

Going Through the Cycle

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Today I got an email from a European user of SCOR who had questions about how to calculate order cycle time, based on an unclear understanding of it being equal to deliver, make, and source cycle times, with some issues around how accurate the calculation is for Make-to-Order versus Make-to-Stock environments and so on. This, like Perfect Order Fulfillment, is due to a misunderstanding of the use of “level 2” or diagnostic metrics, and how they relate to Order Fulfillment Cycle time. I want to clear up misconceptions about order fulfillment cycle time in this article so, to the best degree possible, everyone understands how to apply it and diagnose problems with it.

Like all SCOR “Level 1” or Strategic Metrics, Order Fulfillment Cycle Time is not too difficult to understand if you take the perspective of the customer. They hand you the order at “Time X”, and at some “Time Y” they receive the service or material and acknowledge the order is then “done”. “Time Y” – “Time X” is the “Order Fulfillment Cycle Time”. I’ll assume that these orders are all “ship as soon as possible” type orders – where orders are placed for future delivery, this cycle time includes a “dwell” time which I’ll discuss later.

Organizations frequently have difficulty understanding what the ‘trigger’ for the order start is (is it when we got the fax, or when we entered it in the ERP system?) The customer has no concept that there are activities *after* they pass the order on to you, so from their perspective, the order cycle starts when they send the order to you, however it gets in your hands. I’ve heard all the arguments around shifting the starting point to a system or a transaction, but the reality is always the same. You can measure your internal process all you want, but the external view of the customer is what matters, because they are comparing you to competitors based on their experience, not based on how you’ve configured your order management process. Imagine how you’d feel if you placed an order for furniture for your new house with a reseller, and they quoted you five days turnaround. Two weeks later you call up angrily, and they said “well, the five days starts from when the order enters our system, and it took a week and a half to get it entered”. Irrelevant information!

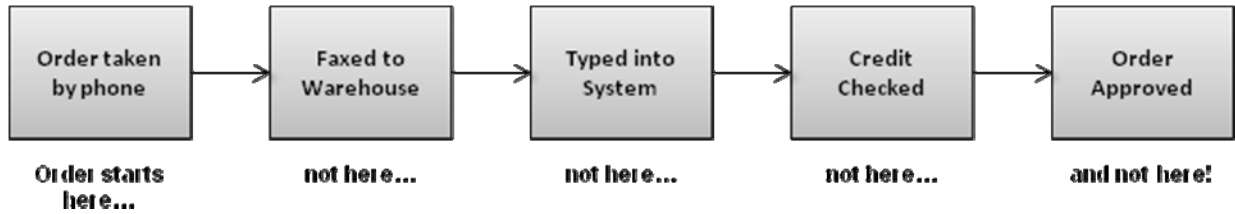


Figure 1: The Order Starts Here

Likewise, companies don't always understand what the 'trigger' for the order finish is. Is it when we shipped? When it arrived at the customer? When it was received? Is it when we shipped plus some average shipping transit time? Again, take the customer perspective. The order is received by them and "signed off" (taken ownership of) at some point in time. When you shipped it is irrelevant. It's when it is in their hands that it is relevant. You bought a nice Flat-Screen TV for the holidays, and it departed the warehouse at the time it was committed to be shipped. However, due to shipping delays, air traffic problems, who knows what – it arrives a week after you wanted it. From your perspective, it was late, and when it was actually shipped is irrelevant!



Figure 2: The Order Finishes Here

If I'm looking at my company's Order Fulfillment Cycle Time performance, the calculation is quite simple. I'm going to look at the total time taken for all orders within a period, and divide it by the number of orders. This gives me the average Order Fulfillment Cycle Time.

$$\frac{\sum(\text{Customer Order Receipt Time} - \text{Customer Shipment Receipt Time})}{\text{Total Orders Shipped}}$$

