

Simulation & Gap-Filling Methods

How each missing field was filled, every assumption with its source and range, and how the results are, and should be, validated.

Version 3.0 • 22 October 2026 • Input: 02_Cleaned (document 2) • Output: folder 03_Simulated (26 tables)

Every table carries a **basis** label; every researched number is cited (section 6); every assumption has a low / base / high range.

New in version 3: a head count from employee ids (section 3.4b): payroll people are paid on the working days they do not scan, so labour, the P&L and cost per case now count about 161 paid people instead of the 115 FTE the scans show. Version 2 (Binzagr's mappings of 22 Oct) added paid hours per person, wages by WMS role, standards by line size, billing on Binzagr's revenue codes and labour cost per activity, per case and per pallet.

40 sources (S01-S40); 41 parameters with low / base / high	161 paid FTE from employee ids (202 ids scan a month)	22 / 24 checks pass (2 information warnings)	SAR 0.77-1.02 simulated labour per loose case picked (clients pay 0.50-0.80)
--	---	--	--

1. What this layer is

The cleaned data cannot answer the PoV questions on its own: it has scans but no attendance, activity counts but no prices, balances but no invoice ageing. This layer fills each of those gaps with the best available method, and says which method was used on every row. Four labels are used:

Label	Meaning	Example
Actual	Straight from 02_Cleaned (Binzagr data, cleaned).	Billable pallets loaded per month
Inferred	Derived from Binzagr data by a stated rule or model; no outside numbers.	Standard seconds per pick; client type; channel label
Researched	A published fact or figure, cited.	Expat levy SAR 800 / month; Eid al-Adha 27 May 2026
Client	A figure Binzagr stated in a meeting; used only as a check.	Case rate SAR 0.50-0.80 for the same activity
Simulated	Computed from researched or assumed parameters; always with low / base / high.	Paid hours; loaded cost; rate card; P&L

How to present results. Only the **change** is a result: recoverable labour of about **SAR 639,485 a year** (Monte Carlo P10-P90 SAR 491,647 - SAR 805,806), about 11 FTE. Levels such as the EBIT margin are set by construction and are not evidence until Binzagr's actual P&L arrives (document 4).

Contents

1. What this layer is	1
2. Gap-filling map	3
3. Techniques	4
3.1 Loaded labour cost (Simulated)	4
3.2 Work content per scan (Inferred)	4
3.3 Standard times (Inferred)	5
3.4 Paid shifts under Saudi Labour Law (Simulated)	5
3.4b Head count from employee ids (Inferred -> Simulated, new in version 3)	5
3.5 Roles, benchmark target and recoverable hours (Inferred -> Simulated)	6
3.6 Labour cost per activity and rate card (Simulated)	6
3.7 Simulated P&L; (Simulated)	7
3.8 Scenarios and Monte Carlo (Simulated)	8
3.9 Badge-sharing risk (Inferred)	8
3.10 Client type and principal (Inferred)	8
3.11 Site profile and temperature (Inferred, low confidence)	8
3.12 Customer channel labels (Inferred)	9
3.13 Receivables ageing (Simulated)	9
3.14 Outlet activity and churn proxy (Inferred)	9
3.15 Van-rep profile (Inferred)	9
3.16 Calendar and events (Researched, checked against Actual)	9
4. Assumptions register	10
5. Validation	11
5.1 Validation already done	11
5.2 Validation still needed (with Binzagr data)	12
5.3 When prediction models are built	13
6. Sources	13
7. Limitations	14

2. Gap-filling map

One line per missing field. "Validated now" lists the checks already run (section 5.1); the last column points to the client data that would confirm or replace the stand-in (section 5.2 and document 4).

#	Missing for the PoV	Filled in	Technique	Label	Main assumptions	Validated now	Validate with
1	Paid hours / attendance	sim_session_attendance	Labour-law shift simulation on person sessions (payroll number) (3.4)	Simulated	T01-T05, M06	S04	Clock-in by payroll no.
1b	Head count: who is paid	sim_person_month_labour, inf_jeddah_headcount	Employment spell per person; payroll people salaried (3.4b)	Inferred / Simulated	T01-T03, T07-T08; spell rule	S05, S20	HR headcount; attendance
2	Loaded labour cost	sim_labour_cost_model	Cost build-up by WMS role from researched components (3.1)	Simulated	L01-L25, T07-T08	S02, S17	Actual payroll cost
3	Work content per scan	sim_activity_volumes	Idle-capped inter-scan cycle time (3.2)	Inferred	M01	MC variants	Time study / standards
4	Standard times	sim_standard_times	P50 of badge-month mean cycle times, by activity and line size (3.3)	Inferred	M02, M04	MC variants	Time-and-motion study
5	Role of each shift	sim_session_attendance_role	Dominant activity family (benchmark); WMS role from Binzagr list (cost) (3.5)	Inferred / Actual	M07	S17	Job titles
6	Productivity target	target_span_productivity	P75 of Binzagr's own eligible shifts, same role (3.5)	Inferred	M03	Sensitivity	Best sites / shifts (Raza)
7	Recoverable hours and SAR	recoverable_h_base	Gap to target x capture rate (3.5)	Simulated	M03, M05	S04, S07	Attendance; pilot
8	Rate card and revenue	sim_rate_card	Cost-recovery pricing on Binzagr's revenue codes (3.6)	Simulated	C01, C02	S08, S08b, S16	Contract rates
8b	Labour cost per activity / case / pallet	sim_activity_volumes, sim_cost_per_unit_wh_month	Task-based posting of session cost (3.6)	Simulated	C06	S15, S08b, S19	Facility cost per case
9	P&L baseline	sim_jeddah_pnl_monthly	Cost-recovery P&L on the head-count base (3.7)	Simulated	C01, C02	S03, S05, S06, S20	Actual Jeddah P&L
10	Uncertainty ranges	sim_scenarios, sim_monte_carlo_*	Scenarios + triangular Monte Carlo (3.8)	Simulated	all ranges	S07, S07b	-
11	Badge sharing	inf_badge_session_risk	Rules + IsolationForest (3.9)	Inferred	thresholds	S13	Attendance + badge ids
12	Client type / principal	inf_client_principal_map	Item-code match to product master (3.10)	Inferred	80% / 5% match	S12	Client list
13	Site profile, temperature	inf_warehouse_profile	Volume breaks + product-name keywords (3.11)	Inferred	keyword list	-	Site register
14	Customer channel	inf_customer_channel_map	English + Arabic name keywords (3.12)	Inferred	25% / 1.5x rule	-	Official code names
15	Receivables ageing	sim_receivables_*	FIFO allocation of balances to invoices (3.13)	Simulated	FIFO payments	S09	AR ageing report
16	Outlet churn	inf_outlet_activity	Recency vs usual purchase cadence (3.14)	Inferred	max(60 d, 3 x gap)	S10	Closure list
17	Van-rep routes	inf_salesman_route_profile	Aggregation of invoices per rep-day (3.15)	Inferred	-	-	Route plans, van loads
18	Holidays and Hijri events	ref_calendar_events	Umm al-Qura calendar + cited events (3.16)	Researched	S25-S30	S11	done
19	Opportunity levers	sim_opportunity_levers	Jeddah labour + four Riyadh sales levers	Simulated	C07	-	Binzagr margins

3. Techniques

3.1 Loaded labour cost (Simulated)

Binzagr's WMS user list gives each badge a role (menu level): tally clerk, storekeeper or warehouse manager; logins not in the list are treated as operatives. Labour is costed per role, as Binzagr posts it (wage x task x duration, S39). Monthly cost of one operative = cash pay + statutory and employer costs; expat and Saudi operatives are costed separately and blended with an assumed Saudi share. Storekeepers use the same build-up on a storekeeper basic salary (expat postings SAR 1,500-2,500, S34-S35: no real premium); warehouse managers = cash wage SAR 5,000-12,000 (S36) + 15-30% on-costs. Paid leave and public holidays are spread over the days worked.

