Safety Stock Formula

How to Use It and Why It's Important

ZOHO Inventory

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This e-book will give you an overview of the calculation of Safety stock formula and how it can help you to avoid 'out-of-stock' situation.

ONE

1. John's dilemma

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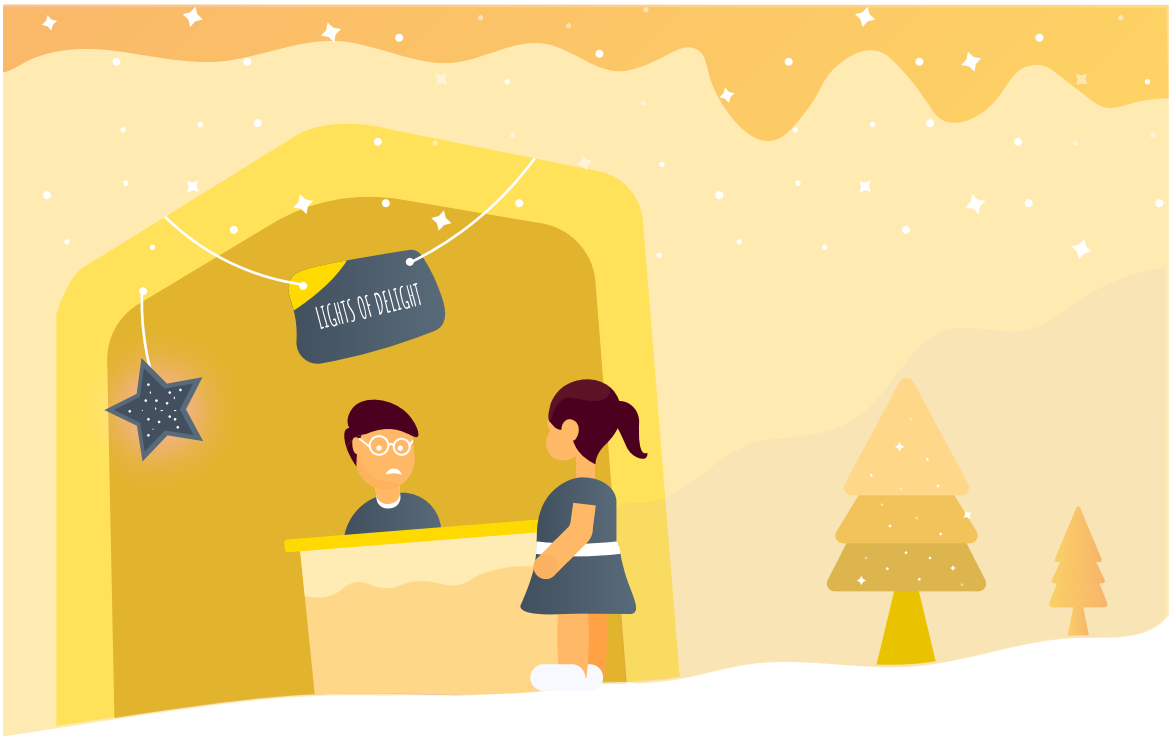

"Sorry, we are out of stock!"

John says with a long face to Lesley, his regular customer. Looks like he's not making any sales today. Was there a way he could have prevented this?

John owns a small lighting store in an upscale area of Nashville. He took over the business about three years ago and shifted its focus from designer bulbs to a new product: string lights. John sourced his string lights from a wholesaler in Maryland, who can usually deliver an order of lights in about five days. Because John's store is small, without much storage space, he decided to keep minimal stock on hand and order just enough for the sales he expected.

Initially, this meant placing a new order for 25 sets of lights every time his stock dipped below 35 sets. Demand for the product was pretty steady — he could count on selling about 4 or 5 sets of lights every day — so this worked out well and allowed him to have just enough stock to meet his customers' needs. The small size of his orders meant that he never had too much excess on hand for his storage space.

Business was pretty smooth until last year, when an influential home designer shared some of her creative ideas for decorating bedrooms and backyards with string lights on Instagram. There was a sudden rise in the demand for string lights. John had a hard time meeting the demand — every month his spare stock was getting utilized, and still he had to turn down customer requests.

He thought it was just a temporary phase that he would eventually be able to manage by sticking to his stocking strategy, but then he started experiencing delays in supply because of unpredictable factors like poor weather conditions and labor strikes. He toyed with the idea of ordering in bulk, but the lack of storage space was a major obstacle.

The day he turned down Lesley's request, he realized he had to take immediate steps and take control of the situation. He'd learned from his business mentor that the solution for this kind of problem lies in the **safety stock formula**.

Safety stock refers to the amount of merchandise that a retailer should always possess to avoid out-of-stock situations.

