Manufacturing Footprint Strategy
Making the Right Things in the Right Places

IfM Briefing Day
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AGENDA

1. Why this is important
2. IfM toolkit & applications
3. Make-or-buy
4. Global network design
5. Summary & questions
HOW GLOBAL MANUFACTURING NETWORKS DEVELOP

1. Founding plant serving home market
2. Expand to gain critical mass in home market
3. Develop footholds in attractive markets
4. Outsource low value components
5. Offshore low value products
6. Acquire competitor(s) to achieve global reach
WHY THIS IS IMPORTANT

• Networks inherited not designed
• Huge potential benefits
• Difficult & risky
• Very high stakes
AGENDA

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OUTLINE OF IfM APPROACH

1. ROADMAPPING
   Business imperatives
   Technology trends

2. MAKE-or-BUY
   Production core competences
   Strategic & low cost sourcing

3. GLOBAL NETWORK DESIGN
   Number/location/roles of plants
   Network synergy

4. MANUFACTURING MOBILITY
   Defining executable projects
   Transferring production
### SUMMARY OF APPLICATIONS

<table>
<thead>
<tr>
<th>Scale</th>
<th>Outlet</th>
<th>Outcome</th>
<th>Soft benefits</th>
<th>Hard benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>○ $40bn, 110 plants</td>
<td>Large Vehicles</td>
<td>10 year evolutionary strategy</td>
<td>Significant cost savings</td>
<td>New processes across 33 SBUs</td>
</tr>
<tr>
<td>○ $4bn, 50 plants</td>
<td>Film Products</td>
<td>5 year aggressive realignment</td>
<td>$50-60m pa declared cost savings</td>
<td>120 top managers aligned with change</td>
</tr>
<tr>
<td>○ $1bn, 12 plants</td>
<td>Food Equipment</td>
<td>2 year turnaround plan</td>
<td>Business survival</td>
<td>Minimised business disruption</td>
</tr>
<tr>
<td>○ $2bn, 17 plants</td>
<td>Transport Services</td>
<td>5 year strategy</td>
<td>20% cost saving</td>
<td>M&amp;A integration framework</td>
</tr>
<tr>
<td>○ $2bn, 21 plants</td>
<td>Specialty Chemicals</td>
<td>5 year restructuring/pre-merger plan</td>
<td>Significant cost savings</td>
<td>Refocusing of core business</td>
</tr>
<tr>
<td>○ $3bn, 14 plants</td>
<td>Hydraulic Pumps</td>
<td>Staged evolutionary strategy</td>
<td>Access to growth markets</td>
<td>Trained trainers for staged roll-out</td>
</tr>
<tr>
<td>○ $15bn, 200 plants</td>
<td>Electrical Devices</td>
<td>Footprint design model</td>
<td>Significant cost savings</td>
<td>Post M&amp;A optimisation</td>
</tr>
<tr>
<td>○ $5bn, 20 plants</td>
<td>FMCG</td>
<td>Continuous strategy process</td>
<td>Enablement of global expansion</td>
<td>Agreed vision and guidelines</td>
</tr>
<tr>
<td>○ $1.5bn, 45 plants</td>
<td>Plastic Products</td>
<td>5 year re-configuration plan</td>
<td>Significant cost savings</td>
<td>Consensus across complex organisation</td>
</tr>
<tr>
<td>○ $10bn, 60 plants</td>
<td>Petrochem</td>
<td>Ideal future network</td>
<td>Fundamental shift in network approach</td>
<td>Distillation of key drivers</td>
</tr>
<tr>
<td>○ $16bn, 40 plants</td>
<td>Aerospace</td>
<td>Impact of new process technology</td>
<td>Optimum return on investment</td>
<td>Filled key gap in corporate process</td>
</tr>
<tr>
<td>○ $2bn, 12 plants</td>
<td>Plastic Toys</td>
<td>Revised vision following turnaround</td>
<td>Scalable model for high growth</td>
<td>Clarity on core competences</td>
</tr>
<tr>
<td>○ $16bn, 45 plants</td>
<td>White Goods</td>
<td>Definition of global footprint levers</td>
<td>Significant cost savings</td>
<td>Global overlay on local business</td>
</tr>
<tr>
<td>○ $9bn, 31 plants</td>
<td>Engineering Plastics</td>
<td>In process</td>
<td>In process</td>
<td>In process</td>
</tr>
<tr>
<td>○ $30bn, 45 plants</td>
<td>Furniture</td>
<td>In process</td>
<td>In process</td>
<td>In process</td>
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</tbody>
</table>