Expat month = basic + housing (25% of basic) + transport + food + GOSI 2% x (basic + housing) + expat levy + iqama / 12 + medical / 12 + end-of-service 0.5 month x (basic + housing) / 12 + air ticket / 24 + recruitment & visa / 24
 Saudi month = wage + GOSI 12.25% x wage + medical / 12 + end-of-service accrual
 Blended month = (1 - s) x expat + s x Saudi, s = Saudi share of operatives (base 20%)
 Cost per worked shift = blended month x 12 / (26 x 12 - 21 leave - 10 holidays = 281 days); per paid hour = shift / 8
 Overtime hour = cash pay / 240 + 50% x basic / 240 (Labour Law Art. 107)

Operative	Component (SAR / month)	Low	Base	High
Expat	Basic salary	1,400	1,800	2,300
Expat	Housing allowance	210	450	690
Expat	Transport	100	200	300
Expat	Food allowance	0	200	300
Expat	GOSI (employer share)	32	45	60
Expat	Expat levy	700	800	800
Expat	Iqama (per month)	54	54	54
Expat	Medical insurance (per month)	67	125	208
Expat	End-of-service accrual	67	94	125
Expat	Air ticket (per month)	62	83	104
Expat	Recruitment and visa (per month)	167	250	417
Expat	Total per month	2,859	4,101	5,358
Saudi	Total wage	4,000	5,000	6,000
Saudi	GOSI (employer share)	470	612	765
Saudi	Medical insurance (per month)	67	125	208
Saudi	End-of-service accrual	167	208	250
Saudi	Total per month	4,703	5,946	7,223
Operative	Blended month	3,043.69	4,470.17	5,917.40
Operative	Cost per paid hour	16.25	23.86	31.81
Storekeeper	Blended month	3,153.57	4,576.33	6,110.62
Storekeeper	Cost per paid hour	16.83	24.43	32.85
Supervisory	Blended month	5,750.00	9,600.00	15,600.00
Supervisory	Cost per paid hour	30.69	51.25	83.87

Sources: wages S01-S03, storekeepers S34-S35 and S37, managers S36, housing S10, GOSI S04-S05, levy and iqama S06, end of service and leave S09, overtime S08, Saudi wage floor S12, insurance S11. Insurance, transport, air ticket, recruitment, manager on-costs and the Saudi share are assumptions. Paid hours by role: Not in user list 44,149, Storekeeper 50,226, Tally clerk 91,893, Warehouse manager 112.

3.2 Work content per scan (Inferred)

Each badge's scans are put in time order. The work content of a scan is the time since the badge's previous scan ended plus the scan's own duration. Gaps longer than the idle cap (base 30 minutes; 15 and 45 in the Monte Carlo) are breaks, not work. Tasks left open are capped at 1 hour. Companion rows written in the same second (a Case Pick next to Picking (Pick), billing rows) get zero, so time is not counted twice. System logins are excluded. Total scan-evidenced work: 51,084 hours over 8 months.

3.3 Standard times (Inferred)

Binzagr's conversion factors give every scan its size in **cases**, so the standard is set per activity **and line-size band** (cases per line: up to 1, 2-4, 5-10, 11-25, 26-60, over 60). It matters for physical moves: a Picking (Pick) line of one case takes about a minute, one of 11-25 cases more than two, so one per-line standard would make shifts with big lines look slow. For each activity and band, the mean cycle time is computed for every badge-month with at least 30 such scans; the **standard is the median (P50) of those badge-month means**. Lenient (P60) and tight (P40) variants feed the Monte Carlo. Sparse bands use the pooled band mean; lines without a conversion factor use the activity standard. One Jeddah-wide standard, so sites can be compared. Standards are relative (from the same population they benchmark), not engineered; Binzagr's time-and-motion study would anchor them.

Activity (P50 seconds per line)	<= 1 case	2-4	5-10	11-25	26-60	> 60
Picking (Pick)	146	168	220	291	231	186
Loading (Pick)	8	8	9	15	19	20
Consolidation (Pick/Put)	14	12	18	28	39	35
Receipt of Shipment (Rcpt)	121	136	167	186	81	91
Move (Put)	23	20	22	26	40	36
Directed Pickup (Pick)	124	140	157	164	124	136

3.4 Paid shifts under Saudi Labour Law (Simulated)

- Each **person** work session is one paid shift of 8 hours, 6 hours in Ramadan (18 Feb - 19 Mar 2026) (Art. 98, S07, S33), plus a 30-minute break (Art. 101). A person = a payroll number in Binzagr's user list; their badges are merged and a new session starts after more than 6 h without a scan on any of them (445 sessions used 2+ badges; in some, two badges were active at the same time for 258 h in total). Logins not in the list stay one person per badge.
- Overtime = scanned span beyond legal hours + break, up to the 12-hour presence limit (Art. 101), costed per Art. 107.
- Badge-sharing correction:** a session longer than 12 hours is impossible for one person, so it counts as two shifts (368 sessions).
- Result: 23,589 sessions -> 186,380 paid hours (incl. 1,390 overtime) = about 115 FTE on scan days alone. That is a floor: a person who works a day without a single scan is invisible to it. Section 3.4b adds those days.
- Observed vs unobserved:** 100,713 paid hours fall inside a scanned span. On the head-count base (245,194 paid hours) 58.9% of paid time does not (46.0% counting scan days only, 66.6% if every login is a salaried person). Scans cannot tell whether that time is unscanned work, waiting, leave or idle, so no savings are claimed on it.

3.4b Head count from employee ids (Inferred -> Simulated, new in version 3)

Binzagr's WMS user list (snapshot on the 1st of each month) shows on average 269 people with an active login at the 9 sites in the log (285 across all Jeddah sites). The log shows 202 employee ids scanning in an average month: 138 payroll people and 64 logins not in the list (desktop logins WA.AD.nnn merged with their plain-number twin: 38 pairs; system logins excluded). Over the 8 months: 297 people and logins, 193 of them payroll people. The list is not a head count on its own: far more people are listed than scan.

