Manufacturing Footprint Strategy
Making the Right Things in the Right Places

IfM Briefing Day
Tuesday 13 May 2014

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AGENDA

1. Why this is important
2. IfM toolkit & applications
3. Global network design – theory & case study
4. 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

1. Why this is important
2. IfM toolkit & applications
3. Global network design – theory & case study
4. Summary & questions
From plant thinking…

High

Project
Job Shop
Batch Flow

Low

Human-paced
Line Flow
Machine-paced
Line flow
Process

EFFICIENCY

Low

High

International Manufacturing Networks
to Develop Global Competitive
Capabilities
Shi and Gregory 98
FOUNDING RESEARCH
Developing global network competitive capabilities

Shi & Gregory 1998
CUMULATIVE LEARNING

Founding Research
From mid 90s

Founding Projects
2003-6

Industrial Forum
2006-7

Position Paper
Dec 2007

Landed Cost

Efficiency

Market Access / Responsiveness

Strategic Resource Access

Learning / Innovation

Dynamic Mobility

Risk

Resilience

Product/Process Global-Local Coherence

Optimising responsiveness and efficiency
by configuring products and processes on the global-local dimension
(adapted from Ghoshal & Bartlett 1998. Sanchez & Mahoney 1996)

Leveraging comparative advantage between the firm and its supply partners
(adapted from Probert 1997)

Leveraging differentiated plant types within the firm
(adapted from Skinner 1974, Ferdows 1998)

Enfolding Research

Ongoing Projects

New Theory & Tools

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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

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### SUMMARY OF APPLICATIONS

<table>
<thead>
<tr>
<th>Scale</th>
<th>Outcome</th>
<th>Hard benefits</th>
<th>Soft benefits</th>
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<tbody>
<tr>
<td>Large Vehicles</td>
<td>$40bn, 110 plants</td>
<td>$50-60m pa declared cost savings</td>
<td>New processes across 33 SBUs</td>
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<td>Film Products</td>
<td>$4bn, 50 plants</td>
<td>Business survival</td>
<td>120 top managers aligned with change</td>
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<td>Food Equipment</td>
<td>$1bn, 12 plants</td>
<td>20% cost saving</td>
<td>Minimised business disruption</td>
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<td>Transport Services</td>
<td>$2bn, 21 plants</td>
<td>Significant cost savings</td>
<td>M&amp;A integration framework</td>
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<td>Speciality Chemicals</td>
<td>$3bn, 14 plants</td>
<td>Access to growth markets</td>
<td>Refocusing of core business</td>
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<tr>
<td>Hydraulic Pumps</td>
<td>$3bn, 200 plants</td>
<td>Significant cost savings</td>
<td>Trained trainers for staged roll-out</td>
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<tr>
<td>Electrical Devices</td>
<td>$15bn, 200 plants</td>
<td>Enablement of global expansion</td>
<td>Post M&amp;A optimisation</td>
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<tr>
<td>FMCG</td>
<td>$5bn, 20 plants</td>
<td>Significant cost savings</td>
<td>Pre-empt need for periodic restructuring</td>
</tr>
<tr>
<td>Plastic Products</td>
<td>$1.5bn, 45 plants</td>
<td>Fundamenta l shift in network approach</td>
<td>Consensus across complex organisation</td>
</tr>
<tr>
<td>Petrochem</td>
<td>$10bn, 60 plants</td>
<td>Optimum return on investment</td>
<td>Distillation of key drivers</td>
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<td>Aerospace</td>
<td>$16bn, 40 plants</td>
<td>Scalable model for high growth</td>
<td>Filled key gap in corporate process</td>
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<td>Plastic Toys</td>
<td>$2bn, 12 plants</td>
<td>In depth process for value creation</td>
<td>Clarity on core competences</td>
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<tr>
<td>White Goods</td>
<td>$16bn, 45 plants</td>
<td>In process</td>
<td>In process</td>
</tr>
</tbody>
</table>

#### 13 very different companies
CATERPILLAR CASE STUDY

Overview
- $40bn sales, 100+ plants worldwide
- 24 month strategy co-development
- Implemented across 30 SBUs in complex organisation
- Evolution towards 10 year vision

Benefits
- New process & common language to engage the senior team
- Broke the default approach of reinvesting in the status quo
- Framework to guide ongoing investment

Strategy process development

Pilot implementations

Roll-out by SBU

2003 2004 2005 2006 2007 2008 2009

Cost optimiser

Prime Product & Component Vision

Trisphere-level integration

Enterprise-level prioritization

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SEALED AIR CASE STUDY

Overview
• $4bn sales, 50+ plants worldwide
• 18 month strategy co-development
• 120 senior managers involved
• Phase 1 now complete

Benefits
• Reinvestment in process technology leadership
• Leading positions in emerging markets
• 120 senior managers involved
• Phase 1 now complete
• $55m declared cost savings so far

Strategy development
Strategy review
Phase 1 implementation
Phase 2 implementation

Strategy Announcement July 2006
• step change in costs
• access to emerging markets
• reinvestment in process technology leadership
Rights issue required to fund $250m
Target annual savings $50m

Strategy Update
Latest financial evaluation:
• investment will total $200m
• savings of $45m in 2009, increasing to $55m in 2010.
Press Release January 2008

