

CENG 6101 Project Management

Introduction to Project Management

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TO DO

- ① Introduction to Construction Industry
- ② Course Introduction
- ③ Introduction to Project Management

Introduction to Construction Industry

- National economies are built on the following main economic sectors:

Primary Industry

- Agriculture, mining, oil exploration, forestry, farming, fishing and hunting, and processing and packaging of raw materials

Secondary Industry

- Construction, smelting, automobile manufacturing, textiles, energy utilities, breweries and bakeries

Tertiary Industry

- Transportation, health care, food service, retail sales, advertising, entertainment, tourism, banking and law

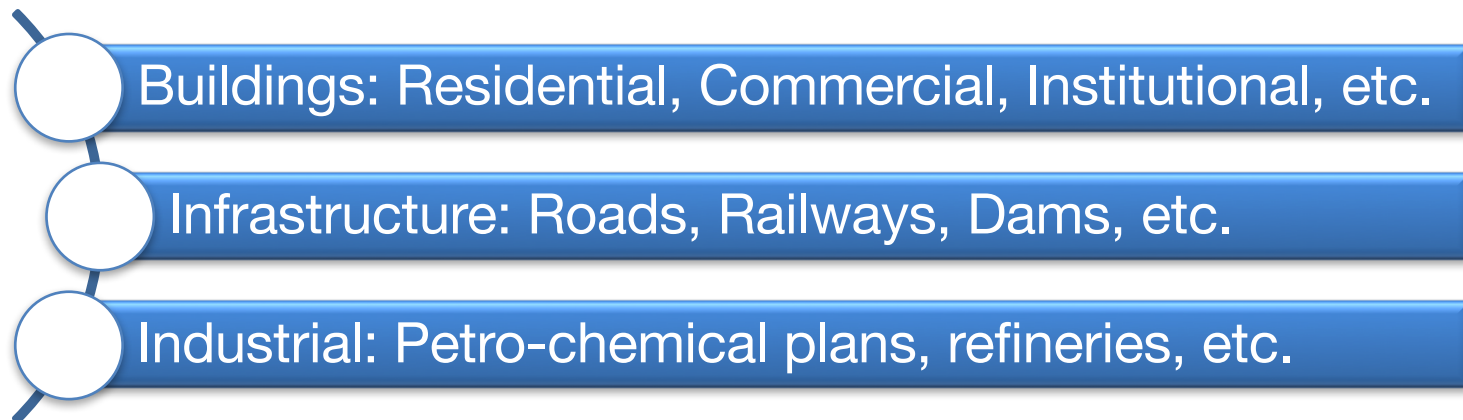
Quaternary Industry

- ICT, Research and Development, and Non-governmental organizations.

- Each of these sectors are interdependent on each other.

Introduction to Construction Industry: Definition

- Construction Industry: is an economic sector which, through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities.
- Construction facilities include:



- According to UN (1996), International Standards Industrial Classification (ISIC): Construction is defined generally as an economic activity directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature, and other such engineering constructions as roads, bridges, dams, etc.

Introduction to Construction Industry

- In the case of Ethiopia, the definition adopted by the National Accounts department of MoFEC is the same as that of ISIC.
- The activities actually covered under the industry are the construction and maintenance activities of (MoFEC, 2005):
 - 1) Residential buildings in urban and rural areas,
 - 2) Non- residential buildings, i.e. factory buildings, ware houses, office buildings, garages, hotels, schools, hospitals, clinics, etc.,
 - 3) Other construction works, like roads, dams, dikes, athletic fields, electricity transmission lines, telephone & telegraph lines, etc.
- Also includes activities such as quarrying of stone, gravel crushing, and manufacturing of bricks are accounted in the construction industry.

Introduction to Construction Industry

- Key characteristics:

Unstable construction demand due to the specialized character of each facility, seasonability, and exposure to economic fluctuation and demographic influences

Custom-built nature, resulting in project-oriented production

Floating labour force due to unstable construction demand

Immobility (creates reliance on local markets)

High initial expense

Complexity

Introduction to Construction Industry

- Key characteristics:

Unique financing procedure: customer has to pay in installments during construction process. Also, the source of the customer's short and long term finance also relies on the loans secured with constructed facility

No buffer between production and demand as stockpiling construction facilities in inventories is impossible

Continuously changing technology

Many stakeholders:
Client, Consultant,
Contractor, Supplier,
etc.

Disintegrated
production process

Similar to service
industry: product
decided ahead

Introduction to Construction Industry

- Role of construction industry:
 - **Output generation:** Satisfy basic physical and social needs through buildings and infrastructure
 - **Employment creation:** Due to the flexibility of the technology used in construction industry, it can create significant employment opportunity to skilled and unskilled labour force
 - **Income generation and redistribution:** Stimulating economic growth through backward and foreword linkages through its requirements for goods and services from other industries
 - **Revenue generation:** generation of revenue for government from corporate income taxes of companies, the rental income, sales tax, capital gain tax and employees income tax from those employed in the construction industry

Introduction to Construction Industry

- Construction industry in Ethiopian: Average growth rate of 29.9% from 2010 to 2014.
 - **Contribution to national income:** Share to GDP increased from 4.0% in 2009, 7.6% in 2013, 8.5% in 2015.
 - **Contribution to employment:** In 2005, construction industry employed 1.4% of the total employed population (31.4 million), and 2015, it employed 507,000 workers.
 - **Contribution to government revenue:** Rental income tax is one of the major sources of revenue
 - **Multiplier effect:** Ripple effect of construction is felt in service, industrial, and agricultural sectors.
- Regulatory Framework:
 - National Construction Industry Development Policy, 2013
 - Ethiopian Construction Project Management Institute (ECPMI) under regulation No. 289/2013
 - Ministry of Construction, 2015.

Introduction to Construction Industry

- Evolution of the Ethiopian Construction Industry:

First Period: Prior to 1968

- Most civil works (including roads) carried out by foreign contractors through ICB

Second Period: 1968 - 1982

- Some small domestic contractors started to emerge:
- BERTA, National engineers and contractors (NEC),
- Ethiopian building road construction (ETBRC)

Derg regime

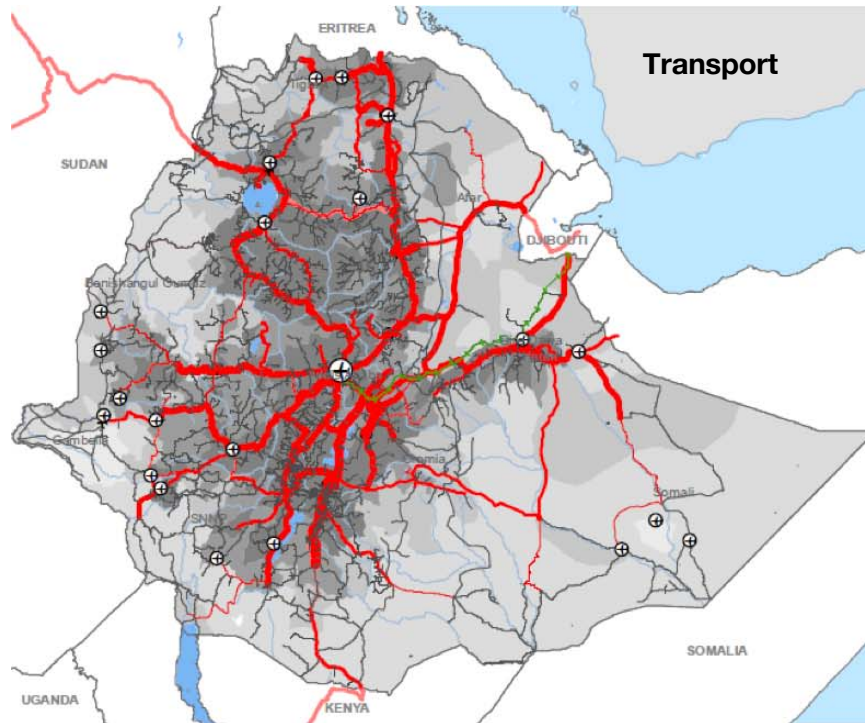
- Construction companies under state control since 1982
- State-owned construction companies were established
- Building capacity of the ERA
- No competitive bidding

EPRDEF regime

- Since 1991
- free market system
- Role of private contractors in the industry flourished while that of public companies diminished
- State company becoming more active since 2011

