MASSACHUSETTS INSTITUTE OF TECHNOLOGY

MIT Center for Transportation & Logistics

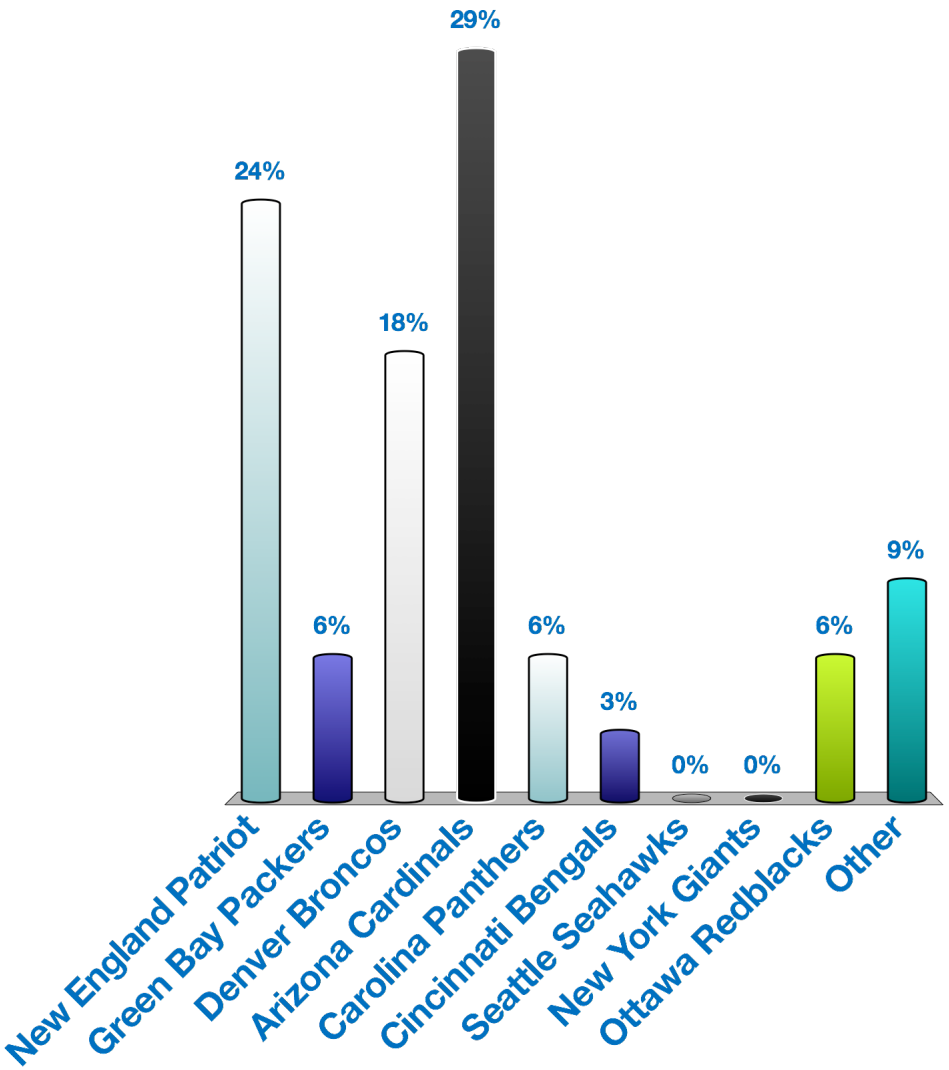
Introduction to Scenario Planning

Arizona State Freight Plan:
Scenario Planning Workshop

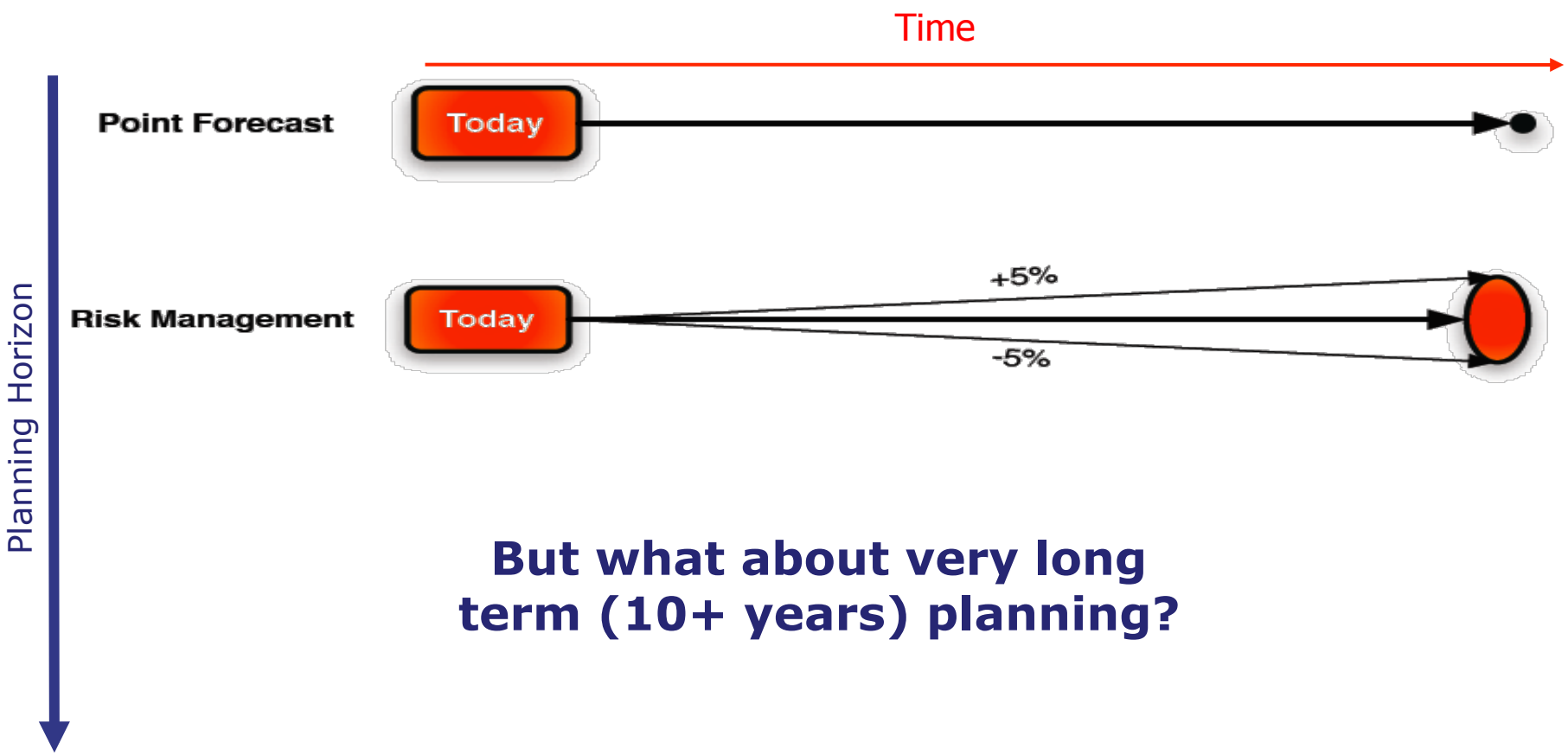
5 November 2015

Which NFL team will win Super Bowl L in 2016?

A. New England Patriot
B. Green Bay Packers
C. Denver Broncos
D. Arizona Cardinals
E. Carolina Panthers
F. Cincinnati Bengals
G. Seattle Seahawks
H. New York Giants
I. Ottawa Redblacks
J. Other

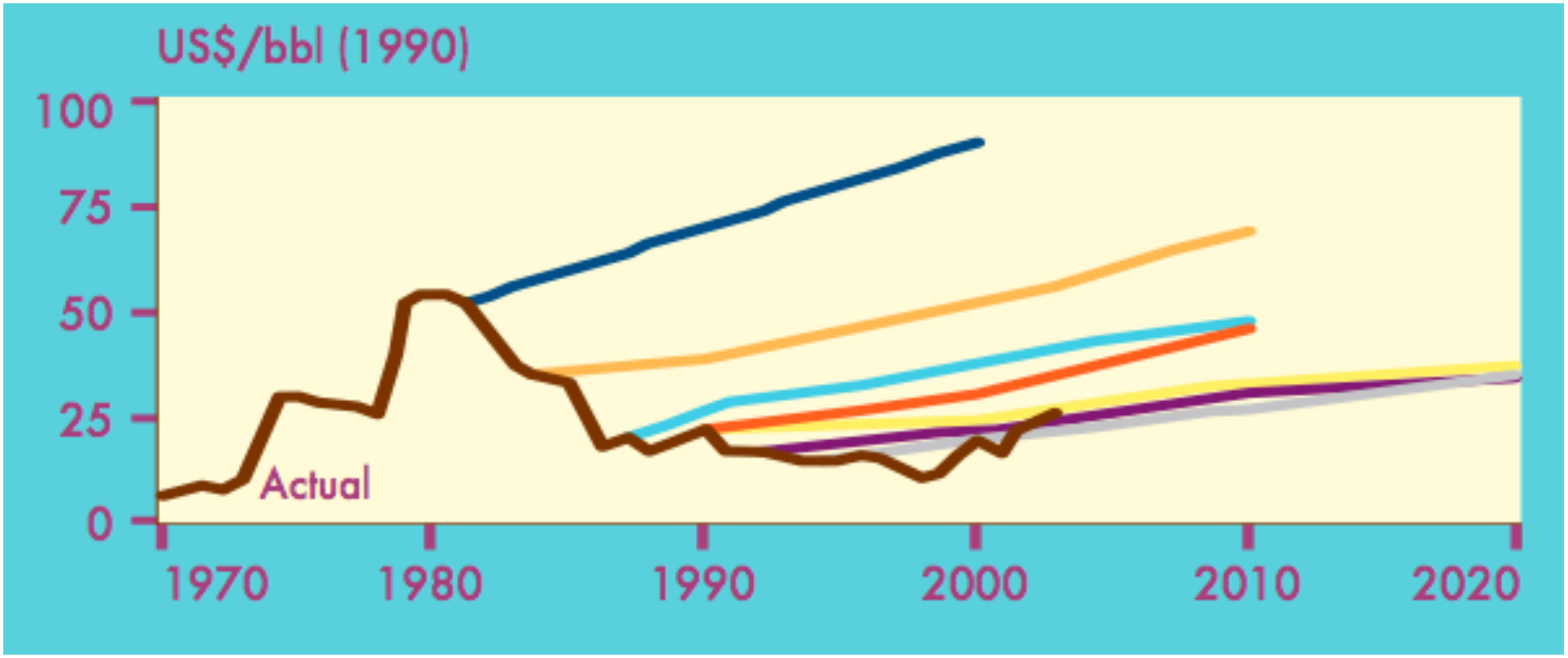


How should we plan for the future?



