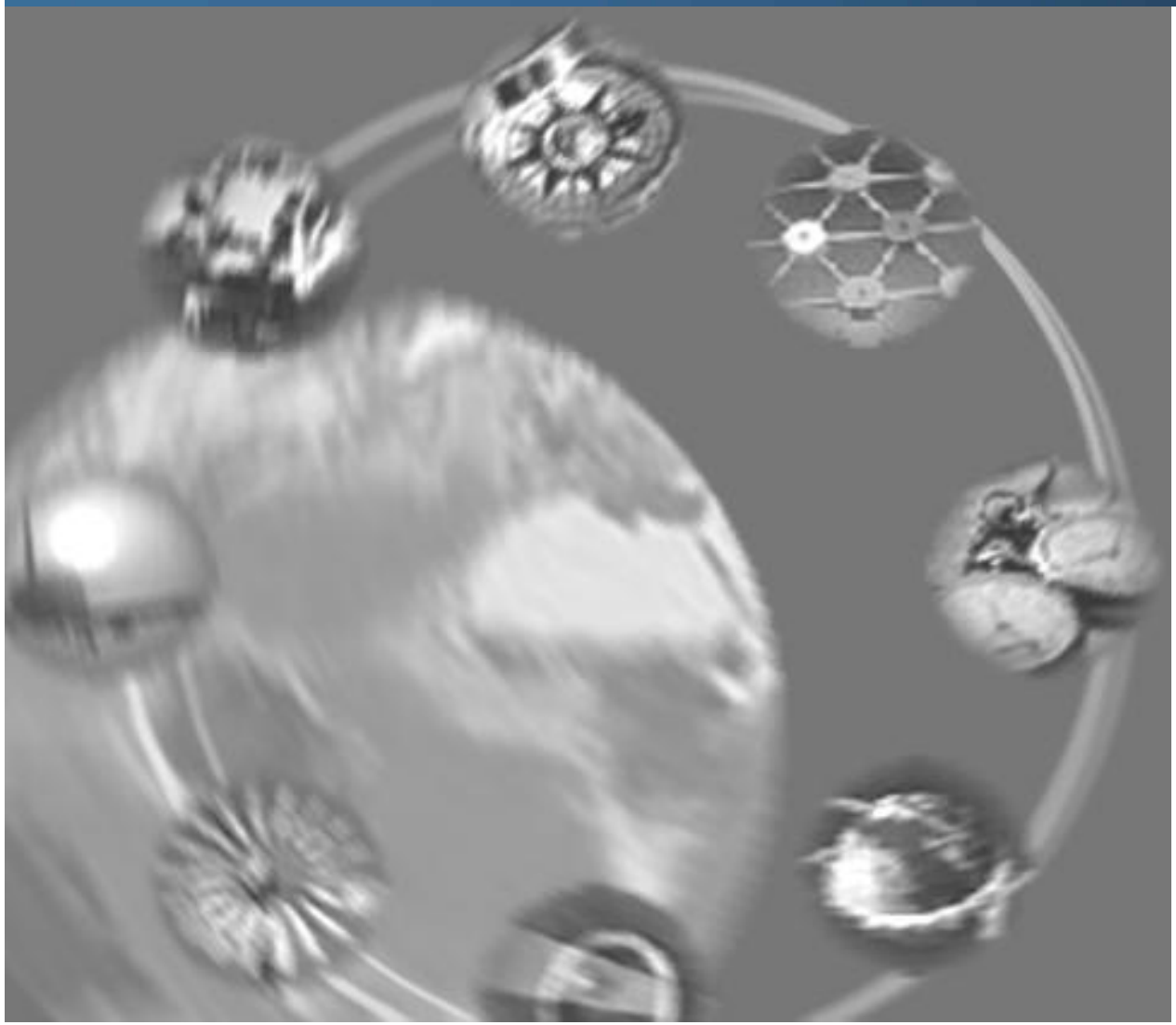
Project Delivery Systems

Delivery Organizations, Functional/Contractual Relationships

401.649 Cost Planning for Construction Projects

Mar. 11th, 2009



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Back to the SNU campus expansion pj…

The campus expansion program board has recently decided to award a Design Build contract for the IT research center project to ‘X’ construction company, hoping to deliver the project in time and within their budget.

Since ‘X’ company does not have an in-house design team to carry out such a mega project they hired ‘Y’ design company, which is renowned in the local area.

As project manager …

Please find potential problems that might be caused by functional and contractual relationships among the project organizations.

Project Description: a new IT research center near the College of Engineering (37동) to be built with a budget of U$ 100 M. The research center will consist of multiple intelligent buildings equipped with many high-tech facilities.

Lecture Outline

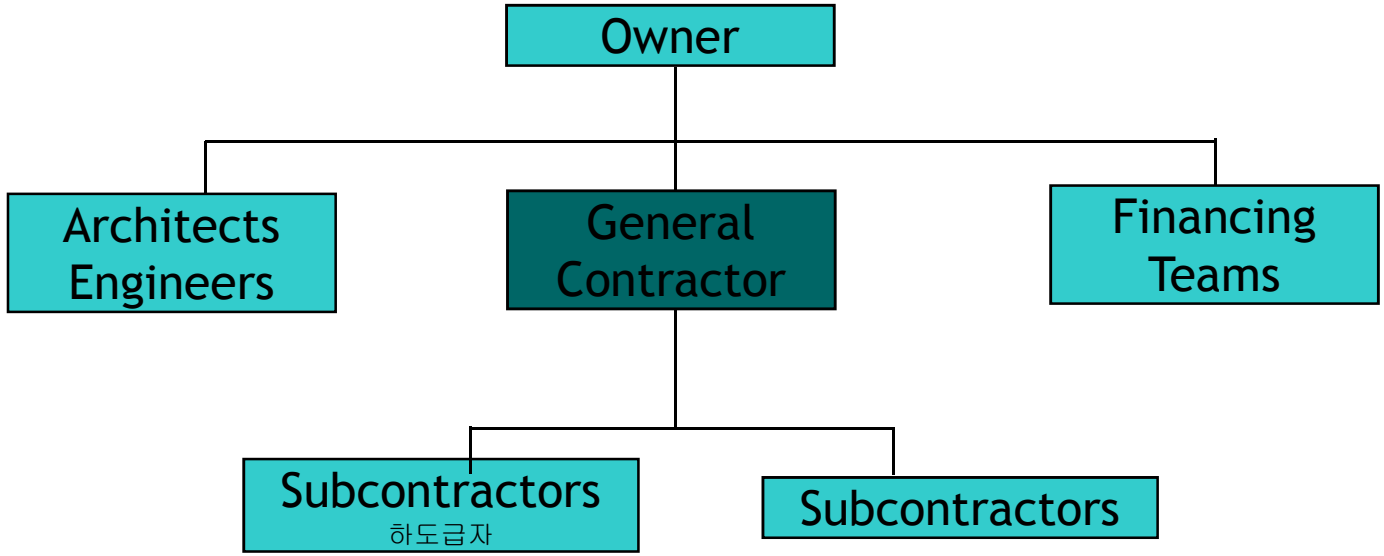
- ✓ Implications of Functional/Contractual Relationships
- Delivery Organizations
- Potential Benefits of Choosing an Appropriate Delivery Systems
- Case Project

