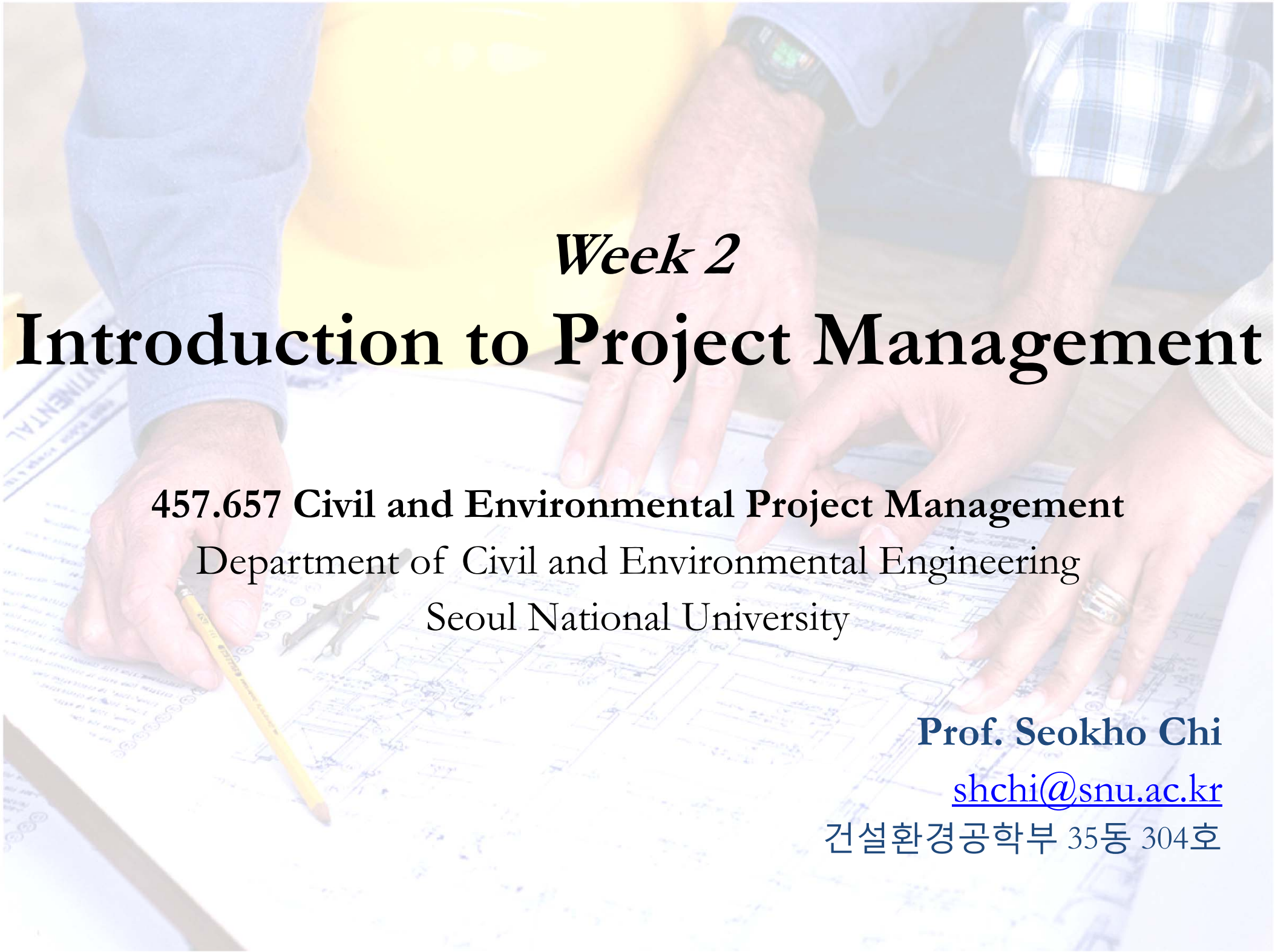

Week 2

Introduction to Project Management

457.657 Civil and Environmental Project Management

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What is a Project? (PMBOK Chapter 1)

- **"A temporary endeavor undertaken to create a unique product, service, or result."** (PMBOK, pg. 5)
  - *Temporary* means that every project has a defined beginning and a defined end.
  - Projects involve doing something which has not been done before and which is, therefore, *unique*.
- **Examples?**
  - Developing a new product or service
  - Effecting a change in the structure, staffing, or style of an organization
  - Developing or acquiring a new or modified information system
  - Constructing a building or infrastructure
  - Implementing a new business process or procedure

What is a Project?

- **A project is**
  - Decided by people, materials, and equipment
  - Characterized by phases, multiple participants from different organizations, scheduling, cost constraints and creativity.
  - Very dynamic in nature and involves considerable coordination and communication.

What is Project Management?

Why is PM important?

What should we do for successful PM?

What is Project Management?

- "A process that helps project teams coordinate their efforts so they may create the right product (or service, process, or plan) at the right time, for the right customer, within the resource limits established by the organization" (PMMJ, pg. 2)

- "The art and science of coordinating people, equipment, materials, money, and schedules to complete a specified project on time and within approved cost." (PMEC, pg. 8)

What is Project Management?

- "The application of knowledge, skills, tools, and techniques to project activities in order to meet or exceed stakeholder needs and expectations from a project." (PMBOK, pg. 6)
  - Meeting or exceeding stakeholder needs and expectations invariably involves balancing competing demands among:
    - Scope, time, cost, and quality
    - Stakeholders with differing needs and expectations
    - Identified requirements (needs) and unidentified requirements (expectations)

- ***Communication and Leadership!***

World's 5 Mega Construction Projects

Construction Industry

- Not a new industry

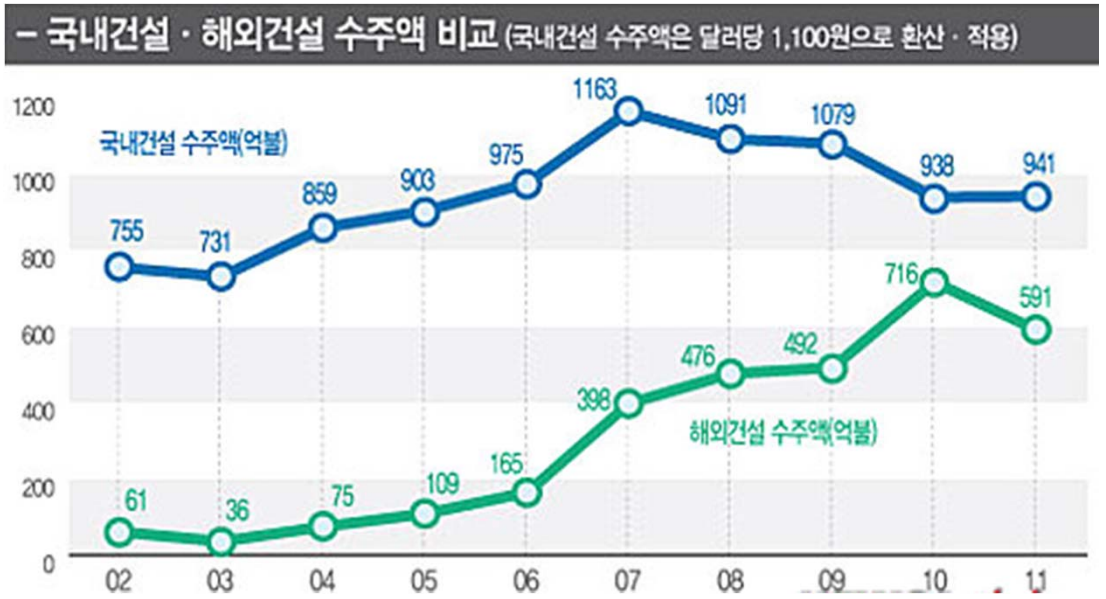
- Continuously evolving

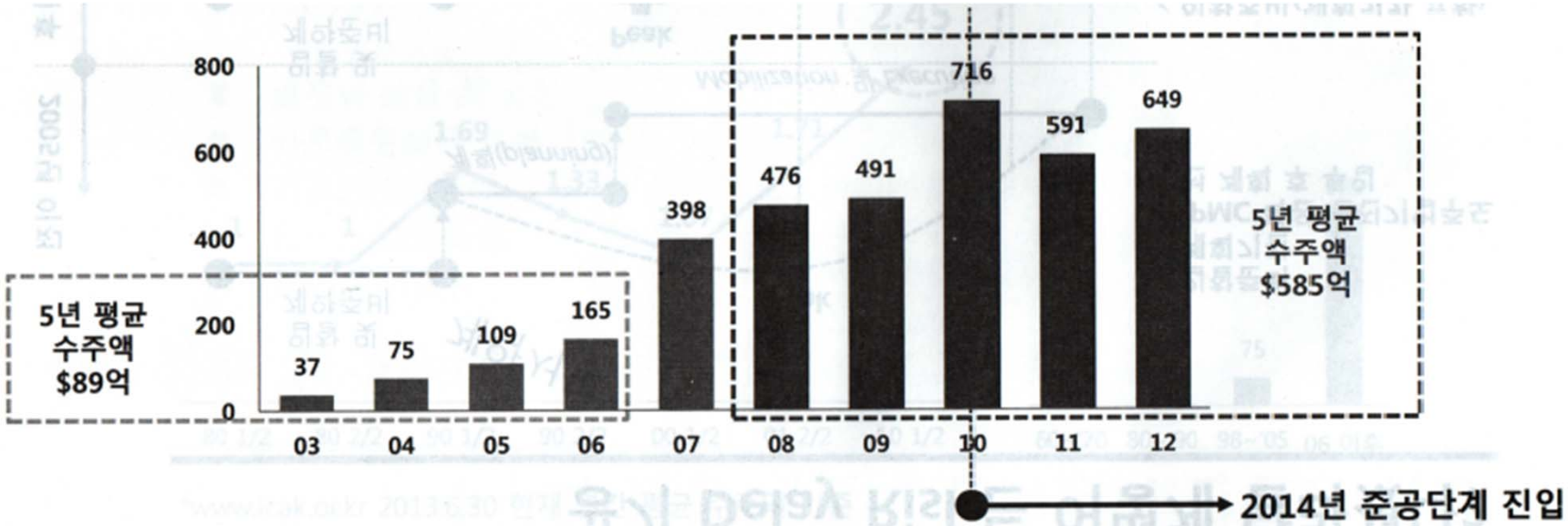
Type	Residential	Building	Infrastructure	Industrial
				

Nature of Construction Industry

- **Large** (CERIC 2013)

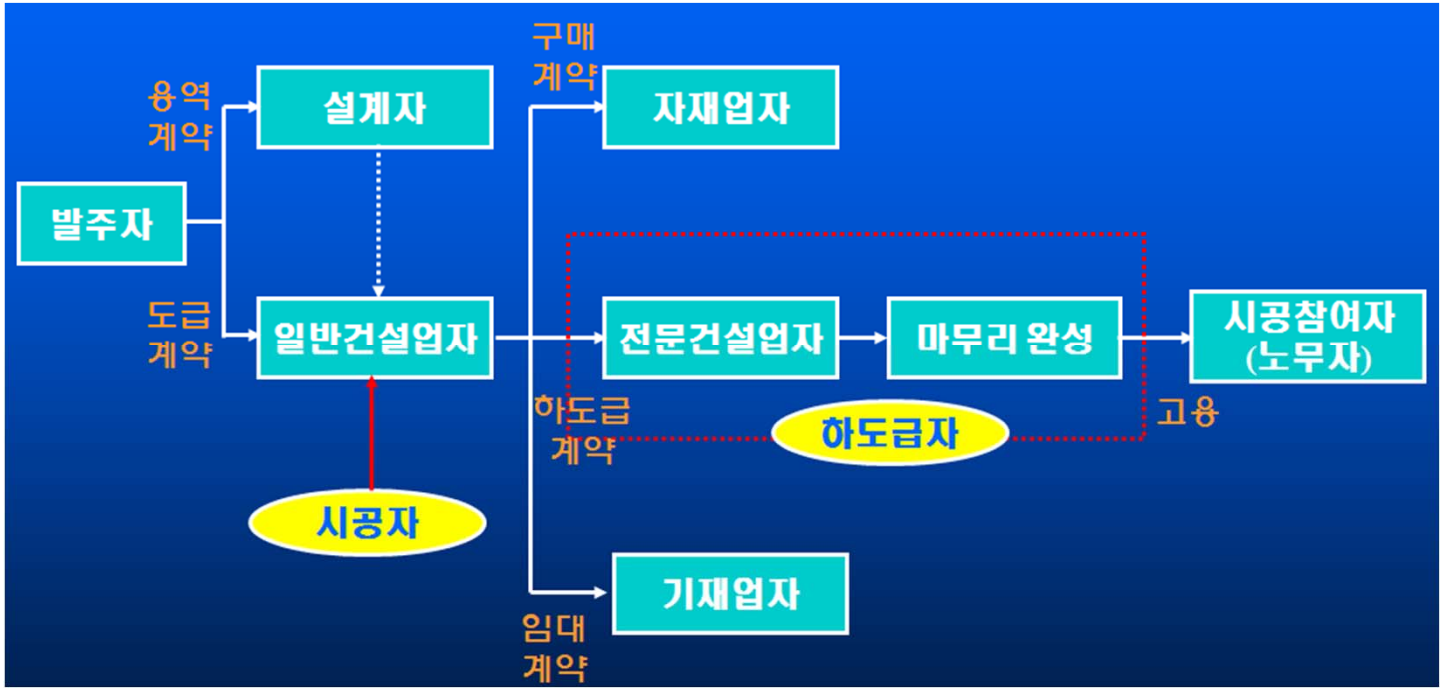
7.5% of the total employment in Korea (about 2,000,000 people)





