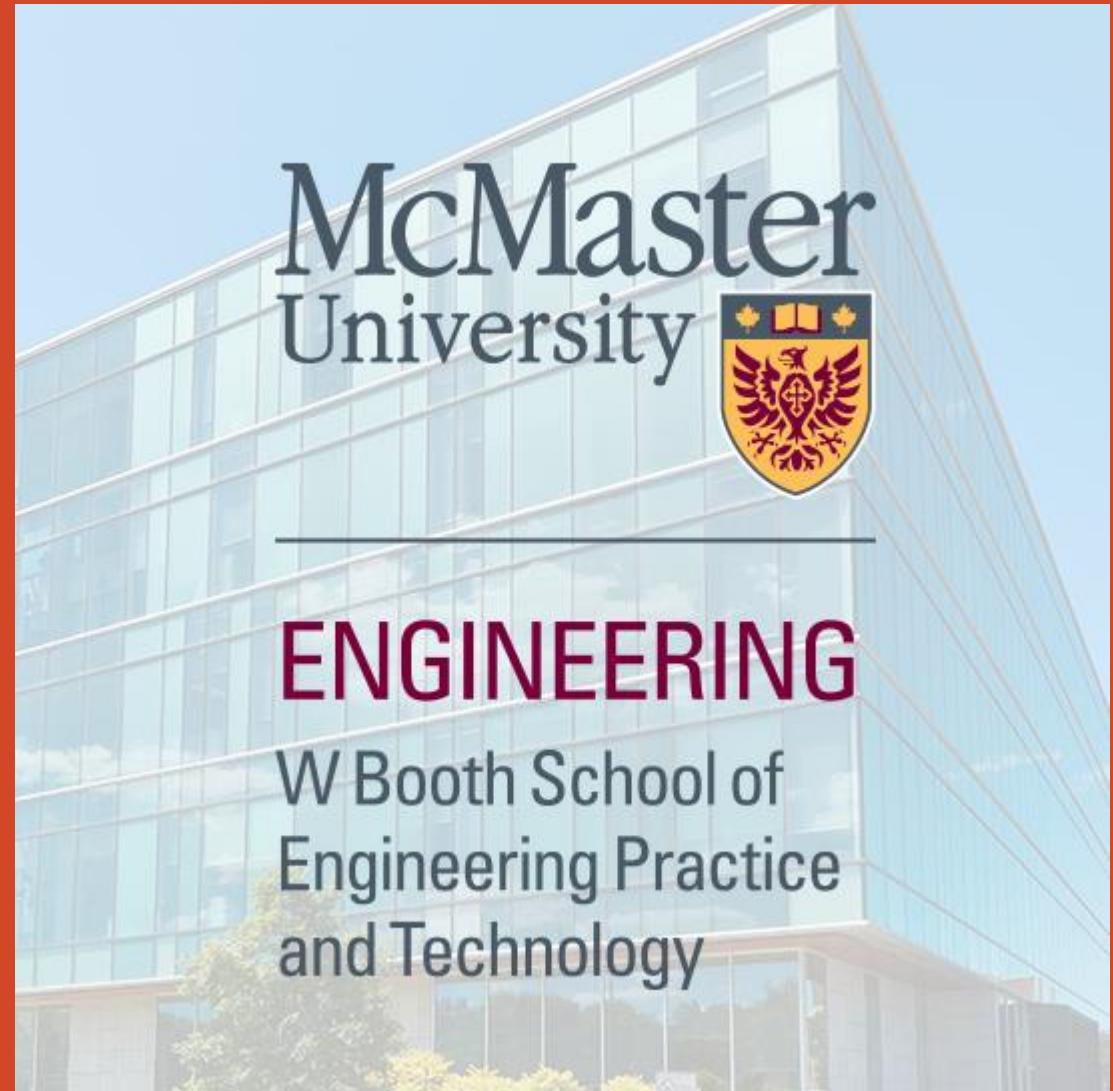


Practical Project Management for Today's Business Environment

Week 3: Project Planning:
Traditional Vs. Agile Approaches

Dr. Mikhail Hanna, PhD, PMP, PMI-RMP



Learning Objectives

- Understand the fundamental differences between Waterfall and Agile methodologies.
- Learn to apply these methodologies in the right contexts.
- Explore industry-specific examples (construction, software, and product development) to understand high-level project planning.



Agenda

Learning Objectives

Waterfall Methodology Overview

Agile Methodology Overview

Waterfall Vs Agile Comparison

Planning in Different Industries

Strategic Planning Case Studies

Group Exercise



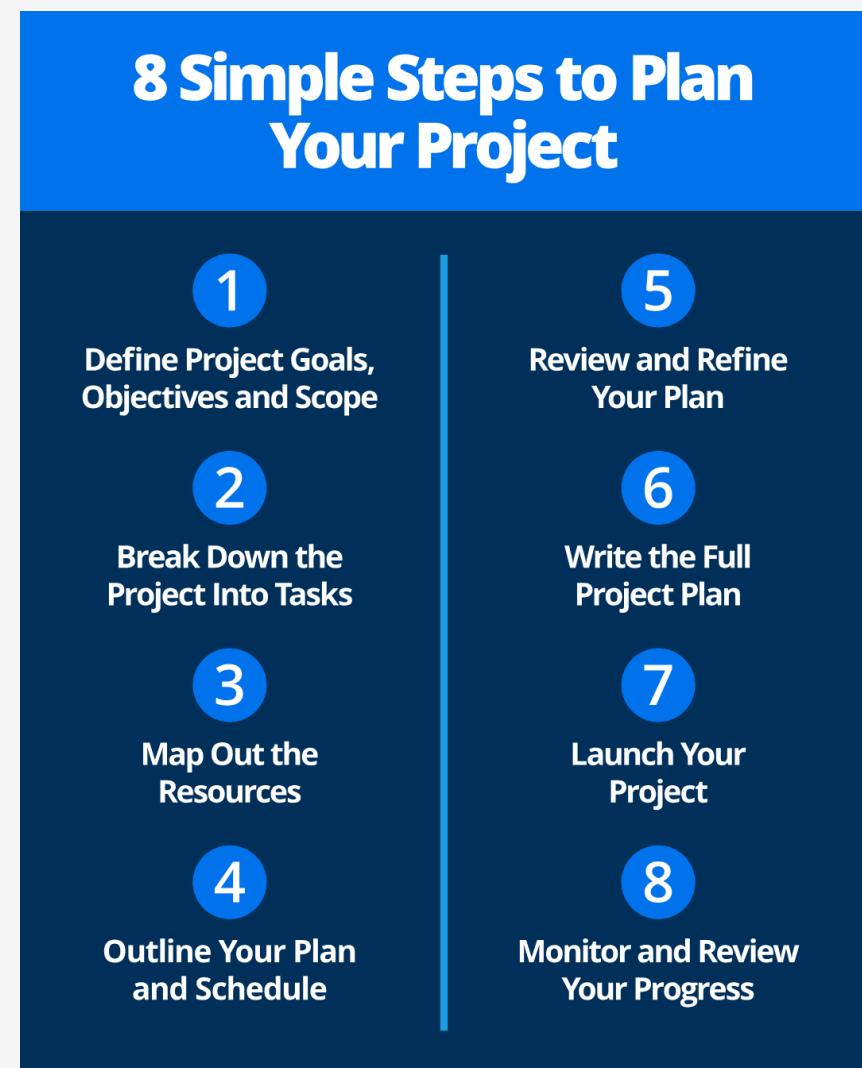
Planning Overview





What is Project Planning?

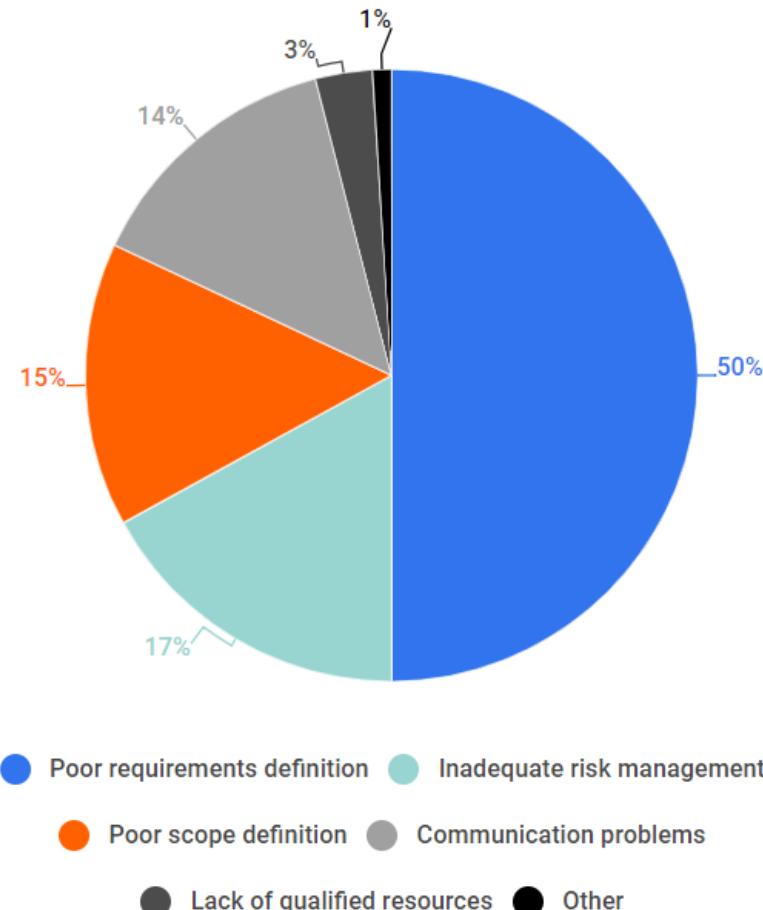
- **Definition:** Project planning is the process of defining project objectives, scope, and deliverables to achieve success.
- **Importance:** Projects often fail due to lack of planning.
- **Example:** The Denver International Airport construction project, which faced significant delays due to poor initial planning.