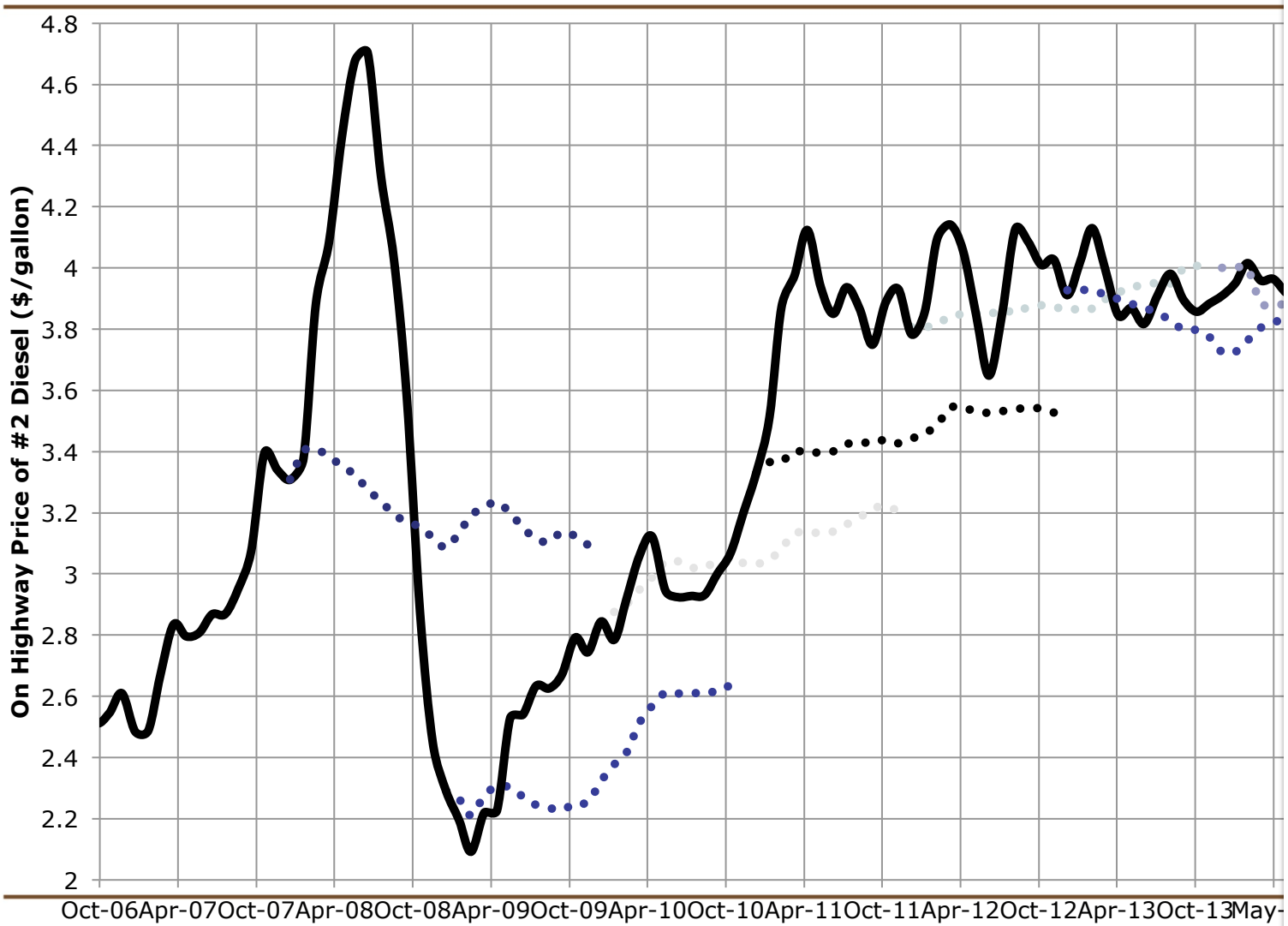
But what about very long term (10+ years) planning?

Long term planning is impacted by events



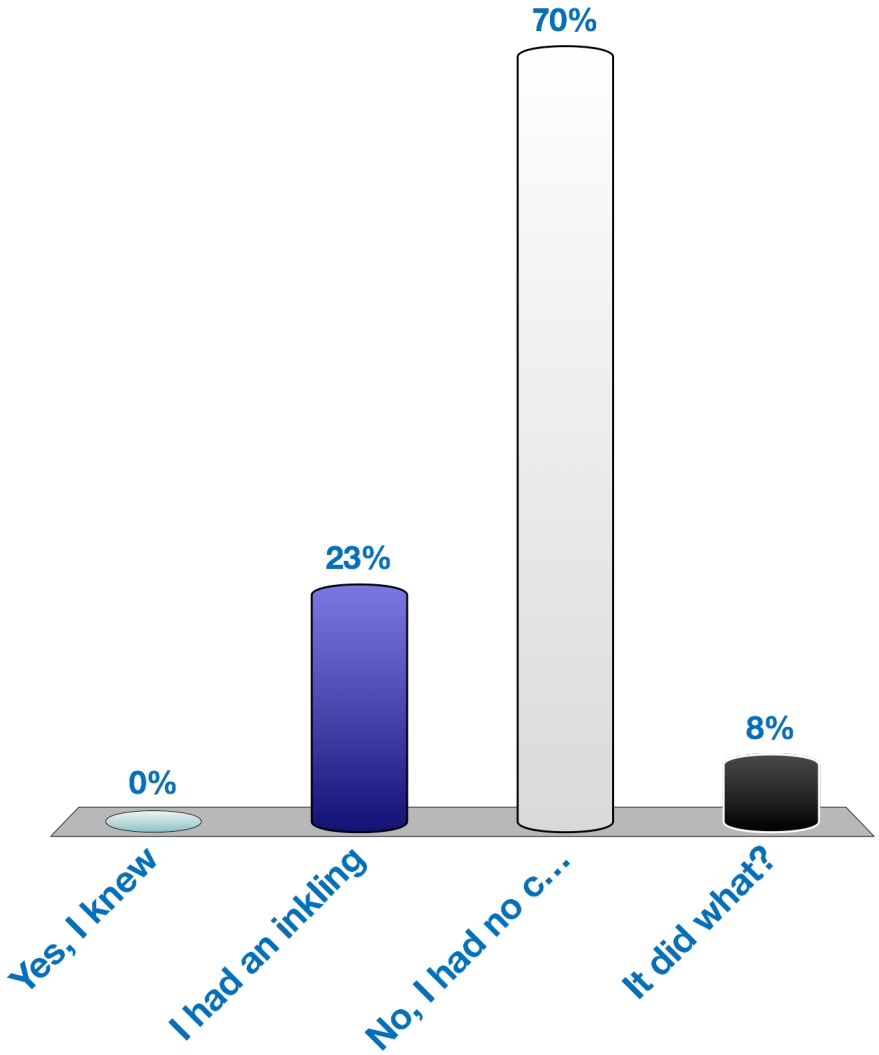
Source: Scenarios: An Explorer's Guide, Shell International 2003.

#2 Diesel Prices in US



In the summer of 2014, I knew the price of fuel would decrease by more than a $1 a gallon

A. Yes, I knew
B. I had an inkling
C. No, I had no clue
D. It did what?



Why are we so bad at predicting the future?

We are all "Provincials in Time"

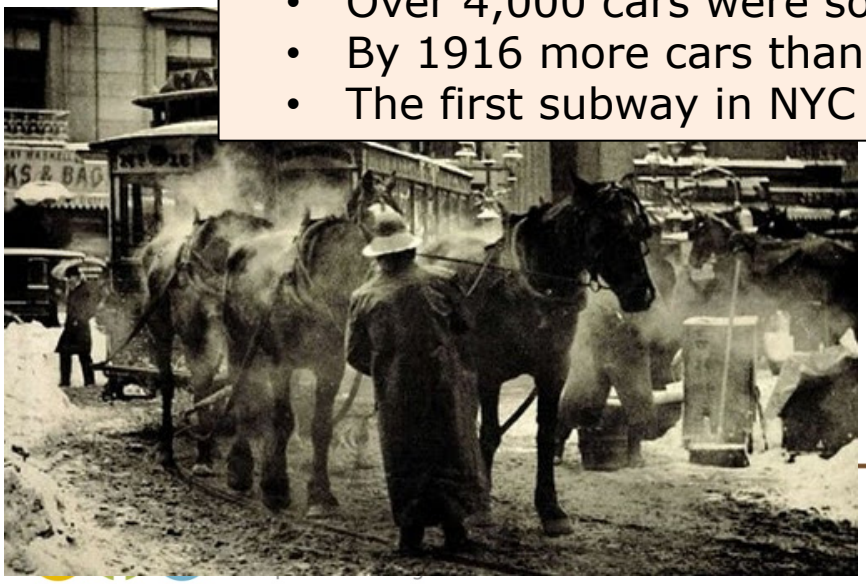
1. We look to the future through today's lenses.
2. We forget how we got to today
   – it seems pre-ordained
3. We think today will go on for forever
   – change happens slowly

The situation was dire!

- More than 150,000 horses in NYC producing over 2,000 tons of manure per day
- Estimates of manure reaching 3rd floors by 1930 & nine feet in London by 1950
- 1st International Urban Planning Conference held in NYC in 1894 – cut short!

Interestingly, though . . .

- Over 4,000 cars were sold in the US in 1900.
- By 1916 more cars than horses were registered in NYC.
- The first subway in NYC was operating by Oct 1904.

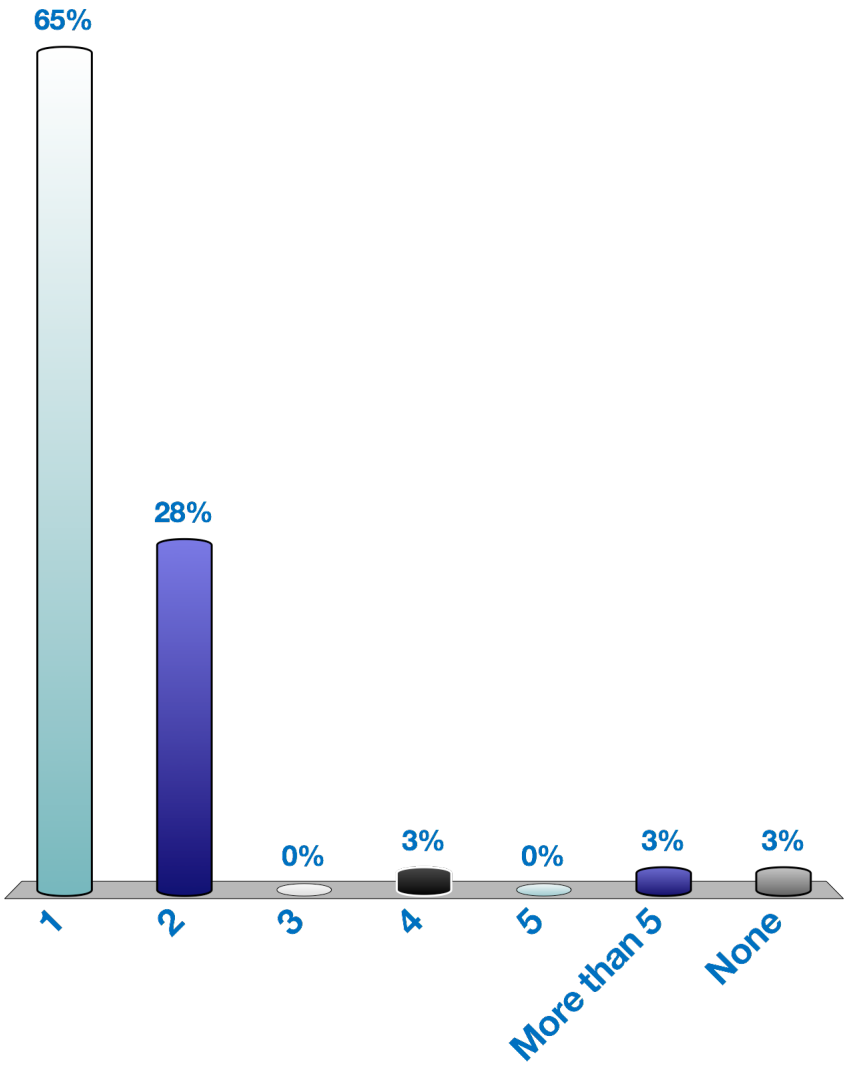


Source: "From Horse Power to Horsepower," Eric Morris, ACCESS no. 30, Spring 2007.

