

Optimizing Inventory using Product Interchangeability in SAP APO



Applies to:

SCM 4.1 Onwards For more information, visit the [Supply Chain Management homepage](#).

Summary

This article provides useful insights on how inventory can be optimized across the supply chain using product interchangeability. The following article focuses mainly on supersession functionality of product interchangeability. The article is also supported by a business case describing how inventory can be optimized by the supply chain.

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Product Interchangeability

In Supply Network planning, demand can be transferred from one product to another product using product interchangeability functionality in SAP APO. Product interchangeability is supported in heuristics and optimizer.

SNP supports the following product interchange ability methods:

- Product discontinuation
- Supersession chain
- Form Fit Function Class

Short Description on each of the methods of product interchangeability

- **Product Discontinuation:** as the name suggests, this method is typically when a new product is to be introduced and/or an old product needs to be removed from the portfolio. This method can be effectively used to manage product obsolescence.
- **Supersession chain:** This functionality is an enhancement of product discontinuation. Supersession is used to transfer demand from product to another till the system finds suitable receipts. If no receipts exist for any product in the supersession chain, system creates receipt elements for the last product in the supersession chain.
- **Form Fit Function class:** as the name implies, this functionality is used when the products in consideration are identical in form, fit and function. That is, in case of stock out of one product, another product can be used. However as against in supersession, demand is created on the main product if there no suitable receipt elements for the child products.

Configuration required for Product Interchangeability

Following configurations are required for activation of product interchangeability

- Activation of Product Interchangeability in SNP Global Settings
SPRO→APO→Supply Chain Planning→Supply Network Planning→Basic Settings→Maintain Global SNP Settings
- Maintenance of groups, number range and planning package: Refer SAP Note 1057389 to download videos on how to maintain group range, number range and planning package number range.
- Other Configuration: In addition to the above, there are other configurations that need to be maintained. They are as follows :
 - Maintain Attribute Properties: Define the attributes of a supersession chain; standard SAP already defines many attributes. One may activate the attributes desired as per the requirement or define new attributes.<some of the attributes are explained in the Business Case Section and Process Flow>
 - Maintain member types: the objects amongst which the supersession may be defined are defined here. Standard SAP provides product, group and assembly as members.
 - Maintain replacement types: this defines what kind of replacements is possible between different members defined in the previous step. One can also activate or deactivate the replacements defined by standard SAP.
 - Maintain Interchangeability Types and Assign Replacement Type: under this head, one defines what kind of interchangeability should be activated for the system. For example, whether supersession needs to be activated, FFF needs to be activated and others needn't be activated.
 - Maintain reason code: one can also define a reason code by maintaining some text against it. The planner can select the reason code while maintaining the supersession rule.
 - Consistency Checks: various kinds of consistency checks are provided by SAP

Product Interchangeability in Demand Planning

Demand planning supports supersession of product and product discontinuation. Following four functions are supported by Demand planning which are similar to product supersession in SNP:

- Like Modeling
- Phase in/out Modeling
- Product Split
- Realignment

All the above functionalities are primarily used for product discontinuation.

One can navigate to above functions through the same transaction as product interchangeability or profiles for these transactions can be maintained independently as well.

Product interchangeability in SNP

Functional requirements for setting up product interchangeability in SNP

SAP offers standard planning book 9ASNP_PS with data view PROD_SUBST. This data view contains 2 key figures:

- Substitution demand (Associated Info object : 9APSUBAB)
- Substitution receipt (Associated Info object : 9APSUBZU)

Else if your own planning area is to be used, these key figures need to be included in the planning area and then subsequently in the data view.

The standard SAP provides 2 order categories

- EN
- EO

which are associated with the above key figures.

In case, standard info objects are not being used, these order categories can be assigned while defining the planning area. Similarly, the same key figures may be added to the Actual Stock macro in cases where copy of standard planning book 9ASNP94 is being Since planning book 9ASNP94 does not offer substitution key figures, these key figures also need to be added in the total demand and total receipts key figures in the data view.

In order that heuristics considers substitution elements in the back ground, option 'Add products from supersession chain' needs to be selected in the back ground job.

