

resources, which results in starting, stopping & restarting of projects
Project portfolio sys design: classification of project, selection criteria depending upon classification, sources of proposals, evaluating proposals, ranking proposals, managing portfolio of projects

Project types: compliance (must-do, incl emergency, meet regulations, usually have penalties if not impl), strategic (directly support long-run mission, increase revenue/market share, ex: new products, R&D), operational (support current ops, improve perf, reduce product cost, improve efficiency of delivery sys, ex: upgrade building green rating)

Financial Selection Criteria: payback, NPV, IRR (internal rate of return, inverse of payback)
Payback model: measures time project takes to recover investment; uses more desirable, shorter paybacks; emphasises cash flows (key factor in business)
Payback limitations: ignores time value of money, assumes cash inflow only for investment period, does not consider profitability

Net Present Value: $I_0 + \sum_{t=1}^n \frac{F_t}{(1+k)^t}$, I_0 is initial investment (negative), F_t is net cash inflow for period t , k is required rate of return, want positive
Non-financial strategic criteria: capture larger market share, make it difficult for competitors to enter the market, develop enabler product which by interduction will increase sales in more profitable products, develop core tech to be used in next-gen products, reduce dependency on unreliable suppliers, prevent government intervention & regulation

Multicriteria selection models:
Checklist model: use list of questions to review potential projects & to determine accept/reject, fails to answer relative importance/value of potential project & doesn't allow for comparison with others

Multicriteria scoring model: use several weighted qualitative and/or quantitative selection criteria to evaluate project proposals, can use for comparison

Selection model advantages: bring projects to closer alignment with org strategic goals, reduce number of wasteful projects, help identify proper goals for projects, help everyone involved understand how & why project is selected

Project relativity matrix: 2 dimensions (technical feasibility, NPV), white elephant (low, low, showed promise at one time but are no longer viable), oyster (low, high, technological breakthroughs with high commercial payoffs), bread-and-butter (high, low, evolutionary improvements to current products & services), pearl (high, high, revolutionary commercial opportunities using proven tech advances)

Challenges to advancing projects: need to balance needs of project with org, uniqueness & short duration of projects relative to ongoing longer term org activities, multidisciplinary & cross-functional nature of projects creates authority & responsibility dilemmas

Functional org: different segments of project delegated to functional units, coordination maintained through normal management channels, used when interest of 1 functional area dominates project or has dominant interest in project success

Functional +: no structural change, flexibility, in-depth expertise, easy post-project transition
Functional -: lack of focus, poor integration, slow, lack of ownership

Dedicated project teams: teams operate as separate units under leadership of full-time project manager, in projectised org where projects are dominant form of business functional depts are responsible for providing support to teams

Dedicated +: simple, fast, cohesive, cross-functional integration

Dedicated -: expensive, internal strife, limited tech expertise, difficult post-project transition
Hybrid/Matrix: overlaid on normal functional structure, 2 chains of command (functional & project), project participants report simultaneously to both functional & project managers, optimise use of resource (allows participation on multiple projects while performing normal functional duties)

Matrix +: efficient, strong project focus, flexible, easy post-project transition

Matrix -: dysfunctional conflict, infighting, slow, stressful

Weak matrix: authority of functional manager predominates, project manager has indirect authority

Balanced matrix: the project manager sets overall plan & the functional manager determines how work is to be done

Strong matrix: project manager has broader control, functional departments act as subcontractors to project

Matrix division of responsibilities:
Project manager: what has to be done, when should the task be done, how much money is available to do the task, how well has the total project been done

Functional manager: how will it be done, how will project involvement impact normal functional activities, how well has the function input been integrated

Negotiated issues: who will do the task, where will the task be done, why will the task be done, is the task satisfactorily completed

Choosing the appropriate project management structure:
Organisational considerations: how important is the project to the firm's success, what percentage of core work involves projects, what level of resources (human & physical) are available

Project considerations: size of project, strategic importance, novelty & need for innovation, need for integration (number of depts involved), environmental complexity (number of external interfaces), budget & time constraints, stability of resource reqs

