Challenges of Future Civil Engineer

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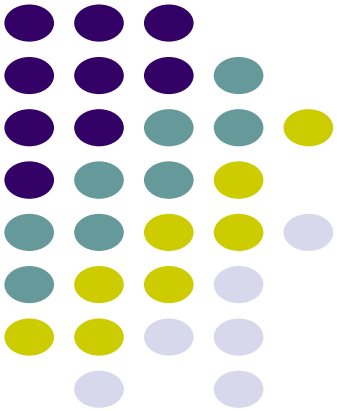

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Outline

1. Introduction: Civil engineering profession
2. Civil engineering standard of competence
3. Challenges of construction industry
4. Future direction
5. Closing remarks – The importance of knowledge and innovation

Prologue

‘There is no such thing - as the favourable wind - for those who do not know where to go’

(Lucius Annaeus Seneca, 5th BC)

Introduction: Civil Engineering Profession (1/2)

1. A **civil engineer** is a person who practices civil engineering – the application of planning, designing, constructing, maintaining, and operating infrastructures while protecting the public and environmental health, as well as improving existing infrastructures that have been neglected.
2. **Civil engineering** is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works like roads, bridges, canals, dams, and buildings.
3. Basis of engineering profession practice:
   - ethical behavior:
   - competent performance;
   - innovative practice;
   - engineering excellence;
   - equality of opportunity;
   - social justice; and
   - sustainable development.

Introduction: Civil Engineering Profession (2/2)

4. Engineers plan, design, & build sustainable infrastructures in a finest build environment.
5. NSF (1994): *A civilization's rise and fall is linked to its ability to feed and shelter its people and defend itself. These capabilities depend on infrastructure - the underlying, often hidden foundation of a society's wealth and quality of life*.
6. Like medical doctors, civil engineers serve community (the people, the country); and for this reason, they are always respected.
7. A civil engineer can't be rich because he/she isn't profit making; he can't be poor neither because his remuneration is protected by government & association.
8. To better serve, engineers should be competent, otherwise the community will be sacrificed.

Civil Engineering Standard of Competence (1/6)
(Knowledge, Skill, & Attitude)

Unit (Compulsory)	Element
1. Code of ethics	Intellectual responsibility and engineering profession's contribution to the national and international community
	Code of ethics and professional practice
	Environmental sustainability principles
	Professional responsibility of behavior & work products

Unit (Compulsory)	Element
2. Skill in engineers' professional work	Production of intellectual and varied work outputs
	State of the art skills in engineering field
	Engineering methods
	Quality assurance principles
	Engineering tools & appropriate technology
	Testing, measurements, & evaluation

Civil Engineering Standard of Competence (2/6)
(Knowledge, Skill, & Attitude)

Unit (Compulsory)	Element
3. Engineering planning & design	Planning & design needs formulation
	Planning and/or design needs proposal
	Planning and /or design execution
	Design evaluation
	Supporting documents preparation
	Integrity of design identification principles

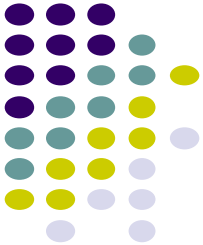
Unit (Compulsory)	Element
4. Engineering work management & communication skill	Self management principles application
	Engineering work management principles
	Leadership principles in engineering work
	Effective communication
	Engineering information management

Civil Engineering Standard of Competence (3/6)
(Knowledge, Skill, & Attitude)

Unit (Optional)	Element
5. Education & training	Engineering education and/or training program development
	Engineering education and/or training program implementation

Unit (Optional)	Element
6. Research, development, & commercial endeavor	Research
	Research output development concept
	Research output development resources identification
	Research & development market analysis
	Research & development output commercialization

Civil Engineering Standard of Competence (4/6)
(Knowledge, Skill, & Attitude)