Product interchangeability is not supported by net change planning. Hence, in case, a new substitution rule is maintained, it is advisable that complete heuristics is taken on the products under consideration.

Product interchangeability in PPDS

PPDS also supports product interchangeability, however in a linear super session chain. That is, although many products are maintained in the super session chain, only one product is valid at any given point of time. MRP run in PPDS behaves in the same way in SNP. Any stock or receipt is considered as a valid receipt and only receipts of the remaining quantity are planned for the successor product. During the planning phase, substitution information for a component in a planned order is only contained in this product substitution order.

If the substitution rule is maintained at a location, the system assigns a planning package to the products under the rule. This ensures that all the products are planned simultaneously during the MRP run. Internally, system assigns heuristics SAP_PP_I001 as the package heuristics to ensure that the relevant products are called during the heuristics and with the correct sequence. This heuristics cannot be run interactively or assigned in the product master. In the standard system, package 001 is assigned to all the product location and SAP_PP_I001 is default heuristics that is assigned to this package.

Integration with R/3

Product substitution orders (demands and receipts) are not transferred to SAP R/3.

Hence during the planning phase, there may be a discrepancy between MD04 screen in R/3 and product view in APO.

During the execution phase, it is imperative that the substitution orders are part of the planned order. R/3 considers the receipt on the substituted product as long as the planned order is converted to production order in APO, that is, as long as conversion indicator is set in APO. It is only during execution phase that the substitution orders are reflected in R/3.

However as mentioned above, if the supersession contains multiple products, substitution receipt should be created for only one product at any given point of time.

Business Case for implementing Supersession of product interchangeability

Consider an organization where SNP heuristics is implemented. Considering the nature of heuristics, it is possible that inventory is not optimized across the supply chain. Supersession can be effectively used to manage certain scenarios such that inventory is optimized with minimal intervention of the planner.

The following scenario is applicable for any chemical industry. In the chemical sector, active ingredients are manufactured only in strategic sites and are imported to the selling locations. In most cases, although the base material may be the same, but the product code in the system is different because of registration issues, change in chemical properties due to different sources of raw materials at different sites, legal issues, etc.

In a business scenario where SNP heuristics is implemented, system operates in a linear fashion, that is, system does not consider any constraints and also not consider alternative sources of supply or alternate sources of production.

In such cases, heuristics continues to throw the demand to the default supplying plant without considering any resource constraint. Even if capacity leveling heuristics is being used, the manufacturing site cannot control the demand coming onto the bottleneck resource. This situation of not being able to manage demand defeats the purpose of capacity leveling in case the resource is already being fully utilized.

In absence of product interchangeability, the receiving planner would have to continuously manage the demand either by maintaining multiple BOMs (PPMs) or multiple transportation lanes. In case the planner can source the material from alternate source of supply; he would have to manually select the same for respective orders. This becomes cumbersome if this has to be carried out for a long horizon and for multiple products.

In such cases, supersession functionality of product interchangeability can be effectively implemented. The only mandate is that product code for the same material should be different. In most of the industries, the product code is different if it is being procured from different manufacturing sites due to registrations, chemical properties, etc. Hence this condition is satisfied in most of the cases.

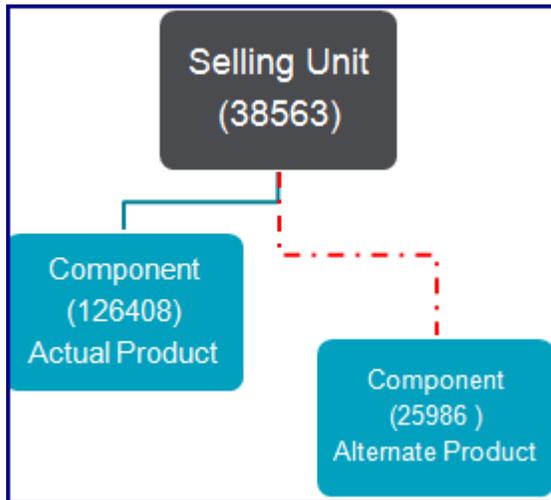
In this case, the actual product is the component/raw material which is present in the default BOM/PPM whilst the alternate product is the component which can be used in lieu of the actual product. Thus, although, the material is the same, they have different product codes in the system.

