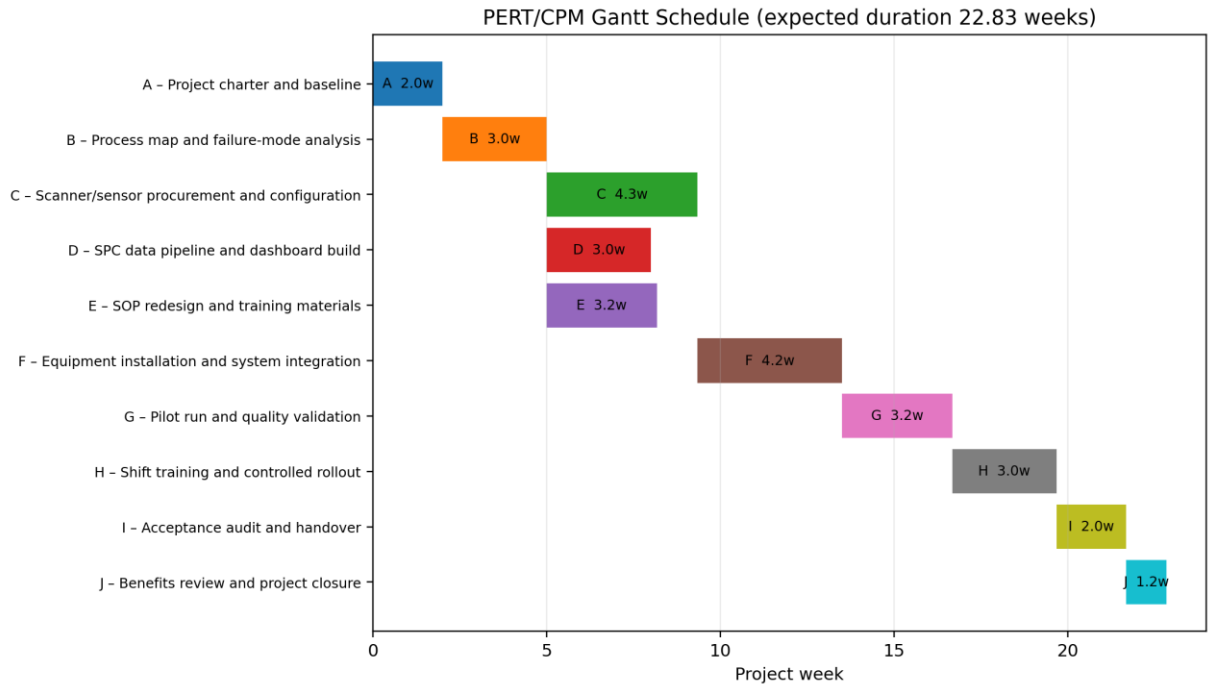
Conceptual process map proposed for a parcel processing Centre; it is not a proprietary DHL process diagram.



Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Appendix D – PERT/CPM Activity Schedule and Gantt Chart

Expected activity durations, early/late dates and total float are calculated from illustrative three-point estimates.



Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Excel Output – PERT/CPM Schedule

ID	Activity	Expected weeks	ES	EF	LS	LF	Float	Critical
A	Project charter and baseline	2.00	0.00	2.00	0.00	2.00	0.00	Yes
B	Process map and failure-mode	3.00	2.00	5.00	2.00	5.00	0.00	Yes
C	Scanner/sensor procurement a	4.33	5.00	9.33	5.00	9.33	0.00	Yes
D	SPC data pipeline and dashboa	3.00	5.00	8.00	6.33	9.33	1.33	No
E	SOP redesign and training mat	3.17	5.00	8.17	10.33	13.50	5.33	No
F	Equipment installation and syst	4.17	9.33	13.50	9.33	13.50	0.00	Yes
G	Pilot run and quality validation	3.17	13.50	16.67	13.50	16.67	0.00	Yes
H	Shift training and controlled rol	3.00	16.67	19.67	16.67	19.67	0.00	Yes
I	Acceptance audit and handove	2.00	19.67	21.67	19.67	21.67	0.00	Yes
J	Benefits review and project clo	1.17	21.67	22.83	21.67	22.83	0.00	Yes

Excel-generated output 2. Source: assignment workbook; simulated inputs are labelled.