Unit (Optional)	Element
7. Engineering consultancy and/or construction work/installation	Engineering consultancy exercise
	Construction/installation tender & contract
	Construction/installation execution
	Site work management
	Commissioning

Unit (Optional)	Element
8. Production/ Manufacturing	
	Quality assurance program
	Process operation, control, & optimization
	Inventory management
	Production performance measurement

Civil Engineering Standard of Competence (5/6)
(Knowledge, Skill, & Attitude)

Unit (Optional)	Element
9. Material & component	Special material and component need and utilization
	Material or component sources
	Material & component procurement supervision
	Material or component characteristics evaluation
	Material or component maintenance

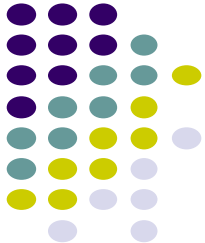
Unit (Optional)	Element
10. Business management & technical marketing	Engineering sources management
	Human resources management
	Business, financial & legal/ contractual management
	Engineering product/service knowledge management
	Engineering product/service marketing principles
	After sales service principles

Civil Engineering Standard of Competence (6/6)
(Knowledge, Skill, & Attitude)

Unit (Optional)	Element
11. Construction management & asset maintenance	Engineering public policy to boost development sector
	Technical investment policy development
	Technical management for public welfare policy formulation
	Asset procurement
	Asset control and optimization
	Asset maintenance
	Asset removal

Source: Indonesian Engineer Association

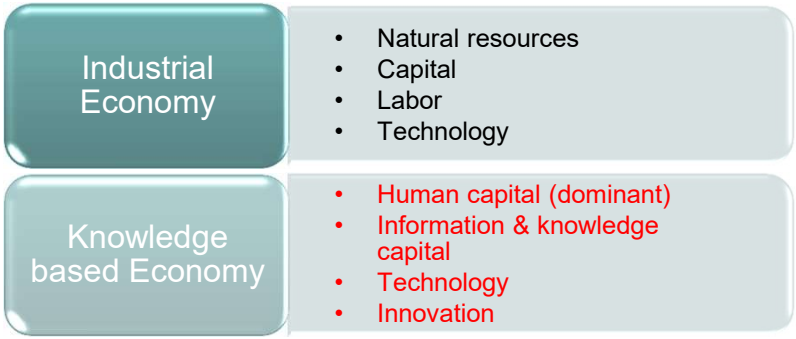
Challenges of Construction Industry



1. Construction is a very fragmented industry; at least in 6 dimensions:
   a. In construction process: from materials to built infrastructure; manufacture → distributor → supplier → sub-contractor specialist → general contractor.
   b. In project coordination: owner, consultant, contractor.
   c. In project life cycle; from needs to demolition; idea → conceptual plan→ Pre-FS → FS → basic design → EIA → DED → procurement → construction → supervision→ operation → maintenance → rehabilitation → demolition.
   d. In project delivery system: DBB, EPC, DB, Performance based contract; PPP.
   e. In sector responsibility: Ministry of Public Works; Ministry of Transportation; Ministry of Housing; Ministry of Telecommunication; Ministry of Energy; Electricity, etc.
   f. In regional authority: national, provincial, regency, city.
2. In consequence, there is always delay, idle, and waste, making construction industry less competitive; planning & coordinating are very important; the basics of project management.
3. Not as in manufacturing industry, work accomplishment in construction industry depends more on talented and skilled manpower.
4. Resources are always limited; challenges become more constraining; build not only an economic infrastructure, but a sustainable infrastructure in a finest built environment; triple bottom lines principles.
5. Making competition harder and harder.
6. Construction industry should become more and more competitive.