Some Changes Can Happen Rather Quickly . . . Mobile Communications

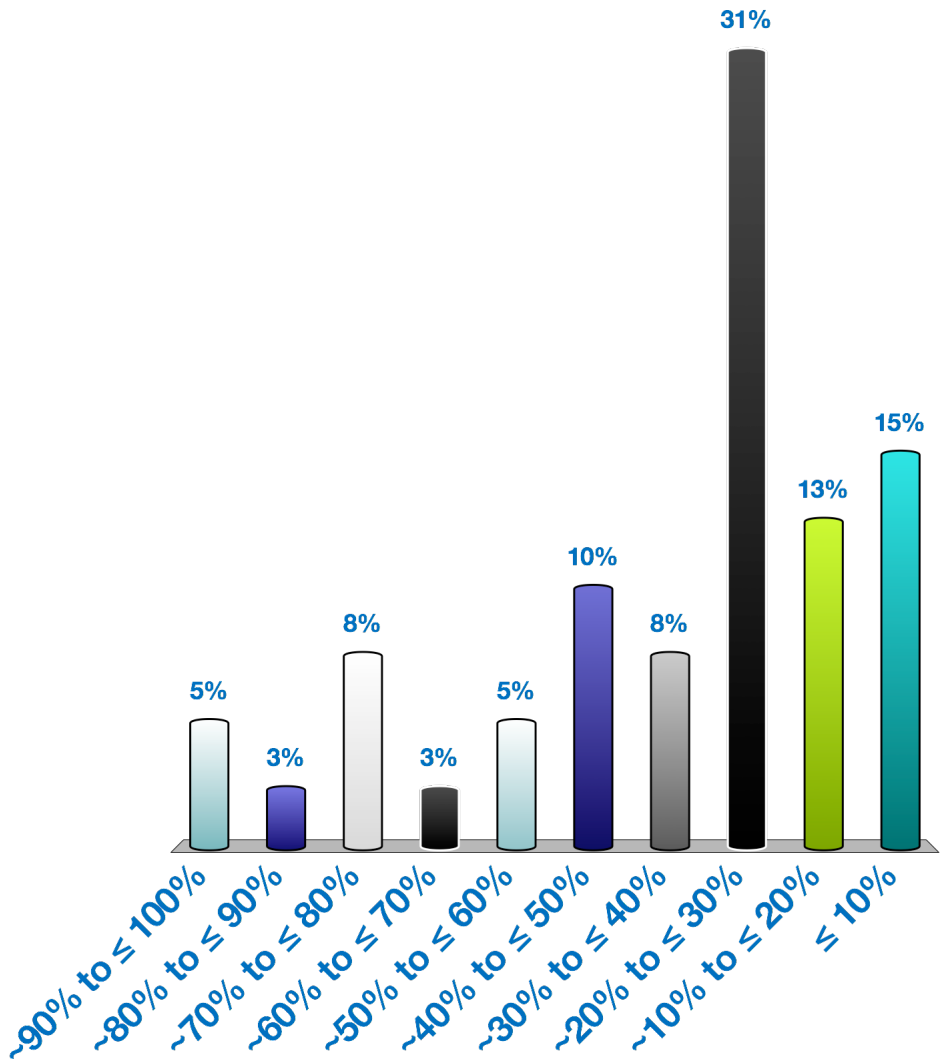
How many phones do you have with you right now?

A. 1
B. 2
C. 3
D. 4
E. 5
F. More than 5
G. None



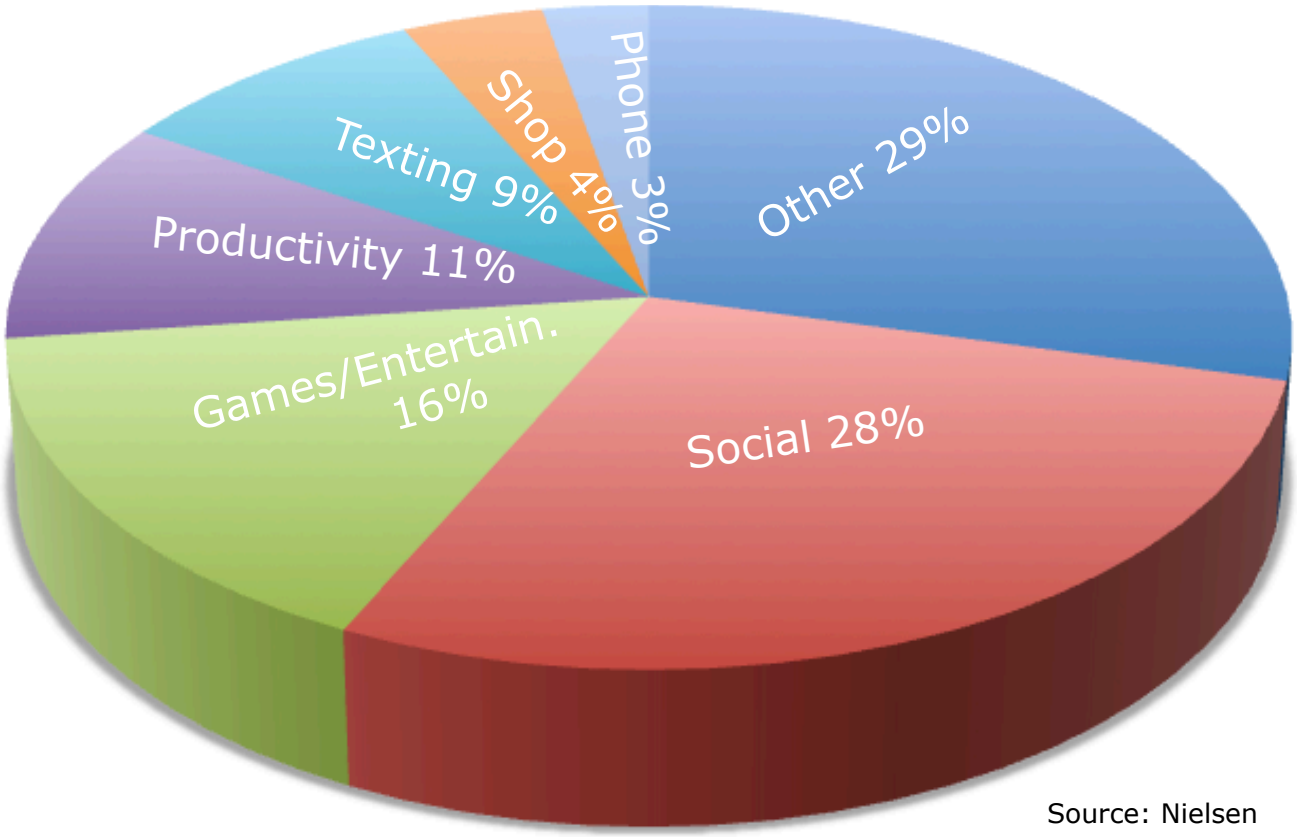
What percentage of the time do you use your smartphone(s) as a phone?

A. ~90% to ≤ 100%
B. ~80% to ≤ 90%
C. ~70% to ≤ 80%
D. ~60% to ≤ 70%
E. ~50% to ≤ 60%
F. ~40% to ≤ 50%
G. ~30% to ≤ 40%
H. ~20% to ≤ 30%
I. ~10% to ≤ 20%
J. ≤ 10%



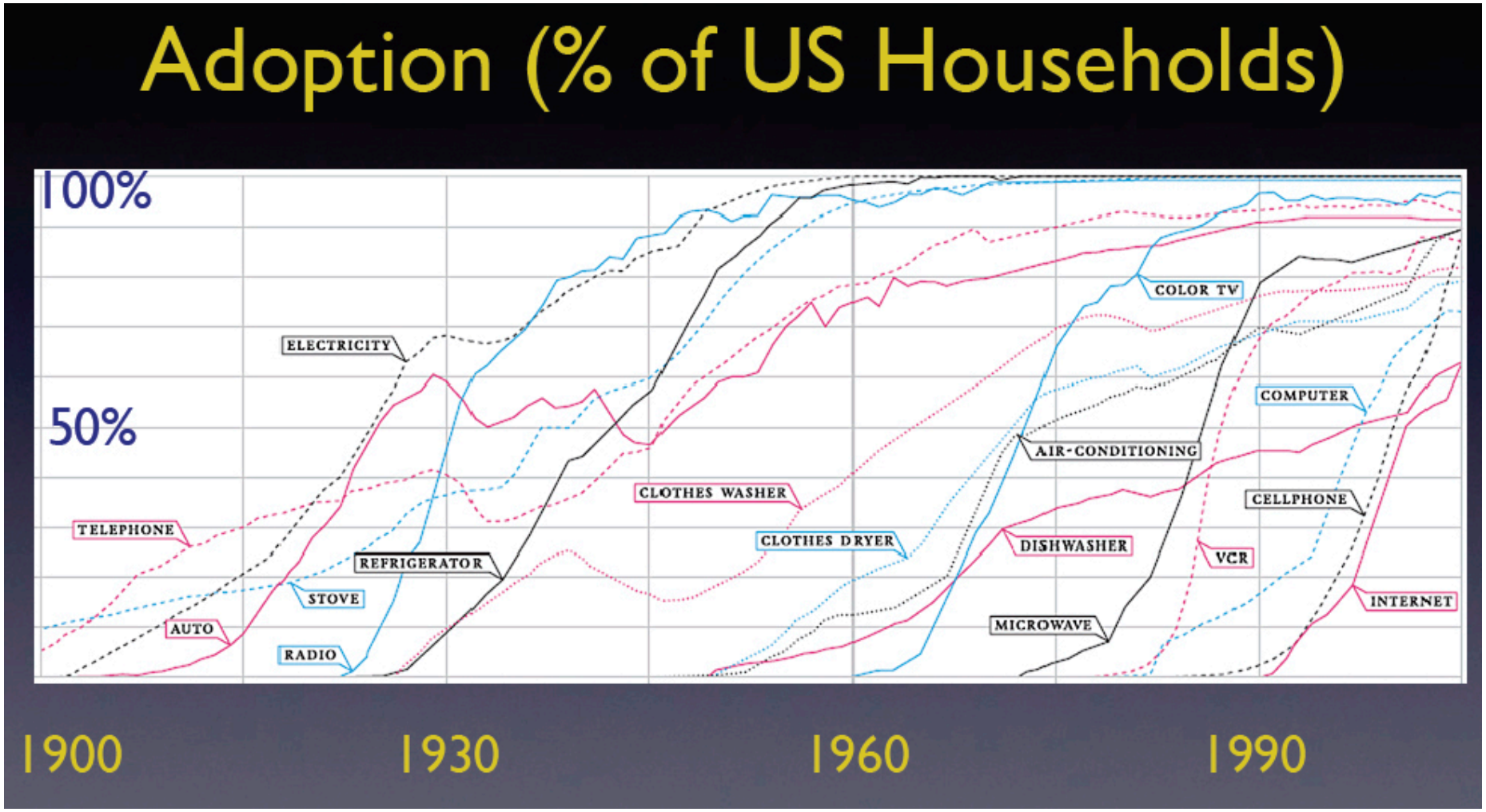
Some Changes Can Happen Rather Quickly . . . Mobile Communications

