1.463
Globalization of E&C Industry

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Session 2

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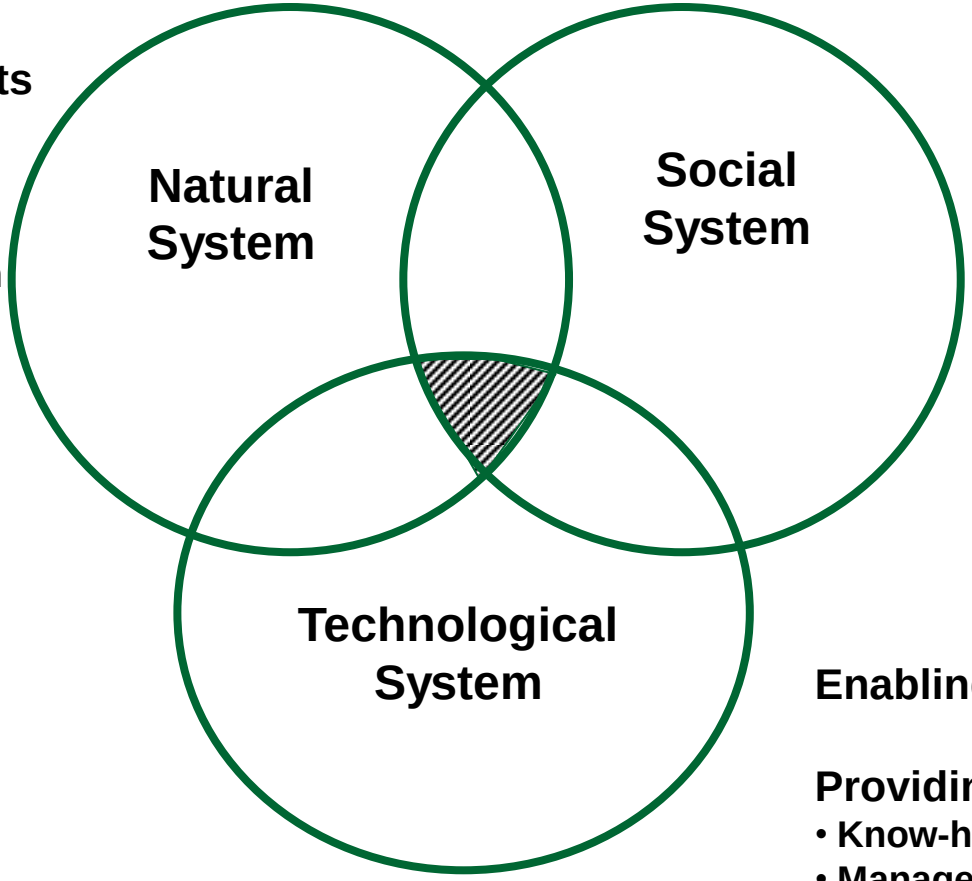
The engineering & construction industry is currently in a transition state. Forces from both the demand and the supply sides have made it necessary to re-examine strategies for growth and competitiveness.

Constructed Facilities

Setting Constraints

Establishing:
- **Limits to intrusion**
- **Need for protection**



Setting Demand

Establishing:
- **Policies**
- **Regulations**
- **Norms and Standards**

Enabling Supply Provision

Providing:
- **Know-how**
- **Management**
- **Organization**

The Role and Importance of Construction in Economic Development

- Construction Sector Contribution to Gross Domestic Product (GDP)
- Construction Role in Gross Fixed Capital Formation
- Construction Sector Contribution to Employment
- Construction, Industrialization and Economic Growth
  - Backward Linkages
  - Forward Linkages
  - Other Contributions

Construction

- Construction is known as the “engine of growth.”
- By any standards it is a giant.
- Some have recently called it a “sleeping giant.”
- All indications are that it is reawakening.