PJ Delivery Methods/ Organizations

(사업수행 방식/주체에 따른 분류)

- General Contractor (GC 일식도급/일반건설업체)
- Construction Manager (CM 건설사업관리방식/건설사업관리자)
- Multiple Primes (분할도급)
- Design-Build (DB 설계시공일괄도급)
- Turnkey
- Build-Operate-Transfer (BOT)

General Contractor *DBB (Design- Bid -Build)*

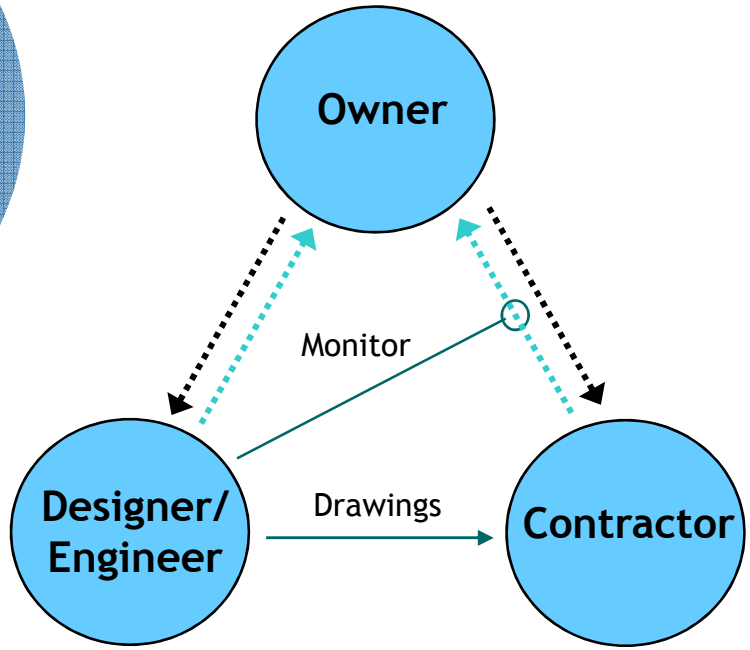


A single business entity acting as the contractor in complete and sole charge of the field operations (Clough 1981).

Cats & Dogs Analysis

- The owner wants a project to be delivered with quality, in time, and within budget.
- Meanwhile, project functions pursuit profits from the project, while providing quality service in time.
- Then, given contractual and functional relationships, who would be cats and dogs, and
- What are potential problems that would be caused by contractual and functional relationships?

Cats & Dogs



*** Contractual Relation**

Money

Service (with quality & in time)

*** Functional Relation**

- What if the designer provides low buildability design?
- What if the designer is too strict during monitoring the construction process?
- Who would be cats and dogs? And what would be potential problems?

General Contractor: Fixed Price

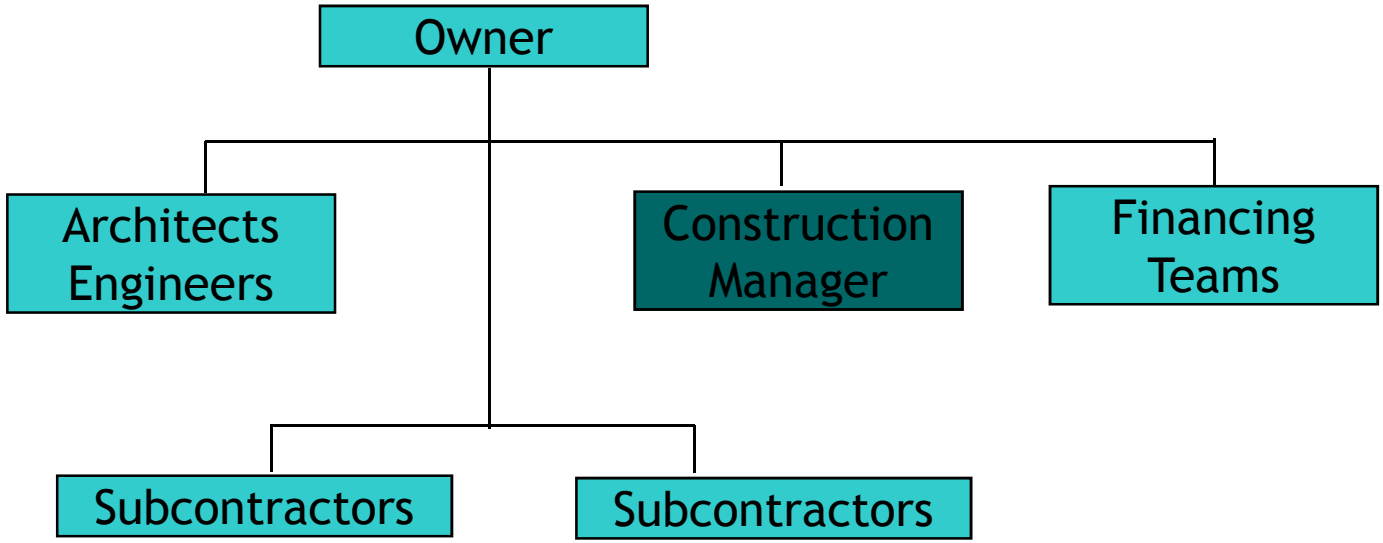
Advantages
• Selection of wide range of design professionals
• Having the design professional monitor construction with the owner
• Exploring design alternatives and making changes during design phase
• Total cost known at the start of construction
• Total site construction responsibility delegated to one entity
Disadvantages
• Depriving the owner of contractor's planning knowledge
• Possibly creating an adversarial relationships among parties
• Making design changes during construction expensive and difficult
• Linear nature of waiting to start construction
• having no share in any savings the contractor may find during construction

General Contractor: Reimbursable Price

* Only those different from GC working for a fixed price are listed below;

Advantages
• Not necessarily having design documents complete before awarding a contract, which allows the contractor to be involved in pre-construction planning and the use of fast-tracking
• Easy changes, provided that the portion of the work has not been awarded to a subcontractor
Disadvantages
• Less price accountability and possibly less efficiency, since the contractor has no motivation to limit costs
• Total construction cost not known until the end