Direction of Development (1/5)

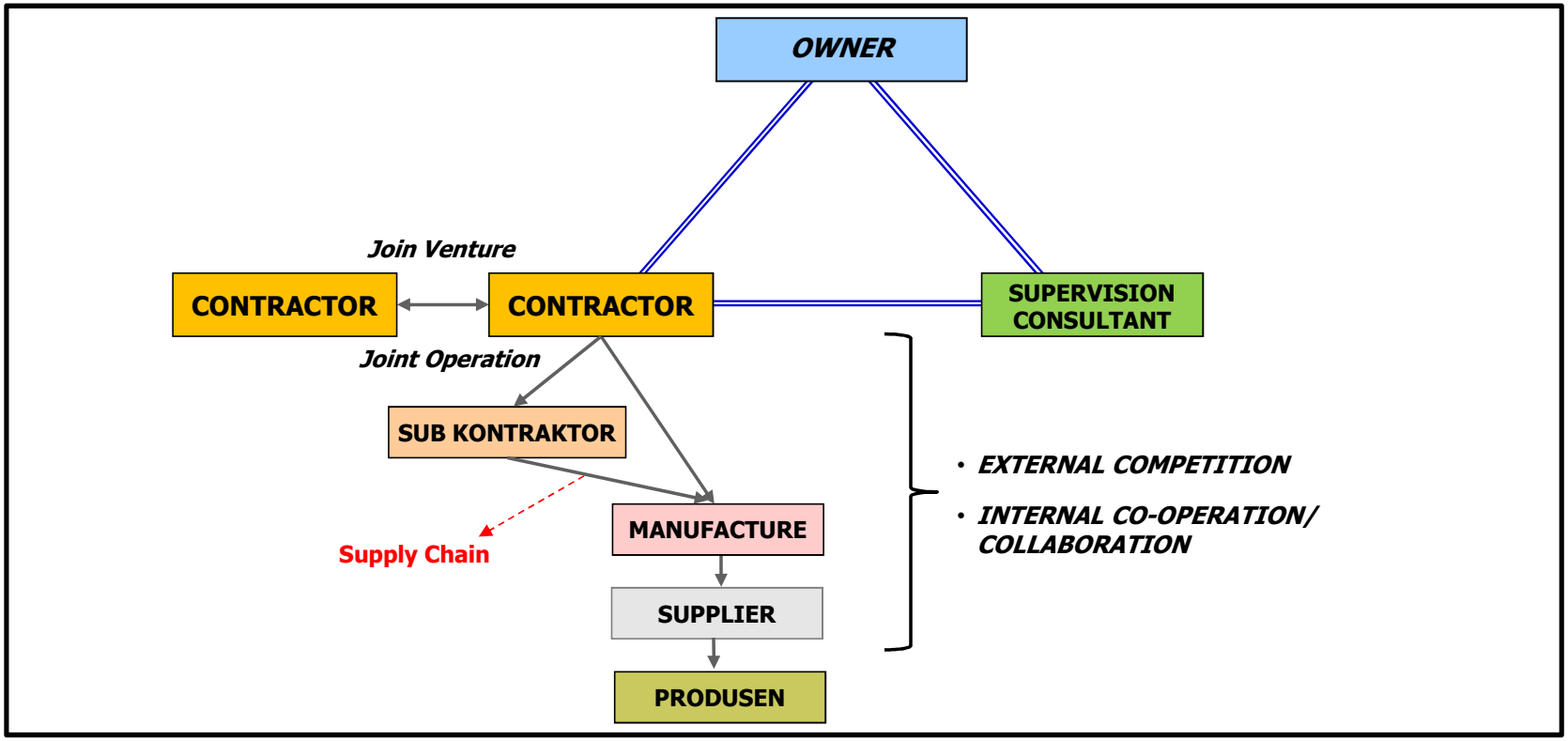
1. The future of competitiveness; creating values for money (VfM); developing sustainable infrastructure:
   - would not only depend on productivity & efficiency, because physical resources are always limited;
   - but much more on creativity & innovation, based on knowledge which is without limit.



