INFO5990 – Professional Practice in IT Notes

Weekly Readings

Week 1

Foundational Reading: Benchmarking Global Competitiveness

Innovation is a trademark feature of American competitiveness and has powered its global dominance since the post-World-War industrial revolution. Countries that lead the world in generating advanced technologies and leveraging the full productive capacity of their digital economies can gain a strategic competitive advantage.

Digital technologies have risen to prominence as a critical determinant of economic growth, national security, and international competitiveness. The digital economy has a profound influence on the world's trajectory and the societal well-being of ordinary citizens. It affects everything from resource allocation to income distribution and growth.

Deep investments in ICT assets: Computer hardware, software, and internet, and broadband infrastructure, for example, are crucial determinants of growth in advanced economies. In addition to the demonstrated positive impact from ICT sectors on the total economy, a transformational shift has occurred from the ICT manufacturing sector to the ICT service sector. This move from a hardware- to software-centric level of growth has been particularly pronounced in developing countries due to deeper and wider mobile-cellular networks. Beyond the increasing contributions of ICT-services to GDP growth, investments in the ICT sector have significantly boosted labour productivity.

Targeted ICT investments in 5G technologies and infrastructure along with R&D innovation combine to bolster the digital economy and accelerate the ICT-sector's diffusion effect to less technologically intensive sectors. It is evident that the IT industry is central to the digital pivot for developed and developing countries. Accelerated adoption of rapidly developing technologies such as cloud computing, robotic automation, artificial intelligence (AI), machine learning, the internet of things (IoT), and 5G technologies is promising for the IT industry and should promote ongoing growth.

Foundational Reading: 17 Predictions

- AI optimized manufacturing

  By 2025, this ubiquitous stream of data and the intelligent algorithms crunching it will enable manufacturing lines to continuously optimize towards higher levels of output and product quality. As a result, we will enjoy higher quality products, produced faster, at lower cost to our pocketbooks and the environment.
- A far-reaching energy transformation

  The creation of a sustainable, net-zero future will be built through a far-reaching energy transformation that significantly reduces the world's carbon emissions. We'll see a diversity of new technologies aimed at both reducing and removing the world's emissions – unleashing a wave of innovation to compare with the industrial and digital Revolutions of the past.
- A new era of computing

  By 2025, quantum computing will have outgrown its infancy, and a first generation of commercial devices will be able tackle meaningful, real-world

problems. They will significantly shorten product development cycles and reduce the costs for R&D.

- Healthcare paradigms shift to prevention through diet

  By 2025, healthcare systems will adopt more preventative health approaches based on the developing science behind the health benefits of plant-rich, nutrient-dense diets. This trend will be enabled by AI-powered and systems biology-based technology.

- 5G will enhance the global economy and save lives

  With 5G networks in place, tied directly into autonomous bots, goods would be delivered safely within hours. The roll-out of 5G creates markets that we only imagine - like self-driving bots, along with a mobility-as-a-service economy - and others we can't imagine, enabling next generations to invent thriving markets and prosperous causes.

- A new normal in managing cancer

  Technology drives data, data catalyses knowledge, and knowledge enables empowerment. In tomorrow's world, cancer will be managed like any chronic health condition —we will be able to precisely identify what we may be facing and be empowered to overcome it. Early detection and intervention in common cancer types will not only save lives but reduce the financial and emotional burden of late discovery.

- Robotic Retail

  Historically, robotics has turned around many industries, while a few select sectors - such as grocery retail - have remained largely untouched. Retailers will operate at a higher order of magnitude on productivity, which will in turn result in positive and enticing returns in the online grocery business.

- A blurring of physical and virtual spaces

  The line between physical space and virtual will forever be blurred. One thing the current pandemic has shown us is how important technology is for maintaining and facilitating communication - not simply for work purposes, but for building real emotional connections. In the next few years, we can expect to see this progress accelerate, with AI technology built to connect people at a human level and drive them closer to each other, even when physically they're apart.

- Putting individuals at the heart of healthcare

  By 2025, the lines separating culture, information technology and health will be blurred. Engineering biology, machine learning and the sharing economy will establish a framework for decentralising the healthcare continuum, moving it from institutions to the individual. From daily care to pandemics, these converging technologies will alter economic and social factors to relieve many pressures on the global human condition.