Two Sets of Issues of Concern to the Engineering & Construction Industry

I. How is demand for its output generated and affected by modern societies?

II. How is the industry's supply system shaped to cope with changing demand?

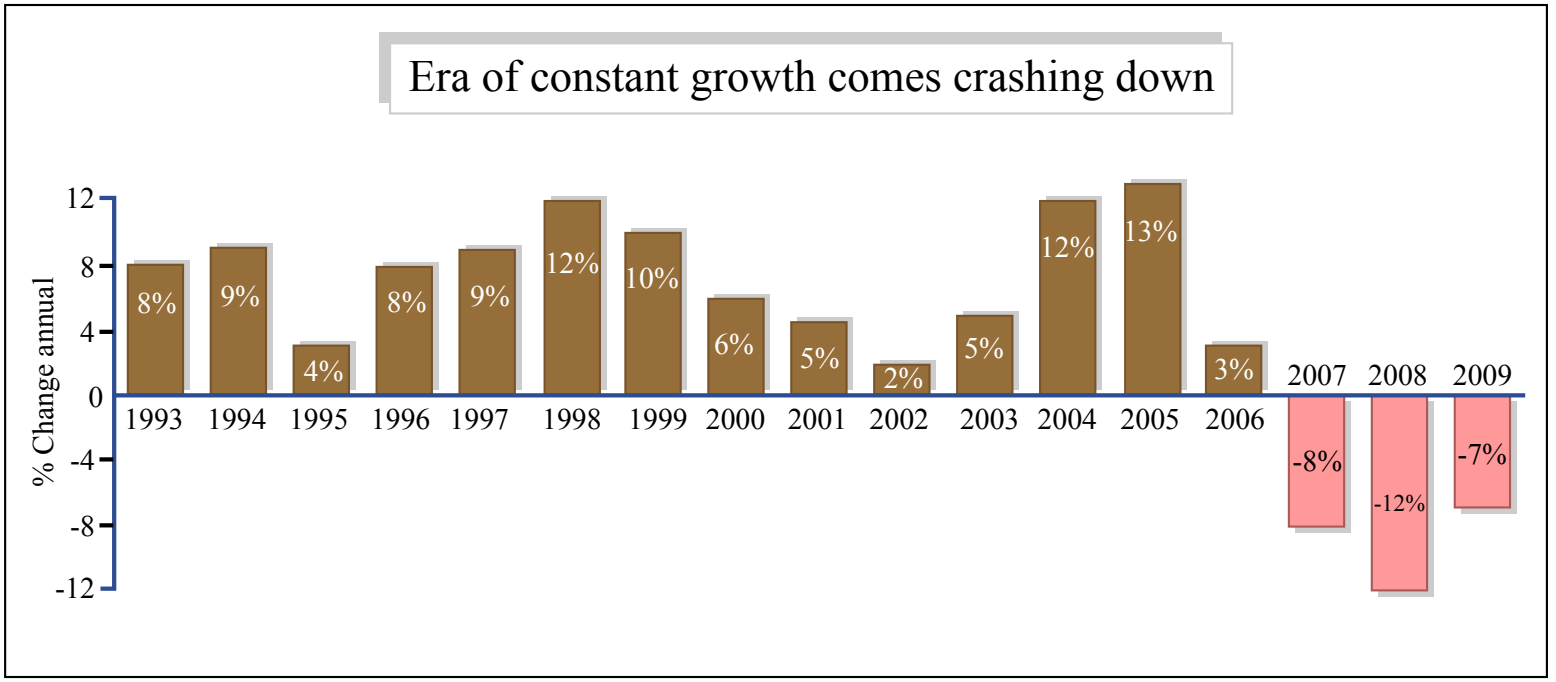
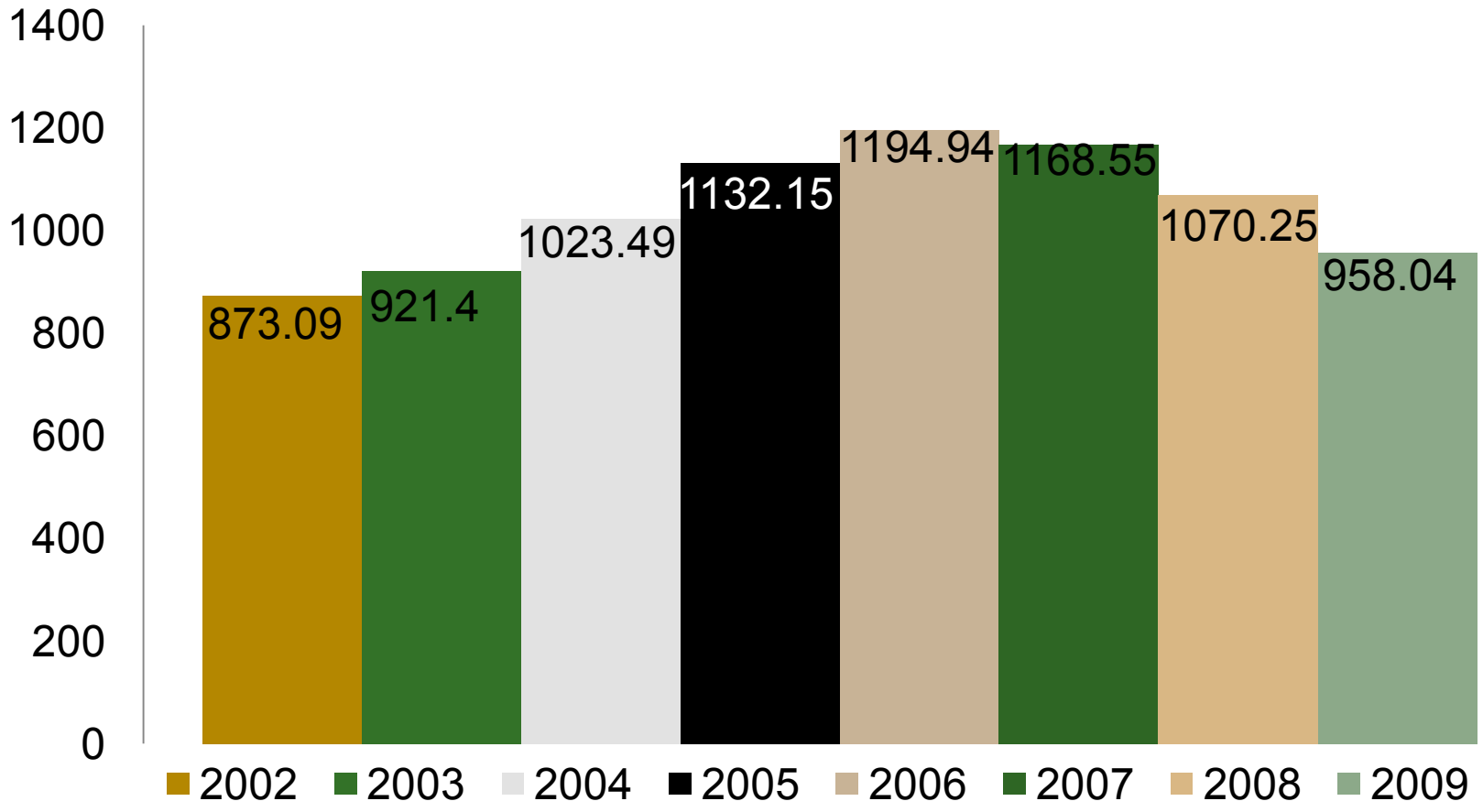