2. Keywords of creativity & innovation: open mind, trustworthy, collaboration, multi-disciplinary knowledge.
3. Four types of relationship:
   a. Counter productive (lose-lose);
   b. Competitive (win- lose) - transactional;
   c. Co-operative (win-win) – preferred;
   d. Collaborative (win-win) – strategic.
4. We should move from win-lose to win-win; to have internal collaboration, while participating in external competition.
5. Strategies:
   a. Adopt lean concept (T, F, V):
      - enhance flow smoothness; supporting activities;
      - improve transformation;
      - create values.
   b. Improve supply chain management (SCM).
   c. Develop integrated value chain; JO; JV; partnership;
   d. Promote alternative project delivery (DBB, EPC, DB, PBC, PPP, etc).

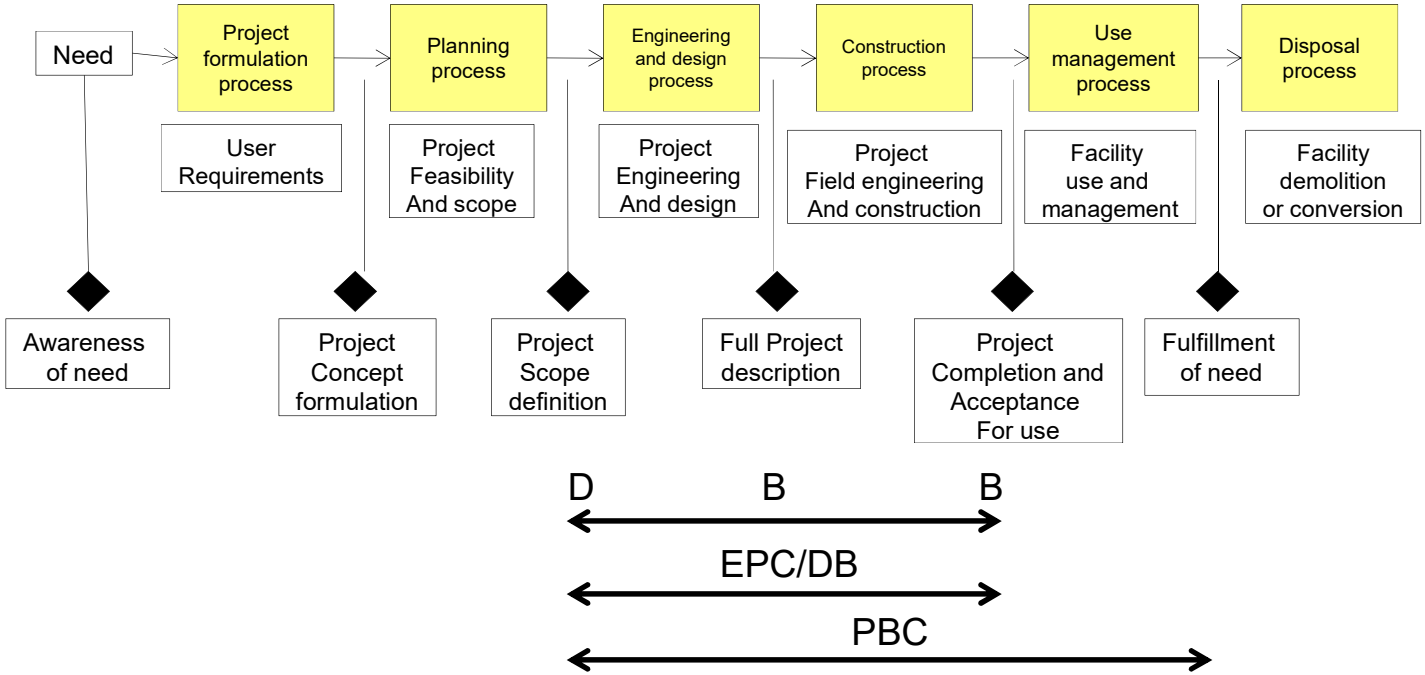
Direction of Development (2/5)

PARTNERSHIP TOWARDS INTEGRATED VALUE CHAIN



Direction of Development (3/5)