The safety stock formula is simple. To use it, you just need to know three things about your business:

a) Average demand
b) Variability
c) Lead time

Let's look at what John did to calculate his safety stock:

TWO

2.Calculating the average demand

2.Calculating the average demand

John calculated the average demand of his business based on the trends in his past sales. These were his monthly sales of string lights for last year:

Month	Demand
Jan	155
Feb	108
Mar	144
Apr	170
May	187
June	210
July	233
Aug	250
Sept	257
Oct	268
Nov	275
Dec	289

$$\text{Average monthly demand} = \frac{\text{Total of monthly demand}}{\text{Number of months}}$$

$$= 2546/12$$

$$= 212 \text{ sets per month}$$

Average monthly demand = 212 sets per month

THREE

3.Calculating the variability in demand

3.Calculating the variability in demand

Now that John knows the average demand for his product, it is time to determine the variability. The mathematical term for this is standard deviation. In simple language, it captures the difference between the actual monthly demand and the average monthly demand. The following table displays the difference between the average demand and the actual demand for each month:

Month	Demand	Difference from average	Square of difference
Jan	155	-57	3249
Feb	108	-104	10816
Mar	144	-68	4624
Apr	170	-42	1764
May	187	-25	625
June	210	-2	4
July	233	21	441
Aug	250	38	1444
Sept	257	45	2025
Oct	268	56	3136
Nov	275	63	3969
Dec	289	77	5929
Average	212		3169

Take the square of each month's difference, then average those squares together. That average is known as the variation. As you can see above, John's variation is 3169.

The square root of the variation is the standard deviation, which represents our sales variability.

$$\text{Standard deviation} = \sqrt{3169}$$
$$= 56.292$$

To make his calculations simpler, John rounded up the standard deviation to a whole number, 56.

FOUR

4.Determining lead time and its variability

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John remembers one particularly difficult month last year, when an unexpected snowstorm delayed one of his shipments and the lights finally reached his store 10 days later than expected. He could have made much better sales for that month if he'd had the stock he expected during those 10 days! So it is important to consider the lead time of stock orders as well. Lead time is how long it takes an item to reach the retailer, starting from when it is ordered from the supplier. Since John isn't in control of the manufacture or distribution of his string lights, the number of days it takes for them to reach his store is an important factor for the calculation of his safety stock.

The lead time and average demand should always be calculated using the same unit of measure.

If the lead time is expressed as a number of days, it should be converted to months to match the average demand. For example, if the lead time for the month of May was 7 days, divide it by 30.42 (the average days in a month) to get 0.23 months.

Do the same for the remaining months to arrive at the average, and then calculate the standard deviation using the same method we showed for the variability of demand.

John started scanning the bills he got from his supplier and compared the order dates with the dates on his delivery receipts.These were his findings:

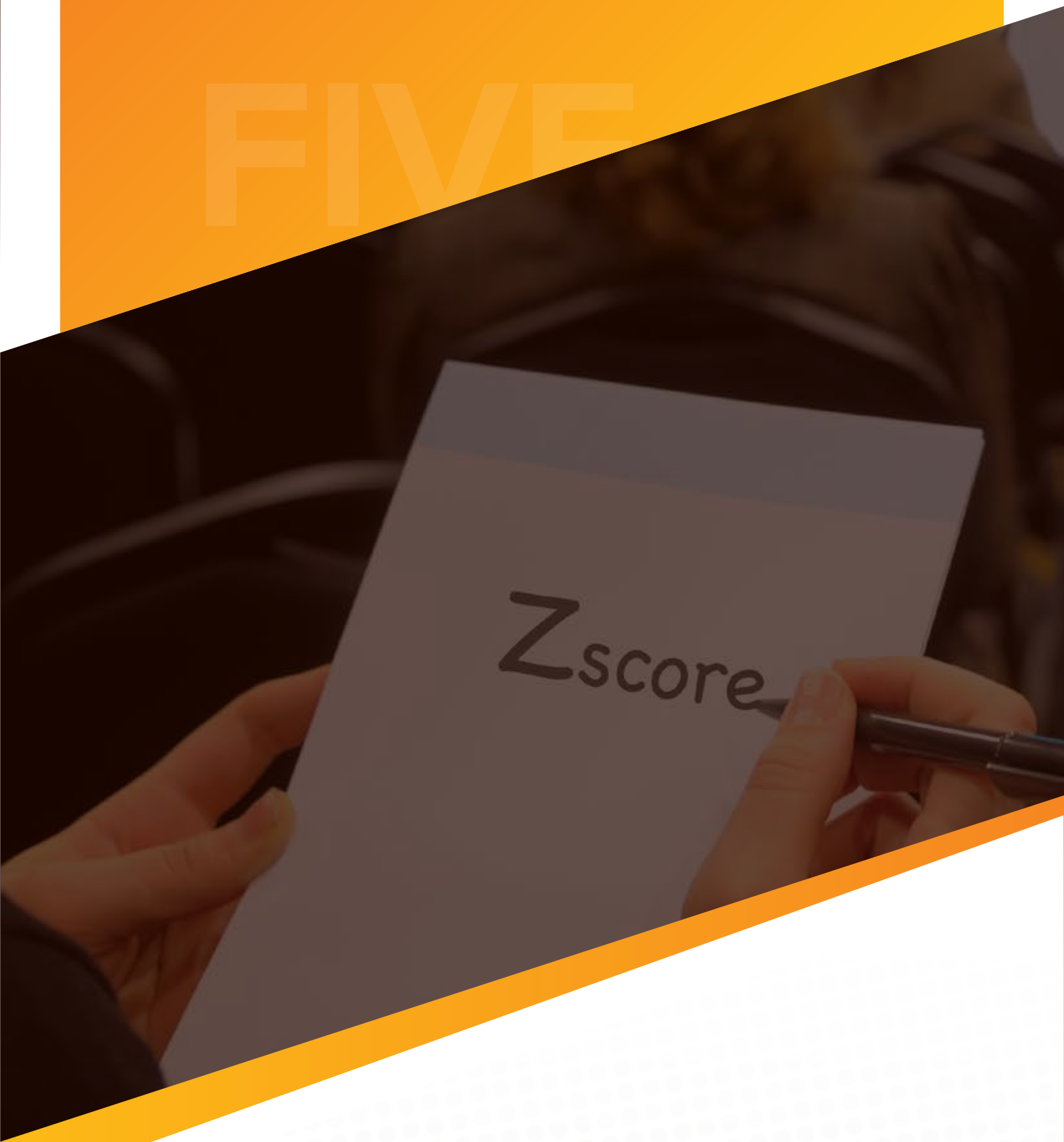
Month	Lead time (days)	Lead time (months)	Difference from average	Square of difference
Jan	5	0.16	-0.08	0.0063
Feb	16	0.53	0.28	0.0796
Mar	5	0.16	-0.08	0.0063
Apr	7	0.23	-0.01	0.0002
May	7	0.23	-0.01	0.0002
June	5	0.16	-0.08	0.0063
July	8	0.26	-0.02	0.0004
Aug	7	0.23	-0.01	0.0002
Sept	8	0.26	0.02	0.0004
Oct	5	0.16	-0.08	0.0063
Nov	8	0.26	0.02	0.0004
Dec	8	0.26	0.02	0.0004
Average	10.75	0.24		0.0089