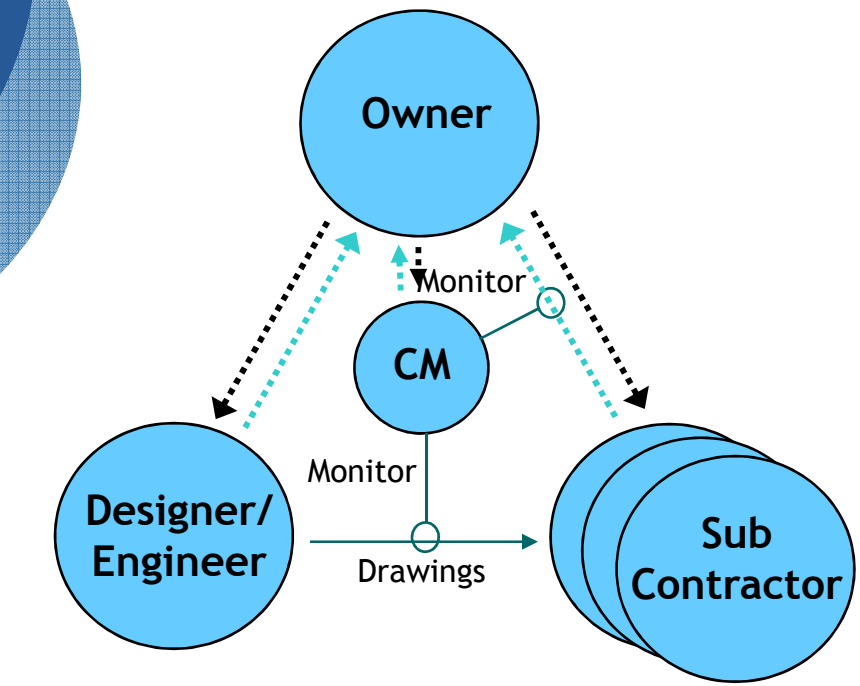
Construction Manager



A single business entity acting as a construction consultant to the owner, either for a fixed fee or a fee as a percentage of the cost (Christopher, 1998) → CM for Fee (Agency CM)

*cf. CM at Risk (Constructor CM, CM/GC, Construction Manager as Constructor: CMc)

Cats & Dogs



*** Contractual Relation**

Money

Service (with quality & in time)

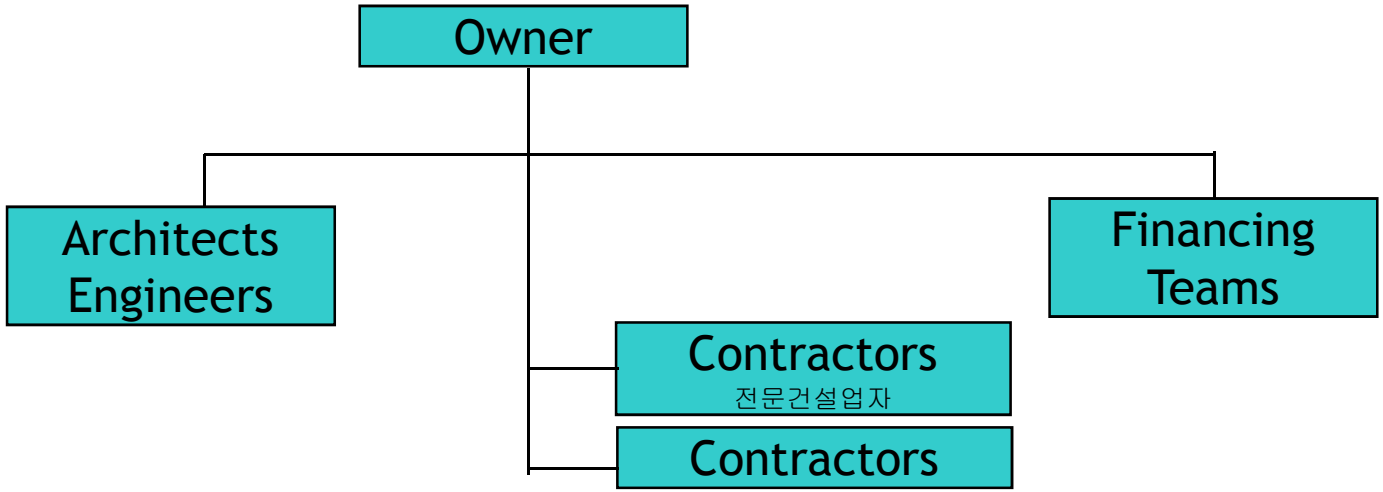
*** Functional Relation**

- What if the designer provides low buildability design?
- For what kind of owners can CM be the most effective way?
- What if an unqualified CM is hired?
- Who would be cats and dogs? And what would be potential problems?

Construction Manager

Advantages
• Allowing fast-tracking, since the individual contracts can be awarded as soon as the design documents are complete
• Increasing flexibility for changes
• Reducing the potential for adversarial relationship among parties
• CM involved in pre-construction phases such as estimating, scheduling, value engineering, and labor issues
• Allowing the owner to directly access to material and sub-contractor markets, which can realize savings from bid packaging and contract types (portfolio effect by reducing owners dependence on one large contractor)
Disadvantages
• Total costs and schedule normally not known nor guaranteed at the start of construction
• Hiring an unqualified CM can result in chaos

Multiple Primes (Contractors)