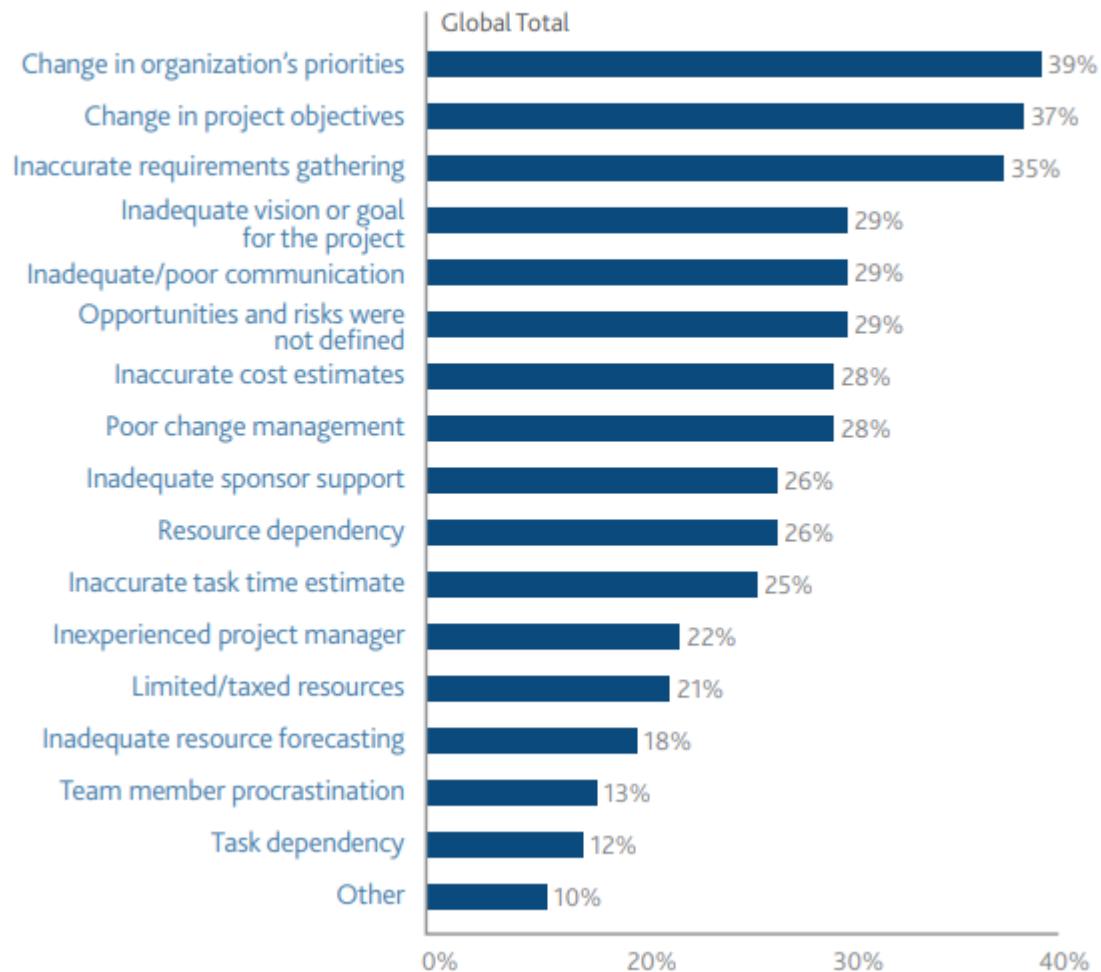


2023 Project Management Research Summary

TOP REASONS WHY PROJECTS FAIL

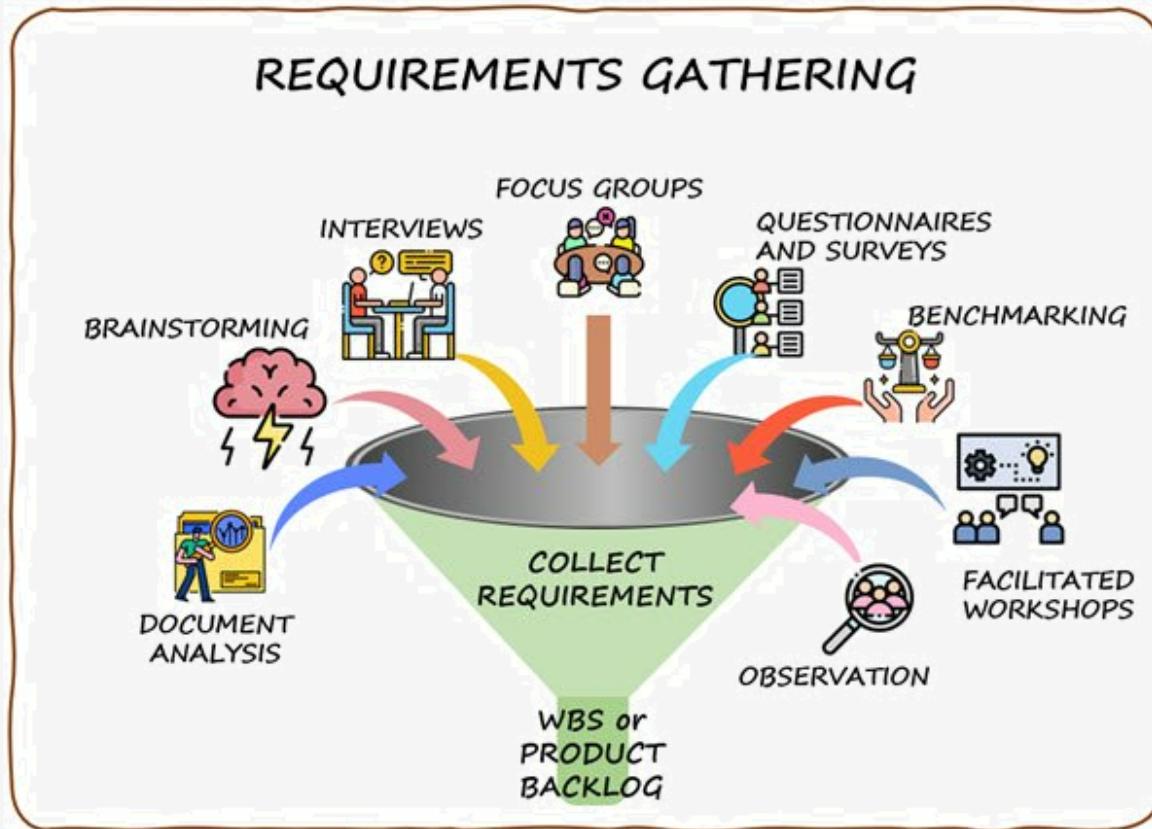


Q: Of the projects started in your organization in the past 12 months that were deemed failures, what were the primary causes of those failures? (Select up to 3)





Scoping a Project – Requirement Gathering





Scoping a Project – Requirement Gathering

Functional Requirements	Non-Functional Requirements
They define a system or its component.	They define the quality attribute of a system
It specifies, "What the system should do?"	It specifies, "How should the system fulfill the functional requirements?"
User specifies functional requirement.	Non-functional requirement is specified by technical peoples e.g. Architect, Technical leaders and software developers.
It is mandatory to meet these requirements.	It is not mandatory to meet these requirements.
It is captured in use case.	It is captured as a quality attribute.
Defined at a component level.	Applied to a whole system.
Helps you to verify the functionality of the software.	Helps you to verify the performance of the software.
Functional Testing like System, Integration, End to End, API testing, etc are done.	Non-Functional Testing like Performance, Stress, Usability, Security testing, etc are done.
Usually easy to define.	Usually more difficult to define.



Requirement Traceability Matrix

What is a Requirements Traceability Matrix (RTM)? A requirements traceability matrix is a document that demonstrates the relationship between requirements and other artifacts. It's used to prove that requirements have been fulfilled. And it typically documents requirements, tests, test results, and issues.

Work Breakdown Structure





Work Breakdown Structure (WBS)

The WBS assists project leaders, participants, and stakeholders in the development of a clear vision of the end products or outcomes to be produced by the project.

It provides the framework for all deliverables throughout the project life cycle.

Design: The WBS provides a graphical representation or textual outline of the project scope.

Some of the main roles the WBS plays in supporting clarity for project definition are that it:

Decomposes: the overall project scope into clearly defined deliverables.

Defines: the scope of the project in terms that the stakeholders can understand.

Provides: a structure for organizing information regarding the project's progress, status, and performance.

Supports: tracking of risks to assist the project manager in identifying and implementing necessary responses



Work Breakdown Structure (WBS)

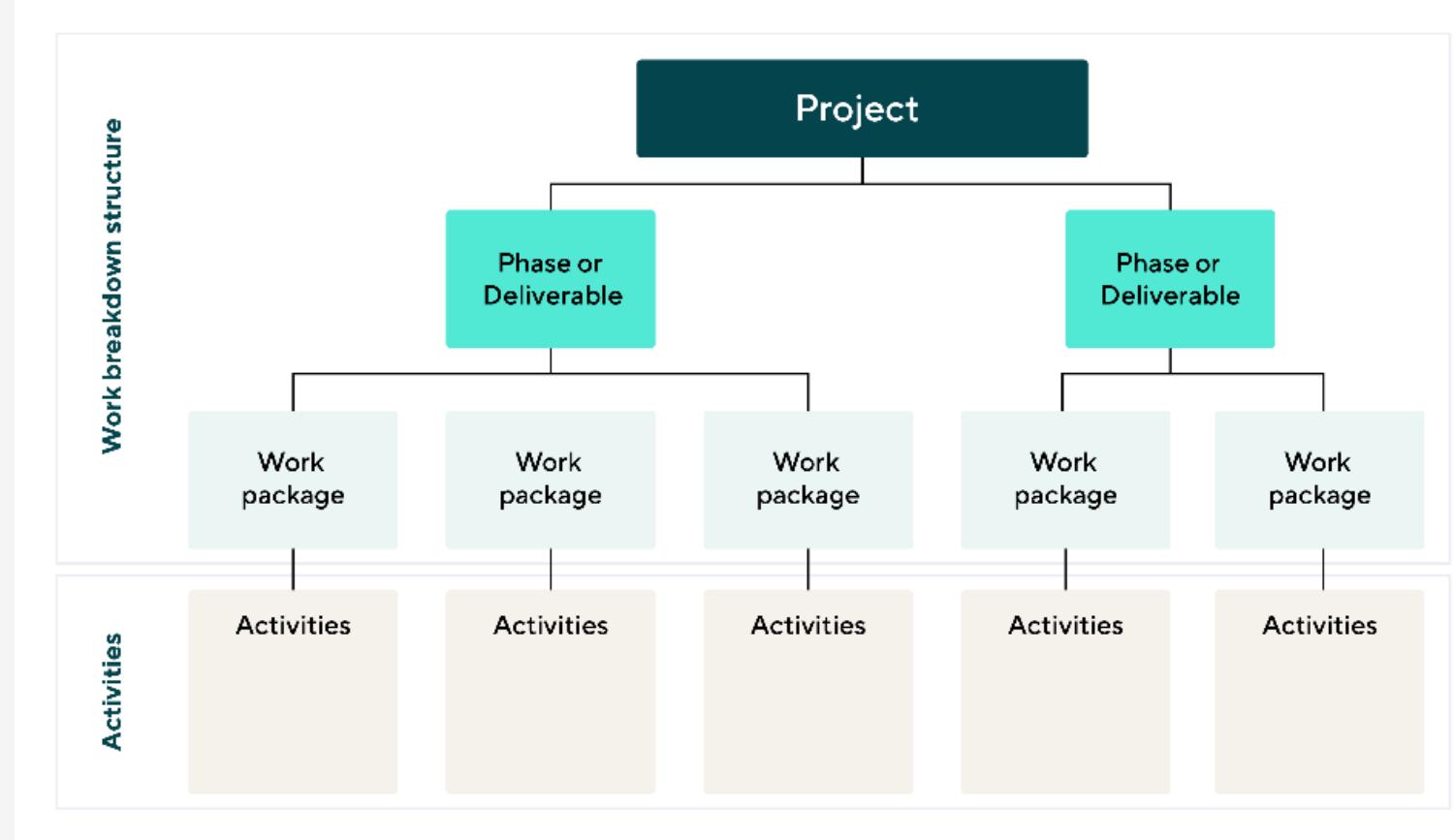
Levels:

The depth of the WBS is dependent upon the size and complexity of the project and the level of detail needed to plan and manage it.

The 100% Rule:

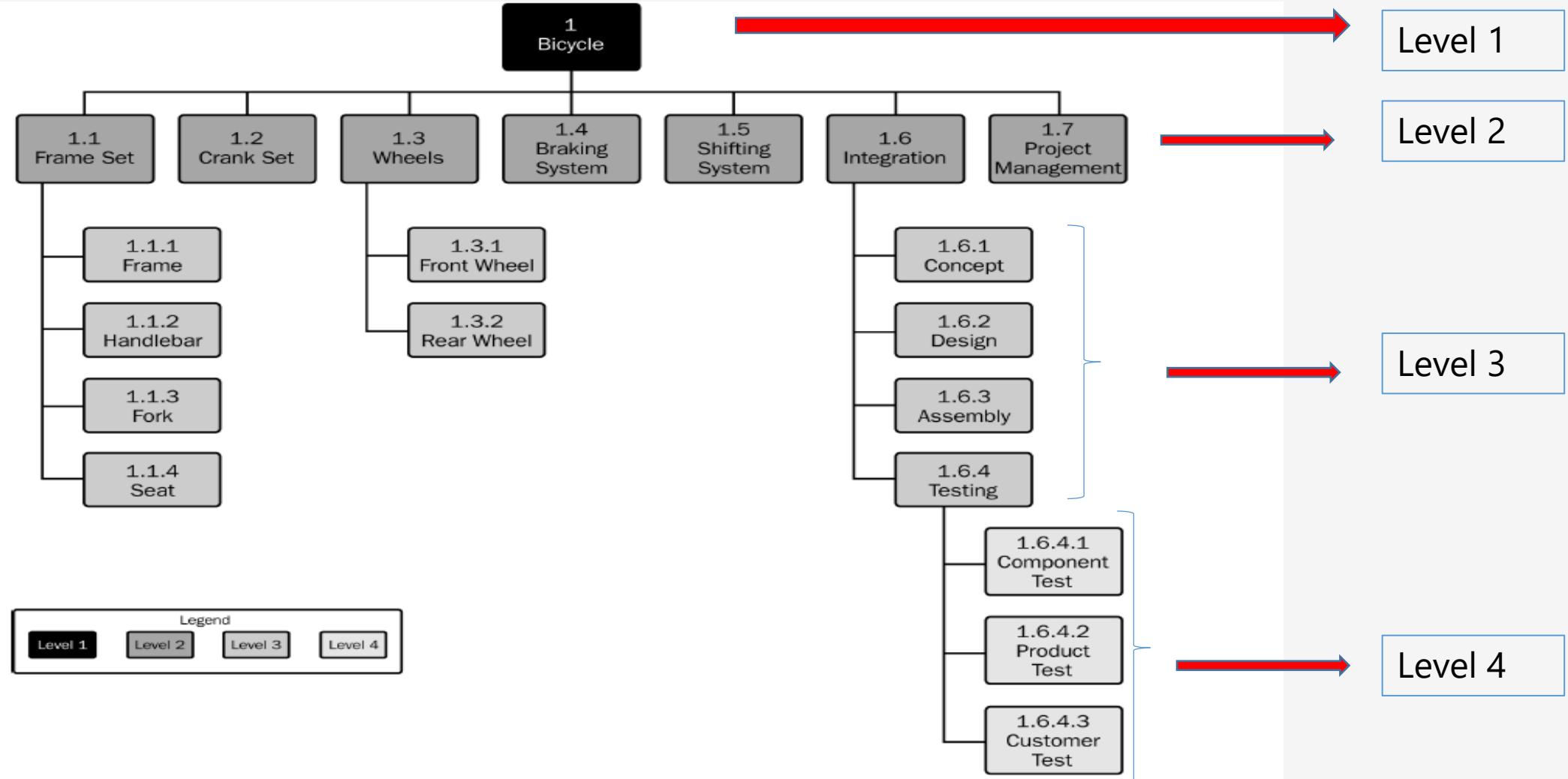
This rule states that the WBS includes 100% of the work defined by the project scope and captures all work deliverables to be completed, including project management.