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- State of Ethiopia's Infrastructure:



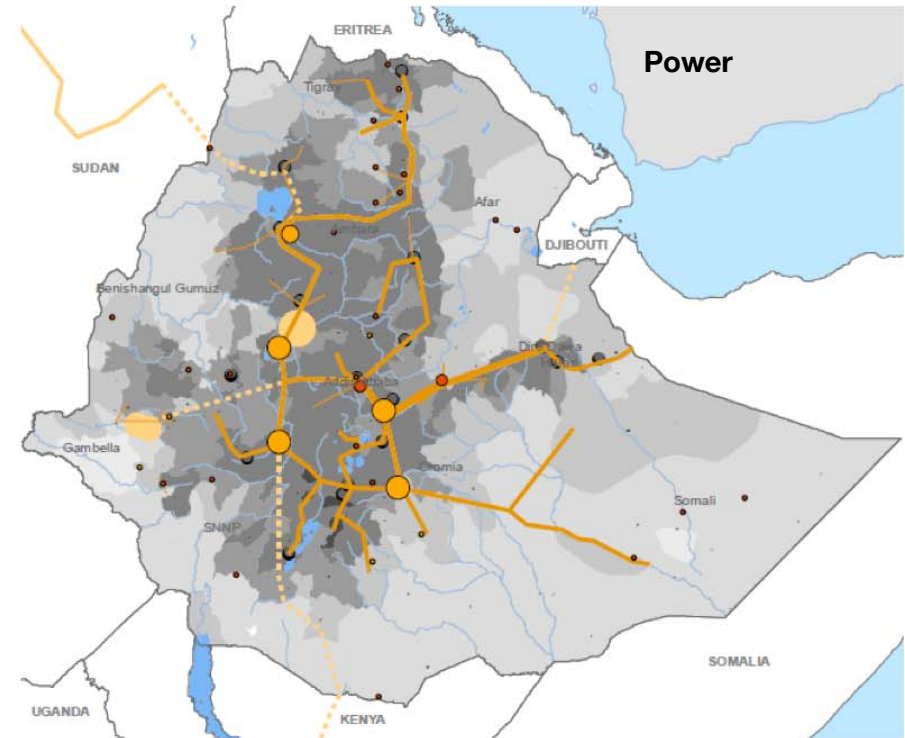
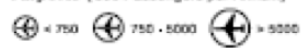
Railroad (Million Traffic Unit per Annum)



Road Traffic (Avg Annual Daily traffic)



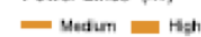
Airports (000 Passengers per Annum)



Power Plants | Type and Capacity (MW)



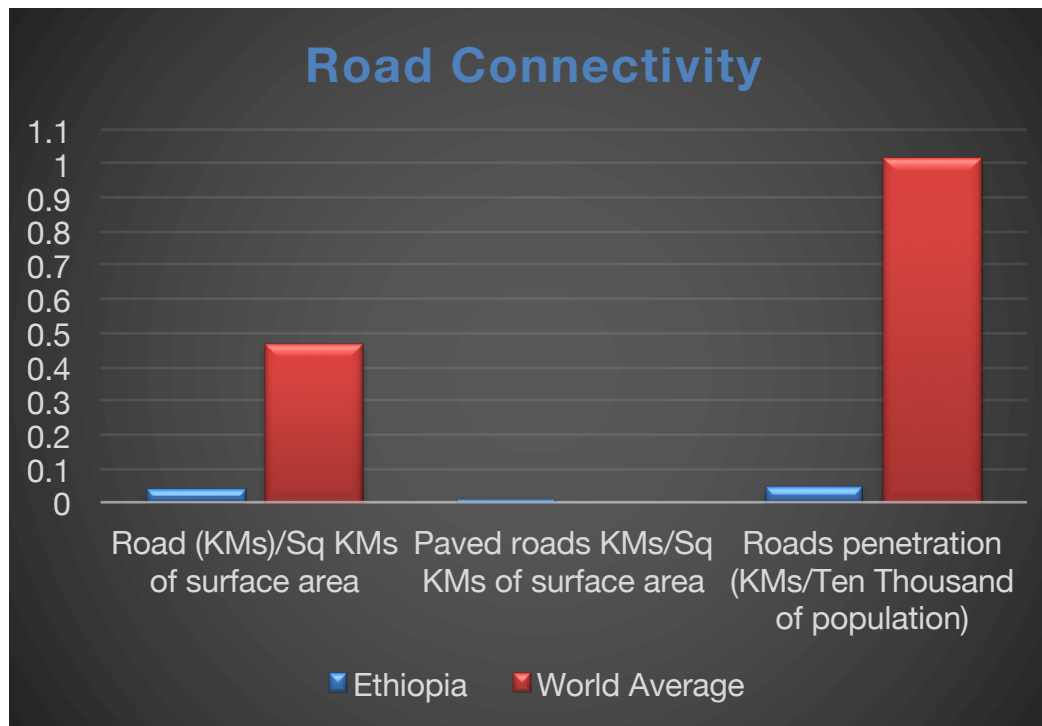
Power Lines (kV)



Source: AICD (2010)

Introduction to Construction Industry

- Ethiopia's Infrastructure: Where do we stand?



Air:

Airports:63

No of Airports/Million of Population: 0.74 (World average 12.97)

Rail Penetration:

Total length of Railway Lines 681(KMs)

Rail lines(KM/thousand sq. KM): 0.07 (World average 9.20)

Energy:

Production (Bn KW): 3.268 (World 19,020 Bn KW)

Consumption (Bn KW): 2.941 (World 17,480 Bn KW)

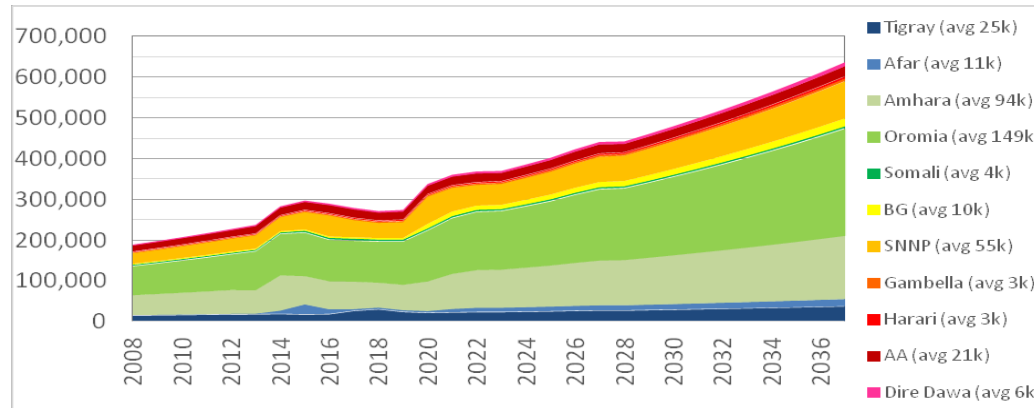
Production (Bn KW/Mn population): 0.038 (World 2.8BnKW/Mn population)

Consumption (Bn KW/Mn population): 0.34 (world 2.57BnKW/Mn population)

Source: Focus Africa (2016)

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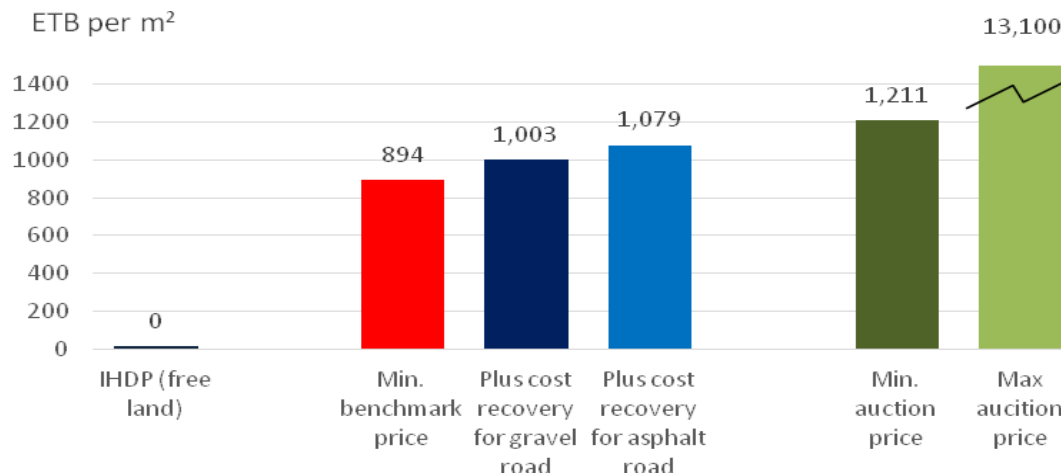
- Ethiopia's Housing Need:
- New urban household formation, by region and by year



