**Purpose**

This document provides details for how the Regional Ordering process works. This replenishment process is currently implemented for domestic National Brand (NB) Hard Goods (HG) and Specialty verticals only. Private Brand (PB), Direct Import (DI) and Fill-in Distribution vendors are out of scope. PB and DI proposals are not in-scope because they are not replenished using SO99. Fill-in vendor proposals are not in-scope as this process is only focused on primary vendor proposals.

This process is reducing excess inventory while working within the confines of Chewy’s legacy systems. Regional Ordering leverages current system outputs and applies a heuristic, outlined below, to maximize regional in-stocks while minimizing the amount of inventory purchased necessary to cover projected customer sales; leading to decreased network excess inventory.

**Scope**

This document outlines the steps and logic within this Regional Ordering process. This document does not go into detail about how SO99 works nor how its outputs are calculated. Same applies to all other data inputs used within this process. This model is also only applicable to Retail FC locations and does not currently include our deconsolidation centers – TLA, TNY – or freezer locations – CFF1, WFF2.

**Regional Ordering Process**

There are seven steps in this process that produce an APPROVE/REJECT recommendation for each proposed item-FC based on a regional evaluation. FC-Region pairings are shown in Appendix 1. These steps are shown in Table 1. All data sources used to gather data necessary for this process are detailed below in Appendix 2.

|  |  |
| --- | --- |
|  | Process Step |
| 1 | Gather current Region On-Hand (OH) state |
| 2 | Gather current Item-Region demand forecast by week |
| 3 | Gather current Region On-Order (OO) state by week |
| 4 | Calculate Future Inventory Projections by week |
| 5 | Create Proposal Tunnel |
| 6 | Create combined inventory projections and proposal tunnel |
| 7 | Output Approve/Reject recommendation for each proposed item-FC |

Table 1. Regional Ordering Process Steps

Step 1: Gather OH State

This step is responsible for pulling Chewy’s OH inventory (units) for the current day at the item-FC level and then aggregating to the item-region level. Current OH is defined as the sellable inventory present in an FC and does not include units in non-pickable locations.

Step 2: Gather Demand Forecast

The goal of this step is to gather item-region demand forecasts (units) by week for a rolling 365 days where each week starts on Monday. The commercial forecast is used for an item-FC’s forecast when present as it accounts for overrides input by the demand planners. If not, then the statistical forecast from SO99 will be used. The item-FC-week forecasts are then aggregated to the item-region-week level.

Step 3: Gather OO State

This step pulls all open purchase orders and transfer orders for each item-region. Transfer orders account for FC to FC transferred units and purchase orders account for all units purchased from a vendor. Not accounting for transfer orders would lead to overordering. Open order data, both transfer and purchase orders, is pulled from SO99 and does not include orders that have an expected receipt date in the past. The process assumes that orders in the past will not arrive. As done for the forecasts, open orders are aggregated to the week they are expected to be received and available to sell. This provides an expected receipt plan by week for each item-region.

Step 4: Create Future Inventory Projections

In this step the process creates an inventory projection for each item-FC. Inventory projections are a forward-looking projection of the OH+OO inventory state based on current OH, weekly order receipt plan, and weekly demand forecast. This step starts by creating a single dataset representing the data gathered in steps 1-3. A user defined function (UDF), created by Inventory Optimization, is used to generate the inventory projection for an item-FC. The output is a projection of the weekly OH+OO units for each item-region.

Step 5: Create Proposal Tunnel

This step retrieves all SO99 proposals that have a proposal release date of the current day. The proposal release dates are based on vendor-FC calendars. These calendars represent when orders are to be placed with the vendor each week. As such, this process assumes that the vendor calendars are correctly setup for each FC to ensure that proposals are generated on the correct cadence.

