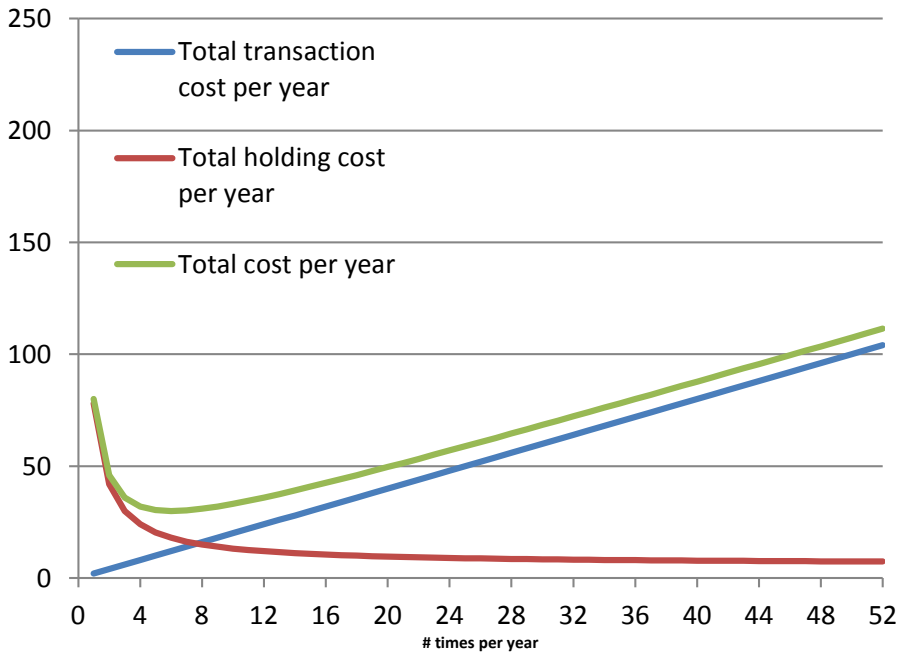
Finding the Best Frequency for a Recurring Activity

The Trade-off Between Holding Cost and Transaction Cost

by Kathy Iberle



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Key Points

- **Doing an activity has a cost (known as the *transaction cost*) but not doing an activity *also* has a cost (known as the *holding cost*).**
- **The optimum cadence or frequency for a recurring activity is a tradeoff between the transaction cost and the holding cost.**
- **The cumulative holding cost over time is usually much bigger than you think.**

Cadence and Cost

This white paper presents the mathematics behind the determination of an optimal cadence or frequency for a repeating activity, such as sprint planning or investigation analysis. The heuristics or rules-of-thumb presented in our other articles are simplifications or applications of this math. If you'd like to see the actual math, you've come to the right place.

A cadence is a rhythmic frequency. For instance, a recurring activity which happens every week is said to be on a weekly cadence. The *optimal* cadence is the cadence which produces the most profit for the organization.

The optimal cadence for a recurring activity is a balance between the cost of doing the activity and the cost of ***not*** doing the activity. Let's look at this in more detail.

Transaction Cost: The Cost of Doing an Activity

Imagine your organization is researching a new product. You're looking into market needs, customer desires, feasibility, and probable cost for a number of different options. Your organization meets quarterly to review the results of the investigations. Based on the results, you decide which investigations to stop and which new ones to start.

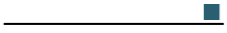
There is a cost each time you have the review and analysis meeting. The cost of the meeting includes:

- The time of all the people who are attending the meeting
- All preparation prior to the meeting – analysis, slide preparation, writing of reports, etc.
- The cost of scheduling the meeting room, coordinating calendars and so forth.

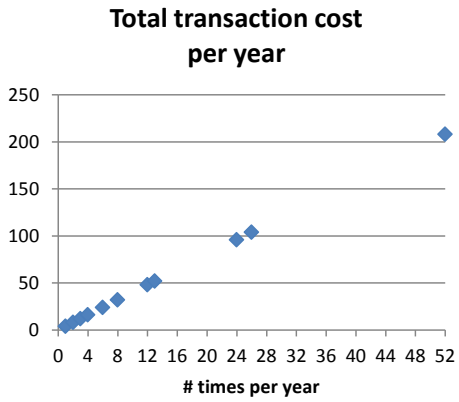
This cost is known as the *transaction cost*. Every time that the meeting is held, the transaction cost must be paid.