Org culture: system of shared norms, beliefs, values & assumptions that bind people together, thereby creating shared meanings; personality of org that sets it apart from other orgs

Org culture benefits: provides sense of identity to members, helps legitimise management system of org, clarifies & reinforces standards of behaviour, helps create social order

Diagnosing org culture: study physical characteristics (architecture, office layout, decor, attire), read about org (annual reports, internal newsletters, vision statements), observe how people interact within org (pace, lang, meetings, issues discussed, decision-making style, comm patterns, rituals), interpret stories & folklore surrounding org (anecdotes, heroines, heroes, villains)

Org culture dimensions: member identity (job, org), team emphasis (individual, group), management focus (task, people), unit integration (independent, interdependent), control (loose, tight), risk tolerance (low, high), reward criteria (performance, other), conflict tolerance (low, high), means-ends orientation (means, ends), open-system focus (internal, external, degree to which org monitors & responds to changes in external env)

Culture challenges for structuring projects: interacting with culture & subcultures of parent org, interacting with project clients or customer orgs, interacting with other orgs connected to project

Mechanisms for sustaining org culture: formal statement of principles, top management behaviour, reactions to org crises, allocation of rewards & status, rituals, stories, symbols

Defining the project: defining project scope, establishing project priorities, creating WBS, integrating WBS with org, coding WBS for information sys

Project scope: definition of end result or mission of project — a product/service for client/customer — in specific, tangible & measurable terms

Scope statement: statement of work (SOW)

Scope statement purpose: clearly define deliverables for end user, focus project on successful completion of its goals, to be used by project owner & participants as planning tool & measuring project success

Project scope checklist: project objective; deliverables; milestones; technical reqs; limits & exclusions; reviews with customer

Project charter: can contain expanded version of scope statement, document authorising project manager to initiate & lead project

Scope creep: tendency for project scope to expand over time due to changing requirements, specs, priorities

Priority matrix: budget/cost, schedule/time, performance/scope, constrain, enhance (optimise), accept

Work Breakdown Structure: hierarchical outline (map) that identifies products & work elements involved in project, defines relationship of final deliverable to subdeliverables & in turn their relationships to work packages, best suited for design & build projects that have tangible outcomes rather than process-oriented projects

WBS Hierarchy: project, deliverable, sub-deliverable, lowest sub-deliverable (lowest management responsibility level), cost account (group of work packages for monitoring progress & responsibility), work package

WBS benefits for project manager: facilitates evaluation of cost, time & technical perf of org on project; provides management with info appropriate to each org level; helps in dev of OBS, which assigns project responsibilities to org units & individuals; help manage plan, schedule & budget; define comm channels & assists in coordinating various project elements

Work Package: defines work (what), identifies time to complete, time-phased budget to complete (cost), resources needed to complete (how much), person responsible for units of work, monitoring points/milestones for measuring success (how well)

Org Breakdown Structure: how company organised to discharge work responsibility for project

OBS details: provides framework to summarise org work unit perf, identifies org units responsible for work packages, ties org units to cost control accounts

Intersection of WBS & OBS: project control point/cost account

WBS coding system: defines levels & elements of WBS, org elements, work packages, budget & cost info, allows reports to be consolidated at any level in org structure

Responsibility Matrix: linear responsibility chart, summarises tasks to be accomplished & who is responsible for what on the project

RM details: list project activities & participants, clarifies critical interfaces between units & individuals that need coordination, provides means for all participants to view responsibilities & agree on assignments, clarifies extent/type of authority that can be exercised by each participant

Project communication plan: what info needs to be collected & when, who will receive info, what methods will be used to gather & store info, what are limits on who has access to certain kinds of info, when will info be communicated, how will it be communicated

Comm plan steps: stakeholder analysis, info needs, sources of info, dissemination modes, responsibility & timing

Information needs: project status reports, deliverable issues, changes in scope, team status meetings, getting decisions, accepted request changes, action items, milestone reports