SO99 generates proposals daily,, but they are only actioned by Supply Planning on the proposal’s release date which corresponds to the vendor’s order-day calendar. Although new proposals are generated daily, not all assorted item-FCs will have a proposal to action as there is enough inventory OH+OO to cover expected future demand. As there are assorted item-FCs that do not receive a proposal any given day it is important that the dataset includes both non-proposed and proposed item-FC. This ensures that the *Regional Need* for an item account for all inventory in the region as not doing this will lead to overordering. *Regional Need* represents how many units the region “needs” to bring it back to its Safety Stock (SS). *Regional Need* is calculated by subtracting the region’s inventory position (IP) from the region’s SS. For each item-FC record the model retrieves the projected SS and IP values that correspond to the expected receipt date. IP represents the projected OH+OO for the item-FC. For item-FCs that have a proposal the expected receipt date is the due date for the proposal. Assorted item-FCs without a proposal will inherit the minimum expected receipt date in the region. For example, if we have 3 item-FCs in the Central region but only 2 received a proposal, the item-FC without a proposal will inherit the minimum expected receipt date between the two item-FCs with a proposal.

Future SS and IP values are pulled in based on the item-FC’s expected receipt date week or the region’s minimum expected receipt date week. Item-FC *Need* is calculated as SS minus IP. Each item-FC is given a ranking based on its *Regional Need,* with the highest *Need* FC in the region ranked first. This ranking represents the order in which proposals are to be evaluated for each item-region.

Step 6: Create Combined Dataset for Recommendations

This step creates the final dataset used for evaluating whether to approve or reject the proposal. It begins by combining the future weekly inventory projections with the proposal tunnel to create the dataset used to produce the ordering recommendations in step 7. Within this step additional preprocessing is done to create new fields that are required in step 7 to give a recommendation. These new fields are: *Projected Regional OOS* and *Remaining Regional Need.* Projected Regional OOS is when the item is projected to have zero units OH the week of a proposal’s expected delivery date. Remaining *Regional Need* informs the model how many units are still needed in the region to get back to SS. This is needed so that the model knows how many units are still needed if the current proposal, along with all higher ranked proposals, are ordered. *Regional Need%* for each proposal is capped at 100%.

Step 7: Create Ordering Recommendations– Approve/Reject

The last step produces a recommendation of either Approve or Reject for each proposal by evaluating each item-FC record against the criteria shown in Table 2. All assorted item-FCs without a proposal will not be actioned and will have recommendation of “*REJECT: Did not Propose*”. All rejected proposals will be removed from the purchase order sent to the vendor. Only approved proposal lines will be placed on-order.

|  |  |  |
| --- | --- | --- |
| Priority | Recommendation | Condition |
| 1 | Approve | Item is projected to be regionally OOS the week of the proposals expected receipt date  AND  FC has the greatest *Need* in the region |
| 2 | Approve | *Regional Need%* >= 50% |
| 3 | Reject | *Regional Need%* < 50% |

Table 2. Order Recommendation Criteria

Priority #1 ensures that each item will be regionally in-stock regardless of the regional *Need%.* For example, even if the regional *Need%* is 10%, which is lower than the threshold set in priority #2, the proposal line will still be accepted to prevent a regional OOS situation. The model assumes a 100% vendor FR. So, if Chewy receives less than the total quantity ordered, regional in-stock may be negatively impacted. The 50% *Regional* *Need* threshold is a configurable setting within the model. This value was set to 50% as we assume this value addresses regional in-stock while mitigating overstock.

Exception Management Process

There is a known risk that some purchase orders will be rejected by the vendor due to not meeting purchase minimums such as minimum total dollar amount or total order weight. While this is a known risk, there are only 30-40 known vendors where removing proposed line-items leads to total PO rejection by the vendor. These known vendors are managed via an exception process within the overall process. The exception process evaluates the *Region* *Need%* at the Vendor-FC level instead of the item-FC-Vendor level. This ensures that rejected items are not removed from the order and cause the purchase order to no longer meet the vendor’s purchase minimums. If a vendor-FC proposal for an exception vendor has a *Regional Need%* greater than or equal to 50% then the order will be placed. If not, then it will be rejected. While this exception process does not reduce the amount of unneeded inventory purchased as much as the primary regional ordering logic does, it does reduce the amount of unnecessary inventory purchased into more than 1 FC in a region.

**Regional Ordering Examples**

To provide a visual for how the above logic works from end to end, here is an example that highlights each step in the process for item 159026 (Pet Fit for Life Water Fountain Replacement Filters).

Step 1: Gather OH State

The process begins with retrieving the current state of Chewy’s sellable units for Retail FCs for each item. Item-FC level data is then aggregated to item-Region level.