Employment spell = first to last scan day of each person, extended to 1 Feb / 30 Sep when first / last seen in the first / last week of the data

Working days = Saturday to Thursday inside the spell; expected worked days = working days x 281 / 312 (= 90.1%, after annual leave and public holidays)

Paid days without a scan = max(0, expected worked days - paid shifts), at the legal hours of the day (8 h, 6 h in Ramadan) and the role's cost per worked shift

Base: payroll people are salaried (paid days without a scan count); other logins are paid only on scan days

Who counts as paid	FTE	Paid hours (8 months)	Labour per year	Paid time with no scan
Scan days only (floor; version 2)	115	186,380	SAR 6,945,349	46.0%
Head-count base: payroll people salaried	161	245,194	SAR 9,220,175	58.9%
Every login a salaried person (ceiling)	199	301,854	SAR 11,309,712	66.6%

Month	Listed active	Ids scanning	Payroll people	Other logins	FTE scan days	FTE base	FTE all ids
2026-02	274	226	164	62	127	176	204
2026-03	272	228	160	68	120	184	225
2026-04	275	229	157	72	137	187	229
2026-05	276	192	133	59	98	159	206
2026-06	261	187	122	65	108	158	202
2026-07	263	189	124	65	115	153	194
2026-08	263	198	129	69	114	146	181
2026-09	265	169	113	56	102	128	148

Payroll people scan on 73% of their expected working days. The base adds 7,653 paid days without a scan over 8 months (SAR 2,274,827 a year, on top of SAR 6,945,349 on scan days). That cost is spread over the service families pro rata, like overhead, so cost per unit is shown two ways: on worked time (scan days) and on all paid days. Recoverable labour does not change: it is measured on worked shifts only. Attendance by payroll number (V1) and HR headcount (V4) replace this inference.

3.5 Roles, benchmark target and recoverable hours (Inferred -> Simulated)

Comparing earned standard hours with full paid shifts would claim around 75% savings, because scans cover only part of the work. Instead each shift is compared with Binzagr's own best shifts doing the same work, over the time the scans can see:

Role = activity family with the most scans in the session

Observed hours = scanned span, capped at paid hours; earned hours = sum of P50 standards of the session's scans

Span productivity = earned / observed, for eligible shifts only (at least 30 scans, at least 4 h span, not a system login, not a warehouse manager, not a batch-posting session)

Target = P75 of span productivity among eligible shifts of the same role (roles with fewer than 30 eligible shifts get no target)

Recoverable hours = $\max(0, \text{observed} - \text{earned} / \text{target}) \times \text{capture rate } 70\%$; recoverable SAR = hours x shift cost / legal hours

Role	Eligible shifts	Target (P75)
Picking	6,762	0.69
Loading / shipping	1,725	0.44
Internal movement	1,627	0.74
Inbound	764	0.63
Inbound admin	450	0.10
Inventory control	368	0.29
Consolidation	141	0.22
Returns	88	0.50
Replenishment	86	0.58
Quality control	32	0.08
Outbound admin	8	none (fewer than 30 shifts)
Inter-warehouse transfer	2	none (fewer than 30 shifts)

12,043 eligible shifts. Batch-posting sessions (over 90% of scans in the same second as the previous one: 871 sessions, mostly WA.AD.nnn, HM1008 and AMR2100 logins) keep their paid hours but are not benchmarked; excluding the storekeeper login BHAS210004 entirely would lower recoverable hours by about 1%. Base result: 17,388 recoverable hours over 8 months (26,082 a year), valued at each person's role cost. The method is conservative: the target is a level Binzagr already reaches, unobserved time is excluded, and only 70% of the gap is assumed captured.

3.6 Labour cost per activity and rate card (Simulated)

Task-based posting. Binzagr posts labour per task (wage x task x duration, per user) and costs the facility per case and per pallet (\$39). Here each person session's paid cost is spread over its scans in proportion to cycle time (time the scans cannot see is spread pro rata), so the full labour cost lands on activities and reconciles to the riyal (check S15). Binzagr's transaction mapping (\$40) then shows where labour goes:

Binzagr type of movement	Labour cost (8 months)	Share
Duplicate	SAR 2,565,075	55.4%
Basic Service	SAR 939,209	20.3%

Binzagr type of movement	Labour cost (8 months)	Share
Added Value	SAR 630,253	13.6%
In House	SAR 478,411	10.3%
Duplicate In House	SAR 17,284	0.4%

"Duplicate" means billed under another code (the Picking (Pick) scan is billed as Case Pick / Pallet Pick), not wasted work. In-house work no client pays for (moves, replenishment, cycle counts) takes 10.3% of labour; inbound paperwork (shipment audit, reconciliation, closing POs) 14.5%. Per unit (each family incl. its share of overhead and of paid days without a scan, split over its billed activities by billed lines; worked time only in brackets): **SAR 1.02 per loose case picked** (0.77), SAR 7.57 per pallet picked (5.70), **SAR 16.06 per pallet received** (12.10); per case shipped, loose and in full pallets, SAR 0.50 (0.38; 60% of cases leave in full pallets). The case / pallet split by billed lines matches the split by actual pick time (80.4% vs 80.1% for case picks; check S19).

Rate card. Only the activities Binzagr marks Revenue Generation are billed (inbound receipt, damaged receipt, unload / unpick, case pick per case, pallet pick, consolidation, re-palletisation, pallet split, returns put-away); loading, LP audit and QC are cost. Code 100 is left out until Binzagr confirms it ("Picked Volume" in the mapping, "Item Import" in the log). Posted labour is grouped into five service families (billed activity + the cost activities that support it); overhead is spread pro rata; each family is split over its billed activities by billed lines, then grossed up.

Rate per unit = (family labour cost + share of overhead) x billed-line share / units x 1 / labour share of opex (C01, base 50%) x 1 / (1 - EBIT margin) (C02, base 6.5%)

Service	Unit	Units (8 months)	Labour / unit	Worked time	Low	Base	High	Check
Case pick	case picked	2,957,408	1.02	0.77	1.81	2.17	2.53	0.65
Consolidation	line consolidated	278,651	1.36	1.02	2.41	2.90	3.37	
Inbound receipt	pallet received	117,453	16.06	12.10	28.54	34.35	39.88	13.46
Pallet pick	pallet picked	96,590	7.57	5.70	13.45	16.19	18.80	
Returns put-away	return put away	9,802	8.07	6.08	14.33	17.25	20.03	
Re-palletisation	pallet re-palletised	3,176	1.92	1.45	3.42	4.11	4.77	
Unload / unpick	pallet unloaded / unpicked	2,636	16.06	12.10	28.54	34.35	39.88	
Pallet split	pallet split	1,067	1.92	1.45	3.42	4.11	4.77	
Damaged-goods receipt	damaged pallet received	940	16.06	12.10	28.54	34.35	39.88	

Checks: labour per loose case picked on worked time (SAR 0.77) is not above the highest of the SAR 0.50-0.80 per case Badr quoted for the same activity at different clients (S08b, pass), but it is above the lowest (96% of the higher price, 153% of the lower one). With paid days without a scan spread in (SAR 1.02) it is above both. Either case picking does not cover its labour at those prices, or the simulated wages or head count are too high; Binzagr's facility cost per case settles it (V11, V12). The full cost-recovery case rate (SAR 2.17) is 2.7-4.3x his figures because storage revenue is not modelled, so handling carries all non-labour cost and margin (information warning S08c). Receiving vs a US survey (0.264 billing-hours per pallet x SAR 51.0/h = SAR 13.46) is +155%: ours carries the inbound paperwork and the opex gross-up (information warning S08d; a pass/fail test at +/-50% in version 1).