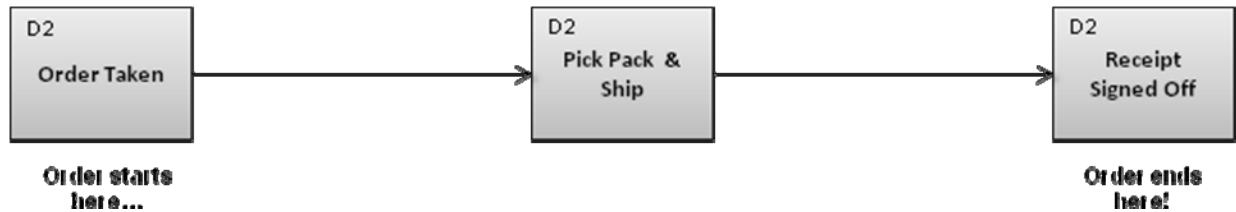
So, I've had several people ask me now how to calculate Order Fulfillment Cycle Time using the cycle times of Source, Make, and Deliver. This is because in the SCOR documentation, there is an indication that Order Fulfillment Cycle Time relates to Source, Make and Deliver:

$$\text{Order Fulfillment Cycle Time} \approx \text{Source Cycle Time} + \text{Make Cycle Time} + \text{Deliver Cycle Time}$$

The problem here is the "≈" or "proportional-to" symbol. It is not equal to the sum of the times, but is proportional to the times. The cycle times of each major process contribute or affect the total cycle time, but there is no simple mathematical formula for calculating, in all

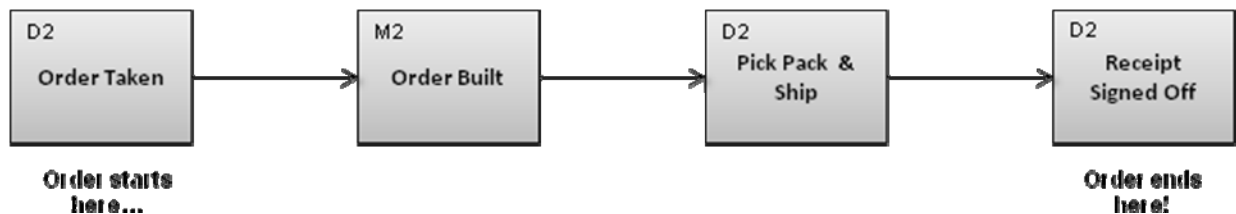
cases, exactly how they contribute. You use the source, make, and deliver cycle times for “diagnosing” what are problems with the total cycle time.

Consider the following (abbreviated) case where we have a make-to-stock strategy and plenty of inventory:



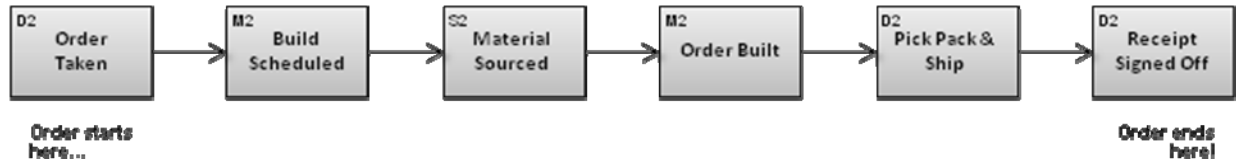
If we had a problem with order cycle time, we would look at each (sub) process step and see what the contribution was to the delay in the system, and so on. In this case order cycle time is essentially equal to deliver cycle time. It doesn’t matter how long the make cycle time, or source cycle time is, at all (if we have plenty of inventory: if our inventory drops to zero, and we have delays waiting for more build, then we need to include build time – but only some of the time! I am purposefully keeping this simple.)

Let’s look at another (simplified) case, where we have a make-to-order strategy, and have plenty of raw inventories:



I have added “D2” and “M2” to indicate “Deliver” and “Make” type processes. In this case, when we get to the Pick Pack & Ship stage, there is no inventory, so instead of picking & packing, we have another cycle through manufacturing to build the product. Only when that cycle is finished, can we go ahead and ship the material out and signoff that it is in the customer’s hands. Instead of one big “D” cycle, there is a big “D” cycle and an inner “M” cycle. In this case the order cycle time is essentially equal to the sum of the D2 type processes and the sum of the M2 type processes. We continue to see a very linear relationship between total order cycle time and the component cycle times (and again, I’m assuming that we have plenty of raw material – if we occasionally have zero raw material and have to wait for sourcing, then we need to include source time – but only some of the time! I’m again purposefully making this simple.)