Diagram, table

Description automatically generated

Step 2: Gather Demand Forecast

Demand forecasts are pulled at the item-FC-day level and are then aggregated to the item-region-week level. For the sake of space, we will only show the daily forecasts for 3 weeks of data to keep the document short – Table 4. In the actual process this data is pulled for the next 365-days.

Diagram

Description automatically generated with low confidence

Step 3: Gather OO State

On order information is pulled in and each PO has its due date matched to the week it is due to arrive. For example, the first PO due to arrive at EFC3 is scheduled for arrival on 6/23 which corresponds to the week of 6/20. The data is then aggregated to the item-region-week level for later use.

Graphical user interface, application

Description automatically generated

Step 4: Create Future Inventory Projections

For this example, we are only showing the next 5 weeks of inventory projections in consideration of space, but the process will do this for the next 52 weeks.

The highlighted on-order units due in for each week correspond to the weekly OO quantities calculated in step 3 previously. The current OH units will match the values obtained in step 1. The weekly forecasts are from step 2 as shown by the West region forecast in red. Using these three inputs the UDF calculates the projected OH units by week – shown in last column.

Table

Description automatically generated

Step 5: Create Proposal Tunnel

This item has 9 item-FC proposals to be released for the current date.

Table

Description automatically generated

Since only 9 assorted FCs received a proposal of the 11 total assorted FCs, the model pulls in these missing item-FCs so that a correct region SS and IP is calculated. Item-FCs that did not receive a proposal are denoted as “DNP”.

Table

Description automatically generated

The last procedure within this step is to retrieve SS and IP values from SO99 for the corresponding due date of the proposal. As mentioned before, DNP records (such as AVP1) will inherit the minimum due date for the item-region proposals’ due dates. For instance, CLT1 will inherit 7/18/22 as this is the earliest due date in the East region and EFC3 will inherit 6/30 as shown by the highlighted cells in the above and below tables.

Table

Description automatically generated

As mentioned previously, the model will have bias towards over purchasing if these DNP assorted item-FCs are not accounted for in calculations. For example, let’s look at the Southeast region. If CLT1 is excluded, then regional SS would be 48 units instead of the 70 when CLT1 is included. This would cause the model to calculate a 52.5% *Regional Need%* since the region would have a *Need of* 21 units instead of 35.

Step 6: Create Combined Dataset for Recommendations

For calculating *Regional Need%* in the East region the model starts with AVP1 as it is ranked first in the region. Since 40 units are being proposed on a *Regional Need* of 12 units, the *Regional Need%* for AVP1’s proposal line is 32%. As the process assumes each proposal is ordered when calculating *Need%*, the remaining *Need* in the region is now 0 units. The next highest ranked FC in East region is AVP2 with a proposal for 30 units. As no *Regional Need* remains after ordering 40 units into AVP1, AVP2 and EFC3 will both have a 0% *Regional Need*.

Lastly, the process joins the proposal dataset with the inventory projections. It does this by matching the proposal’s due date week with the same week from the inventory projection dataset. Using the projected OH units, the model applies an OOS flag where zero OH units will denote a region OOS (TRUE). Such is the case with the East region for the week of 6/27/22.

Table

Description automatically generated

Step 7: Create Ordering Recommendations– Approve/Reject

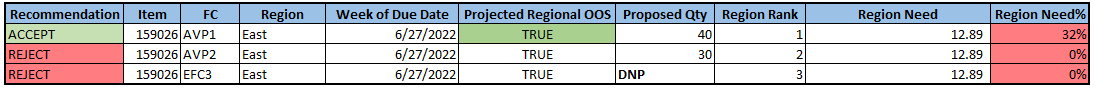
There are three scenarios, shown in Table 3, in which an item-region proposal(s) will fall in to.

|  |  |
| --- | --- |
|  | Scenario |
| 1 | Item is projected to be OOS in the region |
| 2 | 1 or more proposal lines are Approved for a region |
| 3 | All proposals in a region are Rejected |

Table 3. Decision Scenarios

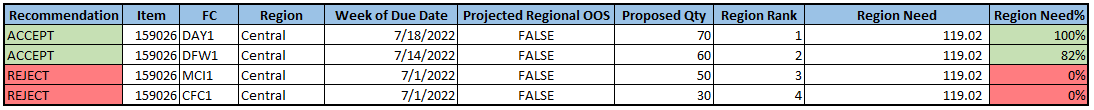
*Scenario 1 - Item is projected to be OOS in the region*