Housing need will be more pounced in Oromia and Amhara regions. Addis Ababa will only account to 5% of the house need (2037)

Source: World Bank (2015)

- The financial burden of providing basic services to land plots is enormous:










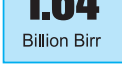
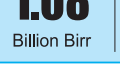


Benchmark prices for residential land in Addis Ababa (red) are less than cost recovery for even the most basic infrastructure (blue)

Source: World Bank (2015)

BUDGET BREAKDOWN

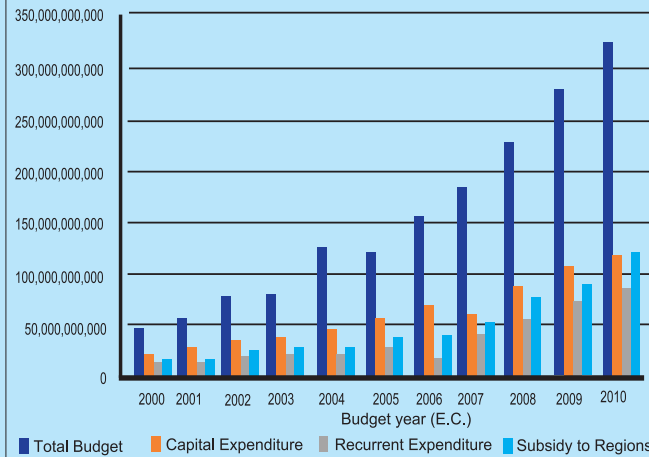
Region's Subsidy SDG's

Oromia		42.25 Billion Birr
Amhara		26.48 Billion Birr
Southern		24.66 Billion Birr
Tigray		7.93 Billion Birr
Afar		3.71 Billion Birr
Somalia		12.24 Billion Birr
Gambella		1.63 Billion Birr
Benishangul		2.24 Billion Birr
Harari		931.9 Million Birr
Addis Ababa		1.64 Billion Birr
Dire Dawa		1.08 Billion Birr

BIG TICKET ITEMS % of Budget

Road & Housing	Education	Debt	Agriculture	Defense	Hydro Energy	Health
15.6 %	13.4 %	5.3 %	3.75 %	3.75 %	2.81 %	2.81 %
						
50 Billion	43 Billion	17 Billion	12 Billion	12 Billion	9 Billion	9 Billion

Ethiopian Budget Evolution



2010 E.C Budget Expenditure 320.8 Bln Total Budget

117.3 Billion	Subsidies
114.7 Billion	Capital
81.84 Billion	Recurrent
7 Billion	Support for SDG










2010 E.C Budget Financing

221.8 Billion	Domestic Revenue
17.14 Billion	External Assistance
28.62 Billion	External Loan and Credit
53.88 Billion	Deficit

With the current Ethiopian fiscal year ending on June 30, the last few weeks in the month of June are usually when the details of spending plan for the upcoming fiscal year is revealed to the House of Peoples' Representatives (HoPR). Keeping up with that timetable, Abraham Tekeste (PhD), finance minister of Ethiopia, presented his budget speech to HoPR last Thursday. This budget

bill came weeks after the report of the Auditor General indicating that billions of birr allocated through the budget bill of 2008 EC has been mismanaged by several federal agencies in Ethiopia. Regardless, Abraham heralded a 320 billion birr budget plan which is 17 percent higher than the budget approved for the current fiscal year. For detailed breakdown of the proposed budget figures and historical trend analysis of the budget instrument in Ethiopia, SEE THE FULL STORY ON PAGE 10.

Major Institutions

Ethiopian Roads Authority		45.8 Billion Birr
Ministry of Defense		12.0 Billion Birr
Ministry of Health		9.63 Billion Birr
Ministry of Agriculture and Natural		9.50 Billion Birr
Ministry of Water, Irrigation & Elec.		8.83 Billion Birr
Ministry of Education		4.82 Billion Birr
Ministry of Urban Dev. & Housing		3.02 Billion Birr
Federal Police Commission		2.79 Billion Birr
Addis Ababa University		2.21 Billion Birr

Introduction to Construction Industry

- Construction Industry Reports:
- UK:
 - Latham Report 1 – Trust and Monies (1993)
 - Latham Report 2 – Constructing the Team (1994)
 - Egan Report 1 – Rethinking Construction (1998)
 - Egan Report 2 – Accelerating Change (2002)
- Singapore:
 - Reinventing Construction (1999)
- Ethiopia:
 - Ethiopian Economic Association (EEA). (2006). *Report on the Ethiopian Economy: The Current State of The Construction Industry, Volume VI 2006/07.*
 - Ethiopian Construction Policy, 2014.

Introduction to Construction Industry

- Ethiopia's Infrastructure: Future Needs
- Addressing Ethiopia's infrastructure deficit will require a sustained annual expenditure of \$5.1 billion over the next decade.
- An option will be to improve efficiency through better execution of construction projects.

Potential gains from greater efficiency

US\$ million per year

	ICT	Power	Transport	Water	Irrigation	Total
Underrecovery of costs	--	42	37	23	--	102
Overstaffing	9	--	--	--	--	9
Distribution losses	--	24	--	9	--	33
Under collection	--	15	28	1	--	44
Under maintenance	0	0	263	0	0	263
Total	9	40	290	9	0	451

Source: Briceno-Garmendia and others (2008)

Course Introduction

- Course Objectives:
 - Develop ability to prepare detailed project plan
- Text book:
 - *Project Management: Techniques in Planning and Controlling Construction Projects*, 2nd Edition, Ahuja, Dozzi, and AbouRizk, John Wiley and Sons, 1994.
- Grading:
 - Distribution
 - Examination
- Course Outline: 16 week graduate course
 - Scheduling
 - Estimation
 - Control
 - Change management

Introduction to Project Management

- What is a project?

“A temporary endeavor undertaken to create a unique product or service”

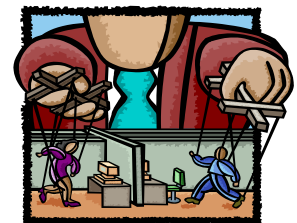


- Temporary: definite beginning and end with specific objectives.
- Unique product or service: different owner, designers, contractors, location (may have repetitive elements from previous projects).
- Challenge of research is to capture repetitive elements but incorporate uniqueness.



- What is project management?

“Application of knowledge, skills, tools, and techniques to project activities to meet project requirements”



Introduction to Project Management

- Project, Program, and Portfolio Management:
- Portfolio Management
 - Refers to a collection of projects or programs and other works that are grouped together to facilitate effective management of that work to meet strategic business objectives.
 - Deals with the centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related works.
- Program Management
 - A program is defined as a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.

Introduction to Project Management

- Project, Program, and Portfolio Management

Table 1-1. Comparative Overview of Project, Program, and Portfolio Management

	PROJECTS	PROGRAMS	PORTFOLIOS
Scope	Projects have defined objectives. Scope is progressively elaborated throughout the project life cycle.	Programs have a larger scope and provide more significant benefits.	Portfolios have a business scope that changes with the strategic goals of the organization.
Change	Project managers expect change and implement processes to keep change managed and controlled.	The program manager must expect change from both inside and outside the program and be prepared to manage it.	Portfolio managers continually monitor changes in the broad environment.
Planning	Project managers progressively elaborate high-level information into detailed plans throughout the project life cycle.	Program managers develop the overall program plan and create high-level plans to guide detailed planning at the component level.	Portfolio managers create and maintain necessary processes and communication relative to the aggregate portfolio.
Management	Project managers manage the project team to meet the project objectives.	Program managers manage the program staff and the project managers; they provide vision and overall leadership.	Portfolio managers may manage or coordinate portfolio management staff.
Success	Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the program satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of aggregate performance of portfolio components.
Monitoring	Project managers monitor and control the work of producing the products, services or results that the project was undertaken to produce.	Program managers monitor the progress of program components to ensure the overall goals, schedules, budget, and benefits of the program will be met.	Portfolio managers monitor aggregate performance and value indicators.

