Solution-Driven Integrated Learning Paths

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  - Global Supply Chain
  - Basics of Operation Management
  - Demand Management, Forecasting, and S & OP
  - Professional Advancement
  - Special Interest Topics
- Plant Tours
- Networking Events/Peer Interaction
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- Assess your learning needs
- Use teamwork
- Prepare to learn
- Create your own Action Plan

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www.softconference.com/apics
Steven Crane, CSCP, is Director Strategic Supply Chain Management NAFTA, Wacker Chemie AG, where he is responsible for strategic supply chain management for the Wacker Polymers Division. This includes demand planning, supply planning, and sales and operations planning. Currently, Crane is working on the implementation of APO and S&OP for several businesses in the division.

A Roadmap to World Class Forecasting Accuracy

Six Keys to Improving Forecast Accuracy

Stephen P. Crane, CSCP
Wacker Chemical Corporation
Director Strategic Supply Chain Management

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- WACKER Company Overview
- Why Forecast?
- Forecasting Challenges
- Six Keys to Improving Forecast Accuracy
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  - Data Aggregation
  - Sales Adjustments to Statistical Forecast
  - Measurement & Exception Reporting
- Forecasting Accuracy Results
- Conclusions
WACKER Company Overview

Why Forecast?

Forecasting Challenges

Six Keys to Improving Forecast Accuracy

– Process, People, & Tools
– Statistical Forecasting
– Forecasting Segmentation
– Data Aggregation
– Sales Adjustments to Statistical Forecast
– Measurement & Exception Reporting

Forecasting Accuracy Results

Conclusion

Over 90 Years Of Success

Wacker Chemie AG

• Founded in 1914 by Dr. Alexander Wacker
• Headquartered in Munich, Germany

WACKER Group (2007)

• Sales: €3.78 billion
• EBITDA: €1.00 billion
• Net income: €622 million
• Net cash flow: €644 million
• R&D: €153 million
• Capital expenditures: €699 million
• Employees: 15,044

We Are Committed To Benchmark-Quality Products Designed For Our Focus Industries

Industries

• Adhesives
• Automotive and transport
• Construction chemicals
• Gumbase
• Industrial coatings and printing inks
• Paper and ceramics

Products:

• Polymer powders and dispersions for the construction industry
• Polyvinyl acetate solid resins, polyvinyl alcohol solutions, polyvinyl butyral and vinyl chloride terpolymers
WACKER Company Overview

Why Forecast?

Forecasting Challenges

Six Keys to Improving Forecast Accuracy
– Process, People, & Tools
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Forecast Types

Most companies use three types of forecasts:
– Sales or channel forecast
– Corporate planning forecasts
– Supplier forecasts

These forecasts are very different in their use, frequency, and definition.

Need consistent demand signal across these three forecasting processes, but most companies don’t know how to align them.

Why Forecast?

The forecast drives supply planning, production planning, inventory planning, raw material planning, capital planning, and financial forecasting.

Companies that are best at demand forecasting average:
– 15% less inventory
– 17% higher perfect order fulfillment
– 35% shorter cash-to-cash cycle times
– 1/10 the stockouts of their peers

1% improvement in forecast accuracy can yield 2% improvement in perfect order fulfillment

3% increase in forecast accuracy increases profit margin 2%

Source: AMR Research 2008
What Is A Good Forecast?

- World class forecasting accuracy performance
  - 95% currency by product line
  - 90% by product family
  - 85% product mix level

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- 90%

What Is A Good Forecast?

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  - 95% currency by product line
  - 90% by product family
  - 85% product mix level

- 90%
Management Is Often the Problem

Forecasting Challenges

- Typical forecasting process involves historical demand data loaded into a database using software to generate statistical forecasts.
- Statistical software is rarely allowed to operate on its own.
- Management usually overrides the statistical forecast before agreeing to the final forecast.
- Forecasting is often a difficult and thankless endeavor with high inaccuracies.
- Companies react to inaccuracies with investments in technology, but do not guarantee any better forecasts.
- There are often fundamental issues that need to be addressed before improvements can be achieved.