The rule applies to all levels within the hierarchy.





Work Breakdown Structure (WBS)





WBS Example 1

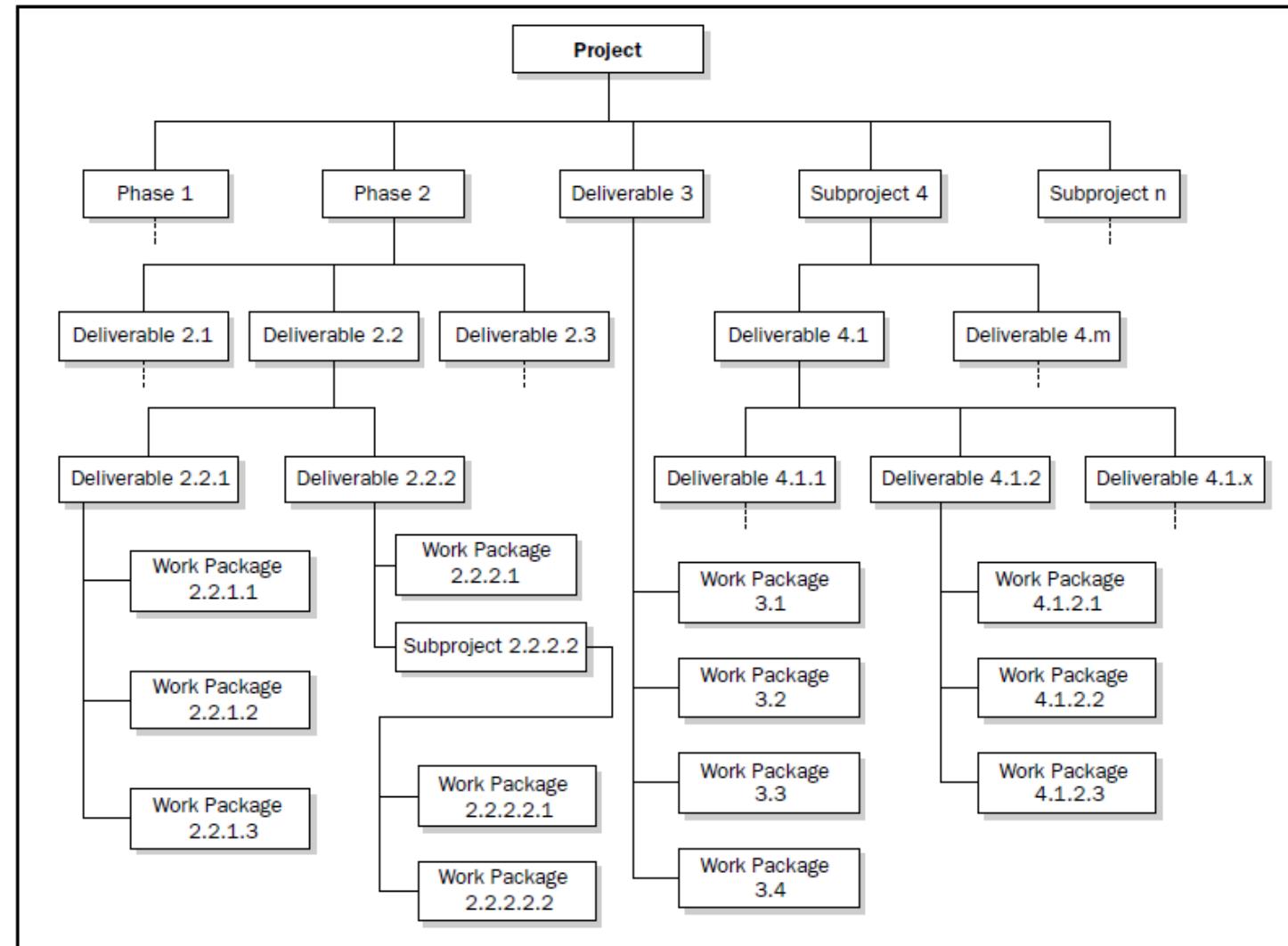


Figure 5-8. Sample Work Breakdown Structure with Some Branches Decomposed Down Through Work Packages



WBS Example 2

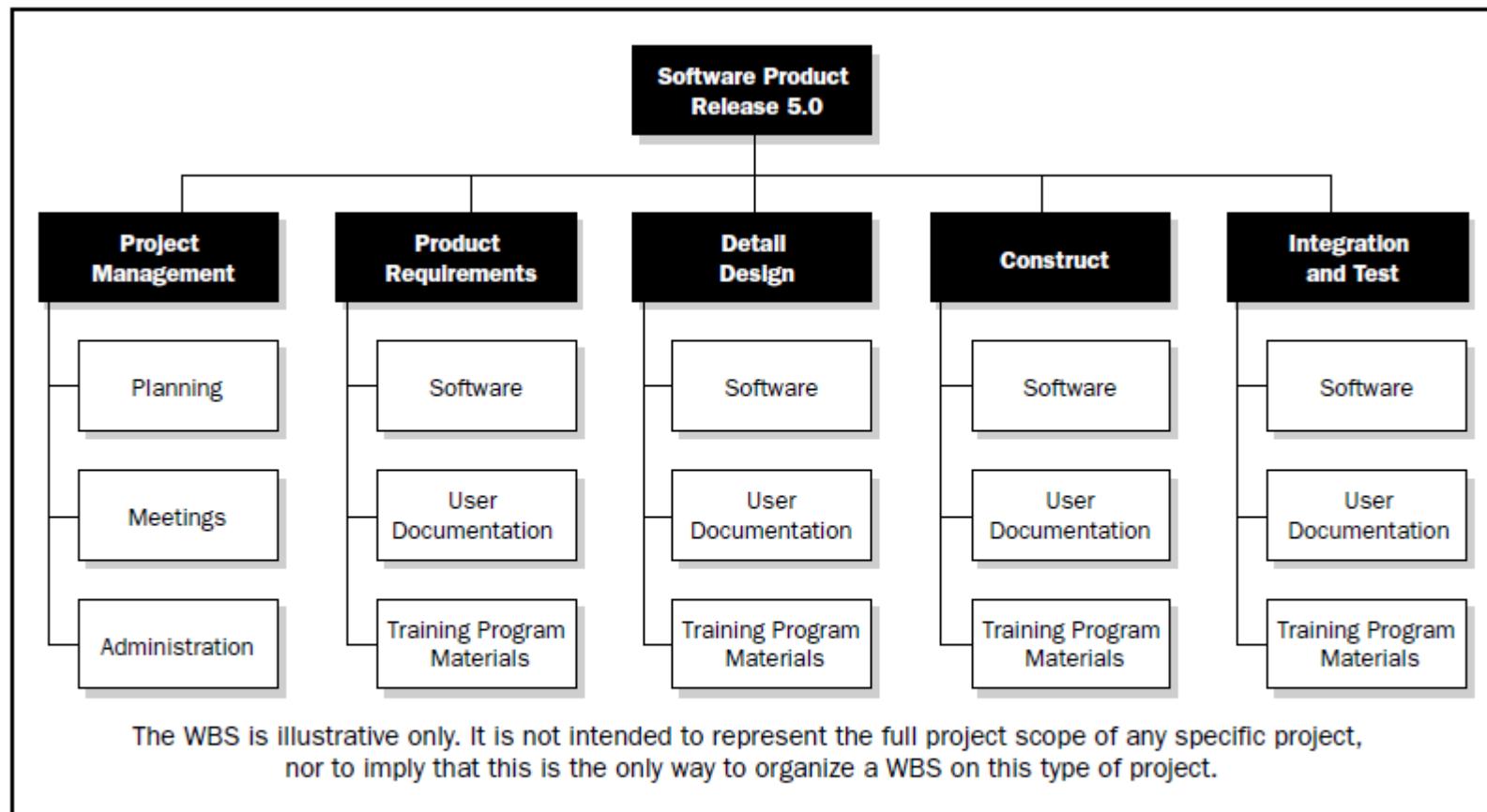


Figure 5-9. Sample Work Breakdown Structure Organized by Phase



WBS Dictionary

Many WBS tasks are vague and must be explained more so people know what to do and can estimate how long it will take and what it will cost to do the work

A **WBS dictionary** is a document that describes detailed information about each WBS item

The approved project scope statement and its WBS and WBS dictionary form the **scope baseline**, which is used to measure performance in meeting project scope goals

Work Package Name: <i>From the WBS</i>	WBS ID: <i>From the WBS</i>								
Description of Work: <i>Description of the work to be delivered in sufficient detail to ensure a common understanding by stakeholders.</i>									
Milestones: 1. List any milestones associated with the work package. 2. 3.									
ID	Activity	Resource	Labor			Material			Total Cost
			Hours	Rate	Total	Units	Cost	Total	
	<i>From Activity list or schedule</i>	<i>From Resource requirements</i>	<i>Total effort.</i>	<i>Labor rate.</i>	<i>Hours X rate.</i>	<i>Amount</i>	<i>Cost</i>	<i>Units X cost.</i>	<i>Labor + Material.</i>
Quality Requirements: <i>Quality metrics used to verify the deliverable.</i>									
Acceptance Criteria: <i>Criteria that will be used to accept the WBS element.</i>									
Technical Information: <i>Technical information or reference to technical documentation that contains technical information.</i>									
Contract Information: <i>Relevant contract information that contains constraints, resource information, or other relevant information.</i>									