Promoting Alternative Project Delivery (APD)



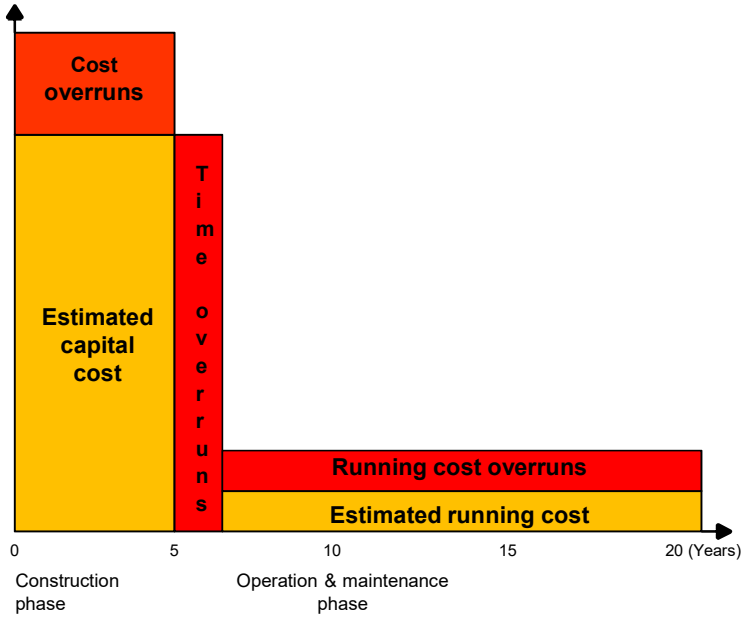
Note:
Promote Construction Management (CM), Design Build (DB), Performance Based Contract (PBC) project delivery;
Way of facilitating the growth of specialized contractors.

Direction of Development (4/5)

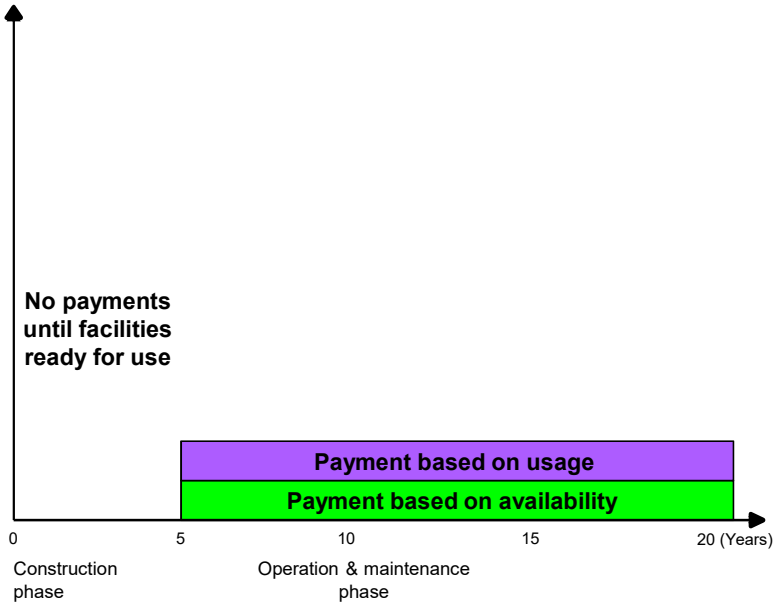
Public Private Partnership (*PPP*) Development in Public Procurement

1. PPP is one of public procurement alternatives; public & private co-operation in infrastructure financing in order to attain more efficient funding (Delmon, 2009).
2. Challenge: how to provide better public service, through better quality, cost, delivery, and sustainability.