3.7 Simulated P&L (Simulated)

Revenue = Actual billable units x base rates; labour = simulated paid shifts x cost + paid days without a scan (head-count base, 3.4b); other opex = labour x (1 / 0.5 - 1); optimised labour = labour - recoverable labour. Because the rates recover cost plus margin, the 8-month baseline margin is exactly 6.5% **by construction**; months differ only because volumes and staffing move differently. Only the change is a result.

Month	Revenue	Labour	Other opex	EBIT	Recoverable	Margin	Optimised
2026-02	1,924,525	792,759	792,759	339,007	53,766	17.6%	20.4%
2026-03	1,770,563	885,886	885,886	-1,208	35,451	-0.1%	1.9%
2026-04	1,887,531	897,788	897,788	91,956	62,789	4.9%	8.2%
2026-05	1,530,050	745,631	745,631	38,789	45,681	2.5%	5.5%
2026-06	1,537,105	753,757	753,757	29,590	54,359	1.9%	5.5%
2026-07	1,600,721	736,590	736,590	127,541	58,357	8.0%	11.6%
2026-08	1,500,573	726,618	726,618	47,337	59,774	3.2%	7.1%
2026-09	1,397,131	607,755	607,755	181,621	56,146	13.0%	17.0%

3.8 Scenarios and Monte Carlo (Simulated)

Three deterministic scenarios set every input low, base or high together. The Monte Carlo draws 5,000 combinations: each labour-cost and cost-structure parameter from a triangular(low, base, high) distribution, the target percentile from triangular(0.60, 0.75, 0.90), the capture rate from triangular(0.5, 0.7, 0.9), and the standard variant (P60 / P50 / P40), idle cap (15 / 30 / 45 minutes) and who counts as paid (scan days / head-count base / every login) with probabilities 25 / 50 / 25%. Seed 20261021, so results are reproducible. The scenarios pair low cost with scan days and high cost with every login.

Scenario	FTE paid	Labour cost / yr	Recoverable / yr	% of labour	FTE recov.	Margin -> optimised
Conservative	115	SAR 4,742,559	SAR 218,740	4.6%	5.3	4.0% -> 5.8%
Base	161	SAR 9,220,175	SAR 639,485	6.9%	10.7	6.5% -> 9.7%
Stretch	199	SAR 15,150,673	SAR 1,578,771	10.4%	19.7	10.0% -> 15.6%

Monte Carlo metric	P10	P50	P90	Input (Spearman rank correlation with recoverable SAR)	rho
Labour cost per year	SAR 6,838,024	SAR 9,214,394	SAR 11,415,787	target percentile	0.74
Recoverable labour per year	SAR 491,647	SAR 633,749	SAR 805,806	capture rate	0.59
Recoverable % of labour	5.1%	7.0%	9.9%	basic salary	0.13
Recoverable hours per year	20,267	25,885	32,591	total wage	0.10
FTE recoverable	8.3	10.6	13.3	saudi share of operatives	0.08
Optimised EBIT margin	8.3%	10.1%	12.1%	housing pct of basic	0.07
				food allowance	0.07
				storekeeper basic salary	0.06
				idle cap min	-0.06
				recruitment visa amortised	0.05

Recoverable labour is driven by management choices (how ambitious the target is, how much of the gap is captured), far more than by wage assumptions: exactly what Binzagr can decide on. The labour cost itself is driven by who counts as paid (Spearman 0.92, vs 0.24 for the basic salary): the head count is the first thing to confirm.

3.9 Badge-sharing risk (Inferred)

Per person session. Rules: span over 12 h and over 16 h, a site switch within 2 minutes, scan rate above the 99.5th percentile, two badges of the same payroll number active together for more than 30 minutes. Model: an IsolationForest (300 trees, 3% contamination, seed 7) on span, scans, scans per hour, sites, fast switches, badges used, concurrent hours and same-second share. High = over 16 h, or over 12 h / concurrent badges and flagged by the model; medium = over 12 h, concurrent badges, or any rule plus the model; low = rule or model alone. Result: high 198, medium 427, low 488, none 22,476 sessions. These are candidates to check against attendance, not findings.

3.10 Client type and principal (Inferred)

Each client's item codes are matched to the product master. More than 80% of items found = Binzagr business unit (the items are Binzagr products); under 5% = external 3PL client (own item codes); the principals behind the items are counted. Result: 26 business units and 5 external clients (3069, 3030, 3024, 3017, 3099). Confidence is high when one principal holds 80% or more.

3.11 Site profile and temperature (Inferred, low confidence)

Structural changes = month-on-month change of 50% or more (with at least 2,000 rows): 2100-12 stops after April; activity moves from 2100-01 to 2100-07 in August. Temperature = share of item scans whose product name contains cold-chain words (frozen, ice cream, chilled, fries, cheese, butter, yoghurt, McCain, and Arabic equivalents): 50% or more = likely cold-chain, 15-50% = mixed. The product master's TEMP_COND is 1 for every product, so it could not be used.

3.12 Customer channel labels (Inferred)

For each customer-hierarchy code, the share of its customers whose English or Arabic name contains channel words (baqala, tamweenat, supermarket / aswaq, hypermarket chains, restaurant / bufia / matam, pharmacy, perfumes, trading, fuel station). A label is given when one channel reaches 25% of names and is at least 1.5 times the next; confidence is medium at 50% or more. Code 10160 (SAR 18.7M of sales) stays "mixed / unclear".

3.13 Receivables ageing (Simulated)

Balances are one snapshot (20 Oct 2026). Assumption: payments clear the oldest invoices first (FIFO), so each credit customer's balance sits on its most recent van-sales invoices; due dates follow the customer's payment term (e.g. ZC04 = 30 days after month end). 1,616 credit customers with a balance (SAR 3,819,782) -> 6,011 open invoices (SAR 3,483,551); SAR 336,231 cannot be matched to invoices in the window (other channels or older debt) and is kept per customer. Buckets: 1-30 days overdue SAR 343,217; 31-60 days SAR 145,546; 61-90 days SAR 48,691; over 90 days SAR 53,478; not yet due SAR 2,892,620.

3.14 Outlet activity and churn proxy (Inferred)

Per customer: first and last purchase, invoices, purchase days and the median gap between purchases. Lapsed (churn proxy) = no purchase for longer than max(60 days, 3 x the outlet's usual gap); slowing = more than 30 days. Result at 20 Oct 2026: no purchase in Mar-Oct 2026: 14,022; active: 3,816; lapsed (churn proxy): 662; slowing: 483.