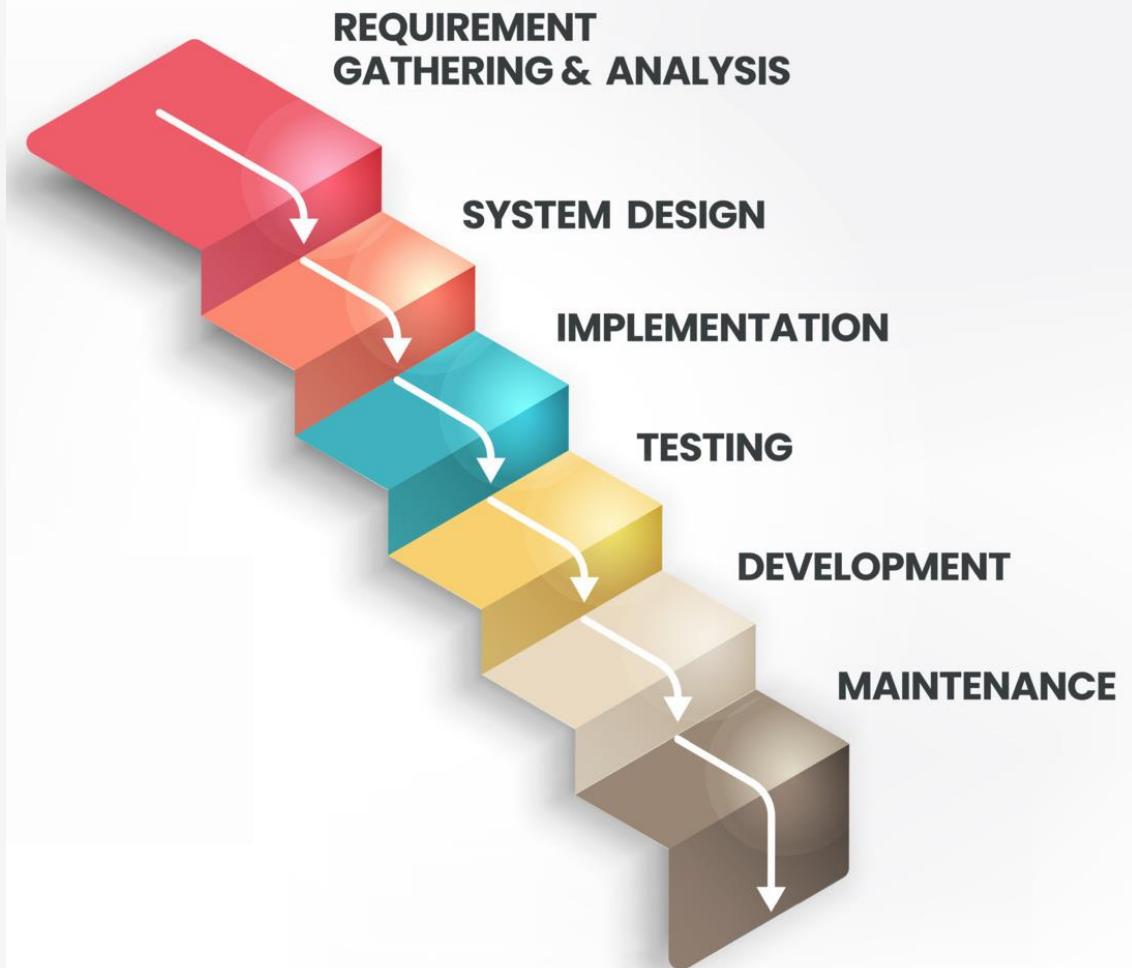
Waterfall Model





Overview: Waterfall Methodology

- **Definition:** is a breakdown of development activities into linear sequential phases, meaning they are passed down onto each other, where each phase depends on the deliverables of the previous one and corresponds to a specialization of tasks.
- **Phases:** Requirements → Design → Implementation → Testing → Maintenance.
- **Strengths:** Simple to understand, ideal for fixed-scope projects, high predictability.
- **Weaknesses:** Lack of flexibility, inability to handle scope changes.





Waterfall Cast Study: Construction Projects

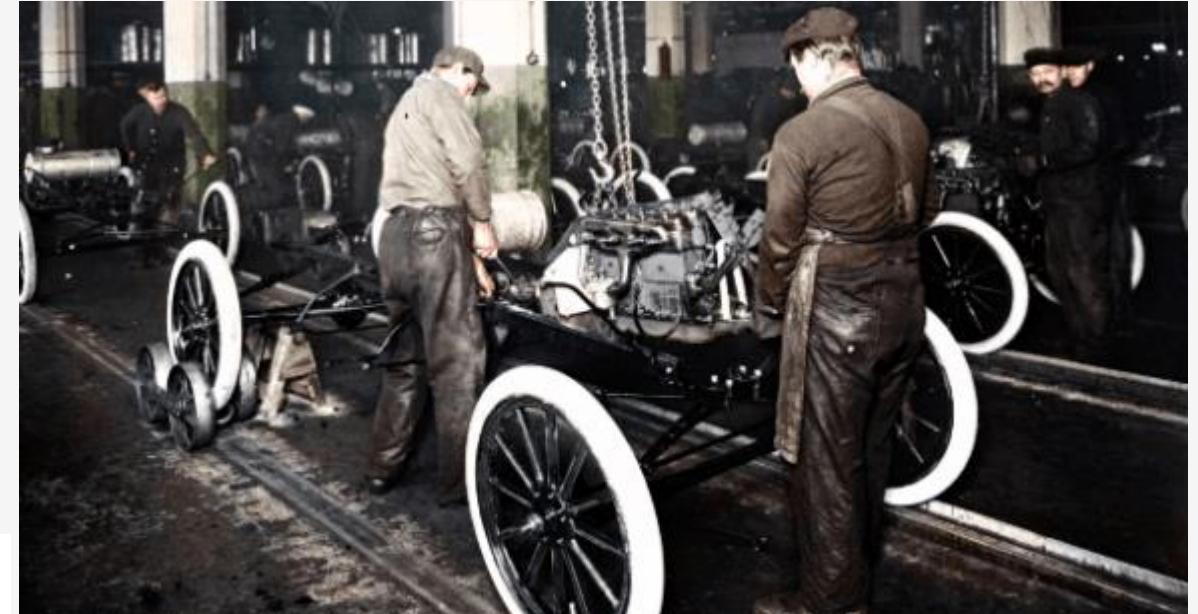
- **Example:** The Golden Gate Bridge construction, which followed a Waterfall model with fixed stages: design, approval, and construction.
- **Challenges:** Limited ability to address unforeseen challenges like weather delays.
- **Success:** Delivered within scope and budget despite long-term planning.



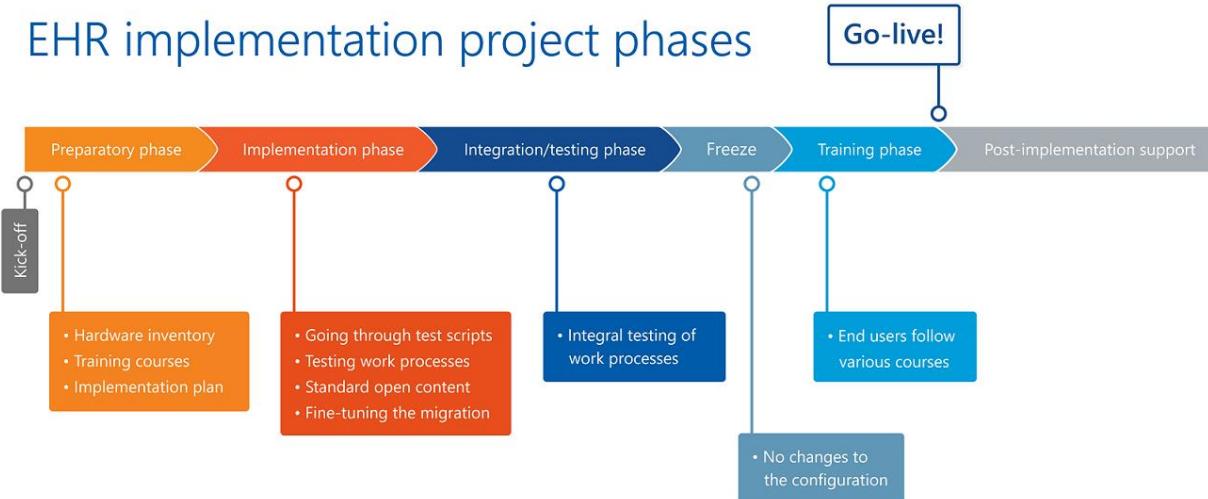


Waterfall Cast Study: Other Industries

- **Manufacturing:** Ford's assembly line production, each phase completed in sequence.



EHR implementation project phases



- **Healthcare:** The implementation of electronic health records (EHR) systems, requiring sequential steps (data collection, design, deployment).

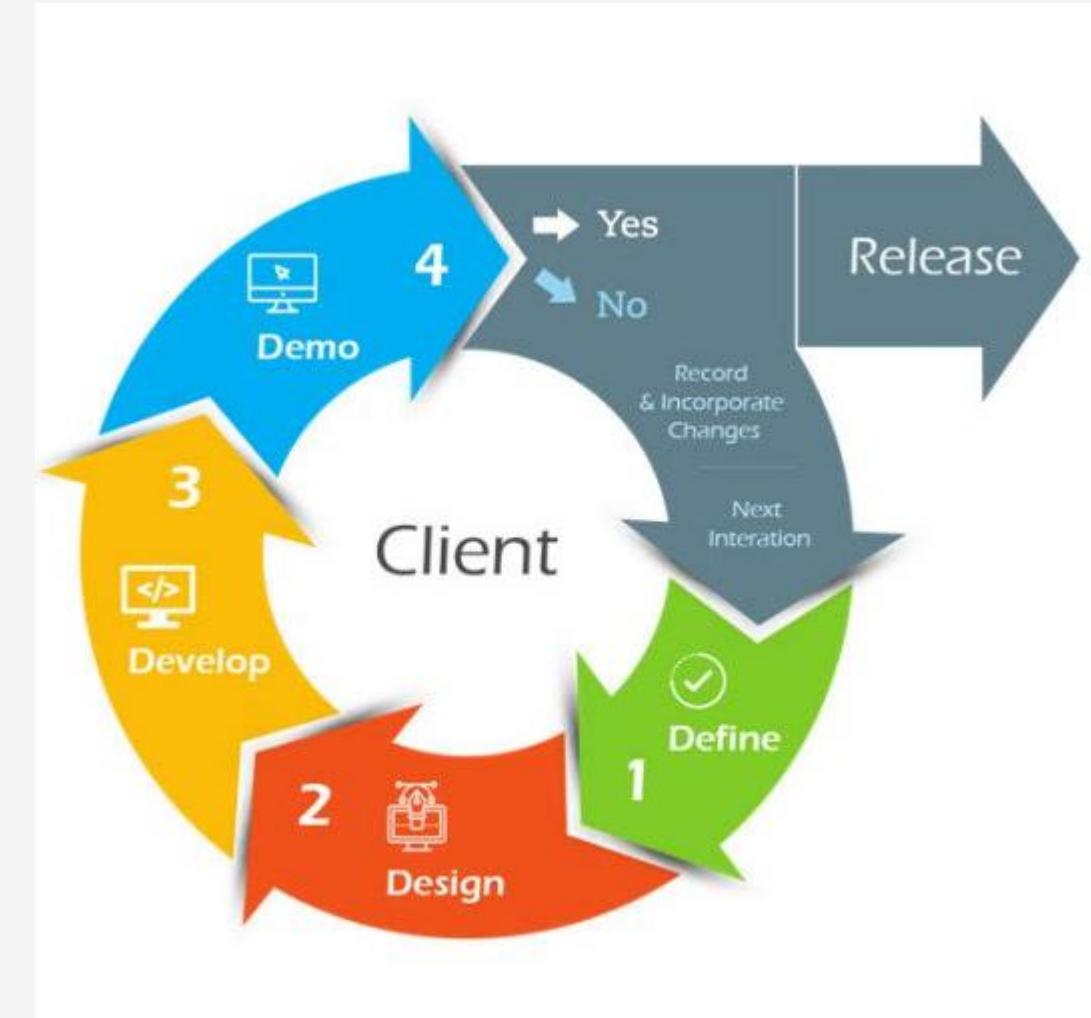
Agile Methodology





Agile Methodology Overview

- **Definition:** a project management framework that breaks projects down into several dynamic phases, commonly known as sprints. The Agile framework is an iterative methodology. After every sprint, teams reflect and look back to see if there was anything that could be improved so they can adjust their strategy for the next sprint.
- **Key Features:** Iterative, flexible, focused on collaboration.
- **Phases:** Sprints (time-boxed cycles), daily standups, product backlog.
- **Challenges:** Requires highly engaged teams and flexibility in deliverables.