Forecasting Challenges

- When businesses know their sales for next week, next month, and next year, they only invest in the facilities, equipment, materials, and staffing they need.
- There are huge opportunities to minimize costs and maximize profits if we know what tomorrow will bring—but we don’t.

Therefore we forecast!
World Class Forecasting Accuracy Requires Making The Right Decisions

Six Keys To Improving Forecast Accuracy

Step 1: Defining the Process, People, & Tools
Step 1:
Defining the Process, People & Tools

Process
- Forecast accuracy improvement occurs with the **proper blending** of process, people, and IT tools.
- **Overemphasis** on any one leads to an imbalance that can defeat the desired result.
- The process should be defined first, then followed by roles and responsibilities, and then IT applications.
- The more people that touch a forecast, the greater the bias and the greater the forecast error.

People
- People are critical to the forecasting process and how it's used within the organization.
- They need to understand **how their role fits** with the work process and how to make improvements.
- Position descriptions need to be defined with clear responsibilities that are accepted by the organization.
- **Full-time positions are essential.**
- Limit number of people making decisions about final forecast.
Forecasting software is sometimes “sold” as the answer to forecasting issues. Software does not solve forecasting problems. Processes and people solve problems. Implementing forecasting software should not be considered an IT project, but a business process improvement project. Forecasting applications can eliminate much of the manual work associated with forecasting if configured properly.

**Six Keys To Improving Forecast Accuracy**

**Step 2: Establish Statistical Forecasting Capability**

Many supply chains are too complex to manually generate forecasts for all products and customers. Forecasting engines are widely used to improve forecast accuracy by generating statistical forecasts. Statistical forecasting uses sales history to predict the future by identifying trends and patterns within the data to develop a forecast. Need to decide at what level the forecasting should be done:
- Product family
- Individual product
- Product/customer
- Product/customer ship-to
- Plant/product/customer ship-to
Step 2:
Statistical Forecasting Capability

- Need to decide how often to forecast
  - Quarterly
  - Monthly
  - Weekly
  - Daily
- Determine how much sales history is required for meaningful statistical forecast (minimum 2 years)
- Sales history master data must be correct especially when migrating from legacy systems. Very difficult to do correctly
- Analyze the forecast error associated with using available forecasting algorithms to optimize accuracy of forecast

Step 2:
Statistical Forecasting Capability

- Typical statistical forecasting methods include
  - Multiple regression analysis
  - Trend analysis
  - Seasonal
  - Simple moving average
  - Weighted moving average
  - Exponential smoothing
  - Automatic selection

Recommended

Adjustments Necessary to History

- Data errors
- Lost product volume
- Lost customers
- One time customer outages
- Discontinued products
- Non-optimal sourcing
Step 3: Forecasting Segmentation (80/20 Analysis)

It is crucial to distinguish the “high-value” items for special attention while automating the “not-as-valuable” items.

### COV (Coefficient of Variation)

\[
\text{COV} = \frac{\text{STD Deviation}}{\text{Ave.}}
\]

### Statistical Forecastability

(1/\text{COV})

### Demand Notes

<table>
<thead>
<tr>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statistical Forecastability</td>
<td></td>
</tr>
</tbody>
</table>

### Sales Volume/Impact

<table>
<thead>
<tr>
<th>High</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-High Impact Items</td>
<td>Non-HI Items</td>
</tr>
</tbody>
</table>

- Manage by Exception using Exception Reports
- Collaborate with Customer (if possible)
- Gather Business Intelligence for all HI Items
- Use Data Aggregation in Statistical Model for all Non-HI Items

~ 80% Total Volume

### Statistical Forecasting Example

- High
- Low
- Average Monthly Demand
- Statistical Forecasting

- High
- Low
- Non-High Impact Items

- High
- Low
- Non-HI Items
Six Keys to Improving Forecast Accuracy

Step 4: Data Aggregation

- SAP APO 4.1 used for forecasting and demand planning
- Forecasting done at product/customer ship-to level
- Thousands of unique customer/product combinations exist to manage
- Too much data for Planners to review monthly
- Sales history for many combinations (~80%) was sporadic and difficult to forecast, i.e., high forecasting errors
- So how do you get a good forecast for sporadic combinations?
  - Forecast at a more aggregate level