Nature of Construction Industry

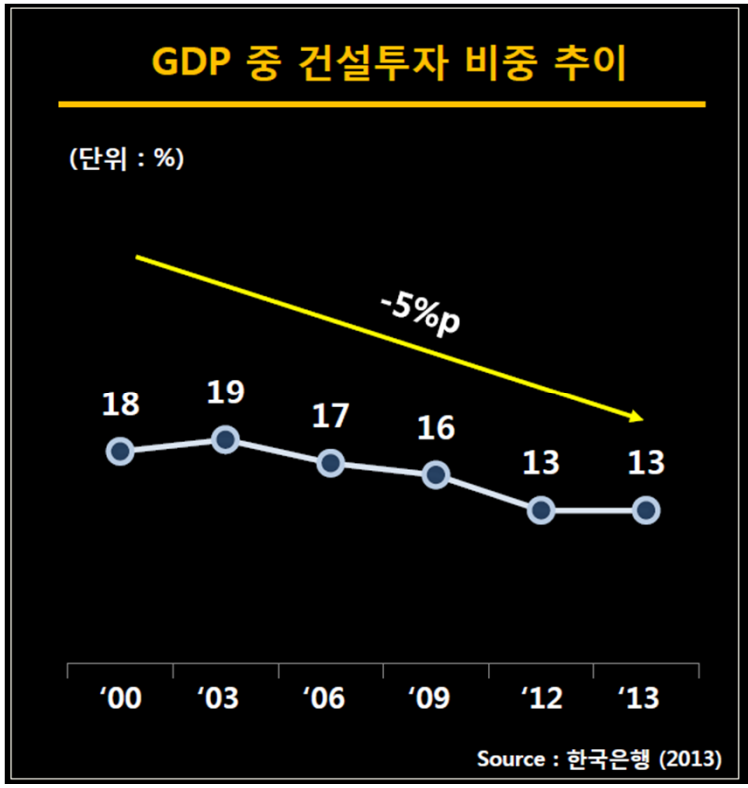
- Unique, Complex, Labor-oriented
- Diverse sectors, project types, companies, and stakeholders
- Traditional, Experience-oriented
- Sustainability, High risk



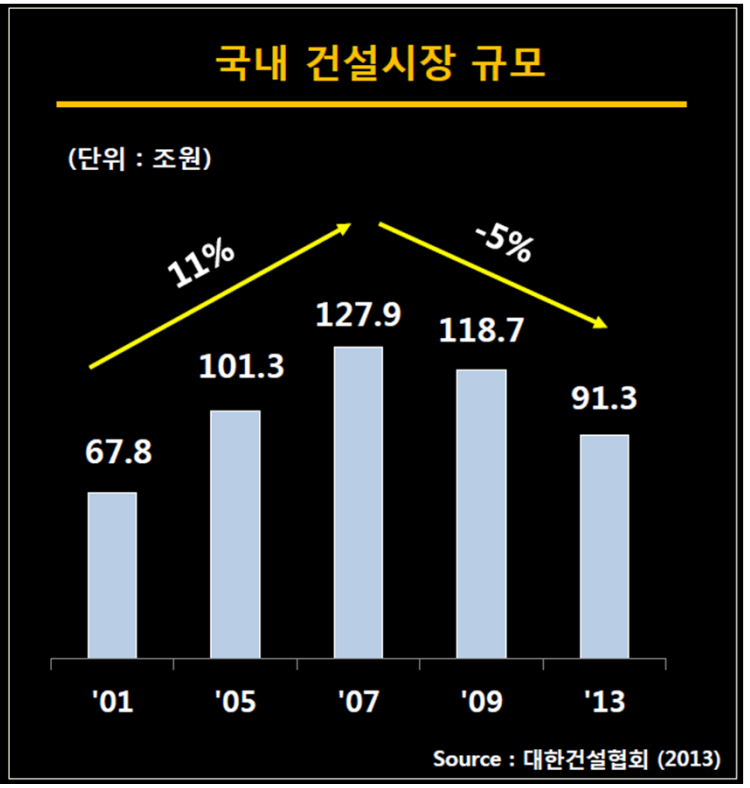
Issues in Korean Construction Industry

- **Domestic Construction Market in Korea**

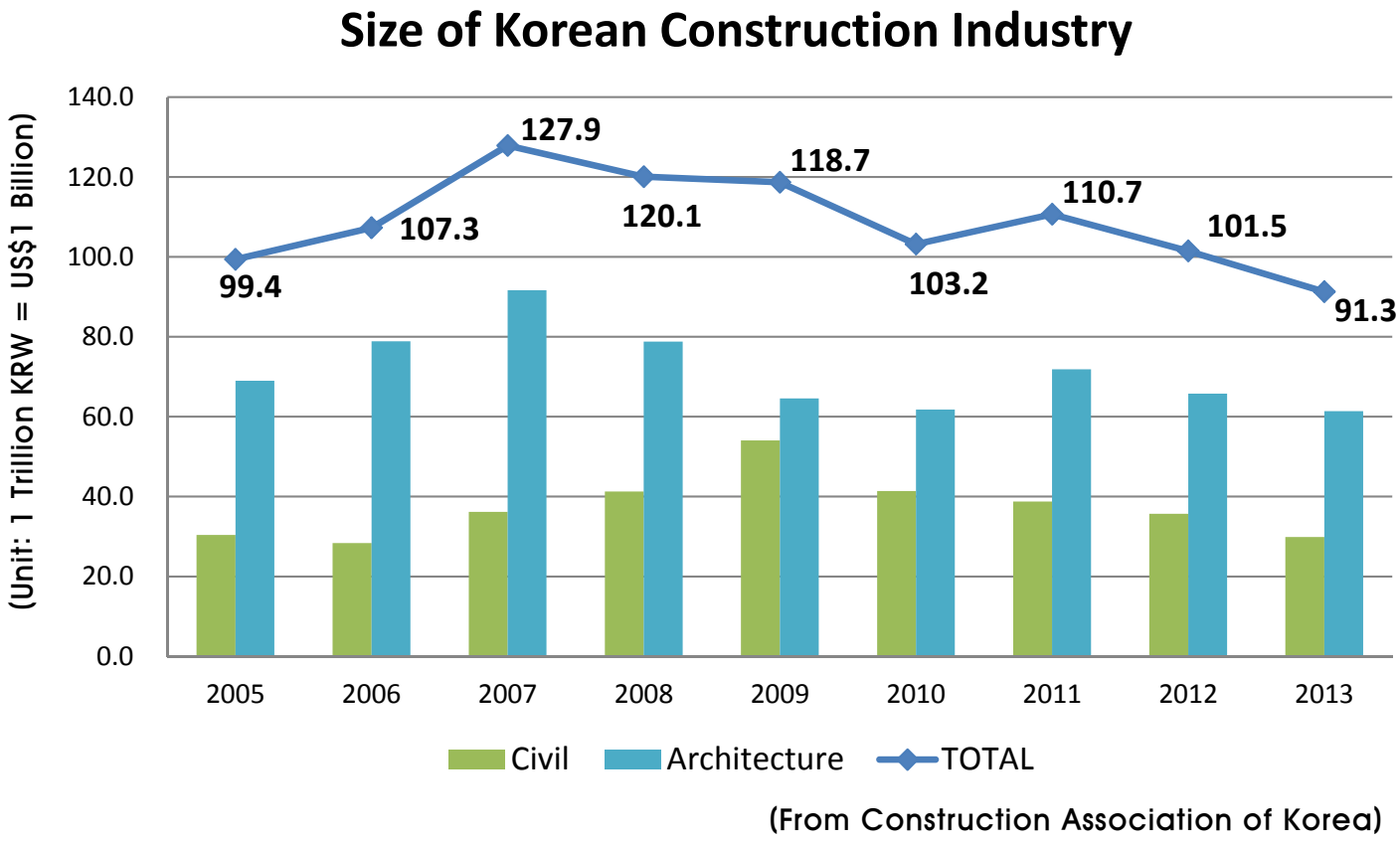
GDP Construction



Size of Domestic Construction Market



Size of the Korean Construction Industry

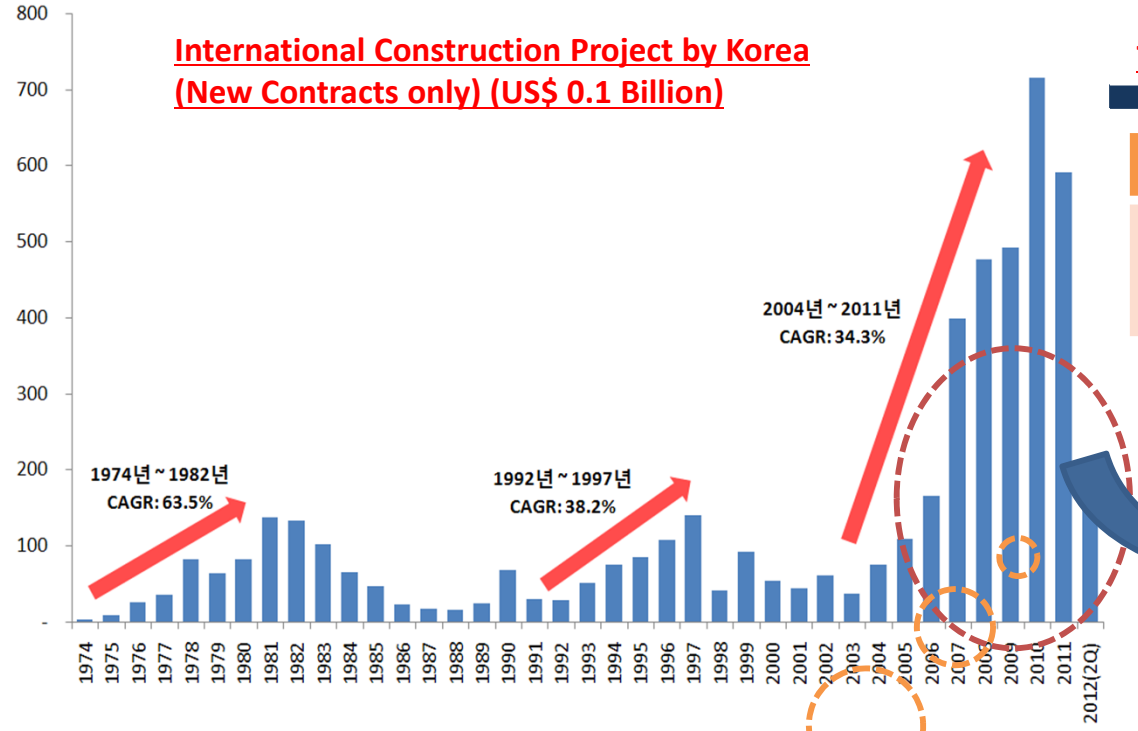


(From Construction Association of Korea)

(Unit: 1 Trillion KRW = US$1 Billion)

Year	TOTAL	Growth	CIVIL	Growth	ARCHI.	Growth	Residential	Others
2012	101.5	-8.3	35.7	-8.1	65.8	-8.4	34.3	31.5
2013	91.3	-10.0	29.9	-16.2	61.4	-6.7	29.3	31.2

Major Issues in International Construction



Trends in the Recent Years (New Contracts Only)

	2009	2010	2011	2012
Total $ (US$ 0.1 Billion)	491	715	591	648

It will continuously increase at least up to $1,000/year

- Increased Project Size (Mega Project)
- **Major Issues → Earning Shock!**
  - ❖ Lean to Middle-East, Asia
  - ❖ Lean to plant projects
  - ❖ High risk on schedule (Heavy Liquidated Damage)
  - ❖ Lack of labor sources
  - ❖ Risk on ROI due to severe competition