- The future of construction has already begun

  Construction will become a synchronized sequence of manufacturing processes, delivering control, change and production at scale. It will be a safer, faster, and more cost-effective way to build the homes, offices, factories and other structures we need to thrive in cities and beyond. Precision in planning and execution enables construction professionals to control the environment, instead of it controlling them, and creates repeatable processes that are easier to control, automate, and teach.

- Reversing climate change

  A scale up of negative emission technologies, such as carbon dioxide removal, will remove climate-relevant amounts of CO2 from the air. It will ultimately help to prevent global warming from reaching dangerous levels and give humanity the potential to reverse climate change.
- A new era of medicine

  Medicine has always been on a quest to gather more knowledge and understanding of human biology for better clinical decision-making. AI is that new tool that will enable us to extract more insights at an unprecedented level from all the medical 'big data'.
- Closing the wealth gap

  Improvements in AI will finally put access to wealth creation within reach of the masses. Artificial intelligence is improving at such a speed that the strategies employed by these financial advisors will be accessible via technology, and therefore affordable for the masses.
- A clean energy revolution supported by digital twins

  Over the next five years, the energy transition will reach a tipping point. The cost of new-build renewable energy will be lower than the marginal cost of fossil fuels.
- Understanding the microscopic secrets

  Every surface on Earth carries hidden information that will prove essential for avoiding pandemic-related crises, both now and in the future. Technology that accelerates our ability to rapidly sample, digitalize and interpret microbiome data will transform our understanding of how pathogens spread.
- ML and AI expedite decarbonization in carbon heavy industries

  Over the next five years, carbon-heavy industries will use machine learning and AI technology to dramatically reduce their carbon footprint.
- Privacy is pervasive and prioritized

  Five years from now, privacy and data-centric security will have reached commodity status – and the ability for consumers to protect and control sensitive data assets will be viewed as the rule rather than the exception.

The next five years will see profound improvements in addressing challenges such as feeding a global and growing population; improving access to and quality of healthcare; and significantly reducing carbon emissions to arrest the negative effects of climate change, etc. as entrepreneurs, the investment community and the world's largest enterprise R&D organizations focus on developing and deploying solutions that will deliver tangible results.

Week 2

Foundational Reading: IT and Business Alignment

IT Business alignment is defined as the dynamic actualization of organizational goals and objectives and the Operationalization of the IT strategies according to those objectives.

IT business alignment is also defined as the organizational imperative to actualize a positive relationship between the use of information technologies and stated and accepted measures of financial and business performance. However, IT business alignment is easier said than done in practice as there exist significant gaps between what the business wants and what the IT systems deliver. This is mainly due to an inadequate understanding of how IT systems

work and how they deliver value as well as due to cultural aspects in addition to a lack of coordination and cooperation between the business and IT departments.

To leverage IT strategically, efficiently, and efficaciously, organizations can do six things or six characteristics that would ensure that IT and business are aligned with each other. These 6 steps are:

- Recognize and realize that IT can be used as a transformative tool in organizations
  To do this, businesses must realize the potential of IT to integrate disparate and discreet business functions and processes
- Organizations must use IT to target customers both from within and externally using IT
- IT and business staff must communicate in a way which is mutually comprehensible
  To actualize tighter IT business alignment, the organization must rotate staff between these functions so that they have a working knowledge and a personal experience of how it feels to be on the other side.
- Defining the goals and objectives for the IT department in a clear and coherent manner.
  This entails management by objectives wherein the IT department is given the financial, operational, and strategic objectives that are expressed in the SMART model.
- Devise foolproof and near accurate as well as reliable and measurable Returns on Investment (ROI) from the IT systems.
  Often, organizations fail to devise as well as define the ROI from the IT investment, which results in a lack of clarity on whether the IT spends, is worth the time and the effort.
- Get all these aspects together into a (preferably) written document that enumerates the IT and business strategies and how they are expected to work together.
  - At the risk of sounding repetitive, we want to emphasize that unless the IT staff are given a requirement and a specifications document.

The key to successful IT business alignment is the creation of value at each step of the value chain of the organizations' internal and external processes. This value is created through technology as well as process improvements. IT is used by many organizations to automate, integrate, assimilate, and deliver real time information in the business processes. Organizations also use IT to ramp up their operations which are known as actualization of the benefits from the economies of scale. Apart from that, IT is used to expand into newer geographical and virtual market segments as automating and using IT often results in an anywhere, anytime, everywhere, every time experience for the end users.