Estimating: process of forecast/estimating time & cost of completing project deliverables

complex, non-routine, one-time effort limited by time, budget, resources, perfs specs designed to meet customer needs

Project characteristics: established objective, defined life span with beginning & end, requires participation across the org, typically involves doing sth never done before, has specific time, cost, perf reqs

Project life cycle:
Defining: goals, specs, tasks, responsibilities

Planning: schedules, budgets, resources, risks, staffing

Executing: status reports, changes, quality, forecasts

Closing: train customer, transfer docs, release resources, evaluation, lessons learned

Factors leading to increased use of PM: compression of product life cycle, knowledge explosion, triple bottom line (planet, people, profit), corporate downsizing, increased customer focus, small projects represent big problems

Project Manager: manages temporary, non-repetitive activities, frequently acts independently of formal org, marshals resources for project, linked directly to customer interface, provides direction, coordination & integration to the project team, responsible for performance & success of the project, must induce right people at right time to address the right issues and make right decisions

PM Technical Aspects: scope, WBS, schedules, resource allocation, baseline budgets, status reports

PM Sociocultural Aspects: leadership, problem solving, teamwork, negotiation, politics, customer expectations

Integrated management of projects: strategic alignment, portfolio management, PM, with org culture env wrapped around

Integration of projects with org strategy: use of selection criteria to ensure strategic alignment and project priorities (effective use of org resources); selection process that is systematic, open, consistent & balanced; all selected projects become part of portfolio that balances risk for org; portfolio management ensures only most valuable projects approved & managed across entire org; value of project not only ROI but also strategic fit & best use of org resources

Integrative PM approach benefits: provide senior management with overview of all PM activities, big picture of how org resources used, risk assessment of project portfolio, rough metric of org's improvement in managing projects relative to others in industry, linkages of senior management with actual project execution management

Portfolio Management Functions: oversee project selection, monitor aggregate resource levels & skills, encourage use of best practices, balance projects in portfolio in order to represent risk level appropriate to the organisation, improve communication among all stakeholders, create total org perspective that goes beyond silo thinking, improve overall management of projects over time

Program: a series of coordinated, related, multiple projects that continue over an extended time and are intended to achieve a goal

Traditional PM: focus on thorough, upfront planning of entire project, requires high degree of predictability to be effective

Agile: relies on incremental, iterative dev cycles to complete less predictable projects, ideal for exploratory projects in which requirements need to be discovered and new tech tested (uncertain about how long, what is required, allows change in reqs), focus on active collaboration between project team & customer reps

Traditional	Agile
Design up front	Continuous design
Fixed scope	Flexible
Deliverables	Features/reqs
Freeze design as early as possible	as late as possible
Low uncertainty	high
Avoid change	embrace
Low customer interaction	high
Conventional project teams	self-organised

Agile Details: use iterations to develop workable product that satisfies the customer and other key stakeholders, stakeholders & customers review progress & re-evaluate priorities to ensure alignment with customer needs & company goals, adjustments are made & a different iterative cycle begins that subsumes the work of the previous iterations & adds new capabilities to the evolving product

Agile Advantages: useful in developing critical breakthrough tech or defining essential features; continuous integration, verification & validation of the evolving product; frequent demonstration of progress to increase likelihood that end product will satisfy customer needs; early detection of defects & problems

Agile Limitations: does not satisfy top management's need for budget, scope & schedule control; self-organisation & close collaboration principles can be incompatible with corporate cultures; appears to work best on small project with 5-9 people, requires active customer involvement & cooperation

Agile Principles: focus on customer value, iterative & incremental delivery, experimentation & adaptation, self-organisation, continuous improvement

Project uncertainty dimensions: scope & tech **Scrum:** holistic (interconnected emphasis) approach for use by cross-functional team collaborating to develop new product, defines product features as deliverables & prioritises them by perceived highest value to the customer, re-evaluates priorities after each iteration/sprint to produce fully functional features, phases: analysis, design, build, test