Source: PMBOK (PMI)

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- Project, Program, and Portfolio Management

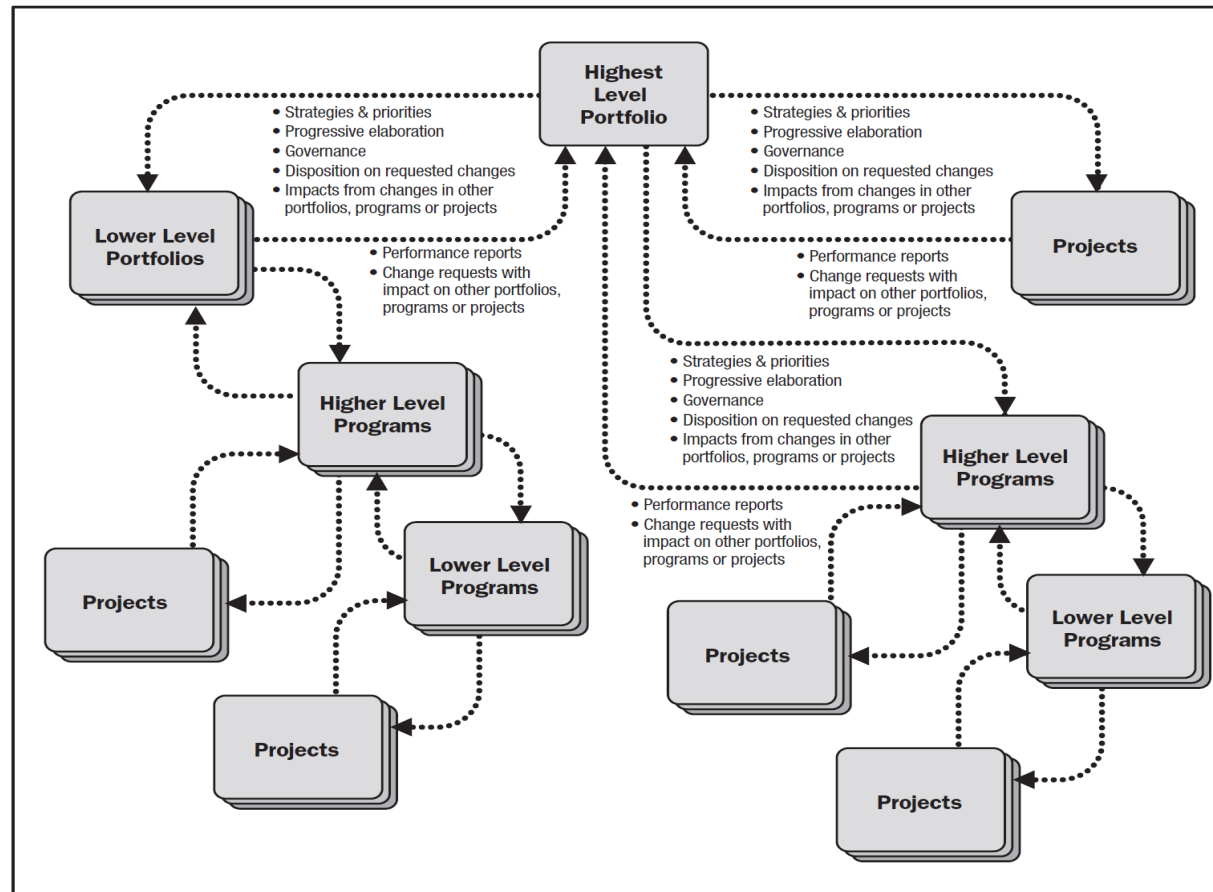
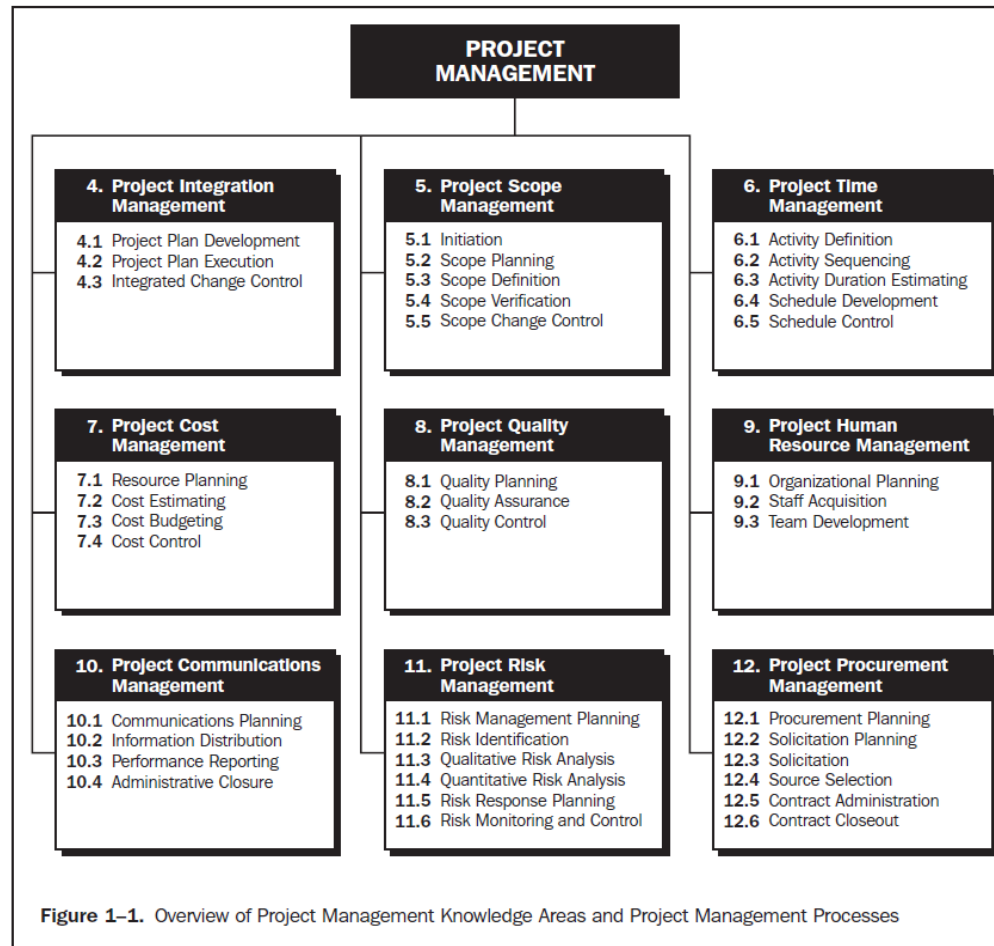


Figure 1-1. Portfolio, Program, and Project Management Interactions

Source: PMBOK (PMI)

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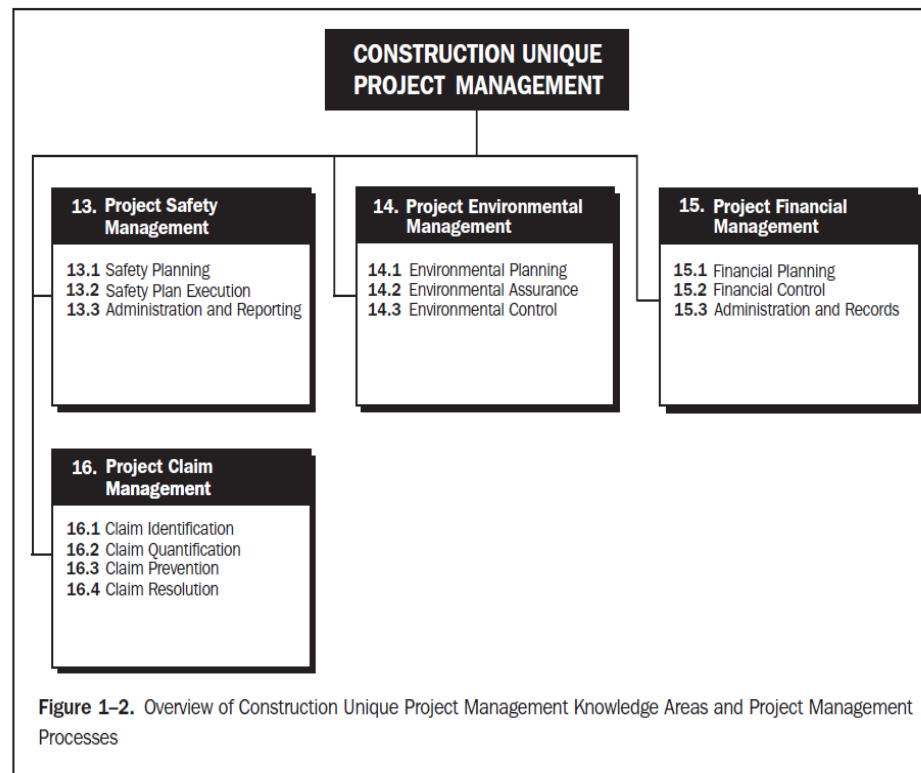
- PM knowledge areas and processes



