Special Topic Webinar: Demand Sensing in SAP Integrated Business Planning for demand

Anna Linden, Product Manager, SAP SE
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Agenda

- Topic Introduction and Business Benefit
- Proof of Concept Results
- How to Set-Up and Run Demand Sensing
- Forecast Error Calculation in Demand Sensing
Introduction -
What is Demand Sensing?
Demand Sensing - Key Points and Benefits

- Computes a sensed demand plan for a short term horizon such as 6-8 weeks
- Sensed demand plan is in daily buckets
- Incorporates the latest demand drivers such as new sales orders
- Reaches a better forecast accuracy in the short term horizon due to more accurate, and a larger number of input factors
- Ensures good customer service levels
- Minimizes stock-outs
- Helps to avoid costly firedrills
SAP Integrated Business Planning: Taking Supply Chain Planning to a New Level

State-of-the-Art business processes
Leverage new technologies to enable new business processes with highly flexible UI’s

Connected planning processes
Break down planning silos through connected and integrated planning processes

Leverage end-to-end visibility
End-to-end visibility on strategic, tactical, operative and execution level

Faster planning cycles
React faster to changes in the business through complete integration, one user experience

Productivity & Automation
Focus on what's important for your business and repurpose the resources focused on firefighting instead
New and sophisticated planning algorithms address the changing focus in supply chain planning

**Demand Sensing**

More accurate, daily demand plans for the short-term horizon of 4-6 weeks

**Inventory Optimization**

Most-efficient inventory deployment to meet service level targets

**Fast, priority-based Response Management**

React to short term changes in demand or supply with adjustments
Faster Planning Cycles in SAP Integrated Business Planning

Short-term Planning Horizon
High frequency (e.g. Daily)
Detailed, more accurate planning
Limited reaction capabilities

Long-term Planning Horizon
Low frequency (e.g. Yearly)
Roughcut planning
Full control

Operational Level
- Demand Sensing (Short-term Forecasting)
- Supply Priorities & Order Confirmation

Tactical Level
- Sales & Operations Plan.
- Inventory Optimization
- Demand Planning
- Supply and Allocations Planning

Strategic Level
- Strategic S&OP
- Strategic Inventory Opt.
- Business Planning
- Network Design and Policy Setting
Connected Planning Processes in SAP Integrated Business Planning

Sales & Operations Planning

• Application
• Design
• Model
• Tools

SAP HANA Platform

Integrated Business Planning Platform

Architecture  Performance  Scaleability  Integration

Supply Chain Control Tower
End-to-End Visibility

IBP for Sales & Operations
Strategic and Tactical Decision Processes

IBP for Demand
Demand Sensing & Statistical Forecasting

IBP for Inventory
Multi-Stage Inventory Optimization

IBP for Response & Supply
Allocations Planning & Order Rescheduling
Unconstrained & Constrained Supply Planning

Unified SAP HANA Platform for Cloud Deployment

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Simplified Definition

SAP Integrated Business Planning for demand

= “Traditional” Demand Planning
(mid- or long-term forecasting)

+ Demand Sensing
(short-term forecasting)
From Statistical Forecasting to a Consensus Demand Plan
Granularity: Weekly or Monthly

- Input from Sales Departments
- Input from Marketing Departments
- Input from local Demand Planners

- Corrected Sales History
- Statistical Forecast (Output from Algorithms)

- Consensus Demand Plan

- Actuals can be adjusted automatically or manually
- Analysis of historical data helps predict the future
- Usage of proven forecasting models
- Automatic model selection can be used
- Graphic monitoring and correction of historical data and forecast results

- Include manual input from the experts to also address influencing factors that are not yet in the systems as well as experience of the single employees
From a Consensus Demand Plan to a Sensed Demand Plan
Granularity: Daily

Demand Sensing
- does not replace the typical demand planning process or the statistical forecasting
- uses the consensus forecast, which is in weekly buckets, as a key input to further optimize the demand plan in the short term horizon
- adjusts the mid-to long-term forecast based on certain patterns, brings additional demand signals into consideration, and break it down to the daily level.