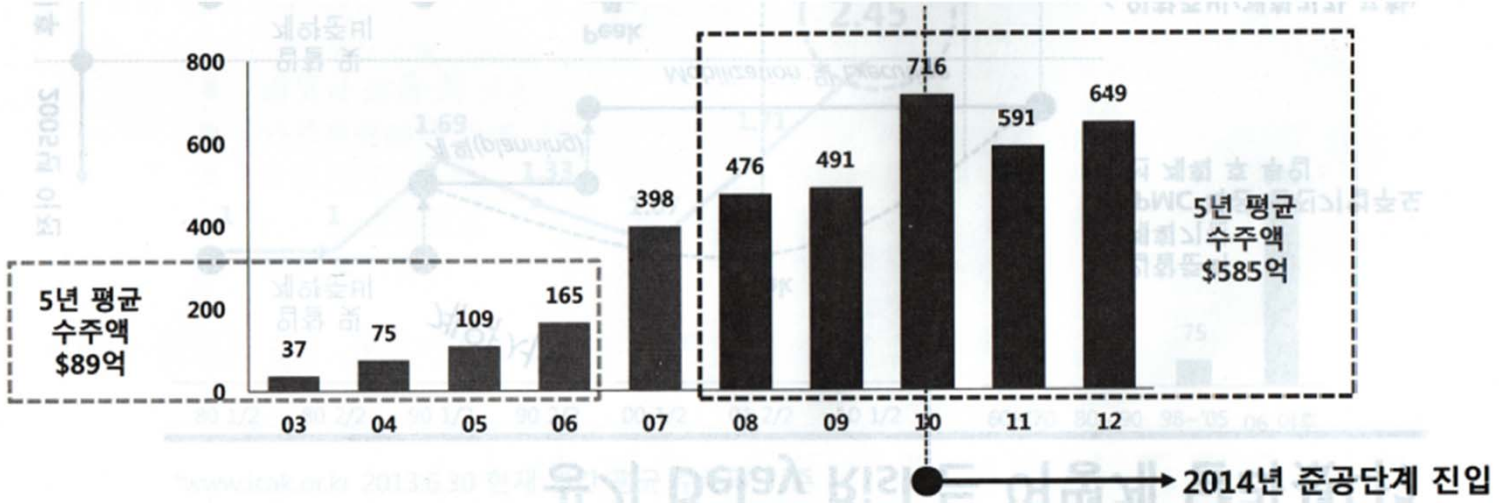
EFFORTS TO CHANGE

- **Advancement of construction policies to meet global standards**
- **Investment on global expert education program for strategic project management**
- **Enhance global position of Korean construction companies to reduce project risks**
  - ❖ **Subcontracting → General Construction → Engineering, Procurement, Construction → Project Management/Total Solution**
  - ❖ **Emphasis on Project Management, Engineering**

Source: Seminar Material of Dr. Seok In Choi at CERIK

Issues in Korean Construction Industry

- **Separated Bidding and Project Delivery Process**



Bidding Phase

Management Team
Market Analysis
Bidding Packaging
Contact Analysis
Feasibility Analysis
Negotiation
Others

Award

Implementation Phase

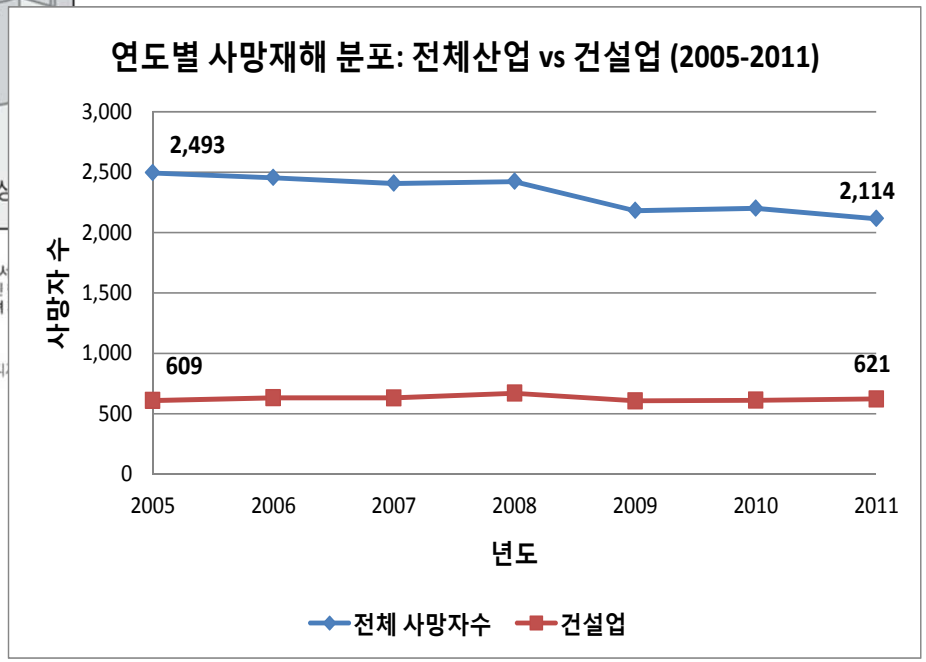
Construction Team
Project Delivery Plan
Specific Planning, Design,
Construction, and O&M
Contract Satisfaction
Subcontracting
Others

Issues in Korean Construction Industry

- **Construction Safety**

(한국산업안전공단, 2011)

2011	Total	Rate to Industry
Injuries in Construction	**22,782 Workers**	**25%**
Fatality	**621**	**30%**
Fatality / 10,000 Workers	**2.0**	**U.S., Japan 1.0**

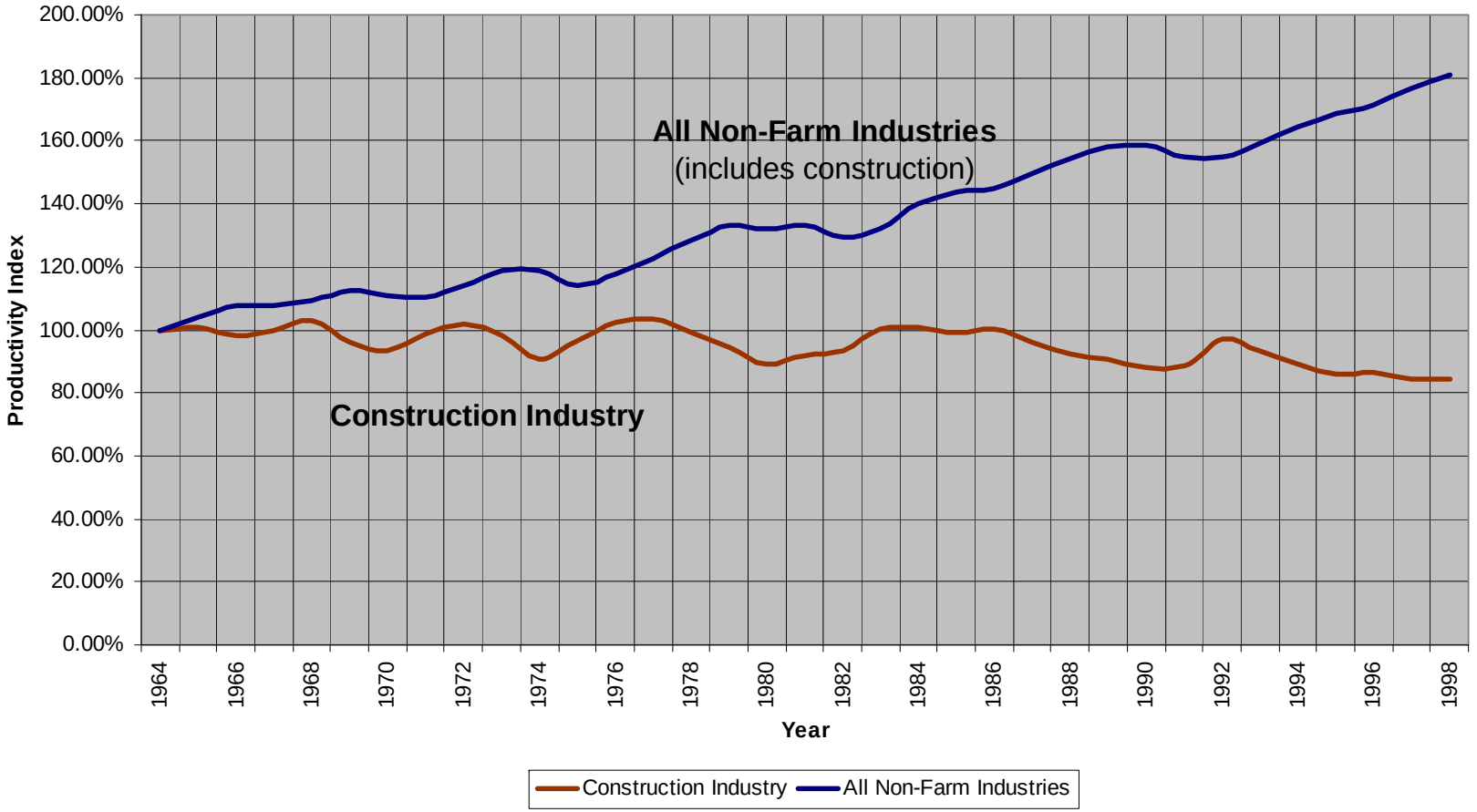


Issues in Korean Construction Industry

- **Productivity**

**2012년 대한민국 건설업의 노동생산성을 전년도 대비 20.1% 하락했으며 기준점인 2008년에 비해서는 절반수준으로 하락하였음*

Productivity Index (1964-1998)
(Constant $ of contracts / workhours of hourly workers)
sources: US Bureau of Labor Statistics, US Dept. of Commerce



Major Issues in the Korean Construction Industry

- **Need for Construction Society Changes to be Prepared for the Future**
  - Renew/renovation projects
  - Improvement of construction productivity
  - Revisit too-competitive contract bidding approaches (e.g., price-oriented selection)
  - Revisit quantity-based prequalification processes into qualitative project management information-based one such as construction quality, change management performance, satisfaction on project milestones, safety, etc.
  - Improve higher value-added project planning capabilities of companies to discover projects, enhance project management performance, and achieve strategic project financial plan
  - Enhance social image of SOC projects that should become the baseline for the public well-being
  - Introduce and expand the use of IFRS(International Financial Reporting Standards) for better financial management and ROI(Return on Investment)
  - Achieve transparency and objectiveness of construction projects

Source: Seminar Material of Dr. Seok In Choi at CERIK

Importance of Project Management

CONSTRUCTION PROJECT

Residential	Building	Infrastructure	Industrial

Planning → **Design** → **Construction** → **Operation & Maintenance**

(PMBOK, 2000)

Scope Management	**Procurement** Management
HR Management	**Decision/Risk** Management

Social Science Oriented

Time Management	**Cost** Management
Quality Management	**Safety** Management

Engineering Oriented

PROJECT SUCCESS!