Figure by MIT OpenCourseWare.

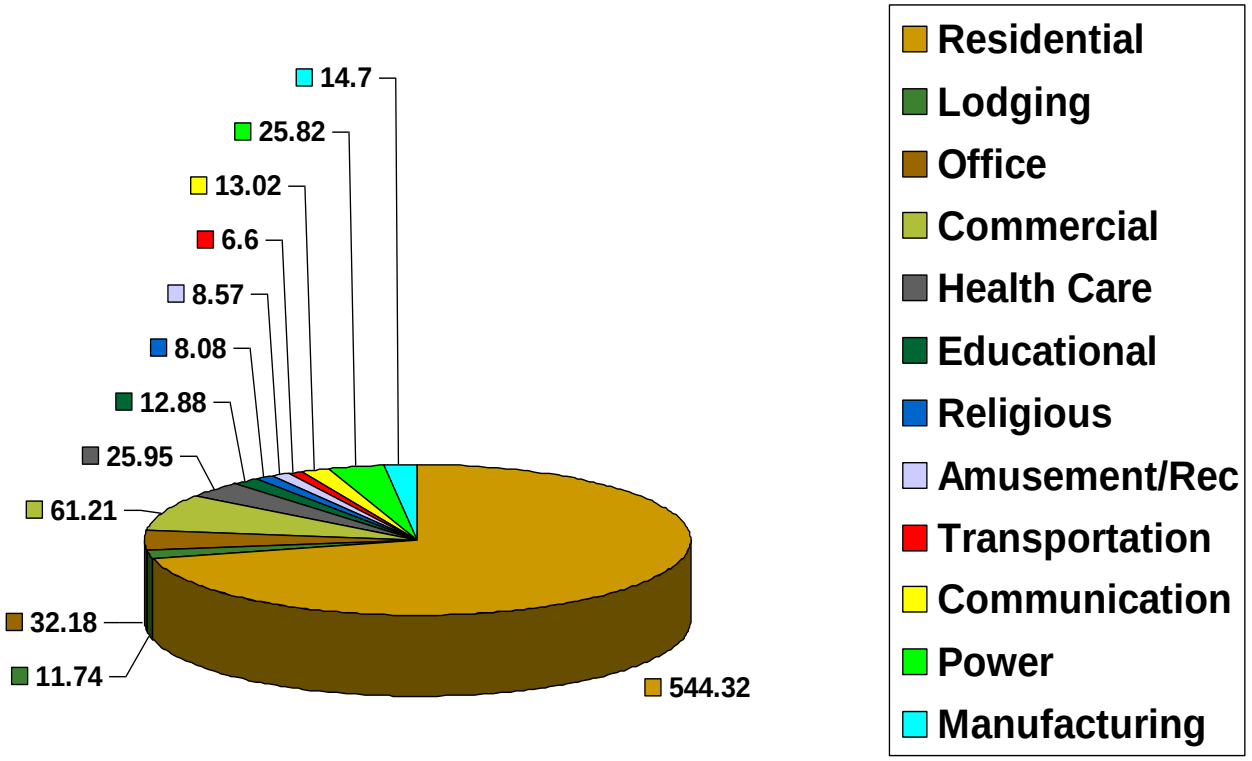
Total Value of Construction Put In Place