PPP → Public service provision → economic development



Traditional Public Procurement

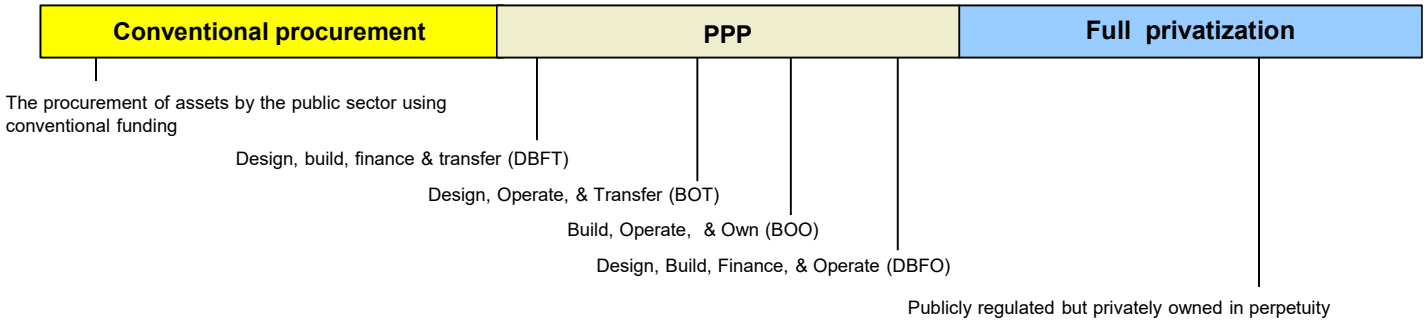


PPP Public Procurement

Source: Price Water House Coopers (2003)

Direction of Development (5/5)

. *Full range of public procurement options* (KPMG, KLegal):



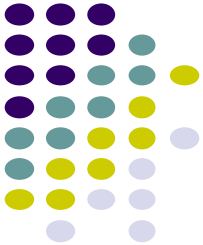
1. Lower cost of money.
2. Most of the risks retained by public sector.
3. Bureaucracy.
4. Lack of accountability .
5. **Limited VfM.**

1. Higher cost of money.
2. Optimum risk allocation.
3. **Higher VfM:**
   - management skills;
   - efficiency;
   - innovation.

PSC
(Public Service Comparator)