3.15 Van-rep profile (Inferred)

From invoices per rep and day: drops (distinct customers), invoices, sales, weekday pattern. Median 6 drops per day and SAR 526 per drop. Planned routes and van loads are not in the data.

3.16 Calendar and events (Researched, checked against Actual)

Hijri dates from the Umm al-Qura calendar; events from cited announcements: Ramadan 18 Feb - 19 Mar (S30), Founding Day 22 Feb (S29), Eid al-Fitr holiday from close of 18 Mar for 4 days, Eid on Fri 20 Mar (S25, S26), Arafat 26 May and Eid al-Adha 27 May (S27, S28), National Day 23 Sep (S29). Check against the warehouse: activity index = rows per day / median of the same weekday; a closure is a non-Friday below 0.15. Closures observed exactly on 21-23 Mar, 26-28 May and 23 Sep; Ramadan ran about 13% above a normal weekday. With one Ramadan in the data, yearly Hijri seasonality cannot be learned yet: events are features.

4. Assumptions register

Every parameter with its range. For the model parameters (M), low = conservative savings and high = stretch. "Assumption" = no authoritative public figure: set from the nearest evidence and varied in the Monte Carlo.

ID	Parameter	Unit	Low	Base	High	Basis	Sources	Note
L01	Basic salary	SAR/month	1,400	1,800	2,300	Researched	S02, S03, S01	Postings: Riyadh warehouse worker 1,200-1,400; Jeddah labour 1,800-2,000. GASTAT non-Saudi male wages: no schooling 1,956, primary 2,088, lower secondary 2,305.
L02	Housing pct of basic	share	0.15	0.25	0.3	Researched	S10, S02	25% of basic is the market norm (allowance); shared company accommodation is often cheaper -> low 15%.
L03	Transport	SAR/month	100	200	300	Assumption	S02	Company transport is normally provided (posting S02); cost per head assumed.
L04	Food allowance	SAR/month	0	200	300	Researched	S02	SAR 200 food allowance in the Jeddah posting.
L05	GOSI employer rate expat	share of basic+housing	0.02	0.02	0.02	Researched	S04, S05	Non-Saudi: 2% occupational hazards, employer only.
L06	Expat levy	SAR/month	700	800	800	Researched	S06	~SAR 800/worker/month; may be lower for establishments with a higher Saudi share.
L07	Iqama fee	SAR/year	650	650	650	Researched	S06	SAR 650 per 12 months.
L08	Medical insurance	SAR/year	800	1,500	2,500	Assumption	S11	Basic-class worker cover; national average premium per insured person is SAR 4,511 (all classes) - workers sit well below it.
L09	End-of-service months per year	months of wage	0.5	0.5	0.5	Researched	S09, S10	Art. 84: half a month per year for the first 5 years; base = basic + housing.
L10	Air ticket biennial	SAR/2 years	1,500	2,000	2,500	Assumption	S02	Air ticket provided (S02); price assumed.
L11	Recruitment visa amortised	SAR per hire over 24 months	4,000	6,000	10,000	Assumption		Visa, recruitment agency and onboarding, amortised over a 2-year contract. No authoritative public figure.
L20	Total wage	SAR/month	4,000	5,000	6,000	Researched	S12, S01	Nitaqat counts a Saudi fully from SAR 4,000. GASTAT Saudi male lower-secondary average 7,352 (all occupations).
L21	Basic share of wage	share	0.7	0.75	0.8	Assumption	S10	Basic ~75-80% of wage when housing is 25% of basic.
L22	GOSI employer rate saudi	share of basic+housing	0.1175	0.1225	0.1275	Researched	S04, S05	Old scheme 11.75%; new scheme 12.25% (to Jun 2026), 12.75% (from Jul 2026).
L23	Saudi share of operatives	share	0.1	0.2	0.3	Assumption		Actual workforce mix is unknown (see O4_Gaps).
L12	Storekeeper basic salary	SAR/month	1,500	1,900	2,500	Researched	S34, S35, S37	Expat storekeeper postings SAR 1,500-2,500 basic + benefits (same band as operatives); Paylab gross 2,357-7,624 (all nationalities). Tally clerks use the operative basic salary (L01).
L24	Manager monthly wage	SAR/month	5,000	8,000	12,000	Researched	S36	Paylab warehouse manager gross SAR 3,240-11,953 (P10-P90), ~8,092 after 5 years.
L25	Manager oncost share	share of wage	0.15	0.2	0.3	Assumption	S04, S06, S09	GOSI, medical, end of service and (if expat) levy / iqama on top of the cash wage.
T01	Working days per month	days	26	26	26	Researched	S07	6-day week, Friday rest (Art. 98/104).
T02	Daily hours	hours	8	8	8	Researched	S07	Art. 98.
T03	Daily hours ramadan	hours	6	6	6	Researched	S07, S33	Art. 98 / MHRSD.
T04	Break hours	hours	0.5	0.5	0.5	Researched	S07	Art. 101: 30-minute rest after 5 hours.
T05	Max hours at workplace	hours	12	12	12	Researched	S07	Art. 101.
T06	Overtime premium on basic	share	0.5	0.5	0.5	Researched	S08	Art. 107.
T07	Annual leave days	days/year	21	21	21	Researched	S09	Art. 109 (30 after 5 years).
T08	Public holiday days	days/year	10	10	12	Researched	S25, S28, S29	Eid al-Fitr 4 + Eid al-Adha 4 + Founding Day + National Day.
T09	PF&D allowance	share	0.1	0.12	0.14	Researched	S13	Personal ~5% + fatigue 3-5% + delay 2-4%.
C01	Labour share of warehouse opex	share	0.4	0.5	0.6	Researched	S15, S14	Labour up to ~50% of opex; order picking alone up to 55%.
C02	EBIT margin 3PL	share	0.04	0.065	0.1	Researched	S16	DHL Supply Chain FY2025 EBIT margin 6.5%.
C03	US receiving fee per pallet	USD	5	10.52	15	Researched	S17, S18	Benchmark only (cross-check of the rate card).
C04	US receiving labour rate	USD/hour	30	39.88	60	Researched	S17	Benchmark only.
C05	KSA storage per pallet month	SAR	80	150	250	Researched	S19	Storage revenue is NOT modelled (pallet positions unknown) - context only.