**15 very different companies**
1. Why this is important
2. IfM toolkit & applications
3. Make-or-buy
4. Global network design
5. Summary & questions
## MAKE-OR BUY – Key Concepts from the Academic Literature

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td><strong>Comparative Advantage</strong></td>
<td>Economic benefits from specialisation between firms</td>
</tr>
<tr>
<td><em>Ricardo 1815</em></td>
<td></td>
</tr>
<tr>
<td><strong>Global Competitiveness</strong></td>
<td>Companies specialise more as they grow globally</td>
</tr>
<tr>
<td><em>Porter 1986</em></td>
<td></td>
</tr>
<tr>
<td><strong>Core Competences</strong></td>
<td>Companies specialise more as technologies become more complex</td>
</tr>
<tr>
<td><em>Prahalad &amp; Hamel 1990</em></td>
<td></td>
</tr>
<tr>
<td><strong>Lean Manufacturing</strong></td>
<td>Lean supports more specialisation via standard interfaces (e.g. Toyota)</td>
</tr>
<tr>
<td><em>Womack et al 1990</em></td>
<td></td>
</tr>
<tr>
<td><strong>Make-or-Buy</strong></td>
<td>Make-or-buy decisions based on strategic importance vs. supplier effectiveness</td>
</tr>
<tr>
<td><em>Probert et al 1998</em></td>
<td></td>
</tr>
<tr>
<td><strong>Outsourcing Risks</strong></td>
<td>Too much outsourcing impacts competitive capability and creates new competitors</td>
</tr>
<tr>
<td><em>Gregory et al 2003</em></td>
<td></td>
</tr>
<tr>
<td><strong>Innovation in Production</strong></td>
<td>Advanced production supports innovation that is difficult to copy</td>
</tr>
<tr>
<td><em>Pisano &amp; Shih 2012</em></td>
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</tbody>
</table>
MAKE-or-BUY: Core Analysis Tool

Conclusions
1. **Plate pressing** is core to competitive differentiation
2. **Gaskets** are a candidate for strategic alliance or acquisition
3. **Assembly** can be licensed
4. **Slabs, frameparts and connections** should be sourced at lowest cost
5. **Accessories** and **Painting** require supplier development
MAKE-OR-BUY TOOLSET – 2 PARTS

Core Analysis Tool

Alliance/Risk Analysis Tool

Helps define the general positioning of products, components or processes against 4 decision quadrants using best known data & judgment.

Use second tool on RH quadrant & indeterminate answers.

Helps to clarify more subtle 'strategic alliance' and 'make some' decisions.

Answering these questions helps define the choice between make, strategic alliance or buy and to identify the key risks that need to be mitigated.

- Make
- Make/strategic alliance
- Make some
- Make/strategic alliance
- Make some
- Make
- Make/strategic alliance
- Make

Start

- Could the supplier become an effective competitor?
- Does performing this work package enhance our ability to innovate?
- Are we neglecting the supplier’s too much negotiating strength?
- Would the supplier make this capability available to our competition?
- Is the true cost of supplier development prohibitive?
- Is the transfer irreversible?
- Is performing this work-package necessary in order to manage supplier?

