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# *Optimizing the Supply-Chain Configuration for New Products*

Presented by

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# Talk Outline

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- **Problem definition**
- **Current practice**
- **Digital camera example**
- **Comparison of solution approaches**
- **Observations**
- **Next steps**

# Sourcing Optimizer Motivation

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- **How to configure a new product's supply chain?**
  - **Various vendors can supply a raw material**
  - **Multiple processes can produce assembly**
- **Two vendors can deliver an identical product. Which one do you pick?**
  - **A quotes 100 days at \$1.00 per unit**
  - **B quotes 3 days at \$1.10 per unit**

# Relevant Supply Chain Costs

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- **Cost-of-goods sold**
- **Safety stock cost**
- **Pipeline stock cost**
- **Time-to-market cost**
- **Quality cost**
- **Capacity and flexibility cost**

# Current Practice = Target Costing

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- Market price set outside the design group
- Gross margin for product is set
- This dictates product's maximum unit cost
- Maximum unit cost bounds UMC
- UMC is then allocated to subassemblies
  - Having established target UMC, designers independently source their portion of the supply chain

# Current Practice

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- **Numerous factors to consider when choosing options**
  - **Functionality, price, quality, flexibility, etc**
  - **Firm establishes minimum thresholds for each factor. Chooses minimum cost parts and processes among qualifying set**
- **Justification for current approach**
  - **Other factors are difficult, if not impossible, to quantify**
  - **UMC will dictate whether or not product's business case is successful**
  - **Design team is not the same team that has to live with the options selected**

# Sourcing Optimizer Problem Statement

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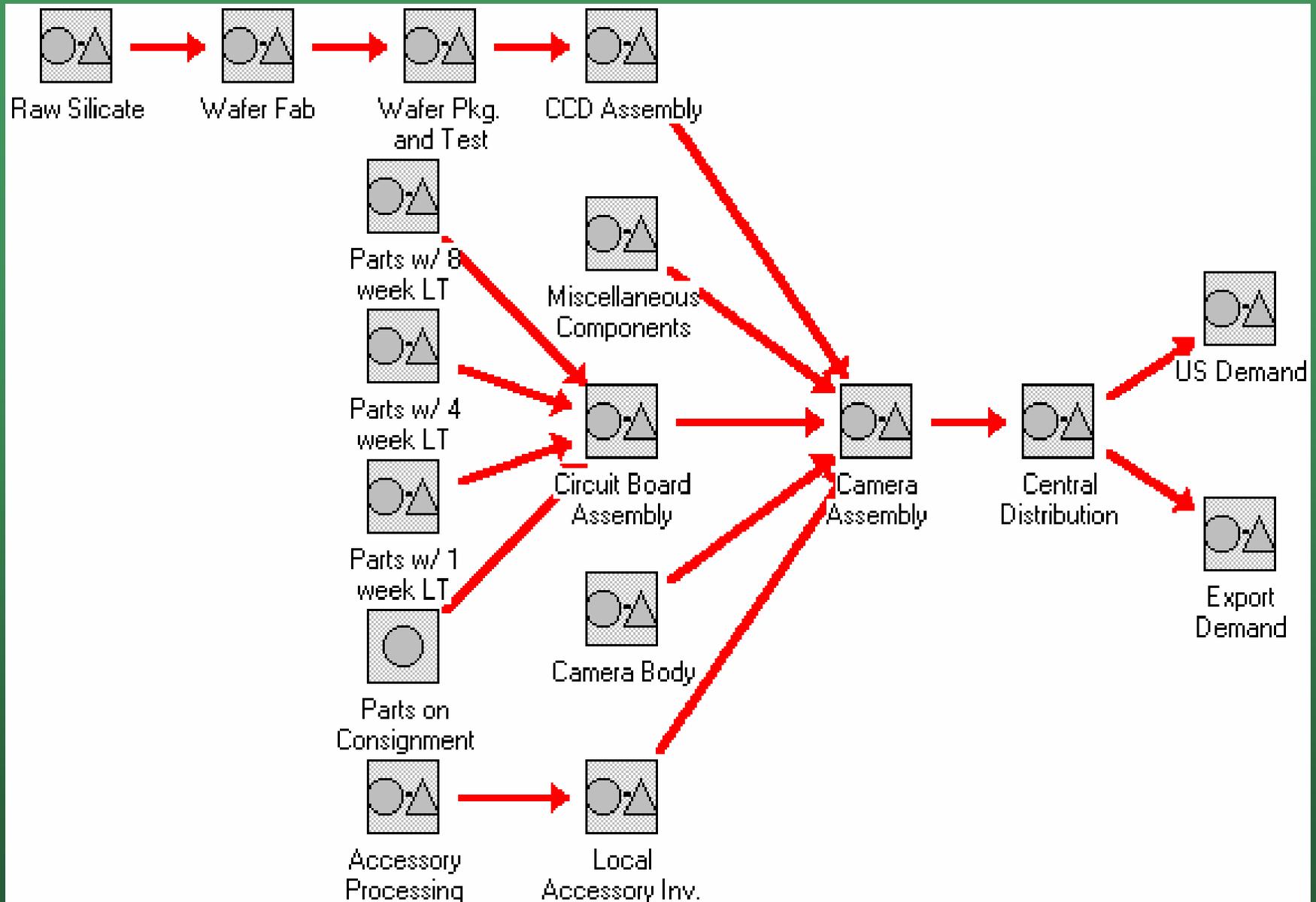
- **Define a supply chain configuration as the set of options selected for each stage in supply chain**
- **Stages include procurement; production, assembly and test processes; distribution channels; and transportation modes**
- **Intent: develop a DSS for determining options in SC configuration, given a stable product design**