Source: US Department of Commerce Annual Value of Construction Put-in-Place in Current Dollars

Private Construction in 2004

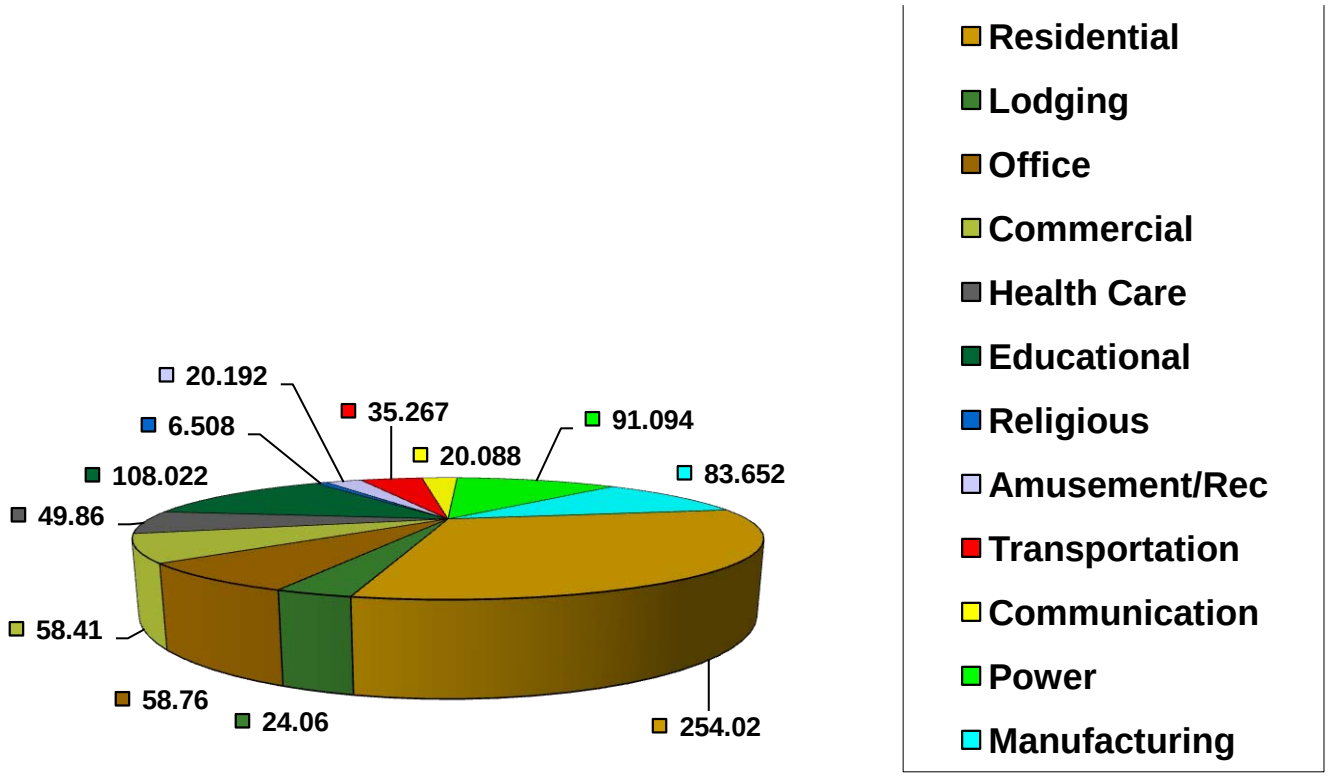
Total $999.76 Billion



Source: Dept. of Commerce. Construction Put-In-Place. Details May Not Add Total Since All Types of Construction are not Shown Separately.