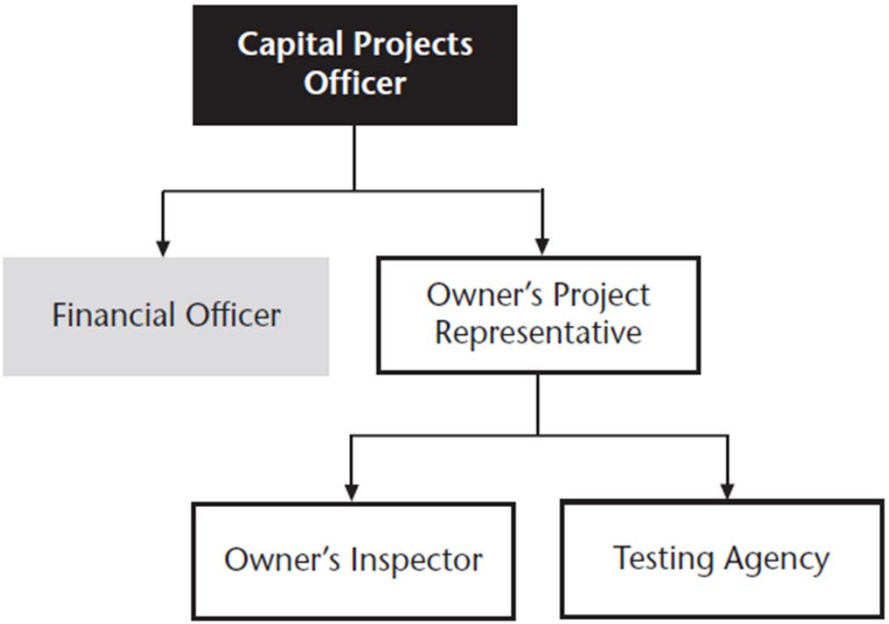
Happy Client
Happy Constr. Firms
Happy Society

Project Participants/Stakeholders

- **Owners** (Public, Private)
- **Designers** (Architect, Engineer)
- **Constructors** (General, Sub)
- **Management consultants**
- **Material suppliers**
- **Operating equipment vendors**
- **Labor**
- **Accountants**
- **Attorneys**
- **Financial institutions**
- **Inspection / Testing companies**
- **General public**

Project Participants - Owner

- **Role**
  - Initiates a project, finances it, contracts it out and benefits from its outputs



Owner's Organization for the Construction Project

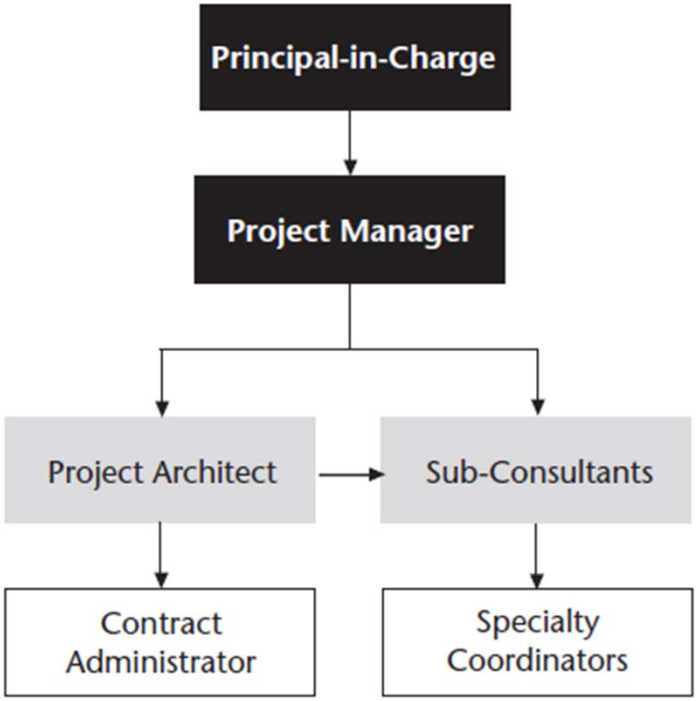
- **Capital Projects Officer**
  - Owner or upper-management-level individuals
  - Makes ultimate decisions, authorizes major changes, and oversees the construction phase periodically
- **Financial Officer:** Manages the cash flow of the project
- **Owner's Project Representative**
  - Owner's project manager responsible for the project
  - Primary contact participating on a daily basis
- **Owner's Inspector (clerk of the works)**
  - Mainly observes, reports the quality of construction works
- **Testing Agency**
  - Outside testing agency contracted by the owner
  - Tests materials to verify their specified standard

**Shop Drawings*: Drawings explaining item fabrication and installation produced by contractors, suppliers, manufacturers, etc. (e.g., 50m = 5 x 10m-rebar)*

**RFI*: Information request from CM to A/E to clarify any parts of construction documents*

Project Participants – Designer (A/E)

- **Role**
  - Develops the owner's concept on paper and construction documents
  - Architect: Lead designer administrating construction as the owner's agent
  - Engineer: Designs structural, mechanical, electrical, and plumbing systems

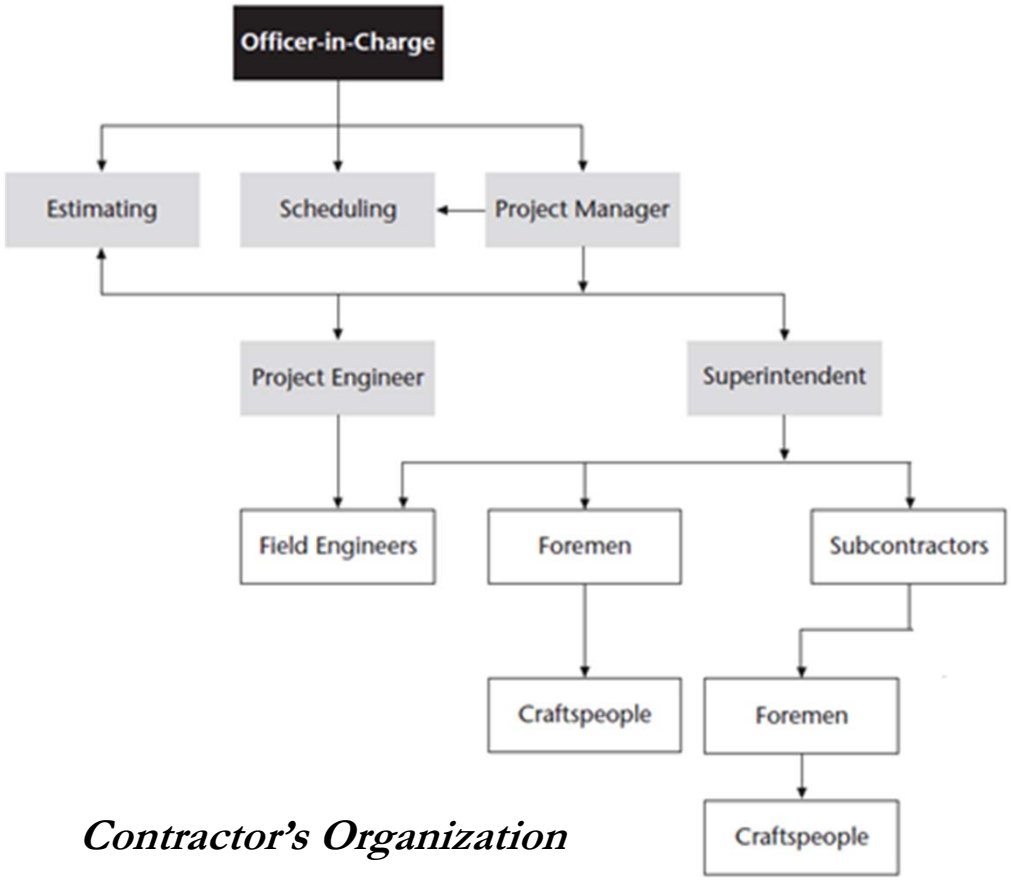


Architect's Organization

- **Principal-in-Charge:** Owner or upper-management-level person
  - Makes ultimate decisions and handles major issues
- **Project Manager:** Primary contact
  - Responsible for the project, organizes the project team
- **Project Architect**
  - Designs the project and produces construction documents
- **Contract (construction) Administrator**
  - Processes shop drawings, payments, RFI, change orders
  - Observes construction and have meetings with the contractor
- **Sub-consultants**
  - Engineering firms: Civil, environmental, structural, mechanical, or electrical
  - Interior design firms
- **Specialty coordinators**
  - Inspectors and engineers hired by sub-consultants
  - Provides services on the jobsite during the construction phase

Project Participants - Contractor

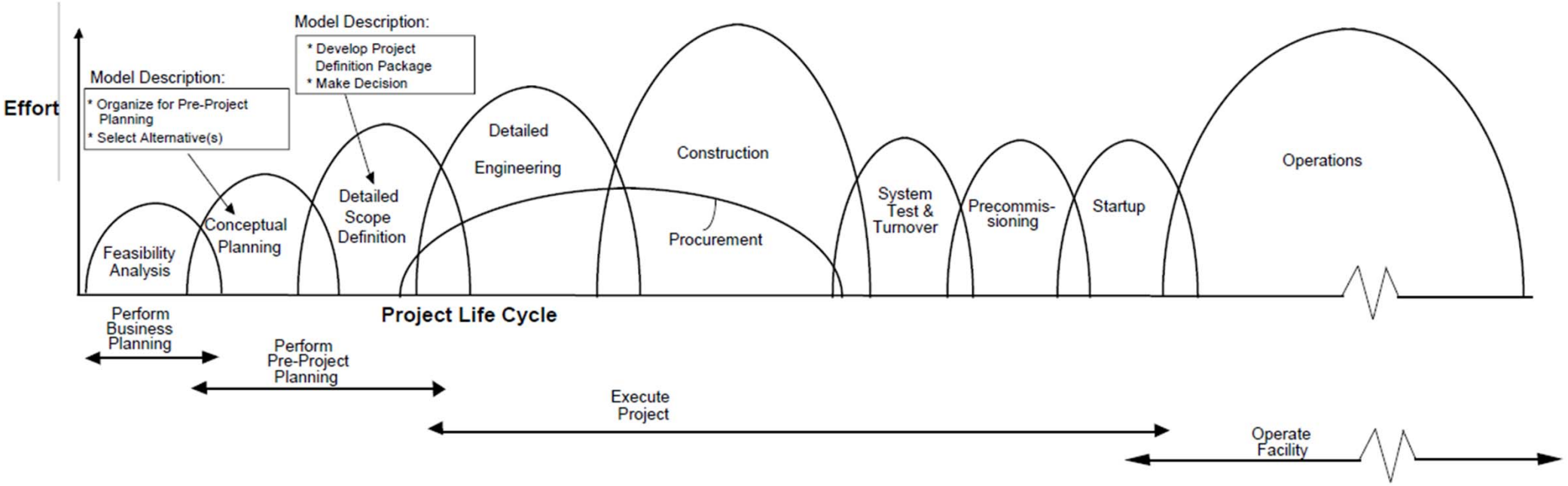
- **Role**
  - Provides the labor, material, equipment, and expertise to complete the project



Contractor's Organization

- **Office-In-Charge:** Owner or upper-management-level
  - Makes ultimate decisions and handles major issues
- **Project Manager:** Primary contact
  - Responsible for the project, organizes the project team
- **Superintendent**
  - Responsible for the project's physical construction (labor, material , equipment, safety, subcontractor, etc.)
  - Primary contact participating on a daily basis
- **Project Engineer**
  - Performs paperwork activities to keep the project going and on track for the project manager (subcontract agreements, material submittals, shop drawings, payment requests, change orders, RFI)
- **Field Engineer**
  - Lowest tier on the management side of the contractor's employee
  - Issues RFI to clarify the construction documents, order materials, review shop drawings and submittals, etc.
  - Assists the superintendent