Strategy Update
We remain committed to our growth strategies, which capitalize on our strong global footprint.
Press Release July 2008

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OUTLINE OF APPROACH

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

High Level Process

1. Evaluate Strategic Context

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario
STRATEGIC CONTEXT

High Level Process

1. Evaluate Strategic Context
   - Strategic landscape & imperatives
   - Make-or-buy guidelines

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario
High Level Process

1. Evaluate Strategic Context

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Underlying Model

NETWORK CONFIGURATION
NETWORK DESIGN PRINCIPLES

Plant Disposition
Number / dispersion
Location logic

Individual Plant Roles
Process stages
Layout
Geographic role
Contribution to network

Coordination of Network
Network standards
Network operations

NETWORK CAPABILITIES
PROJECTED BENEFITS

Affects

Many interacting relationships

- Customer Responsiveness
- Landed Cost
- Access to Resources
- Agility
- Innovation/Learning
- Control of Risk

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A. PLANT ROLES

1. Evaluate Strategic Context

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

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5. Test & Confirm Target Scenario

Plant Roles

A. Individual Plant Roles
B. Network Coordination
C. Plant Disposition

Impact of Moving to a Country with Lower Labour Cost

Each element
- Impacts cost and flexibility
- Modifies response of these to other variables

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A. PLANT ROLES FRAMEWORK
Simplification and Case Example

1. PRODUCT & PROCESS DEVELOPMENT

2. SCALE UP

3. FEEDER (low volume, high variety)

4. ASSEMBLER (ram rod)

5. FEEDER (high volume, low variety)

6. ASSEMBLER (large scale)

Full Range

Service Focus

Cost Focus

Primary  Secondary
B. COORDINATION

1. Evaluate Strategic Context

2. Develop Network Design Principles
   - A. Individual Plant Roles
   - B. Network Coordination
   - C. Plant Disposition

3. Identify Potentially Attractive Network Scenarios

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario
### B. COORDINATION: Recording Philosophy

<table>
<thead>
<tr>
<th>Primary Responsibilities</th>
<th>SBU</th>
<th>Product</th>
<th>Region</th>
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</table>
C. DISPOSITION

1. Evaluate Strategic Context

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario

A. Individual Plant Roles
B. Network Coordination
C. Plant Disposition

- Numbers
- Sizes
- Locations

Global Landed Cost

Ex-works cost
Logistics Costs

Many, Small Plants
Dispersion
Few, Large Plants

Lead Times

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FOOTPRINT SCENARIO DEVELOPMENT

1. Evaluate Strategic Context

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

   i. Clean sheet vision
   ii. Quick wins/incremental
   iii. Breakthrough scenario

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario

Scenario Aspiration

Scenario Generation
   • Elementary
   • Heuristics
   • Guided Experience

Aided by standard analyses of key metrics e.g.
   • Labour cost density - guidance on transportability.
   • Site cost curves - guidance on number/size of plants

Differentiated Plant Roles

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WHERE: NETWORK DESIGN
Example Before Optimisation
WHERE: NETWORK DESIGN
Example After Optimisation
SCENARIO EVALUATION

1. Evaluate Strategic Context

2. Develop Network Design Principles

3. Identify Potentially Attractive Network Scenarios

4. Assess Impact on Strategic Capabilities

5. Test & Confirm Target Scenario

COSTS
- Often 1st Priority
- Need Landed Cost Analysis
- Appropriate level of detail
- Treatment of Switching Costs

ASSESS
- Cost Efficiency
- Customer Responsiveness
- Resource Accessibility
- Agility
- Innovation & Learning
- Risk Management
## SCENARIO EVALUATION

### 1. Evaluate Strategic Context

### 2. Develop Network Design Principles

### 3. Identify Potentially Attractive Network Scenarios

### 4. Assess Impact on Strategic Capabilities

### 5. Test & Confirm Target Scenario

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**Discussion and understanding are more important than the final score**

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<th>Factor</th>
<th>Wtg</th>
<th>#</th>
<th>Criteria</th>
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<th>B</th>
<th>C</th>
<th>D</th>
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<td>Customer Response (leadtimes)</td>
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SCENARIO EVALUATION

1. Evaluate Strategic Context

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5. Test & Confirm Target Scenario

Different scores for different capabilities suggest alternative options
TESTING AND CONFIRMATION

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<table>
<thead>
<tr>
<th>In $m</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
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<tr>
<td>Labour cost saving</td>
<td>162</td>
<td>209</td>
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<tr>
<td>Transport cost penalty</td>
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<td>-54</td>
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<td>Fixed cost saving*</td>
<td>221</td>
<td>265</td>
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<td>Total</td>
<td>330</td>
<td>474</td>
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<td>Closure cost</td>
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<td>Capex for transfer*</td>
<td>700</td>
<td>600</td>
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<tr>
<td>Pay-back time</td>
<td>7.5</td>
<td>5.6</td>
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A. Check Validity of Critical Conclusions
B. Validate Financials of Recommended Footprint

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AGENDA

1. Why this is important
2. IfM toolkit & applications
3. Global network design – theory & case study
4. Summary & questions
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 & green technology
- 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/services/overview/large/footprint/