Procurement Risk Management at HP: Applying financial engineering to manage risks in the supply chain

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Procurement Risk Management Group
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Agenda

1. About HP
2. Motivation for risk mgmt in high-tech industries
3. Challenges in applying conventional risk management techniques
4. Procurement Risk Management at HP
5. Implementing the uncertainty management culture
About HP

HP is a leading provider of product, technologies, solutions & services to consumers & businesses.

<table>
<thead>
<tr>
<th>Personal Systems Group</th>
<th>Imaging &amp; Printing Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Desktops</td>
<td>• Consumer printing</td>
</tr>
<tr>
<td>• Workstations</td>
<td>• Business printing</td>
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<tr>
<td>• Notebooks</td>
<td>• Digital imaging</td>
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<td>• Emerging technologies</td>
<td>• Digital publishing</td>
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<table>
<thead>
<tr>
<th>Enterprise Systems Group</th>
<th>HP Services</th>
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<tbody>
<tr>
<td>• Servers</td>
<td>• Customer support</td>
</tr>
<tr>
<td>• Storage</td>
<td>• Managed services</td>
</tr>
<tr>
<td>• Software</td>
<td>• Consulting &amp; integration</td>
</tr>
<tr>
<td>• Solutions</td>
<td>• Solutions expertise</td>
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HP market leadership today

- #1 globally in inkjet, all-in-one, and single-function printers, mono and color laser printers, large-format printing, scanners, print servers, and ink and laser supplies
- #1 globally in total server revenue and shipments
- #1 globally in total disk storage systems, total external disk storage systems and open storage area networks
- #1 globally in network and system management software
- #2 globally in notebook PCs
- #1 globally in Pocket PCs
- #2 globally in PCs
- #2 globally in handhelds
- #3 globally in IT services
Supply chain competitive differentiation

Points of common leverage

- No/low-touch contract manufacturing
- Vertically integrated, high volume
- Direct configure-to-order
- Value-added systems & solutions
- Services logistics supply chain

CRM: Customer Relationship Management  PDM: Product Data Management

Direct procurement, leading the industry

- We are the largest buyer in the world for most commodities in the electronics industry.
- Our procurement influence is significant.
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High-tech components can exhibit significant cost volatility

![Graph showing DRAM memory & TFT panels high cost volatility]
… coupled demand volatility of high-tech products

High-tech products exhibit very short life-cycles & extreme demand volatility

Lack of risk mgmt processes has resulted in billions of dollars in losses

**Dell Computer**
- **Price risk**
  - May 14, 2004: Stock drops 3% as earnings are held back by memory prices
  - Oct 18, 1999: Stock drops 13% as higher memory prices result in a $470M earnings shortfall

**Cisco Systems**
- **Demand risk**
  - April 2001: $2.5B inventory write-off due to rapidly weakening demand coupled with locked-in supply agreements

**Ford Motor Company**
- **Price risk**
  - December 2001: Ford posted $1B loss on palladium & other precious metals contracts. Shareholder files suit alleging mistake in company’s hedging

**Agilent Technologies**
- **Availability risk**
  - July 1999: Stock price drops 26% after an inability to obtain key components cause revenue shortfall
Objectives of PRM @ HP:
Measure & Manage Procurement Uncertainties

Price-Cost Matching Problem
Supply-Demand Matching Problem

Uncertainty Symptoms
Hidden Material Costs
Shortage & Inventory Obs. Costs
Margin Risk
Uncertain Product Prices

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Conventional risk management techniques are difficult to implement for high-tech components

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<th>Challenges in applying these to high-tech components</th>
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</thead>
<tbody>
<tr>
<td>• Applicable for mostly for managing price uncertainty; rarely for demand uncertainty</td>
<td>• Price, demand and availability uncertainty are equally important</td>
</tr>
<tr>
<td>• Hedging using mainly traded instruments with standard contract structures</td>
<td>• No traded instruments</td>
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<tr>
<td>• Certain other bi-lateral structured contracts which are derivatives of traded instruments.</td>
<td>• Currently procured mostly from “unstructured” contracts which have non-binding quantity and pricing terms supported by forecasts of future demand and pricing.</td>
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Lack of traded markets hinders price discovery

