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Data Analysis Report

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Quality Assurance 344

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Introduction

This report applies a statistical workflow to retail and service data to identify variation, quantify risk, and inform decisions consistent with ECSA outcomes. A baseline is established, then Statistical Process Control is applied to product streams using Western Electric Rules A to C to test the capability against a set VOC. Producer's and consumer's risks are analysed via Type I and II error and a targeted data correction rerun is tested. Using ANOVA the link between quality and economics by optimising barista staffing under reliability, and cost constraints on delivery times is explored.

Descriptive Analytics

The data spans three tables, customers having 5000 entities, products having 60 entities, and sales logs having 100 000 rows. The products that the dataset covers are, operations, prices, and time-series sales. Product cover categories namely Cloud Subscription, Keyboard, Laptop, Monitor, Mouse, Software. All appear in equal numbers, indicating either a deliberately stratified catalogue or a decision that avoids categorical imbalance.

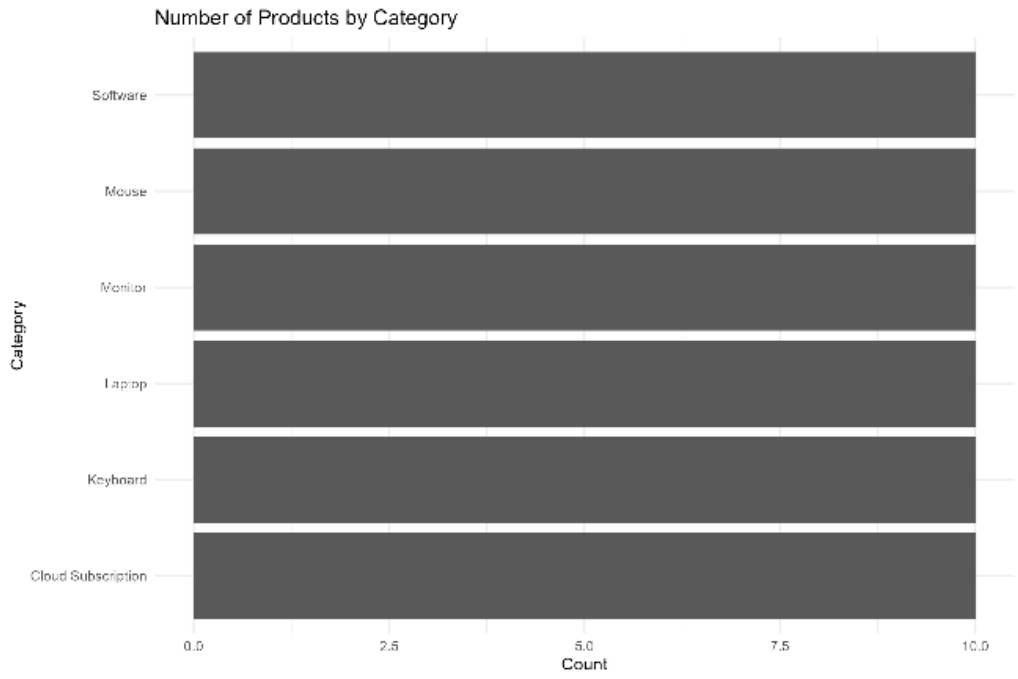


Figure 1: Products by category

Customer Age and Income are well populated with no missing values. Products exhibit a Markup centred at 20.46 (IQR = 9.57) and a highly skewed SellingPrice, with 10 out of 60 (16.7%) price outliers that is consistent with a few high-ticket items. The sales table has Quantity IQR = 20 and Delivery hours IQR = 13.50.

Table 1: Data summary

Category	Mean	Standard Deviation	Median
Age (years)	51.55	21.22	51.00
Income (R)	80 797.00	33 150.11	85 000.00
Markup (pp)	20.46	6.07	20.34
Selling Price (R)	4 493.59	6 503.77	794.19
Quantity (units)	13.50	13.76	6.00
Delivery Hours (h)	17.48	10.00	19.55

Missingness is limited to 560 out of 100 000 rows (0.56%) in the sales log. Delivery vs picking hours has a moderate-strong relationship with $r = 0.583$, while Quantity is essentially uncorrelated with $|r| < 0.005$, suggesting that workflow duration drives delivery performance.

Delivery lead time is clearly bimodal as there is a dense mass between roughly 15 and 30 hours with a centre in the low 20s. A distinct spike near 0 to 2 hours separated by a gap suggests two fulfilment regimes, possibly an instant and standard method. This could also be an indication of a flaw in the system.

Figure 2: Delivery hour distribution

Monthly sales quantities rise through 2022 then experience a sharp discontinuity around the turn of 2023 that is followed by partial recovery mid-2023 and softening toward years end. This might be more evidence of a systematic flaw rather than seasonality.

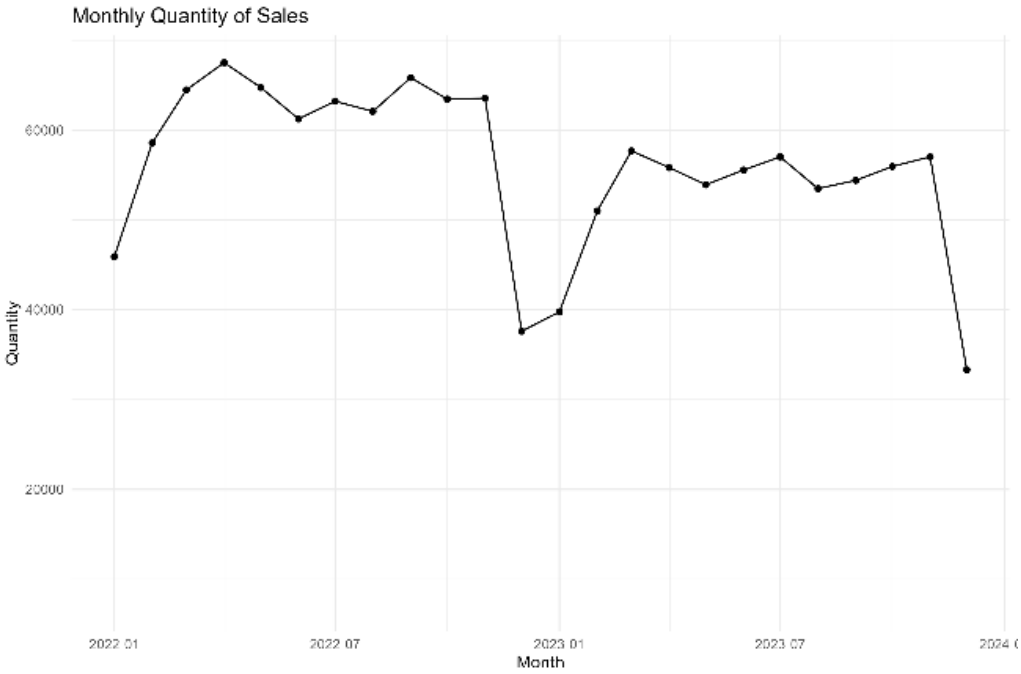


Figure 3: Monthly sales

Picking hours and delivery hours are positively associated with an evident linear component but also clustering into regimes. One at low times, one broad mid-range, and another at high picking times.

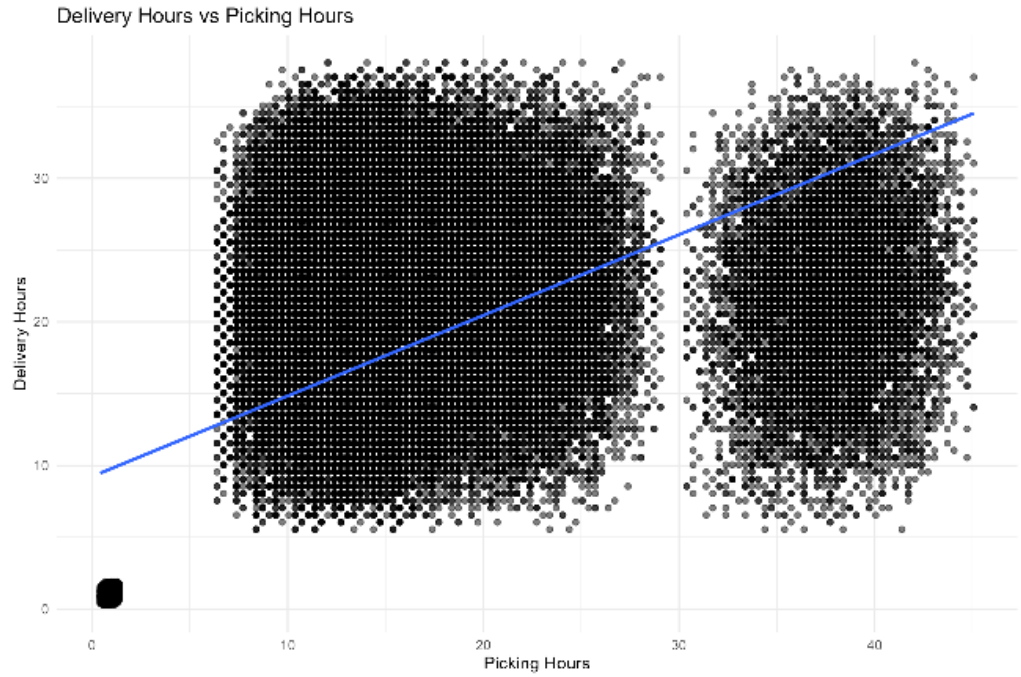


Figure 4: Delivery and picking hours

Pricing shows category specific mark-up structures as Cloud Subscriptions have the highest central tendency and wide IQR. Software and Keyboards are mid-to-high with moderate dispersion while Monitors and Laptops sit a bit lower down.