→ The demand planning process becomes a 2-step approach
### Difference between Demand Sensing and Classical Statistical Forecasting

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<tr>
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<th>Statistical Forecasting</th>
<th>Demand Sensing</th>
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<tr>
<td><strong>Basic Principle</strong></td>
<td>Forecasting</td>
<td>Pattern Recognition</td>
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<tr>
<td><strong>Planning Horizons</strong></td>
<td>Computes a demand plan for the mid- to long term horizon (usually up to 1-2 years)</td>
<td>Computes a demand plan for the short term horizon (usually 6 weeks)</td>
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<td><strong>Planning Cycles</strong></td>
<td>Monthly or quarterly cycles, sometimes weekly</td>
<td>Weekly and sometimes daily cycles</td>
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<td><strong>Historic Data Usage</strong></td>
<td>Seasonalities and trends over a longer term horizon (e.g. 2 years) are picked up.</td>
<td>Short term patterns over the last year. Seasonalities and trends are taken over from the consensus forecast</td>
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Effect of Demand Sensing

National DC

Weekly forecast of 40 units

Daily Replenishment Schedule w/ updated forecast

4, 4, 4, 4, 4

East DC

East Daily Demand Trend

West DC

West Daily Demand Trend

4, 4, 4, 4, 4
Effect of Demand Sensing

Weekly forecast of 40 units

National DC

Daily Replenishment Schedule w/ updated forecast

East DC

7, 7, 5, 3, 3

East Daily Demand Trend

Sales trends are picked up with Demand Sensing and updates short term forecast.

West DC

7, 1, 3, 5, 5

West Daily Demand Trend

Weekly forecast of 40 units in National DC, which leads to daily replenishment schedules for East and West DCs. The demand trends in East and West are analyzed, and sales trends are updated to reflect the forecast improvements.
Who Benefits from Demand Sensing?

Basically every company that wants to achieve a more accurate short term demand plan can benefit from Demand Sensing. The use cases are wide spread. Below are some examples, e.g. companies that...

- **struggle with volatile markets and demand shifts**, e.g. Manufacturers of Consumer Products or Consumer Electronics
- receive **orders** from their customers and want to include them into the short term planning horizon
- **already applied demand driven business strategies** but want to further improve, e.g. flexible and complex deployment planning
- are capable of **adjusting their production plan within a short term horizon** and want to further improve on this aspect
- are capable of **adjusting their transport plan within a short term horizon** and want to further improve on this aspect
- want to **close the gap between a monthly demand planning cycle and daily or weekly demand requirements** for the short term horizon
## Different Demand Sensing Projects – Different Goals

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<th>Become Demand Driven</th>
<th>Further Automize the Demand Driven Approach</th>
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<td><strong>Initial State</strong></td>
<td>No short-term forecasting. Only consensus forecasting in weekly or monthly buckets.</td>
<td>Already good consensus demand plan and manual creation of a detailed, daily sensed demand plan.</td>
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<td><strong>Goal</strong></td>
<td>Significantly improve short term forecast accuracy to streamline post-processes such as Supply Planning</td>
<td>Free-up resources from short term forecasting process and automize the Demand Sensing process.</td>
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<td><strong>Improvements due to Demand Sensing</strong></td>
<td>High increase in forecast accuracy</td>
<td>Smaller increase in forecast accuracy. Better productivity of the planning team. More resources available for critical projects</td>
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What planning processes does Demand Sensing impact?

Illustration of the different planning horizons

- **Inventory Optimization**
  - **Deployment and transportation decisions**
  - **Production and packaging sequences**
  - **Material purchasing**

Today

Short Term Planning Horizon
Extended Planning Process with SAP IBP for demand and SAP APO

SAP Advanced Planning & Optimization (APO)

Demand Planning (DP)
Supply Network Planning (SNP)

Demand Sensing in SAP Integrated Business Planning for demand

Mid-Term Forecast
Short-Term Forecast

Master Data, Sales Orders
Forecast adjustments
Master Data, Sales Orders

SAP Enterprise Resource Planning (ERP)

SAP Demand Signal Management

Point-of-Sale (POS) Data
Market Research Data

*POS Data Integration towards IBP is available. Usage of POS data in Demand Sensing is a roadmap topic.
Proof of Concept Results
Timing may vary with assessment scope and customer resource availability.
Demand Sensing Proof of Concept Results – Two Examples

Customer who did not have a demand sensing process before

- Reduction in forecast error across the demand sensing horizon: 18% - 49%
- Weekly consensus demand forecast error across the demand sensing horizon: 50% - 68%

Customer who had a demand sensing process before

- Reduction in forecast error across the demand sensing horizon: 4% - 6%
- Weekly consensus demand forecast error across the demand sensing horizon: 40% - 43%
SAP Customer Use Case: Predicting Supply Chain

Combined Value = Greater than the Sum of the „Parts“

Demand Sensing

+10% Forecast Accuracy

• Powerful algorithms
• Pattern recognition
• Predictive forecasting

Inventory Optimiz.

