

The agreed list: nine quantities nobody disputes

Chapter 1. Write down what nobody contests before the argument starts, with the system it comes from and the person who owns it. Nothing else enters the calculation.

Item / SKU		Owner	
Prepared by		Date	

Quantity	Where it comes from	Value	Unit	Owner	Last checked
Selling price	sales ledger				
Landed cost (price + freight + duty + handling on arrival)	purchase ledger, not the invoice alone				
Unit margin	price less landed cost				
Mean weekly demand	order book, dated when the customer asked				
Standard deviation of weekly demand	the same rows, around the forecast, demand not shipments				
Mean lead time	goods receipts: order release to available to pick				
Standard deviation of the lead time	the same receipts: the number no system holds				
Holding rate a year (four components, sheet 2)	finance: capital, warehousing, obsolescence, insurance				
Cost of placing one order	purchasing and receiving, per event, not per unit				

Derived at once	Value	Checked by
Annual demand = weekly x 52		
Holding cost of one unit a year, h = landed cost x holding rate		
Margin of a lost unit / cost of holding one unit a year (m / h)		
Annual revenue and annual margin of the line		

AF-7: 47.50 and 28.60 EUR, margin 18.90; 1,840 units a week, standard deviation 462; 6.0 weeks, standard deviation 1.9; 13.40 per cent, so 3.8324 EUR a unit a year; 385.00 EUR an order. $m / h = 4.93$.

The holding rate, built and owned

Chapter 6. A percentage that looks like an observation and is a construction. Four components, four owners, and one sensitivity row before any figure uses it.

Company		Finance owner	
Approved by		Date	

Component	Owner and source	Rate	How computed	Reviewed
Cost of capital	treasury: weighted average cost of capital			
Warehousing (space, racking, handling, energy)	logistics: site cost / average inventory value			
Obsolescence (scrap, write-down, expiry)	quality / finance: write-offs for age / average inventory			
Insurance	risk: premium quoted as a rate on stock value			
Other (state it or write none)				

Total holding rate		Landed cost		$h = \text{cost} \times \text{rate}$	

Rate tested	Order quantity	Inventory value	Total cost a year	Optimal cycle service level
8.0%				
10.0%				
your rate				
16.0%				
20.0%				
25.0%				

Chapter 6: from 8 to 25 per cent the order quantity moves from 5,674.50 to 3,209.98, the inventory value from 296,981.16 to 261,738.52 EUR, the optimal service level by half a point, and the total cost from 38,849.12 to 92,111.35 EUR. The rate decides what the answer costs, not what it is.

Lead time, measured from receipts

Chapters 3 and 13. One row per replenishment. Start the clock at order release, stop it at available to pick. Keep the early receipts: scatter has no sign.

Item / supplier		Measured by	
Window		Date	

Item	Done / n.a. / open	Evidence / note
Before computing		
Window old enough that every order in it has landed (no open orders dropped)		
Partial deliveries resolved by a stated rule (to the last, or to the first with its quantity)		
Expedited or emergency orders flagged and analysed apart, not mixed in		
Changes of site, route or incoterms split the history in two		
Result		
Mean of the column; standard deviation of the same column		
Receipts in the sample and the precision they allow (29 for +/- 0.5 week, 79 for +/- 0.3, as floors)		
Correlation of each lead time with the one before: runs or alternation? (Appendix C)		

Chapter 13: never measure from the promise date. A supplier who promises a new date every time and meets every promise has a perfect on-time record and a large standard deviation.

Where the variance comes from

Chapters 4 and 5. Two parents, built on different exponents. Split them before anyone chooses a service level or a network.

Item / SKU		Owner	
Prepared by		Date	

Term	Formula	Your item	AF-7
Demand during the lead time (centre)	$D \times L$		11,040.00
Demand term of the variance	$L \times \sigma_D^2$		1,280,664.00
Lead time term of the variance	$D^2 \times \sigma_{LT}^2$		12,222,016.00
Total variance	sum of the two		13,502,680.00
Standard deviation during the lead time, σ_L	square root of the total		3,674.60
Same with a perfectly regular supplier	$\sigma_D \times \sqrt{L}$		1,131.66
Share from the market	demand term / total		9.4845%
Share from the supplier	lead time term / total		90.5155%

Test	Answer
Which term dominates? (Then: forecasting work, or a supplier conversation?)	
Does the answer survive the precision of σ_{LT} ? Read the share at the low and high end of the band	
What would have to be true for the other term to dominate?	
Independence of demand and lead time: plausible here? If they move together, the formula is a floor	
Five assumptions of Chapter 4 checked, including one order outstanding at a time	

Chapter 5: lead time irregularity is a volume disease. The lead time term carries the square of the demand rate, so it dominates large, steady lines and vanishes on small, erratic ones.