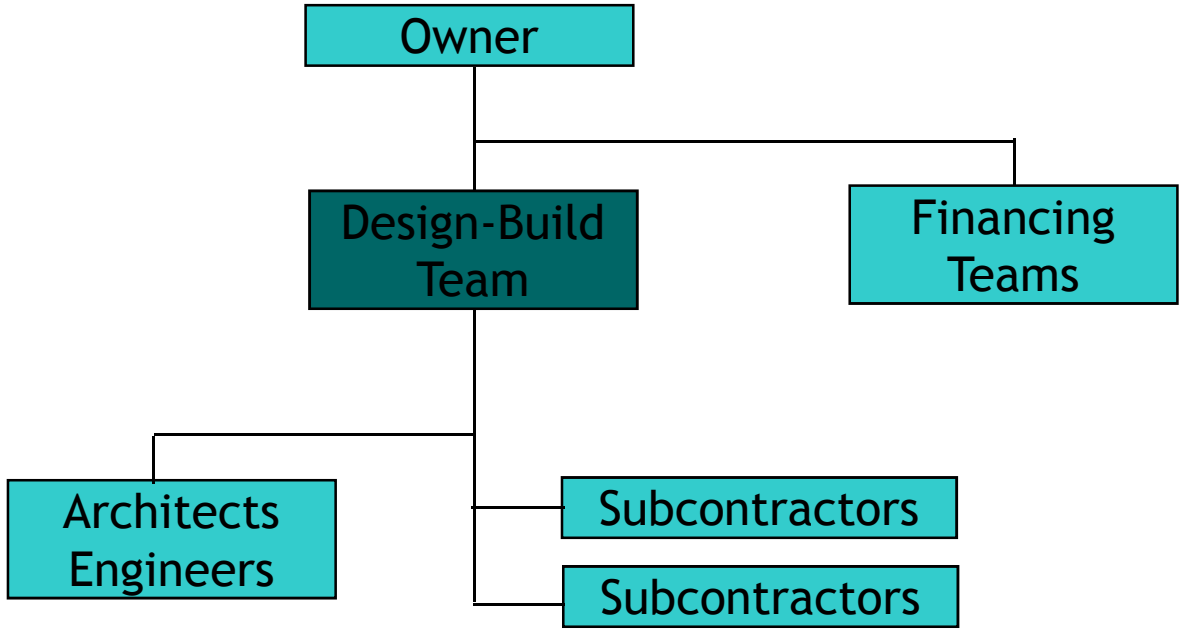


The owner is responsible for overall project management and coordination. More than one contractor hold contracts directly with the owner to perform specific parts of the same project.

Multiple Primes

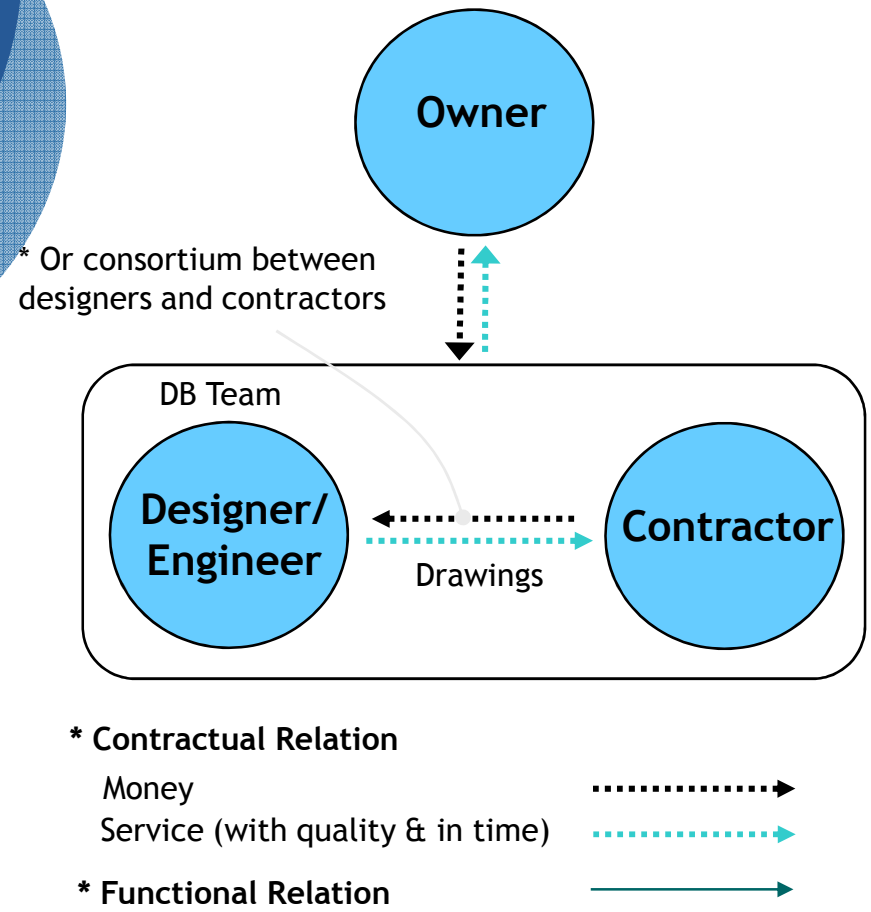
Advantages
• Allowing fast-tracking, since the individual contracts can be awarded as soon as the design documents are complete
• Increasing flexibility for changes
• Allowing the owner to directly access to material and sub-contractor markets, which can realize savings from bid packaging and contract types (portfolio effect by reducing owners dependence on one large contractor)
Disadvantages
• Total costs and schedule normally not known nor guaranteed at the start of construction
• Requiring owners' knowledge on construction and heavy involvement
• Having no pre-construction services from a contractor

Design-Build



A single business entity that performs both the design and construction of a project. The team can be one company or a partnership of firms (Christopher, 1998).

Cats & Dogs



- Can it be a productive way in terms of time?
- If the DB team provides low quality design, who will monitor?
- What if the designer provides low buildability design?
- Who might be cats and dogs? And what would be potential problems?

Design-Build: Fixed Price

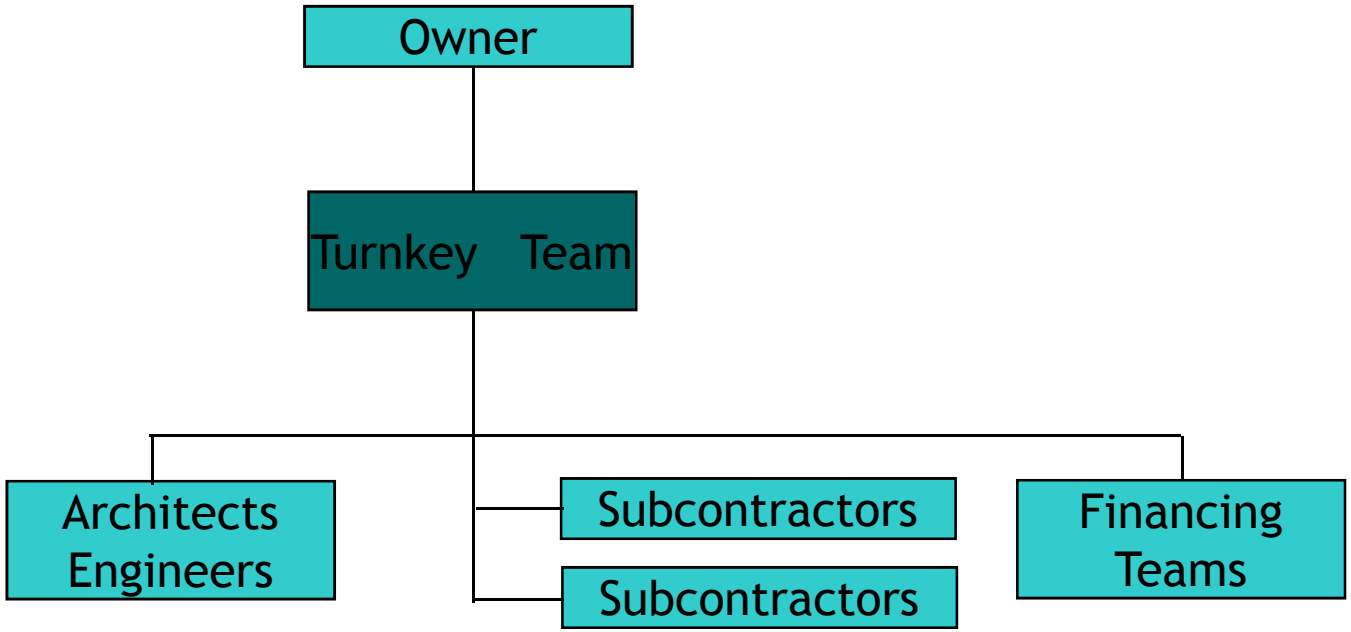
Advantages
• Total cost known before the start of design and construction
• Enhanced teamwork between the designer and contractor
• The owner has no liability for change orders
• Allowing fast-tracking
• Total design and construction responsibility delegated to one entity
• No needs for a separated selection process for the designer and contractor
Disadvantages
• Making design changes often expensive and difficult for the owner
• Reduced flexibility in and control over the detailed design process
• Requiring owners' knowledge to establish the initial parameters and monitor the process
• Entirely dependent on one entity: low design quality
• having no share in any savings the contractor may find during construction