Source: PMBOK (PMI)

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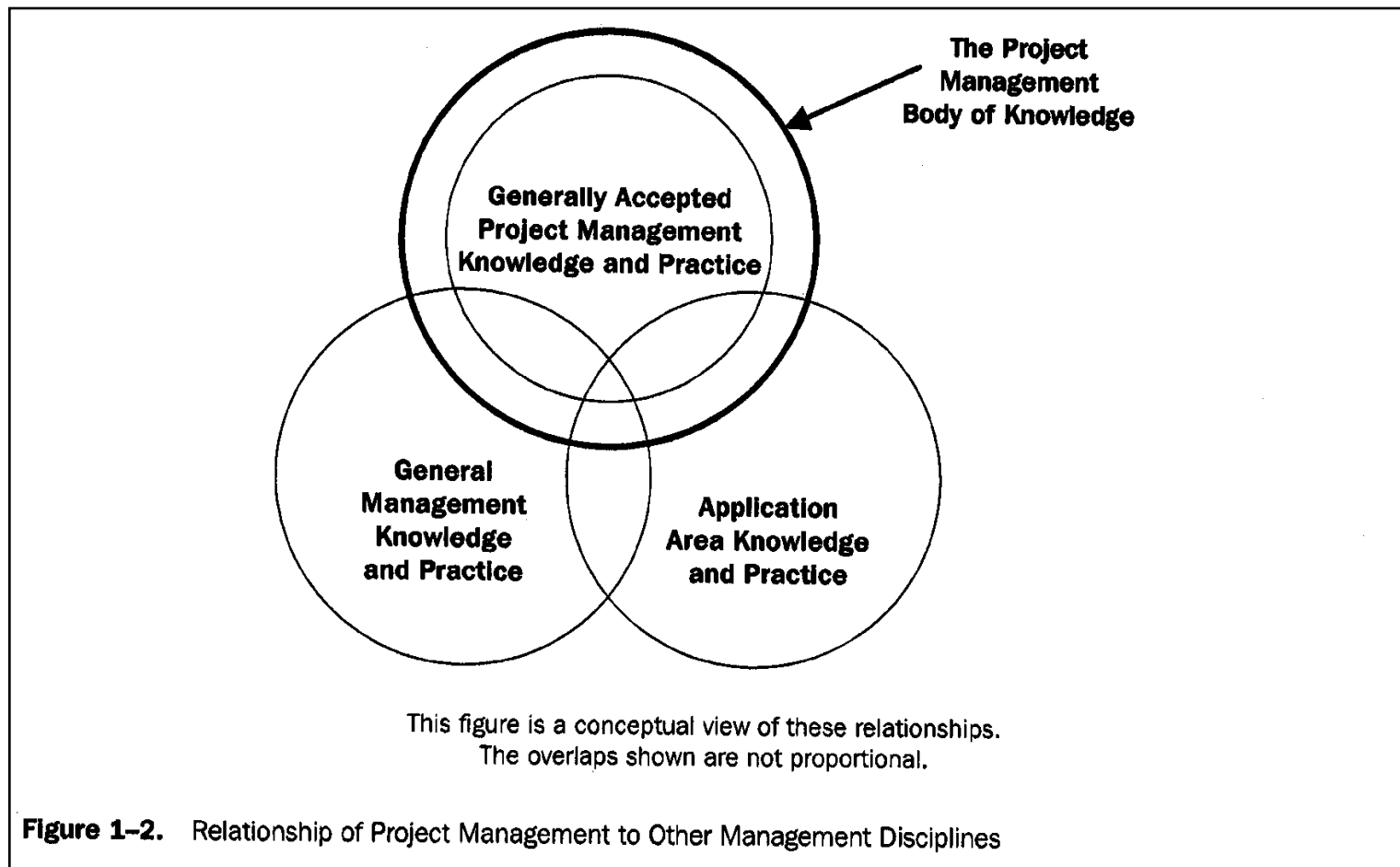
- Unique PM knowledge areas and processes for construction industry



Source: PMBOK (PMI)

Introduction to Project Management

- Relationship to other management disciplines



Source: PMBOK (PMI)

Introduction to Project Management

- Areas of expertise required

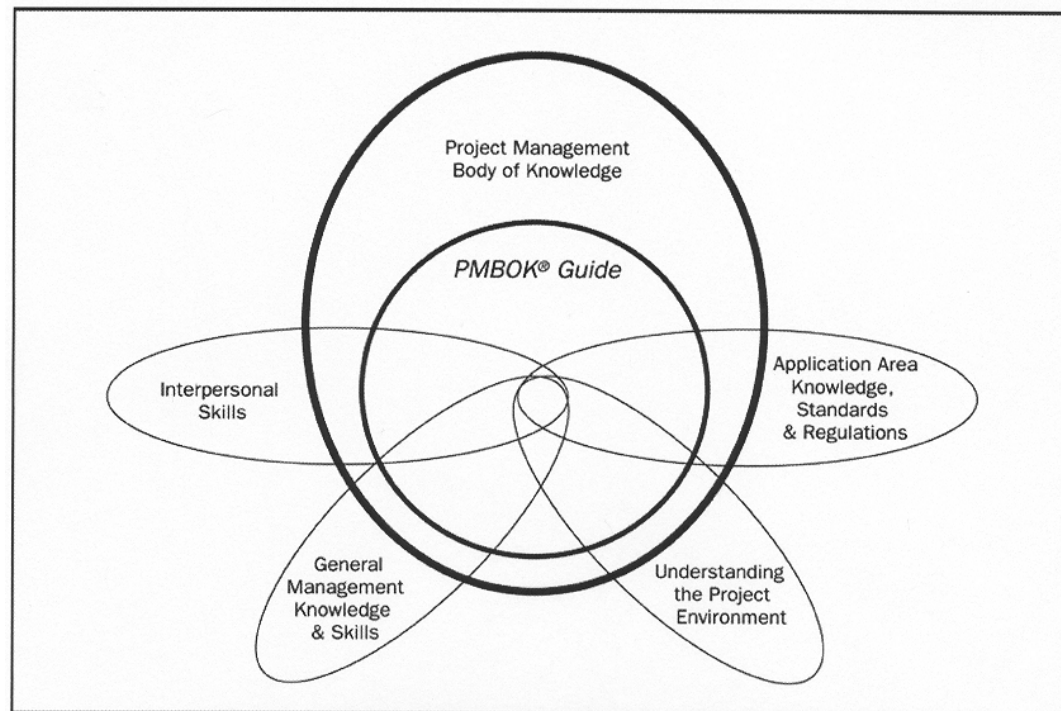
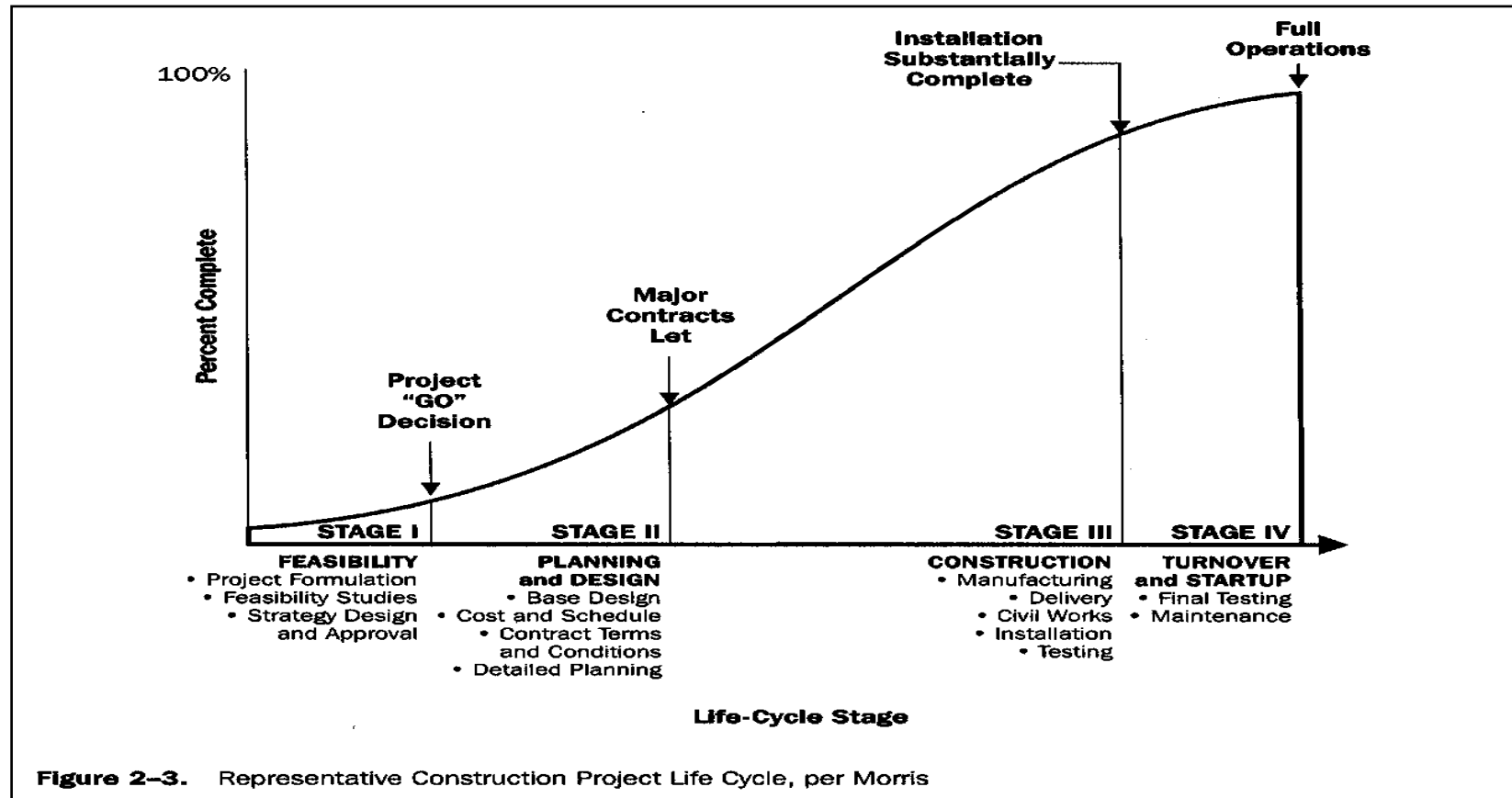


