What Makes an Infrastructure Resilient - The Food System

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Food Continuum Paradigm

- Food **Security**: Supply *sufficiency* – access to nutritionally adequate and safe food
- Food **Safety**: System *reliability* – reducing exposure to natural hazards/errors/failures
- Food **Defense**: System *resiliency* – reducing the impact of system attacks
- Food **Quality:** Supply *desirability*
- Food **Protection**: Safety & Defense continuum

Food System Protection

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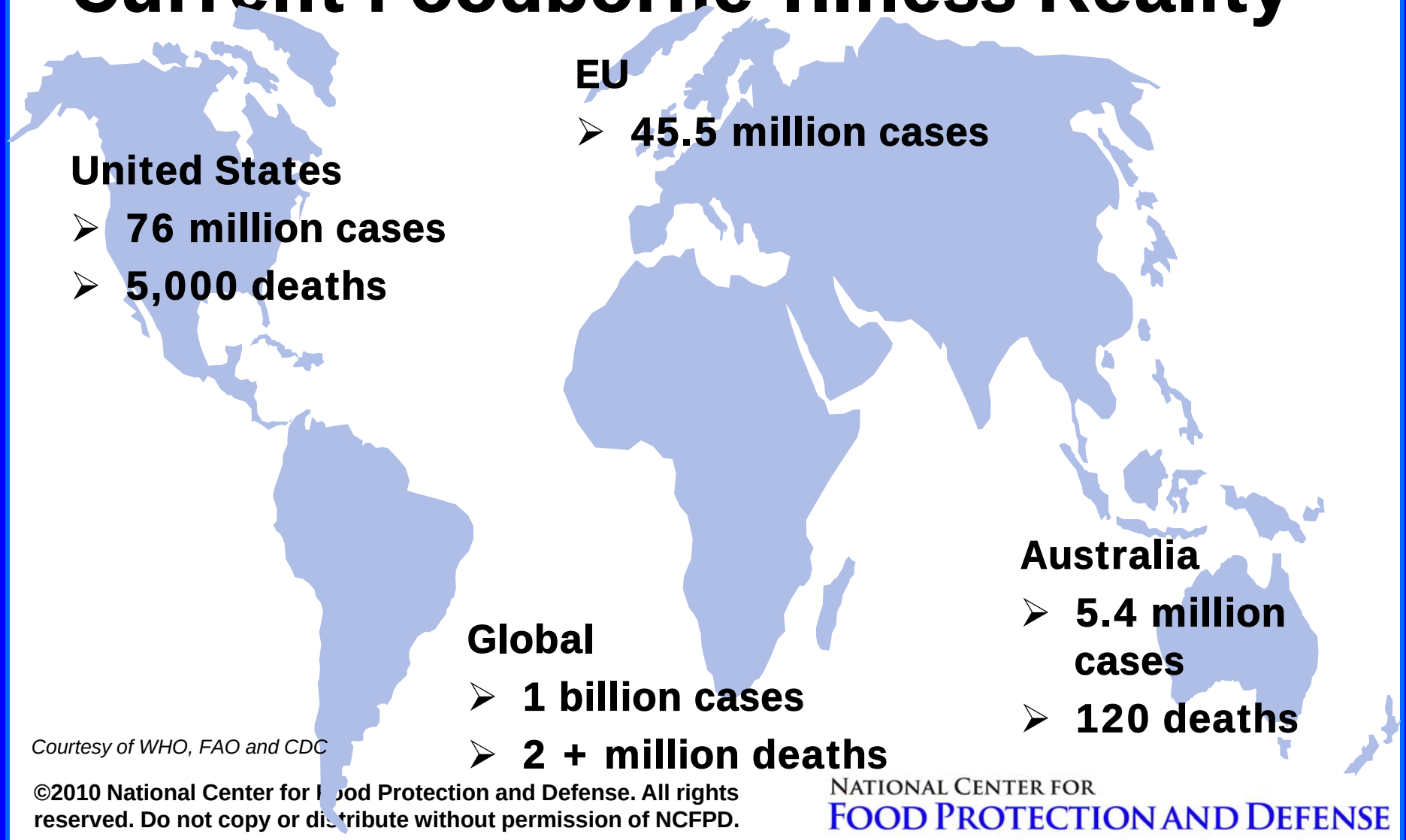
Types of Food System Infrastructure Resilience

- Resilience of supply of food
  - Only a vulnerability for a very few select materials in the developed world
  - Ongoing risk in the developing world
- Resilience of *safe* supply of food
  - Ongoing risk across the world