Scrum roles & responsibilities:
Product owner: acts on behalf of customer to represent interests, responsible for product backlog priorities & process selection

Development team: 5-9 people with cross-functional skillsets responsible for delivering product, sets own goals, organises itself, makes decisions

Scrum master: facilitates scrum process and resolves impediments at the team & org level by acting as buffer between team & outside interference

Scrum practices:
Sprint: time-controlled mini-project that implements specific portion of a system, 30 day time box with specific goals & deliverables, frozen scope defined from sprint backlog

Daily Scrum: daily meeting of all team members to report progress (15 min max), also called standup

Sprint final half-day review meeting: review & identify changes needed for following sprints

Sprint meetings: sprint planning, daily scrum, sprint review, sprint retrospective

Product backlog: customer's prioritised list of desired key features for the completed project, can only be changed by product owner

Sprint backlog: amount of work team commits to complete during the next sprint, developed & controlled by team

Scaling: using several teams to work on different features of large scale project at same time

Staging: upfront planning to manage interdependencies of the different features to develop, involves developing protocols & defining roles to coordinate efforts & assure compatibility & harmony

Strategy Importance: Project managers must respond to changes to organisation mission and strategy appropriately, if understand strategy can become effective advocates of projects aligned with firm's mission

Mistakes by not understanding role of projects in accomplishing strategy: focus on problems/solutions with low strategic priority, focus on immediate customer rather than whole marketplace & value chain, over-emphasising tech that results in projects that pursue exotic tech that does not fit strategy or customer need, trying to solve customer issues with product/service rather than focusing on 20% with 80% of value (**Pareto's law**), engaging in never-ending search of perfection that only team really cares about

Strategic management: requires every project to be clearly linked to strategy; provides theme & focus of organisational future direction (responding to changes in external env — env scanning, allocating scarce resources of firm to improve competitive position — internal responses to new programs); requires strong links among mission, goals, objectives, strategy, impl

Strategic management activities:
Review & define org mission: identify & communicate purpose of org to stakeholders, identify scope of org in terms of product/service, provides focus for decision making, used for eval org perf

Set long-range goals & objectives: translate mission to specific, concrete & measurable terms; sets targets for all levels of org in a cascaded manner; where is org headed and when it will get there; focus managers on where org should move to

Analyse & formulate strategies to reach objectives: focus on what needs to be done to reach objectives, realistic view of past & current position, SWOT analysis, alternatives generated & assessed, strategy formulation & assignation

Implement strategies through projects: focus on how strategies will be realised with resources, maintain link between strategy (what) & impl (how), requires resource allocation, action & completion of tasks, prioritisation

SMART objectives: Specific, Measurable (indicators of progress), Assignable (to one person for completion), Realistic (what can realistically be done with avail resources), Time related (state when objective can be achieved)

SWOT analysis: internal (strengths, weaknesses) & external (opportunities, threats) analysis

Scenario planning: longer term, steps: clarifying core business & assessing drivers of change in industry env, dev potential scenarios & assess impact of STEEP factors, dev potential contingency strategies & best future strategic options, identifying early indicators & establishing triggers for strategic action

STEEP factors: social, tech, env, economic, political

Project portfolio management benefits: build discipline to project selection process, link project selection to strategic metrics, prioritise project proposal across common set of criteria rather than politics/emotion, allocate resources to projects that align with strategic direction, balance risk across all projects, justifies stopping projects that don't support strategy, improves comms & supports agreement on project goals

Project portfolio management problems:
Implementation gap: lack of understanding & consensus on strategy among to management & middle-level (functional) managers who independently implement strategy

Org politics: project selection based on persuasiveness & power of people advocating projects

Resource conflicts & multitasking: Multiproject env creates interdependency relationships of shared

task of balancing expectations of stakeholders& need for control while project is implemented

Estimating importance: support good decisions, schedule work, determine how long project should take & cost, determine whether project worth doing, develop cash flow needs, determine how well the project is progressing, develop time-phased budgets & establish project baseline