Design-Build: Reimbursable Price

* Only those different from DB working for a fixed price are listed below;

Advantages
• **Expecting a high quality work, since design-build team selection is made only on qualifications**
• **Easy changes, provided that the portion of the work has not been awarded to a subcontractor**
Disadvantages
• **Less price accountability and possibly less efficiency, since the contractor has no motivation to limit costs**
• **Total construction cost not known until the end**

Turnkey



DB+Financing, A single business entity that performs the design, construction and financing of a project. The project is turned over to the owner, when construction is complete (Christopher, 1998).

Turnkey: Fixed Price

Advantages
• Total cost known before the start of design and construction
• Enhanced teamwork between the designer and contractor
• The owner has no liability for change orders
• Allowing fast-tracking
• No needs for a separated selection process for the designer and contractor
•Total design, construction, short-term financing and responsibility delegated to one entity
• Maximizing the project value by the use of a cap, since the turnkey team carries the financing costs as well

Turnkey: Fixed Price

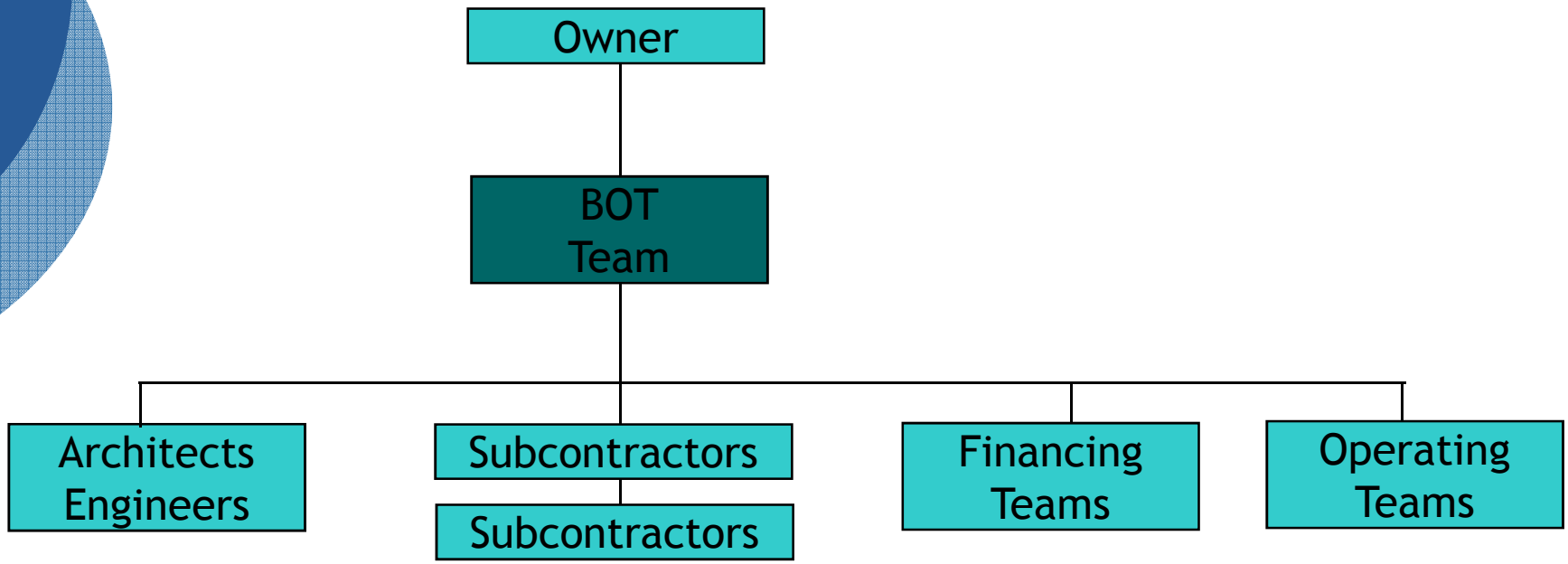
Disadvantages
• Making design changes often expensive and difficult for the owner
• Reduced flexibility in and control over the detailed design process
• Requiring owners' knowledge to establish the initial parameters and monitor the process
• Entirely dependent on one entity
• having no share in any savings the contractor may find during construction

Turnkey: Reimbursable Price

* Only those different from Turnkey working for a fixed price are listed below;

Advantages
• **Expecting a high quality work, since design-build team selection is made only on qualifications**
• **Eliminate the lengthy proposal process**
• **Easy changes, provided that the portion of the work has not been awarded to a subcontractor**
Disadvantages
• **Less price accountability and possibly less efficiency, since the contractor has no motivation to limit costs**
• **Total construction cost not known until the end**

Build-Operate-Transfer



Turnkey+Operation, A single business entity that performs the design, construction, financing and temporary operation of a project. The project is turned over to the owner at the end of the operation period (Christopher, 1998).

Build-Operate-Transfer

Advantages
• Total cost and financial arrangement known before the start of design and construction
• Enhanced teamwork between the designer, contractor and operator
• The owner has no liability for change orders
• Allowing fast-tracking
• Total design, construction, financing, and operation responsibility delegated to one entity
• No needs for a separated selection process for the designer, contractor, and operator, and financial arrangement
• Potentially introducing new technologies and management techniques

Build-Operate-Transfer

Disadvantages
• Making design changes often difficult for the owner
• Reduced flexibility in and control over the detailed design process
• Requiring owners' knowledge to establish the initial parameters and monitor the process
• Entirely dependent on one entity

Lecture Outline

- ✓ Implications of Functional/Contractual Relationships
- ✓ Delivery Organizations
- Potential Benefits of Choosing an Appropriate Delivery System
- Case Project

Potential Benefits of Alternative Delivery Systems

- Shorten the project duration by increasing concurrency or eliminating bidding time.
- Provide flexibility for changes during construction.
- Create more designer-contractor teamwork by reducing adversarial relationships.

