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Manufacturing
Flow Management
Supply Chain Management Processes

Information Flow

Tier 2 Supplier  Tier 1 Supplier  Manufacturer  Customer  Consumer/End user

Supply Chain Management Processes

Product Flow

Purchasing  Logistics  Marketing

Production  R&D  Finance

Customer Relationship Management

Supplier Relationship Management

Customer Service Management

Demand Management

Order Fulfillment

Manufacturing Flow Management

Product Development and Commercialization

Returns Management

Manufacturing Flow Management

• Manufacturing Flow Management – includes all activities necessary to obtain, implement, and manage manufacturing flexibility and to pull the products through the plants.

• Manufacturing flexibility is the ability to manage manufacturing resources and uncertainty to meet various customer requests at the lowest possible cost.
Manufacturing Flow Management

Strategic Sub-Processes

- Review Manufacturing, Sourcing, Marketing, and Logistics Strategies
- Determine Degree of Manufacturing Flexibility Requirement
- Determine Push/Pull Boundaries
- Identify Manufacturing Constraints and Determine Capabilities
- Develop Framework of Metrics

Process Interfaces

- Customer Relationship Management
- Supplier Relationship Management
- Customer Service Management
- Demand Management
- Order Fulfillment
- Product Development & Commercialization
- Returns Management

Operational Sub-processes

- Determine Routing and Velocity through Manufacturing
- Manufacturing & Material Planning
- Execute Capacity and Demand Plans
- Measure Performance

Forces for Change

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- Globalization
- Technology
- Shifts in channel power
- Growth in outsourcing
- New mentality
  - From: “We sell what we make”
  - To: “We make what we sell”
- Supply chain management
Influences on Manufacturing Flexibility

- Product characteristics
  - Differentiation vs. standardization
  - Product complexity
  - Profit margins

- Customer Demand characteristics
  - Demand volumes and fluctuation
  - Tolerance for out-of-stocks
  - Tolerance for waiting

- Lead time
  - Manufacturing process time
  - Suppliers’ lead times
  - Customer delivery lead time
### Strategic Manufacturing Flow Management Process

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<table>
<thead>
<tr>
<th>Process Interfaces</th>
<th>Strategic Sub-Processes</th>
<th>Activities</th>
</tr>
</thead>
</table>
| Customer Relationship Management | Review Manufacturing, Sourcing, Marketing, and Logistics Strategies | - Establish preparedness for future market changes  
- Forecast expertise needed  
- Forecast/study laws and regulations |
| Supplier Relationship Management | Determine Degree of Manufacturing Flexibility Requirement | - Determine customer tolerance time  
- Establish quality policy and controls  
- Define minimum batch size and cycle time  
- Plan capacity growth  
- Establish make vs. buy decisions |
| Customer Service Management | Determine Push/Pull Boundaries | - Review customer service goals  
- Determine inventory/stocking points  
- Evaluate postponement opportunities |
| Demand Management | Identify Manufacturing Constraints and Determine Capabilities | - Document capabilities  
- Determine stock quantities and location  
- Develop disposal/disposition requirements  
- Develop contingency plans  
- Develop supplier development strategy  
- Develop acceptance criteria  
- Develop communications mechanisms  
  - to other processes supporting requirements  
  - to “order acceptance” guidelines |
| Order Fulfillment | Develop Framework of Metrics | - Develop measurement framework  
- Establish communication and feedback loops |
| Product Development & Commercialization | | |
| Returns Management | | |

Strategic Sub-Process #1

Review Manufacturing, Sourcing, Marketing, and Logistics Strategies

- Assess strategic fit
- Competitive priorities
- SWOT analysis
  - Threats and opportunities?
Generic Manufacturing Strategies

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Air University: The Intellectual and Leadership Center of the Air Force

Aim High…Fly - Fight - Win

Lean Manufacturing

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- Characteristics:
  - Focus on perfect, first-time quality (zero defects)
  - Waste minimization
    - Overproduction
    - Waiting
    - Unnecessary transport
    - Overprocessing of parts
    - Inventories
    - Unnecessary movement by employees
    - Defective parts
  - Focus on continuous improvement, minimizing variability
  - Typically relies on short production plans

- Best applied to: Standardized, price-sensitive products with stable demand and long life cycles
Agile Manufacturing