Make one place

Make some

Continue to make

Make some

Make

Make some

Make some

Make

Make some

Buy

Make

Make some

Make some

Make some

Make some

Make some

Make some

Core Analysis Tool

Alliance/Risk Analysis Tool

Strategic Importance

Supplier Effectiveness

Make

Supplier Development

Assembly
Accessories
Connections
Gaskets
Slabs
Frameparts
Plates
Painting
Welding

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Make some

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Make some
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OUTLINE OF APPROACH

3. GLOBAL NETWORK DESIGN

Number/location/roles of plants
Network synergy
GLOBAL NETWORK DESIGN – 3 Key Elements

1. Plant specialisation

2. Network co-ordination

3. Plant location

Network Synergies

- Landed Cost Efficiency
- Market Access & Responsiveness
- Strategic Resource Access
- Learning & Innovation
- Dynamic Agility
- Risk Resilience
- Sustainability
<table>
<thead>
<tr>
<th>Concept</th>
<th>Source</th>
<th>Key Concepts</th>
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</thead>
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<tr>
<td>Division of Labour</td>
<td>Smith 1776</td>
<td>Economic wealth is based on the SPECIALISATION OF LABOUR</td>
</tr>
<tr>
<td>Focus Factories</td>
<td>Skinner 1974</td>
<td>Performance can be significantly improved by FOCUSING FACTORIES around different missions</td>
</tr>
<tr>
<td>Product vs. Process</td>
<td>Hayes &amp; Schmenner 1978</td>
<td>One primary dimension for plant specialisation is PRODUCT vs. PROCESS focus</td>
</tr>
<tr>
<td>Flexibility vs. Efficiency</td>
<td>Hayes &amp; Wheelwright 1979</td>
<td>.. Another primary dimension is specialising on FLEXIBILITY vs. EFFICIENCY</td>
</tr>
<tr>
<td>Strategic Plant Roles</td>
<td>Ferdows 1989 &amp; 1997</td>
<td>Specialising plants based on the STRATEGIC REASON FOR LOCATION (access to low cost, skills or markets)</td>
</tr>
<tr>
<td>Network Decoupling</td>
<td>Mason-Jones et al 2000</td>
<td>Networks can be DE-COUPLED into efficient, primary processes and responsive, secondary processes</td>
</tr>
<tr>
<td>Modular Networks</td>
<td>Sturgeon 2002</td>
<td>High performance networks are made up of differentiated plants with STANDARDISED INTERFACES &amp; INTERCONNECTIONS</td>
</tr>
<tr>
<td>Product Configuration</td>
<td>Srai &amp; Gregory 2007</td>
<td>NETWORK TRANSFORMATION can be enabled by PRODUCT CONFIGURATION (e.g. standardisation, modularisation)</td>
</tr>
</tbody>
</table>
**FOOTPRINT LEVERS**

- A means of creating *network-associated synergies* (i.e. benefits over-and-above those derived from running an independent set of plants)
- Covers the 3 elements of network design principles: plant specialisation, network coordination and plant location