Getting a good forecast for sporadic combinations

- Compile non-high impact items from segmentation analysis
- Program forecast model to aggregate non-high impact items to logical planning source (plant, warehouse, prod. unit, etc.)
- Generate statistical forecast at aggregate planning source
- Disaggregate statistical forecast to lowest forecast level in model based on past history (plant/product/customer ship-to)
- Aggregation to the plant/product level reduced number of combinations to review by 80%

Aggregation produces a more accurate forecast for sporadic items allowing more time to focus on high impact items
Step 5: Sales Adjustments to Statistical Forecast

Six Keys to Improving Forecast Accuracy

Accurate forecasting is not just getting a forecast from the customer. The customer isn’t always right!

- Seasonality of the business
- State of the economy
- Competition and market position
- Product trends

It’s also important to ask customers the right sales questions to validate forecast assumptions:
- Where does this project rank today?
- When are you looking to make a purchasing decision?
- When will you be implementing?
- What would you like to see happen as a next step?
Step 5: Sales Adjustments to Statistical Forecast

**Adjustments Made to Forecast**
- Pre-buying
- Promotional impacts
- Upside and downside volumes
- Customer plants expected to be down
- New business
- New customers

**Adjustments Made to History**
- Data errors
- Lost product volume
- One time customer outages
- Packaging changes
- Discontinued products

Decide where adjustments should be made

---

Six Keys to Improving Forecast Accuracy

Step 6: Measurement & Exception Reporting

If you cannot effectively measure forecasting performance, you cannot identify whether changes to the process are improving forecast accuracy.

Effective measures should evaluate accuracy at different levels of aggregation (plant, warehouse, sales region, etc.).

Measuring and reporting forecast accuracy helps to build confidence in the forecasting process.

Once people realize that sources of error are being eliminated, the organization will begin to use the forecast to drive business operations decisions.
Step 6: Measurement & Exception Reporting

- A variety of analyses and exception-based measurements are needed to understand where the biggest sources of forecast error are
  - Identifying High Impact exceptions for Sales review
  - Accuracy of adjustments made to statistical forecast
  - Identifying non-High Impact exceptions
  - Current month variances (Forecast – Actual)
  - Forecast but no sales
  - Sales but no forecast
  - No sales in last 12 months

High Impact Exceptions for Sales Review

- Identify High Impact “Exceptions” to focus forecast review
  - Decreasing or increasing sales rates
  - Aggressive statistical forecast based on historical run rates

|------------------|------------------|----------------------|-----------|-----------------------|----------------|-----------------
| Customer A       | 2,167,904        | 1,465,968            | 701,936   | 1,691,155             | 476,749        | 225,187        |
| Customer B       | 286,650          | 494,531              | 207,881   | 281,859               | 4,791          | 203,090        |
| Customer C       | 316,315          | 454,387              | 138,072   | 313,809               | 2,506          | 135,566        |
| Customer D       | 743,619          | 906,002              | 162,383   | 680,000               | 63,619         | 98,764         |
| Customer E       | 20,266           | 0                    | 20,266    | 50,000                | 29,734         | (9,467)        |
| Customer F       | 244,023          | 370,466              | 126,443   | 205,698               | 38,325         | 88,117         |
| Customer G       | 332,211          | 252,729              | 79,482    | 330,000               | 2,211          | 77,271         |
| Customer H       | 20,312           | 40,547               | 20,236    | 113,400               | 93,088         | (72,853)       |
| Customer I       | 50,000           | 130,416              | 80,416    | 80,000                | 30,000         | 50,416         |
| Customer J       | 301,221          | 111,502              | 189,719   | 159,757               | 141,464        | 48,255         |
| Customer K       | 40,479           | 56,471               | 15,992    | 102,000               | 61,521         | (45,529)       |
| Customer L       | 142,709          | 84,879               | 57,830    | 155,800               | 13,091         | 44,739         |
| Customer M       | 163,592          | 237,196              | 73,604    | 193,000               | 29,408         | 44,196         |
| Customer N       | 0                | 1,603                | 1,603     | 40,000                | 38,397         |               |
| Customer O       | 40,615           | 0                    | 40,615    | 37,800                | 2,815          | 37,800         |
| Customer P       | 0                | 52,893               | 52,893    | 16,000                | 36,893         |               |
| Customer Q       | 152,434          | 194,153              | 41,719    | 140,000               | 12,434         | 29,285         |
Accurate customer intelligence provided by Sales can significantly improve forecast accuracy.

