**Final Project**

**Introduction –**

Inventory is the arguably the most important aspect of a sales business to manage, if you don’t have goods to sell you can’t sell them, but how much excess inventory is too much? Excess inventory, first and foremost, reduces available cash flow for an organization (Gartenstein, 2019). Reduced cash flow can lead requiring loans to cover liabilities and pay interest on that loan, or it can eliminate the ability to take advantage of a capital-requiring opportunity. In recent times, during the uncertainty of the pandemic, reduced cash flow from excess inventory meant the difference between weathering the storm and closing for good (Lazar, 2020). Using machine learning, forecasting sales quantity amounts per item, per location can help give businesses the opportunity to ensure they have enough inventory for upcoming sales, all while reducing excess inventory and the costs associated with that excess.

**Research Questions –**

1. Using historical sales data, can one predict the maximum inventory needed on hand for a particular item in a particular time period? (i.e., for May 2022 we will need 22 of item x, and in June of 2022 we will only need 17)
2. Combining the predictions of inventory needs with up-to-date manufacturing and/or delivery times, can one create a dynamically changing minimum inventory number for each item? (i.e., it’s the middle May of 2022 and we have 10 of item x left, we need to order 15 by May 22 to have the stock we need for June.)
3. Can one optimize the relationship between number of orders to a manufacturer (hence, shipping costs) and keeping the absolute minimum number of stock on hand? (i.e., Should we order 15 on May 22, or 5 on May 22 then 5 on June 2, etc.)
4. Can these predictions and optimizations be broken down to the region, district, state, or even city level? (i.e., West Coast needs 12 in May 2022, Midwest needs 5 for May 2022, etc.) (i.e., San Diego needs 5, Los Angeles needs 3, Chicago needs 2, etc.)
5. Can one build price modeling into the forecasting to ensure inventory is purchased at lowest possible average-per-unit price? (i.e., the price of item x is forecasted to go up in July of 2022, is it more profitable to buy and hold excess inventory at a lower cost?)
6. Could acquiring regional warehouse capabilities help reduce excess inventory even further? (i.e., San Diego only needs 2 of item x in store, because if they really need it, more is 1 day shipping away)

**Approach –**

By first analyzing historical sales data, a model can be created to forecast future sales amounts per item. Using this forecast model, one can create a dynamically changing minimum level of inventory to trigger new orders instead of creating static over-estimates. This dynamic inventory level will ensure enough product is in stock for upcoming sales, without compromising and overstocking excess inventory just to be certain.

References

Gartenstein, D. (2019, January 28). The Disadvantages of Holding Too Much Inventory on Hand. Small Business - Chron.com. Retrieved October 6, 2021, from <https://smallbusiness.chron.com/disadvantages-holding-much-inventory-hand-22710.html>.

Lazar, R. (2020, September 21). Overcoming Excess Inventory Challenges With a Digital Approach. WWD. Retrieved October 6, 2021, from <https://wwd.com/business-news/business-features/excess-inventory-inturn-1234591284/>.