Starting with the highest ranked FC the model recognizes that the *Region Need%* for AVP1’s proposed 40 units is 32% which is below the acceptance criteria of 50%. However, since the region is projected to be OOS the week of 6/27/22 the *Region Need%* condition is ignored, and the proposal is given an accept recommendation. This is because regional OOS takes precedence over *Region Need%* during the evaluation process. The proposal line for AVP2 is Rejected as well due to having 0% *Regional* *Need.* EFC3 is automatically rejected as it did not receive a proposal and therefore no action is needed by the planner.



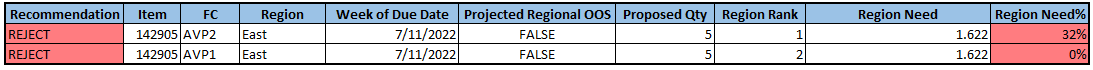
*Scenario 2 - 1 or more proposal lines are Approved for a region*

In this scenario since the item is not projected to be regionally OOS the model utilizes the *Regional Need%* value for determining to accept or reject. As DAY1 has a 100% *Regional Need%* the proposal will be approved for ordering. DFW1 proposal is next to be evaluated and it is given an approve recommendation due to having a 82% *Regional Need%* even after the 70 units are ordered into DAY1.As no *Need* remains in the region, both MCI1 and CFC1 proposals are not needed and will be rejected from ordering.



*Scenario 3 - All proposals in a region are Rejected*

For this scenario we will use item 142905 – P.L.A.Y Pet Lifestyle Squeaky Dog toy - as the prior item did not fall into this use case. The highest ranked FC has a 32% *Regional Need* which does not meet the acceptance criteria of 50% minimum. Therefore, AVP2 is rejectedand subsequently AVP1 as well since the higher ranked proposal was rejected and it also has a 0% *Regional Need* which does not meet acceptance criteria.



Appendix 3 shows additional recommendation examples for the Nail Cap items. These were the initial items used by the team to showcase how this process would handle these items.

**Automated Process for Supply Planning**

To create repeatability and efficiency for Supply, this process has been automated within Knime. The Knime process follows the steps outlined in Table 4 below. There are 4 manual steps for the supply planner to do prior to running the process. The first will be updating the directory in the script to point to the location that the New Item list, step 1 below, is saved to on their local machine. This is a one-time setup. The second manual step is maintaining the vendor exclusion list for vendors that have a hard restriction on purchase minimums. The third manual step is approving proposal lines in SO99 that are not set up for auto-approval. The team made the decision to enable all vendors to be auto approved so that proposal lines flow to Mercury automatically each day, removing the need for planners to manually approve each proposal line within SO99. The last manual step is to upload the ordering template to Mercury and send the new purchase orders to the vendor via EDI or email - depending on whether vendor is EDI enabled or not.

|  |  |
| --- | --- |
| Step | Details |
| 1 | Import New Items list from Mercury and save to CSV File |
| 2 | Create Regional Ordering recommendations using script managed by Inventory Optimization |
| 3 | Planners manually approve proposals in SO99 that did not auto-approve |
| 4 | Extract created PO Lines from Mercury – not yet sent to Vendor |
| 5 | Remove Rejected lines |
| 6 | Create import file to upload for Mercury Order Change |
| 7 | Upload import file to remove rejected lines from POs and send the PO to vendor |

Table 4. Knime Process Steps

Within the Knime process there is an exception handling path for vendors that will reject an entire PO if it does not meet their purchase minimums – i.e., weight or cost. There are about 30-40 vendors that are like this with KONG being the main one. It is the responsibility of the SP to maintain this exclusion list to ensure that orders placed are correct. For the vendors present on the exclusion list, the new regional ordering logic described in this document will not apply. Instead orders with these vendors will be evaluated via the exception process discuss above.

**Assumptions**

For this model to work and have the expected impact on regional OOS and excess inventory, it makes a few assumptions. If any of these assumptions fail, then the expected results will be negatively impacted. For example, a main assumption is that vendors will provide a 100% fill rate (FR). The model does not account for FR and will therefore order the ideal quantity to be ordered, not an increased quantity to account for a low FR. All assumptions are discussed below.