Current Foodborne Illness Reality



United States

- 76 million cases
- 5,000 deaths

EU

- 45.5 million cases

Australia

- 5.4 million cases
- 120 deaths

Global

- 1 billion cases
- 2 + million deaths

Courtesy of WHO, FAO and CDC

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Pew Commission Report: Cost of Unsafe Supply of Food

- Foodborne Illness costs $152 billion/year in the U.S.:

HEALTH-RELATED COSTS
FROM FOODBORNE ILLNESS IN THE UNITED STATES

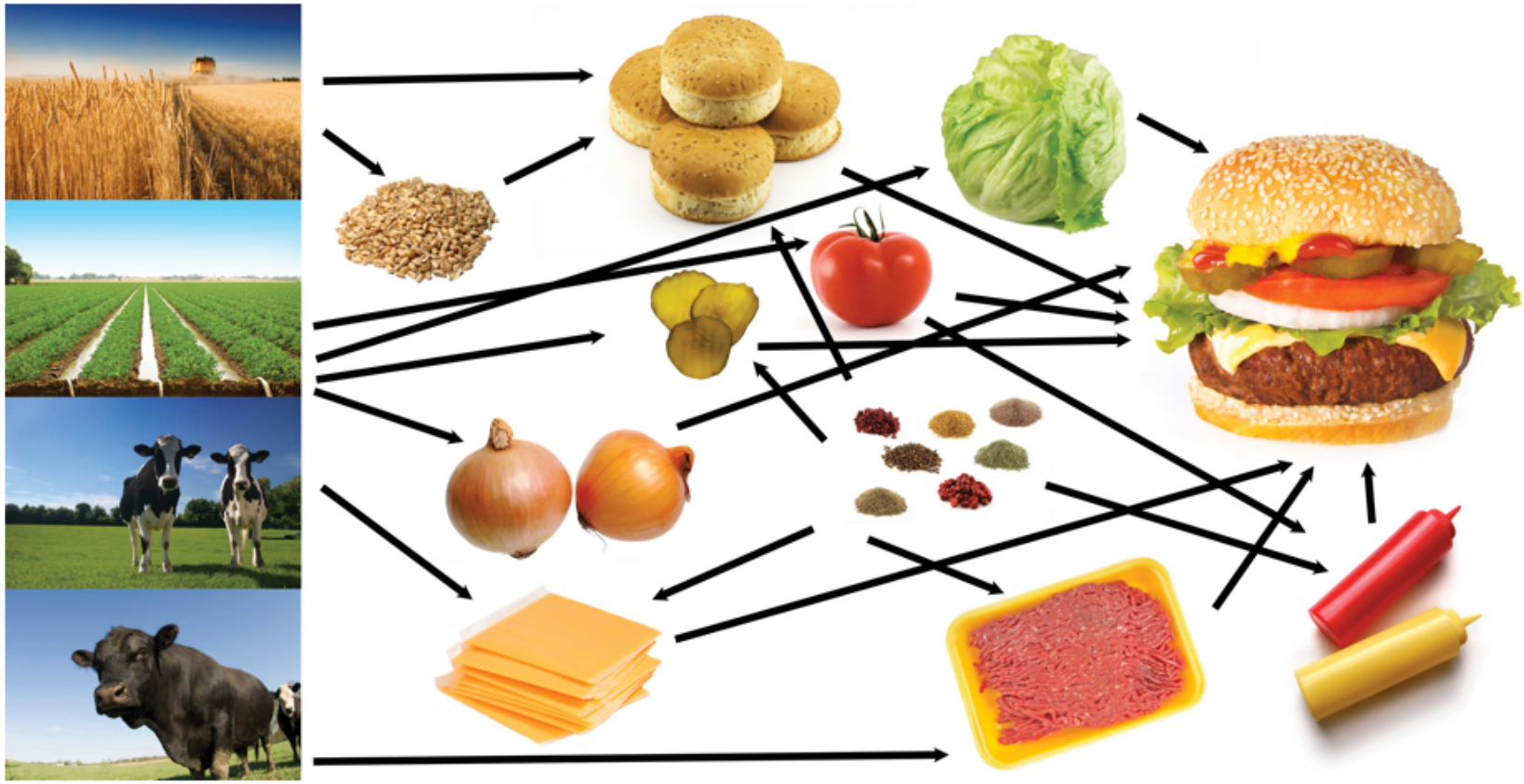
PRODUCE SAFETY PROJECT

by Robert L. Scharff[1]
For the Produce Safety Project at Georgetown University[2]

Foodborne illness is a serious public-health problem in the United States. In 1999, the Centers for Disease Control and Prevention (CDC) estimated that approximately 76 million new cases of food-related illness (resulting in 5,000 deaths and 325,000 hospitalizations) occur in the United States each year [1]. More recent data on sporadic illnesses and outbreaks suggests that this problem is not going away [2, 3].