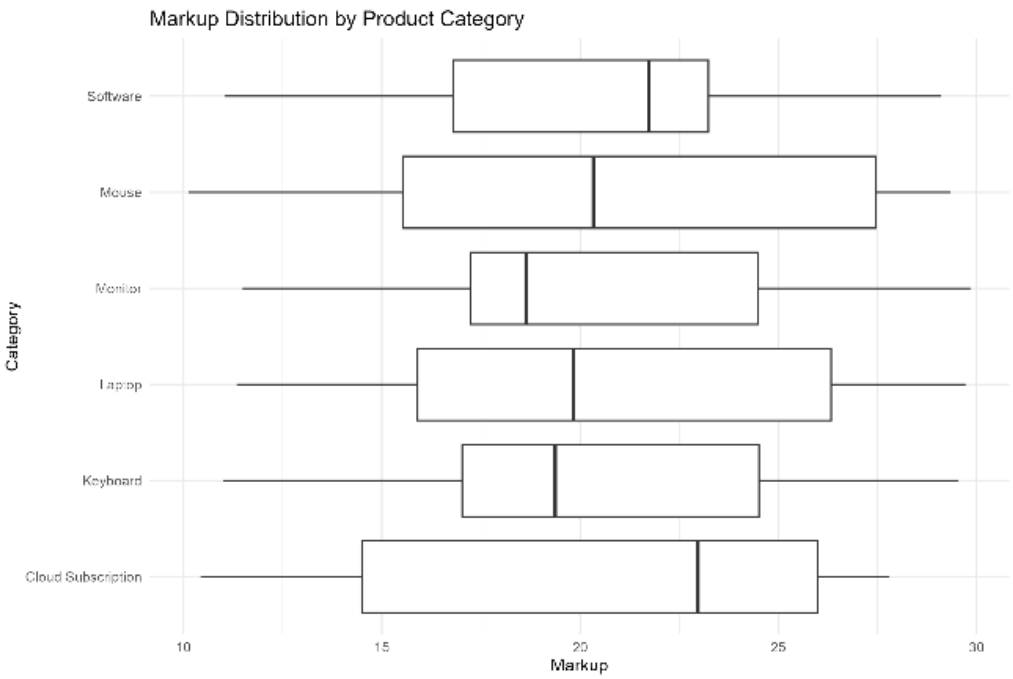


Figure 5: Product distribution

All together the figures indicate that there is a balanced product representation that has two fulfilment modes and took a probable sales shock around early 2023.

SPC Setup & Monitoring

Statistical Process Control (SPC) charts were developed to assess the consistency and stability of delivery times across all product types (*Short summary of SPC (Statistical Process Control) and Limits*, n.d.). The data was first arranged sequentially by date and order time to simulate real time process monitoring. Using this ordered data subgroups of 24 observations were created to represent rational samples for each product type. The first 30 samples were used to establish the initial process parameters like the centre line and the one, two, and three sigma control limits for both the X-bar ($\bar{x}$) and S-charts. These baseline limits were then applied to the remaining data to identify any samples that exceeded control boundaries or displayed abnormal variation patterns.

Across the 60 products the Phase-I limits were established and remaining subgroups monitored on $\bar{x}$ and S-charts (as seen in the table in the Appendix). Subsequent investigation yielded frequent $\bar{x}$ signals. Around 274 rule A and 290 rule C exceedances occurred across products in $\bar{x}$ charts. This is mainly concentrated in *MOU* and *SOF* items, while the S-chart was largely quiet.

From the first 1 000 deliveries, no stream was classified as capable under the 0 to 32h VOC requirement. Physical goods clustered around $C_{pk} = 0.56 - 0.59$, whereas software showed

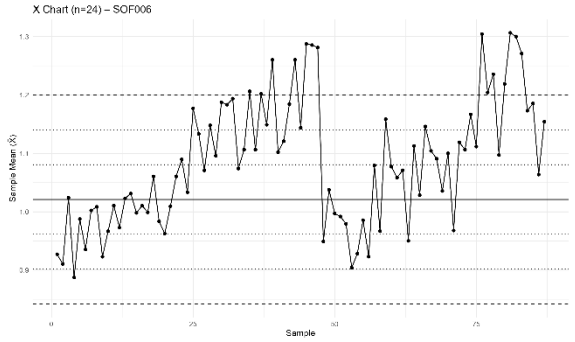
tight dispersion with higher potential ($C_{pk} = 1.18$) but was still flagged under the adopted standard.

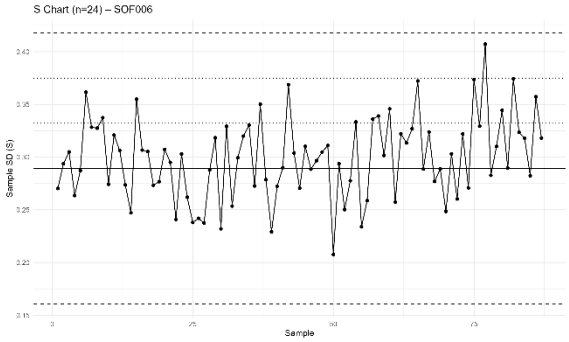
Signals clustered in specific families where short runs within ±1σ suggested intermittent instability rather than sustained control. By contrast, software items generally exhibited tighter scatter and cleaner short term behaviour, whereas physical goods showed drift episodes consistent with batching or logistics effects. The evidence is mixed as good signs include quiet S-charts and several streams exhibiting sustained operation within the ±1σ bands that suggest dispersion is under control and subgrouping was appropriate.

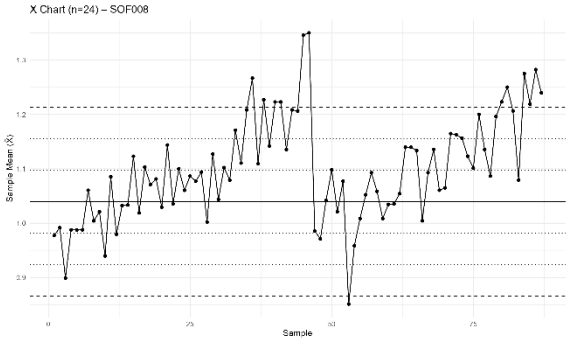
Bad signs are dominated by x̄ rule breaches and upper-band runs in specific families indicating mean shifts and drift episodes that undermine conformance. Capability for most physical goods remains below the 0 to 32h VOC.

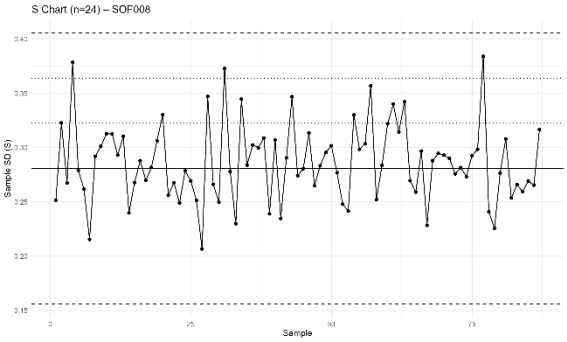
Inconclusive signs arise where signals are intermittent or borderline making it unclear whether observed deviations reflect true assignable causes or natural fluctuation. These cases warrant targeted follow-up before firm action is taken. Overall, variance is generally manageable, but mean shifts especially in *MOU* and several *SOF* lines drive most alarms.

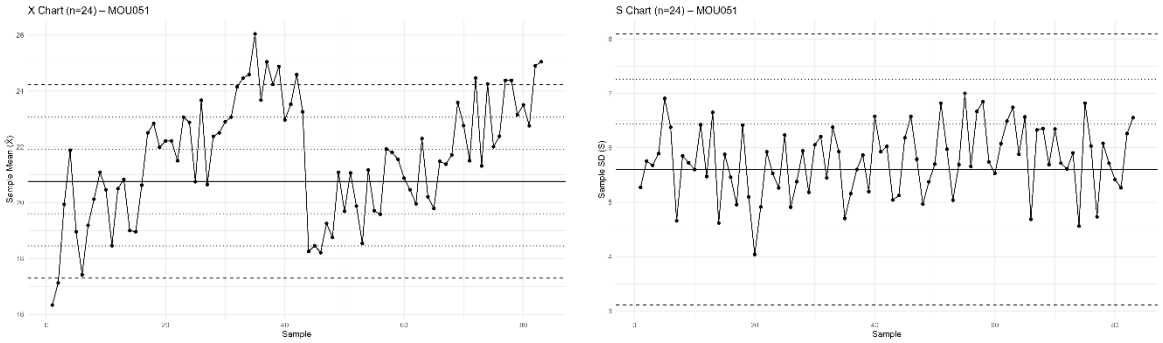
Unstable products such as *SOF006, SOF008, and MOU051* pictured below all exceed rule A allowances. (Full table can be seen in the Appendix)