Once supersession rule is established, the planner can maintain firm orders or create purchase orders on the alternate products in those buckets where the default supplying site would not be able to supply. Heuristics would then consider the receipts on the alternate product as valid receipts and then would not create extra receipts on the default product. Thus unnecessary demand would not be created at the default supplying plant.

This not only reduces the manual intervention of the planner in the system but also optimizes the inventory in the entire supply chain.

Process Flow

Let us try and map the above case in the system and see how supersession can be used to optimize inventory in the supply chain model.



Consider a simple BOM as shown above.

Product 38563 is the Selling unit while 126408 is the component (Active Ingredient) maintained in the BOM. Product 25986 is the alternate product (Active Ingredient) which can be used in place of 126408, in case the stock of the previous component isn't present or the supplying site is unable to supply the same for a particular bucket. Let us also assume that product 126408 is sourced from location 4401 whilst the product 25986 is sourced from location 4516 while packing for product 38563 is packed at location 4774.

Situation without Product Interchangeability

Without supersession, heuristics would continue to create dependent demand on 126408 even when the supplying side (4401) isn't in a position to supply the same, may be due to capacity constraints. Even if the stock of the alternate product (25986) is present, heuristics wouldn't consider the same as relevant stock and keep on creating demand on 126408 and disturbing the capacity plan at the supplying site (4401).

Let us also assume that another location 4516 promises to supply the alternate product 25986 and hence the receiving country raises a PO for the alternate product. Even in this situation, heuristics at 4774 wouldn't consider the PO on the alternate product 25986 as a valid receipt and keep on requesting for the actual code 126408 from the 1st supplying side, that is 4401.

Thus, even when there is inventory in the supply chain, system is suggesting creating more and more inventory.

To manage this situation, the planner at the receiving end either needs to establish a second transportation lane and manually change the purchase requisitions or change the BOM of the selling unit so that the dependent demand is generated on the alternate product code. However this involves manual intervention from the planner and dissuades him to use the system generated receipts.

Situation with Product Interchangeability

Alternatively, if planner maintains the supersession rule at 4774, such that,

Predecessor product: 25986

Successor Product 126408; and if there is existing stock of the predecessor product, then heuristics considers the stock of 25986 as relevant receipt and does not create any extra receipt on the actual code 126408. Thus, the supplying country (4401) doesn't get the demand and their capacity plan isn't disturbed.

Before moving further let us try and understand the different attributes that SAP offers in product interchangeability. Let us also see how these attributes are applicable to the business case discussed above.

The values to relevant attributes are maintained using the transaction: /INCMD/UI - Maintain Interchangeability Group

It.	A.	Replacemen	Prec.Me...	Prod...	Pre. Pr...	Pr...	PrQ...	Succ. Me...	Product	Suc. P...	Suc...	SuQu...	Valid-Fr...	Direct...	Use...	Use...	Rea...	Add. Info.
10		Product-Pr...	Product	25986	PRETL...		1	Product	126408	PRETL...		1	12.04.2...	Full	Yes			

The description and the use of each of the attributes is described below.