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Characteristics:
- Flexible demand accommodation
  - Flexible manufacturing
  - Flexible workforce
  - Arbitrary lot sizing
- Reconfigurable operating architecture
- Integrated product design and manufacture
- Short supply chains
- Intense information sharing
- Postponement

Best applied to: Non-standardized or customized, high-margin products with volatile demand and short life cycles
Lean vs. Agile: Similarities and Differences

Both approaches have the same objective:
Meeting customer demands at the least total cost

- Lean tends to focus on process – precise, efficient execution; internal perspective
- Agile tends to focus on products – precise, effective accommodation; external perspective
Strategic Sub-Process #2

Determine Degree of Manufacturing Flexibility Required

- Determine customer tolerance time.
- Establish quality policy and controls.
- Define minimum batch size/cycle time.
- Plan capacity growth.
- Establish make vs. buy decisions.

Drivers

Approaches
## Organizational Flexibility

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### Type of Flexibility

<table>
<thead>
<tr>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Flexibility</strong></td>
</tr>
<tr>
<td>Manufacturing Operations</td>
</tr>
<tr>
<td>The ability of the organization to manage production resources and uncertainty to meet various customer requirements.</td>
</tr>
<tr>
<td>Market</td>
</tr>
<tr>
<td>The ability to mass-customize and build close relationships with customers, including designing new products and modifying existing ones.</td>
</tr>
<tr>
<td>Supply</td>
</tr>
<tr>
<td>The ability to reconfigure the supply chain (geographically) as sources of supply and customers change.</td>
</tr>
<tr>
<td>Information Systems</td>
</tr>
<tr>
<td>The ability to align information systems with changing customer demands.</td>
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</tbody>
</table>
### Production Flexibility

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<table>
<thead>
<tr>
<th>Type of Flexibility</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Mix</td>
<td>The ability to change over to a different product quickly and economically without changes in capacity</td>
</tr>
<tr>
<td>Volume</td>
<td>The ability to operate at various batch sizes and/or at different production volumes economically and effectively</td>
</tr>
<tr>
<td>Expansion</td>
<td>Modular building and expanding capacity</td>
</tr>
<tr>
<td>Material Handling</td>
<td>The ability to effectively transport different work pieces between various processing centers over multiple paths</td>
</tr>
<tr>
<td>Process (routing)</td>
<td>The ability to process a given set of part types using multiple routes effectively</td>
</tr>
<tr>
<td>Machine</td>
<td>The ability of a machine to perform different operations economically and effectively</td>
</tr>
<tr>
<td>Work-center (labor)</td>
<td>The ability of the workforce to perform a broad range of tasks economically and effectively</td>
</tr>
</tbody>
</table>

Outsourced Manufacturing

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• Motives
  • Focus on core competence (R&D, NPD, merchandising)
  • Support rapid expansion
  • Shed the assets

• Potential benefits
  • Improved focus on highest priorities
  • Fixed costs become semi-fixed and variable

• Potential costs
  • Loss of control: product quality and service
  • Higher total costs despite low-cost production
Strategic Sub-Process #3

Determine Push/Pull Boundaries

• Review customer service goals.
• Determine inventory/stocking points.
• Evaluate postponement opportunities.

Push Point Pull

MTS MTO
Disconnects in Supply and Demand

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Exhibit A

Exhibit B
Strategic Sub-Process #4

Identify Manufacturing Constraints and Determine Capabilities

- Document manufacturing capabilities/constraints.
- Determine inventory policy (quantities and locations).
- Support returns management activity.
- Develop supplier development strategy.
- Develop acceptance criteria.
- Develop communication mechanisms
  - to other processes supporting requirements.
  - to “order acceptance” guidelines.
Strategic Sub-Process #5

Develop Framework of Metrics

• Develop measurement framework.