Percentage of time spent on Smartphones (US 2013)



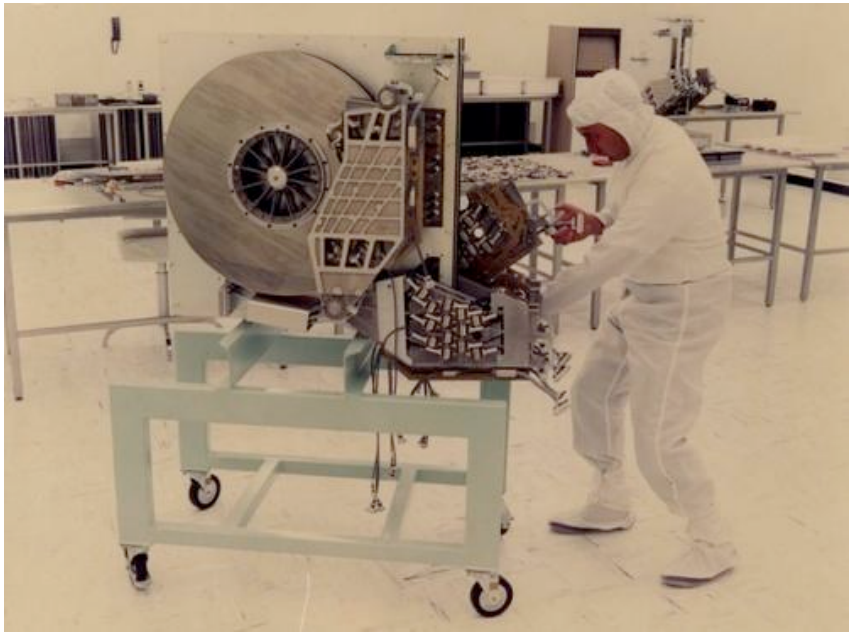
Source: Nielsen

US Technology Adoption Rates from 1900 to 2005



Source: Source: Catlett, Charlie, "Technology adoption rates: historical perspective," International Science Grid This Week, Argonne National Laboratory, http://www.isgtw.org/?pid=1001793, accessed June 2011.

Rapid Changes
. . . Data Storage

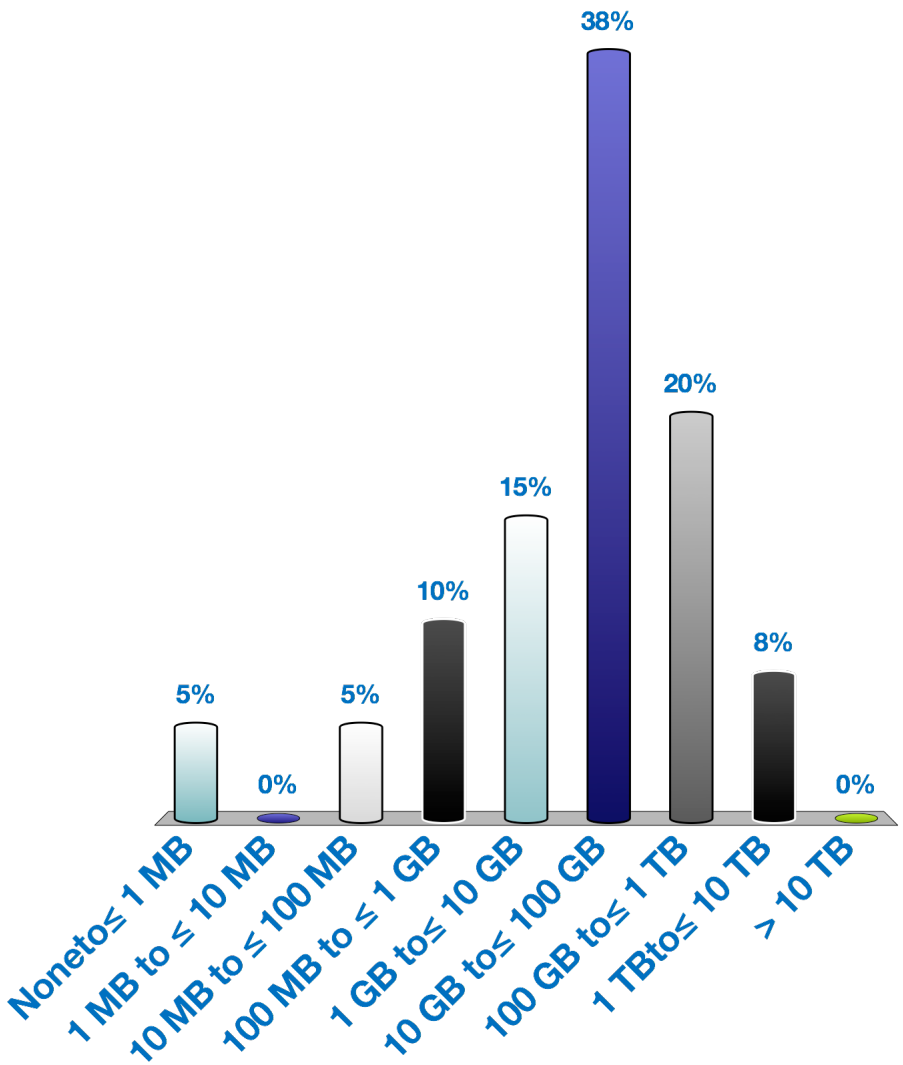


250 MB in 1970!

250 MB in 1990s
~175 3.5” Floppies (1.44 MB)
Stack 2 feet high & ~3 lbs

How much computer storage do you have with you right now?

A. None to ≤ 1 MB
B. 1 MB to ≤ 10 MB
C. 10 MB to ≤ 100 MB
D. 100 MB to ≤ 1 GB
E. 1 GB to ≤ 10 GB
F. 10 GB to ≤ 100 GB
G. 100 GB to ≤ 1 TB
H. 1 TB to ≤ 10 TB
I. > 10 TB



NEVER FORGET

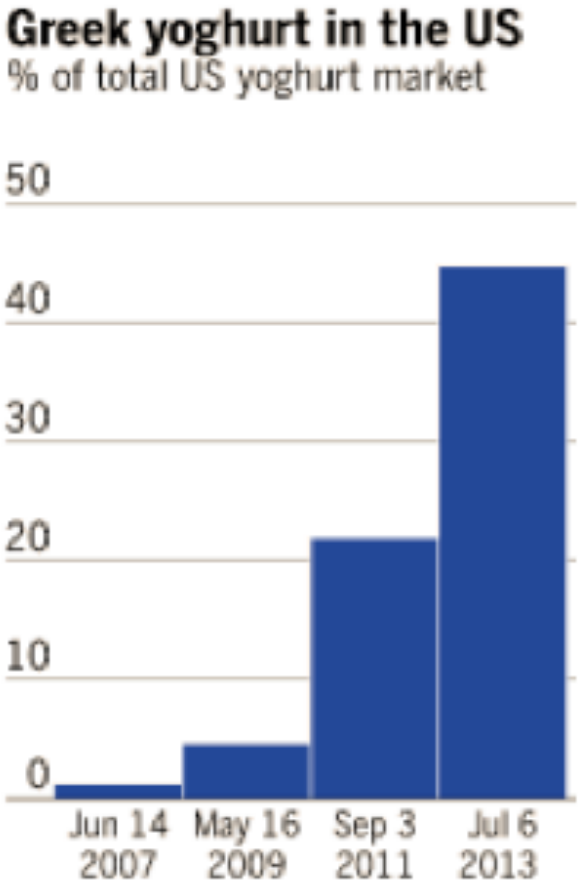
Rapid Changes . . .
Industries & Consumer Tastes