For all these to happen, the IT and the business functions must work together as a team and in a synergistic manner. IT must become a tool of transformation as well as a source of sustained competitive advantage.

Foundational Reading: How CIOs prove Business value

CIOs have many things that they need to do to succeed in the digital era. One of them is demonstrating the value for the projects and services that IT builds and then delivers. CIOs are candid that IT is something of a 'black box' to many business leaders. Demonstrating business value allows business leaders to understand how IT contributes to business goals and, thereby, to buy into the projects IT is managing.

Many CIOs stress business value is the only thing that matters these days because technology on its own is just a cost or an expensive vanity project. As a part of succeeding,

CIOs state that businesses should define their KPIs at the inception of a project and persist them in cycles of measuring, managing, and publishing.

CIOs stress that all projects need to be business projects. They want KPIs identified that provide an agreed upon definition of success. Those KPIs depend upon the business goal and value that should be targeted or demonstrated. CIOs say that ultimately if you can't agree on a way to measure success, you will never know if you got there. CIOs collectively suggested several different potential value metrics. A few examples are:

- Revenue and market growth
- On time project delivery
- Risk mitigation
- Financial Metrics
- Customer satisfaction
- Degree of innovation
- Usage metrics and survey
- Operational Efficiency
- Effectiveness delivery
- Interviews on customer satisfaction
- Security
- On budget delivery
- Quality factors

Having transparent KPIs and measures helps CIOs improve business stakeholder relationships. CIOs say they want dashboards that can aggregate KPI data across silos, functions, and departments to reveal enterprise business value. With this said, CIOs suggest all parties need to agree upfront what the KPIs are, what they mean, and what defines success for them.

Foundational Reading: Why Business value is key to IT success

Enterprise IT creates value in 2 distinct ways:

- Asset value

  Acquisition of new technology is at the foundation of any business. This typically refers to hardware and software that keeps a business operational
- Business value

  Overall impact on business model and service delivery, these are enhancements to business priorities.

There are 3 other drivers of the business value of IT:

- IT and Productivity

  When tasks can be automated, people who would normally accomplish those tasks in their day-to-day can focus on other key functions. This should result in greater all-around productivity. Automation is one way technology works hand and hand with productivity, but another way includes on-demand services that affect the timeliness of key business decisions. Cloud services and big data environments can also be used to unleash productivity.
- IT and forging competitive advantages

  Running the business is essential, growing the business is commendable but transforming the business is critical.
- IT and customer satisfaction

  The promise of faster service delivery, more automation and efficiency, integrated services with access anywhere — are attributes that will keep customers happy and loyal.

Measuring the business value of IT usually becomes important when discussing plans for new technology investments or determining budgets for ongoing support projects. A few ways to measure the business value of IT projects is given below:

- Assess both the strategic value and economic value

  Business value presents itself in two ways: strategic value and economic value. Economic value includes items that reduce cost or increase revenue. On the other hand, as the name suggests, strategic value deals in productivity enhancements, key differentiators that are included in your value proposition and customer satisfaction. Both are important considerations in measuring business value.
- Optimize investments by lowering operational costs

  Drawing a parallel between the amount spent on IT and decreases in operational spending is a good way to come up with thresholds for optimizing IT investments.
- Track changes in operations that exceed KPIs

  The business value of IT is largely visible in operations. Improvements to efficiency, cost reduction and more should result in the organization meeting and exceeding established key performance indicators (KPIs).
- Compare average industry spend

  Getting into financial and budgetary data when explaining the business value of IT to stakeholders can sometimes be a double-edged sword. Quantifying your enterprise IT spend against industry averages is generally an effective benchmark

Week 3

Foundational Reading: Waterfall vs Incremental vs Spiral vs Rad model

To manage the level of complexity during the software development cycle, various SDLC model is implemented by the software companies. Their aim is to deliver a quality software product; however, each model is unique in terms of their software development approach.

