PharmaTherapeutics Research & Development Pharmaceutical Sciences

"Learning Lessons from the Pharmaceutical Industry in Applying Green Chemistry"

Pfizer's R&D Supply Chain

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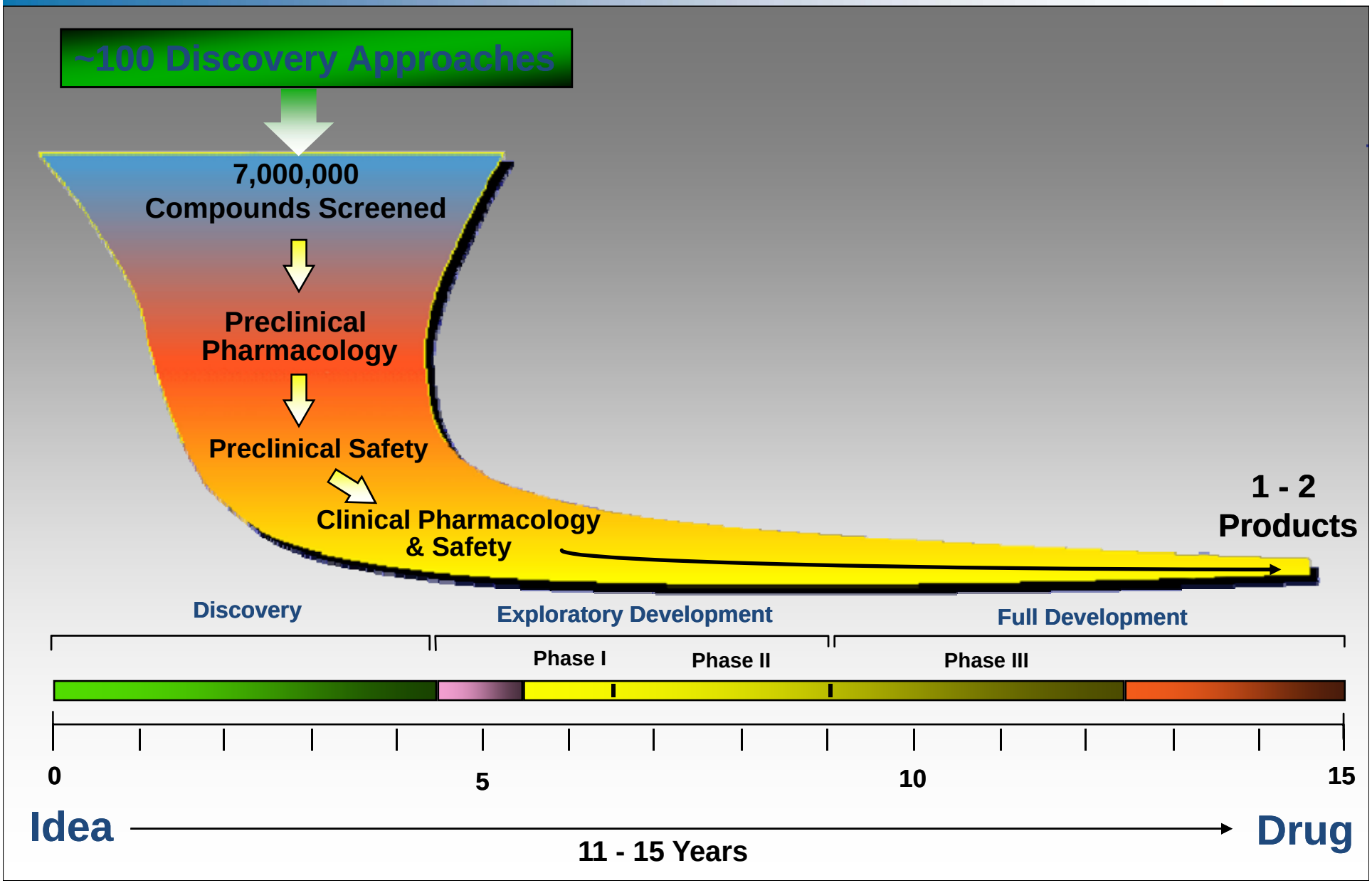
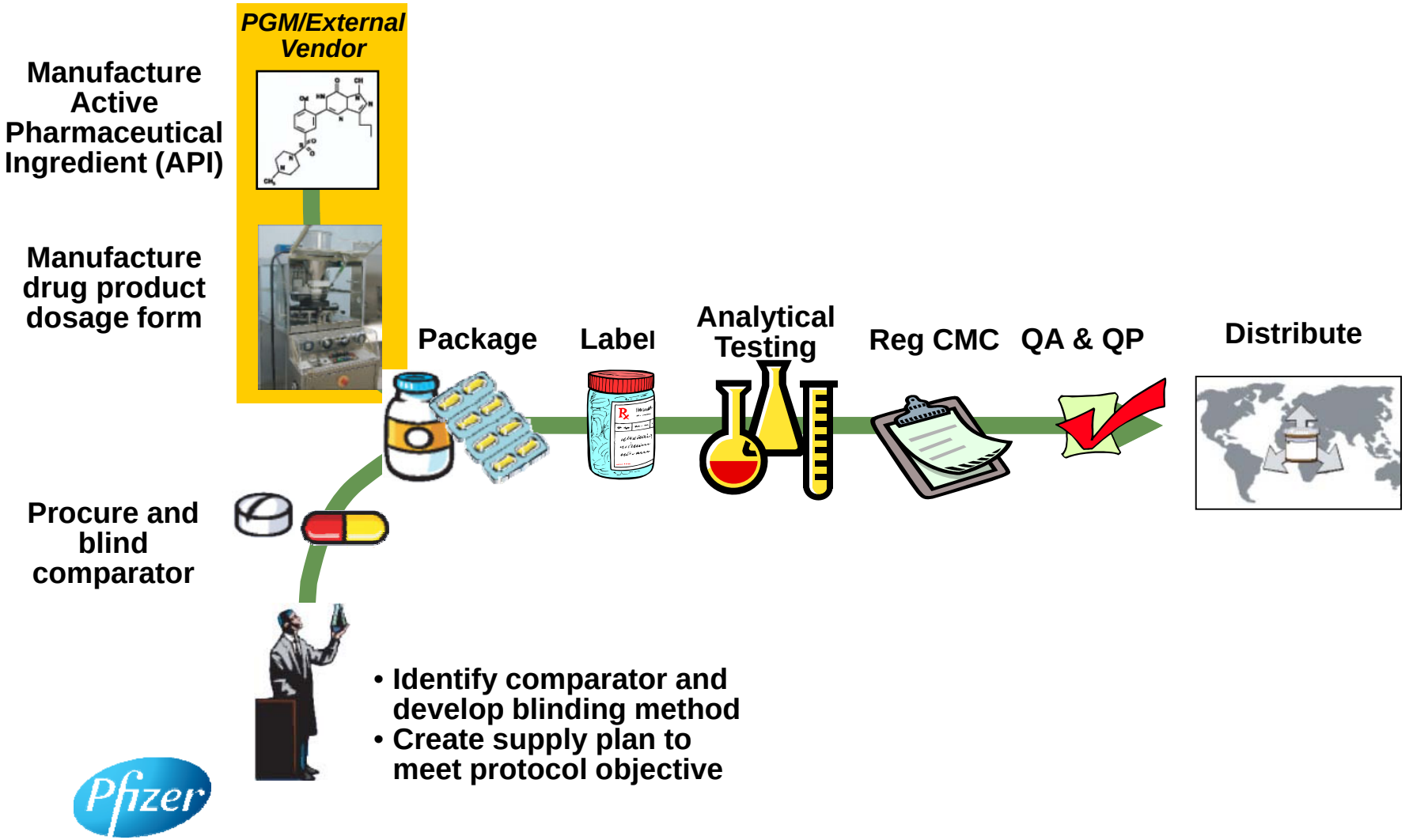
Overview of Drug Development