BORDERS®

BLOCKBUSTER VIDEO

TOWER RECORDS

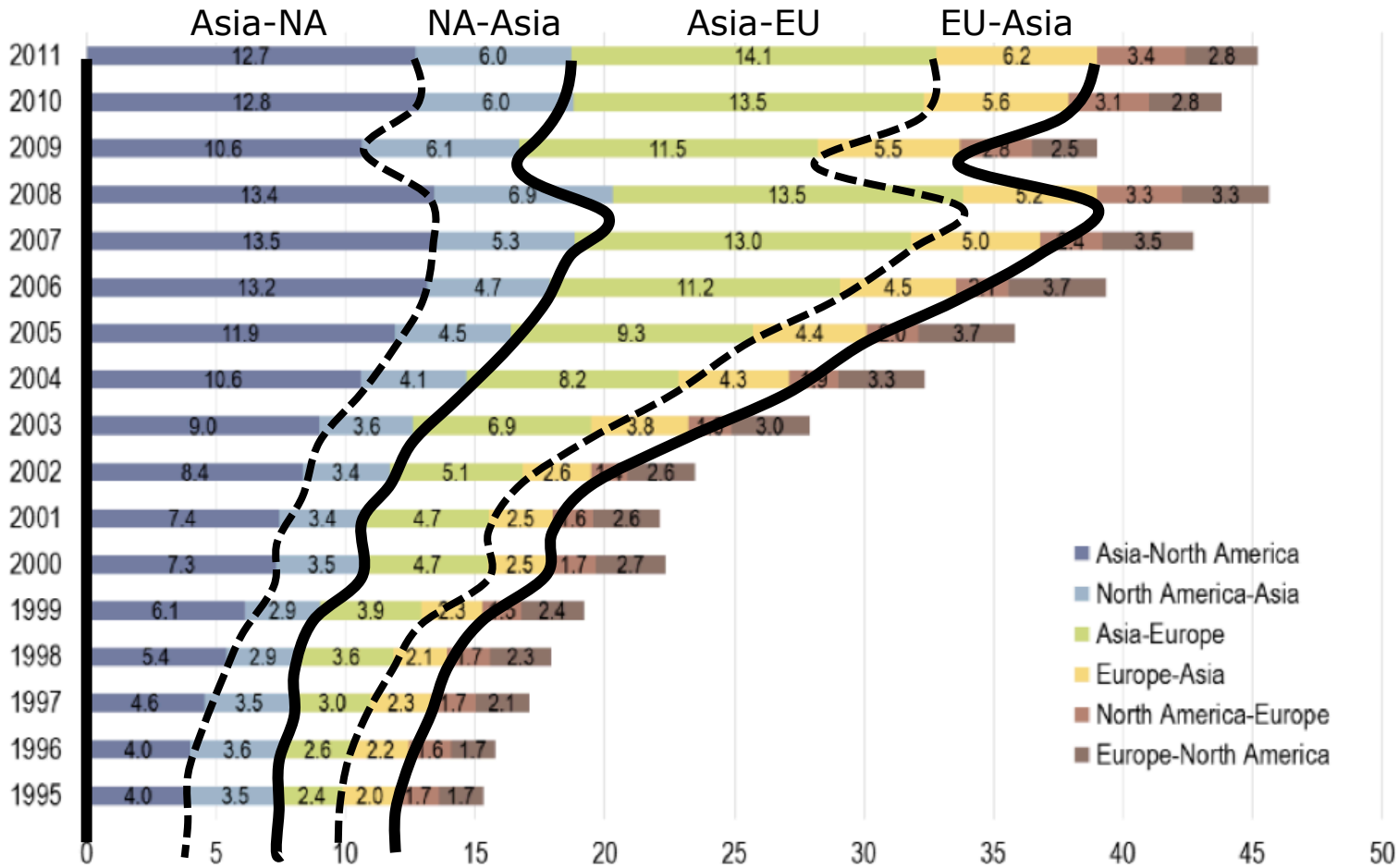
Rapid Changes . . . in Consumer Taste



Rapid Changes . . . Economics

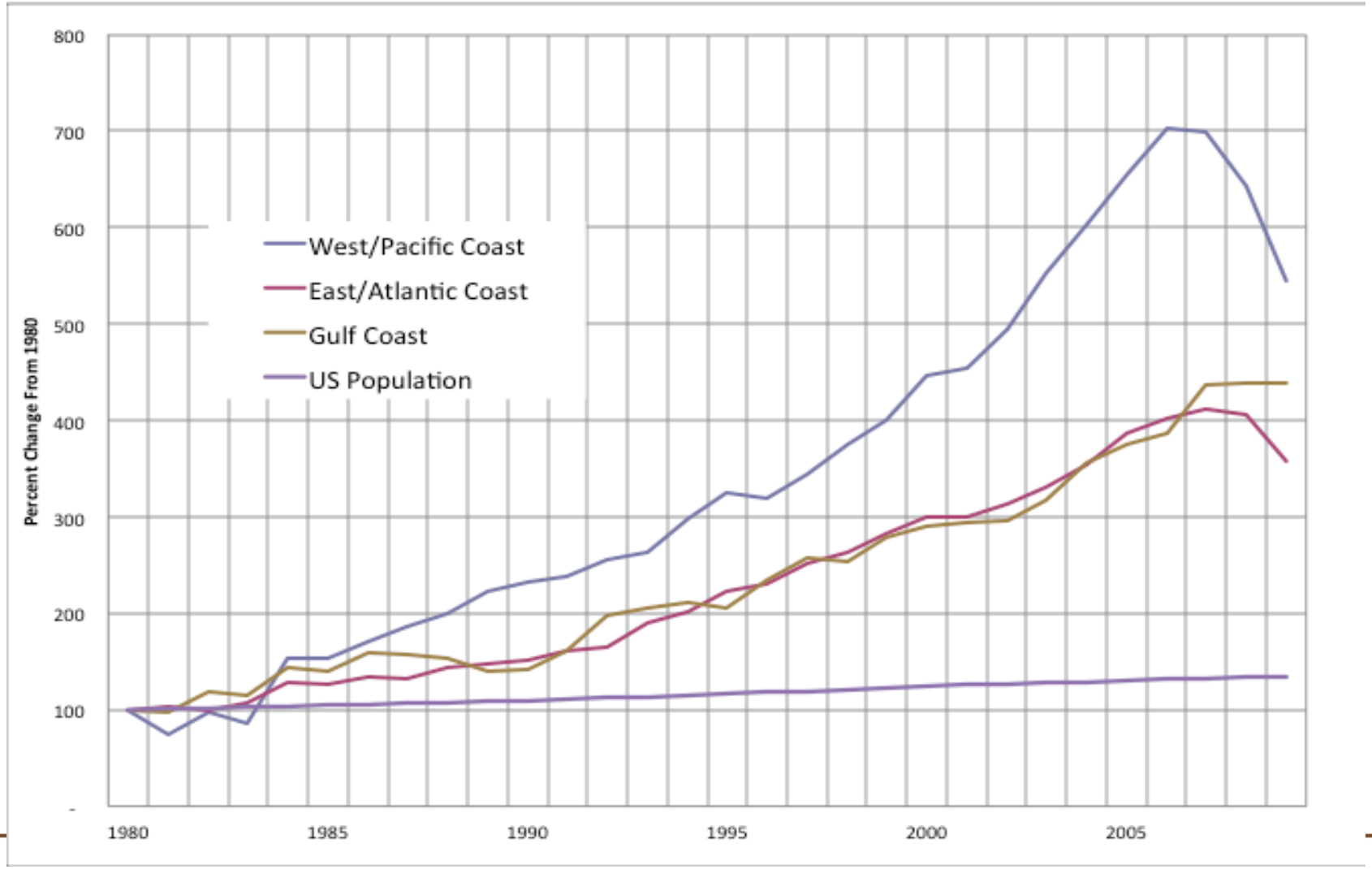
- Global Trade 1981
  - Switzerland was US's 23rd largest trading partner

    . . . China was 24th



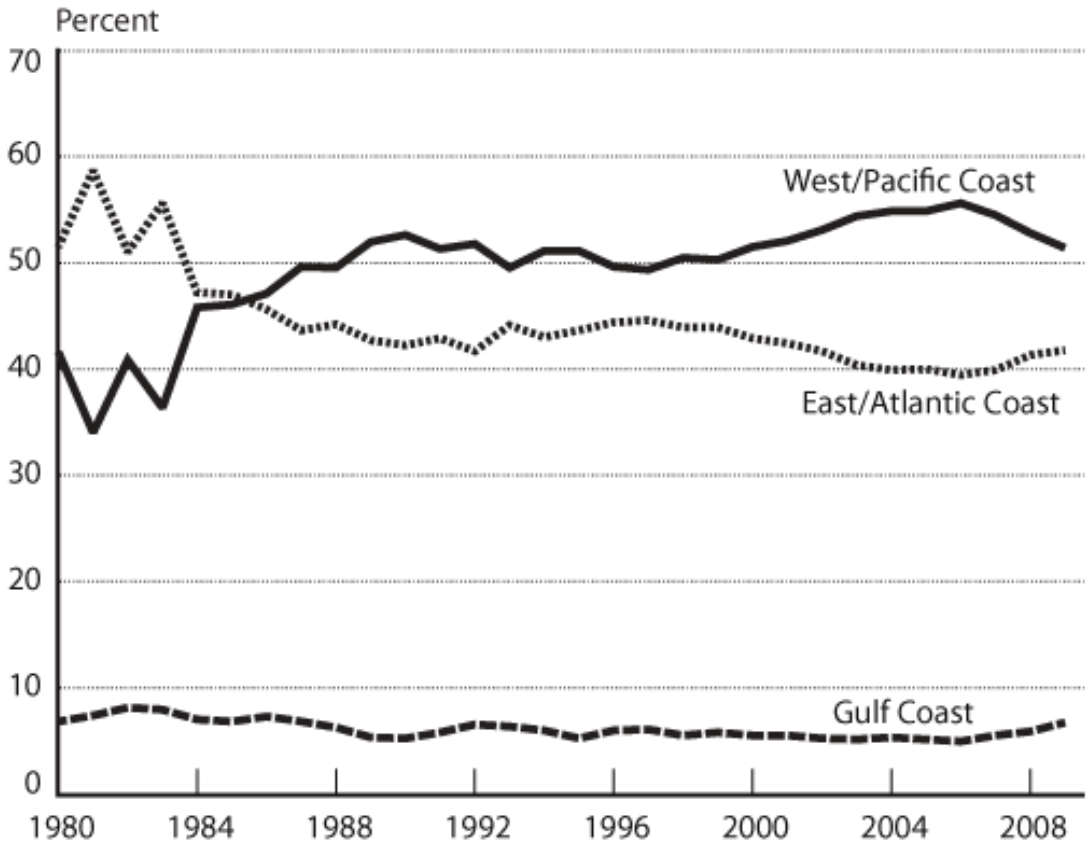
Source: UNCTAD, Review of Maritime Transport.

Rapid Changes . . . Economics



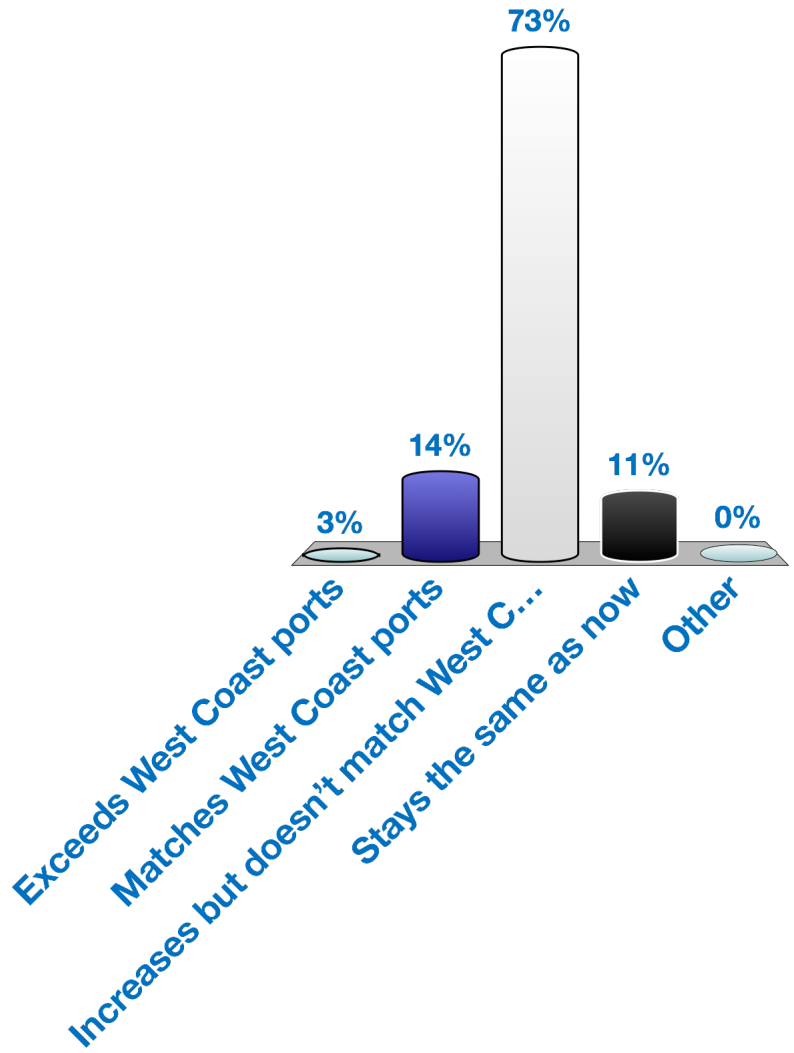
Rapid Changes . . . Economics

Container direction flipped within 5 years!