-15/20% Inventory

• Multi-stage & level inventory optimization

Together

Further

- 9 M$ Inventory

Maintaining 98% customer service level

One Data Model    Real-time Data Visibility
How to Set-Up and Run Demand Sensing
## Steps to Run Demand Sensing for the First Time

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<th>Description</th>
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<td><strong>Step 1</strong></td>
<td>Configure your Planning Area to work with Demand Sensing (see SAP6 or SAPIBP1 as a sample)  &lt;br/&gt;Create the change history snapshot key figure for Consensus Demand</td>
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<td><strong>Step 2</strong></td>
<td>Load master data, sales orders (history and future) and deliveries (history).  &lt;br/&gt;Load latest revision (lag0) of consensus forecast (history and future)</td>
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<td><strong>Step 3</strong></td>
<td>Load the snapshot data / consensus forecast revisions (history)</td>
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<td><strong>Step 4</strong></td>
<td>Create a Forecast Model for Demand Sensing (Full)</td>
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<td><strong>Step 5</strong></td>
<td>Run Demand Sensing (Full)</td>
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<td><strong>Step 5a</strong></td>
<td>Schedule snapshot runs for your consensus forecast revisions in Excel (weekly or 4-weekly) to capture future consensus forecast revisions</td>
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<td><strong>Step 5b</strong></td>
<td>Schedule Demand Sensing (Full) and Demand Sensing (Update) runs weekly and daily via the IBP Microsoft Excel Add-In</td>
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Configuration of the Planning Area
Demand Sensing in SAPIBP1 and SAP6

End-to-End Visibility, Exception Handling, and Performance Management (Ad-Hoc)

1. Demand Planning (Weekly)
2. Demand Sensing (Weekly, Daily)
3. Inventory Optimization (Weekly)
4. Demand Review (Monthly)
5. Consensus Demand Plan
6. Supply Review (Monthly)
7. Pre-S&OP Meeting (Monthly)
8. Executive S&OP Meeting (Monthly)
9. Finance & Sales
10. Sales History & Final Consensus Demand
11. Open Orders & Global Demand Plan
12. Global Demand Plan & Sensed Demand
13. Safety Stock
14. Constrained Demand Plan
15. Constrained Demand Plan
16. Final Consensus Demand Plan
17. Operational Planning / Execution Systems

SAP6
Demand Sensing can be configured as a standalone data model in IBP

From Demand Planning, only the „Consensus Demand Plan“ is a mandatory input.

Demand Sensing requires many key figures that are used by the algorithms internally, but that are typically not visible to or used by a demand planner.

There are certain naming conventions with regards to demand sensing key figures. Demand sensing can only be run successfully if these naming conventions are fulfilled!
## Configuration of the Planning Area
### Demand Sensing Key Figures in SAP6 (Release IBP 1608)

### Main Key Figures:

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### Technical Key Figures (stored, not calculated, not editable, no conversion):

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Required Input Data to Run Demand Sensing

- **Master Data** (Product, Location, Customer, UoM, …)
- **Demand Forecast** (Consensus Forecast) in *weekly buckets*.
  In case you are planning in monthly buckets, please disaggregate to weeks
- **Forecast Revisions/Snapshot** for the past year.
  The revisions should be available in weekly buckets, and the last 52 weeks should be loaded. We derive our change history snapshots from this data.
  In case your sensing horizon is 6 weeks, each forecasted period (e.g. a week) should have six revisions within the snapshot data.
- **Sales Orders**
- **Shipments**
- **Planned Promotion Uplifts (Historic and Future)** – available since IBP release 6.1

In the *ideal case*, plan of using 52 weeks worth of historic data for each of the inputs in order to allow the demand sensing to compute high qualitative results.
Load the „Change History“ Snapshot Data

Introduction – What is a Snapshot?

- A snapshot is the current picture of any time-dependent key figure for any time range
- The „Change History“ snapshots are a mandatory input factor to the Demand Sensing algorithms. Historical snapshots are needed by the demand sensing algorithm in the calculation of the sensed demand regression metrics.
- In case of Demand Sensing, it is required for the mid-term forecast (e.g. consensus demand)
- For Demand Sensing, historical forecast snapshots are loaded manually before the first demand sensing run
- After the first run, the snapshot creation needs to be scheduled on a regular basis via background jobs, (e.g. weekly or monthly, depending how often the mid-term demand plan is generated)