Figure 1-2. Areas of Expertise Needed by the Project Team

Source: PMBOK (PMI)

Introduction to Project Management

- Construction Project Phases and the Project Life Cycle



Source: PMBOK (PMI)

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- Construction project life cycle - Six Frameworks

Chartered Institute of Building (CIOB)	Office of Government Commerce (OGC)	British Standards BS6079-1:2000	Construction Industry Council (CIC) Work Stages	British Property Federation (BPF)	Royal Institute of British Architects (RIBA)
1. Inception	Gate 0 strategic assessment	1. Conception	1. Brief	1. Concept	1. Preparation
2. Feasibility	Gate 1 business justification	2. Feasibility	2. Feasibility	2. Preparation of the brief	2. Concept design
3. Strategy	Gate 2 Procurement strategy Gate 3 Investment decision	3. Realisation	3. Developed design	3. Design development	3. Developed design
4. Pre-construction	Gate 4 readiness for service		4. Production	4. Tender documentation and tendering	4. Production
5. Construction			5. Installation	5. Construction	5. Specialist design
6. Engineering services commissioning			6. As constructed		6. Construction (on and off-site)
7. Completion handover and occupation		4. Operation	7. In use	7. Use and aftercare	
8. Post-completion review / project close-out report	Gate 5 benefits evaluation	5. Termination			

Source: Baldwin and Bordoli (2014)

Introduction to Project Management

- Construction project life cycle – What to do?

Stage	Key actions
1. Inception	The business decision by the client that confirms that a new facility may be required. The commissioning of a project manager to examine the feasibility of the project.
2. Feasibility	A broad ranging assessment of the feasibility of the project. This is undertaken with input from a number of experts who examine all aspects of the proposed facility.
3. Strategy	Establish the project objectives, approach and procedures. Select key team members. Check procedures for ensuring sustainability and environmental issues. Determine the overall procurement approach. Establish all necessary control systems and the means for controlling project value.
4. Pre-construction	Design Development. Principle decisions relating to time, quality and cost management. Secure statutory approvals and consents and the provision of all utilities. Provide all the necessary information for construction to begin.
5. Construction	Construct the building and/or facilities required. Control cost and time within the parameters of the project objectives. Meet environmental performance targets.
6. Engineering services commissioning	Ensure that all operational and statutory inspections and approvals have been satisfactorily completed. Ensure the provision of proper records, test results, certification etc. Arrange for advice on maintenance staff training.
7. Completion handover and occupation	Handover the building and/or facility to the client. Facilitate occupation of the building.
8. Post-completion review/ project close-out report	Evaluate the performance of the project team. Identify lessons learned. A careful, objective review.

Source: CIOB code of practice for project management for construction and development: Baldwin and Bordoli (2014)

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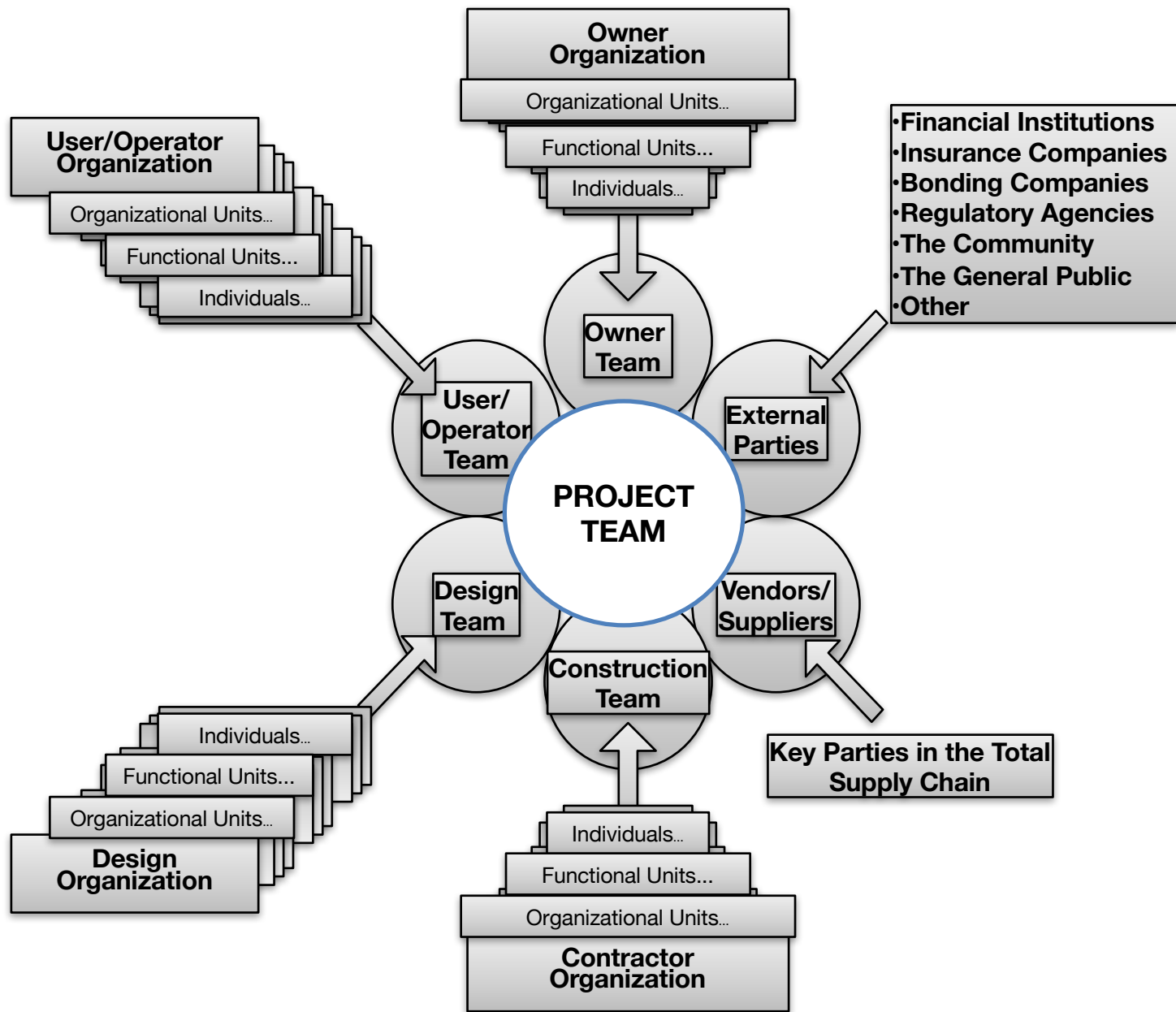
- Project Stakeholders: Client, Professional, and Contractor