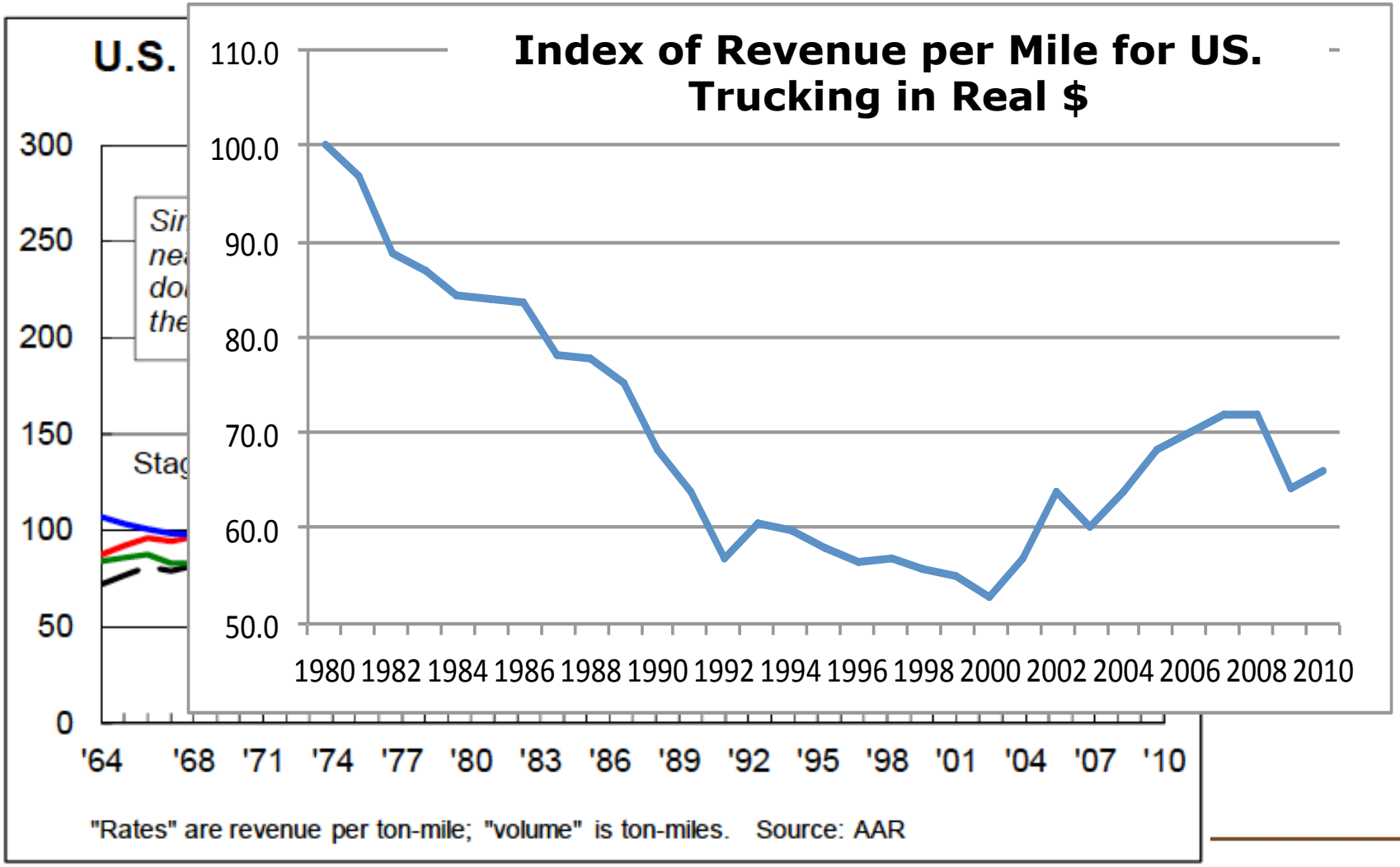


What will happen to the container volume coming in on the East Coast in 5 years due to the Panama Canal expansion?

A. Exceeds West Coast ports
B. Matches West Coast ports
C. Increases but doesn't match West Coast ports
D. Stays the same as now
E. Other

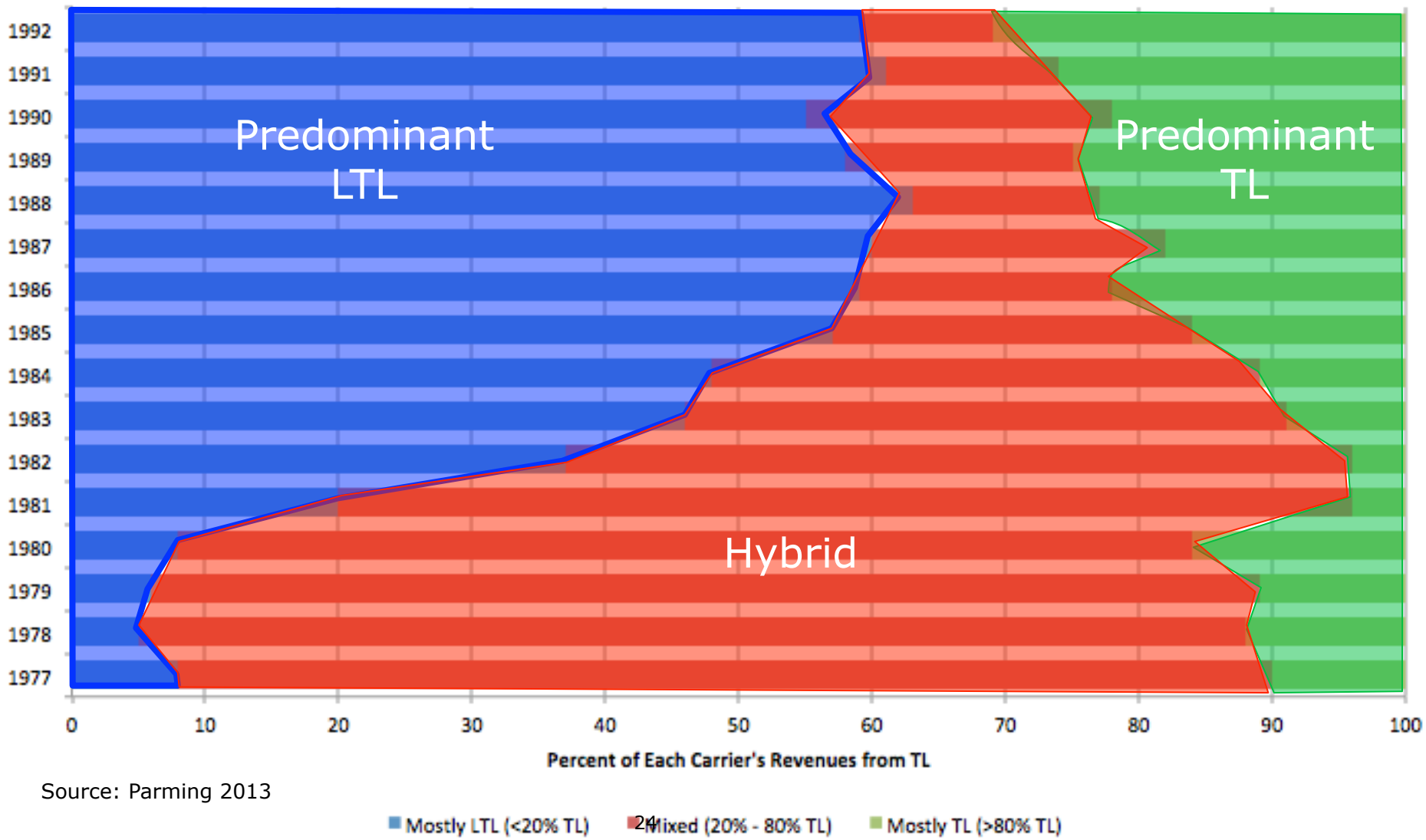


Rapid Changes . . . Deregulation



Source: AAR and ATA

Case of Rapid Change: Deregulation Bifurcation of US Trucking Market



Source: Parming 2013

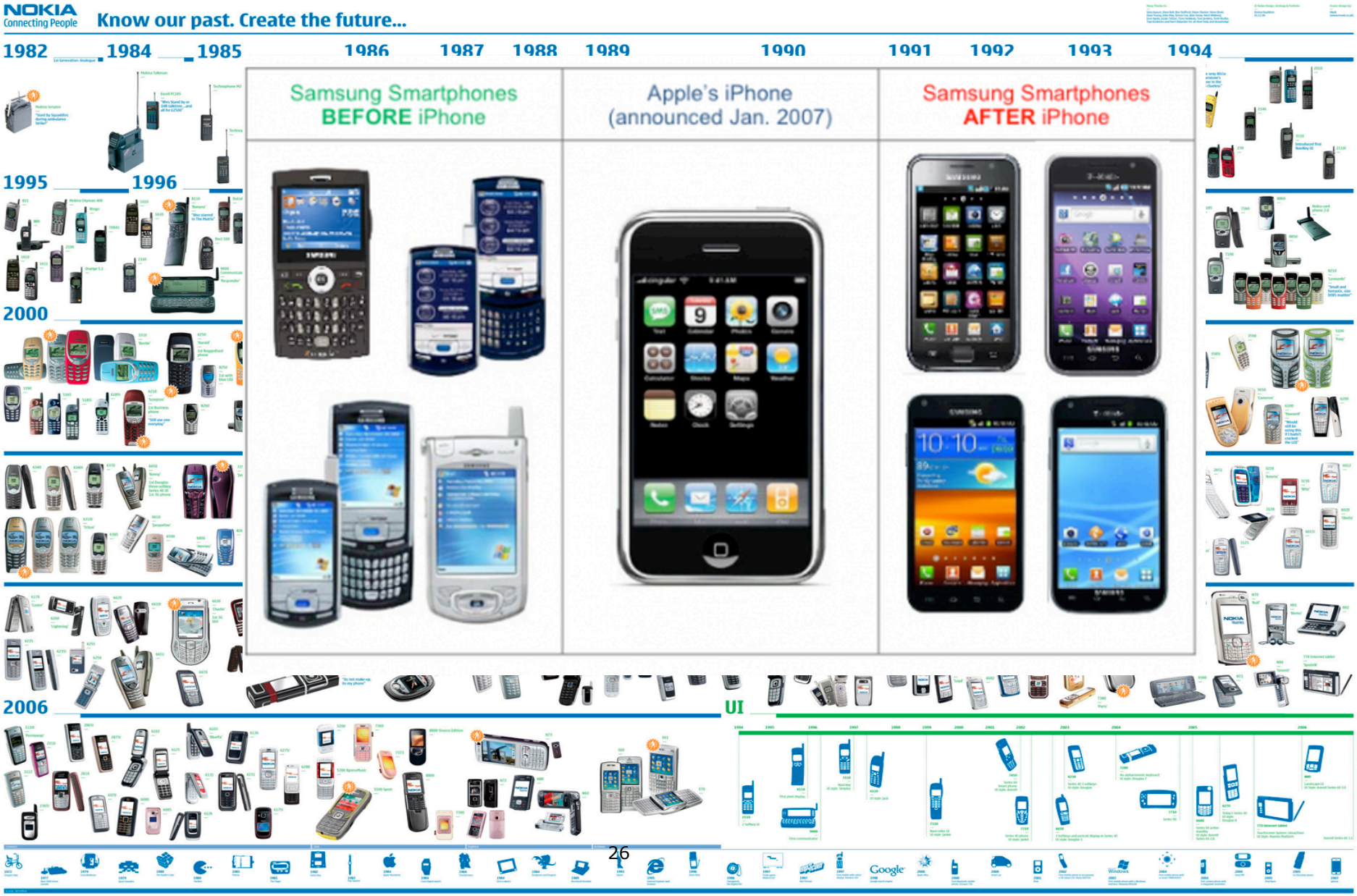
Recapping: Our major limitations for planning

We are all "Provincials in Time"