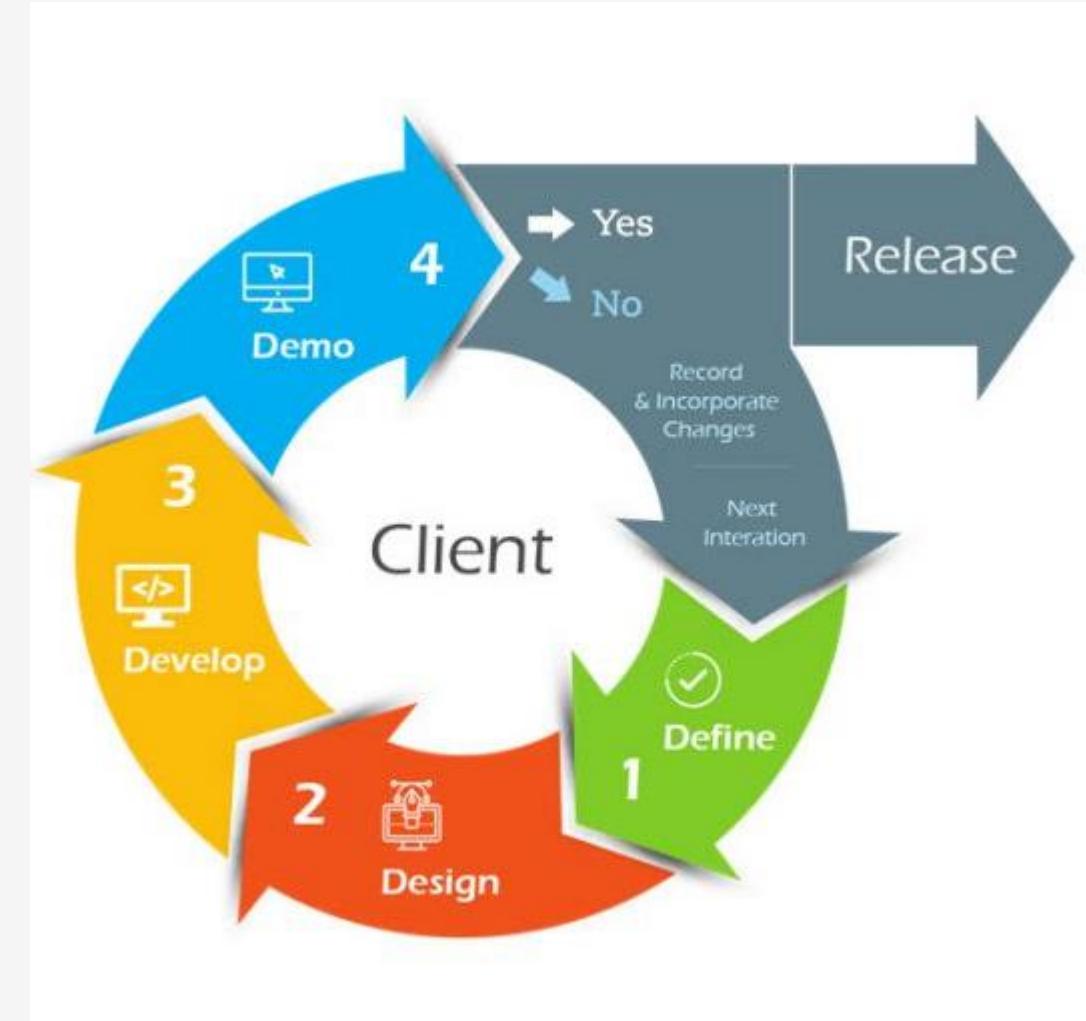
Agile Framework: Scrum and Kanban

Details:

- **Scrum:** Sprint cycles (e.g., 2-4 weeks), Scrum Master, daily standups, product backlog, and sprint review.
- **Kanban:** Visual representation of workflow, continuous delivery.

Example:

- **Scrum:** Google's software development teams use Scrum for Google Maps.
- **Kanban:** Toyota Production System used Kanban to optimize production processes.



The Agile: Scrum Framework at a glance

Inputs from Executives,
Team, Stakeholders,
Customers, Users



Product Owner



Product Backlog

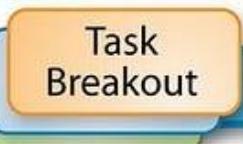


The Team

Feature Creation

Team selects starting at top as much as it can commit to deliver by end of Sprint

Sprint Planning Meeting



Sprint Backlog



Scrum Master



Burndown/up Charts



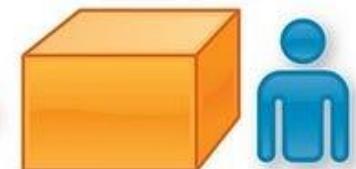
Daily Scrum Meeting



Sprint end date and team deliverable do not change



Sprint Review



Finished Work



Sprint Retrospective



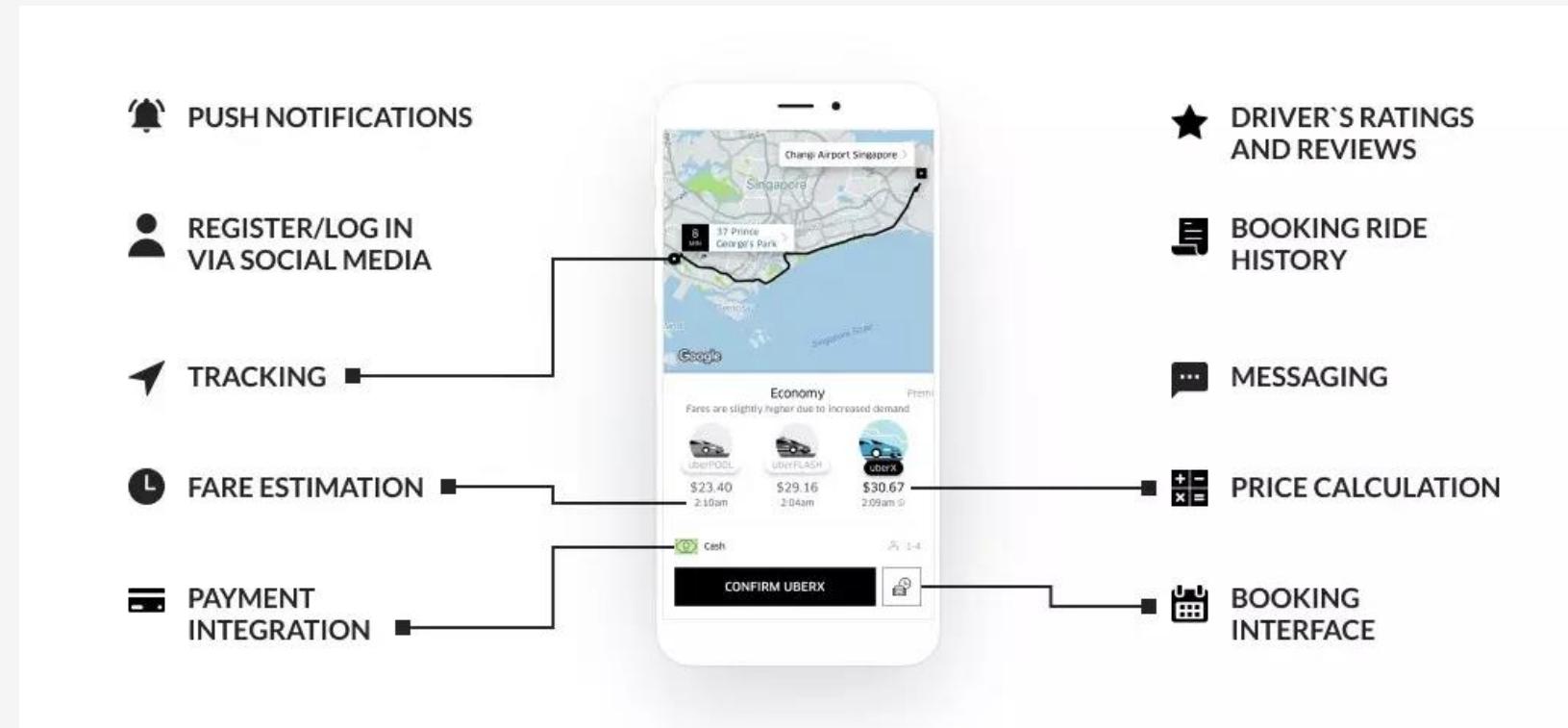
Kanban Board

To do			In progress 4/3	Done
Backlog	Waiting	Ready		
+ add task	+ add task	+ 9 archived tasks + add task	+ add task	+ 2 archived tasks + add task
As a user I can edit all of my details in Profile <small>1/25</small>	As PM I can review all code before updating the website	Deliver promo codes to resellers	Update disavow file	As stakeholder I have access to the recent deployments from my investment view
As page admin I can change the layout any time	As a user I want to have access to all recent changes	As client I can give feedback through my account, no questions asked	New users should be able to find their recent files	Hire a cleaning service for the Manchester office
As an admin I can see all my team activity	As a user I can cancel subscriptions any time	New bugs in the activity report	More bugs with SF-78 feature!	Discuss increasing page view strategies with Petra
As an admin I can edit any of the users details	As a user I can edit all of my details in Profile View	Order a gift for Jake	Speak to Mike 9252458978	Deactivate promo codes
As a user I can sign out		Edit "About us" page		Plan Mark & Jake's annual review meetings
		Each KL's page has to be made searchable		Prep. documents for the tax office



Agile Case Study: Software Development

- **Example:** Development of the Uber app. Initial versions were basic; new features and improvements were rolled out iteratively based on user feedback.



- **Challenges:** Scaling the app globally required frequent updates and sprints to ensure consistency across regions.



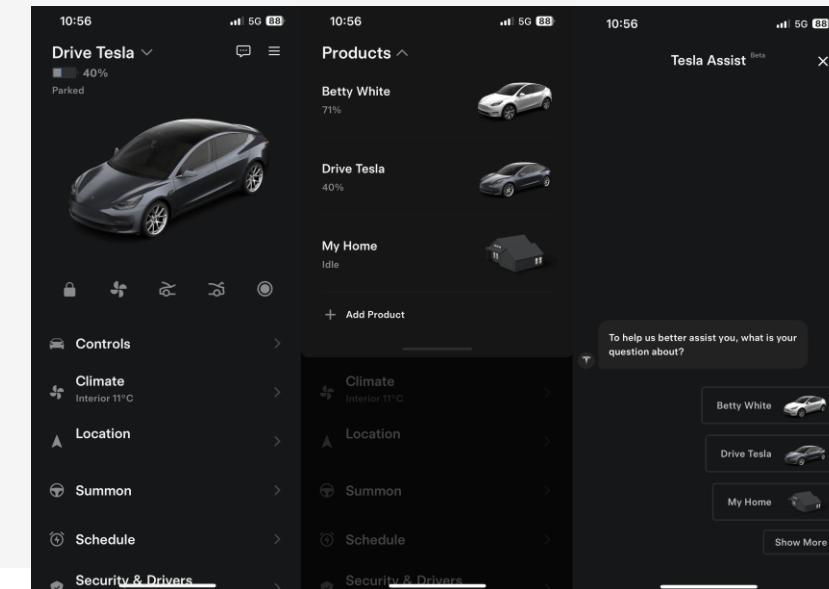
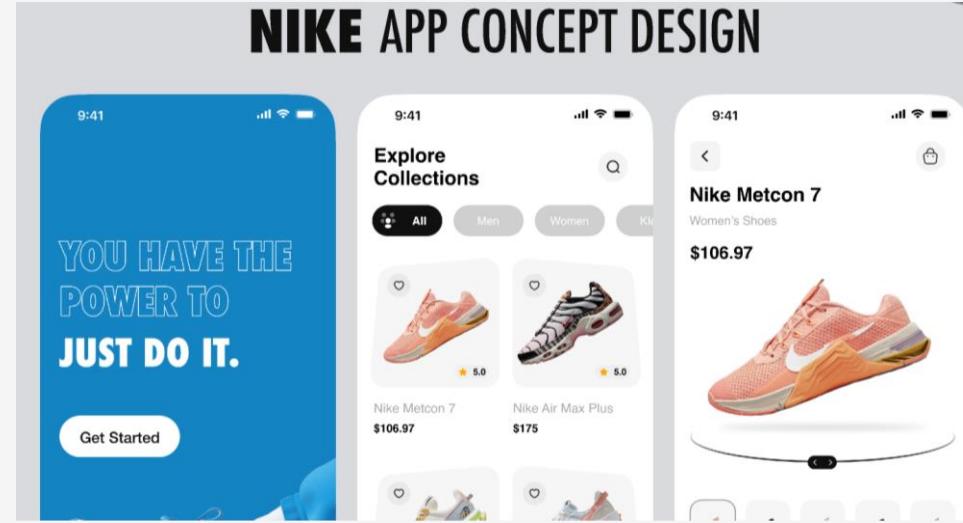
The Key Features of the Uber App

- 01 Ride Booking
- 02 Real-Time GPS Tracking
- 03 Estimated Time of Arrival
- 04 Driver Information
- 05 Surge Pricing Notification
- 06 Payment Options
- 07 Split Fare
- 08 In-app Messaging
- 09 Ride History
- 10 Scheduled Rides
- 11 Multi-stop Trips
- 12 UberPOOL
- 13 Uber Eats Integration
- 14 Maps and Navigation
- 15 Driver Ratings and Reviews
- 16 Safety Features



Agile in Other Industries

- **Marketing:** Digital campaigns for Nike were run using Agile techniques, allowing for adjustments based on consumer response data.
- **Product Development:** The Tesla Model S used Agile for software updates, releasing incremental improvements in user interface and vehicle functionality.