Note:

Customer – uses product – may or may not be the client (owner)

Sponsor – finances project – may or may not be the client (owner)



Introduction to Project Management

● Schools of thought in construction management:

	Theory	Position of planning	Planning process	Uncertainty
PMBOK	Based on theories of production Adopts the transformation model	Embodies 'management-as-planning' as a core belief	Develops a generic project planning process model	Fits squarely into a world of certainty.
Lean Construction	Based on theories of production Adopts the TFV model, and lean thinking Views construction as one-of-a-kind projects, site production, and temporary multi-organisation	Integrates the approach of management-as-planning and the approach of management-as-organisation Suggests using work structuring and production planning systems	Suggests production planning and focuses on stabilising work flow	Views project management as uncertainty reduction. Believes that in practice some uncertainties are caused by the wrong order of decision making. Believes that uncertainty can be managed, and focuses on reducing the variables prior to production.
Construction as Production by Projects (Winch)	Based on theories of economics Adopts the transaction cost economics perspective Views project as organisations, and projects as a transaction between the client and the project participants	Views planning as 'a middle-management, operational discipline, rather than a strategic discipline' Suggests plans-as-resources to guide managers	Plans are nothing, but planning is everything to point out the importance of planning process	Views project as uncertainty reduction. Views uncertainty management as core purpose in the managing construction projects. Views uncertainty as the difference between the information required for a decision and the information available. Uncertainty arises from complexity and predictability.

Source: Baldwin and Bordoli (2014)

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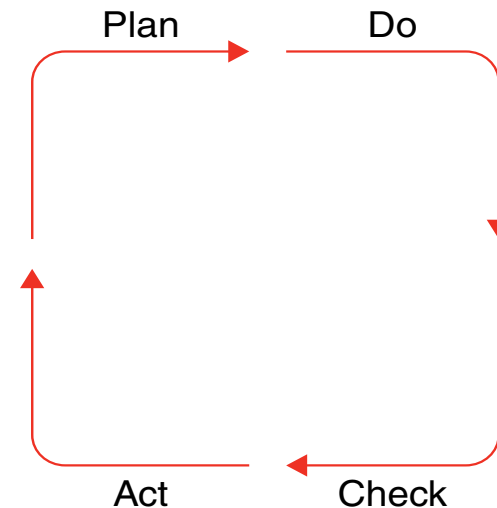
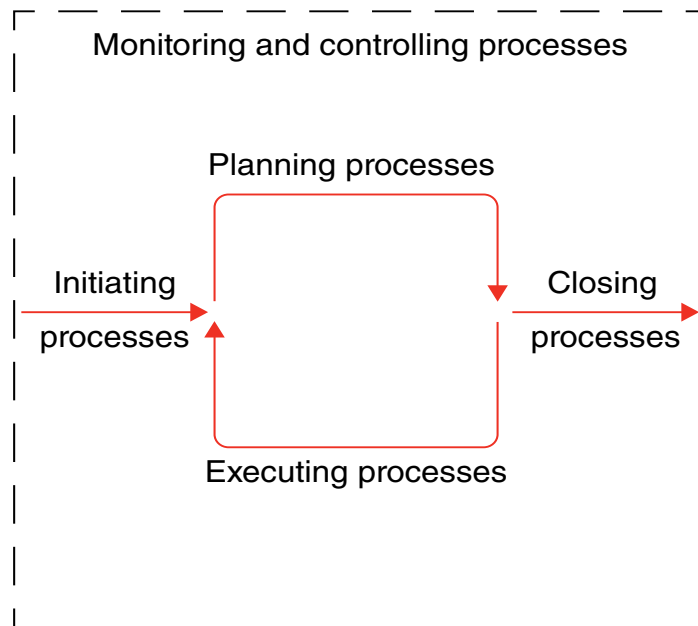
- Schools of thought in construction management:

	Theory	Position of planning	Planning process	Uncertainty
Simultaneous Management	Manager constantly orchestrates contending demands	Views planning as a core theme of project management	Calls for efforts to be paid for the planning process itself	Suggests timely decisions adjusted to uncertainty. Suggests decoupling interdependent tasks and isolating tasks with high uncertainty. If decoupling is impossible, absorb the uncertainty by employing redundant resources selectively, or manage the interface between interdependent tasks.
Morris	Believes that there will never be an overall theory of project management	Views planning as 'a middle-management, operational discipline, rather than the strategic discipline'	Suggests that better management can be achieved by thinking the planning process implicit	Highlights the importance of the management of uncertainty.
Collaborative Working	Views project management as integration and teamwork between the different project participants Encourages the team to perform as a unified entity	Embodies 'manage-as-an-organisation'		Fits squarely into a world of certainty.

Source: Baldwin and Bordoli (2014)

Introduction to Project Management

- PMI approach (Traditional Approach) will be adopted in this course work:



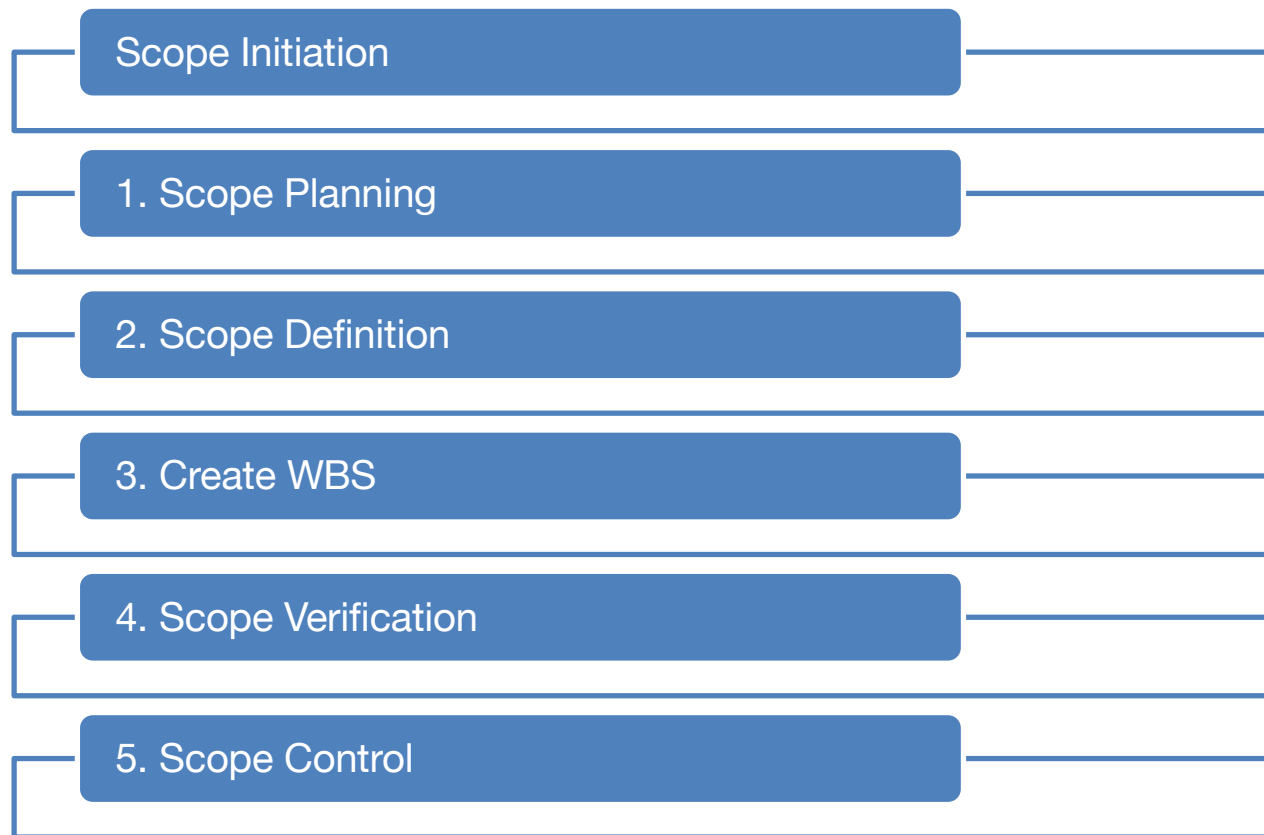
The concept of plan-do-check-act cycle

The Project Management Process

Sources: PMI, 2004

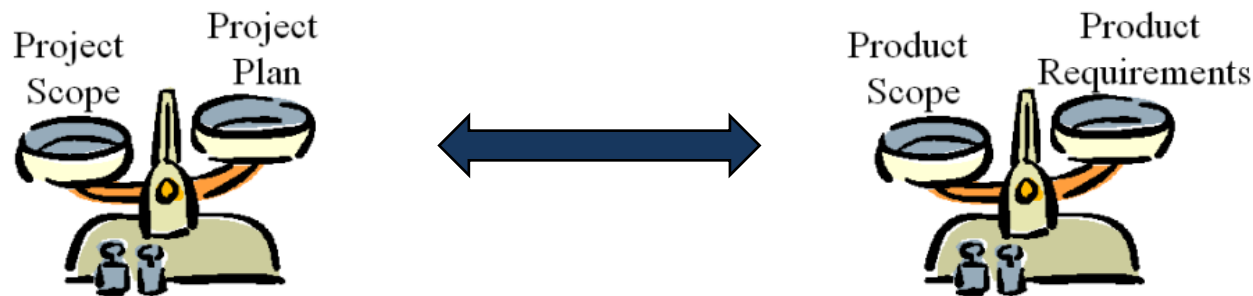
Introduction to Project Management

- Project Scope Management



Introduction to Project Management

- What is scope?
- In the project context, the term scope may refer to:
 - **Product scope**: the features and functions that characterize a product or service.
 - **Project scope**: the work that must be done to deliver a product with the specified features and functions.
- Completion of the **project scope** is measured against the **project plan**, but completion of the **product scope** is measured against the **product requirements**.



Introduction to Project Management

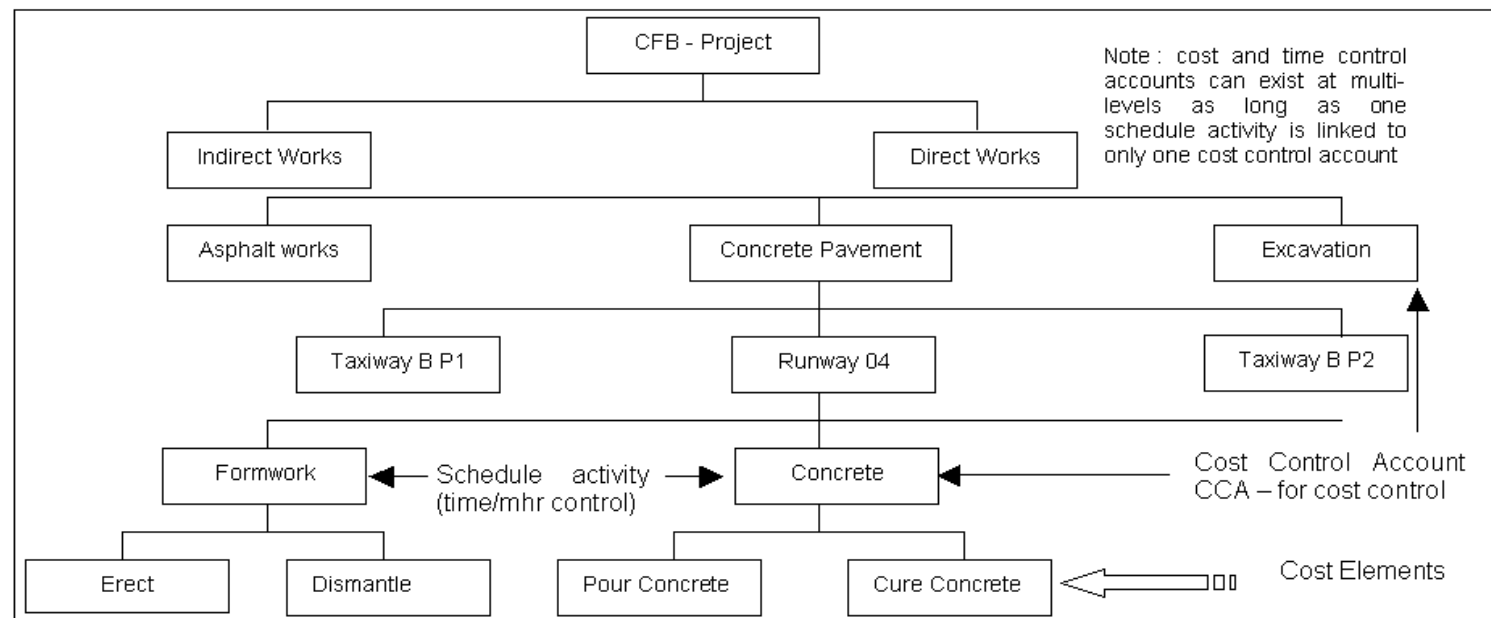
- **Scope Initiation:** Is the process of formally authorizing a new project or that an existing project should continue into its next phase.
- Projects are typically authorized as a result of one or more of the following:
 - Market demand (e.g. oil refinery)
 - Business need (e.g. company expansion)
 - Customer request (e.g. utility substation)
 - Technological advance (e.g. DVD technology)
 - Legal requirement (e.g. handling of toxic materials)
 - Social need (e.g. low income housing)

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1. **Scope planning** is the process of progressively elaborating and documenting the project work (project scope) that produces the product of the project.
2. **Scope definition** is the process of developing a detailed scope statement to be used for subdividing the major project deliverables (as identified in the scope statement) into smaller, more manageable components (to create WBS)
3. **Create WBS:** WBS is a hierarchical deliverable-oriented grouping of project elements that organizes and defines the total scope of the project to create the required deliverables.

Introduction to Project Management

- Create WBS:
- WBS subdivides project work into smaller, more manageable, pieces of work.
- Defines work packages at the lowest level, and the code (chart) of accounts.



Source: Hendrickson and Au, 1989

Introduction to Project Management

- The WBS should not be confused with other kinds of “breakdown” structures used to present project information, other structures includes:
 - Contractual WBS (CWBS) – level of reporting to client
 - Organizational breakdown structure (OBS) – work elements assigned to organizational units or individuals
 - Resource breakdown structure (RBS) – resources by type used on project
 - Bill of materials (BOM) – materials and assemblies for fabrication
 - Risk breakdown structure (RBS) – risks by category

Introduction to Project Management

4. **Scope verification** is the process of obtaining formal acceptance of the completed project scope and deliverables by stakeholders.

5. **Scope control** is concerned with:

- Influencing factors that create scope changes to ensure that changes are agreed upon
- Determining that a scope change has occurred
- Managing the actual changes when and if they occur, and controlling the impact of those changes.

Assignment 1

Assignment 1:

- Read the PMI's PMBOK Guide together with the PMI PMBOK Construction extension and *PRINCE2* guide.
- Prepare and submit a maximum ten-page article which:
 - Briefly summarizes the main contents of each guide in your own words.
 - Compare and contrast the two guides and show the main differences.
 - Report shall be prepared in full with ASCE Construction Research Congress conference paper writing guide
 - Due date: March 29, 2018 before 2:00 PM.
 - Please bring the hardcopy submission to class and email the softcopy to: abraham.assefa@aait.edu.et

References:

- Baldwin. A. and Bordoli, D. (2014). *A Handbook for Construction Planning and Scheduling*. Wiley and Sons limited.
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