The service level translation table

Chapter 8. One table, maintained by one person, showing the readings side by side at the order quantity in force. The only document that ends the argument.

Item		Owner of the translation	
Order quantity		Date	

Cycle service level	z	Safety stock	Fill rate	Units short a year	Cycles short a year	Order line fill rate (measured)
90.00%						
95.00%						
97.00%						
98.00%						
99.00%						
99.50%						
99.90%						
fill rate target:						

Statement to publish with the table	Filled
"A cycle service level of ____ produces a fill rate of ____ at a batch of ____ units."	
"A fill-rate target of ____ requires a cycle service level of ____."	
Which reading the board minute means, in words, with its denominator (cycles, units, lines, events)	
Order line fill rate: taken from the order management system, not modelled (it needs the line-size distribution)	

AF-7: 98.0000 per cent of cycles is a fill rate of 99.3846 per cent at 4,384.50 units; a 98 per cent fill rate needs 94.3945 per cent. 0.4364 cycles a year are expected to contain a shortage: one year of records cannot arbitrate the policy.

The total cost test for a stocking proposal

Chapters 9 and 10. Any change to a stock policy is judged on the three terms together, never on the inventory value alone. Stock and flow are cited apart.

Proposal		Proposed by	
Reviewed by		Date	

Term	Formula	Today	Proposed	Change
Holding	$(Q / 2 + z \times \sigma_L) \times c \times i$			
Ordering	$(D / Q) \times S$			
Shortage	$\sigma_L \times G(z) \times (D / Q) \times m$			
TOTAL a year	sum			
Inventory value (balance sheet, once)	$(Q / 2 + z \times \sigma_L) \times c$			
Fill rate	$1 - \sigma_L \times G(z) / Q$			

Item	Done / n.a. / open	Evidence / note
The four questions the memo did not ask		
Does the total fall, not only the inventory?		
Is the cash released a stock (once) and the cost a flow (every year)? Horizon stated?		
Is the return on released cash already inside the holding rate (cost of capital)? Then it is not added again		
What service does the proposal buy or give up, in units short a year?		

Chapter 10: moving AF-7 from 98.0000 to 94.3945 per cent releases 48,865.25 EUR once, is worth 6,547.94 EUR a year of holding, and raises total cost by 18,490.12 EUR a year. Every sentence of the memo was true.

The optimum on one line, and the review that replaces the meeting

Chapter 11. Four inputs, one line, a flat floor. Compute it once, adopt a neighbouring figure if convenient, and review only when an input moves.

Item / SKU		Owner	
Prepared by		Date	

Input	Value	Source
Order quantity Q		
Holding cost of one unit a year h		
Annual demand D		
Unit margin m		

Result	Value
Optimal probability of a shortage per cycle = $Q \times h / (D \times m)$	
Optimal cycle service level $\alpha^* = 1 - \text{that}$	
z^* and safety stock at the optimum	
Total cost at α^* , and at the figure actually adopted	
Width of the dispute: highest less lowest total across the plausible range	

Review trigger (recompute when ...)	Threshold	Last reviewed
Margin changes		
Order quantity changes (supplier terms, ordering cost)		
Holding rate re-built		
Demand level changes		
A supplier conversation changes the spread (recompute the batch too: case two)		

AF-7: α^* 99.0708 per cent, worth 2,168.94 EUR a year against the vote; the whole dispute from 97 to 99.5 per cent is 6,197.72 EUR on a line earning 1,808,352.00 EUR of margin.

The supplier regularity case, on one page

Chapters 12 and 13. Three components, three owners, signed before the call. Two species of money cited apart. Every figure a ceiling.

Supplier / item		Purchasing	
Operations / Finance		Date	

Line	Formula	Value	Owner signs
Spread today and target (weeks)	measured, sheet 3		
Annual gain at the voted service level	holding + shortage today less at target		
Break-even premium per unit	gain / units bought (exact: case three)		
Premium as a share of the price	premium / landed cost		
Income statement over the contract horizon	gain x years (up front: discounted)		
Cash released, once (not added)	inventory today less at target		
Fill rate today and at target	sheet 5		

Item	Done / n.a. / open	Evidence / note
Honesty items on the brief		
One order outstanding assumed: 2.5 orders are open; figures are ceilings		
Sigma_LT estimated from ____ receipts: precision +/- ____ weeks		
The released cash is not counted twice (its capital charge is in the holding rate)		
Partial moves priced row by row before the call		

AF-7: 24,154.77 EUR a year, 130,170.70 EUR once, 0.2525 EUR a unit (0.8827 per cent of the price; 0.2512 exactly), 72,464.30 EUR over three years, fill rate 99.3846 to 99.7557 per cent.