The average lead time is 0.24 months, so John compared each month's actual lead time to 0.24 to find the difference from the average. Just like before, the standard deviation is the square root of the average of the squared differences.

$$\text{Standard deviation} = \sqrt{0.0089}$$
$$= 0.0944$$

So, with this figure John has a standard number which he can further use for calculating the Safety Stock.

FIVE



5.Assigning Z-score

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The last step in calculating safety stock is to assign an appropriate Z-score.

The Z-score is a way of deciding how confident you want to be about having enough stock.

Using a higher Z-score gives you a higher chance of having enough stock to meet the demand. A lower Z-score means you'll run a bit more risk of running out.

Z-Score	Confidence level (%)
1	84
1.28	90
1.65	95
2.33	99

John referred to the table above and decided to use a Z-score of 1.65, which gives him a 95% chance of having enough stock. Then he was ready to calculate his safety stock:

$$\text{Safety stock} = \begin{matrix}(\text{Z-score} \times \sqrt{\text{avg lead time}} \times \text{std. dev. of demand}) \\ + (\text{Z-score} \times \text{std.dev. of lead time} \times \text{avg demand})\end{matrix}$$

$$= (1.65 * \sqrt{0.24} * 56) + (1.65 * 0.0944 * 212)$$

$$= 46.2 + 33.02$$

$$= 79.22$$

Safety stock = 79.22

This time John rounded to the nearest whole number and got a safety stock figure of 79.

So what does this number mean? It says that, considering John's past fluctuations in demand and lead time, he should always store 79 units of string lights, to avoid going out-of-stock.

SIX

6.Calculating the re-order point

6. Calculating the re-order point

John has arrived at the final stage of his calculations. The only thing he has left to do is to calculate the re-order point. John is now aware that he should always possess 79 units to avoid the risk of going out-of-stock. But, would it be wise for him to wait for the stock to reach this level and only then place an order with his supplier? The answer is definitely NO!!. Doing this can put his business in jeopardy. Hence, to overcome it he needs to complete the final step which is, calculating the Re-order point.

Re-order point is the threshold you maintain such that, if the stock level falls to this level, you raise a new purchase order with your supplier.

The re-order point is a summation of your average demand and safety stock, which we already calculated in the previous steps. So, to find out the re-order point for his business all John had to do is, put both the figures together and add them.

$$\text{Re-order point} = \text{Average demand} + \text{Safety stock}$$

$$= 212 + 79$$

$$= 291$$

Re-order point = 291

So here is the final answer. If there's a spike in demand or a delay in supply due to another sudden snowstorm, John will be well covered if he sets his re-order point at 291. Next time the stock level reaches this point, he should quickly act on it and initiate a purchase order with his supplier. Maintaining the re-order point that he calculated with the safety stock formula will keep his customers satisfied, keep his risk of running out comfortably low, and keep the cash register ringing.

SEVEN

7.Automate

re-order point notifications

7. Automate re-order point notifications

Re-order point is a fantastic tool for inventory control. It helps you to order items at the right time, which not only is a systematic approach but also, a good measure to cut down on the holding cost.

Zoho Inventory helps you to set re-order points for different items. Attach a re-order point based on the past trend and get notified. automatically when the stock level reaches this point.

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