Properties of Model	Water-Fall Model	Incremental Model	Spiral Model	Rad Model
Planning in early stage	Yes	Yes	Yes	No
Returning to an earlier phase	No	Yes	Yes	Yes
Handle Large-Project	Not Appropriate	Not Appropriate	Appropriate	Not Appropriate
Detailed Documentation	Necessary	Yes but not much	Yes	Limited
Cost	Low	Low	Expensive	Low
Requirement Specifications	Beginning	Beginning	Beginning	Time boxed release

Flexibility to change	Difficult	Easy	Easy	Easy
User Involvement	Only at beginning	Intermediate	High	Only at the beginning
Maintenance	Least	Promotes Maintainability	Typical	Easily Maintained
Duration	Long	Very long	Long	Short
Risk Involvement	High	Low	Medium to high risk	Low
Framework Type	Linear	Linear + Iterative	Linear + Iterative	Linear
Testing	After completion of coding phase	After every iteration	At the end of the engineering phase	After completion of coding
Overlapping Phases	No	Yes (As parallel development is there)	No	Yes
Maintenance	Least Maintainable	Maintainable	Yes	Easily Maintainable
Re-usability	Least possible	To some extent	To some extent	Yes
Time-Frame	Very Long	Long	Long	Short
Working software availability	At the end of the life-cycle	At the end of every iteration	At the end of every iteration	At the end of the life cycle
Objective	High Assurance	Rapid Development	High Assurance	Rapid development
Team size	Large Team	Not Large Team	Large Team	Small Team
Customer control over administrator	Very Low	Yes	Yes	Yes

Foundational Reading: Top 6 software development models

Software development models are basically a set of specific tools and approaches used during the project's life cycle. Their objectives are to boost productivity while reducing operating costs, which means that the software development model you choose can often make or break your project. The SDLC comprises all stages of software production — from analysis to deployment and support, and it will differ depending on the software engineering model you follow. The SDLC can be broken down into several phases. Below is a simplified breakdown of these phases, which are present in most software engineering operating models:

- Planning (Requirement Analysis)

  During this phase, the software delivery and business teams collect information to outline the product's business objectives. The team creates a Software Requirements Specification (SRS) — a document that includes the objectives, goals, and system requirements for the product. This document should also document key agreements between stakeholders. The requirements-gathering process helps to align business objectives with the product being developed.

- Prototype design

  During this stage, the software delivery team defines how the project will be developed and reflects this information in the Design Document Specification (DDS). This document covers the frameworks, platform specifications, limitations, and delivery estimates. Ideally, this documentation is made available to all parties involved in the development process (developers, testers, managers, and the client).
- Development (Implementation)

  This is the core phase of all software process models, during which engineers develop the solution according to the requirements. This step involves a lot of code-writing and fine-tuning.
- Quality Assurance and testing

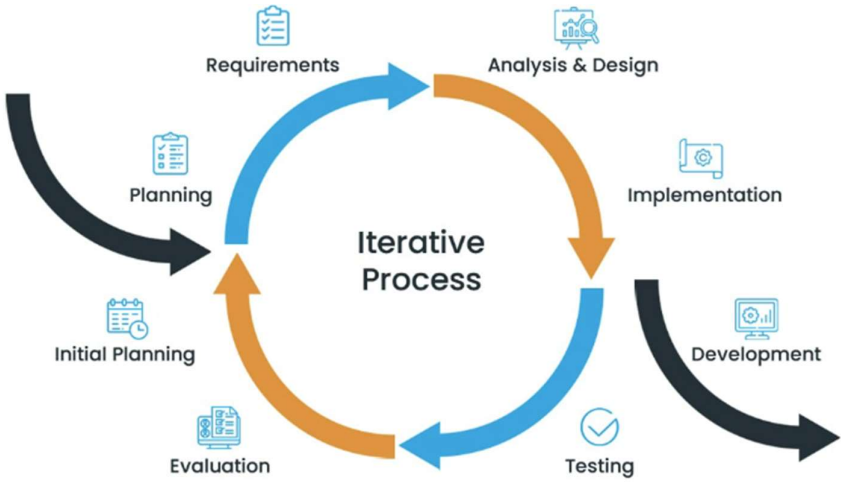
  This phase consists of code reviews and module assessment. It's a continuous process, especially for the Agile life cycle model. When people talk about testing, they usually refer to unit and integration testing. Unit testing verifies specific sections of the app to ensure it works as planned, while integration testing ensures that all modules work as one system.
- Delivery

  Once engineers and testers are done with their work, the project manager, the client, and the stakeholders must approve the project. After they do, it's time for the product to hit the market.
- Maintenance

  Many models include the post-deployment software development modelling phase. In fact, most applications require regular maintenance to remain relevant. This phase covers compatibility upgrades, performance optimization, and monitoring, as well as bug fixes.