from foodborne illness in the United States [7]. This approach is an improvement over past studies because it takes into account illnesses from all pathogens identified by Mead et. al. (1999); includes measures for health losses that are not included in many past studies; and presents uncertainty using confidence intervals and a sensitivity analysis. The methodology follows principles used by economists at the Food and Drug Administration (FDA) and

Resilience and Supply Chain Complexity



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Resilience and Supply Chain Complexity

bleached wheat flour
malted barley flour
thiamine
riboflavin
Niacin
folic acid
reduced iron
Water
corn syrup
sesame seeds
soybean oil
Yeast
Salt
calcium sulfate
calcium carbonate
calcium silicate
soy flour
baking soda
wheat gluten
calcium propionate
enzyme
mono- and diglycerides
diacetyl tartaric acid esters
ethanol
sorbitol
polysorbate 20
potassium propionate
sodium stearoyl lactylate
corn starch
ammonium chloride
ammonium sulfate
calcium peroxide
ascorbic acid
azodicarbonamide

Milk
milkfat
Water
cream
sodium citrate
salt
sodium phosphate
sorbic acid
artificial color
cheese culture
acetic acid
soy lecithin
Enzymes
starch

Cucumbers
water
Vinegar
Salt
calcium chloride
Alum
natural flavorings
polysorbate 80
turmeric

USDA inspected beef

Soybean oil
pickles
distilled vinegar
water
egg yolks
HF corn syrup
sugar
onion powder
corn syrup
spice
spice extractives
salt
xanthan gum
mustard flour
prop. glycol alginate
sodium benzoate
potassium sorbate
mustard bran
garlic powder
hydrolyzed proteins
caramel color
paprika
Turmeric
calcium disodium EDTA

lettuce

dehydrated onions

Grill Seasoning
Salt
Pepper
cottonseed oil
soybean oil

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Resilience and Global Supply Chain Complexity

Vinegar
Argentina
Australia
Austria
Belgium
Brazil
Canada
China
Chile
Colombia
Denmark
Dom. Rep
France
Germany
Greece
Hong Kong
Israel
Italy
Japan
S. Korea
Lebanon
Peru
Poland
Portugal
Serbia
Philippines
Russia
S. Africa
Singapore
Spain
Sweden
Turkey
Taiwan
U.K.

Garlic Powder
Brazil
Canada
China
Germany
India
Israel
Japan
S. Korea
Mexico

Tomatoes
Belgium
Canada
Colombia
Costa Rica
Dom. Rep.
Guatemala
Israel
Morocco
Mexico
Netherlands
New Zealand
Poland
Spain

Beef
Australia
Canada
Chile
Costa Rica
Honduras
Japan
Mexico
Nicaragua
New Zealand
Uruguay

Wheat Gluten
Australia
Belgium
Canada
China
Czech Rep.
France
Germany
Kazakhstan
Lithuania
Netherlands
Poland
Russia
Switzerland
Thailand
U.K.