ID	Parameter	Unit	Low	Base	High	Basis	Sources	Note
C06	Client case rate example	SAR/case	0.5	0.65	0.8	Client	S39	Badr: the same case activity is billed SAR 0.8 to one client and SAR 0.5 to another. Used only to check the simulated case-pick rate.
C07	Distributor gross margin	share	0.12	0.16	0.2	Researched	S38	Turns extra Riyadh sales into profit in the opportunity levers (no Binzagr cost data yet).
M01	Cycle idle cap minutes	minutes	15	30	45	Assumption		Gap between scans longer than this is a break/idle, not work content.
M02	Standard time percentile	percentile of badge-month mean cycle	0.6	0.5	0.4	Assumption		Standard = time the median performer needs (low = more lenient, high = tighter).
M03	Target performance percentile	percentile of shift performance	0.6	0.75	0.9	Assumption	S23	Target = what the best X% of Binzagr shifts already achieve. Base P75 (top quartile).
M04	Direct shift min events	events	30	30	30	Assumption		Shifts with fewer scans are treated as indirect/occasional (excluded from savings).
M05	Savings capture rate	share	0.5	0.7	0.9	Assumption	S23	Share of the modelled gap that is realistically captured (rostering is lumpy).
M06	Badge sharing split hours	hours	12	12	12	Researched	S07	Sessions longer than the 12h legal presence limit are split into two worker-shifts.
M07	Bulk posting same second share	share of scans	0.85	0.9	0.95	Assumption		Sessions with more than this share of scans in the same second as the previous scan are batch confirmations (95th percentile of sessions = 0.89); paid hours count, but they are not benchmarked.

5. Validation

5.1 Validation already done

ID	Check	Result	Detail
S01	Every simulated/inferred table carries a basis label column	PASS	missing: none
S02	Parameters: base within [low, high]; every Researched parameter cites a source in the register	PASS	researched without source: none; bad basis: none; 41 parameters, 40 sources
S03	Billable volumes in the simulated P&L equal Actual counts in O2_Cleaned (Binzagr revenue codes; case pick in cases)	PASS	differences: none; cases picked 2,957,408
S04	Session rules: paid >= legal hours; 0 <= recoverable <= observed; savings only on eligible shifts; >12h sessions split	PASS	none
S05	Monthly P&L labour cost reconciles to session cost + paid days without a scan (head-count basis), and its scan-day part to the sessions	PASS	P&L 6,146,784 = sessions 4,630,232 + paid days without a scan 1,516,551
S06	Baseline EBIT margin equals the benchmark margin parameter (cost-recovery construction)	PASS	6.5000%
S07	Monte Carlo quantiles ordered; Base scenario inside the P10-P90 band	PASS	recoverable P10 491,647 / Base 639,485 / P90 805,806
S07b	Scenario ordering Conservative < Base < Stretch	PASS	none
S08	Rate card positive and ordered (low <= base <= high) for every billed activity	PASS	9 activities
S08b	Case-pick labour per loose case on the days people worked is not above the highest case rate Binzagr quoted (otherwise every client would be priced below labour)	PASS	worked-time labour SAR 0.77 per loose case vs client rates SAR 0.50-0.80: at SAR 0.50 the price would not cover it (question V12); incl. paid days without a scan SAR 1.02 (facility basis, to compare with Binzagr cost per case, V11)
S08c	Information: full cost-recovery case-pick rate vs Binzagr's example rates (differs because storage and other charges are not modelled)	WARN	cost-recovery SAR 2.17 per case vs client SAR 0.50-0.80
S08d	Information: receiving rate vs US survey conversion (US handling fee only; ours carries inbound admin and the opex gross-up)	WARN	receiving base SAR 34.35 vs external SAR 13.46 (+155%)
S09	Receivables: balance = allocated + unexplained; open <= invoice; due >= invoice date; item totals = customer totals	PASS	1,616 customers, 6,011 open items
S10	Outlet activity: one row per customer in the master, status always set	PASS	18,983 rows
S11	Official Eid dates fall inside the event windows and the warehouse data shows closures on them	PASS	observed closures: 2026-03-21, 2026-03-22, 2026-03-23, 2026-05-26, 2026-05-27, 2026-05-28, 2026-09-23
S12	Client typing consistent with item-code matching	PASS	binzagr business unit: 26, external 3pl client: 5
S13	Badge-sharing risk: every session tiered; all >16h sessions are high risk	PASS	none: 22476, low: 488, medium: 427, high: 198
S15	Labour cost posted to activities reconciles to session labour cost (to the riyal)	PASS	posted 4,630,232 vs sessions 4,630,232

ID	Check	Result	Detail
S16	Only activities Binzagr marks 'Revenue Generation' are billed, and each of them has a rate	PASS	billed 153, 172, 183, 204, 206, 350, 391, 400, 410; Binzagr revenue codes in the log 153, 172, 183, 204, 206, 350, 391, 400, 410 (code 100 excluded: log says Item Import, mapping says Picked Volume)
S17	Every session has a cost tier from the WMS role; supervisory and bulk-posting sessions carry no savings	PASS	bulk-posting sessions 871; supervisory 14
S18	No employee names from the WMS user list appear in any simulated table	PASS	none
S19	Splitting outbound cost by billed lines matches the split by actual pick time (Picking scans linked to their Case Pick / Pallet Pick row) within 5 points	PASS	case pick share: 80.4% by lines vs 80.1% by pick time; 100.0% of 516,761 Picking scans linked
S20	Head count: scan-day FTE <= payroll head count <= all employee ids each month; payroll people scanning <= active people in Binzagr's user list; person-month costs reconcile to the sessions	PASS	FTE 115 / 161 / 199; employee ids scanning 202 a month; user-list active people 269
S14	Every parquet has a CSV twin with equal rows; no file over 29 MB	PASS	none

- **Reproducibility:** every random step is seeded (Monte Carlo 20261021, IsolationForest 7), so a re-run of the scripts on 02_Cleaned gives the same tables (version 1 was re-run on a fresh copy and matched byte for byte).
- **Against Binzagr's own prices and pick times:** labour per loose case picked on worked time (SAR 0.77) is within the SAR 0.50-0.80 per case Binzagr quoted (S08b); with paid days without a scan (SAR 1.02) it is not, which is a question for Binzagr (V11, V12). Splitting outbound cost between case and pallet picks by billed lines matches the split by actual pick time (S19). Loaded expat cost (SAR 4,101 a month) sits inside the range implied by job postings and statutory costs.
- **Against Binzagr's own data:** billable volumes equal the Actual event counts (S03); the official Eid dates show up as closures in the warehouse data (S11); client typing agrees with item-code matching (S12).
- **Head count:** the three bases are ordered (scan days < head-count base < every login) and labour on each basis reconciles to scan-day cost + no-scan cost to the riyal (S05, S20).
- **Sensitivity:** the Monte Carlo shows which inputs matter (3.8), so validation effort goes to the head count, the target percentile, the capture rate and the basic salary first.

5.2 Validation still needed (with Binzagr data)

Each simulated or inferred item has a test that Binzagr data would settle. Thresholds are our proposal for agreeing the model is fit for the PoV; the item is replaced by the actual data whenever that data arrives. Requests are numbered as in document 4.