The SDLC process of software development will help in delivering the project on schedule and in budget. It helps the project stay on track, maximises the productivity, reduces the development time and provides better management. There are different types of SDLC models, a few given below:

- The iterative model



Iterative software process models begin with a smaller set of requirements. Developers use these requirements to analyse and gradually implement features. Afterward, these features are evaluated and tested to identify new requirements. This cycle is called an "iteration". This life cycle repeats numerous times, introducing new

design choices, coding, and requirements changes. It is suitable for large scale projects with multiple modules and for projects with clearly defined objectives and tasks.

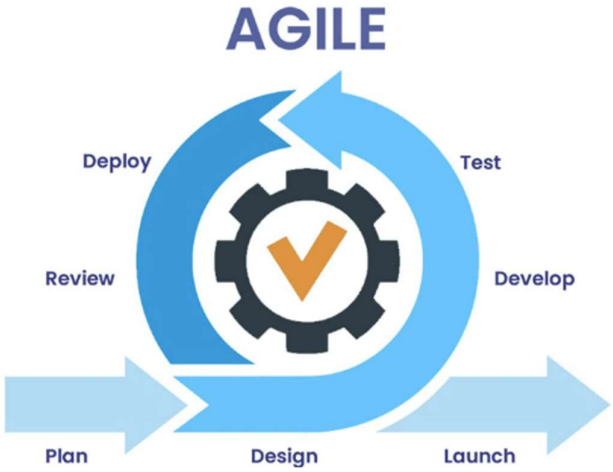
Advantages:

- Coding begins at the start
- Cost effective way of implementing requirement changes
- Streamlined management as production is divided into smaller pieces
- Bugs and defects are easier to spot at earlier phases.

Disadvantages:

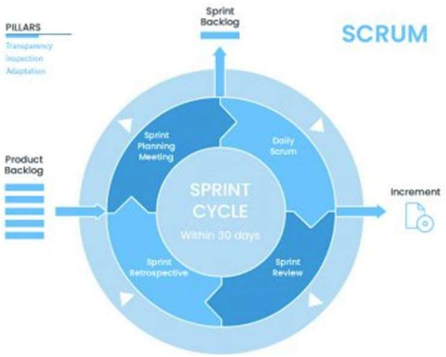
- Difficult to analyse risk
- Potential design issues in later stages
- Too reliant on baseline plan
- A resource heavy model

- The agile model



Agile focuses on continuous release cycles and cross-functional development. It's one of the most flexible and popular types of SDLC models. Agile is quite similar to Iterative, where teams work in repeated increments. However, unlike Iterative, Agile doesn't rely on the baseline plan. The plan, along with the requirements, is continuously modified throughout the life cycle. It is suitable for large scale or smaller projects. Best for outsourcing and managed IT services and for adding new features to a working prototype. There are 2 subdivisions to Agile:

- Scrum

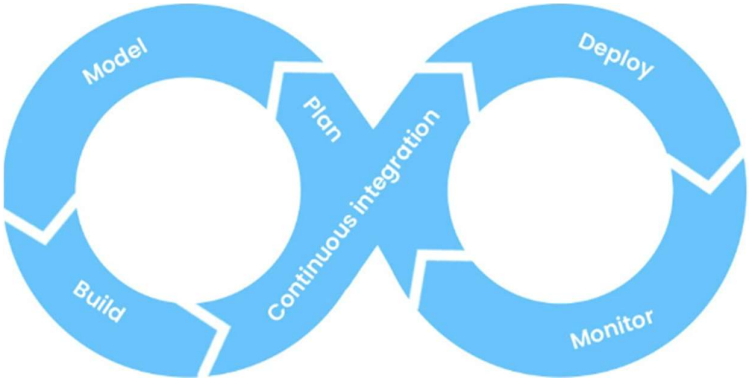


- Kanban

Advantages:
- Easy to change requirements and baseline plan
- Fast release of prototype
- Focus on communication between developer and client
- Client's engagement integrated to the life cycle
- Continuous evaluation and feedback

Disadvantages:
- Difficult to estimate final production costs
- Possible architectural conflicts due to constant requirement changes.