Waterfall Vs Agile: Key Differences

Scope: Waterfall has a fixed scope from the start, while Agile allows the scope to evolve.

Customer Involvement: Waterfall engages customers at the beginning and end; Agile involves customers throughout.

Risk Management: Waterfall addresses risk upfront, while Agile spreads risk across sprints.

Example: Comparing the Sydney Opera House project (Waterfall) to Facebook's development (Agile).

AGILE VS. WATERFALL

The main difference between Waterfall and Agile can be illustrated with the following triple constraints which can provide a rough overview. The rest of the differences that can provide a better overview can be found in the following table.

	Waterfall	Agile
Fixed Variable	Scope	Time Cost
Time	Scope	Cost
Focus	On processes	On people
Management	By plans	By changes
Development style	Waterfall / Long iterations	Incremental, iterative, short iterations
Requirements	Planned at the beginning	Updated before every iteration
Customer involved	At the beginning and the end	All the time
Feedback	Minimal	Frequent
Social aspects	Plan and control	Trust, responsibility, motivation
Team organization	Hierarchical	Self-organized teams
Leadership	Directing	Coaching
Change management	Minimization of changes	Accept and adapt to changes
Documentation	Exhaustive	Just enough
Communication	Mainly written	Mainly personal
Product delivery	As a whole at the end	Frequent, but partial



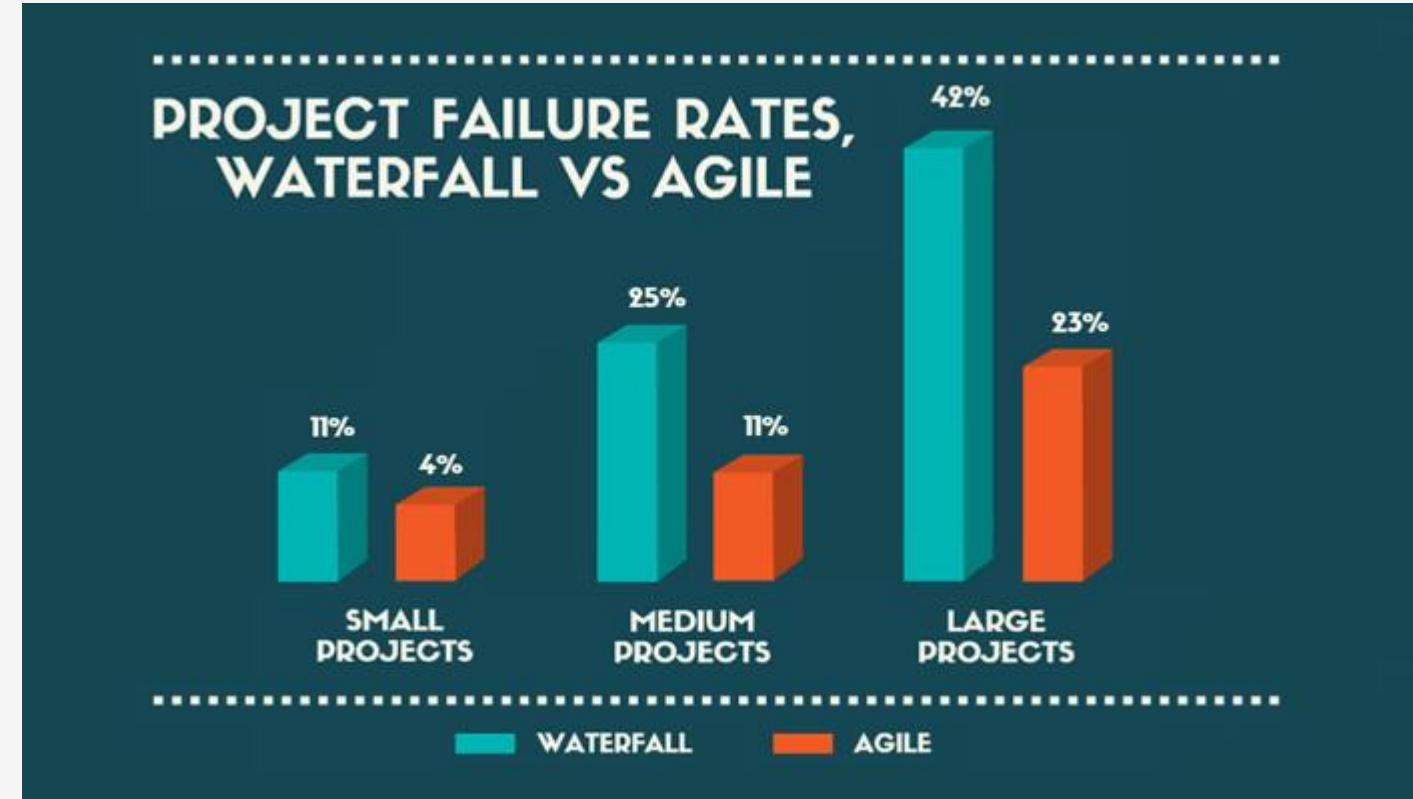


Decision Factors: Waterfall Vs Agile

Key factors include project complexity, flexibility, time sensitivity, and industry norms.

When to Choose Waterfall: Projects where scope and requirements are stable (e.g., government infrastructure).

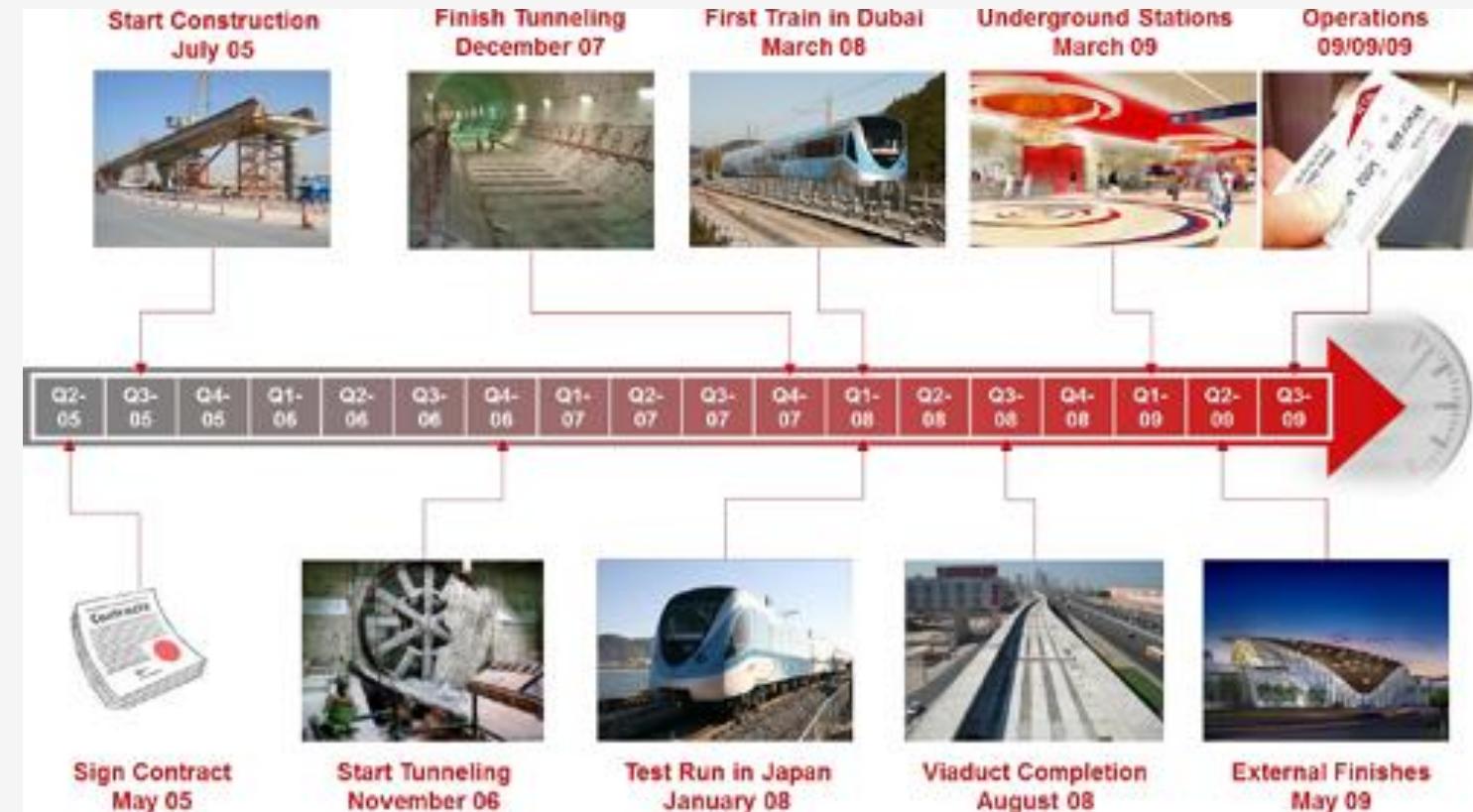
When to Choose Agile: Projects with high levels of uncertainty (e.g., tech startups).





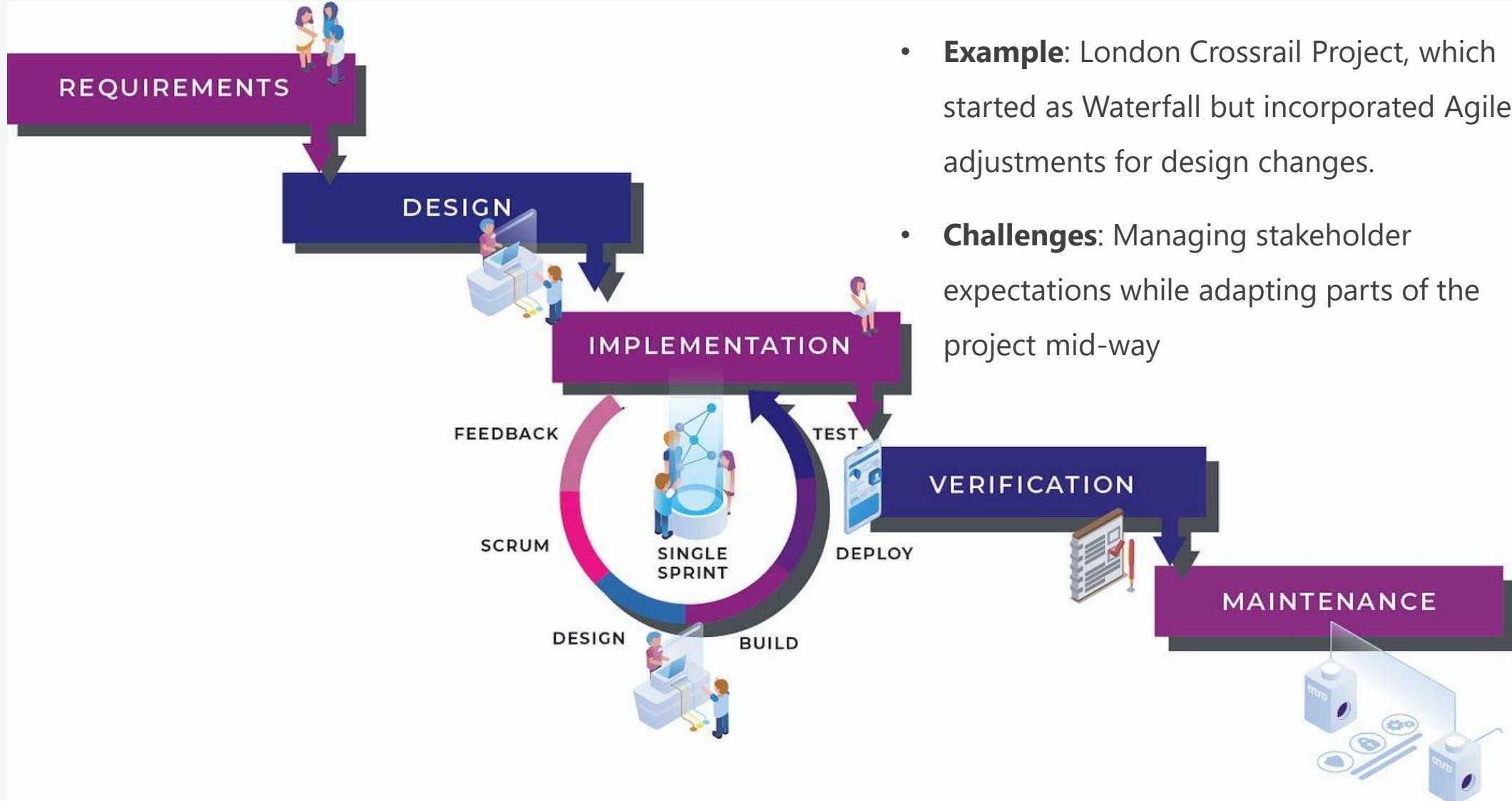
Construction Industry: Waterfall Approach