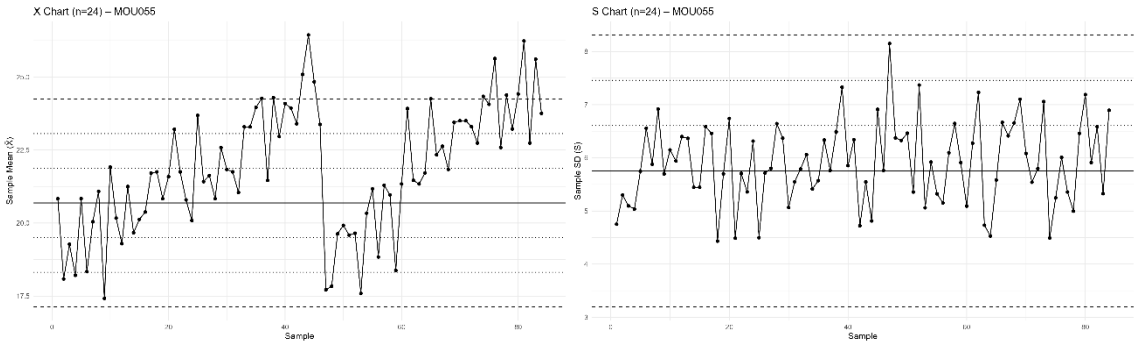




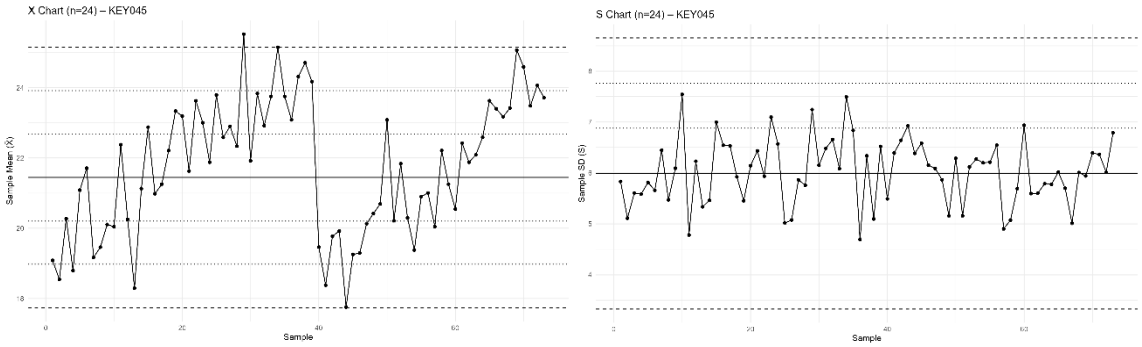




Products violating rule C include *MOU055, MOU053, SOF002*, and *MOU055*.



Whereas an example of a stable product would be *KEY045*.



A snapshot of the first 1 000 deliveries highlighting best C_{pk} (*SOF008, SOF003, SOF010, SOF009, SOF007*) and worst C_{pk} (*KEY049, KEY045, KEY050, LAP028, MOU053*) to support that most physical goods are off-centre while several *SOF* lines have tighter dispersion yet still fail VOC conformance.

Table 2: Product reliability

ProductID	mean	sd	Cp	Cpu	Cpl	Cpk
SOF003	1.07	0.295	18.0	34.9	1.21	1.21
SOF007	1.09	0.304	17.5	33.8	1.19	1.19
SOF008	1.08	0.292	18.2	35.2	1.23	1.23
SOF009	1.09	0.305	17.5	33.8	1.19	1.19
SOF010	1.07	0.296	18.0	34.80	1.20	1.20
KEY045	21.8	6.30	0.847	0.538	1.16	0.538

KEY049	22.0	6.31	0.845	0.529	1.16	0.529
KEY050	21.9	6.27	0.850	0.539	1.16	0.539
LAP028	21.8	6.23	0.856	0.544	1.17	0.544
MON035	21.5	6.09	0.875	0.575	1.18	0.575

Risk and Data Error Analysis

Type I (Manufacturer's) Error

Type I error rates for rule A, the per-sample false-alarm probability is 1 in 370 ($\alpha = 0.0026998$). For rule B, the probability of a point falling within ±1σ is $p_{in} = 0.682689$. The per-start probability for rule C is 5.35754×10^{-7}, meaning that such sequences should be exceedingly rare under pure randomness.

Type II (Consumer's) Error

Using the bottle-filling parameters, the control limits were set at UCL = 25.089 L and LCL = 25.011 L around a nominal mean of 25.05 L, with a process standard deviation of 0.013 L under control, the computed miss-detection rate is $\beta = 0.84$, implying only 16% power per subgroup and an out of control Average Run Length $(ARL_1) = 6.3$. The producer's risk remains low ($\alpha = 0.0027$), but the chart is relatively insensitive to 1.3σ shifts that exposes customers to prolonged off-target output unless sensitivity is increased.

Data Corrections & Re-analysis

The dataset was repaired by fixing "NA" prefixes and relabelling them to their correct category. The 10-SKU markup pattern was reapplied, and Category was aligned to ProductID. The corrected files *products_Headoffice2025* and *products_data2025* files were then generated for further assessment.

Revisiting the new data in the same manner as part 1, the outcomes are consistent with part 1's structure but cleaner. The delivery time distribution remains bimodal.

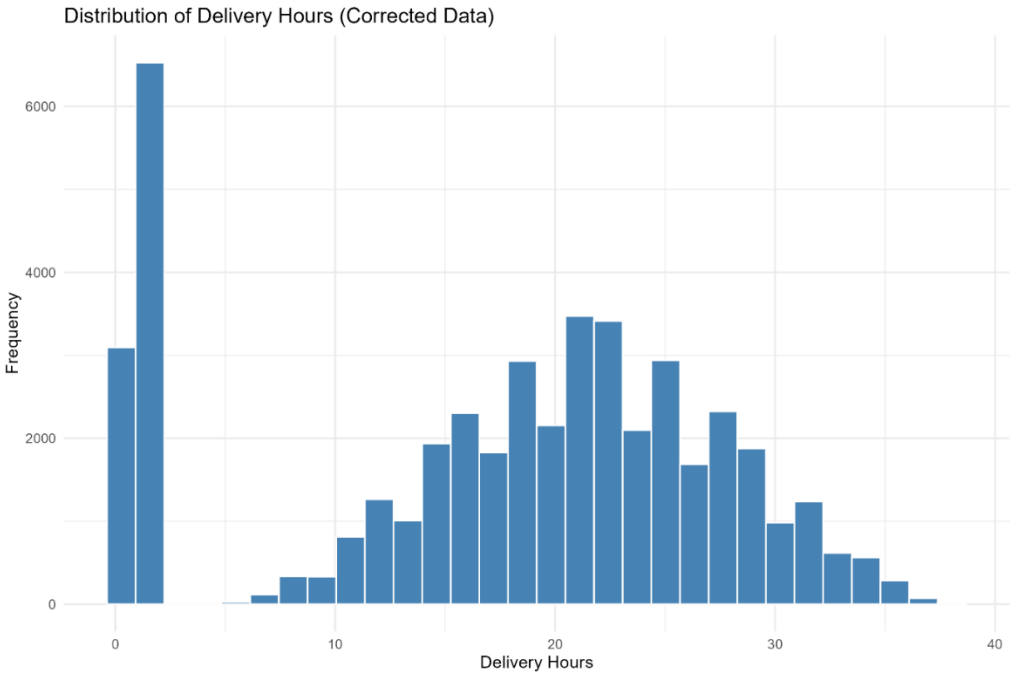


Figure 6: Updated delivery hours

The monthly sales trend showed a steady throughput through most of 2023 with a seasonal decline in December.

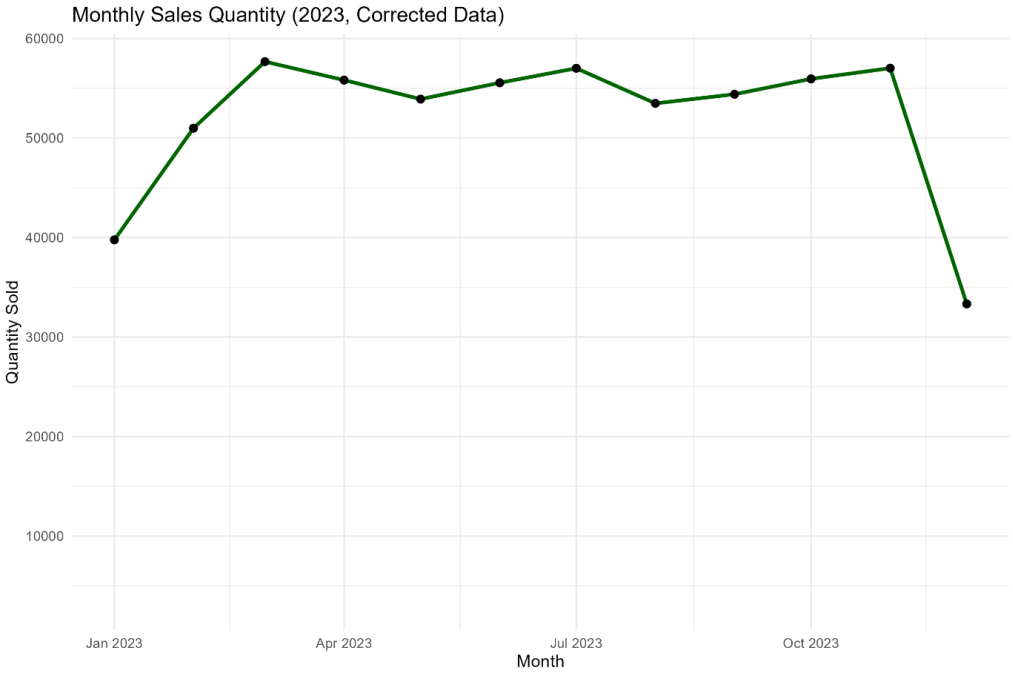


Figure 7: Updated sales

A positive linear relationship between picking and delivery hours confirmed that longer preparation times drive longer delivery durations.