Accuracy of Forecast Adjustments

If adjustments to the statistical forecast do not improve forecast accuracy, why make them?

<table>
<thead>
<tr>
<th>Month</th>
<th>Actual Demand</th>
<th>Stat Forecast</th>
<th>Error</th>
<th>S&amp;OP Forecast</th>
<th>Error</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan06</td>
<td>6,255,069</td>
<td>7,596,954</td>
<td>4,523,202</td>
<td>5,909,531</td>
<td>4,354,679</td>
<td>5.7%</td>
</tr>
<tr>
<td>Feb06</td>
<td>9,167,030</td>
<td>9,875,001</td>
<td>5,200,971</td>
<td>9,646,871</td>
<td>3,794,898</td>
<td>6.4%</td>
</tr>
<tr>
<td>Mar06</td>
<td>11,997,007</td>
<td>11,932,441</td>
<td>4,550,214</td>
<td>10,797,113</td>
<td>2,479,211</td>
<td>4.2%</td>
</tr>
<tr>
<td>Apr06</td>
<td>10,625,000</td>
<td>12,512,901</td>
<td>5,887,901</td>
<td>13,477,086</td>
<td>3,950,086</td>
<td>7.5%</td>
</tr>
<tr>
<td>May06</td>
<td>9,815,000</td>
<td>9,846,867</td>
<td>4,231,867</td>
<td>11,297,105</td>
<td>9,586,393</td>
<td>3.2%</td>
</tr>
<tr>
<td>Jun06</td>
<td>8,541,000</td>
<td>11,385,000</td>
<td>4,844,000</td>
<td>9,311,634</td>
<td>7,140,634</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

Last 6 Month Ave. 57,069,281 59,582,446 26,523,078 61,515,332 17,966,033 15.0%

These items have the biggest overall impact to forecast accuracy results.

Determine the source of the variances.

Forecast but No Sales

Zero out the history for these customers in the forecast model.

Current Month Variance Analysis

- These items have the biggest overall impact to forecast accuracy results
- Determine the source of the variances

Forecast Variances - By Ship-to Customer JULY 2006

<table>
<thead>
<tr>
<th>Product</th>
<th>Customer</th>
<th>JULY Actual</th>
<th>JULY Forecast</th>
<th>JULY Variance</th>
<th>JULY Forecast Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>2,134,314 KG</td>
<td>1,611,990 KG</td>
<td>522,324 KG</td>
<td>67.6%</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>1,230,867 KG</td>
<td>900,000 KG</td>
<td>330,867 KG</td>
<td>63.2%</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>433,674 KG</td>
<td>147,542 KG</td>
<td>286,132 KG</td>
<td>-93.9%</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>0 KG</td>
<td>240,000 KG</td>
<td>240,000 KG</td>
<td>0.0%</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>61,117 KG</td>
<td>300,000 KG</td>
<td>238,883 KG</td>
<td>0.0%</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>165,799 KG</td>
<td>330,000 KG</td>
<td>164,201 KG</td>
<td>50.2%</td>
</tr>
<tr>
<td>7</td>
<td>G</td>
<td>431,901 KG</td>
<td>268,665 KG</td>
<td>163,236 KG</td>
<td>39.2%</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
<td>424,536 KG</td>
<td>262,575 KG</td>
<td>161,961 KG</td>
<td>38.3%</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td>334,660 KG</td>
<td>174,096 KG</td>
<td>160,565 KG</td>
<td>7.8%</td>
</tr>
<tr>
<td>10</td>
<td>J</td>
<td>20,040 KG</td>
<td>175,167 KG</td>
<td>155,127 KG</td>
<td>11.4%</td>
</tr>
<tr>
<td>11</td>
<td>K</td>
<td>490,342 KG</td>
<td>355,456 KG</td>
<td>134,886 KG</td>
<td>62.1%</td>
</tr>
<tr>
<td>12</td>
<td>L</td>
<td>40,642 KG</td>
<td>171,132 KG</td>
<td>130,490 KG</td>
<td>23.7%</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>264,235 KG</td>
<td>143,679 KG</td>
<td>120,557 KG</td>
<td>16.1%</td>
</tr>
<tr>
<td>14</td>
<td>N</td>
<td>181,589 KG</td>
<td>77,946 KG</td>
<td>103,644 KG</td>
<td>-33.0%</td>
</tr>
</tbody>
</table>