• Establish communication and feedback loop.
How MFM Affects EVA®

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- Obtain repeat business
- Increase product availability
- Provide desired product features
- Reduce direct labor and materials
- Improve manufacturing processes
- Increase plant productivity
- Reduce waste and rework
- Increase labor utilization
- Increase order fill and orders shipped complete
- Reduce order cycle time
- Reduce expedited shipments
- Reduce damage and handling
- Reduce packaging
- Reduce human resources costs/improve effectiveness
- Reduce general overhead / mgmt. / admin. costs
- Reduce component, WIP & finished goods inventory
- Reduce obsolete inventory
- Buy to order, make to order, or JIT
- Reduce accounts receivable through faster payment
- Improve asset utilization and rationalization
- Improve investment planning and deployment

ECONOMIC VALUE ADDED

\[
\text{ECONOMIC VALUE ADDED} = \frac{\text{NET PROFIT MARGIN}}{\text{NET SALES}} - \text{CAPITAL CHARGE}
\]

\[
\text{CAPITAL CHARGE} = \frac{\text{COST OF CAPITAL}}{\text{TOTAL ASSETS}} \times \text{TOTAL ASSETS}
\]

\[
\text{COST OF CAPITAL} = \text{COST OF CAPITAL} \times \text{TOTAL ASSETS}
\]

\[
\text{NET PROFIT MARGIN} = \frac{\text{SALES} - \text{CGS}}{\text{TOTAL EXPENSES}}
\]

\[
\text{GROSS MARGIN} = \frac{\text{SALES} - \text{CGS}}{\text{TOTAL EXPENSES}}
\]

\[
\text{NET PROFIT} = \frac{\text{GROSS MARGIN}}{\text{NET SALES}} - \text{CAPITAL CHARGE}
\]

\[
\text{TOTAL EXPENSES} = \text{CURRENT ASSETS} + \text{FIXED ASSETS} + \text{OTHER CURRENT ASSETS}
\]

\[
\text{INVENTORY} = \text{CURRENT ASSETS} + \text{FIXED ASSETS} + \text{OTHER CURRENT ASSETS}
\]
Common Production Measures

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- **Efficiency**
  - Plant productivity
  - Labor productivity
  - Machine productivity

- **Cycle Time**
  - On-time availability
  - Cycle time variance
  - Cycle time competitiveness

- **Safety**
  - Employee safety
  - Customer safety
  - Environmental record

- **Quality**
  - Complete order fill
  - Defects
  - Scrap rate/variance
  - Desired features

- **Cost**
  - Production costs
    - Direct materials
    - Direct labor
    - Overhead
  - Setup costs
  - Inventory costs
Operational Process

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Operational Sub-Processes:

- Determine Routing and Velocity through Manufacturing
- Manufacturing & Material Planning
- Execute Capacity and Demand Plans
- Measure Performance

Activities:

- Translate Demand Management output into resource and production planning
- Review aggregate production plan
- Integrate capacity of managed manufacturing facilities
- Develop master production schedule (MPS)

- Generate:
  - Detailed capacity planning
  - Time-phased requirements (MRP)

- Manage inventories
  - Raw materials, subcomponents, and packaging
  - Work in process
  - Finished goods

- Control production activity (shop floor management)

- Examine and report quality levels of manufactured product
- Identify root causes of quality issues
- Measure process performance
Operational Sub-Process #1

Determine Routing and Velocity through Manufacturing

- Translate demand management output into resource and production planning.
- Review aggregate production plan.
- Integrate capacity of managed manufacturing facilities.
- Develop master production schedule (MPS).
MFG Resource Planning

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Customer Orders

Forecasts

Demand Mgt

FG Inventory?

Master Production Schedule

ATP to CRM

Material Requirements Planning

Inventory Records

End Items (Independent Demand)

Components (Dependent Demand)
Operational Sub-Process #2

Manufacturing and Material Planning

• Generate:
  - Detailed capacity planning.
  - Time-phased requirements (MRP).
Operational Sub-Process #3

Execute Capacity and Demand Plans

• Manage inventories:
  • Raw materials, subcomponents, and packaging.
  • Work in process.
  • Finished goods.

• Control production activity (shop floor management).
Operational Sub-Process #4

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Measure Performance

• Examine and report quality levels of manufactured product.

• Identify root causes of quality issues.

• Measure process performance.

Conclusions

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• Manufacturing flow management involves more than the production function and final assembly.

• Manufacturing flow management acts in support of overall strategy, supply chain strategy, and customer service objectives.

• Determining and implementing the “right” degree of manufacturing flexibility is key.

• Measurement must focus on contribution to overall success.