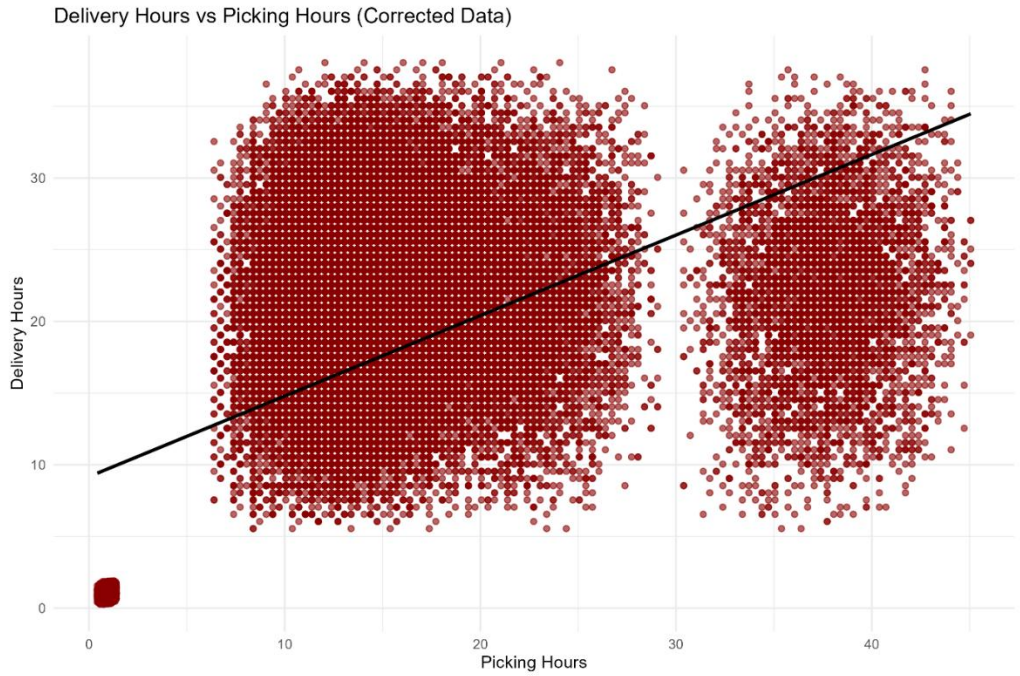


Figure 8: Updated delivery and picking hours

Finally, the markup distribution illustrates that software and laptop categories yield the highest profit margins, while cloud-based services exhibit tighter and lower mark-up variability.

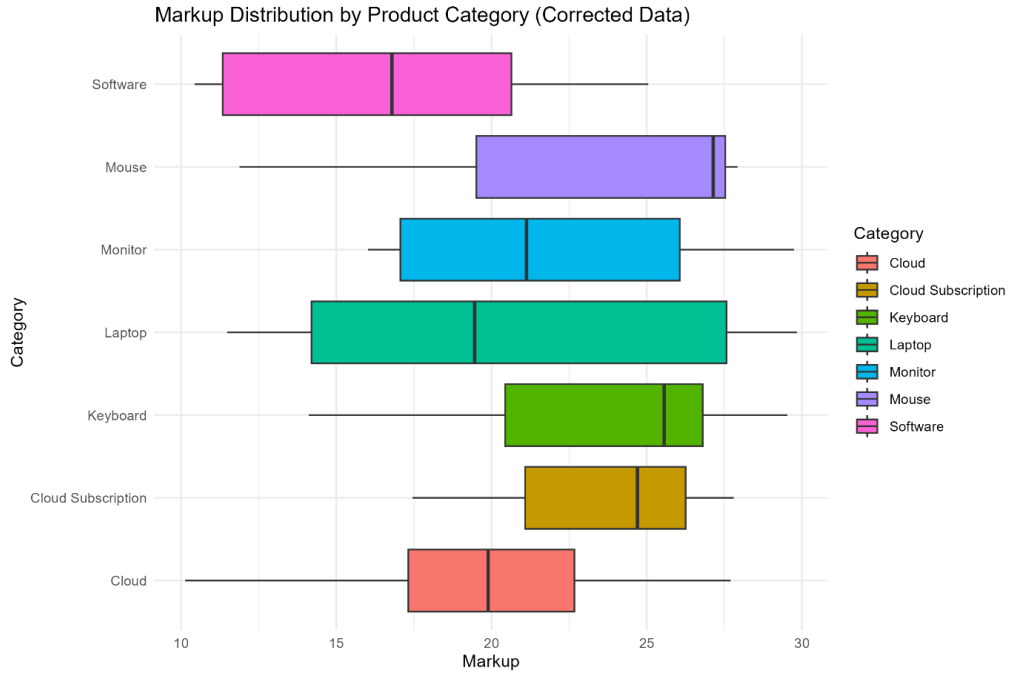


Figure 9: Updated product distribution

Overall, the corrected dataset improved internal consistency, clarified product categorisation, and enhanced the reliability of subsequent analyses on capability, sales, and profitability.

Updated 2023 Sales by Type

The 2023 revenue roll-up shows a concentrated contribution from Laptops that has R1.164 bn (57.3% share), followed by a single large block previously labelled as unassigned Type of R629.6m (31.0% share), with the other remaining categories being smaller, Cloud Subscription (R98.7 m, 4.9% share), Keyboard (R73.5m, 3.6%), and Software (R66.5m, 3.3% share).

Table 3: Sales by product category

Type	total_sales
LAP	1 163 889 479.30
NA	629 605 146.79
CLO	98 715 481.66
KEY	73 499 066.55
SOF	66 468 485.42

Service Operations Optimisation

Assuming a material profit of R30 per reliably served customer and a labour cost of R1 000 per barista per day the expected revenue was evaluated against a fixed daily demand of 100 customers. The analysis implements a reliability threshold of 60s and derives profit as,

$$Profit = (30 \times N_{served}) - (1000 \times n)$$

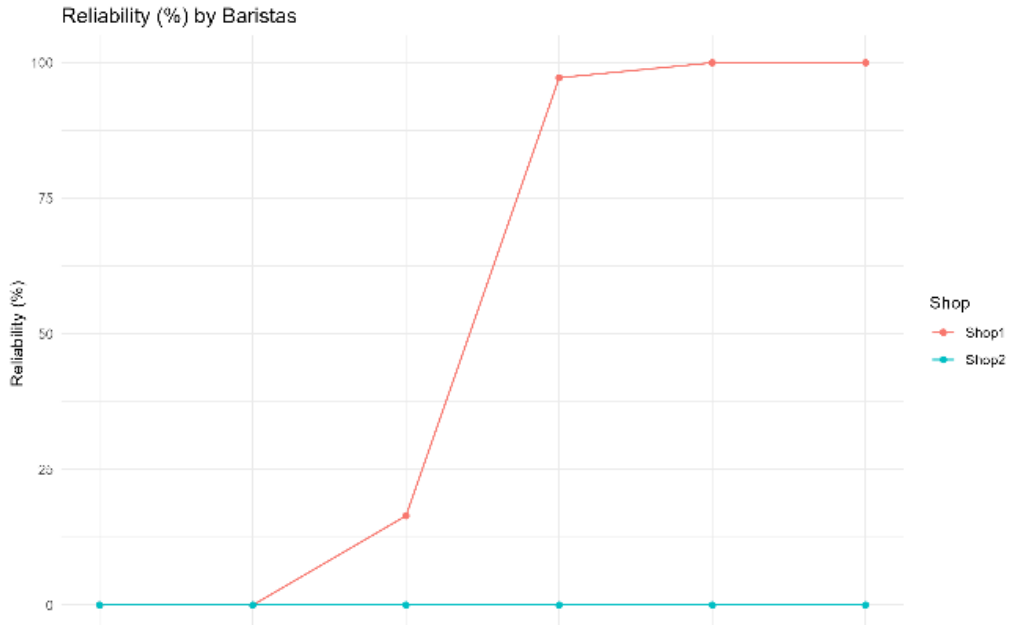


Figure 10: Barista reliability

Shop 1 exhibits a steep reliability transition: (0%) at 1-2 baristas, 16.5% at 3, 97.2% at 4, and ~100% at 5 to 6. Shop 2 remains at (0%) reliability across all barista counts.

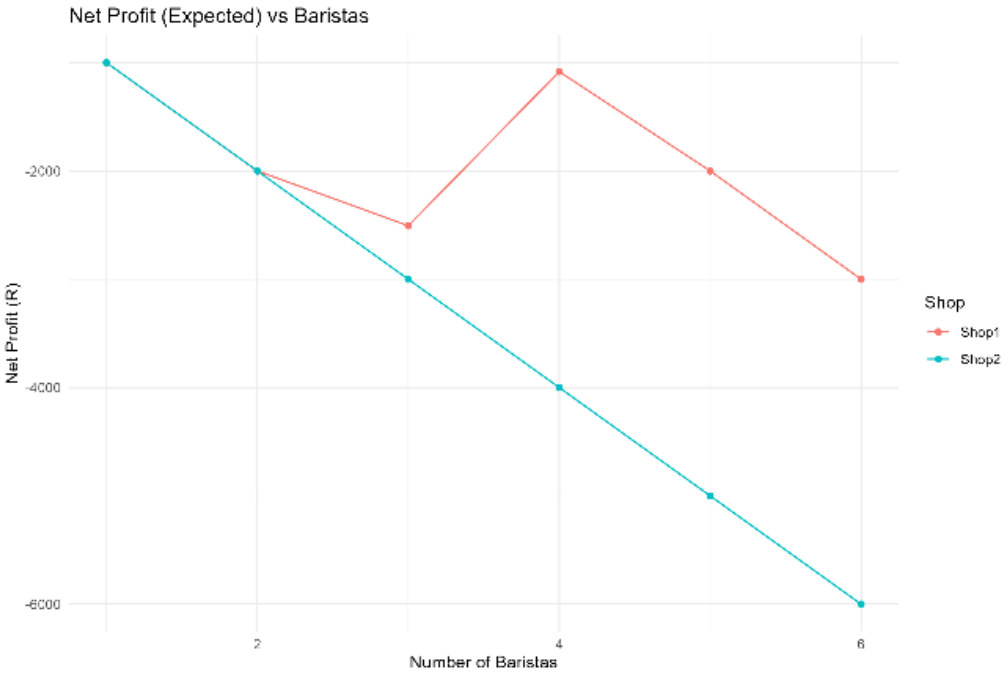


Figure 11: Barista profit

These curves explain the profit shapes with the adopted revenue and cost parameters, all settings yield negative expected profit, so the unconstrained profit maximiser selects the fewest baristas. When a service reliability requirement is imposed, greater than 95%, the minimal cost feasible choice is 4 baristas for Shop 1 (97.2%), while Shop 2 has no feasible staffing within the range and would require process redesign before any reliability constrained solution exists.