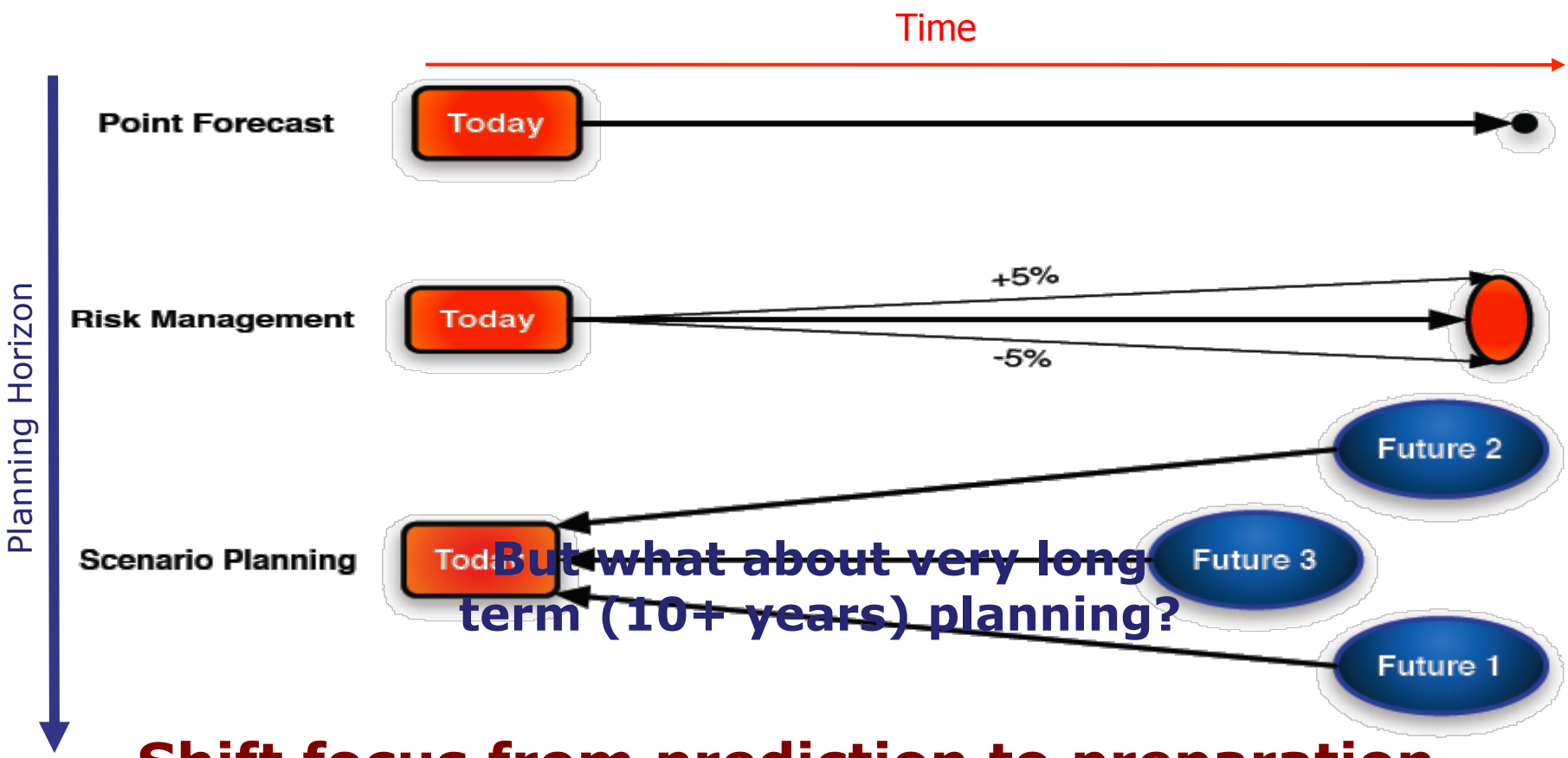
1. We look to the future through today's lenses.
2. We forget how we got to today
   – it seems pre-ordained
3. We think today will go on for forever
   – change happens slowly

We get lulled into the current Dominant Design!

Dominant Design . . . Cell Phones



Different Methods for Planning

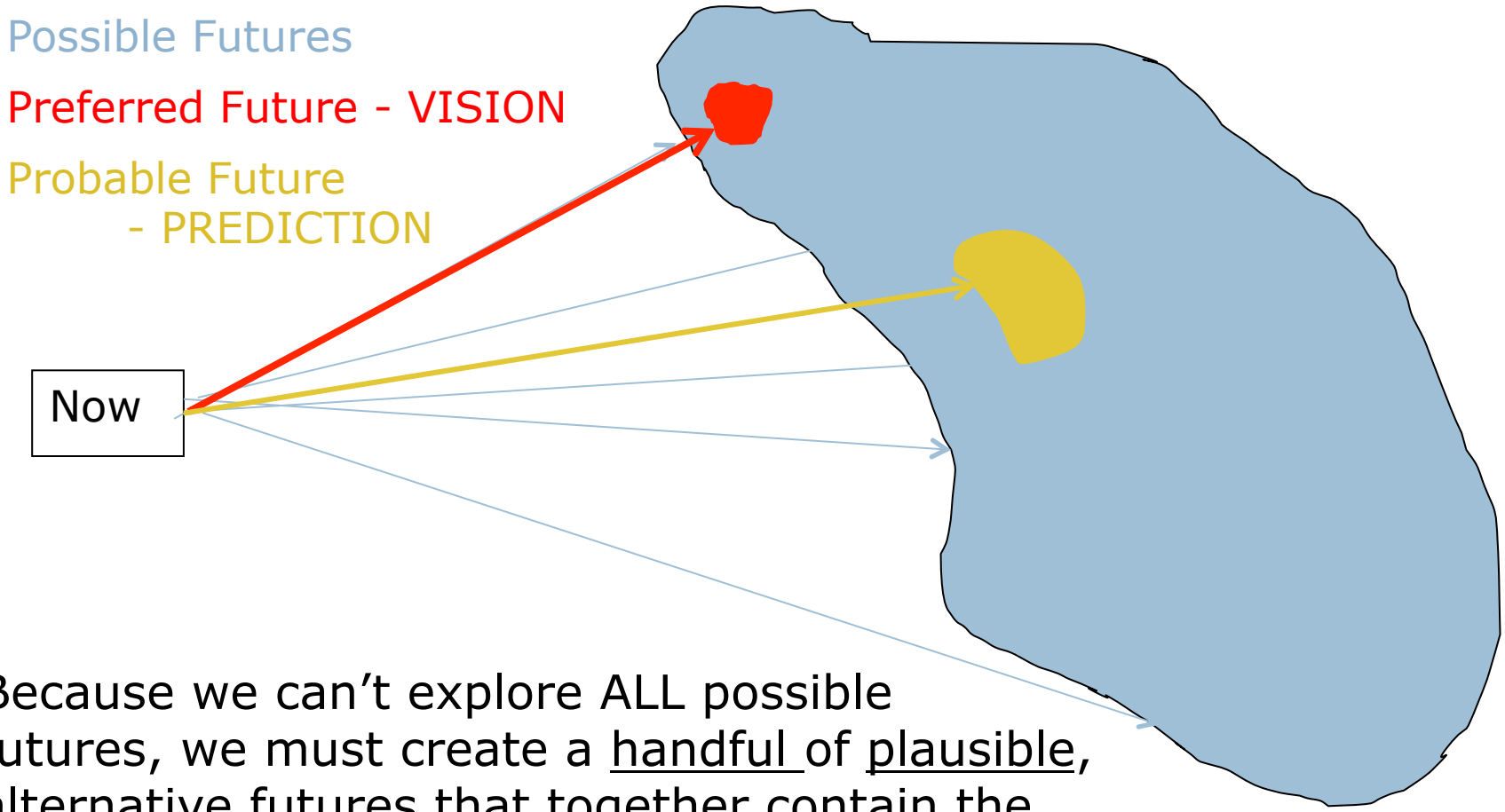


But what about very long term (10+ years) planning?

Shift focus from prediction to preparation

So many potential futures, so little time . . .

Preferred vs. Probable vs. Plausible



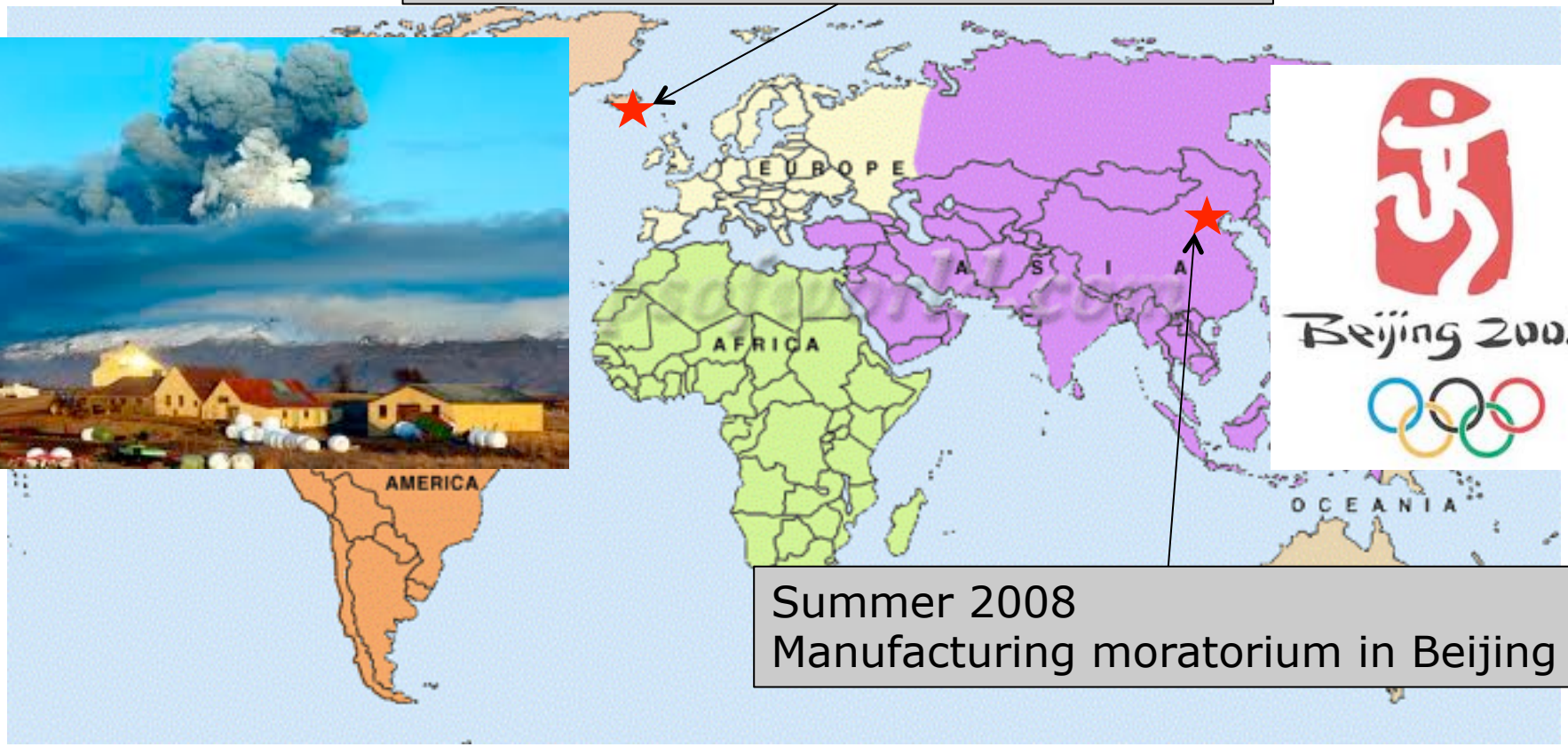
Because we can't explore ALL possible futures, we must create a handful of plausible, alternative futures that together contain the most relevant uncertainty dimensions

Scenario Planning

- Criteria for a good set of scenarios
  - They are Situations NOT Solutions
  - Comprehensive – Cover STEEP forces
  - Decision Making– capture right decision
  - Plausibility – within realistic limits
  - Alternatives – no favorites or preferred (Unofficial/Official)
  - Consistency – internal logic is aligned
  - Differentiation – structurally different
  - Memorability – easy to recall after event (name helps)
  - Challenge – push against established wisdom
- Accuracy of event forecasting is not important
  - The skill we are developing is preparation not predicting
  - The focus is on effects not on individual events

Effects versus Events

14 April 2010
Eruption of the Eyjafjallajökull Volcano



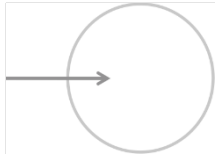
Beijing 2008

Summer 2008
Manufacturing moratorium in Beijing

Translating *Events* into *Effects*

Freight Flow Patterns

How can an event impact freight flows?