The regularity clause: term sheet

Chapter 13. Buy regularity, not speed. Four definitions before a number; five parts in the clause; the premium withdrawn, not a penalty.

Supplier		Contract ref.	
Buyer		Date	

Definition or clause	What it must say	Drafted wording	Agreed
1. What is measured	elapsed time from order release to available to pick; the two document dates named		
2. The statistic committed	the standard deviation of that time, over a stated rolling window of consecutive receipts		
3. The population	all receipts, no exclusions: expedited, unusual, carrier changes		
4. Who computes it	the buyer, from its own receipts, shared quarterly with the working		
5. The price	a premium per unit below the break-even of the row achieved		
6. The review	quarterly, on the rolling window		
7. A miss	the premium is withdrawn; no penalty		
8. Not in the clause	no request for a shorter mean lead time		

Chapter 13: a late-delivery penalty prices the tail, is blind to early deliveries and compensates instead of correcting. Most of the 1.9 weeks is legal under any penalty clause ever written.

A network proposal, tested before the study

Chapter 14. Decompose the variance first, count cycle stock and orders, and compare networks at the same service to the customer.

Proposal		Sponsor	
Reviewed by		Date	

Line	Formula	One location	n locations	Difference
Share of the variance from demand	Chapter 5: pooling acts on this share only			
Safety stock	$z \times \sqrt{n \times \text{demand term} + \text{lead time term}}$			
Cycle stock	$\text{central } Q / 2 \times \sqrt{n}$			
Inventory value	$(\text{safety} + \text{cycle}) \times \text{cost}$			
Ordering cost a year	$\text{central} \times \sqrt{n}$			
Holding cost a year	$\text{inventory} \times \text{rate}$			
Shortage cost a year (same alpha)	$\sigma_{L-L} \times G(z) \times \text{orders} \times m, \text{ per location}$			
Fill rate	from the same terms			
Total a year, same fill rate	case one			

Also	Answer
Regional demands correlated? (pooling weaker than the square root)	
Handling, premises, transport and misplaced stock priced separately	
Would a supplier conversation change the answer? (price the network at the target spread)	

AF-7: 91,485.19 EUR more inventory and 8,401.59 EUR a year of ordering at the same cycle service level; at the same fill rate, 65,815.76 EUR and 17,220.90 EUR a year all in (case one).

The bias control

Chapter 15. One subtraction, the sign kept, against demand not shipments, over a window long enough for noise to cancel. A bias is a stock policy nobody voted.

Item		Forecast owner	
Window		Date	

Result	Value
Mean signed error over the window, as a share of demand	
Offset of the reorder point: $D \times L \times \text{bias}$ (units)	
Effective $z = \text{voted } z + \text{offset} / \sigma_L$	
Holding leg + shortage leg = net effect a year (both legs)	
Decision: taken to the board as a policy, then forecast repaired	

AF-7: 10 per cent under costs 8,952.25 EUR a year net; 10 per cent over earns 2,168.93, because it carries z to 2.3542 against an optimum of 2.3538. The asymmetry is 4.13 times.

Monday morning: the plan and the assumptions register

Conclusion and Appendix C. One measurement, one meeting, one number to stop arguing about; and the seven refusals written next to every figure.

Company		Sponsor	
Start		Date	

Action	Owner	By	Done
Measure the lead-time standard deviation from goods receipts (sheet 3)			
Measure the forecast bias, sign kept (sheet 11)			
Publish the translation table (sheet 5)			
Compute the optimum once and retire the quarterly service level review (sheet 7)			
Sign the three-owner page and hold the supplier meeting (sheets 8 and 9)			

Refusal (Appendix C)	Direction of the error	Stated in the document?
Demand is not exactly normal; lead times are right skewed		
The holding rate is a construction, not an observation		
One part number does not stand for a portfolio		
A stockout costs more than the unit margin (or less, if backordered)		
The computed optimum is a landmark, not a policy		
More than one order is outstanding (figures are ceilings)		
1.9 weeks is an estimate from a sample		

Conclusion: the service level dispute is worth 6,197.72 EUR a year; the bias 8,952.25; the supplier 24,154.77 plus 130,170.70 once; four depots 91,485.19 of stock plus 8,401.59 a year of orders.