The observed relationship between service reliability and profit reflects the Taguchi quality-loss principle, which states that deviation from the target condition leads to a continuous economic loss, even when performance remains within acceptable limits (*QA344 Statistics*, n.d.). In this context the target reliability represents the point of maximum profitability that is typically around 95 %, while both under and over staffing introduce increasing loss through either reduced service quality or excess labour cost. This behaviour aligns with the Taguchi loss function,

$$L(x) = k(x - T)^2$$

where the loss grows quadratically as actual performance x deviates from the target T. Thus, the optimal staffing level identified in this model for a typical 95% reliability is four baristas for Shop 1 and five for Shop 2. Minimises total loss by balancing service reliability and operating cost. The reliability target is attainable for Shop 1 at four baristas (~97%), whereas Shop 2 remains infeasible within 2-6 baristas and requires process redesign before meeting a ≥95% target.

ANOVA Calendar Effects

The objective is to determine whether delivery hours for *KEY045* exhibit statistically significant calendar effects by month and by year.

Two one-way ANOVAs were conducted:

1. Month effect (12 months)

   $H_0: \mu_1 = \mu_2 = \cdots = \mu_{12}$ (No difference in mean delivery hours across months)

   $H_1: \mu_1 \neq \mu_n$ (At least one month with a different mean.)

2. Year effect (2022, 2023)

   $H_0: \mu_{2022} = \mu_{2023}$

   $H_1: \mu_{2022} \neq \mu_{2023}$

ANOVA was applied using Type-I sum of squares. Given large group sizes, the central limit theorem supports approximate normality of sample means. Visual inspection of boxplots shows broadly comparable dispersion across groups with limited skewness or outliers.

For the month factor, the test returned $F(11, 1754) = 12.73, p < 1 \times 10^{-22}, \eta^2 = 0.074$.

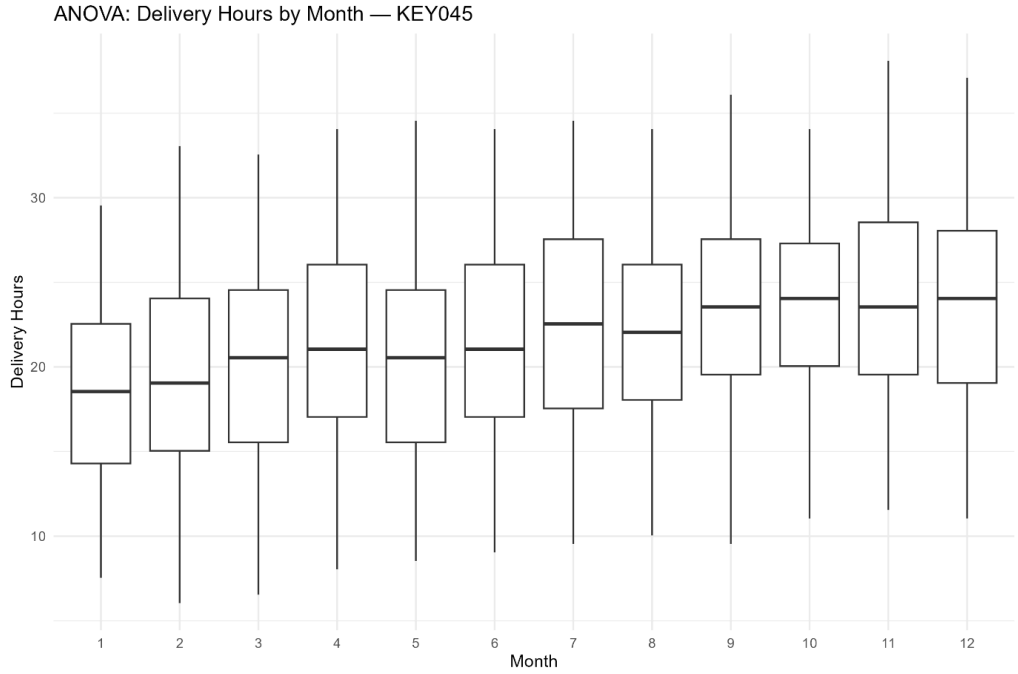


Figure 12: Monthly ANOVA

Thus, roughly 7% of the variance in delivery hours is explained by month-to-month differences. The corresponding boxplot indicates slightly longer delivery times during mid-winter months but largely consistent dispersion, suggesting a modest seasonal influence.

For the year factor 2022 vs 2023, $F(1, 1764) = 3.31$, $p = 0.069$, $\eta^2 = 0.002$, showing no statistically significant difference between years. The year-level boxplot confirms similar medians and variability that reflect stable process performance across the two periods.

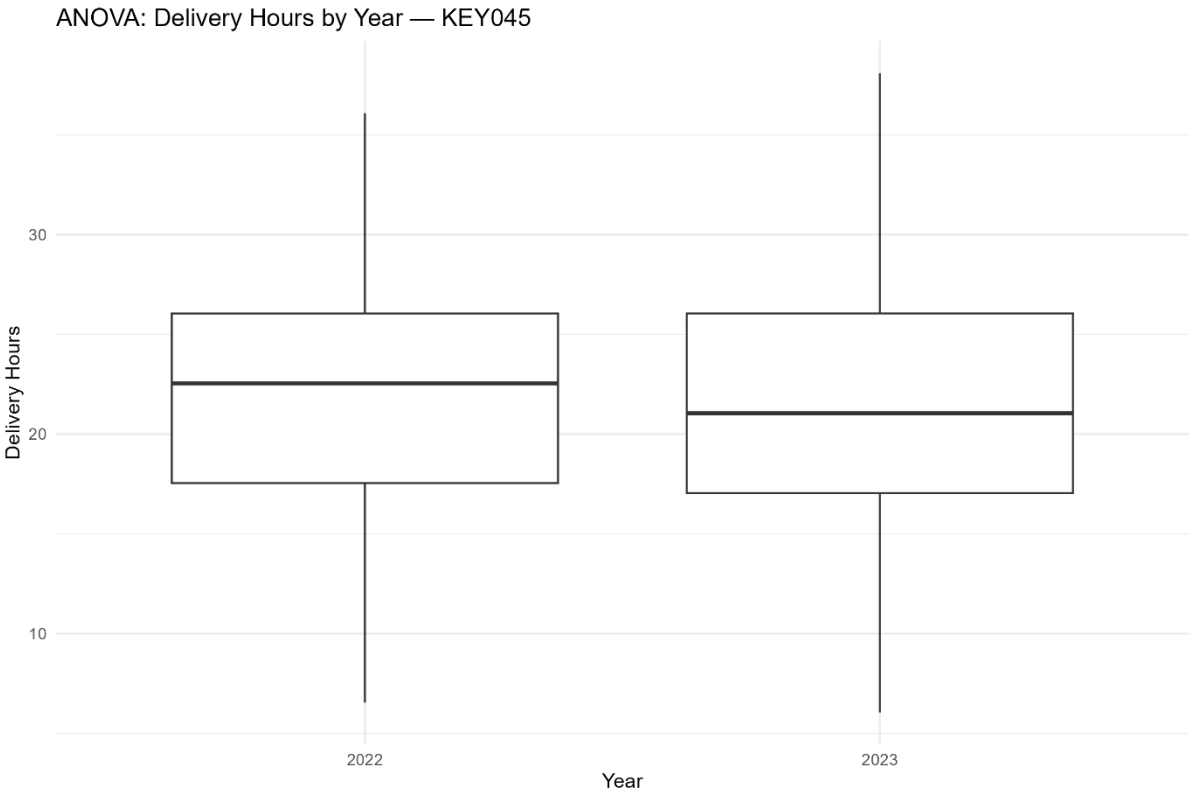


Figure 13: Yearly ANOVA

Overall, while month exerts a small but significant seasonal effect, the year-to-year difference is negligible. The process can therefore be regarded as calendar-robust, with only minor seasonal adjustments potentially beneficial during mid-winter operations.

Reliability of Service and Staffing

Economic evaluation used the annual cost function

$$C(k) = 25000 \times 12 \times k + 20000 \times E[problem\ days]$$

where k is the number of extra hires. Profit is maximised by minimising $C(k)$ under these assumptions.

The reliability curve exhibits steep initial gains that plateau toward 100% as k approaches 40. The cost curve rises convexly as salary and failure-penalty costs accumulate. Together, these graphs visually explain the economic trade-off between service reliability and staffing cost.