Estimation accuracy factors: planning horizon, project duration, people, project structure & org, padding estimates, org culture, other non-project factors

Estimating guidelines: have people familiar with tasks make estimate; use several people to make estimates; base estimates on normal conditions, efficient methods & normal level of resources; use consistent time units; treat each task as independent; don't make allowances for contingencies, adding risk assessment helps avoid surprises to stakeholders

Top-down estimates: derived from someone who uses experience and/or info to determine the project duration & total cost, are made by top managers who have little knowledge of the processes used to complete the project, time & costs are not considered, grouping tasks may lead to omissions & unrealistic times & costs, accuracy -20% to +60%, cost 0.1–0.3%

Conditions for top-down: strategic decision making; high uncertainty; internal, small project, unstable scope

Top-down intended use: feasibility/conceptual phase, rough time/cost estimate, fund reqs, resource capacity planning

Bottom-up approach: can serve as a check on cost elements in WBS by rolling up work packages & associated cost accounts to major deliverables at work package level, more accurate but takes more time, accuracy level may not be required for some projects, accuracy -10% to +30%, cost 0.3–1%

Conditions for bottom-up: cost & time important, fixed-price contract, customer wants details

Bottom-up intended use: budgeting, scheduling, resource reqs, fund timing

Preferred estimating approach: rough top-down estimates, dev WBS/OBS, make bottom-up estimates, dev schedules & budgets, reconcile diffs between top-down & bottom-up estimates

Top-down approaches:

Consensus: use xp of senior and/or mid managers to estimate total project duration & cost; typically involve meeting where experts discuss, argue & ultimately reach decision for best guessestimate

Delphi: about likelihood that certain events will occur, ask experts, then return summary of opinions (anon), encourage to reconsider/change based on others' opinions, repeat 2–3x, median will move toward 'correct' estimate, avoid ego, domineerring, bandwagon, halo effect, no need for physical contact

Ratio: use cost/time per area/capacity size/features/complexity

Apportion: extension of ratio, use if projects closely follow past projects in features & cost, pay

contractor by completion of parts or split costs based on deliverables in WBS (each has percent allocated)

Function point: for software & system projects, take several elements (input, output, inquiries, files, interfaces), rate complexity, multiply number of each with complexity, total is estimate

Learning curve: take number of units & improvement rate

Bottom-up approaches:

Template: start wirh standard task cost/time estimates then adjust specifics

Parametric applied to specific tasks: need to do X work, 1 person can do Y work in Z time

Range estimates for work packages: low, average, high for each, useful if work packages have significant uncertainty

Phase estimating: hybrid top-down & bottom-up, macro long-term (rest of project) & micro short-term (current phase, need, specs, design, produce, deliver), for projects with high uncertainty, customers may be able to change features & re-evaluate project at each stage, but customers & clients typically want form estimates of time & overall cost up front

Level of detail: varies in WBS with project complexity, each management level can focus on what they need; excessive detail is costly, fosters focus on departmental outcpmes & create unproductive paperwork but insufficient detail is also costly, fosters lack of focus on goals & leads to wasted effort on non-essential activities

Cost types:

Direct: clearly chargeable to specific work package, ex: labour, materials, equipment

Direct (project) overhead: directly tied to identifiable deliverable/work package, ex: salary, rents, supplies, specialised machinery

General & administrative overhead: indirectly linked to specific package apportioned to project, carried for project duration, ex: ads, accounting, senior management

Cost views: committed, scheduled budget, actual cost

Adjusting estimates: done for specific activities as risks, resources & situation particulars become more actively defined, mitigate risks by recognising mistakes can occur (ex: include independent testers to check design), allowing for difficult conditions in contracts affecting scope (if excessive ground water adjust foundation estimates)

Reasons for adjusting estimates: interaction costs hidden in estimates, normal conditions do not apply, things go wrong in projects, changes in project scope & plans

Estimating DB: estimated & actuals on labour, costs, equipment, benchmarking ratios, code of accounts for various project types