- The DevOps models

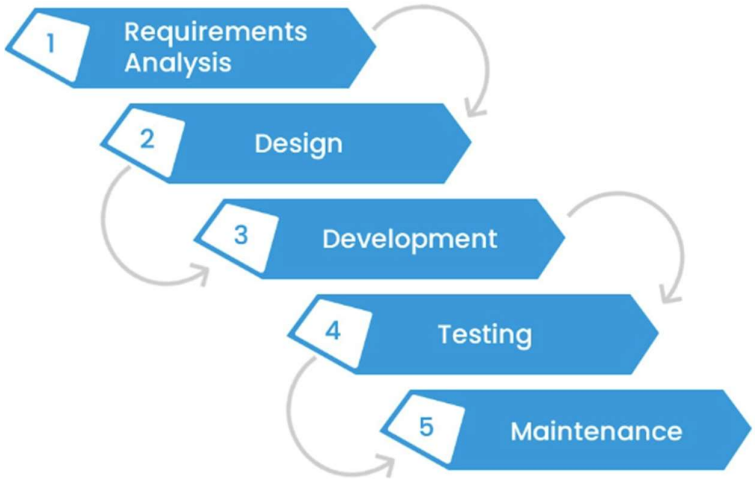


DevOps is built around the principles of automation and collaboration. This model's primary goal is to enhance cooperation between the operations team and developers thanks to continuous feedback. It is suitable for complex projects which require a lot of QA and testing. It is also recommended for large teams with multiple departments.

Advantages:
- Automation and optimization of processes
- Continuous feedback cycle between engineers and testers
- Streamlined product delivery
- Productivity improvements in house
- Early error and defect detection

Disadvantages:
- Lack of focus on documentation
- Difficult to manage emerging product features
- A challenging adoptive curve

- The waterfall models



Waterfall is one of the oldest types of software development life cycle methodologies. It focuses on a linear approach with SDLC phases following one another sequentially. The outcome of each phase affects the input of the next one. Therefore, it's much more difficult and costly to return to earlier phases. It is suitable for the smaller and mid-sized projects with clearly defined requirements.

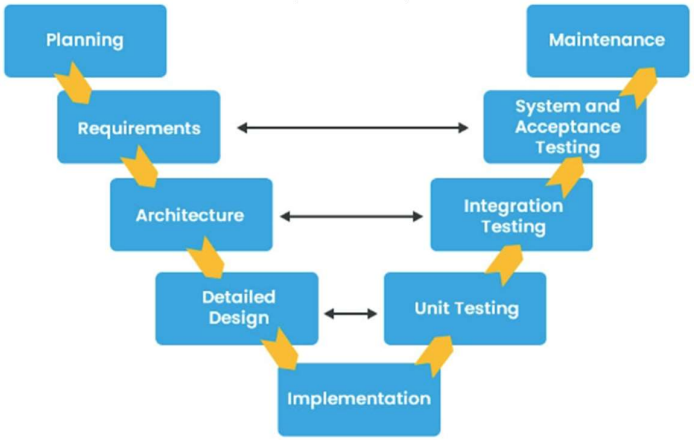
Advantages:

- Straightforward and easily manageable
- Clearly defined tasks and milestones
- Easy to prioritize tasks

Disadvantages:

- Lacks the versatile nature of agile development
- Phases can't overlap
- It is time consuming
- Too costly to return to prior phases

- The verification and validation model (V-model)



Verification and Validation is a sequential methodology, just like Waterfall. But there's a difference — in this methodology, every step goes in parallel with testing. It is useful for mid-sized and large projects with explicit objectives and requirements.

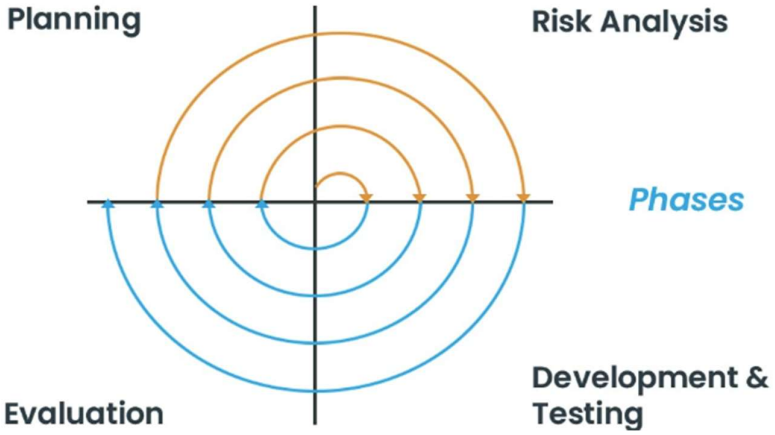
Advantages:

- Simple and straightforward
- Critical issues are taken care of in the initial phases
- In depth requirement documentation

Disadvantages:

- Lack of flexibility
- Too costly and time consuming

- The Spiral model



Spiral combines the Iterative and Waterfall methodologies with an emphasis on risk assessment. It consists of the usual SDLC phases built on the baseline spiral. Each cycle repeats in "spirals" that allow teams to evaluate risks and get precise estimates. The loop repeats until the product complies with requirements. It is suitable for larger projects with complex requirements and new products with multiple testing stages.

Advantages:

- Precisely documented
- Accurate time and budget estimates
- Excellent risk assessment
- Can apply new changes to new iterations

Disadvantages:

- Success depends on skilled risk managers
- Requires a large resource pool
- Time consuming

Foundational Reading: The ultimate guide to IT Project Management

An information technology (IT) project is a type of project that deals with IT infrastructure, information systems or computers. Examples of an IT project include web development, software development, mobile app development, etc. IT project management (ITPM) is the planning, scheduling, execution, monitoring and reporting of IT projects. Since they are often very wide in scope, IT project managers must deal with risk, interdependent integrations, software updates, scope creep and so on. Therefore, IT projects require more than the typical project management tools and skills to complete.

The six phases of an IT project are based on the six phases of project management, which are used in conjunction with the IT phases to manage the project. They are as follows:

- Initiation

  During the first phase of an IT project the objective of the project must be identified. Then, a project proposal, including a business plan, that meets the needs of the project must be written. In addition, a feasibility study might be conducted to ensure the proposal is airtight.

- Definition

  After the project proposal has been approved, the project moves into the definition phase. This is where the objectives of the project are finalized and the requirements for a successful project are identified. The project scope can also be outlined, and a project plan may be created during this phase. Budgets are also set, and resources are determined.
- Design

  The design phase of an IT project is when the project team sets out to find the best solution for achieving their goal. This includes creating multiple designs and prototypes. Once a suitable design has been chosen, specifications for the development team are created and shared.
- Development

  The development phase is when the development team is assigned tasks and project management tools are selected. Additionally, technicalities are outlined, raw materials are requested and so on. The main goal of this phase is to make the entire plan as crystal clear as possible to avoid issues in the implementation phase.
- Implementation

  The implementation phase is where the final deliverable of the IT project is developed; unsurprisingly, this is often the longest phase of the project. The project team sets out to complete their tasks, while the manager monitors and controls the work, resources, cost, quality, and risk.
- Follow up

  Finally, once the implementation phase is complete, the final project is delivered to the customer/client/stakeholder. The follow up phase is all the work that comes after the project is delivered, and includes setting up support teams, training the end-users, creating a post-mortem and ultimately ending the project.

An IT project manager is responsible for overseeing an organization's IT department and managing teams to execute IT projects on time and within budget. Some of the duties of an IT project manager include:

- Setting project goals and creating plans to meet them
- Maintaining the project schedule and budget, creating status reports
- Managing resources, including the team, equipment, etc.
- Assigning tasks to team members
- Developing strategy to deliver projects on time and within budget
- Using IT project management tools to track progress and performance
- Assessing project risks
- Developing IT risk management strategies
- Leading regular meetings with team and stakeholders

IT project management software is used by managers to organize and control the processes of their IT projects. Like any software tool, its main purpose is to increase efficiency. IT project management software boosts efficiency by giving users the features they need to monitor and track progress and performance. This keeps their IT projects on track to meet tight schedules and budgets. Some key features common among IT project management tools include task and time tracking, real-time data, unlimited file storage, multiple project views to support hybrid methodologies, planning, scheduling, and reporting. Following are the steps to manage an IT Project:

i. Collect requirements
ii. Select team
iii. Use a Gantt chart
iv. Use a Kanban board
v. Monitor progress
vi. Manage workload
vii. Make changes
viii. Get reports