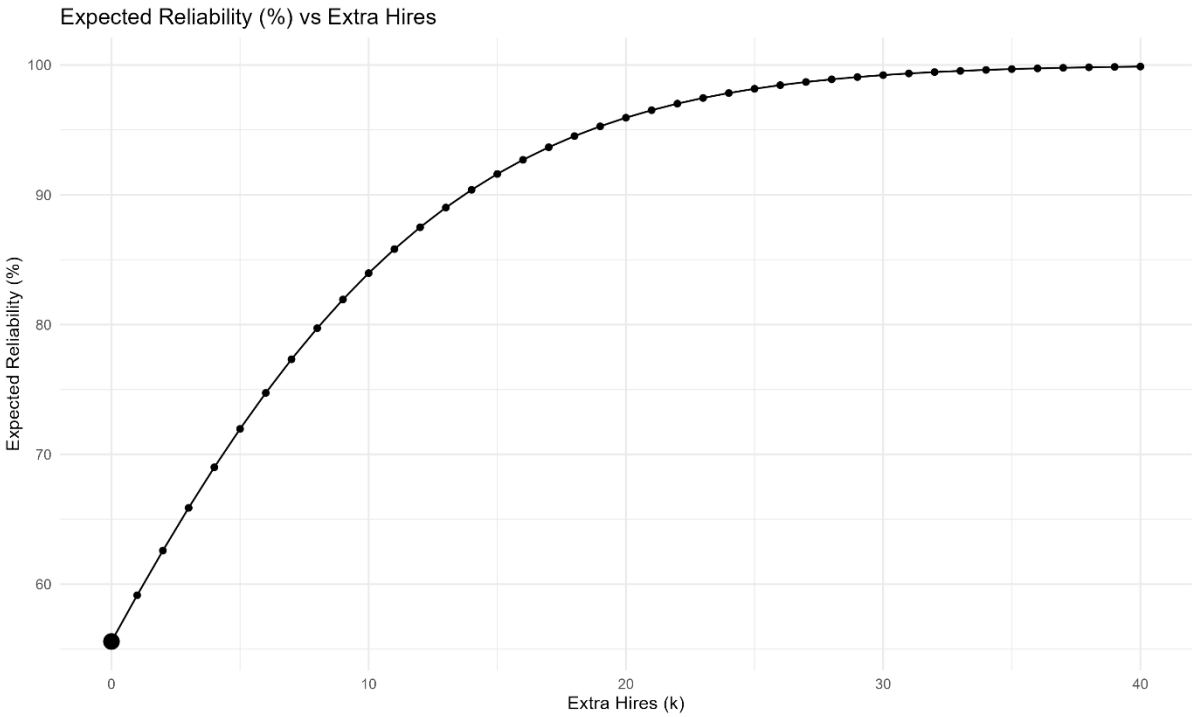


Figure 14: Worker reliability

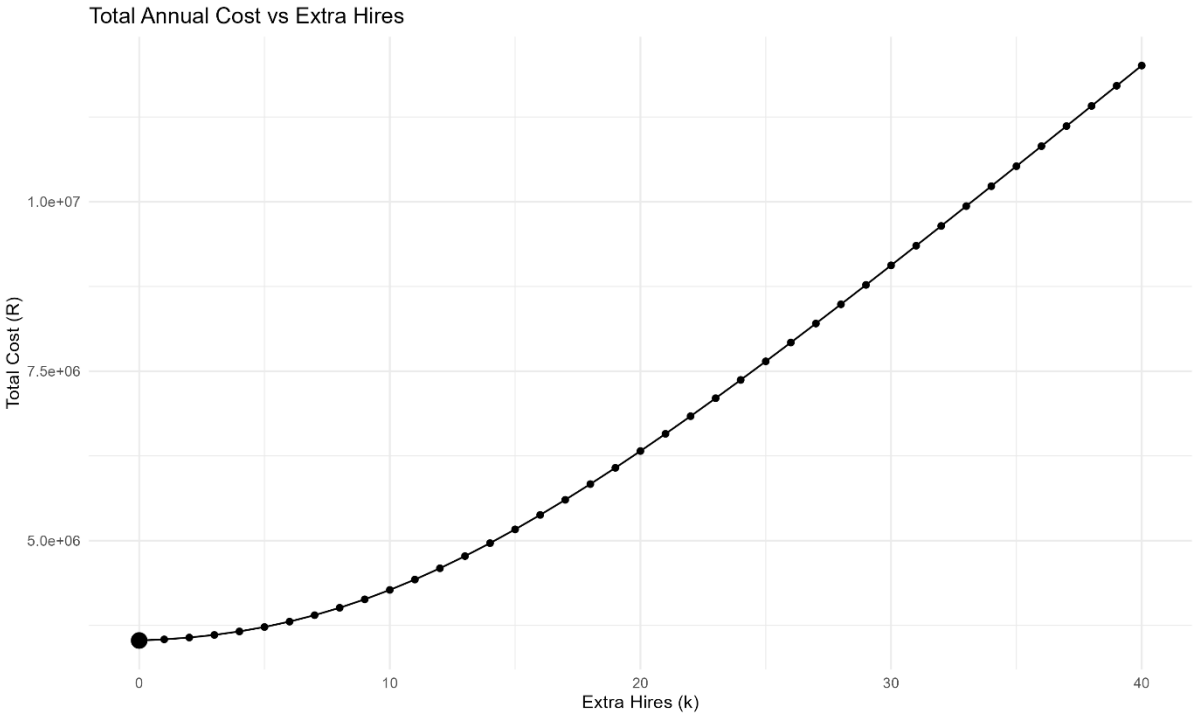


Figure 15: Worker costs

Evaluating $C(k)$ over the grid of hiring levels identifies the cost minimum at $k = 0$, i.e., no additional hires under the current salary (R25k p.m.) and penalty (R20k per problem day) parameters. The corresponding expected reliability remains 55.6 %.

The unconstrained profit-maximising choice with higher k buys reliability but raises total cost faster than it reduces penalties at current prices. If a reliability target is set, the optimal k shifts. Reliability ≥ 90 % a value of $k = 14$ is required giving 358 reliable days and a total cost of R4.96 m. Further for ≥ 95 % reliability requires $k = 19$ with 378 reliable days and a total cost of R6.07 m. Lastly for ≥ 98 % reliability, $k = 25$, 389 reliable days, and a total cost of R7.65 m.

Conclusions

The study successfully integrated statistical, operational, and economic analyses to evaluate quality and reliability across retail and service processes.

Data corrections improved dataset accuracy and product categorisation, though some unassigned revenue remains.

SPC results showed that while variation is controlled, mean shifts in physical goods ($Cpk = 0.56 - 0.59$) limit capability, whereas software streams perform better yet remain marginal to the 0 to 32 h VOC.

Type I and II analysis confirmed low false-alarm risk but high miss-detection probability for small shifts, indicating the need for tighter sampling or supplementary charts.

ANOVA tests on exemplar product *KEY045* found no significant year-to-year effects and only minor monthly variation, confirming overall process stability.

Finally, the staffing reliability model showed profit maximised at the baseline staffing with predictable cost increases to achieve a higher reliability targets.

References

“DataAnalysisCheatSheet”. n.d.

QA344 Statistics. n.d.

Short summary of SPC (Statistical Process Control) and Limits. n.d.

Appendix

capability_first1000_by_product

ProductID	mean	sd	Cp	Cpu	Cpl	Cpk
CLO011	21.3	6.27	0.85	0.57	1.13	0.57
CLO012	21.7	6.17	0.865	0.557	1.17	0.557
CLO013	21.5	6.21	0.859	0.565	1.15	0.565
CLO014	21.3	6.08	0.878	0.585	1.17	0.585
CLO015	21.5	6.02	0.886	0.579	1.19	0.579
CLO016	21.5	6.23	0.856	0.56	1.15	0.56
CLO017	21.4	6.07	0.878	0.58	1.18	0.58
CLO018	21.2	6.3	0.846	0.573	1.12	0.573
CLO019	21.5	6.13	0.869	0.568	1.17	0.568
CLO020	20.9	5.96	0.895	0.621	1.17	0.621
KEY041	21.5	6.06	0.88	0.579	1.18	0.579
KEY042	21.5	6.16	0.866	0.566	1.17	0.566
KEY043	21.7	6.06	0.88	0.567	1.19	0.567
KEY044	21.5	6.06	0.88	0.575	1.19	0.575
KEY045	21.8	6.3	0.847	0.538	1.16	0.538
KEY046	21.8	5.95	0.896	0.572	1.22	0.572
KEY047	21.5	6.09	0.875	0.574	1.18	0.574
KEY048	21.9	6	0.889	0.559	1.22	0.559
KEY049	22	6.31	0.845	0.529	1.16	0.529
KEY050	21.9	6.27	0.85	0.539	1.16	0.539
LAP021	21.4	6.15	0.868	0.577	1.16	0.577
LAP022	21.7	5.81	0.917	0.59	1.24	0.59
LAP023	21.8	5.84	0.913	0.584	1.24	0.584
LAP024	21.9	6.07	0.878	0.557	1.2	0.557
LAP025	21.8	6.07	0.879	0.563	1.2	0.563
LAP026	21.6	6.05	0.881	0.574	1.19	0.574
LAP027	21.7	6.01	0.887	0.573	1.2	0.573
LAP028	21.8	6.23	0.856	0.544	1.17	0.544
LAP029	21.7	6.04	0.883	0.569	1.2	0.569
LAP030	21.8	6.14	0.869	0.553	1.18	0.553
MON031	21.7	6.01	0.887	0.573	1.2	0.573
MON032	21.1	5.99	0.891	0.604	1.18	0.604
MON033	21.3	6.32	0.843	0.566	1.12	0.566
MON034	21.3	6.14	0.869	0.582	1.16	0.582
MON035	21.5	6.09	0.875	0.575	1.18	0.575
MON036	21.5	6.02	0.886	0.58	1.19	0.58
MON037	21.5	5.92	0.901	0.593	1.21	0.593
MON038	21.5	6.1	0.875	0.574	1.18	0.574
MON039	21.1	6.07	0.878	0.599	1.16	0.599