Construction Segments in 2009

Total $958 Billion



TOP 20 GLOBAL CONTRACTORS

Rank				Firm	'07 Revenue ($ Mil)	
2006	2007	2008	2009		Total	Int'l.
1	1	1	1	Vinci, Rueil-Malmaison, France	41,715.6	14,684.7
2	2	2	3	Bouygues, Paris, France	32,062.0	12,090.0
3	3	3	2	China Railway Group Ltd. Beijing, China	27,018.4	867.2
4	6	4	4	China Railway Construction Corp. Beijing, China	24,298.4	416.4
5	4	5	5	Hochtief AG, Essen, Germany	23,861.0	21,313.4
6	5	6	8	Grupo ACS, Madrid, Spain	23,130.1	3,653.1
7	7	7	6	China State Construction Eng'g Corp. Beijing, China	21,517.4	3,244.5
8	10	8	7	China Communications Const. GRP, Beijing, China	20,004.6	4,177.9
9	17	9	11	FCC, Fomento De Constr., Y Contratas SA, Madrid, Spain	19,046.8	6,854.9
10	8	10	12	Skanska AB, Solna, Sweden	18,546.9	13,982.2
11	9	11	10	Bechtel, San Francisco, California, USA	17,696.0	11,742.0
12	18	12	9	China Metallurgical Group Corp., Beijing, China	16,906.8	625.7
13	12	13	15	Kajima Corporation, Tokyo, Japan	16,413.2	3,006.5
14	16	14	17	Obayashi Corp., Irving, Tokyo, Japan	15,877.0	3,013.0
15	14	15	13	Strabag SE, Vienna, Austria	15,797.0	12,689.2
16	11	16	21	Taisei Corp., Tokyo, Japan	15,149.0	2,144.0
17	23	17	20	Balfour Beatty PLC, London, UK	14,986.0	6,469.0
18	20	18	16	Fluor Corp., Irving, Texas, USA	13,332.3	7,940.4
19	22	19	19	Bilfinger Berger AG, Mannheim, Germany	12,642.0	8,475.0
20	15	20	14	Shimizu Corp., Tokyo, Japan	12,603.3	1,342.8
			18	Eiffage, Asnieres-sur-Seine, France	N/A	N/A

A/E/C Firms Differentiation:

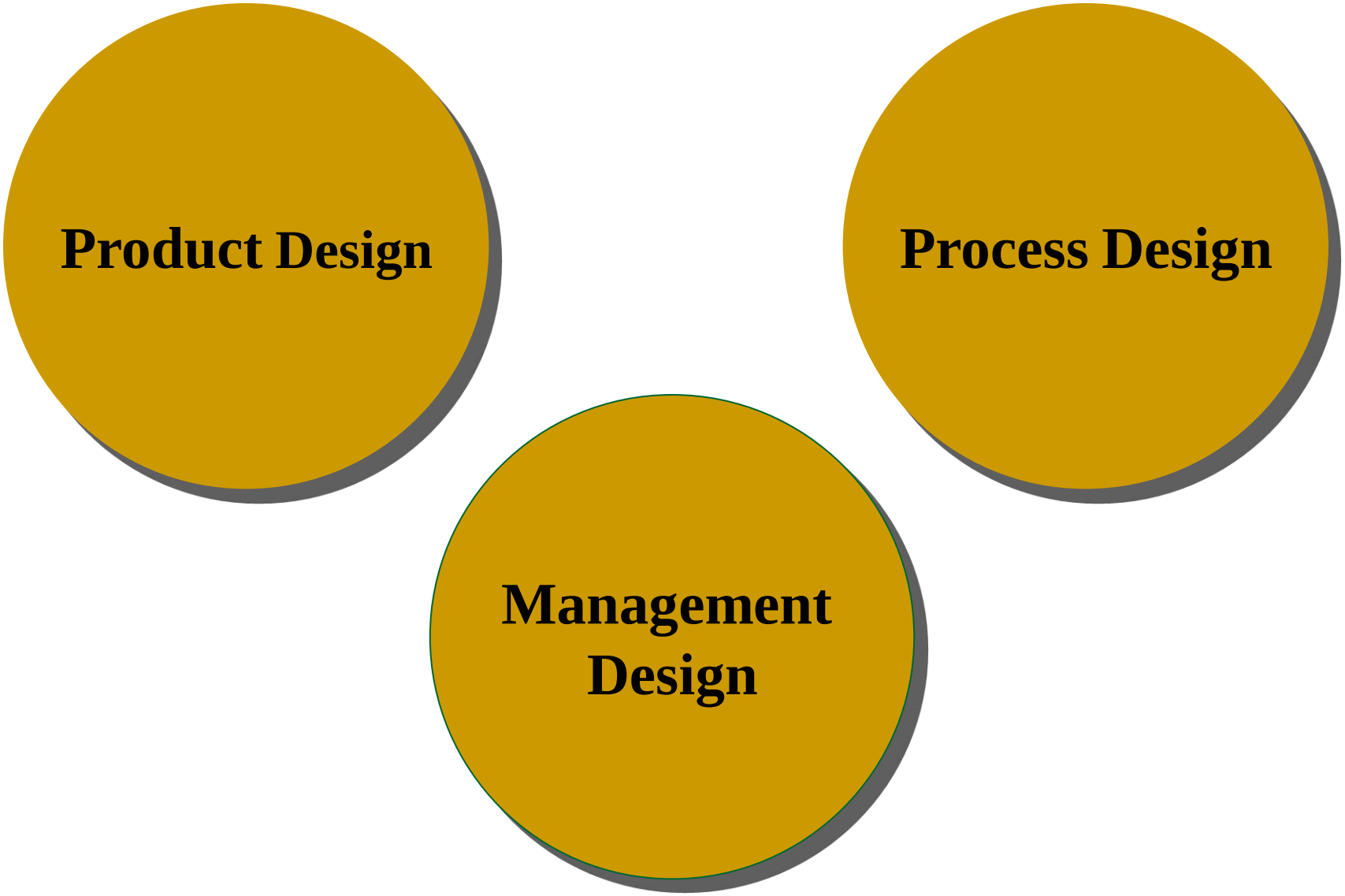
Four Thrust Areas

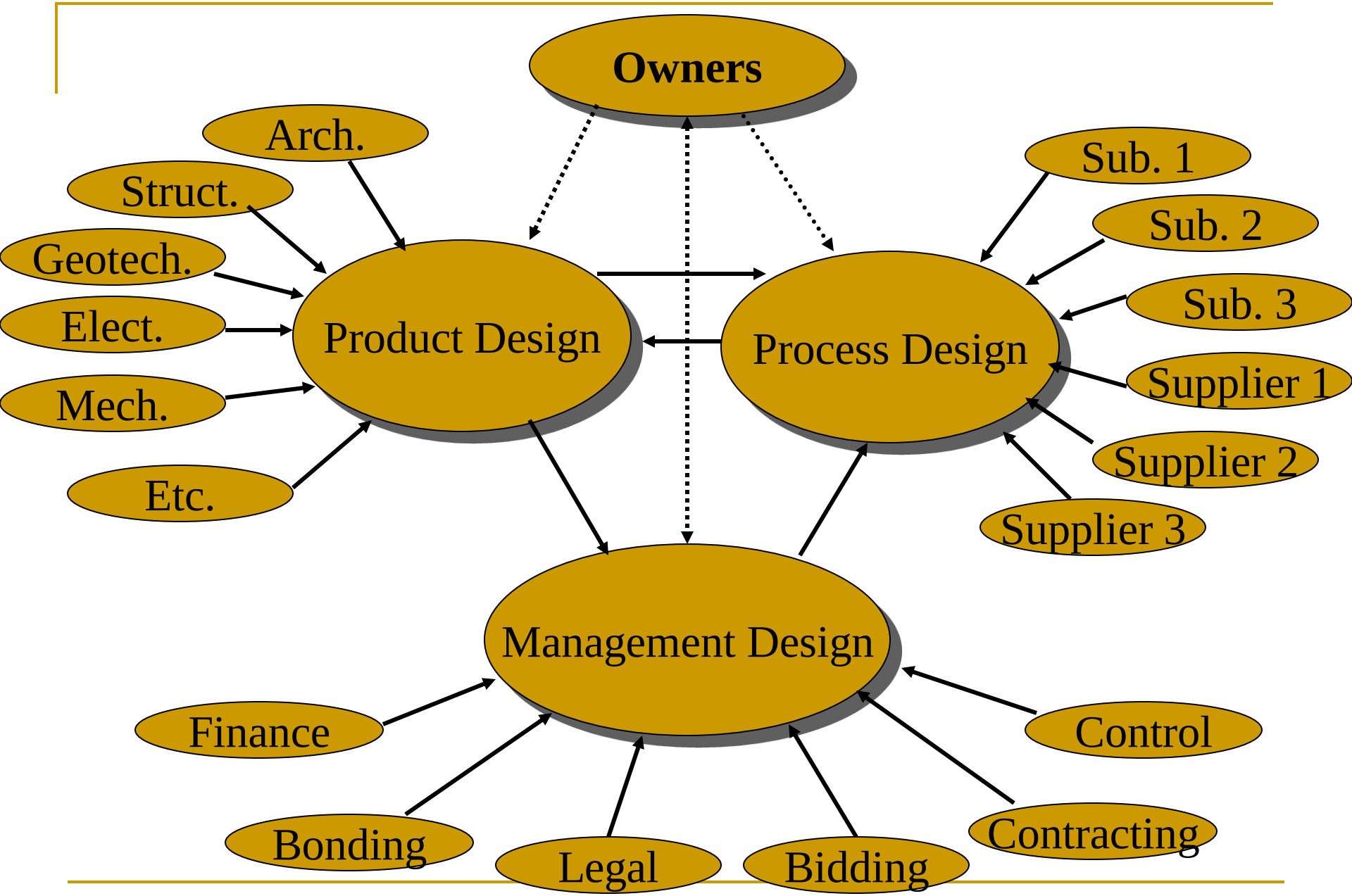
1. Technology of Assembly
   - Design
   - Construct