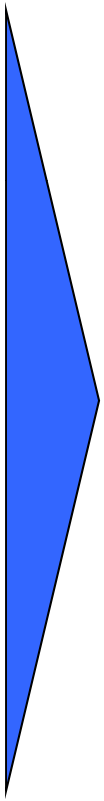
Overview of R&D Clinical Supplies



Recent changes in the Supply Chain

Historical Business Model was Unsustainable

- Deteriorating industry image
- Loss of exclusivity of products
- Price controls / importation
- Competition
- Escalating cost of drug development
- Excess Capacity built into the chain

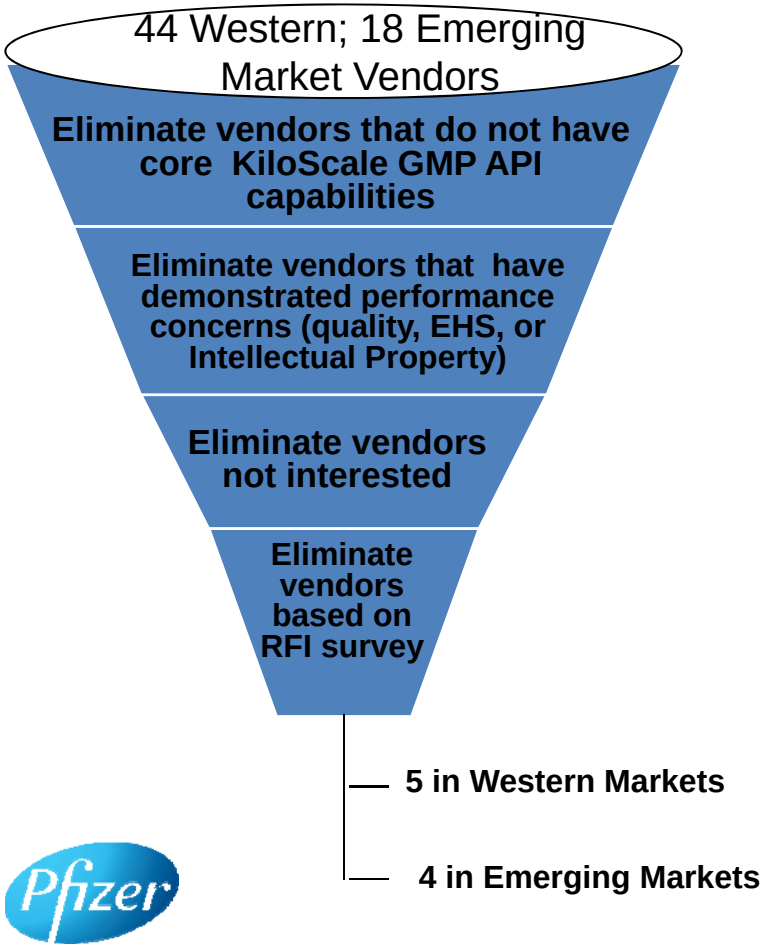


Actions required by Industry

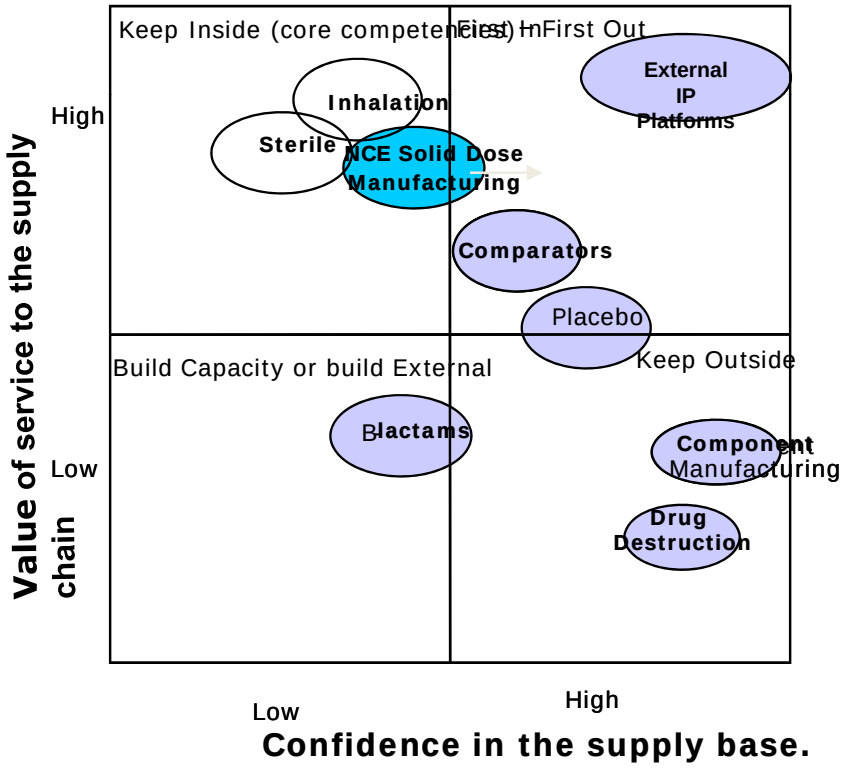
- Reduce cost by closing aging facilities which would require $MM in future capital investments
- Leverage global network and assets that have appropriate capacity for future demand
- Outsource appropriate activities and global sourcing
- More efficient use of inventory
- 2 generation development to reduce cost of goods
- New engineering approaches