* Item demand forecasts are representative of future unit sales
* Vendor will have 100% FR and On-time delivery (OTD)
* SO99 calculations are correct for quantity to order, Safety Stock, and projected inventory position
* Vendor-FC Lead Times and Ordering Day Calendar are correct
* Orders with due dates in the past are not included in On-Order metrics
* Assorted Item-FCs without a proposal inherit the earliest delivery date of the FCs that did propose in the region

**Risk**

This is a post-hoc process applied to current replenishment system output. It is not a true optimization, but rather a heuristic that is dependent on tools which are not optimized or the most reliable for Chewy’s Supply Chain. While this process is making improvements to how Chewy does replenishment utilizing the current systems’ input and outputs, it is not reflective of how Chewy should be ordering inventory in a steady state. With that said, it does provide the best recommendation based on the current tools and resources available. Furthermore, to reiterate what was said at the start, this process is an easy and inexpensive path towards reducing excess inventory while maintaining regional in-stocks while staying within the confines of Chewy’s legacy systems.

**Appendix 1: FCs in each Region**

|  |  |
| --- | --- |
| *Region* | *FC* |
| Northeast | AVP1 |
| Northeast | AVP2 |
| Northeast | EFC3 |
| Northeast | MDT1 |
| Central | CFC1 |
| Central | DAY1 |
| Central | DFW1 |
| Central | MCI1 |
| Southeast | CLT1 |
| Southeast | MCO1 |
| West | PHX1 |
| West | RNO1 |
| West | WFC2 |

**Appendix 2: Data Sources**

|  |  |
| --- | --- |
| Data Point | EDW Location |
| On-Hand (OH) | Inventory\_snapshot.inventory\_snapshot\_sellable\_quantity |
| On-Order (OO) | Chewy\_prod\_740.C\_ONORDER\_DET.onordqty |
| Demand Forecast | Priority of Datapoint used:   1. forecast\_current\_manual\_forecast\_quantity 2. forecast\_current\_statistical\_forecast\_quantity |
| Weekly Inventory Projections | UDF: Sandbox\_supply\_chain.inventory\_projection(<params>)  Input Parameters:   * SKU# * week * current on-hand * forecast * current on-order |
| SO99 Proposals | Chewy\_prod\_740.t\_proposals\_edit  Filters:   * prundate = current date <- This is the Release Date * status != ‘X’ <- Do not want Fill-in Distribution proposals * Supplier not an FC location as we do not order self-transfer proposals |
| SO99 SS | Chewy\_prod\_740.T\_TUNNEL\_D\_STK\_UNION.stkmin |
| SO99 IP | Chewy\_prod\_740.T\_TUNNEL\_D\_STK\_UNION.stkono |
| SO99 Need | SO99 SS – SO99 IP |
| Proposal Release Date | Chewy\_prod\_740.t\_proposals\_edit.prundate |
| Proposed Order Quantity | Chewy\_prod\_740.t\_proposals\_edit.qty |
| Vendor Review Period (RP) | Chewy\_prod\_740.C\_ITEMLOCATION.minresint |
| Item-FC-Vendor MOQ | Chewy\_prod\_740.C\_ITEMLOCATION.minreslot |
| Proposal Expected Due Date | Chewy\_prod\_740.t\_proposals\_edit.duedate |

**Appendix 3: Nail Cap Examples**

*Item* *126803 – Purrdy Paws Soft Cat Nail Caps, 40 count, Small, Clear*

For this item, it has two proposals approved. These two proposals were evaluated based on their *Regional Need%* as both regions are not projected to be OOS. The single proposal in the East region is rejected as well as the total need in the East region is 0 units even though the proposed 1 unit would satisfy AVP1’s *Need.*

Table

Description automatically generated

*Item* *126853 - Purrdy Paws Soft Dog Nail Caps, 20 count, XX-Large, Clear*

For this item, it also has two proposals that are to be ordered while the rest are to be rejected. Both approved proposals were approved based on having a *Regional Need%* greater than 50%. East and Southeast proposals are rejected due to the regions not projected to be OOS and their *Regional Need%* is less than 50%.

Table

Description automatically generated