Let’s look at the last simple case, where we have a make-to-order strategy and only source raw material on the order build trigger:



In this case, when we get to the pick, pack & ship stage, we have no inventory, so we trigger a build. In the build stage, when we want to pick up raw material, there is no inventory so we trigger material sourcing. The material arrives, and we build the order, then we ship it, and finally sign off with the customer. There are two inner cycles to the deliver cycle, the build cycle, and inside the build cycle, there is a material sourcing cycle. In this case the order cycle time would be essentially equal to the sum of the deliver, build, and source cycle times.

So, here's the hard part. Consider if I have all three types of materials in my supply chain - and I can get orders for any mixture of the components together. Consider that sometimes my inventories indeed for both raw and finished goods drop to zero, and I have extra cycles to do replenishment. How would you ever be able to calculate the order cycle time then from the component S, D, and M cycle times? In short, you shouldn't bother worrying! The order cycle time is the sum of all the individual order cycle times together, divided by the number of orders – this accounts for complex mixed orders, simple orders, and everything in between. It's just that simple! You don't need to understand the component cycle times unless there is a problem. The calculation is simple and neat, and it is relatively easy to source the data. What do you do if order cycle times are bad? What you need to do now is a process of diagnoses, using the component S, D, and M cycle times. It could be bad because:

- Deliver cycle time is bad – this affects all orders;
- Make cycle time is bad – this affects all orders with MTO materials;
- Source cycle time is bad – this affects orders with MTO and order-triggered raw sourcing materials.

You will analyze now the drivers of order cycle time to understand where the problem seems to lie. In this case you will probably partition the orders by types of material mixes in the order to see which classes of orders don't achieve the targeted order cycle time. For instance, you'd probably divide orders into these six classes which account for all the different combinations.

- MTS-only orders
- MTO-only orders
- MTO + Raw Order-triggered orders
- MTS + MTO orders
- MTS + MTO+Raw Order-triggered orders
- MTS + MTO + MTO+Raw Order-triggered orders

You'd start Pareto analysis of which groups of orders miss the cycle time targets, and then in turn start benchmarking the type of processes cycle times which drive each class of orders. You've got to really roll up your sleeves now.

Let me go back to 'dwell time' which I mentioned at the beginning of the article. Sometimes customers will send an order in for future shipping. For instance, I will be having a big promotion at Christmas and I place the order July 1st. The lead time the material is 5 days, so I would be receiving the material on the 6th of July according to normal rules, but I don't want to receive the material until the 20th of November because my sales start around the 25th. The Dwell Time in this case is months – over four! The order cycle time would be terrible if I looked at the 25th of November versus the 1st of July. So, in this case, you must subtract the dwell time from the order for the purposes of calculating the true "net" order cycle time. In that case, the true "Net" cycle time would be the material lead time (here 6 days) because that would be the "Gross" order cycle time (November 20th – July 1st) minus the dwell time (four months and three weeks).

I would like to leave you with a few key takeaways from this note on Order Fulfillment Cycle Time:

- 1) There is only one way to correctly calculate **Order Fulfillment Cycle Time**. You need to (a) add together all the "Net" order cycle times over a period (b) divide the result by the total number of orders to (c) see the **Order Fulfillment Cycle Time**.
- 2) If based on benchmarking or customer feedback the cycle time has problems, you'll have to look at root-cause diagnostic metrics.
- 3) You will have to look at the actual supply-chain configurations to determine the influences from Source, Make, and Deliver cycle times. There may be combinations of all three types of "sub-cycles" driving the key metric.
- 4) By classifying different types of orders by their different types of driving supply-chain configurations will you then be able to use diagnostic data on sub-metrics to find root causes to your problems.
- 5) Use the metrics to diagnose, not calculate. Use transactional data to calculate.