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<th>Snapshot Type: Original</th>
<th>Snapshot Type: Change History</th>
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<td>Usage</td>
<td>Used by planners to compare the key figure values at different times</td>
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<td>Used only by Demand Sensing internally</td>
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<td>Revision Handling</td>
<td>One revision is stored per snapshot key figure</td>
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<tr>
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<td>Multiple revisions are stored in one snapshot key figure.</td>
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<tr>
<td>Visualization</td>
<td>Data can be visualized in Excel Planning View and Analytics</td>
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<td>Only the last revision can be visualized</td>
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Load the „Change History“ Snapshot Data
Sample Snapshot File

Forecasted periods within revision
(14 weeks in this example)

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<th>B</th>
<th>LOCID</th>
<th>C</th>
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</tbody>
</table>

Revision of April 20, 2015

Revision of April 27, 2015
Load the „Change History“ Snapshot Data
Generate Snapshot Key Figure for demand sensing

Productive use of Demand Sensing

Load historic snapshot data for a certain historic timeframe at this point and up to this point

Generate snapshots regularly (e.g. weekly) via the scheduled jobs
Create a Forecast Model for Demand Sensing
One time activity, revised regularly (e.g. quarterly / yearly)

Define the demand sensing forecast model, containing the algorithms “Demand Sensing (Full)” or “Demand Sensing (Update)”

---

<table>
<thead>
<tr>
<th>Algorithms</th>
<th>Demand Sensing (Full)</th>
</tr>
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<tbody>
<tr>
<td><strong>Consensus Forecast:</strong></td>
<td>Consensus Demand Plan Qty</td>
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<tr>
<td>Signal Horizon:</td>
<td>Future</td>
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<td><strong>Snapshot Signal:</strong></td>
<td>SUF</td>
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<tr>
<td>Maximum Forecast Increase:</td>
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<tr>
<td>Maximum Forecast Decrease:</td>
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<tr>
<td><strong>Future Ordered Quantity:</strong></td>
<td>Current Open Order Qty</td>
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<td>Signal Horizon:</td>
<td>Future</td>
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<td>Confirmed Qty</td>
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<td>Delivered Qty Adjusted</td>
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<td>Signal Horizon:</td>
<td>Historical</td>
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<td>*Daily Average Calculation Horizon:</td>
<td>4 Weeks</td>
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<tr>
<td>Quantity Ratio Calculation Horizon:</td>
<td>8 Weeks</td>
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<tr>
<td>Select Workdays:</td>
<td>Monday: ✔️</td>
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<td></td>
<td>Friday: ✔️</td>
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Create a Forecast Model for Demand Sensing
Detailed Information about Demand Sensing Set-Up

https://zinnovationdiscovery-supportportal.dispatcher.hana.ondemand.com/#/innovation/6CAE8B26E4CB1ED58287A284EB327D84
Create a Forecast Model for Demand Sensing
Demand Sensing Algorithms

Pre-Processing algorithm:

Promotion Elimination (available with IBP for demand 6.1)
- Uses a consumption logic to eliminate the promotion uplifts

Demand Sensing algorithms:

Demand Sensing (Full)
Complete (re-) calculation of the sensed demand for the forecast horizon, taking all input factors into account. The steps include:
- Bias adjustment and correlation analysis based on input signals
- Threshold determination and adjustment
- Weekly to daily disaggregation
- Order adjustment

Demand Sensing (Update)
Takes any new information from the current week for orders/shipments into account
- Sensed demand calculation based on the regression weights obtained as part of the „Full“ Run that was done at the beginning of the week
- The „Update“ Run affects the whole sensing horizon that was also used in the „Full“ Run
Create a Forecast Model for Demand Sensing
When to use Demand Sensing Full and Update Runs

- **Scenario 1 (best practice):**
  Demand Sensing (Full) is run in the beginning of the week and Demand Sensing (Update) is running daily

- **Scenario 2:**
  Demand Sensing (Full) is run in the beginning of the week; no daily updates. This scenario could be used in case a sub-weekly update of the sensed demand plan is not needed

- **Scenario 3 (not recommended):**
  Demand Sensing (Full) is run on every day of the week
Run Demand Sensing Job
Recurring Activity
# Analyze Data

## Chart:

### Series:

- Confirmed Qty
- Statistical Forecast Qty
- Consensus Demand without Promotions
- Sensed Demand Qty