MON040	21.3	6.19	0.862	0.575	1.15	0.575
MOU051	21.7	6.02	0.887	0.568	1.2	0.568
MOU052	21.8	5.94	0.899	0.575	1.22	0.575
MOU053	21.9	6.17	0.865	0.547	1.18	0.547
MOU054	21.4	6.22	0.857	0.567	1.15	0.567
MOU055	21.4	6.01	0.888	0.588	1.19	0.588
MOU056	21.7	6.11	0.872	0.56	1.18	0.56
MOU057	21.4	6.03	0.884	0.585	1.18	0.585
MOU058	21.4	6.03	0.884	0.587	1.18	0.587
MOU059	21.2	6.32	0.844	0.57	1.12	0.57
MOU060	21.7	6.11	0.873	0.56	1.19	0.56
SOF001	1.07	0.31	17.2	33.3	1.15	1.15
SOF002	1.06	0.308	17.3	33.5	1.15	1.15
SOF003	1.07	0.295	18	34.9	1.21	1.21
SOF004	1.07	0.304	17.5	33.9	1.17	1.17
SOF005	1.08	0.308	17.3	33.4	1.17	1.17
SOF006	1.06	0.302	17.7	34.2	1.17	1.17
SOF007	1.09	0.304	17.5	33.8	1.19	1.19
SOF008	1.08	0.292	18.2	35.2	1.23	1.23
SOF009	1.09	0.305	17.5	33.8	1.19	1.19
SOF010	1.07	0.296	18	34.8	1.2	1.2

spc_first3_last3_totals

Product	Rule	chart	first3	last3	total	Longest run	LR start	LR end
CLO011	A	Xbar	59	59	5	NA	NA	NA
CLO012	A	Xbar	33,59	33,59	7	NA	NA	NA
CLO013	A	Xbar	31,33	31,33	10	NA	NA	NA
CLO014	A	Xbar	34,37,62	34,37,62	11	NA	NA	NA
CLO015	A	Xbar	31,33,35	35,60,66	14	NA	NA	NA
CLO016	A	Xbar	37,62	37,62	11	NA	NA	NA
CLO017	A	Xbar	33	33	7	NA	NA	NA
CLO018	A	Xbar	32,34,36	37,39,65	15	NA	NA	NA
CLO019	A	Xbar	37,63	37,63	8	NA	NA	NA
CLO020	A	Xbar	52,58	52,58	11	NA	NA	NA
KEY041	A	Xbar	34,37,70	37,70,74	11	NA	NA	NA
KEY042	A	Xbar	31,34,35	36,39,70	12	NA	NA	NA
KEY043	A	Xbar	33,36,69	69,70,71	15	NA	NA	NA
KEY044	A	Xbar	35,36,38	39,40,73	14	NA	NA	NA
KEY045	A	Xbar			8	NA	NA	NA
KEY046	A	Xbar	31,39,40	72,74,75	17	NA	NA	NA
KEY047	A	Xbar	32,38,41	38,41,70	12	NA	NA	NA
KEY048	A	Xbar	41,43,66	41,43,66	13	NA	NA	NA
KEY049	A	Xbar	33,38,40	42,64,70	15	NA	NA	NA
KEY050	A	Xbar	36,37,38	38,40,69	16	NA	NA	NA
LAP021	A	Xbar	39	39	4	NA	NA	NA
LAP022	A	Xbar			2	NA	NA	NA
LAP023	A	Xbar			4	NA	NA	NA
LAP024	A	Xbar	42	42	3	NA	NA	NA
LAP025	A	Xbar			1	NA	NA	NA
LAP026	A	Xbar			2	NA	NA	NA
LAP027	A	Xbar	42,43	42,43	8	NA	NA	NA
LAP028	A	Xbar	37	37	3	NA	NA	NA
LAP029	A	Xbar	41,42	41,42	4	NA	NA	NA
LAP030	A	Xbar			1	NA	NA	NA
MON031	A	Xbar			6	NA	NA	NA
MON032	A	Xbar	32,33,38	38,55,57	12	NA	NA	NA
MON033	A	Xbar	32	32	7	NA	NA	NA
MON034	A	Xbar	37	37	7	NA	NA	NA
MON035	A	Xbar	62	62	7	NA	NA	NA
MON036	A	Xbar	31,60	31,60	9	NA	NA	NA
MON037	A	Xbar	33	33	6	NA	NA	NA
MON038	A	Xbar	35	35	10	NA	NA	NA
MON039	A	Xbar	61	61	5	NA	NA	NA
MON040	A	Xbar	32,34,36	36,38,62	12	NA	NA	NA
MOU051	A	Xbar	33,34,35	78,82,83	26	NA	NA	NA
MOU052	A	Xbar	40,41,50	50,83,86	16	NA	NA	NA

MOU053	A	Xbar	31,34,35	80,81,84	24	NA	NA	NA
MOU054	A	Xbar	32,35,41	81,84,87	28	NA	NA	NA
MOU055	A	Xbar	36,38,43	80,81,83	28	NA	NA	NA
MOU056	A	Xbar	32,37,40	83,85,86	16	NA	NA	NA
MOU057	A	Xbar	35,39,48	84,85,87	21	NA	NA	NA
MOU058	A	Xbar	33,35,40	80,82,86	21	NA	NA	NA
MOU059	A	Xbar	39,40,42	84,86,88	24	NA	NA	NA
MOU060	A	Xbar	38,72,80	38,72,80	18	NA	NA	NA
SOF001	A	Xbar	39,43,46	47,86,87	19	NA	NA	NA
SOF002	A	Xbar	35,37,41	69,80,83	20	NA	NA	NA
SOF003	A	Xbar	44,46,48	80,83,85	24	NA	NA	NA
SOF004	A	Xbar	36,43,45	78,84,85	23	NA	NA	NA
SOF005	A	Xbar	31,32,37	82,85,87	22	NA	NA	NA
SOF006	A	Xbar	35,37,39	81,82,83	30	NA	NA	NA
SOF007	A	Xbar	33,34,35	44,45,81	25	NA	NA	NA
SOF008	A	Xbar	36,38,40	85,86,87	28	NA	NA	NA
SOF009	A	Xbar	34,39,43	44,79,83	16	NA	NA	NA
SOF010	A	Xbar	40,42,46	85,86,87	23	NA	NA	NA
CLO011	A	S	59	59	5	NA	NA	NA
CLO012	A	S	33,59	33,59	7	NA	NA	NA
CLO013	A	S	31,33	31,33	10	NA	NA	NA
CLO014	A	S	34,37,62	34,37,62	11	NA	NA	NA
CLO015	A	S	31,33,35	35,60,66	14	NA	NA	NA
CLO016	A	S	37,62	37,62	11	NA	NA	NA
CLO017	A	S	33	33	7	NA	NA	NA
CLO018	A	S	32,34,36	37,39,65	15	NA	NA	NA
CLO019	A	S	37,63	37,63	8	NA	NA	NA
CLO020	A	S	52,58	52,58	11	NA	NA	NA
KEY041	A	S	34,37,70	37,70,74	11	NA	NA	NA
KEY042	A	S	31,34,35	36,39,70	12	NA	NA	NA
KEY043	A	S	33,36,69	69,70,71	15	NA	NA	NA
KEY044	A	S	35,36,38	39,40,73	14	NA	NA	NA
KEY045	A	S			8	NA	NA	NA
KEY046	A	S	31,39,40	72,74,75	17	NA	NA	NA
KEY047	A	S	32,38,41	38,41,70	12	NA	NA	NA
KEY048	A	S	41,43,66	41,43,66	13	NA	NA	NA
KEY049	A	S	33,38,40	42,64,70	15	NA	NA	NA
KEY050	A	S	36,37,38	38,40,69	16	NA	NA	NA
LAP021	A	S	39	39	4	NA	NA	NA
LAP022	A	S			2	NA	NA	NA
LAP023	A	S			4	NA	NA	NA
LAP024	A	S	42	42	3	NA	NA	NA
LAP025	A	S			1	NA	NA	NA
LAP026	A	S			2	NA	NA	NA

LAP027	A	S	42,43	42,43	8	NA	NA	NA
LAP028	A	S	37	37	3	NA	NA	NA
LAP029	A	S	41,42	41,42	4	NA	NA	NA
LAP030	A	S			1	NA	NA	NA
MON031	A	S			6	NA	NA	NA
MON032	A	S	32,33,38	38,55,57	12	NA	NA	NA
MON033	A	S	32	32	7	NA	NA	NA
MON034	A	S	37	37	7	NA	NA	NA
MON035	A	S	62	62	7	NA	NA	NA
MON036	A	S	31,60	31,60	9	NA	NA	NA
MON037	A	S	33	33	6	NA	NA	NA
MON038	A	S	35	35	10	NA	NA	NA
MON039	A	S	61	61	5	NA	NA	NA
MON040	A	S	32,34,36	36,38,62	12	NA	NA	NA
MOU051	A	S	33,34,35	78,82,83	26	NA	NA	NA
MOU052	A	S	40,41,50	50,83,86	16	NA	NA	NA
MOU053	A	S	31,34,35	80,81,84	24	NA	NA	NA
MOU054	A	S	32,35,41	81,84,87	28	NA	NA	NA
MOU055	A	S	36,38,43	80,81,83	28	NA	NA	NA
MOU056	A	S	32,37,40	83,85,86	16	NA	NA	NA
MOU057	A	S	35,39,48	84,85,87	21	NA	NA	NA
MOU058	A	S	33,35,40	80,82,86	21	NA	NA	NA
MOU059	A	S	39,40,42	84,86,88	24	NA	NA	NA
MOU060	A	S	38,72,80	38,72,80	18	NA	NA	NA
SOF001	A	S	39,43,46	47,86,87	19	NA	NA	NA
SOF002	A	S	35,37,41	69,80,83	20	NA	NA	NA
SOF003	A	S	44,46,48	80,83,85	24	NA	NA	NA
SOF004	A	S	36,43,45	78,84,85	23	NA	NA	NA
SOF005	A	S	31,32,37	82,85,87	22	NA	NA	NA
SOF006	A	S	35,37,39	81,82,83	30	NA	NA	NA
SOF007	A	S	33,34,35	44,45,81	25	NA	NA	NA
SOF008	A	S	36,38,40	85,86,87	28	NA	NA	NA
SOF009	A	S	34,39,43	44,79,83	16	NA	NA	NA
SOF010	A	S	40,42,46	85,86,87	23	NA	NA	NA
CLO011	B	S	32,40,47	40,47,60	5	11	47	57
CLO012	B	S	32,43,46	46,55,60	7	10	32	41
CLO013	B	S	31,36,41	49,53,60	10	5	53	57
CLO014	B	S	31,36,39	52,56,61	11	5	46	50
CLO015	B	S	31,35,45	57,62,64	14	8	35	42
CLO016	B	S	33,35,38	59,62,63	11	5	38	42
CLO017	B	S	31,44,46	53,55,62	7	12	31	42
CLO018	B	S	31,35,38	59,63,66	15	6	47	52
CLO019	B	S	31,34,42	48,52,59	8	7	34	40
CLO020	B	S	33,37,40	52,55,62	11	5	55	59