Impact on sourcing patterns

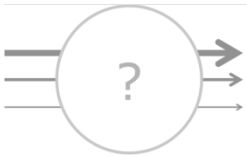
Where are raw products and WIP sourced from? Are materials sourced in or out of the region?

Impact on flow destination

Where is the demand located? How are final destination locations distributed?

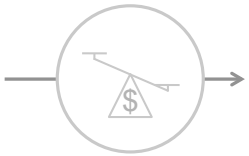
Impact on routing

How is freight moved within the region? Are there intermediate shipment points or mode switches?



Impact on flow volume

How will the total volume of freight shipped in and through the region change?



Impact on value density

How will the product characteristics change? How does the value density change?

The Real Value of Scenario Planning

- Forecasting Challenges
  - Without step changes, forecasting would be easy!
  - Step changes are driven by events, and . . .
  - Events are next to impossible to predict, but . . .
  - Planners do a pretty good job preparing, so . . .

- Scenario planning allows us to shift from

Predicting future **Events**

To

Preparing for potential **Effects**

Questions, Comments, Suggestions?

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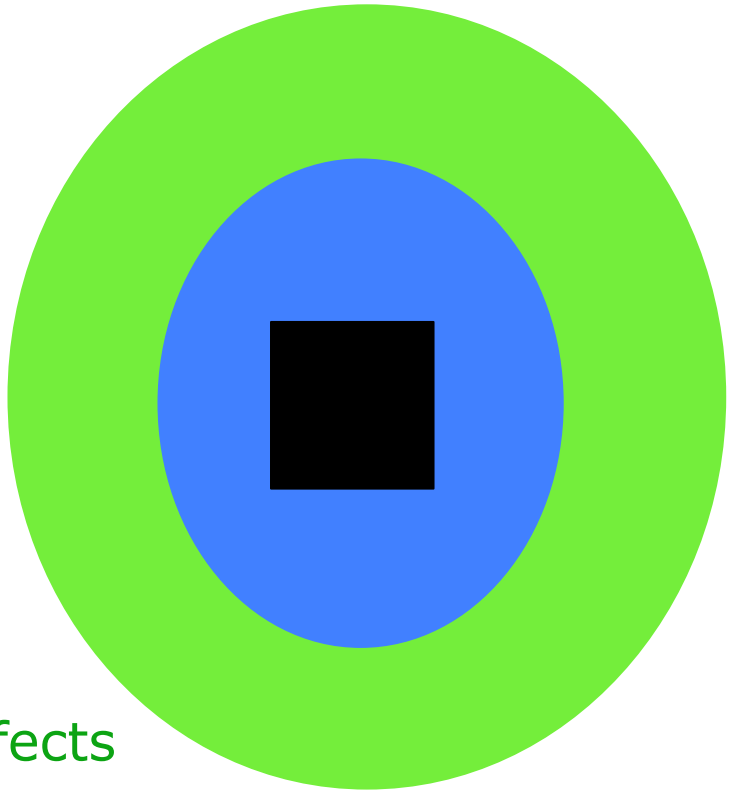
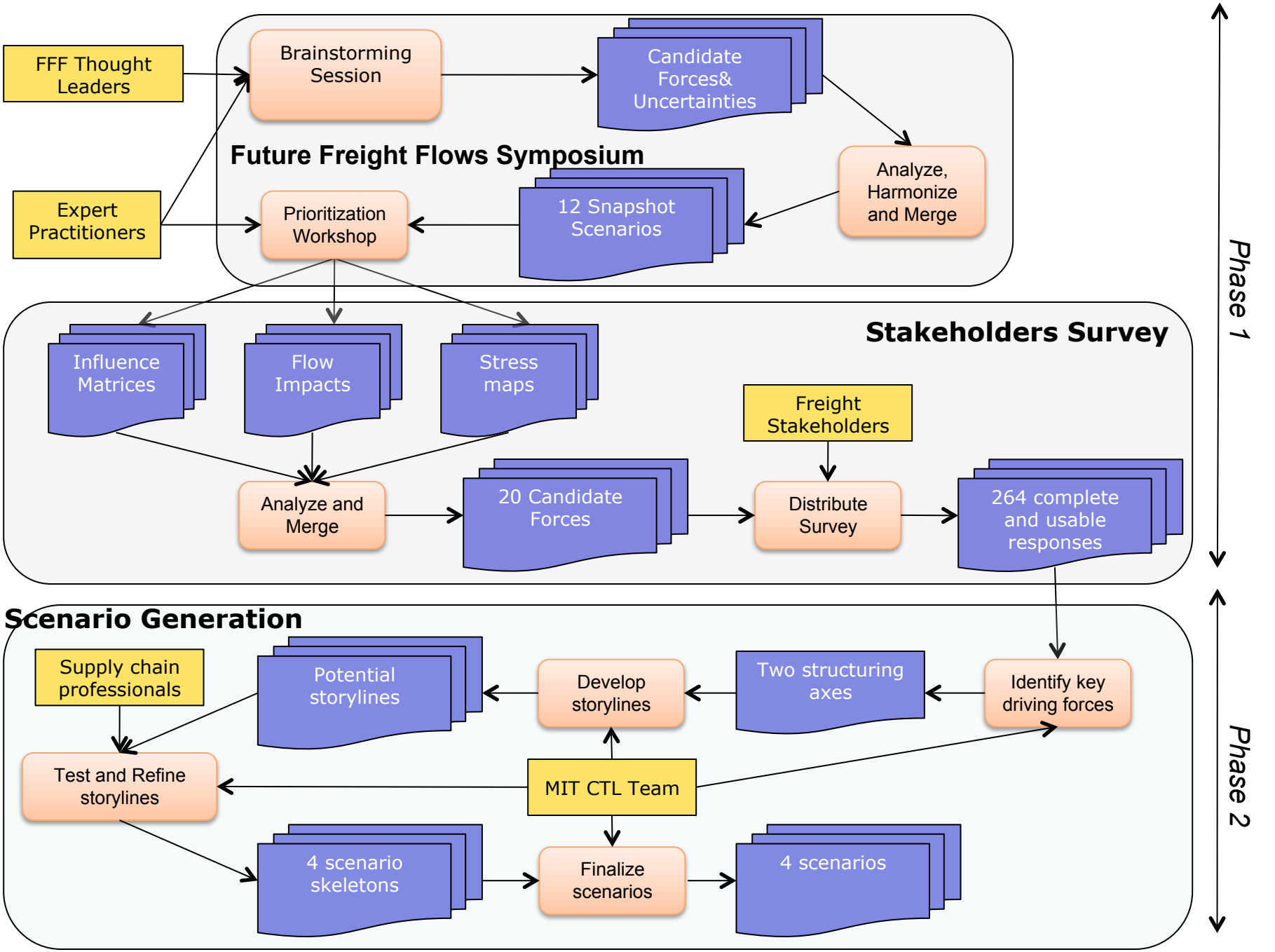
Lets Create Scenarios!

Strategy vs. Factors vs Forces

- **Strategy**
  - Things you control
  - Solutions & aproaches
- **Factors ("Inside-out")**
  - You cannot control
  - You may be able to influence
  - Direct and obvious effects
- **Forces ("Outside-in")**
  - You cannot control
  - You cannot influence
  - Indirect, ambiguous & unknown effects



A scenario is a set of driving forces


FFF Thought Leaders
Expert Practitioners
Brainstorming Session
Candidate Forces& Uncertainties
Future Freight Flows Symposium
Analyze, Harmonize and Merge
Prioritization Workshop
12 Snapshot Scenarios
Phase 1
Stakeholders Survey
Influence Matrices
Flow Impacts
Stress maps
Freight Stakeholders
Analyze and Merge
20 Candidate Forces
Distribute Survey
264 complete and usable responses
Scenario Generation
Supply chain professionals
Potential storylines
Develop storylines
Two structuring axes
Identify key driving forces
Test and Refine storylines
MIT CTL Team
4 scenario skeletons
Finalize scenarios
4 scenarios
Phase 2

Driving Forces Survey - STEEP

- Social
  - **Urban congestion/bottlenecks (~Phoenix)**
  - **Population growth**
  - **Increased consumption per capita**
  - Slower migration to Arizona
  - Labor Shifts (Shortage of truck drivers, millennials, etc.)

- Technological
  - **Autonomous Trucks**
  - Alternative fuels
  - Solar roadways
  - Availability of CNG or LNG stations inter & intra state
  - Drones for delivery

Drones

- Expected Industries of Adoption
  - Security and monitoring:
  - Exploration, aid efforts, disaster recovery:
  - Delivery and Errands
  - Logistics: Remote delivery
  - Journalism, filmmaking, and photography:
  - Farming:

Driving Forces Survey - STEEP

- Economic
  - **Port development in Mexico**
  - **Development of the Canamex (I-11) Corridor**
  - **Economic growth in Arizona**
  - **Increasing international exports/ trade with**
  - **Increasing international trade with Asia, EU**
  - **Increasing domestic trade with California**
  - **Oil prices / fuel costs**
  - Activities and flow at Ports of Long Beach and LA
  - Macro global economic conditions
  - National economic conditions in the US
  - Globalization of business to Mexico and Asia in particular
  - Mexico continued growth as a manufacturing leader
  - Increasing Arizona manufacturing
  - Establishment of new industries in Arizona
  - Industrial location patterns

Driving Forces Survey - STEEP

- Environmental
  - **Increasing temperature due to climate change**
  - Increased extreme events
  - Increasing demand for water – commercial and residential
  - New NOx standards – federal or state

Driving Forces Survey - STEEP

- Political
  - **Federal funding for infrastructure investments**
  - **Truck/Container size & weight limits on highways**
  - *Infrastructrue improvement in line with OSOW dimensions*
  - *Increased road capacity*
  - Investments in border crossings
  - Execution of MAP-21 Act
  - Land use regulations and restrictions
  - Increased Federal guidelines for electronic logs on smaller companies

Driving Forces Survey – STEEP+

- Non-Categorized
  - Condition and capacity of the transportation system
  - Inland port / rail connection to LA/Long Beach and Houston
  - Lack of RoW for network expansion
  - Access to competitive rail
  - Collectivization of freight to negotiate lower rates and spur investment in freight logistics
  - Overweight corridors between rail ramp and Mexico and other key industrial clusters, preferably state-wide to benefit all
  - A comprehensive freight transportation network model [MA-political? Not sure what this means]
  - Equilibrium position between rail (intermodal) and truck in U. S. economy
  - Truck stops with Emission free idle service idle area
  - Disruptions/bottlenecks at US/Mexican border crossings