- Allow a contractor to participate in the design process for such tasks as value engineering, constructability analysis, and cost estimating.
- Provide incentives for the contractor, which also can save the owner money.
- Provide alternative financing methods.

Lecture Outline

- ✓ Implications of Functional/Contractual Relationships
- ✓ Delivery Organizations
- ✓ Potential Benefits of Choosing a Appropriate Delivery Systems
- ▪ Case Project

In Warsaw, Poland, in 1996…

Market Situation

- Privatization actively undergoing
- Steep increases in office rent in Warsaw expected within a few years
- A lot of office buildings already being developed by western construction companies (mostly the US and German companies)
- Land acquisition cost still cheap
- Shortage in local subcontractors and labor market

Warsaw Trade Tower

- Developer: D Corporation
- Building Type: Business Center (42 floors)
- Budget: U$120 M
- Construction Period:36 Months (Planned)
- Delivery Method: Fast-tracking, Construction Management

Names and numbers have been edited for developer's confidentiality and educational purpose

Project Chronicle

- Land purchase in Jan, 1996
- Mobilizing a site office in Feb, 1996
- Groundbreaking in June, 1996
- Earth caving start in Dec., 1996
- Construction start for sub-structure of the building, in May, 1997
- Construction start for super-structure of the building, in Nov, 1997
- Construction completion, May, 2000 (one year delayed and within the budget)

Names and numbers have been edited for developer's confidentiality and educational purpose

View of Completed Project

http://pub84.ezboard.com

Successes/Failures of the Project

- The construction of the project has not started yet, since its groundbreaking 6 months ago.
- Due to the late start of construction and frequent design changes during construction, the completion of the project has been one year delayed.
- However, despite delayed construction, the project has been completed within the initial budget.
- Why? delays, a lot of changes, but within the budget.

Names and numbers have been edited for developer's confidentiality and educational purpose

FT without Well Planned Strategies

Delays in the start of construction are mainly attributed to the following reasons:

- It took longer to get a construction permission than expected.
- Difficulties in hiring sub-contractors also contributed to the construction delays.
- Frequent owners' scope changes created a lot of design changes, which in turn resulted in subsequent construction changes.

Hiring CM was successful…

Construction completion with the initial budget was possible by adopting the construction management delivery method for the project.

- CM's good understanding on the local construction code made it easier to execute construction.
- CM played a role as a coordinator to mitigate possible conflicts among diversified project functions.
- All of these factors, together with management cost-saving, contributed to the construction completion within the initial budget.

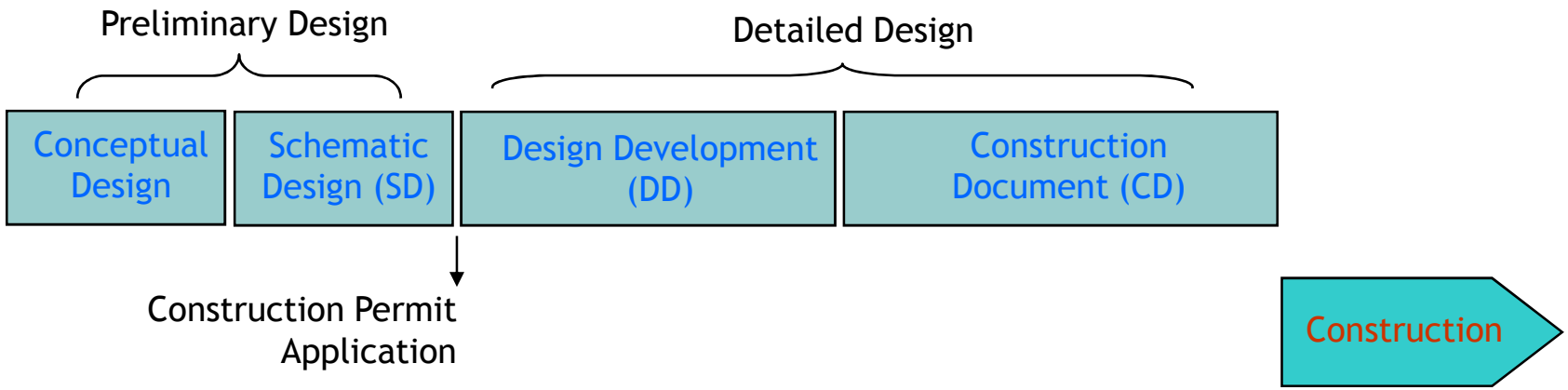
Hiring CM was successful…

Staff Cost	Gen. Con.	CM
D Corporation	12 MIL	1.8 MIL
CM hired		3 MIL
Local	0.6 MIL	0.6 MIL
Total	12.6 MIL	5.4 MIL

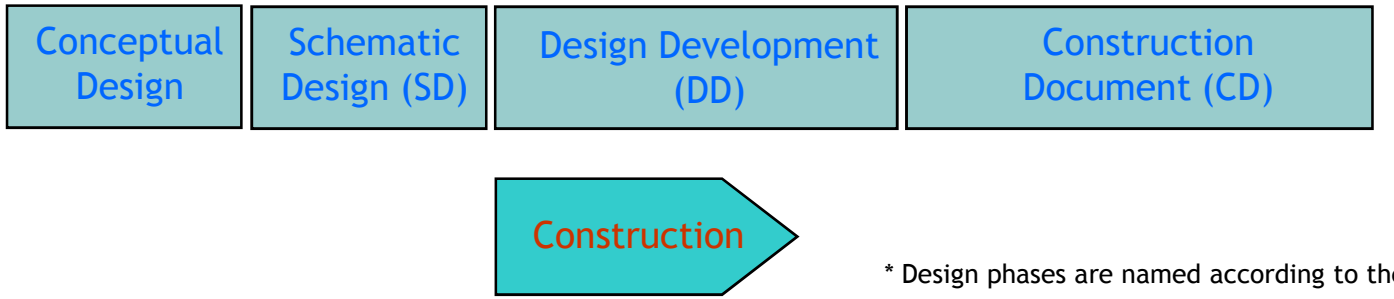
Discussion

Fast-Tracking

Sequential Delivery



Fast-Tracking



* Design phases are named according to the AIA Standard.