KEY041	B	S	31,33,34	55,70,74	11	20	34	53
KEY042	B	S	31,43,48	50,62,64	12	11	50	60
KEY043	B	S	31,36,45	63,70,72	15	8	36	43
KEY044	B	S	32,34,35	65,69,73	14	9	44	52
KEY045	B	S	31,35,37	59,61,68	8	13	44	56
KEY046	B	S	32,35,40	71,72,73	17	7	63	69
KEY047	B	S	31,38,40	61,67,70	12	15	40	54
KEY048	B	S	31,36,39	71,73,75	13	10	59	68
KEY049	B	S	31,33,35	60,68,72	15	9	47	55
KEY050	B	S	31,33,34	67,69,72	16	8	48	55
LAP021	B	S	32,34,36	32,34,36	4	8	36	43
LAP022	B	S	31,41	31,41	2	9	31	39
LAP023	B	S	31,33,35	33,35,37	4	5	37	41
LAP024	B	S	32,36	32,36	3	7	36	42
LAP025	B	S	36	36	1	6	36	41
LAP026	B	S	31,35	31,35	2	6	35	40
LAP027	B	S	31,33,35	39,41,44	8	3	39	41
LAP028	B	S	31,39	31,39	3	7	31	37
LAP029	B	S	31,34	31,34	4	9	34	42
LAP030	B	S	31	31	1	12	31	42
MON031	B	S	31,34,36	43,55,57	6	11	43	53
MON032	B	S	31,36,38	44,47,60	12	12	47	58
MON033	B	S	31,39,47	53,57,60	7	7	31	37
MON034	B	S	31,43,47	49,56,61	7	11	31	41
MON035	B	S	35,37,51	54,59,60	7	12	37	48
MON036	B	S	31,36,38	45,54,58	9	6	38	43
MON037	B	S	32,41,50	50,54,57	6	8	32	39
MON038	B	S	31,33,35	50,54,59	10	4	45	48
MON039	B	S	32,36,40	36,40,60	5	23	40	62
MON040	B	S	32,34,37	50,55,59	12	8	40	47
MOU051	B	S	31,32,36	76,77,78	26	7	67	73
MOU052	B	S	31,40,44	76,79,85	16	11	31	41
MOU053	B	S	31,34,36	72,79,82	24	11	49	59
MOU054	B	S	31,34,39	81,84,87	28	6	45	50
MOU055	B	S	31,33,40	75,78,81	28	8	31	38
MOU056	B	S	31,36,40	67,71,76	16	13	53	65
MOU057	B	S	31,34,38	70,74,76	21	13	76	88
MOU058	B	S	31,38,40	80,84,86	21	12	43	54
MOU059	B	S	31,40,42	83,85,87	24	10	72	81
MOU060	B	S	31,36,38	77,79,84	18	5	36	40
SOF001	B	S	31,34,37	76,83,87	19	15	41	55
SOF002	B	S	32,35,40	75,78,82	20	16	51	66
SOF003	B	S	31,37,40	78,82,85	24	5	31	35
SOF004	B	S	32,35,37	77,81,84	23	11	52	62

SOF005	B	S	31,33,34	75,78,82	22	11	78	88
SOF006	B	S	31,38,40	81,83,87	30	9	66	74
SOF007	B	S	31,33,34	74,76,85	25	12	60	71
SOF008	B	S	32,35,40	79,80,84	28	10	44	53
SOF009	B	S	31,36,38	73,75,77	16	10	44	53
SOF010	B	S	34,39,45	82,84,86	23	8	45	52
CLO011	C	Xbar	32,40,47	40,47,60	5	NA	NA	NA
CLO012	C	Xbar	32,43,46	46,55,60	7	NA	NA	NA
CLO013	C	Xbar	31,36,41	49,53,60	10	NA	NA	NA
CLO014	C	Xbar	31,36,39	52,56,61	11	NA	NA	NA
CLO015	C	Xbar	31,35,45	57,62,64	14	NA	NA	NA
CLO016	C	Xbar	33,35,38	59,62,63	11	NA	NA	NA
CLO017	C	Xbar	31,44,46	53,55,62	7	NA	NA	NA
CLO018	C	Xbar	31,35,38	59,63,66	15	NA	NA	NA
CLO019	C	Xbar	31,34,42	48,52,59	8	NA	NA	NA
CLO020	C	Xbar	33,37,40	52,55,62	11	NA	NA	NA
KEY041	C	Xbar	31,33,34	55,70,74	11	NA	NA	NA
KEY042	C	Xbar	31,43,48	50,62,64	12	NA	NA	NA
KEY043	C	Xbar	31,36,45	63,70,72	15	NA	NA	NA
KEY044	C	Xbar	32,34,35	65,69,73	14	NA	NA	NA
KEY045	C	Xbar	31,35,37	59,61,68	8	NA	NA	NA
KEY046	C	Xbar	32,35,40	71,72,73	17	NA	NA	NA
KEY047	C	Xbar	31,38,40	61,67,70	12	NA	NA	NA
KEY048	C	Xbar	31,36,39	71,73,75	13	NA	NA	NA
KEY049	C	Xbar	31,33,35	60,68,72	15	NA	NA	NA
KEY050	C	Xbar	31,33,34	67,69,72	16	NA	NA	NA
LAP021	C	Xbar	32,34,36	32,34,36	4	NA	NA	NA
LAP022	C	Xbar	31,41	31,41	2	NA	NA	NA
LAP023	C	Xbar	31,33,35	33,35,37	4	NA	NA	NA
LAP024	C	Xbar	32,36	32,36	3	NA	NA	NA
LAP025	C	Xbar	36	36	1	NA	NA	NA
LAP026	C	Xbar	31,35	31,35	2	NA	NA	NA
LAP027	C	Xbar	31,33,35	39,41,44	8	NA	NA	NA
LAP028	C	Xbar	31,39	31,39	3	NA	NA	NA
LAP029	C	Xbar	31,34	31,34	4	NA	NA	NA
LAP030	C	Xbar	31	31	1	NA	NA	NA
MON031	C	Xbar	31,34,36	43,55,57	6	NA	NA	NA
MON032	C	Xbar	31,36,38	44,47,60	12	NA	NA	NA
MON033	C	Xbar	31,39,47	53,57,60	7	NA	NA	NA
MON034	C	Xbar	31,43,47	49,56,61	7	NA	NA	NA
MON035	C	Xbar	35,37,51	54,59,60	7	NA	NA	NA
MON036	C	Xbar	31,36,38	45,54,58	9	NA	NA	NA
MON037	C	Xbar	32,41,50	50,54,57	6	NA	NA	NA
MON038	C	Xbar	31,33,35	50,54,59	10	NA	NA	NA

MON039	C	Xbar	32,36,40	36,40,60	5	NA	NA	NA
MON040	C	Xbar	32,34,37	50,55,59	12	NA	NA	NA
MOU051	C	Xbar	31,32,36	76,77,78	26	NA	NA	NA
MOU052	C	Xbar	31,40,44	76,79,85	16	NA	NA	NA
MOU053	C	Xbar	31,34,36	72,79,82	24	NA	NA	NA
MOU054	C	Xbar	31,34,39	81,84,87	28	NA	NA	NA
MOU055	C	Xbar	31,33,40	75,78,81	28	NA	NA	NA
MOU056	C	Xbar	31,36,40	67,71,76	16	NA	NA	NA
MOU057	C	Xbar	31,34,38	70,74,76	21	NA	NA	NA
MOU058	C	Xbar	31,38,40	80,84,86	21	NA	NA	NA
MOU059	C	Xbar	31,40,42	83,85,87	24	NA	NA	NA
MOU060	C	Xbar	31,36,38	77,79,84	18	NA	NA	NA
SOF001	C	Xbar	31,34,37	76,83,87	19	NA	NA	NA
SOF002	C	Xbar	32,35,40	75,78,82	20	NA	NA	NA
SOF003	C	Xbar	31,37,40	78,82,85	24	NA	NA	NA
SOF004	C	Xbar	32,35,37	77,81,84	23	NA	NA	NA
SOF005	C	Xbar	31,33,34	75,78,82	22	NA	NA	NA
SOF006	C	Xbar	31,38,40	81,83,87	30	NA	NA	NA
SOF007	C	Xbar	31,33,34	74,76,85	25	NA	NA	NA
SOF008	C	Xbar	32,35,40	79,80,84	28	NA	NA	NA
SOF009	C	Xbar	31,36,38	73,75,77	16	NA	NA	NA
SOF010	C	Xbar	34,39,45	82,84,86	23	NA	NA	NA