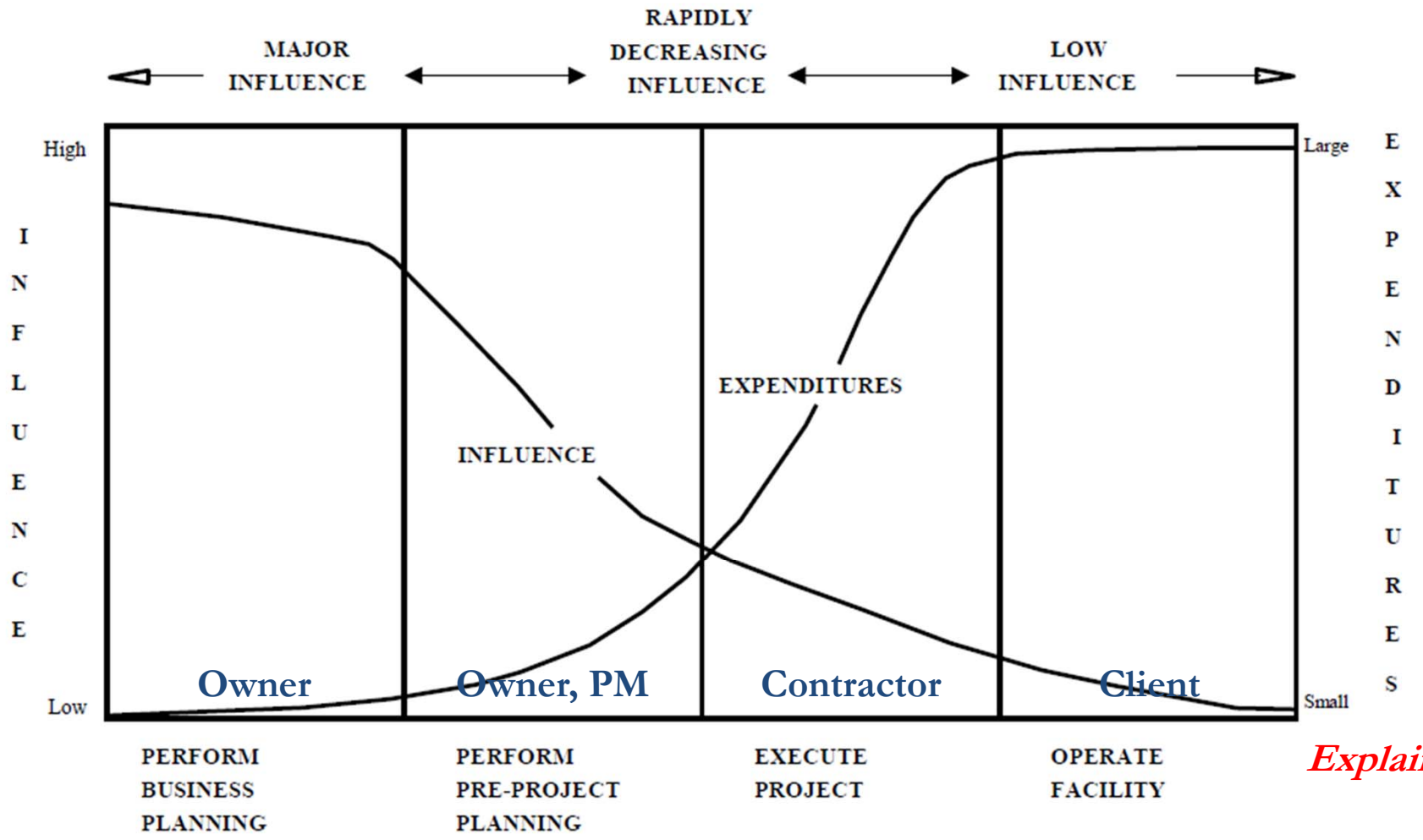
Project Lifecycle



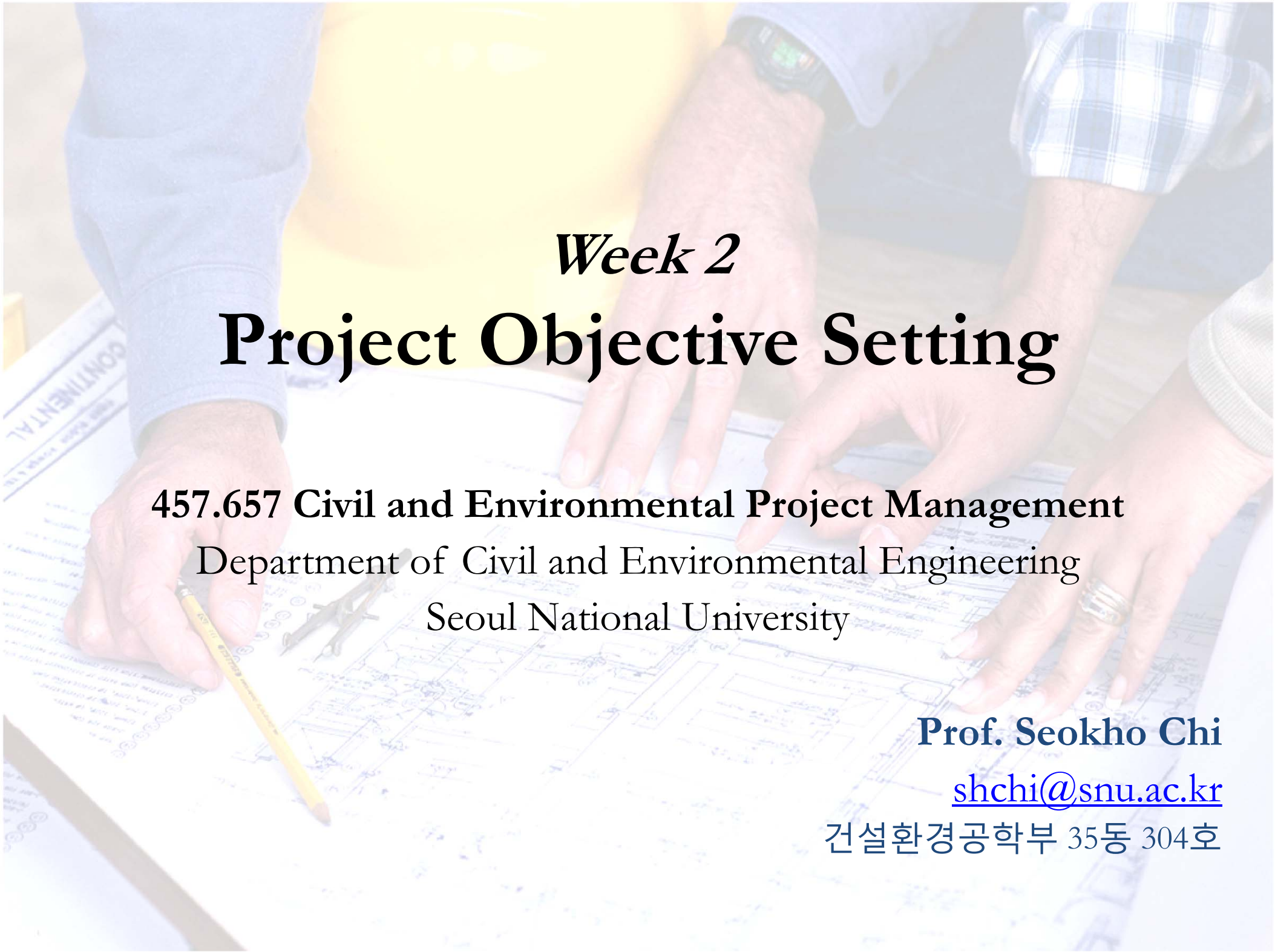
Typical Project Objectives

- Project performance (scope and reliability)
- Safety
- Cost control
- Schedule control
- Quality management
- Contract administration
- Human resource management
- Dispute minimization

Cost-Influence Diagram



"Influence" reflects a company's ability to affect the outcome of a project.
It is much easier to influence during the early project stages, when expenditures are relatively lower.



Week 2

Project Objective Setting

457.657 Civil and Environmental Project Management

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Construction Industry Teams

- Construction is a people intensive industry.
- A project team exists for most construction projects.
- Multiple and overlapping teams are common.
- Effective teams are more likely with a proactive team building process.
- Successful project outcomes are more likely when effective teams are in place.
- Costs associated with team building are very low when compared to the benefits.

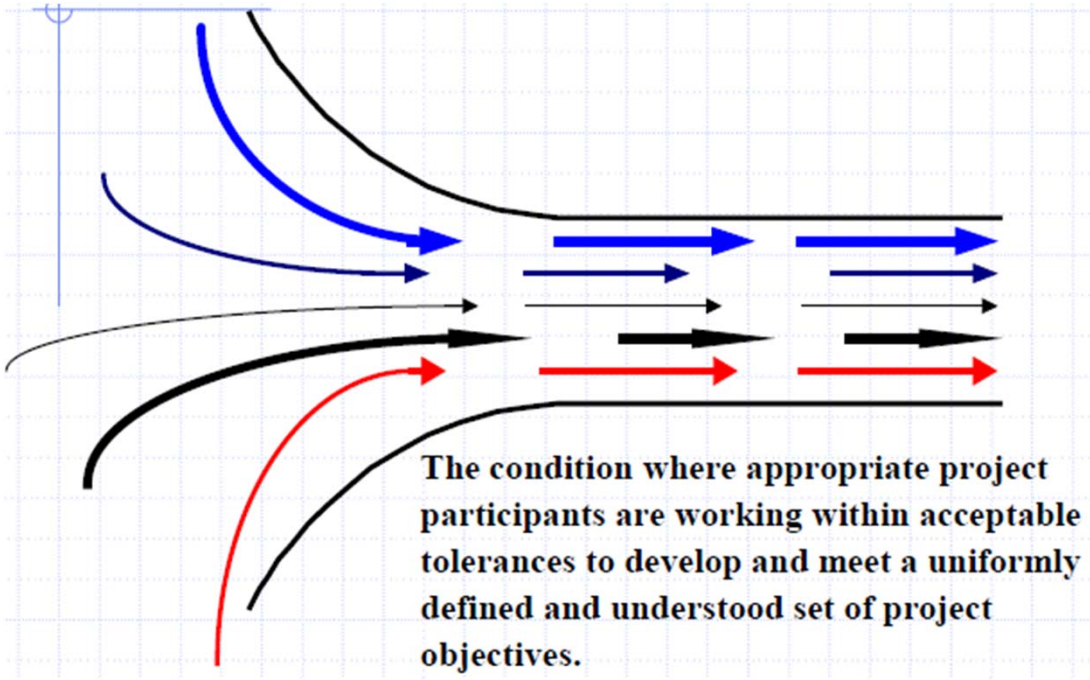
Construction Team Participants

- **Project advocates (owner representatives)**
  - Project manager
  - Contracting officer
  - Owner/client representative
- **Project delivery team**
  - Project manager
  - Contracting officer
  - Owner/client representative
  - A/E designer
  - Specialty consultant
  - Construction contractor
  - Construction manager
- **Make-up of team varies on type and size of project, owner's staffing, etc.**

Team Leader Skills & Alignment

- **Team leader skills**
  - Leadership and decision-making
  - Facilitation
  - Coordination of tasks
  - Communication
  - PM knowledge
- **Alignment**
  - Everyone moves

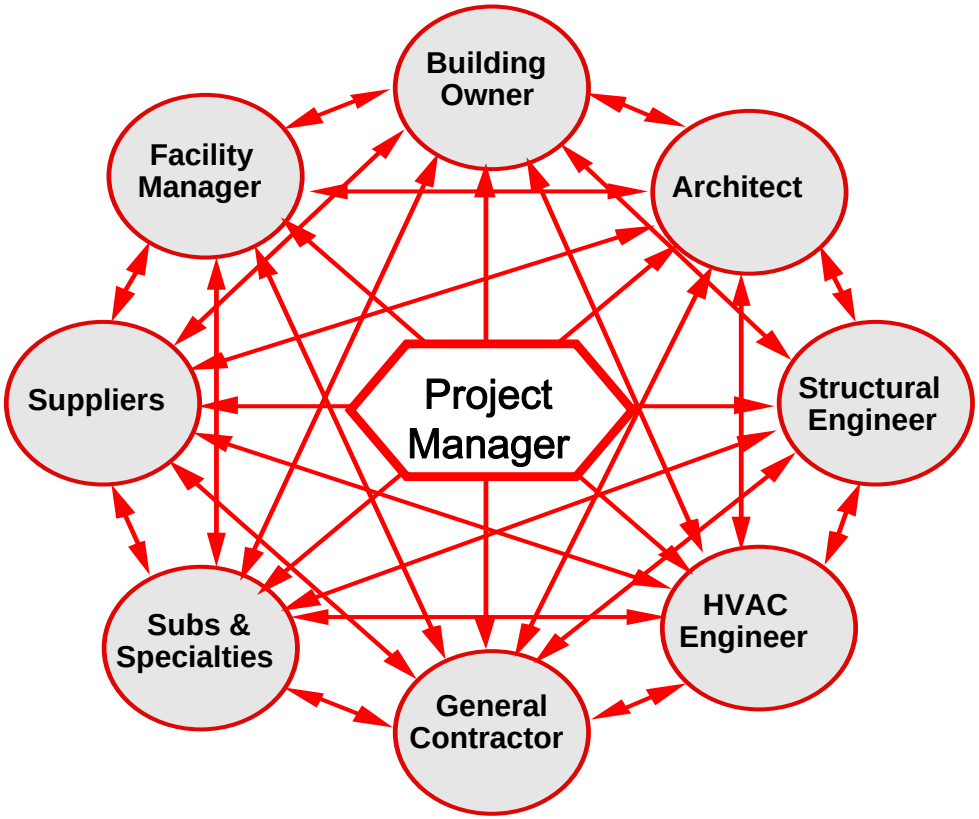
    to the same direction!



Why is Alignment Difficult to Achieve?

- Mixed stakeholders cause project complexity. (SMEs)
- Specialists tend to do their own thing.
- Decentralized decision-makers increase the need for coordination.
- Project cycle time reduction

  can put pressure on alignment.



Different Perspectives on Changes

"We commission hundreds of new build and refurbishment projects of various sizes every year. Many of them do not complete on time or within budget. As a result, we suffer significant losses in terms of both higher construction costs and delayed business opening."

<Client (Owner)>

<Project Manager>

"Many serious project delays can be traced to some seemingly insignificant delays that happened sometime ago somewhere upstream in the project delivery process."

<Contractor>

"We often have to delay the work on-site and even re-do the work because the drawings provided by the designers are either incomplete or inconsistent with the site conditions."

<Design Consultant>

"In many of our projects, we have to make late changes to the design because the client keeps changing their requirements. This results in a waste of staff time as high as 30% in a typical project."