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<td>HIGH vs. LOW RUNNER PLANTS</td>
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<td>LOAD SHEDDING PLANTS</td>
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<td>3</td>
<td>GLOBAL-REGIONAL-LOCAL PLANTS</td>
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<td>PRODUCT LAUNCH PLANTS</td>
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<td>5</td>
<td>CLOSE TO STRATEGIC SUPPLIERS</td>
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<td>6</td>
<td>ACCESS TO SKILLED LABOUR</td>
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<td>7</td>
<td>DIFFERENT PERFORMANCE CULTURES</td>
</tr>
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<td>STANDARD MANUFACTURING PROCESSES</td>
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<td>CONTINUOUS FOOTPRINT RECONFIGURATION</td>
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<td>10</td>
<td>DECOUPLING PRIMARY vs. SECONDARY PRODUCTION</td>
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<td>11</td>
<td>ACCESS TO LOW COST LABOUR</td>
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<td>12</td>
<td>PLANT SIZE GUIDELINES</td>
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<td>PRODUCT FOCUS PLANTS</td>
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<td>PLANTS WITHIN CAMPUSES</td>
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<td>16</td>
<td>CLOSE TO CUSTOMERS</td>
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<td>17</td>
<td>DYNAMIC LOAD SHIFTING</td>
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<td>18</td>
<td>CURRENCY RISK HEDGING</td>
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<td>19</td>
<td>PLANTS FOR DIFFERENT PRODUCT LIFECYCLE STAGES</td>
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<td>20</td>
<td>NETWORK MANAGEMENT ROLES</td>
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<td>21</td>
<td>MARKET ACCESS PLANTS</td>
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<td>22</td>
<td>STANDARD BUSINESS PROCESSES</td>
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<td>23</td>
<td>MODULARISATION &amp; LATE CUSTOMISATION</td>
</tr>
<tr>
<td>24</td>
<td>HIGHLY AUTOMATED PLANTS</td>
</tr>
</tbody>
</table>
WHERE: NETWORK DESIGN
Example Before Optimisation
WHERE: NETWORK DESIGN
Example After Optimisation

Main levers used:
✓ Decoupling
✓ Separate cultures
✓ Low cost labour
Plus
✓ Standardisation
✓ PLC stages
✓ Plant size rules
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"We are one of the world's largest manufacturers, with sales approaching $50bn, and the main reason for starting this process [with IfM ECS] was to secure the long-term optimisation of our production network. Over time the 'burning platform' has changed but the process remained the same, allowing us to constantly update the vision as conditions evolve. Since 2008 this approach has been used in all business divisions and serves to guide Caterpillar's annual, multi-billion dollar capital spend through coordinated investments across the vertically integrated company."

Manager of Global Production Network Planning, Caterpillar

"We worked closely [with IfM ECS] to develop and direct the Global Manufacturing Strategy which will expand our global production capabilities in developing markets around the world, as well as re-aligning our existing production into manufacturing centres of excellence within an optimised network. Our goal is to significantly improve our operating efficiencies, lower our overall cost structure and implement new technologies more effectively, whilst not compromising service, quality or EHS." The company reported a series of updates in press releases over the period 2008 to 2011, where it announced that the overall project involved capital expenditure of $220m, and delivered repeating savings of $55m per annum.

VP Global Manufacturing, Sealed Air

Electrolux has been conducting a collaborative programme with IfM ECS during 2012 and 2013 aimed at applying IfM's research on optimising global manufacturing networks. The project is still ongoing and the future impact is not yet finalised. However, the outcome is expected to guide investment in the future footprint over the next 3-5 years in the order of 3.5 Bsek (400m euros) where the targeted cost savings are in the order of 1.3 to 1.6 Bsek (180m euros) annually. "This project forms a major part of our corporate business strategy and will help to guide the optimisation of our footprint of over 45 plants around the world. This will drive structural changes in terms of cost reduction and responsiveness to customers which will underpin our future competitive differentiation."

SVP Global Manufacturing Operations, Electrolux
ARE WE ON THE CUSP OF A NEW ERA IN TERMS OF MACRO-LEVEL DRIVERS?

From:
- Globalisation of markets
- Availability of low cost labour
- Supply chain fragmentation
  - Mergers & acquisitions
  - Information age

To:
- Power shift west-east
- Sustainability pressures
  - Industry 4.0
- Convergent values & norms
- Rise of the EMNC*
- New policy perspectives on manufacturing

*EMNC = Emerging Multi National Corporation
IN SUMMARY

- Understanding ‘why we need to change’
  - Imperatives & roadmaps

- ‘What’ before ‘Where’
  - Mfg core competences, purpose of partnerships

- ‘Where’: plant roles before location
  - Creating synergy from difference

- ‘How’: making it happen
  - Competences in manufacturing mobility
ANY QUESTIONS

IfM report available to download from:
http://www.ifm.eng.cam.ac.uk/resources/international/making-the-right-things-in-the-right-places/