1. Group Item Number: Identifies a unique step. It is automatically populated in the multiples of 10.
2. Replacement Type: Defines the replacement is between which members, eg : product – product, assembly – assembly, etc. The combinations need to be defined in customizing before we can select the same in the drop down.
 - o For the discussed business case, product – product replacement type shall be used since one product is being replaced by another.
3. Preceding Member type: Based on the replacement type defined above, the member type needs to be selected here. Eg : product, assembly, etc.
 - o For the business case, the preceding member type is product.
4. Preceding Product: the product which will be replaced with the new product or the product which is being phased out.
 - o For the case it is the alternate product 25986.
5. Preceding Product Description: The description of the preceding product. It is automatically picked up from the product master.
6. Preceding Quantity Factor: Incase, there is a proportional relationship between the preceding and the succeeding product, then the quantity of the preceding product is maintained in preceding quantity factor. For example, 2 pieces of preceding product is to be replaced by 4 pieces of succeeding product, then 2 needs to be maintained in the preceding quantity factor and 4 needs to be maintained in the succeeding quantity factor.
 - o For the case, the relationship between the preceding and the succeeding product is 1:1.
7. Succeeding Member type: Based on the replacement type defined above, the member type needs to be selected here. Eg : product, assembly, etc
 - o For the case, one active ingredient is being replaced by another active ingredient so that the successor member type is also product.
8. Successor Product: The product which will replace the old product.
 - o For the case, it the case actual product, 126408, which is present in the BOM of the selling unit.
9. Successor Product Description: The description of the succeeding product.
10. Successor Quantity Factor: as explained above in the preceding quantity factor.
 - o The successor quantity factor is also 1 since the relationship between the two products is 1:1.
11. Valid From: This date specifies the date from which the rule will be effective in the system. That is, only after this date, will the stock & receipts of the alternate product will be considered as valid receipts.
 - o Date from which the receiving site (4774) wants to consider stock/firmed receipts of alternate product as relevant stock for planning.
12. Direction: Full or Forward: Full indicates that the products are interchangeable while forward indicates that the preceding product cannot replace the succeeding product.
 - o For the case under consideration, the direction needs to be full since the future receipts (Purchase orders, etc) of the preceding product also need to be taken up as valid receipts.
13. Use up
 - Yes: indicates that the system should only start creating receipts for the successor product once stock of the predecessor product is exhausted.

- No: indicates that the system should start planning for the successor product from the 'valid from' date
 - Restricted: stock of the predecessor product is used only till the use-up date or the use up quantity.
 - For the above case, the selection needs to be 'Use up' since the inventory of the alternate product needs to be utilized.
14. Use Up Date: reflects the date to which the stock/receipts of the predecessor product are considered valid. This gets activated only when the *restricted* option is selected in the previous filed.
 - Not relevant to the business case since Yes has been selected in the previous option.
 15. Reason Code: A preset code in customizing which represents a reason for maintain the substitution rule.
 16. Additional Information: This represents the additional information that the planner may want to maintain.

These attributes are predefined in SAP. Based upon the requirement and modeling, certain attributes may be activated, certain attributes may be made mandatory whilst the rest may be kept as display only attributes.

For the business scenario in consideration, the following status of the attributes serves the purpose.

Change View "Attribute Properties (Chain Only)": Overview						
Attribute Properties (Chain Only)						
Attribute	Short Text	Required	Disp. Only	Location Depend...	Active	
BACKCASTDT	Successor Product Planning Date	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Location-Spe...	<input type="checkbox"/>	
DENQUANT	Preceding Quantity Factor	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	
DMNDPCNT	Demand Percentage	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input type="checkbox"/>	
EXHAUSTDT	Stock Exhaustion Date	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Location-Spe...	<input type="checkbox"/>	
EXHWRNDT	Stock Exhaustion Warning Date	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Location-Spe...	<input type="checkbox"/>	
FREETEXT	Additional Information	<input type="checkbox"/>	<input type="checkbox"/>	Both	<input checked="" type="checkbox"/>	
NUMQUANT	Succeeding Quantity Factor	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	
PRIOFACT	Priority Factor	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input type="checkbox"/>	
RELTYPE	Direction of Interchangeability	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	
RESCODE	Reason Code for Interchangeability	<input type="checkbox"/>	<input type="checkbox"/>	Both	<input checked="" type="checkbox"/>	
RULEPROF	Rule Profile	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input type="checkbox"/>	
USEUPDATE	Use-up Date	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	
USEUPFLG	Use-up Strategy	<input type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	
VALIDFR	Valid-From Date	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Cross-Locati...	<input checked="" type="checkbox"/>	

These attributes are defined under customizing and can be accessed using the following path: SPRO→APO→Master Data→Product Interchangeability→Application Settings→maintain Attribute properties.