<Source: Managing Changes in Construction Projects>

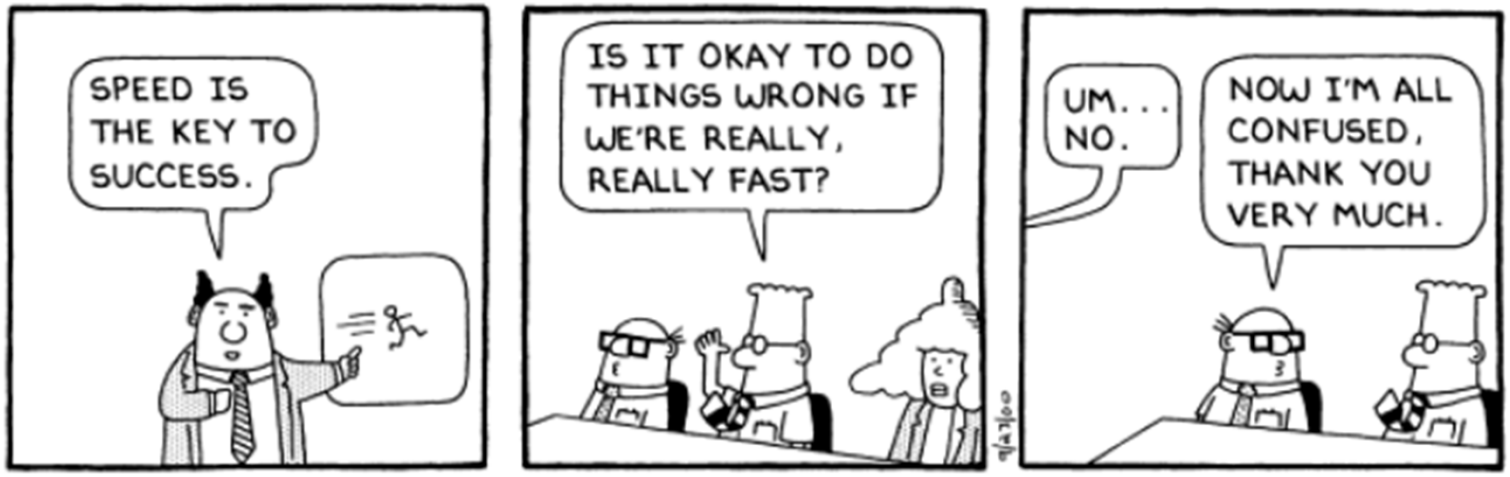
Teamwork Success Factor

- Starts with sponsor defining goals, objectives, priorities, etc.
- Proactive: process starts at project beginning and last for entire project.
- Focus on common goals and priorities
- PM is team leader.
- Effective team building process

- **Objective-setting modifies behavior in three ways**
  - Focuses attention: "should be doing"
  - Regulates energy expenditure: "don't waste time"
  - "Hard" goals increase persistence: "push yourself hard"

Problems in Objective Setting

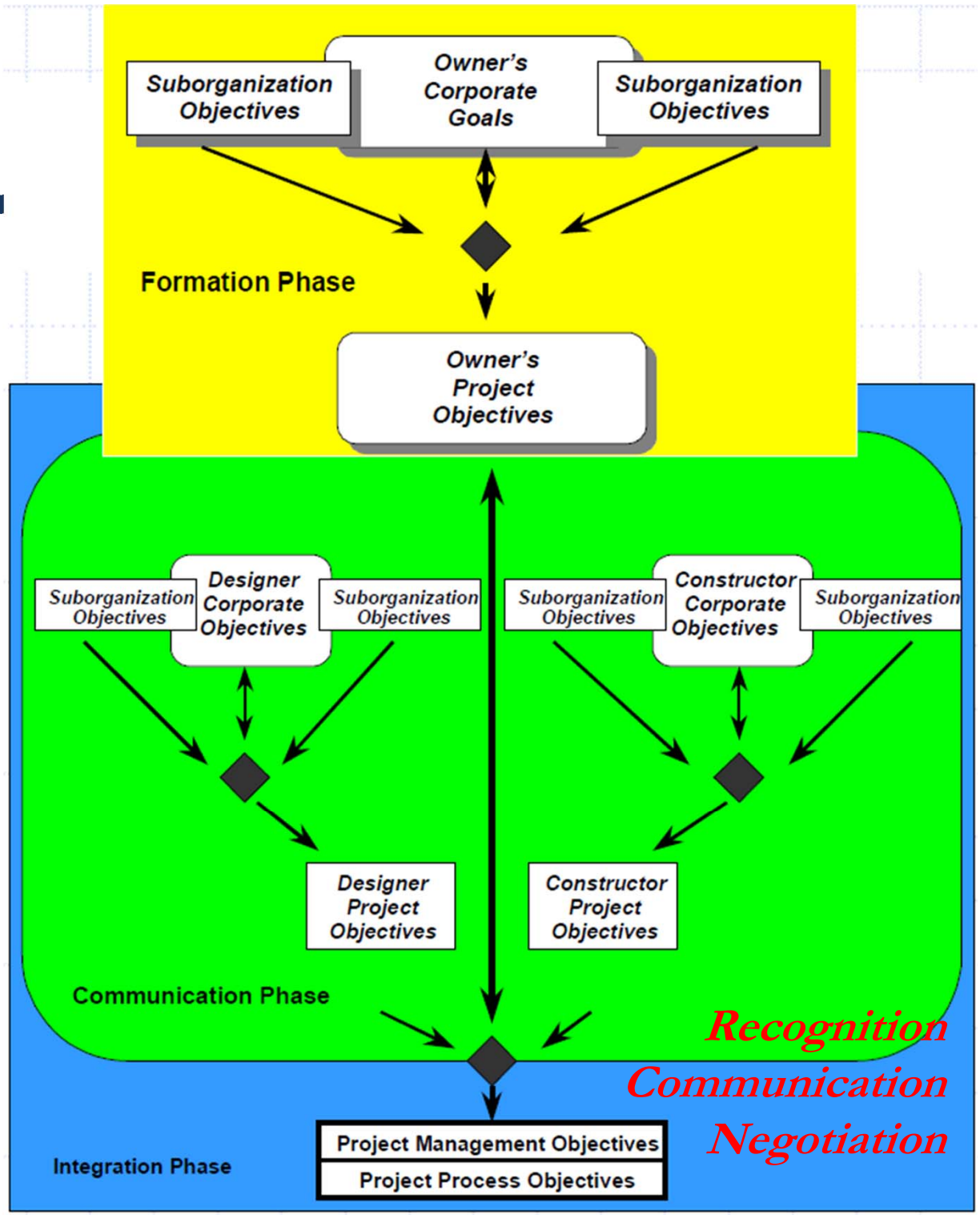
- **The Problem**
  - Different functional groups
  - Projects have complex objectives
  - Objectives often in direct conflict
  - Multiple decision makers
  - Change over time



Objective Setting

- Agreement

- **Formation Phase:** Form a single set of project objectives.
- **Communication Phase:** Disseminate directly or indirectly the developed objectives.
- **Integration Phase:** Project objectives to form an integrated project strategy.



Project Management Objectives

- Safety
- Project cost
- Project schedule
- Operational performance
- Constructed quality measures
- Facility capacity
- Maintainability targets
- Technology content
- Startup goals

Project Process Objectives (*how to behave*)

- Team behavior/code of conduct
- Project procedures
- Roles and responsibility definition
- Communication channels
- Documentation protocols
- Dispute resolution
- Quality control and testing

Checklist

- **Is the objective:**
  - Specific and identifiable?
  - Oriented toward single-ended results?
  - Set against deadlines?
  - Attainable?
  - Responsive to organizational needs?
  - Controllable?
  - Assignable to responsible parties?

Example – Project Objectives

- **Highway project**
  - Project Management
    - No lost workday accidents
    - Ahead of schedule by 5%
    - Within budget
    - No disputes
    - No rework
    - Earn $60,000 in incentives
  - Project Process
    - Open and honest, respect and trust
    - Productive meetings
    - Public relations
    - Conflict resolution process and time limits

Example – Project Objectives

- **Highway project – more specific objectives**

Objective		Goal	Stretch Goal
Safety	Recordable Incident Rate	3.8	3.0
	Lost Workday Case Incident Rate	2.0	1.5
Schedule	Intermediate Startup Schedules	Meet all dates	Ahead of schedule
	Startup All Systems	8/01/2013	7/15/2013
Quality	% Rework (Welder Repair Rate)	< 6% of direct work hours	< 5% of direct work hours
Cost	Total Cost	Meet business plan	10% saving
	Contingency Returned to Client	$6.5 million remaining	$7.5 million remaining

**RIR: Number of Claim / Number of Workers *1,000 (accidents per 1,000 workers)*

**LWCIR: Number of lost workday cases * 200,000 / total hours worked (accidents per hours)*

Alignment Checking

- **The Alignment Thermometer**

1: Strongly Disagree
5: Strongly Agree

Project Name:	LEVEL OF AGREEMENT					
ALIGNMENT ISSUES	1	2	3	4	5	SCORE
1. Stakeholders are appropriately represented on the Project Team.	0	3	5	8	10	
2. Project leadership is defined, effective, and accountable.	0	3	5	8	10	
3. The priority between cost, schedule and required project features is clear.	0	3	5	8	10	
4. Communication within the team and with stakeholders is open and effective.	0	3	5	8	10	
5. Team meetings are timely and productive.	0	3	5	8	10	
6. Our team culture fosters trust, honesty, and shared values.	0	3	5	8	10	
7. The PPP process includes sufficient funding, schedule and scope to meet our objectives.	0	3	5	8	10	
8. Reward and recognition systems promote meeting project objectives.	0	3	5	8	10	
9. Teamwork and team building programs are effective	0	3	5	8	10	
10. Planning tools (e.g., checklists, simulations and work flow diagrams) are effectively used.	0	3	5	8	10	
TOTAL SCORE						

Alignment Checking

- Step 1

Project Name: Project 1	LEVEL OF AGREEMENT					
ALIGNMENT ISSUES	1	2	3	4	5	SCORE
1. Stakeholders are appropriately represented on the Project Team	0	3	5	(8)	10	**8**
2. Project leadership is defined, effective, and accountable.	0	3	(5)	8	10	**5**
3. The priority between cost, schedule and required project features is clear.	0	3	(5)	8	10	**5**
4. Communication within the team and with stakeholders is open and effective	0	3	(5)	8	10	**5**
5. Team meetings are timely and productive.	0	3	5	8	(10)	**10**
6. Our team culture fosters trust, honesty, and shared values	0	3	5	(8)	10	**8**
7. The PPP process includes sufficient funding, schedule, and scope to meet our objectives.	0	3	(5)	8	10	**5**
8. Reward and recognition systems promote meeting project objectives.	0	(3)	5	8	10	**3**
9. Teamwork and team building programs are effective.	0	3	5	(8)	10	**8**
10. Planning tools (e.g. checklists, simulations and work flow diagrams) are effectively used.	0	3	5	8	(10)	**10**
TOTAL SCORE						67