Numbers

100조
건설산업매출

50만
건설기술자

14000
일반건설업체

7만
건설업체

170만
고용창출

15%
GDP 공헌

60%
민간발주

30억
국가기관 발주 30억 이상 조달청 위임

80%
해외 매출 프랜트 비중

87.745%
낙찰하한율

10억
적격심사제하한금액

83

Tradeoffs

Terminologies

발주 **delivery system** [發注]

입찰 **bidding**

낙찰 **awarding**

계약 **contracting**

*조달 **procurement**

*구매 **purchase**

*도급공사 **vs** 직영 **(Force Account Method)**

총액입찰 **vs** 내역입찰 *순수내역입찰

부대입찰

적격심사

PQ

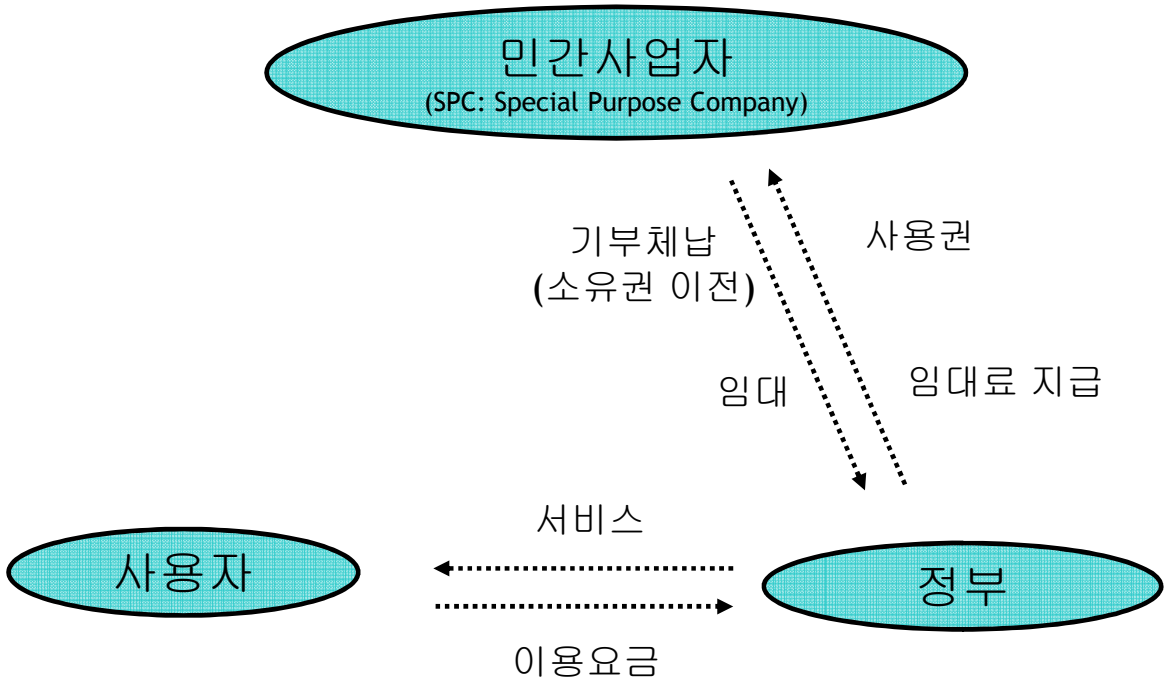
◎ 공사규모별 발주관련 법규 제한사항

구 분		30억	50억	74억	100억 대형공사 →	300억
발주방법	DBB DB CM	건설사업관리(CM) : 필요하다고 인정시 - 국계법 시행령 제73조의2	설계시공분리 원칙		발주계획(일괄,대안, 등) 건교부 제출 및 심의 **의무** (중앙건설심의위원회) - 국계법 시행령 제80조 →	
	PPP				민간투자방식 추진 : 주무관청에서 대상사업지정 -민투법 제8조의2 국내 허용 민간투자방식 : BOT,BTL,BTO,BOO -민투법 제4조	**2000억** 이상 -심의위원회 심의
입찰방법	경쟁방법	2억(전문공사 1억)이하 **수의계약** 가능 -국계법 시행령 제26조 3억(전문공사 1억)이하 **지명경쟁** 가능 - 국계법 시행령 제23조	실적제한 가능(전문공사 3억) -국계법 시행규칙 제 24조 지역제한 가능(전문공사 5억) -회계예규 2200.04-159-3 (2006.12.29)	**일반경쟁 원칙** -국계법 시행령 제 10조		입찰자격사전심사(PQ) **의무** -국계법 시행령 제13조 →
	공동도급	←	지역공동도급 **의무** -국계법 시행령 제72조 ←			
	입찰서류제한	국내입찰 (정부기관) -재정경제부 고시제2006-58호 (2006.12.29) ←	국제입찰 **의무** (정부기관) -좌동 ※정부투자기관 222억		내역입찰 **의무** -회계예규 2200.04-159-3 (2006.12.29) 제18조 부대입찰 **의무** -국계법 시행규칙 제 23조 →	
낙찰자선정방법	DBB		↔		적격심사 **의무** 국계법 시행령 제42조 ※심사기준 : 회계예규 2200.-04-149-18 (06.12.29)	최저가 **의무** -좌동 ※심사기준 : 회계예규 2200.-04-156-4 (06.6.23)
	DB	※ **일괄,대안입찰**은 설계자문위원회, 중앙건설기술심의위원회의 **설계점수**로 낙찰 -국계법 시행령 제86/87조 ※ 단, **대안입찰**에서 대안이 없는 경우는 DBB와 같은 낙찰자 선정법 적용 -국계법 시행령 제86조			↔	
	CM PPP	※ **건설사업관리** 계약에 관한 사항은 재정경제부 장관이 정함 -국계법 시행령 제73조의2 제2항에 ※ **민간투자사업**은 사업계획서 검토 및 평가를 통하여 **우선협상대상자(2인)**을 선정 -민투법 제13조				

BOT, BTO, BTL

	BOT	BTO	BTL
투자비회수	최종사용자 이용료		시설임대료
대상시설	도로, 다리, 터널 등		학교등 공익시설
사업리스크	사업자	정부보장	
사업리스크 보장 방법	NA	개발시 보조금 및 운영중 수익율보장	

BTL


민간사업자
(SPC: Special Purpose Company)
기부체납
(소유권 이전)
사용권
임대
임대료 지급
서비스
사용자
정부
이용요금

JV vs Consortium

구분	Joint Venture (합작기업, 공동출자회사)	Consortium (공동기업체)
목적	사업일반	특정 프로젝트
존속기간 (상대적)	장기	한정 (단기)
법적의미	있음 (법인)	없음 (법인격 결여)
출자	필요	불필요