Item	Test	Data needed	Proposed pass threshold	Req.
Paid hours (3.4)	Simulated vs clocked hours per person-day (payroll number) and per site-month	Clock-in by payroll no.	Site-month totals within +/-15%; median person-day error <= 1.5 h	V1
Head count (3.4b)	Simulated paid FTE per site-month vs HR headcount; are payroll people on shift on days they do not scan?	HR headcount + attendance	Site-month FTE within +/-10%	V1, V4
Unobserved time (3.4)	Recompute the 58.9% with real paid hours	Clock-in by payroll no.	Reported, not tested: it becomes a measured finding	V1
Loaded cost (3.1)	Actual all-in cost per paid hour vs simulated	Monthly labour cost + headcount	Inside the low-high band (SAR 16.25 - 31.81 per hour)	V4
Standard times (3.3)	Data P50 vs time-and-motion time for the 10 activity / line-size pairs with most hours	Time-and-motion study	Within +/-25% for at least 8 of 10	V3
Benchmark target (3.5)	Do Raza's best sites rank high in our productivity?	Best-run sites / shifts	Spearman rank correlation >= 0.5	V3
Rate card (3.6)	Units x contract rates vs P&L revenue; simulated vs contract rate per service	Rate card + P&L	Revenue within +/-5%; rate gaps reported per service	V5
Labour per case / pallet (3.6)	Simulated labour cost per case picked and per pallet received (worked time and all paid days) vs Binzagr's facility costing	Cost per case / pallet by site	Within +/-20% per site-month	V11
Case rates (3.6)	Sample client rates vs simulated labour per unit (must cover it) and vs cost-recovery rates	Sample client rates	Price >= labour per unit for every activity	V12
P&L structure (3.7)	Actual labour share of opex and EBIT margin vs C01 / C02	Jeddah P&L	Labour share 40-60%, margin 4-10% (else re-base)	V5
Badge-sharing risk (3.9)	Share of high-risk sessions explained by two people or a shared / system login	Attendance + badge ids	Precision >= 70% on high-risk sessions	V2
Client typing (3.10)	Inferred type vs Binzagr's client list	Client list	31 of 31 match	V9
Site temperature (3.11)	Inferred regime vs site register	Site register	2100-14 / 2100-15 confirmed; no ambient site cold	V9

Item	Test	Data needed	Proposed pass threshold	Req.
Channel labels (3.12)	Inferred label vs official name of each code	Code names	Labels agree for codes covering $\geq 80\%$ of customers	V7
Receivables FIFO (3.13)	Simulated bucket shares vs actual ageing at the same date	AR ageing report	Each bucket within ± 5 percentage points	V6
Churn proxy (3.14)	Lapsed outlets vs confirmed closures	Closure list	Precision $\geq 60\%$; recall reported	V8
Calendar (3.16)	Official dates vs observed closures	-	Done: all three holidays observed	-

5.3 When prediction models are built

- Validate forecasts on time: train on the earlier months and test on the later ones (no random splits), and compare with a seasonal-naïve baseline (same weekday last weeks) using WAPE / MAPE.
- Treat Ramadan and Eid as features, not as learned seasonality, until a second year of history is available (request G14).
- Classification models (churn, badge sharing) need labels from Binzagr: report precision and recall, never accuracy alone.

6. Sources

ID	Title	Publisher	Date	Link
S01	GASTAT Labour Force Survey Q4 2025 - average monthly wages by nationality, sex, education (via GLMM)	General Authority for Statistics / Gulf Labour Markets & Migration	2026	https://gulfmigration.grc.net/saudi-arabia-average-monthly...
S02	Job posting: labour, Jeddah - SAR 1,800-2,000/month + free accommodation, transport, medical, air ticket; SAR 200 food allowance	Bureau of Emigration & Overseas Employment, Govt of Pakistan	offer expiry 17/04/2025	https://beoe.gov.pk/foreign-jobs/3185707
S03	Job posting: 19 warehouse workers, Riyadh - SAR 1,200-1,400	Bureau of Emigration & Overseas Employment, Govt of Pakistan	2026	https://beoe.gov.pk/foreign-jobs/4093177/4576207/19-wareho...
S04	GOSI contribution rates 2026 (old/new scheme; non-Saudi 2% occupational hazards; base = basic + housing)	Noqta (summary of Social Insurance Law)	2026	https://noqta.tn/en/blog/gosi-contribution-rate-salary-ded...
S05	GOSI rates increase 1 July 2026 (+0.5% pension each side, new-scheme Saudis)	Deel Local Payroll (PaySpace)	2026-07-02	https://payspace.com/blog/saudi-arabia-gosi-contribution-r...
S06	Expat levy ~SAR 800/worker/month; iqama SAR 650/12 months; employer pays	Etqan Law Firm	2025-07-17	https://etqanlawfirm-sa.com/en/labour-iqama-fees-in-saudi-...
S07	Saudi Labor Law working hours: Art. 98 (8h/day or 48h/week; Ramadan 6h/36h for Muslims), Art. 101 (30-min rest after 5h; max 12h at workplace), Art. 104 (Friday rest)	Qoyod (guide to the Labor Law)	2026	https://www.qoyod.com/en/learn/working-hours-weekly-rest-s...
S08	Overtime Art. 107: hourly wage + 50% of basic; hourly basic = basic/240; 720 h/yr cap	Noqta	2026-09-07	https://noqta.tn/en/blog/overtime-pay-calculation-saudi-la...
S09	End-of-service award (Art. 84: half month per year for first 5 years); annual leave 21 days (Art. 109)	Teamed	2025	https://www.teamed.global/gulf-employment-law/saudi-arabia
S10	Housing allowance usually 25% of basic; included in GOSI base and end-of-service base	Qoyod Business Glossary	2026-10-12	https://www.qoyod.com/en/glossary/housing-allowance/
S11	Average health-insurance premium per insured person SAR 4,511 (end 2024; Argaaam study)	Middle East Insurance Review	2025-09-24	https://www.meinsurancereview.com/News/ViewNewsletterArtic...
S12	Nitaqat: Saudi employee counts fully from SAR 4,000/month, half at SAR 3,000	Argaam	2021-04-18	https://www.argaam.com/en/article/articledetail/id/1460333
S13	PF&D allowances: fatigue 3-5%, personal ~5%, delay 2-4%	Supply Chain Digest (quoting Manhattan Associates, enVista)	2013-07-17	https://www.scdigest.com/ontarget/13-07-17-1.php?cid=7230
S14	de Koster, Le-Duc & Roodbergen (2007) Design and control of warehouse order picking - order picking up to 55% of warehouse operating expense; travel ~50% of picker time	European Journal of Operational Research 182(2):481-501	2007	https://doi.org/10.1016/j.ejor.2006.07.009
S15	Labour can account for up to 50% of a warehouse total operating cost (Infor)	MHL News	2009-07-15	https://www.mhlnews.com/labor-management/article/22039898/...
S16	DHL Supply Chain FY2025: revenue EUR 17,778m, EBIT EUR 1,161m, EBIT margin 6.5%	DHL Group annual earnings 2025	2026-03-05	https://group.dhl.com/en/media-relations/press-releases/20...
S17	3PL pricing benchmarks (Fulfillment Advisor 2025 survey, 600+ warehouses): receiving USD 10.52/pallet, receiving labour USD 39.88/h, storage USD 20.17/pallet/month, B2B order USD 4.80	Fulfill.com	2026-06-10	https://fulfill.com/3pl-pricing
S18	3PL pricing guide citing Warehousing & Fulfillment 2025 survey (receiving USD 5-15/pallet, storage USD 15-40/pallet/month)	Red Stag Fulfillment	2025	https://redstagfulfillment.com/freight-rates-and-fuel-surc...
S19	Riyadh storage SAR 80-250 per pallet/month; industrial SAR 15-45/sqm/month	Averx Global	2026-06-18	https://www.averxglobal.com/blog/warehouse-storage-solutio...