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2.1 Million
U.S. Farms

>130,000 U.S.
Processing Sites

>150,000 Foreign
Processing Sites

? Million
Foreign Farms

>40,000 Domestic
Packers/Repackers

>120,000 Foreign
Packers/Repackers

224,000 Retail
Food Stores

935,000 Retail
Food Outlets

Resilience and Infrastructure Awareness

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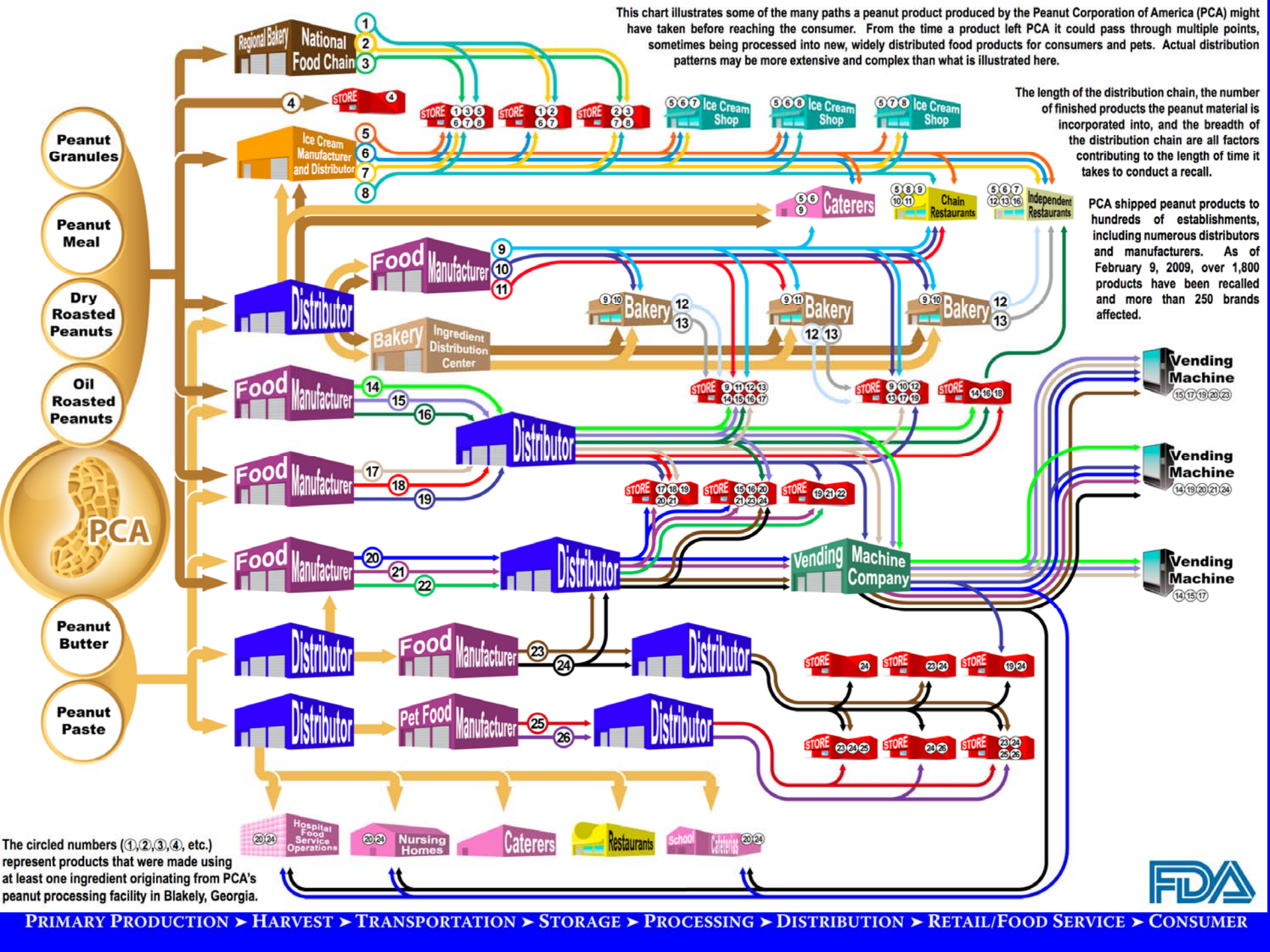
Product Speed To Consumer: The Risks of Supply Chain Efficiency

- Leading yogurt manufacturer goes from plant to retail in all 48 states in <48 hours
- Quick serve restaurants can go from supplier to consumption in 24-96 hours for primary products (burgers, chicken, salad)
- Bottled water has an effective shelf life of ~10 days for 80% of production
- Only seasonally harvested and canned/frozen or specialty products have effective shelf lives of significance


This chart illustrates some of the many paths a peanut product produced by the Peanut Corporation of America (PCA) might have taken before reaching the consumer. From the time a product left PCA it could pass through multiple points, sometimes being processed into new, widely distributed food products for consumers and pets. Actual distribution patterns may be more extensive and complex than what is illustrated here.
The length of the distribution chain, the number of finished products the peanut material is incorporated into, and the breadth of the distribution chain are all factors contributing to the length of time it takes to conduct a recall.
PCA shipped peanut products to hundreds of establishments, including numerous distributors and manufacturers. As of February 9, 2009, over 1,800 products have been recalled and more than 250 brands affected.
Peanut Granules
Peanut Meal
Dry Roasted Peanuts
Oil Roasted Peanuts
PCA
Peanut Butter
Peanut Paste
Regional Bakery
National Food Chain
Ice Cream Manufacturer and Distributor
Distributor
Food Manufacturer
Bakery
Ingredient Distribution Center
Pet Food Manufacturer
STORE
Ice Cream Shop
Caterers
Chain Restaurants
Independent Restaurants
Vending Machine Company
Vending Machine
Hospital Food Service Operations
Nursing Homes
Restaurants
School Cafeterias
The circled numbers (①,②,③,④, etc.) represent products that were made using at least one ingredient originating from PCA's peanut processing facility in Blakely, Georgia.
FDA
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NCFPD Vision

Defending the **safety** of the **food system** through **research** and **education**

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