
Pooling Risks: Is Transshipment More Cost-Effective Than Hubs?



By [Enver Yucesan](#) , INSEAD

Drones, self-driving vehicles and other technologies have made shipping stock between locations a viable alternative to obtaining them from a centralised facility.

It is frustrating for customers to be told that a coveted mobile phone is out of stock or worse, be bumped off an overbooked flight. Disgruntled consumers could turn to rival products or hurt the business's reputation with negative reviews. But holding excess stock to avoid disappointing customers is not a solution, as it also incurs costs in the form of storage, spoilage or working capital requirements.

Companies have long tried to mitigate the cost-service trade-off through risk pooling. The practice comes in various guises, including merging inventories of different stores in a single location, code-sharing (for airlines) and lateral transshipments, which essentially entails moving goods from a well-stocked location to another that is struggling to meet demand.

As a business grows, which approach is the best? Broadly speaking, risk pooling falls into two categories: physical and information pooling. Physical

pooling involves the moving of goods to a centralised stocking location (or shared containers and seats in the case of shipping and airline companies). Information pooling, or transshipment, depends on inventories being visible across all stocking locations rather than physically consolidated in a single location. During the Covid-19 pandemic, for instance, transshipment helped overcome ventilator and vaccine shortages in some countries.

In a [study](#) published in the *IISE Transactions* journal, [Yale T. Herer](#) at the Technion-Israel Institute of Technology and I assessed and compared the costs of various pooling approaches as the number of stocking locations grows. Our analysis, which differs from other studies by factoring in certain costs associated with physical pooling, shows that as long as transshipment costs are no more than five times physical pooling costs, information pooling is more attractive.

Mistaken assumptions?

Although physical pooling has been widely adopted by companies to reduce costs and improve customer service, merging stocking locations can be expensive upfront. Besides building a centralised and more technologically sophisticated facility, the company also must close existing warehouses, transfer existing stocks, implement a new workflow, and even relocate workers. These are known collectively as additional per-location costs.

That's not all. Pooling may lead to higher insurance premiums and higher carbon emissions. Each unit may also incur additional transportation costs and the cost of not satisfying demand off-the-shelf, possibly driven by the loss of goodwill.

Yet past research – most of which was on physical pooling – typically assumed that the above additional per-unit costs were negligible for physical pooling. Information pooling, on the other hand, was commonly presumed to incur per-unit costs on top of transshipment costs.

Our goal is to generate insights into both pooling approaches by characterising their total expected costs in the context of a growing number of locations. By reexamining some classical information-pooling results and accounting for all cost drivers for both types of pooling, we show that physical pooling is not always superior. In fact, if the expected per-location costs are large, then managing a centralised inventory location can be more expensive than managing independent locations, i.e. no pooling.

Information pooling, on the other hand, does not incur additional per-location costs. It also helps offset the costs of holding too much or too little stock across locations. Our analysis shows that, as the number of locations increases, information pooling trumps physical pooling whenever transshipment cost per item is less than five times the cost of shipping it from a central hub.

Meanwhile, we also investigated the problem of dividing a set of locations into pooling groups of given sizes. We found that locations should be divided based on demand variability. In other words, locations that experience high demand volatility should be pooled with other locations of high demand volatility to achieve lower expected total cost.

A viable alternative

Until the past decade, the question of which approach was better would have merely been moot, as information pooling simply was not viable for most businesses. But this has changed with the emergence and proliferation of information technologies, such as cloud computing, and transportation technologies, including connected autonomous vehicles and drones.

Managers in supply chain and inventory management now have more tools at their disposal. Our findings could help managers get the most out of these tools by sizing up the various costs associated with different pooling approaches in the novel context of a business with a rising number of locations. The bottom line: In an age of clouds and drones, decentralisation is a viable alternative to centralisation - and that's before factoring in the advantages of risk mitigation.

Find article at

<https://knowledge.insead.edu/operations/pooling-risks-transshipment-more-cost-effective-hubs>

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About the research

["An asymptotic perspective on risk pooling: Limitations and relationship to transshipments"](#) is published in *IIE Transactions*.

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