- **Example:** The construction of the Dubai Metro followed a Waterfall model, with sequential stages from design to implementation.
- **Challenges:** Major changes mid-project led to cost overruns, as Waterfall didn't accommodate flexibility.





Construction Industry: Hybrid Approach



High-Level Planning – Project Delivery Models





Project Delivery Model Overviews

- Project Delivery is a comprehensive process including **planning, design and construction** required to execute and complete any type of project.
- One of the most important decisions made by any Owner getting on a construction project is the choice of the project delivery method – how the project will be designed and constructed.
- There are many options for delivery methods and many variations within those

An Owner faced with choosing a project delivery method should consider several factors in making the decision, including:

1. Project size
2. Type of project
3. Legislative and regulatory requirements
4. Tolerance for risk
5. Schedule
6. Local market conditions
7. Desired level of involvement
8. Owner's resources and capabilities



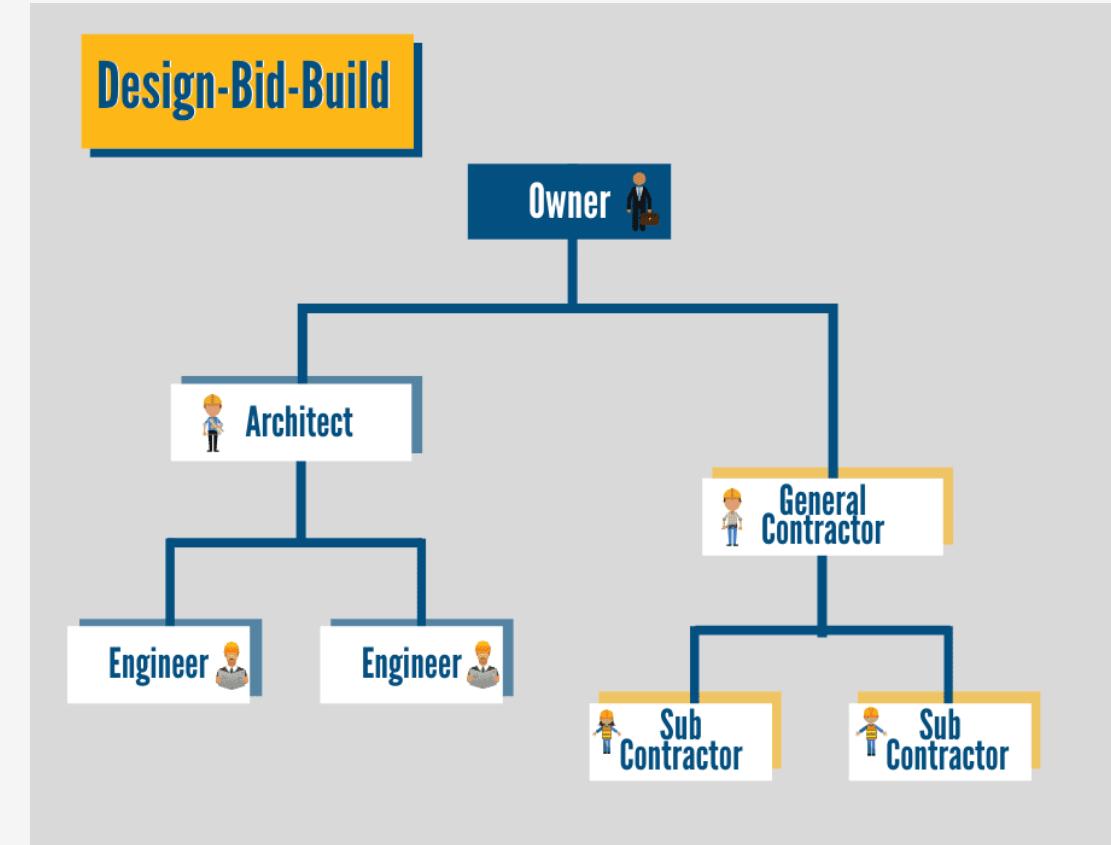
Design-Bid-Build (DBB) Model

Process: Project owner hires a designer to create detailed plans, then contracts a builder via a competitive bidding process.

Advantages: Clear division of responsibilities, competitive pricing.

Challenges: Longer timelines, risk of miscommunication between designers and builders.

Example: The Panama Canal Expansion used DBB, leading to clear phases but eventual delays.





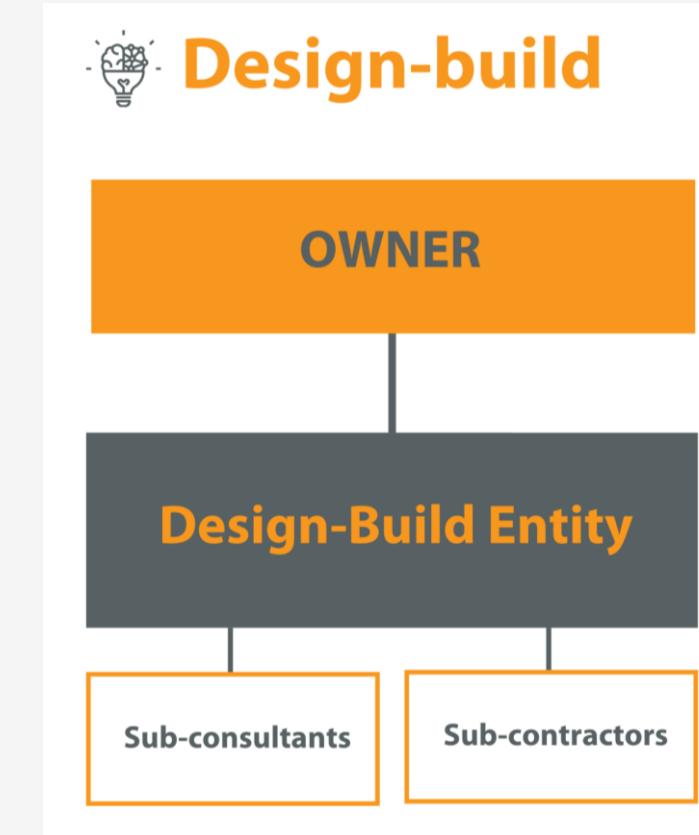
Design-Build (DB) Model

Process: A single contractor handles both design and construction, leading to a more integrated and collaborative process.

Advantages: Faster delivery, improved communication.

Challenges: Less competitive pricing due to fewer bidders, potential for cost overruns if the design is incomplete.

Example: The Oakland Bay Bridge was delivered using the DB model, reducing project duration.



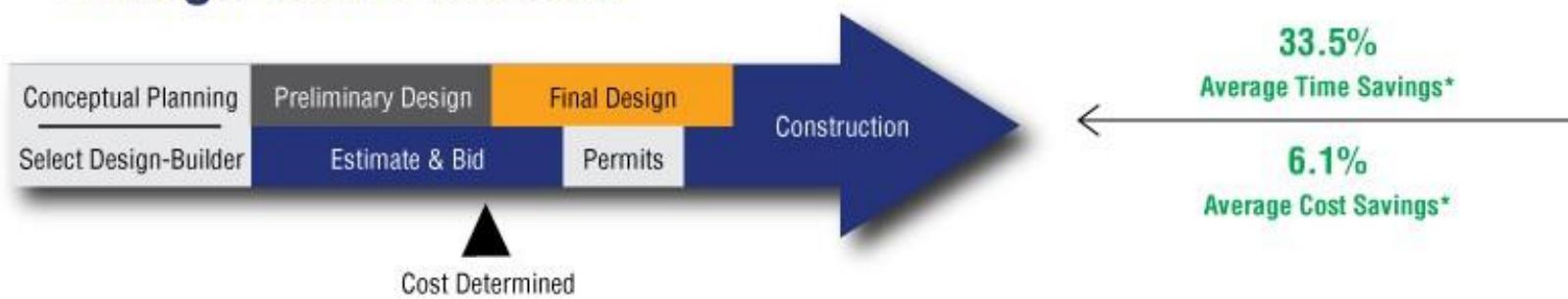


DBB Vs DB Model

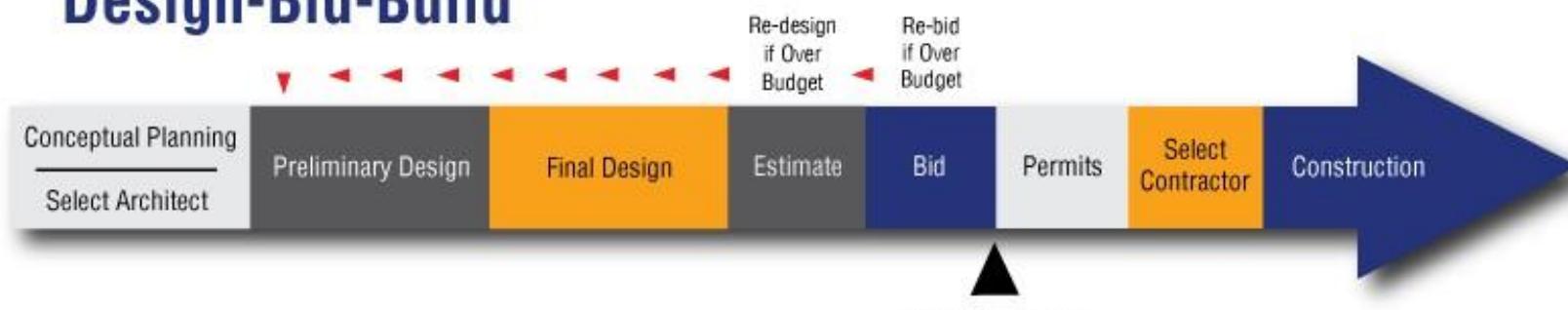
The Benefits of Design-Build

Best Value. Faster Completion. Reduced Cost.

Design-Build Method



Design-Bid-Build



*Source: Construction Industry Institute/Penn State research comprising 351 projects ranging from 5,000 to 2.5 million SQ. FT.