Forecast but No Sales

Forecast but No Sales

Forecast but No Sales

Forecast but No Sales
Sales but No Forecast

- Add forecasts for these customers

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product 1</td>
<td>Customer A</td>
<td>0</td>
<td>0</td>
<td>84,550</td>
<td>28,183</td>
<td>0</td>
</tr>
<tr>
<td>Product 2</td>
<td>Customer B</td>
<td>0</td>
<td>0</td>
<td>61,117</td>
<td>20,372</td>
<td>0</td>
</tr>
<tr>
<td>Product 3</td>
<td>Customer C</td>
<td>0</td>
<td>29,402</td>
<td>20,330</td>
<td>0</td>
<td>16,577</td>
</tr>
<tr>
<td>Product 4</td>
<td>Customer D</td>
<td>0</td>
<td>13,789</td>
<td>12,093</td>
<td>20,339</td>
<td>15,407</td>
</tr>
<tr>
<td>Product 5</td>
<td>Customer E</td>
<td>0</td>
<td>0</td>
<td>40,760</td>
<td>13,587</td>
<td>0</td>
</tr>
<tr>
<td>Product 6</td>
<td>Customer F</td>
<td>0</td>
<td>0</td>
<td>40,587</td>
<td>13,529</td>
<td>0</td>
</tr>
<tr>
<td>Product 7</td>
<td>Customer G</td>
<td>0</td>
<td>5,700</td>
<td>11,400</td>
<td>22,800</td>
<td>13,300</td>
</tr>
<tr>
<td>Product 8</td>
<td>Customer H</td>
<td>0</td>
<td>0</td>
<td>39,635</td>
<td>13,212</td>
<td>0</td>
</tr>
<tr>
<td>Product 9</td>
<td>Customer I</td>
<td>0</td>
<td>0</td>
<td>39,608</td>
<td>13,203</td>
<td>0</td>
</tr>
<tr>
<td>Product 10</td>
<td>Customer J</td>
<td>0</td>
<td>0</td>
<td>35,150</td>
<td>11,717</td>
<td>0</td>
</tr>
<tr>
<td>Product 11</td>
<td>Customer K</td>
<td>0</td>
<td>654</td>
<td>0</td>
<td>34,382</td>
<td>11,679</td>
</tr>
</tbody>
</table>

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Forecast Accuracy Improvement

(Product Mix Level)

<table>
<thead>
<tr>
<th>Year</th>
<th>Process, People, Statistical Forecasting</th>
<th>Forecast Segmentation</th>
<th>Exception Analysis</th>
<th>Forecast Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>40%</td>
<td>50%</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>2004</td>
<td>45%</td>
<td>55%</td>
<td>15%</td>
<td>20%</td>
</tr>
<tr>
<td>2005</td>
<td>50%</td>
<td>60%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>2006</td>
<td>55%</td>
<td>65%</td>
<td>25%</td>
<td>30%</td>
</tr>
</tbody>
</table>

World Class + 6% + 7% + 15%
Forecast Deviation Trend

- Forecast deviation at chemical product level

Target
0%
20%
40%
60%
80%
100%

Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09

Forecast Deviation %
Forecast Deviation Reduced 56%

Forecast Deviation Vs Inventory Levels

Forecast Deviation
Inventory Decreased 29%

Forecast Deviation Vs On-Time Delivery

On-Time Delivery Increased 2%
If you follow the Roadmap to improve your company’s sales forecasting practices, you will experience reductions in costs and increases in customer and employee satisfaction. Costs will decline in inventory levels, raw materials, production, and logistics. But the first step a company must take before realizing these kind of benefits is to recognize the importance of sales forecasting as a management function, and to be willing to commit the necessary resources to becoming world class.