* 건설경영공학, 기문당 177p

GC vs CM at Risk

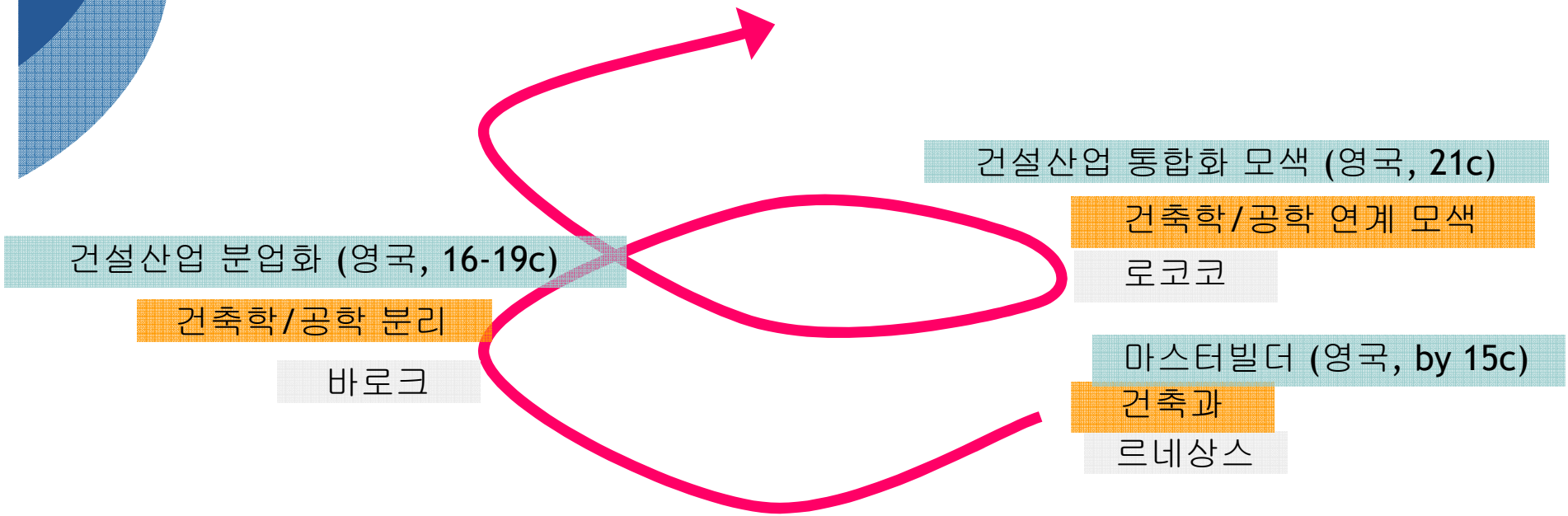
- CM for Fee 방식에서의 CM 기능 유지
  - 프로젝트 초기부터 계획 주도 (초기에는 agent로 출발)
  - 예비설계 후 GMP 제안
  - 시공책임 (보수에 대한 보증, 인센티브)

Black Box vs White Box ?

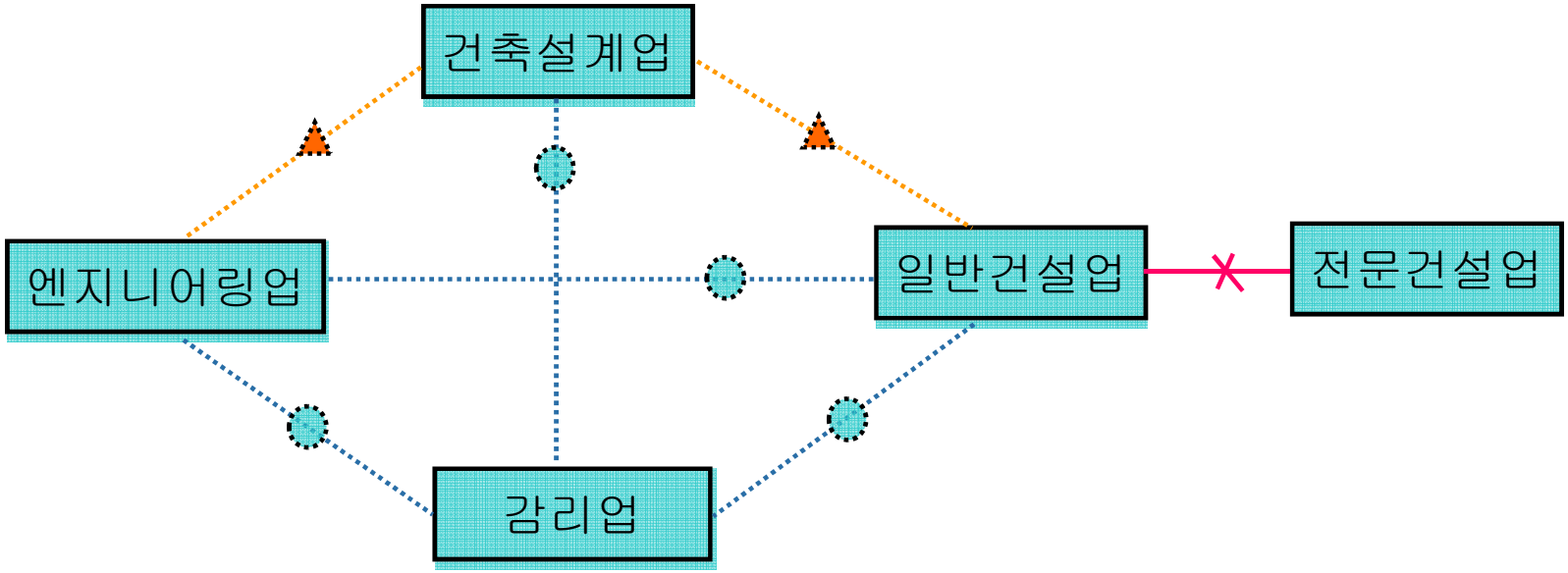
	GC	CM at Risk	CM for Fee
Precon service	NA	CM 검토/조언	
Trade selection	GC*	CM선정/ 발주자승인	CM 조언/ 발주자 선정
Trade subcontracts	GC	CM	owner
Construction service	Direct control	Direct control	Admin contract
공사비보장 (risk sharing)	△	보수, 인센티브	x
공기보장	o	△	x
품질보장	o	o	x
시공책임 (안전/공법)	o	o	x

*NSC: Nominated Sub-Contract

Spiral Evolution



겸업제한 (to be updated)



: 명시적 금지

: 명시적 금지 조항은 없으나 건축사법에 의거 현실적 제약

: 허용

이상호, “한국건설산업대해부”, 보성각 30p

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A2:Big Dig

- Recommending delivery systems for **the Central Artery/Tunnel Project in MA, US**
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