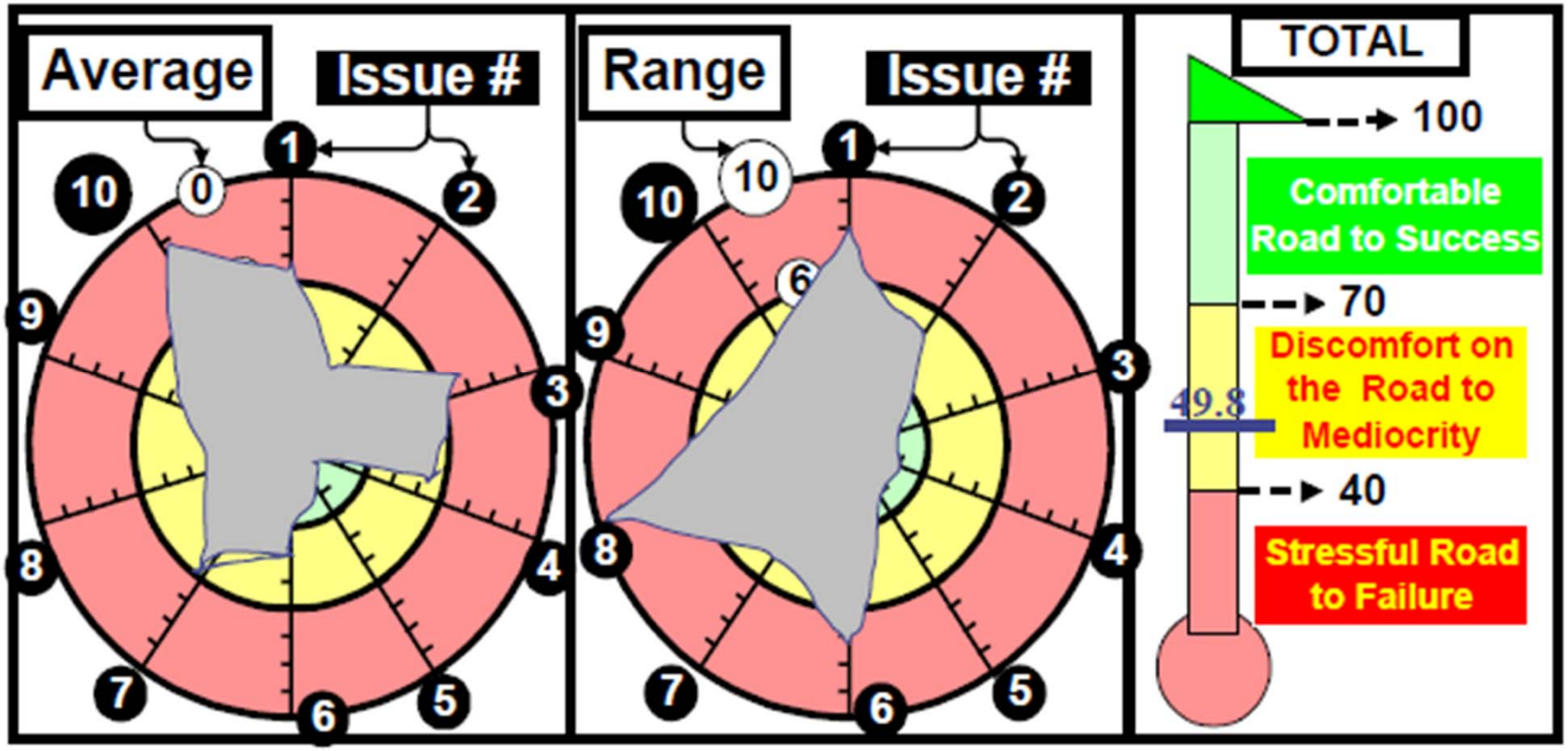
Alignment Checking

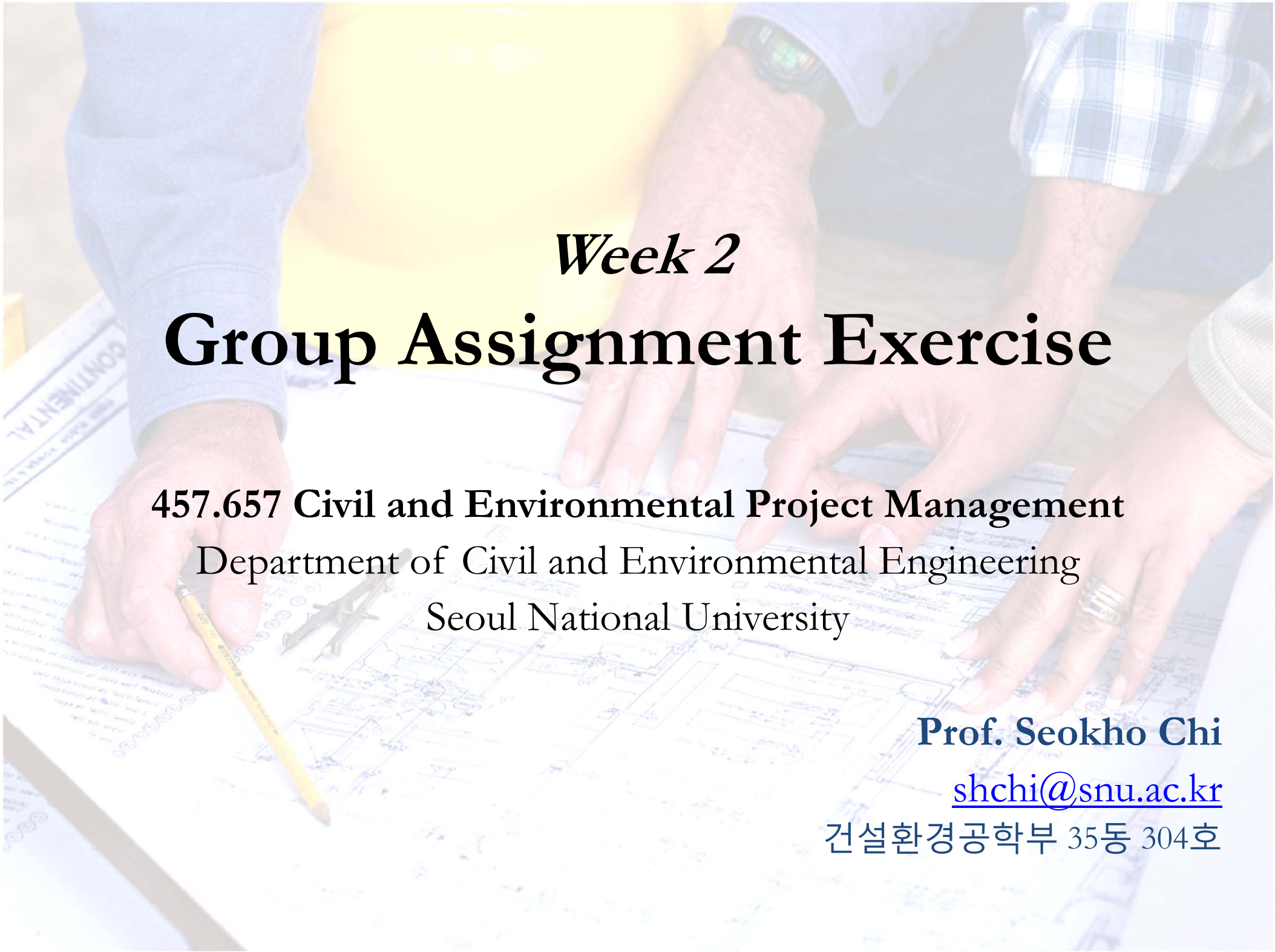
- Step 2

TEAM SCORE	Respondent									
Issue	1	2	3	4	5	6	7	Calculated Average	Calculated Range	Range/ Average
1	3	5	8	3	5	0		24/6 = 4.0	8	2.0
2	8	8	8	5	10	8		47/6 = 7.8	5	0.6
3	3	3	3	5	3	3		20/6 = 3.3	2	0.6
4	5	5	3	5	5	3		26/6 = 4.3	2	0.5
5	8	8	8	10	8	8		50/6 = 8.3	2	0.2
6	3	3	5	8	10	3		32/6 = 5.3	7	1.3
7	0	3	3	5	3	5		19/6 = 3.2	5	1.6
8	0	8	8	10	5	8		39/6 = 6.5	10	1.5
9	3	5	8	8	5	3		32/6 = 5.3	5	0.9
10	0	0	3	0	5	3		11/6 = 1.8	5	2.7
						TOTAL		49.8		

Alignment Checking

- Step 3





Week 2

Group Assignment Exercise

457.657 Civil and Environmental Project Management

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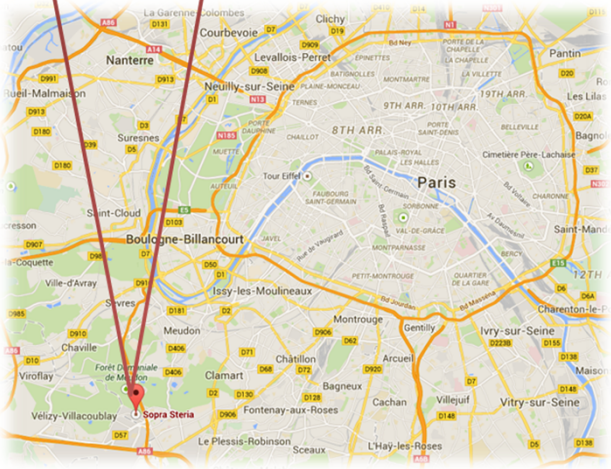
Group Assignment Exercise

- **Form a group of 2-3 students**
- **Select a team name and logo**
- **Agree to team assignments**
  - Group leader
  - Facilitator
  - Recorder
  - Others

Group Assignment Exercise

- **Project Scope Overview**



- World's first large scale **positive-energy** office building
- High Comfort & High Environmental Quality
- Overview of the **future of construction**
- 23,300sq.m.
- 1,500 persons
- 100,000,000€ Initial Budget
- March 2015 - March 2018

This is an example only. Your group project and reports should discuss more detailed information thoroughly!

Group Assignment Exercise

- **Project Management Objectives**

Major Issues	Project Management Objectives
Positive-energy	• Net-zero energy after construction completed • Passive and renewable energy technologies integration
Comfort-oriented design	• High comfort offices • No rework
Others	• Completed within schedule • Within budget • No lost workday accident • No disputes

Group Assignment Exercise

- **Specific Project Management Objectives**

Objectives		Goal	Stretch Goal
Quality	High comfort perceived	90% satisfaction	95%
	Noise insulation	55dB	40dB
	Net-zero energy	0kWh/sq.m./year	-10kWh/sq.m./year
	Passive ventilation	Less cooling	No air conditioner
	Passive design	Basic operating needs of 45kWh/sq.m./year	25kWh/sq.m./year
	Photovoltaic panels	62kWh/sq.m./year	64kW/sq.m./year
	Technology integration	Biomass CHP, EMS, Velum	
Cost	Total cost	Meet project budget	5% saving
	Operation cost	Near zero	Earning money
Time	Meet schedule	Completed within 3 years	10% time saving
	No rework	Less than 5% rework	No rework
Safety	Safe working condition	No lost workday accident	90% worker satisfaction

What about high-rise building projects in the city?

Group Assignment Exercise

- **Project Process Objectives**
  - General processes to support achieving project management objectives

Major Issues	Project Process Objectives
Integrated Team	• Open and honest, respect and trust • Regular meeting and open communication channels • BIM-based design process
Environmental Dispute Resolution	• Multiple certification • Communicate to NGO
Public Communication	• Transparency and openness to public opinion • Regular publication on project advancement

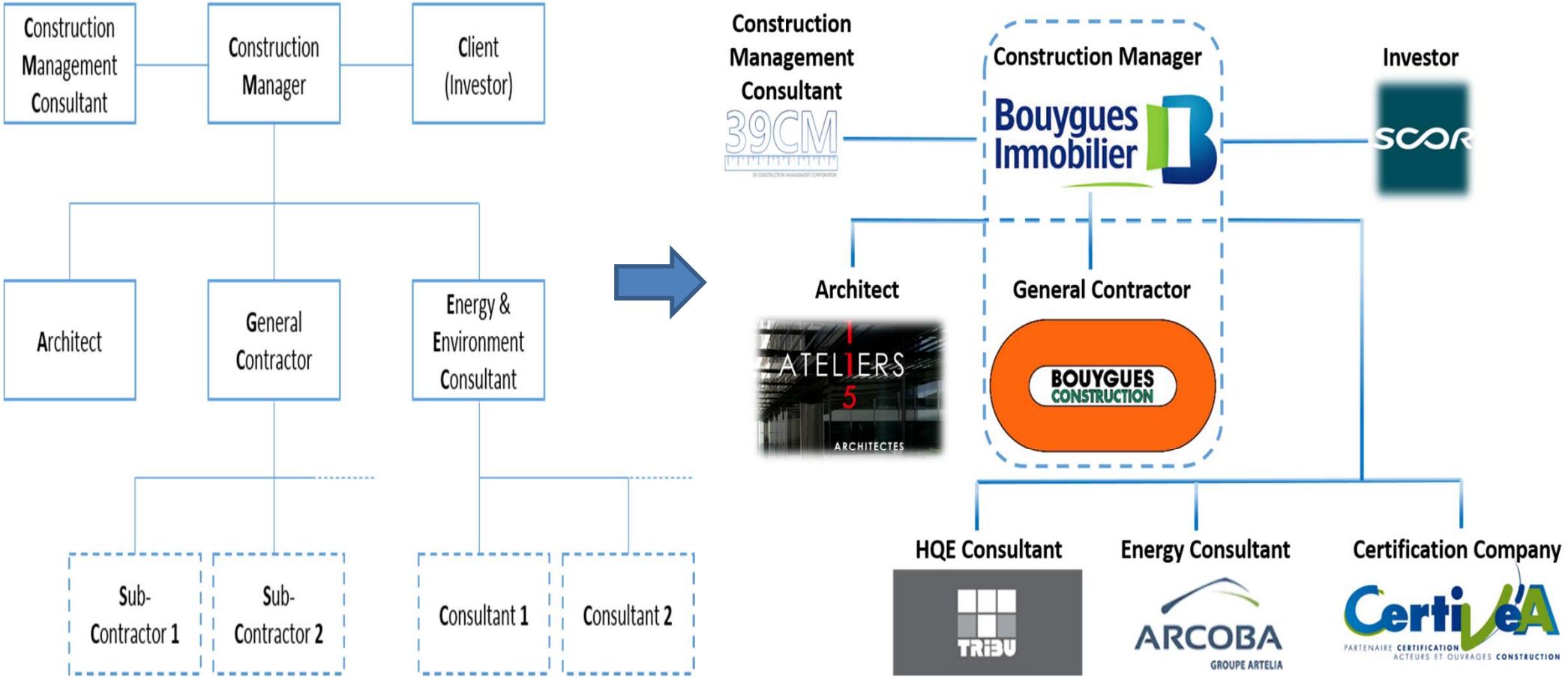
Group Assignment Exercise

- **Specific Project Process Objectives**

Objective		Goal	Stretch Goal
Integrated Team	Respect & trust	90% team members satisfied	95%
	Open	Daily meetings and feedback 60% documents open to everyone	 80%
	BIM integration	75% documents produced through BIM	90%
Environment	Certifications	1 certification	3 certifications
	NGOs	Monthly communication to NGOs	Bi-weekly
Public Communication	Open to public	Respond to public opinions	
	Advertisement	Monthly publication on project advancement	Bi-weekly