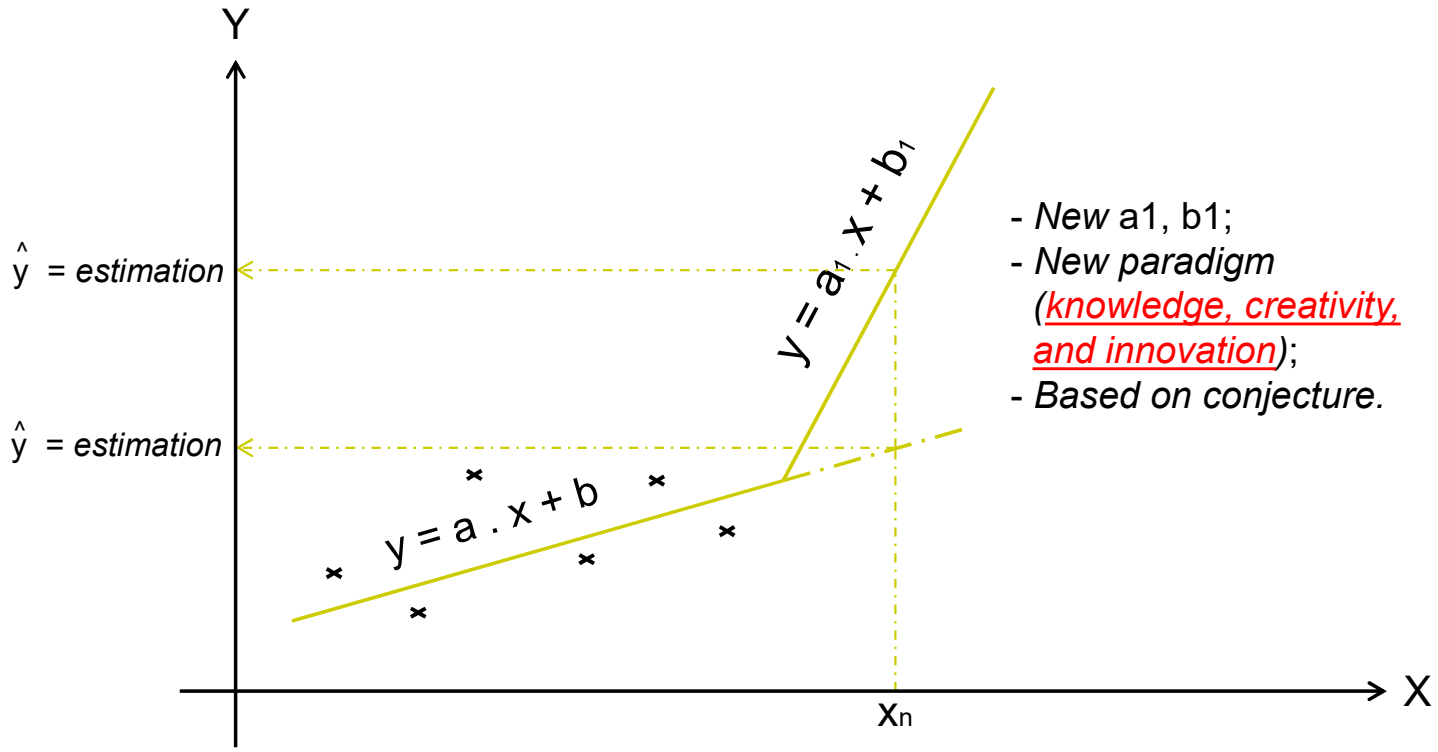
Requirements:
1. Sector optimization in place.
2. Professionalism of private sector.
3. Existence of competition aspect (productivity & efficiency) & collaboration aspect (SCM).
4. Conducive environment (good governance, law enforcement, & institutional capacity).
5. Constructive legal infrastructure & institutional framework.
6. Full government supports.

Closing Remarks – The Importance of Knowledge & Innovation(1/2)



1. To conclude, we're getting back to Karl R. Popper's - an Austrian British science philosopher - great work: 'Conjectures & Refutations: The Growth of Scientific Knowledge', 1962.
2. The future: Projection vs Conjecture:
   a. Future developments would be very dynamic, changes could occur radically.
   b. *Linear projection* is no longer sufficient; we have to understand *conjecture & refutation*.
3. *All problems seeks solutions that create new problems; if we continue reacting the same way linearly, we miss the luxury of exploring the new challenges and solutions* (J.L. Fernandez-Solis, 2009).
4. *Conjecture is an idea which is consistent with data, but not yet proven*:
   - construction industry: fragmented, benefits from manufacturing concept; *transformation, flow*, & *values* (*T, F, V*); *supply chain, integrated value chain*;
   - transportation: is no longer an infrastructure development problem; *flow of containers*;
   - BIM: role of *ICT* in 'project life cycle';
   - concrete placing technology; self compacting concrete;
   - sustainable infrastructure, green building, etc.: applying alternative approach of planning, integrating different knowledge & expertise; multi disciplinarily researches.

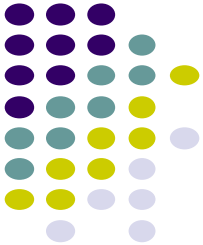
Closing Remarks –
The Importance of Knowledge & Innovation(2/2)



- *New* a1, b1;
- *New paradigm (knowledge, creativity, and innovation);*
- *Based on conjecture.*

Epilogue

'Every morning in Africa, a gazelle wakes up, it knows it must outrun the fastest lion or it will be killed. Every morning in Africa, a lion wakes up. It knows it must run faster than the slowest gazelle, or it will starve. It doesn't matter whether you're the lion or a gazelle-when the sun comes up, you'd better be running'



THANK YOU