After the rule is maintained, then it is necessary that the rule is checked for consistency. Consistency check ensures that there is no discrepancy in maintaining the substitution rule.

After the consistency check, substitution rule needs to be assigned to the model.

Assignment to model can be done through the same transaction, else can be done using transaction tx : /SAPAPO/INCMD_MODEL - Assign Interchangeability Group to a Model

Model Assignment

Model per Interchangeability Group | Interchangeability Group per Model

➔ Drag the model onto the interchangeability group using Drag & Drop

Interchangeability Group	Description	Model	Description
Interchangeability Group		Model	
13	Prod Inter for India PTC	000	000 - Active model
000	000 - Active model		

Once the rule is assigned to the active model, heuristics need to run on the selling unit and the 2 products. It is advisable that low level code is determined before heuristics is run the background. If heuristics is to be run in the background, then option 'Add products from supersession chain' needs to be selected in the background job as shown below.

Scope of Planning

Network (Heuristic)

Location (Heuristic)

Take into account found components in planning run

Add products from supersession chains

Net Change Planning

After the successful completion of the heuristics run substitution orders are created.

Substitution receipts are created on the successor product while substitution demand is created on the predecessor product. The quantity of the substitution receipt is equal to the substitution receipt so as to just consume the stock or receipts on the alternate product. No extra receipts are planned on the predecessor product. As seen below, substitution receipt is created for 126408 whilst substitution receipt is created on 25986, for the same quantity.

As per the screenshot below, substitution receipts are generated for the successor product.

The screenshot displays the SAP APO interface for product 126408 at location 4774. The 'Selection Rule' is set to 'SAP Only receipts'. The interface includes tabs for 'Elements', 'Periods', 'Quantities', 'Stock', 'Pegging Overview', 'Product Master', and 'ATP'. Below the tabs is a toolbar with various icons. The main data area shows a table titled '126408 in 4774 (Make-to-stock)' with the following columns: Start Date, Avail/ReqD, Avail/Re..., Category, Receipt/Rqmt. Elemt., Output ..., and Rec/ReqQty.

Start Date	Avail/ReqD	Avail/Re...	Category	Receipt/Rqmt. Elemt.	Output ...	Rec/ReqQty
	20.05.2010	23:59:59		SNP Product Horizon		
	20.05.2010	23:59:59		PP/DS Horizon		
	24.05.2010	00:00:00	SNPSubRcpt	29435840/1/1		3,078.628
	14.06.2010	00:00:00	SNPSubRcpt	29435841/1/1		282.058
	14.06.2010	00:00:00	SNPSubRcpt	29435842/1/1		1,000

The same quantity of substitution demand is created on the predecessor product.

Product View: 25986, Planning Version 000

Product: 25986
 Location: 4774
 Acct Assignment:
 Selection Rule: SAP Requirements a...

Elements | Periods | Quantities | Stock | Pegging Overview | Product Master | ATP

25986 in 4774 (Make-to-stock)

Start Date	Avail/ReqD	Avail/Re...	Category	Receipt/Rqmt. Elemt.	Output ...	Rec/ReqQty
	16.05.2010	23:55:06	Stock	676/0001/CC		1,360.686
	20.05.2010	23:59:59		SNP Product Horizon		
	20.05.2010	23:59:59		PP/DS Horizon		
	24.05.2010	00:00:00	SNP:ReqSub	29435840/1/1	126408	3,078.628-
	14.06.2010	00:00:00	SNP:ReqSub	29435841/1/1	126408	282.058-
	14.06.2010	00:00:00	SNP:ReqSub	29435842/1/1	126408	1,000-

Thus it is seen that unless product interchangeability is implemented, stock for 25986 is present in the supply chain, heuristics would not consider the same as valid receipt and keep on creating receipts on 126408.

Thus, supersession can be effectively used to manage inventory of alternate products in the supply chain. Integration with R/3

Further on, when the planned order is converted to production order, the stock on the alternate agi code gets utilized. And if the stock of the alternate product isn't enough, then the receipts of the actual product are utilized. Thus during confirmation of the production order, the production planner needn't remember to add the stock of the alternate product, since it will be visible in the production order BOM. This can be seen in the screenshots below.