If the meeting is held quarterly, the transaction cost is paid four times a year:

If the meeting is held only once a year, the transaction cost is paid only once:



The total transaction cost for the whole year is approximately a linear function of the cadence of the meeting or activity, as shown to the right. Only the practical values for a cadence are shown – those which result in a whole number of weeks or months between meetings. The other values have a much higher total transaction cost, because it's so confusing to hold meetings every 3.05882 weeks. In the following graphs, I'll show the total transaction cost as a straight-line continuous function to make the graph easier to read.



In either representation, we can see that the total transaction cost is minimized by never having the meeting at all!

Holding Cost: The Cost of Not Doing an Activity

The meetings are held, however, because they are doing something extremely useful. All the results from the investigations are put together, and it is determined which paths are dead-ends and which new paths ought to be investigated. If the meeting is not held until some later time, this work is not done, and there is a cost associated with that.

The cost of ***not*** having the meeting until later includes:

- The cost of doing unnecessary work. Without the meeting, either no one realizes that this investigation is a dead-end, or there is no one to stop an investigation that is recognized as a dead-end.
- The cost of delayed or lost opportunities. Without the meeting, no one realizes that the collective results suggest a better path. No one starts on that path, so any benefits (such as a new product) will be delayed.
- The cost of creating and maintaining tracking systems. When meetings are months apart, a large amount of information can accumulate, which can require a significant investment in tracking systems.

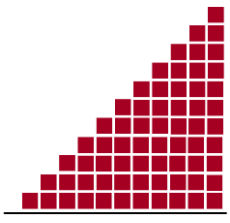
The cost of not having the meeting until a later time is known as the *holding cost*. The holding cost represents the cost of "holding" information from the time it was first available to the time it is acted upon. The total holding cost is a lot bigger than most people think, because it accumulates over time.

It's often easier to see this by taking an extreme example. What if we didn't have our review meeting for a full year?

After the first month, our results show that one investigation is going nowhere, but we continue to do that investigation anyways until the next meeting. Each square in the picture represents the cost of one month of this investigation. The next meeting is one year away, so we pay for our one month of investigation every month until the year is up. Our holding cost is 11 x the average cost of an investigation for one month.

In the second month, another investigation is demonstrated to be going nowhere. But we continue to pay for that investigation also until the next meeting. The squares in the second row represent the cost of this second investigation. The total holding cost is now (11+10) x the average cost of an investigation for one month.

In the third month, the same thing happens. This continues through the entire year. The total holding cost for the entire year is proportional to



H * (11+10+9…..+1) = H * $\sum_{i=1}^{12-1} i$ = H * 66

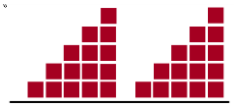
where H = the average cost to hold one month's work for one month.

Now, let's look at the holding cost if we hold the meeting every six months instead of once a year. The cost for the first month's work is repeated until we have the first meeting, at six months.

The cost for the second month's work is repeated only four times,

And so forth over the first six months.

The second six months looks exactly like the first six months.

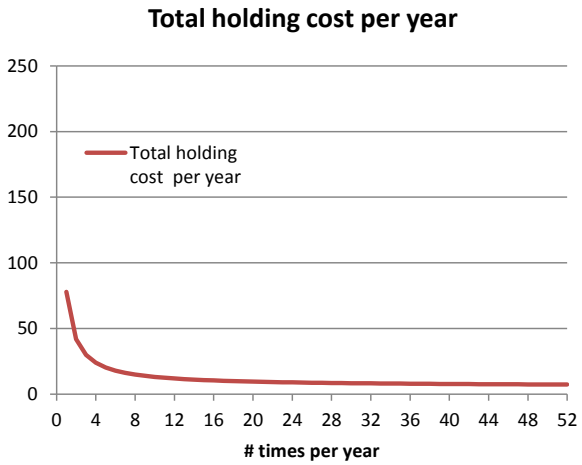


The grand total of the holding cost over the whole year is:

H * 2 * ($\sum_{i=1}^{6-1} i$) = H * 30

Holding just one additional meeting has reduced the total holding cost very dramatically.