2. Management of Assembly on Site
   - Project Management

3. Management of Organizations Specializing in Assembly

4. Interaction of Assembled Systems with Socio-Economic Development and Environmental Protection


Product Design
Process Design
Management Design


Owners
Arch.
Struct.
Geotech.
Elect.
Mech.
Etc.
Product Design
Process Design
Sub. 1
Sub. 2
Sub. 3
Supplier 1
Supplier 2
Supplier 3
Management Design
Finance
Bonding
Legal
Bidding
Control
Contracting

Major Developments of the 1990's

- Globalization and market economy
- World Trade Organization
- Financial markets and privatization
- Information technology and telecommunications
- World Wide Web and e-commerce
- Environment and sustainability
- Science and technology capability as an instrument of economic competitiveness

Consequences:

- Increased demand for movement of goods and information
- Increased demand for human resource development
- Need for increased transparency in government's regulatory systems
- Importance of a robust science and technology infrastructure

Change

On Demand Side:

- Client
- Markets

On Supply Side:

- Technology
- Organization

Changing Nature of Demand

I. TRADE

II. ECONOMIC BLOCS

III. FINANCE

IV. ENVIRONMENT

V. TYPE OF WORK

Changing Nature of Demand

I. TRADE

- International trade in services.
- International trade in construction services and products.
- International trade in construction labor.

TREND

- Is toward further relaxation of barriers to entry into large construction markets.

IMPLICATIONS

- *Increasing need to remain competitive on global basis.*

Changing Nature of Demand

II. Economic Blocs:

1. North American (U.S., Canada, Mexico)
2. European Economic Community
3. Far East Centered in Japan
4. Mercusor

Trends:

1. Potential Future Bloc(s):

Latin America
Middle East
Indian Sub Continent

2. Realignment of Firms Within Each Bloc via:

Merger and Acquisition
Joint venturing
Strategic Alliances

3. Need to Expand Globally

Implications:

Further Erosion of Control over Domestic Market

Changing Nature of Demand

III. Finance

- Financial market is fully global
- New financial packaging and instruments
- Increased risk due to fluctuation in exchange rate

Trends

- Greater involvement by construction in financial packaging
- Greater equity participation
- Greater involvement in operation and management

Implications

- *A close relationship between financial firms and construction firms*
- *Financial engineering and financial packaging services*

Changing Nature of Demand

IV. Environment

- Prevention of further damage to environment
- Correction of damaged environment
- Infrastructure

Trends

- New specialization
- Increased construction opportunity
- Substantial sensitivity to sociopolitical concerns

Implications

- *Niche market strategy*
- *New technological development*
- *New risk mitigation and allocation*

Changing Nature of Demand

V. Type of Work

A. Energy & environment

B. Infrastructure

C. Buildings & housing

D. High-technology and industrial construction

E. Security

Changing Nature of Supply

I. **Globalization**

II. **Manpower**

III. **Technological Changes**

Changing Nature of Supply

I. Globalization

- Geographic
- Internal
- External

Trends

- Organizational readjustment
- Development of brand name identity
- Niche strategy
- Outsourcing

Implication(s)

- *Reorganization, global perspective*

Changing Nature of Supply

II. Manpower

- Demographic characteristics
- Mature labor force
- Less tolerant of physical and manual chores
- Better educated
- More mobility

Trends

- Teamwork, labor-management cooperation
- Commitment to skill development

Implication(s)

- *More reliance on technology*

Changing Nature of Supply

III. Technological Changes

- Advanced materials
- Automation and robotics
- Information technology
  - Sensor technology, communications technology

Trends

- Shift from on-site to off-site production
- Flexible manufacturing
- Computer-controlled production
- Smart sensors, smart agents, smart buildings

Implications

- *Capital intensity*
- *Proprietary technology*

Management of Organization

- Vertical Integration
- Horizontal Networking
- Franchising

Vertical Integration

Technological Stratification

- Niche Strategy
- Brand Name Identification
- Market Aggregation
- Market Making

Horizontal Networking

Market aggregation bargaining with

- Suppliers
- Clients

Franchising

- Marketing
- Technological know-how
- Suppliers
- Flattened organizations

Large Firms

- Global
- Vertical integration
- Proprietary knowledge

Medium Firms

- Regional independence
- Networking
- Proprietary knowledge of markets and suppliers