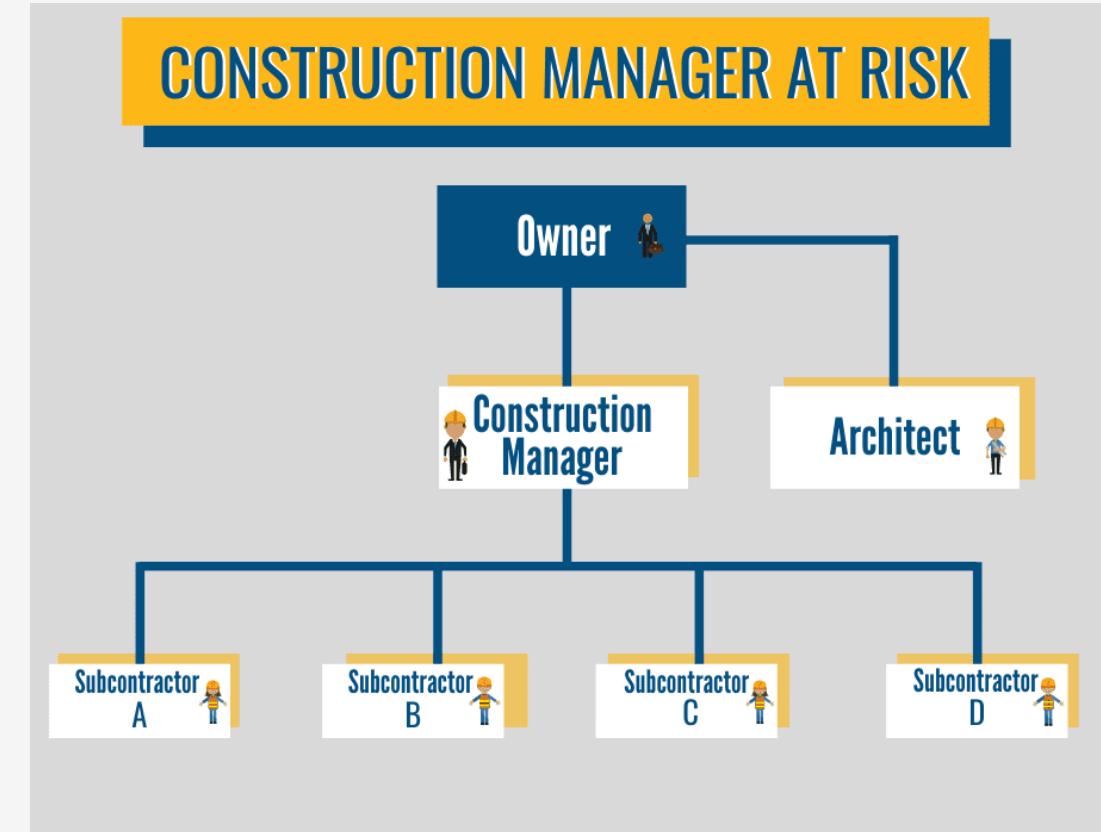
Construction Manager @ Risk (CMAR) Model

Process: A construction manager is hired early and works with the owner and designer to control costs and risks.

Advantages: Better risk management, early contractor involvement.

Challenges: Potential conflicts if the construction manager takes on too much risk.

Example: The Boston Big Dig initially used CMAR, although cost overruns occurred due to scope changes.





Integrated Project Delivery (IPD) Model

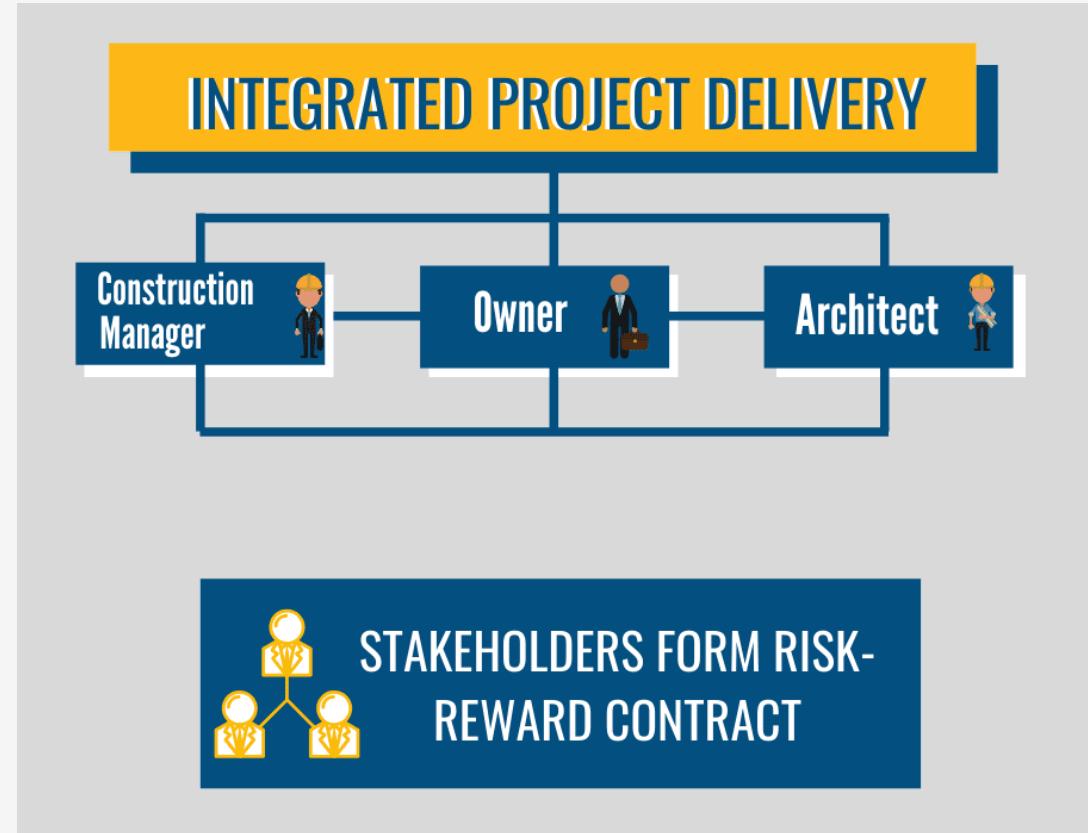
Process: A collaborative approach that involves all key parties (owner, designers, builders) working together from the project's inception to completion.

Advantages: Improved collaboration, shared risk and reward, better alignment of goals.

Challenges: Requires significant upfront investment in collaborative tools and processes.

Example: Sutter Health's California Pacific Medical Center used IPD, reducing waste and improving efficiency.

Ontario Power Generation: Darlington New Nuclear Project – DNNP-1 (OPG, GE Hitachi, Atkins Realis, Aecon)





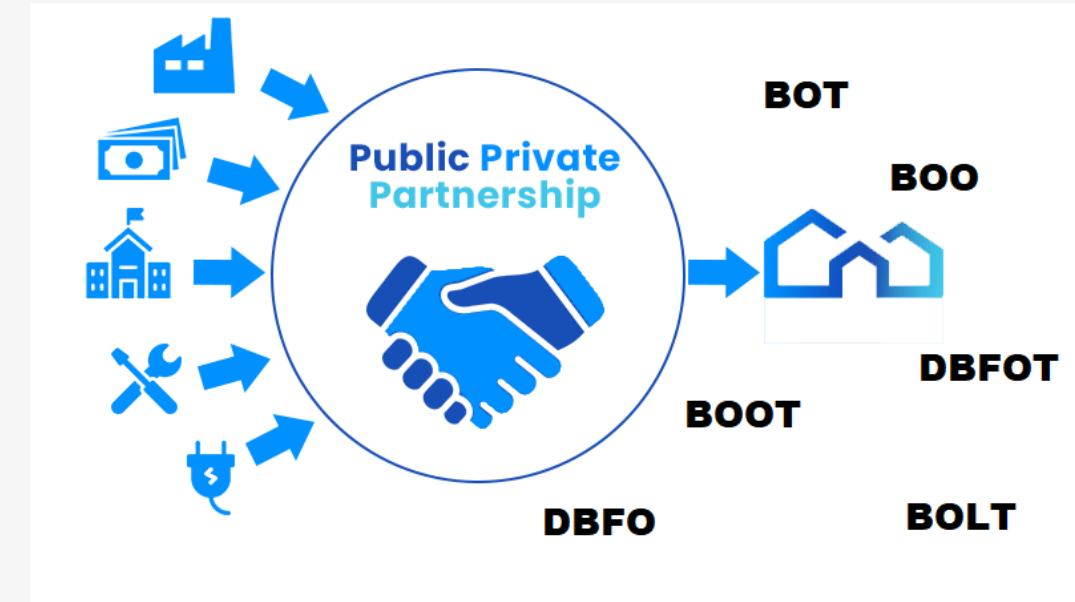
Public Private Partnership (PPP) Model

Process: Public sector partners with private companies to fund, build, and manage large-scale infrastructure projects.

Advantages: Access to private funding, risk sharing.

Challenges: Complex contracts, potential misalignment of public and private goals.

Example: Highway 407 in Ontario, Canada was built and operated through a PPP model.





Choosing the Right Delivery Model

	DBB	DB	CMAR
1. Project Size & Complexity	<ul style="list-style-type: none">• Ordinary projects• Low complexity/uncertainty	<ul style="list-style-type: none">• Low to moderate complexity	<ul style="list-style-type: none">• High complexity/uncertainty• Larger projects
2. Legislative/Regulatory	<ul style="list-style-type: none">• Typically the required method	<ul style="list-style-type: none">• Sometimes permitted	<ul style="list-style-type: none">• Sometimes permitted
3. Risk Tolerance	<ul style="list-style-type: none">• Moderate tolerance• Late cost guarantee	<ul style="list-style-type: none">• Low tolerance• Early cost guarantee• Desire to transfer design-construction coordination risk	<ul style="list-style-type: none">• High tolerance• Early to late cost guarantee
4. Schedule Sensitivity	<ul style="list-style-type: none">• Not schedule sensitive• Cost more important	<ul style="list-style-type: none">• Schedule more important	<ul style="list-style-type: none">• Schedule and quality more important
5. Local Market Knowledge	<ul style="list-style-type: none">• Low bid• Transactional relationships	<ul style="list-style-type: none">• Low bid or negotiated• Relationship-based	<ul style="list-style-type: none">• Negotiated• Relationship-based
6. Owner Influence/Control	<ul style="list-style-type: none">• High	<ul style="list-style-type: none">• Low	<ul style="list-style-type: none">• Moderate to high
7. Owner's Resources & Capabilities	<ul style="list-style-type: none">• Less experienced	<ul style="list-style-type: none">• More experienced	<ul style="list-style-type: none">• More experienced



Industry Example 1



EXAMPLE PROJECT - DBB PEOPLES GAS

System Modernization Program (SMP)

- Replacing over 2,000 miles of natural gas main within Chicago
- \$8B construction cost

Why well-suited for DBB:

- Repetitive work
- Ample time to complete engineering in advance of planned construction
- Desire for competitive pricing



Industry Example 2



EXAMPLE PROJECT - DB

MONADNOCK HALL

Southern New Hampshire University



- 300-bed dormitory
- 100,000 square feet
- \$34M total cost
- 19 month duration

Why well-suited for DB:

- Tight timeline
- Viewed as a typical project
- Owner was able to retain some involvement in design through design progress meetings and submittals



Industry Example 3



UNIVERSITY OF CHICAGO

Center for Care and Discovery

- State-of-the-art facilities for advanced surgery, cancer, interventional radiology and gastroenterology, neuroscience, and high-tech imaging
- 1.1M square feet
- \$700M construction cost

Why well-suited for CMAR:

- Very large project
- High complexity
- Commitment to quality
- Schedule-driven
- Organization with sustained capital portfolio that is able to develop repeat vendor relationships

Group Exercise





Selecting a Project Delivery Model

Scenario: Your group is tasked with building a new community recreation center. The center will include a swimming pool, gymnasium, and multipurpose rooms. The budget is \$10 million, and the project must be completed within 18 months.

Select a Delivery Model: Choose one of the following project delivery models based on the project's scope, timeline, and complexity:

- Design-Bid-Build (DBB)
- Design-Build (DB)
- Construction Manager at Risk (CMAR)
- Integrated Project Delivery (IPD)

Deliverables:

A one-paragraph summary that includes:

- The selected project delivery model.
- A brief justification for the choice.
- A key project risk and its mitigation strategy.

Justify Your Choice: Write down a brief explanation (2-3 sentences) for why your group selected this model.

Identify 1 Key Risk: Identify one major risk for the project and explain how your chosen delivery model helps mitigate this risk.

Takeaways

Waterfall is best for structured, predictable projects.

Agile excels in dynamic environments with frequent changes.

Hybrid approaches are common in complex, modern projects.



Reference Links

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