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<td>• Traded markets set prices for a range of contract types such as spot, futures and options.</td>
<td>• Few traded markets to set prices.</td>
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<tr>
<td>• These markets are typically “efficient” and have numerous buyers and sellers.</td>
<td>• Even if traded markets are available, liquidity is very limited.</td>
</tr>
<tr>
<td></td>
<td>• Number of suppliers &amp; buyers for a particular commodity are limited; large suppliers and buyers hold significant market power to influence prices and availability.</td>
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### Modeling of uncertainties & risks becomes difficult

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| • Since most risk management instruments are derivatives, a replication approach is appropriate.  
• Replication approach results in a risk-neutral valuation.  
• Standard Markovian stochastic processes used to model price uncertainty | • Replication approach to valuation is not valid due to the lack of traded instruments  
• Demand, Price and Availability uncertainties are correlated with one another.  
• Pricing for certain manufactured goods exhibit non-Markovian behavior |

### Lack of risk mgmt biz processes further exacerbate the challenge

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| • Robust business processes for risk management exist in companies that participate in such traded markets.  
• Metrics such as value-at-risk and earnings-at-risk are used to measure the risk in a portfolio.  
• Dedicate risk management organizations in place. | • Business processes and metrics to pro-actively measure and manage risks in procurement are lacking at most companies.  
• The supply chain and procurement organizations manage availability risk through the use of inventory buffers. |
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PRM at HP addresses risks due to high probability events

Impact

Other processes

high

low

supplier bankruptcy
earthquake
quality
data entry mistakes
fire
hurricane
earnings surprises
shipping accident
customs delays
theft of parts or products
demand risk
availability risk
price risk
transit delays

Probability of Adverse Event

high

low
Price uncertainty modeled using econometric models

- Cost uncertainty modeled using econometric models
- Customized to account for unique industry dynamics of each high-tech component like DRAM and TFT-panel

Demand uncertainty scenarios

- Demand uncertainty quantified using a combination of historical data analysis & marketing inputs
- Currently “point” forecasts for demand estimated using ERP tools
Availability uncertainty scenarios

- Pricing does not adjust enough to match supply and demand at all times. Instead under conditions of short-supply, suppliers “allocate” available supply among several buyers – thus resulting in availability uncertainties.
- Lack of adequate historical data implies that availability uncertainties are quantified using interviews.

PRM manages risk using bi-lateral structured contracts with suppliers

Uncertainties to manage
1) Demand, cost and availability uncertainties
2) These uncertainties are strongly correlated

Structured contracts that are combinations of qty & pricing terms
1) Quantity Terms:
   - Fixed Quantity; Minimum and/or maximum quantity; Fixed and flexible % of TAM
2) Pricing Terms:
   - Market-based with specified discounts; Fixed price; Price caps and floors
PRM valuation methodology: Based on a general real-options valuation


PRM Analytics Software Schematic

Real-options based valuation engine

Demand Scenarios
Price Scenarios
Availability Scenarios
Contract Terms
Forward-looking expected costs and distributions
Optimal purchase quantities for each contract
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Organizational challenges in implementing PRM

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<th>Strategy</th>
<th>Metrics &amp; Processes</th>
<th>Skills &amp; Toolsets</th>
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<td>• Currently risk management is not a core part of the supply chain strategy</td>
<td>• Current supply chain metrics do not address risks</td>
<td>• Poor understanding of techniques to measure and manage risks</td>
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<td>• Current processes do not support risk management</td>
<td>• Current ERP and supply chain mgmt systems do not address uncertainties</td>
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PRM solutions and services

Consulting
- Commodity-specific
- Business process
- Deal structuring and valuation
- Change management

Training
- Core concepts
- Forecast scenario generation

Suite of Analytical tools
- HPRisk desktop contract valuation
- HPHorizon demand forecast scenario Tool
- Price forecast Tools
- Inventory buffer calibration tool

Re-engineering business processes to implement PRM

1. New metrics put in place to track supply chain risks
2. Risk mgmt is now a core part of commodity strategy
**PRM results**

Training: >500 people trained

Development:
- 4 Analytical tools
- 5 patents filed

Implementation FY04:
- >30 executed contracts
- $40M realized saving reported by BUs and commodities,
- $3B realized spend reported by BUs and commodities,
- Implemented with 14 component families
- Improved by a factor of 2 the quality of DRAM cost forecast