### Filter:

**HT_001**

**HD_DC_US_E**

**US9001**

## Table: Sensed Demand Qty Comparison

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Location ID</th>
<th>Customer ID</th>
<th>Key Figure</th>
<th>2016 CW32</th>
<th>2016 CW33</th>
<th>2016 CW34</th>
<th>2016 CW35</th>
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<th>2016 CW40</th>
<th>2016 CW41</th>
<th>2016 CW42</th>
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</thead>
<tbody>
<tr>
<td>HT_001</td>
<td>HD_DC_US_E</td>
<td>US9001</td>
<td>Confirmed Qty</td>
<td>1.581</td>
<td>1.639</td>
<td>1.621</td>
<td>1.647</td>
<td>1.467</td>
<td>766</td>
<td>786</td>
<td>772</td>
<td>726</td>
<td>717</td>
<td>715</td>
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<td></td>
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<td></td>
<td>Statistical Forecast Qty</td>
<td>1.480</td>
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<td>1.469</td>
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<td>1.528</td>
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<td></td>
<td>Consensus Demand without Promotions</td>
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<td>1.735</td>
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<td>1.833</td>
<td>1.797</td>
<td>1.828</td>
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<td>Sensed Demand Qty</td>
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<td>Sensed Demand Qty</td>
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Forecast Error Calculation in Demand Sensing

Available with release IBP 1608 (6.3)

https://zinnovationdiscovery-supportportal.dispatcher.hana.ondemand.com/#/innovations/searchid=0090FABF323E1ED6939F322BE038E0CA

→ Manage Forecast Error Calculations (to be available soon)
Business Goals of Forecast Error Calculation

Common Use Cases

- Provide visibility into the forecast error (forecast accuracy) measures at different lead times (lags)

Demand Planning / Demand Sensing Use Cases

- Define error measures companies can use to monitor forecasting performance:
- Compare different forecast key figures to track the forecast value-add
- Regularly monitor the forecast-related KPIs and capture trends
- Find problematic areas where forecasting accuracy goals are not met
- Define appropriate forecast accuracy goals for various segments (e.g. products with highest sales volume or least volatile demand)
New Operator „Forecast Error Calculation“ to run the forecast error calculation, based on the Manage Forecast Error Fiori app settings

Job Chains can be created to subsequently run all necessary steps
Save the lag based information using a copy operator

Create and use the copy operators to copy lag based data into these keyfigures.

<table>
<thead>
<tr>
<th></th>
<th>2016 WEEK06</th>
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<th>2016 WEEK08</th>
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<td>11047.51</td>
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SAP6 Sample Configuration for Demand Sensing

- SENSEDDMANDQTY (Active)
- SENSEDDMANDQTY1WLAG (Active)
- SENSEDDMANDQTY3WLAG (Active)
- SENSEDDMANDQTYBIAS (Active)
- SENSEDDMANDQTYERROR (Active)
New Manage Forecast Error Calculation Fiori Apps Available with release IBP 1608 (6.3)

New Fiori apps to manage the forecast error calculation for different periodicities, lags and planning levels in Demand Planning and Demand Sensing.
New Manage Forecast Error Calculation Fiori Apps Available with release IBP 1608 (6.3)

**Input Settings**

- **Sales History Key Figure:** Confirmed Qty
- **Forecast Key Figure:** Sensed Demand Qty Lag 1
  - Lag of Chosen Forecast Key Figure: 1 Weekly
  - Time Periods in the Past: 2 Weekly
  - Offset Used for Time Periods: 0 Weekly

**Output Settings**

- **Planning Level of Output Key Figures:** Location | Product | Customer | Lag | Weekly
- **Periodicity of the Output Planning Level:** Weekly

**Error Calculation**

- **Output Key Figures**
  - Mean Absolute Percentage Error (MAPE)
  - Mean Squared Error (MSE)
  - Mean Absolute Error (MAE)
  - Mean Absolute Percentage Error (WMAPE)
  - Total Error (TE)
  - Total Absolute Error (TAE)

**Calculation Settings Related to Input Data**

- Minimum Number of Periods with Sales: 12
- Minimum Number of Periods with Sales and Forecast: 12
- Replace Half Values by Zero
- Start History from the First Sales Period
- Exclude Outliers from Forecast Error
- Outlier Judgment: 1.5
Example: Forecast Error Dashboard
Example: Forecast Error Dashboard
FAQ
Easy to Learn More
Recommended links for customers and partners

- IBP on sap.com:

- SAP Online Help & Documentation:
  http://help.sap.com/ibp

- SCN Community Page:
  http://scn.sap.com/community/scm/ibp

- IBP 6.x Starter Edition Offering, incl RDS content:

- Innovation Discovery including Early Knowledge Transfer (EKT) content:
  https://zinnovationdiscovery-supportportal.dispatcher.hana.ondemand.com/#/innovations/searchid=0090FABF323E1ED6939F322BE038E0CA

- IBP Roadmap
Thank you

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