ID	Title	Publisher	Date	Link
S20	UAE 3PL: storage AED 50-120/pallet/month, inbound receiving AED 3-8 per carton, pick & pack AED 8-20/order	UAE Free Zone Finder	2026-08-11	https://uaefreezonefinder.com/uae-fulfillment-warehousing-...
S21	Saudi industrial & logistics rents: Riyadh SAR 208/sqm (+16%), Dammam SAR 231/sqm (+9%), Jeddah +8% (Knight Frank Autumn 2025)	Arabian Business	2025	https://www.arabianbusiness.com/industries/real-estate/sau...
S22	JLL KSA Industrial Q2 2026: Jeddah rents +4.8%; top submarket SAR 300/sqm/yr	Food Business MEA	2026-08-26	https://www.foodbusinessmea.com/?p=2162850
S23	Engineered labour standards typically raise productivity 15-35% (vendor experience)	Easy Metrics	2025-04-25	https://www.easymetrics.com/understanding-engineered-labor...
S24	Buddy punching accounts for 2.2% of gross payroll (Nucleus Research); 19% of employees admit to it	Synerion	2015-01-16	https://blog.synerion.com/buddy-punching-and-employee-time...
S25	Eid al-Fitr 2026 private-sector holiday: 4 days from close of business 29 Ramadan (Wed 18 Mar)	Gulf News	2026-03-04	https://gulfnews.com/world/gulf/saudi/saudi-arabia-announc...
S26	Eid al-Fitr 2026 = Friday 20 March (Shawwal crescent not sighted)	Gulf News	2026-03-18	https://gulfnews.com/world/gulf/saudi/saudi-arabia-announc...
S27	Saudi Supreme Court: Arafat Day Tue 26 May, Eid al-Adha Wed 27 May 2026	Petra (Jordan News Agency)	2026-05-17	https://petra.gov.jo/cgi-bin/index.php/en/news/saudi-supre...
S28	Eid al-Adha 2026 private sector: paid days off from Arafat Day (26 May), minimum 4 days	ZenHR	2026-03-26	https://blog.zenhr.com/en/eid-al-adha-2026-holiday-saudi-a...
S29	2026 Saudi holidays: Founding Day Sun 22 Feb, National Day Wed 23 Sep	ZenHR	2025-12-21	https://blog.zenhr.com/en/saudi-arabia-public-holidays-202...
S30	Ramadan 1447 began Wednesday 18 February 2026 in Saudi Arabia	LatestLY	2026-03	https://www.latestly.com/lifestyle/festivals-events/eid-20...
S31	NielsenIQ State of the Nation 3Q25: traditional trade 23% and e-commerce 5.6% of Saudi FMCG sales	Enterprise AM	2025-12-09	https://enterpriseam.com/ksa/2025/12/09/shoppers-tighten-g...
S32	Baqalahs (small family-run grocers) ~57% of Saudi grocery market; hyper/supermarkets 37% (2018)	Bord Bia	2018-04-13	https://www.bordbia.ie/industry/news/food-alerts/retail-in...
S33	MHRSD: private-sector Ramadan working hours 6 per day (Art. 98)	Ajel	2022-03-26	https://english.ajel.sa/saudi-arabia/mhrsd-announces-ramad...
S34	Job posting: 10 storekeepers, KSA - SAR 1,500-2,000/month + free accommodation, food, transport, medical, air ticket	Bureau of Emigration & Overseas Employment, Govt of Pakistan	offer expiry 28/06/2025	https://beoe.gov.pk/foreign-jobs/3402034/3819070/10-storek...
S35	Job posting: store keeper, KSA - SAR 2,200-2,500/month	Bureau of Emigration & Overseas Employment, Govt of Pakistan	2025	https://beoe.gov.pk/foreign-jobs/3141199/3536608/1-store-k...
S36	Warehouse manager, Saudi Arabia: gross SAR 3,240-11,953/month (10th-90th percentile), ~SAR 8,092 after 5 years (49 respondents)	Paylab Saudi Arabia	2026	https://saudiarabia.paylab.com/en/salaryinfo/management/wa...
S37	Storekeeper, Saudi Arabia: gross SAR 2,357-7,624/month (10th-90th percentile, all nationalities, 38 respondents)	Paylab Saudi Arabia	2026	https://saudiarabia.paylab.com/en/salaryinfo/management/st...
S38	Almunajem Foods (listed Saudi food distributor): gross margin 16% (FY2025 and last twelve months)	multiples.vc	2026-10-21	https://multiples.vc/public-comps/almunajem-foods-valuation...
S39	Binzagr data walkthrough (Badr Almesri): costing per case / per pallet at facility level; client-specific rates (same case activity billed SAR 0.8 to one client, SAR 0.5 to another); labour posted per task (wage x task x duration); HU_ID_2 unused; zero-second tasks are an operator practice	Binzagr - meeting notes and transcript	2026-10-21	
S40	Binzagr WMS mappings: transaction mapping (cost / revenue, type of movement), WMS user list (payroll number, menu level, status), unit-of-sale conversion factors, pallet-id sample	Binzagr - Badr Almesri (files)	2026-10-22	

7. Limitations

- Paid time is simulated from scan sessions plus an employment spell per payroll person: people who never scan are invisible, logins not in the user list are paid only on scan days, and sessions under 4 hours are not benchmarked.
- The head count is inferred from employee ids, not HR records: the user list shows about 269 active people a month but only about 138 payroll people scan; labour cost moves by about SAR 2M a year either way depending on who is paid.
- Standards come from the same population they benchmark (relative, not engineered); P50 standards may embed today's slack, which makes the savings estimate conservative.
- Benchmark role = dominant activity of the session; cost role = WMS menu level (not a job title); 6% of scans come from logins not in Binzagr's user list.

- Rates are cost-recovery, not market prices; storage revenue is excluded; the baseline margin is set by construction; Binzagr's case-rate example is one statement, not a price list.
- Receivables ageing rests on the FIFO assumption; channel labels on name keywords; temperature on product names.
- One Ramadan in the data: seasonality is encoded, not learned.

Reproduce: run, from 03_Simulated/scripts, parameters.py -> sim_labour.py -> sim_pnl.py -> sim_inferred.py -> sim_commercial.py -> sim_opportunity_levers.py -> sim_checks.py -> build_sim_report.py (after 02_Cleaned incl. clean_mappings.py). Requirements: pandas, numpy, pyarrow, scikit-learn, openpyxl.