Appendix E – Capacity and Consumables Model

Normal/peak volume, capacity and reorder-point inputs are illustrative planning assumptions.

Excel Output – Capacity and Reorder Point

Measure	Model output	Interpretation
Normal volume	55,000 parcels/day	84.6% of capacity
Peak volume	75,000 parcels/day	115.4% of capacity
Rated capacity	65,000 parcels/day	Illustrative one-centre capacity
Peak capacity gap	10,000 parcels/day	Temporary capacity required
Safety stock	4,800 labels	2 days × 2,400 labels/day
Reorder point	16,800 labels	2,400 × 5 + 4,800

Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Appendix F – TQM versus Six Sigma Comparison

Comparison of the two quality approaches and their complementary application.

TQM and Six Sigma – Comparative Operating Model

Dimension	TQM	Six Sigma	Recommended use
Primary purpose	Long-term customer satisfaction and continuous improvement across	Reduce process variation and defects using data and a defined improv	Embed a quality culture while selecting targeted projects for high-cost s
Scope	Organisation-wide; involves all functions and employees.	Usually project-based; focuses on measurable process problems.	TQM ownership across operations; Six Sigma project for scanner/sortatic
Core methods	Customer focus, employee participation, leadership, process approach	DMAIC: Define, Measure, Analyse, Improve, Control; statistical tools ar	Use daily huddles and standard work plus DMAIC for repeated defect pa
Measurement	Balanced operational and customer indicators.	Baseline, defect rate, variation, capability and verified financial/operat	Use p-chart, sorting accuracy, complaints, rework and cost per parcel.
Strength	Builds shared ownership and sustained improvement.	Creates disciplined problem solving and measurable results.	Avoid treating Six Sigma as a substitute for leadership or employee invo
Limitation	Can become vague without owners, data and measurable targets.	Can be slow or over-engineered for simple problems; requires skills an	Use proportional governance: rapid containment first, then full DMAIC fo
Speed-to-market trade-off	Encourages prevention and learning but broad participation can requi	Structured validation can extend launch time but reduces repeat failu	Pilot in one shift, set quality gates, then scale when accuracy and safety

Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Appendix G – Operational KPI Dashboard

Proposed targets and simulated baselines for one hypothetical parcel Centre; not published DHL KPIs.

Excel Output – Proposed Operational KPI Dashboard

KPI	Illustrative baseline	Proposed target	Status
On-time parcel delivery	94.8%	97.5%	Action
Sorting accuracy	96.1%	99.0%	Action
Defective parcel rate	3.9%	2.0%	Action
Normal capacity utilisation	84.6%	80.0%	On target
Peak capacity utilisation	115.4%	95.0%	Action
Equipment availability	96.5%	98.0%	Action
First-attempt delivery	93.2%	96.0%	Action
Complaints per 10,000 parcels	13	10	Action
Cost per parcel (€)	€1.45	€1.40	Action

Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.

Appendix H – Operational Risk Register

Qualitative risk scores are planning judgements for the proposed project.

Excel Output – Main Operational Risks

Risk	L	I	Score	Key mitigation
Q4 parcel volume exceeds rated centre capacity	4	5	20	Pre-book flexible labour, additional shift, overflow
Scanner calibration or barcode read failure	3	4	12	Daily verification, preventive maintenance, bypass
Supplier delay for labels or scanner spares	3	4	12	ROP, safety stock, approved alternate supplier and
Dashboard data latency or incomplete scans	3	4	12	Data validation, event logs, reconciliation and mar
Training inconsistency across shifts	3	3	9	Standard work, competency check, refresher traini
Pilot speed compromises safety or quality gate	2	5	10	No-go criteria, safety review, pilot containment an

Excel-generated output 1. Source: assignment workbook; simulated inputs are labelled.