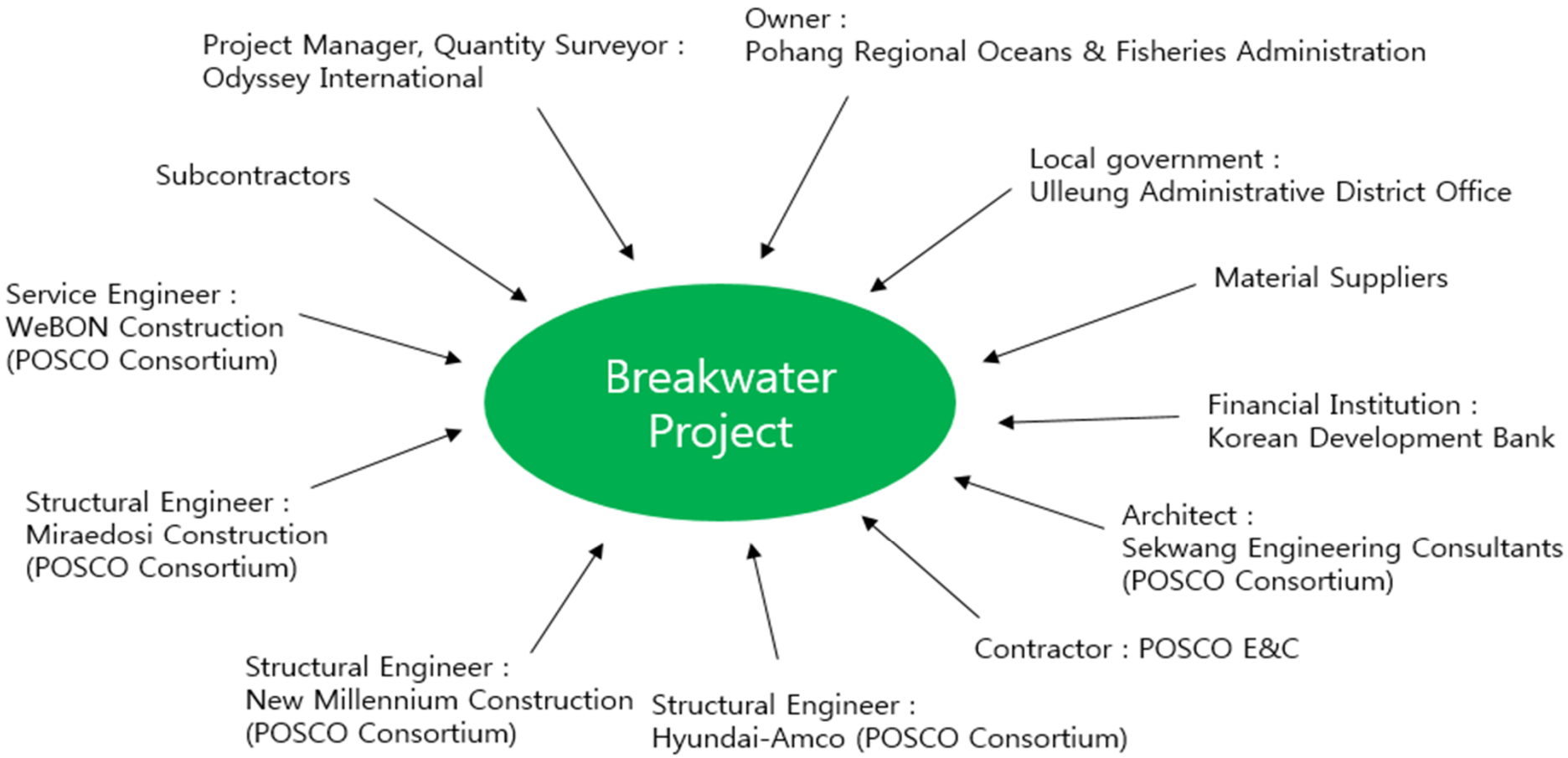
Group Assignment Exercise

- **Delivery and Contract Methods → Stakeholders**



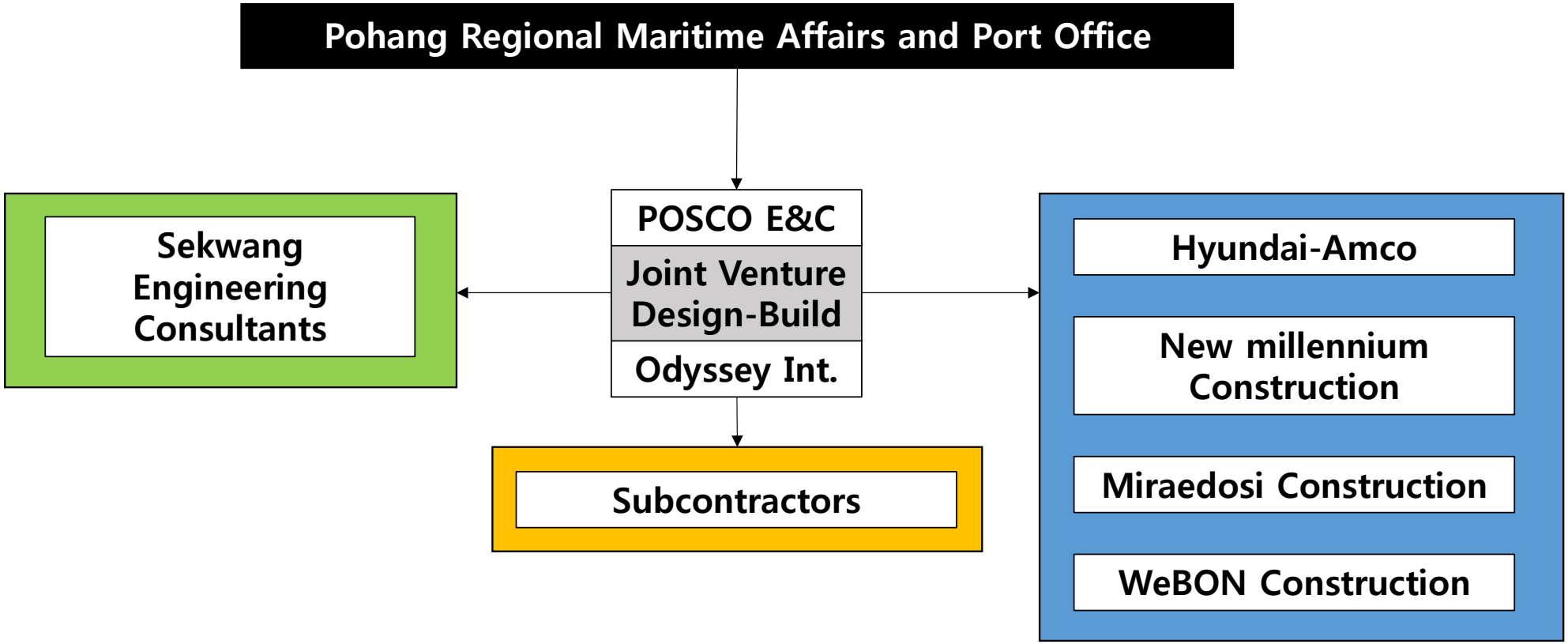
Group Assignment Exercise

- **Major Key Stakeholders (Ulleungdo Breakwater Project)**



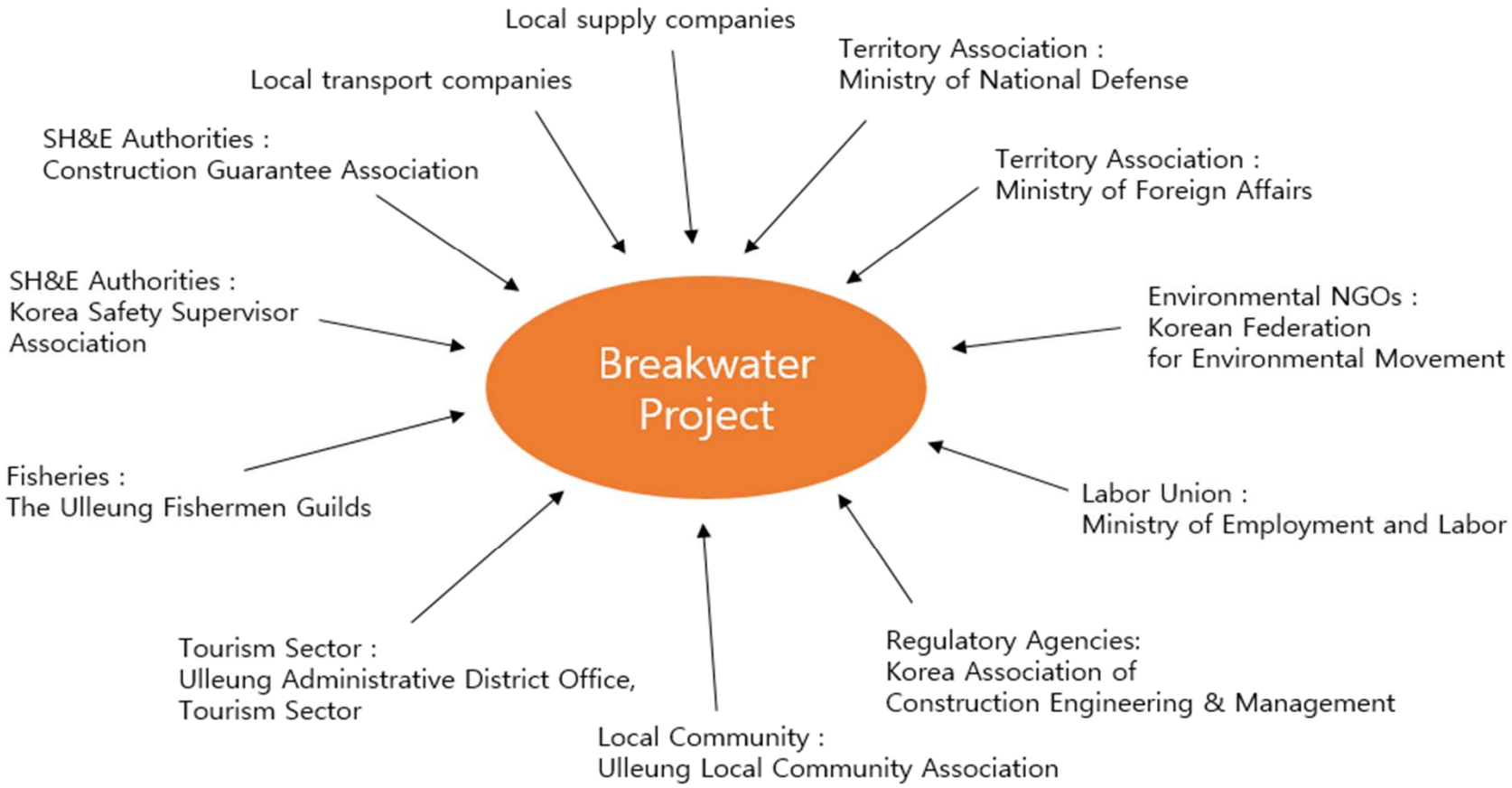
Group Assignment Exercise

- **Major Key Stakeholders (Ulleungdo Breakwater Project)**



Group Assignment Exercise

- **Other Stakeholders (Ulleungdo Breakwater Project)**



What about high-rise building projects in the city?