Small Firms

- Franchising

Projects

Computer-Based:

- Control (of time and cost)
- Inventory
- Knowledge-based systems
- Interactive systems
- Intelligent databases

Firms

- Decision support systems
- Intelligent databases
- Strategic management information systems
- Embodiment of knowledge in institutions and organizations
- Proprietary knowledge
- R&D

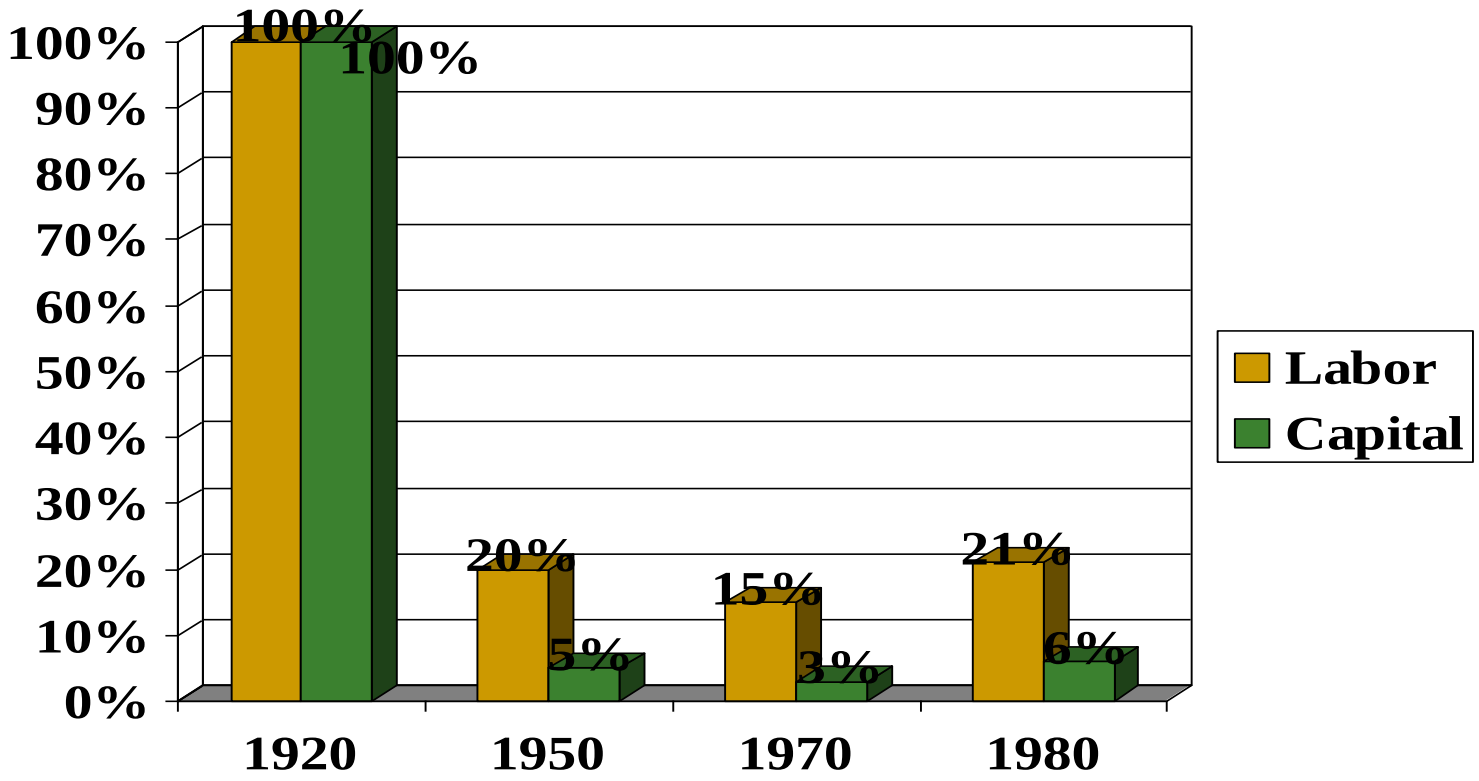
Historically: A Similar Situation in the 1920's

…WHEN THE INDUSTRY'S PRODUCTIVITY INCREASED BY ALMOST AN ORDER OF MAGNITUDE DUE TO THE CONFLUENCE OF TECHNOLOGY AND MARKET

Highway Construction  **Market**

Technology  **Mechanization**

Surfacing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5%
15%
3%
21%
6%
1920
1950
1970
1980
Labor
Capital

Similar Opportunities Exist Today

Market Stability  Infrastructure

Technology

- Information & Communications
- Robotics
- Engineered Materials

1.463J The Impact of Globalization on the Built Environment
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