# Digital Camera Example

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- **Pro-sumer model**
  - Annual demand has a mean of ~4750 units and a standard deviation of ~145
- **Three major subassemblies**
  - **Imager**
  - **Circuit board**
  - **Camera body**
- **Two customer markets: US and export**

# Digital Camera Supply Chain



# Digital Camera Options

Component/Process Description	Option	Product.	
		Time	Cost
Raw Silicate	1	60	\$5
	2	20	\$8
Wafer Fab	1	30	\$800
	2	8	\$825
Wafer Pkg. and Test	1	10	\$200
	2	5	\$225
CCD Assembly	1	5	\$200
	2	2	\$250
Miscellaneous Components	1	30	\$200
Parts w/ 8 Week LT	1	40	\$105
	2	20	\$108
	3	10	\$109
	4	0	\$110
Parts w/ 4 Week LT	1	20	\$175
	2	10	\$177
	3	0	\$179

Note: All data  
has been disguised by scaling

# Digital Camera Options

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Parts w/ 2 Week LT	1	10	\$200
	2	0	\$203
Parts on Consignment	1	0	\$225
Circuit Board Assembly	1	20	\$225
	2	5	\$300
Camera Body	1	70	\$650
	2	30	\$665
Accessory Processing	1	40	\$100
Local Accessory Inv.	1	10	\$60
Camera Assembly	1	6	\$420
	2	3	\$520
Central Distribution	1	5	\$180
US Demand	1	5	\$12
	2	1	\$25
Export Demand	1	11	\$15
	2	2	\$40

# Three Solution Approaches

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- **Minimize unit manufacturing cost**
- **Minimize production time**
- **Minimize supply chain costs**

# SC Configuration Model

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- **Based on strategic inventory placement model, Graves and Willems (1998)**
- **Assumes bounded demand, fixed and guaranteed service times, deterministic lead times, periodic review base-stock control**
- **Supply chain configuration solved as DP with 2-dimensional state space**

# Solution Comparison

	Current Policy	Min UMC	Min Prod Time	Min SC Costs
<b>COGS (\$MM)</b>	<b>17.85</b>	<b>17.85</b>	<b>19.4</b>	<b>18.02</b>
<b>Inventory Cost (\$MM)</b>	<b>1.22</b>	<b>1.16</b>	<b>0.6</b>	<b>0.85</b>
<b>Total Configuration Cost (\$MM)</b>	<b>19.07</b>	<b>19.01</b>	<b>20.0</b>	<b>18.87</b>
<b>Unit Manufacturing Cost</b>	<b>\$3,756</b>	<b>\$3,756</b>	<b>\$4,078</b>	<b>\$3,794</b>
<b>Length of Longest Path</b>	<b>127 dys</b>	<b>127 dys</b>	<b>45 days</b>	<b>118 dys</b>

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# Role of Holding Cost

	15%	30%	45%	60%
Raw Silicate	1	1	1	1
Wafer Fab	1	1	1	2
Wafer Pkg. and Test	1	1	1	1
CCD Assembly	1	1	1	1
Miscellaneous Components	1	1	1	1
Parts w/ 8 Week LT	1	3	4	4
Parts w/ 4 Week LT	1	2	3	3
Parts w/ 2 Week LT	1	1	2	2
Parts on Consignment	1	1	1	1
Circuit Board Assembly	1	1	1	1
Base Assembly	2	2	2	2
Accessory Processing	1	1	1	1
Local Accessory Inv.	1	1	1	1
Digital Capture Device Assembly	1	1	1	1
Central Distribution	1	1	1	1
US Demand	1	2	2	2
Export Demand	1	2	2	2

# Inventory Investment and UMC Interaction

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Initial Investment (\$MM)	UMC (\$/unit)	COGS (\$MM)
3.3	3,773	17.9
2.8	3,794	18.0
2.7	3,800	18.1
2.5	3,825	18.2

# Observations

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- **SC optimization saves \$194K; three times the savings from SIP**
- **Optimization did not make some “obvious” choices**
- **Increasing unit manufacturing cost by \$37 is significant. Need to determine increases in an optimization-based, data-driven manner**
- **As you move farther downstream in the supply chain, higher cost options can be more attractive**
- **More complex the supply chain, more likely optimization will find opportunities**

# Next Steps

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- **Verify/validate the model in practice**
- **Develop software to disseminate**
- **Incorporate side constraints, e.g. number of vendors**