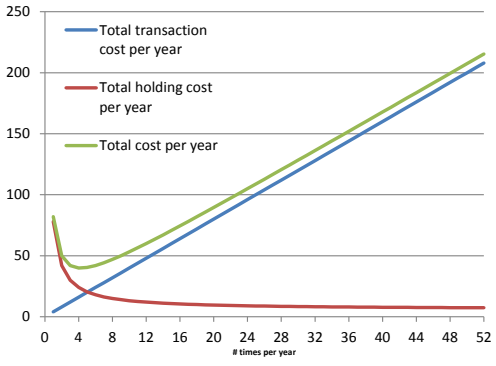
The dependence of holding cost on the cadence is shown in the graph to the right. As meetings get closer together, the value added by one additional meeting goes down.



Total holding cost = H * N * ($\sum_{i=1}^{\frac{T}{N}-1} i$)
where
T = # of time units per year
H = the cost of not having one time unit's information for one time unit.
N = # of batches per year (cadence)

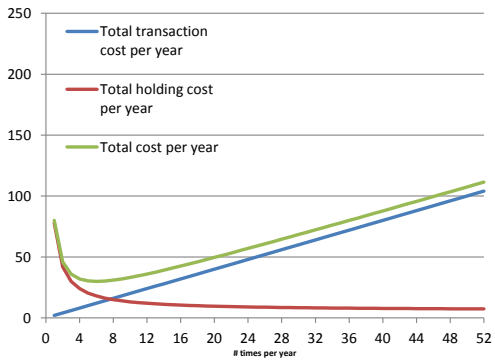
Transaction Cost Plus Holding Cost

Clearly, having the activity more often can result in a lower total holding cost. But, the total transaction cost goes up when we do things more often! How often should we have the meeting in order to minimize the cost? In theory, the optimal cadence can be determined by adding the transaction cost to the holding cost and looking for the overall minimum.



Below on the left, we see the total cost per year. The total cost is a U-curve with a minimum somewhere near the point where the transaction cost and holding cost cross.

The most effective way to change the overall cost is to change the transaction cost, not the holding cost. Generally there is very little that you can do about the holding cost. However, when the transaction cost is significantly lowered, the minimum total cost goes down, as shown on the left. The optimal cadence also shifts to the right, becoming more frequent.



Conclusions

In practice, determining the real transaction cost and holding cost is usually impractical because so many factors are involved. The actual math is very rarely done. However, knowing that the ideal cadence is at the bottom of a flat-bottomed U-curve enables the practitioner to find a good cadence using these heuristics:

- Any cadence in the general vicinity of the optimum cadence will result in nearly the same costs.
- If your current cadence is not as frequent as the optimum, even a small increase in frequency will reduce overall costs substantially. This is usually noticeable.
- If the total cost seems to be going up, you've probably passed the minimum and should back off to a less frequent cadence.

The heuristics work only if the organization is at least moderately aware of the major components of both their holding cost and transaction cost. Making a list of each is often enough to enable the organization to find a better cadence via experimentation.

Learn More:

- ❑ Read the sections on "Cadence" and "Cadence in Action" in *The Principles of Product Development Flow: Second Generation Lean Product Development*; Reinertsen, Donald G.; 2009.

Did you like this paper?

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You might like our other publications on cadence:

- Cadence: Increase Efficiency by Using a Rhythm
- The Use of Cadence in Agile and Traditional Projects: Sprint Length, Integration Frequency, and Other Matters of Rhythm
- Cadence for Rapid Learning Cycles: How Long Should My Rapid Learning Cycles Be?

About the Author

Kathy Iberle has been working with agile software development and Lean development teams for many years. Kathy recently retired from Hewlett-Packard after a multi-faceted career as a developer, quality engineer, and process improvement expert in a variety of product lines. She is now the owner and principal consultant of the Iberle Consulting Group. Kathy has published regularly since 1997, served as co-chair of the Program Committee of the Pacific Northwest Software Quality Conference (PNSQC) in 2009, and participated in the invitation-only Software Test Managers Roundtable for five years.

Kathy has an M.S. in Computer Science from the University of Washington, and an excessive collection of degrees in Chemistry from the University of Washington and the University of Michigan.

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