The planned order needs to be converted to Production order in APO, that is, the conversion indicator must be set in APO.

Product View: 1425709, Planning Version 000

Product: 1425709
 Location: 4774
 Acct Assignment:
 Days' sup. [MON]: 1.38 Rcpt days [MON]: 9,999.99

Elements Periods Quantities Stock Pegging Overview Prod

1425709 in 4774 (Make-to-stock)

Start Date	Avail/ReqD	Avail/Re...	Category	Receipt/Rqmt. Elemt.
	16.05.2010	13:47:24	Stock	SAP9J117/0001/CC
15.04.2010	17.04.2010	10:03:26	PrdOrd (R)	76059846

As seen in the screenshot below, the dependent demand is created on both the predecessor and the successor product.

Context Strategy

Order

- Manufacturing Ord. 7605
 - Receipts
 - 1425709
 - Requirements
 - 126408
 - 25986
 - Operations

Dates/Times

Start Date	15.04.2010	06:21:19
End Date	17.04.2010	10:03:26

Primary Product

Product	1425709
Receipt Qty	3,000 L

As seen in the screenshot above, the APO picks up the stock of the actual product and then utilizes the stock/receipts of the alternate product.

As shown below, it is only during the execution, substitution orders are reflected in R/3. In the production order BOM below, both the actual product and the alternate product is seen.

Production Order Display: Component Overview

Order: 76059846
 Material: 1425709
 Filter: No filter | Sort order: Standard sort

Item	Component	Description	Reqmts qty	U...
0010	02-...	KG
0020	02-...	...	2,678.628	KG
0030	02-...	KG
0040	02-...	KG
0050	0126408	PRETIL...	400	KG
0050	0025986	PR...	2,678.628	KG

The same is reflected while confirmations of the production order.

In the below case, we are trying to confirm only partial quantity of the production order. Hence the existing stock of the alternate product is being utilized. Receipts on the actual product are not being utilized.

If the stock of the alternate product wouldn't have been enough to meet the demand of the selling unit, then the stock from the receipt of the actual product would have been utilized.

The only point that needs to be taken care of is that at any given point of time, only one product is valid at any given point of time.

Confirmation of production order Create : Goods movements

Batch determination

Order: 76059846 | Status: REL PCNF PRC BCRQ EXPL EXTS GM
 Material Number: 1425709

Material	Description	Quantity	U	Batch	Plant
1425709	...	3,000	L		4774
0010001	KG		4774
...	KG		4774
...	KG		4774
0025986	...	1,539.314	KG		4774
...	KG		4774

Thus, supersession not only helps in better planning but also supports execution effectively.

Summary

As seen above, supersession functionality of product interchangeability can be used to optimize inventory across the supply chain.

Product discontinuation is also functionality where stock of the obsolete product can be used before planning of new product. In absence of this functionality, it is highly likely that the inventory of the obsolete product is kept unused and eventually been written off. Using product discontinuation, it can be ensured that the new product is not planned, unless the inventory of the obsolete or outgoing product is utilized, thus minimizing inventory buildup.

Preceding and succeeding quantity factor in supersession can be also be used to optimize inventory. In case the required pack size is not available in the inventory and multiples of that pack size can be used, then the same ratio can be maintained in the preceding and succeeding quantity factor.

For example, if pack size of 500 gms isn't available in the inventory and 2 X 250 gms pack size can be supplied instead of the same, then this can also be mapped in the substitution rule.

Finally, product interchangeability is an effective tool to manage and optimize inventory in the supply chain. This reduces the manual intervention of the planning community, thus building confidence in the results of the planning system and also reducing frustration among the planning community.

Related Content

Sap Help:

http://help.sap.com/saphelp_scm41/helpdata/en/48/b606d63fd194428cd4d17a7bfb64a6/frameset.htm

SDN SCM: <http://forums.sdn.sap.com/thread.jspa?messageID=8939565#8939565>

[SAP Note: 1057389](#)

For more information, visit the [Supply Chain Management homepage](#).

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