Define what should be Outsourced and Process to Outsource

Active Pharmaceutical Ingredient (API) Vendor Screening Process

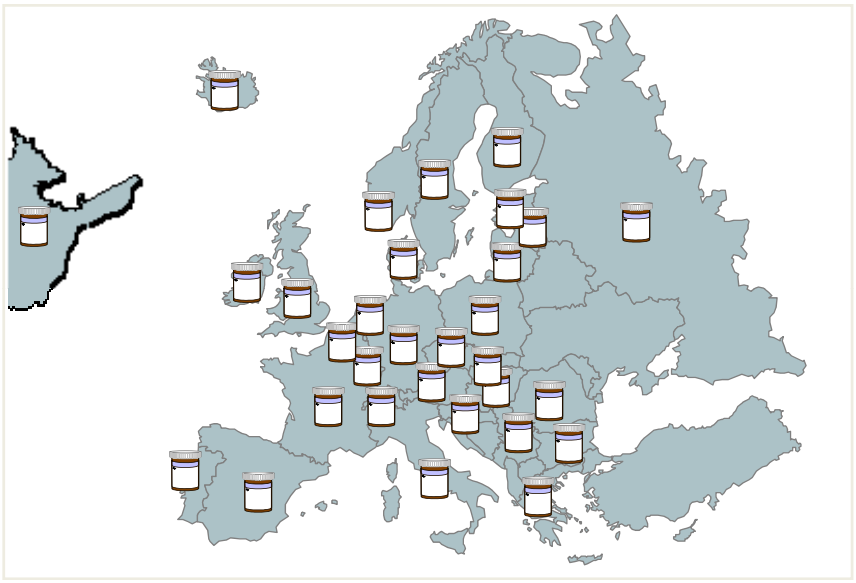


Drug Product Sourcing Considerations

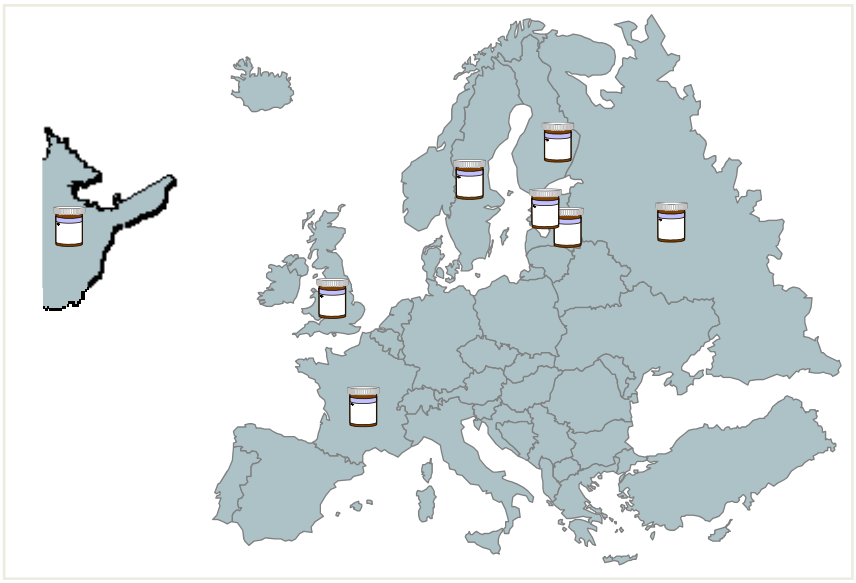


Depot Rationalization Reduces Complexity & Allows Less Material to be Manufactured

Historical: 39 Country Depots



Today: ~12 Country Depots



Benefits For Development Operations

Reduces distribution network complexity

- Rationalization plan to limit impact on delivery times

Improves commutability & flexibility enabling better matching of supply with demand

- Manufacture significantly less supplies, yet maintain supply chain assurance
- Save over 20% in supply cost, including inventory warehouse and destruction charges

2nd Generation Process Changes Environmental and COGS Benefits

Case 1

Synthetic process change
(savings over 13 years)

- 150,000 metric tons of solvent
- >3000 metric tons of titanium dioxide waste
- >1000 metric tons of concentrated hydrochloric acid
- >700 metric tons of 50 % sodium hydroxide solution.

Case 2

Conversion of a Synthetic process to an enzymatic process
(project savings over 13 years)

- 185,000 tonnes of solvent, >90 % reduction
- 4800 tonnes of mandelic acid, a 100 % reduction
- 2000 tonnes of Raney nickel catalyst, a 90 % reduction
- 11,000 tonnes of starting material, >50 % reduction
- Solvent and Energy savings are the equivalent to saving
  413, 550 tonnes of CO_2 emissions

Different Engineering Approaches
API Continuous Processing

Historical Batch Reactors

2 to x000 gallon reactors
Requires large capital facilities
Large volumes of solvents and processing aids
Change scale requires extensive process development to reduce variability

Emerging Continuous Reactors

Greater reliability and reproducibility
Substantial reduction in manufacturing footprint and capital based on new flow technology
Much “Greener” technology based on reduction in solvents and processing aids
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Pfizer