Roles and responsibilities in IT project management mostly mirror those projects in other disciplines. There are stakeholders, who are those who have an interest in the project; teams, who are those with skills to execute the project plan; and the IT project manager, who is the person that is responsible for the planning, procurement, and execution of the project. With IT project management there are three types of teams:

- Project management team

  These teams are not exclusive to IT and are led and staffed with a formal project management methodology.
- Professional services team

  They are often led by a project manager but can be headed by a services vice-president or director. However, they also use formal types of project management.
- Internal IT team

  These are the teams that manage the delivery and maintenance of the technology in an organization. They roll out new systems, set up computers, monitors, phones and other devices for employees and manage the systems. They can be led by a project manager, though that person is usually defined within the company as a director or vice-president of IT.

Foundational Reading: IT Project Management

Project management methods and tools can be deployed across all teams and industries to help improve efficiency and drive results. There are many different sectors where Project management is necessary. A few such examples are:

- Construction project management
- IT project management
- Marketing project management
- Project management in Operations

Week 4

Foundational Reading: Forming project teams

It is well known that teamwork is essential for projects. Bruce Tuckman´s stages of team development – forming, storming, norming, performing and adjourning – are well known in the community and explained in nearly all project management trainings.

A team is a social system, which builds on a "good" match of motivation, competences, and interactions of its constituents' parts. The project manager needs to analyse the project tasks and derive key requirements for all team members. To reach the right mix of project team a joint effort of these 3 parties is involved:

- Project manager

  Analysing the project with its requirements regarding people and developing the team systematically along Tuckman´s five stages.

- Project sponsor

  Ensuring the deployment of the "right" team members from the functional departments to help the project to succeed.
- Project team members

  Performing assigned tasks in the best possible way through motivation, competences, and interaction.

Additionally, a good mixture of people may also build on other criteria, such as age, gender, cultural background, personalities, and disciplines. Thus, the focus of the project manager (together with the sponsor) should be on forming project teams with a mixture that allows the team to dynamically grow throughout the project lifecycle and successfully achieve what is expected from them.

Foundational Reading: Team building in Project Management

Project managers quickly learn the critical significance of the effective project team and the role of team building activities in facilitating project management performance. the importance of developing effective teams comes from three major forces:

- There are more specialists/experts within organizations whose talents need to be focused and integrated into a larger task.
- More organizational members want to become increasingly involved in their total work environment.
- The benefits of people working together can result in important synergy and creativity.

Team building is the process of taking a collection of individuals with different needs, backgrounds and expertise and transforming them by various methods into an integrated, effective work unit. In this transformation process, the goals and energies of individual contributor's merge and support the objectives of the team. As team building is a collective effort of different people coming together, there are major barrier to project team development, these are:

- Differing outlooks, priorities, interests, and judgements of team members

  To overcome this barrier, make effort early in the project life cycle to discover these conflicting differences. Fully explain the scope of the project and the rewards which may be forthcoming upon successful project completion. Sell "team" concept and explain responsibilities. Try to blend individual interests with the overall project objectives.
- Role conflicts

  To overcome this barrier, as early in a project as feasible, ask team members where they see themselves fitting into the project. Determine how the overall project can best be divided into subsystems and subtasks (e.g., the work breakdown structure). Assign/ negotiate roles. Conduct regular status review meetings to keep team informed on progress and watch for unanticipated role conflicts over the project's life.
- Project objectives/outcomes are not clear

  To overcome this barrier, assure that all parties understand the overall and interdisciplinary project objectives. Clear and frequent communication with senior management and the client becomes critically important. Status review meetings can be used for feedback. Finally, a proper team name can help to reinforce the project objectives.
- Dynamic project environments

  To overcome this barrier, The major challenge is to stabilize external influences. First, key project personnel must work out an agreement on the

principal project direction and “sell” this direction to the total team. Also educate senior management and the customer on the detrimental consequences of unwarranted change. It is critically important to forecast the “environment” within which the project will be developed. Develop contingency plans.

- Competition over team leadership

  To overcome this barrier, Senior management must help establish the project manager's leadership role. On the other hand, the project manager needs to fulfill the leadership expectations of team members. Clear role and responsibility definition often minimizes competition over leadership.

- Lack of team definition and structure

  To overcome this barrier, Project leaders need to sell the team concept to senior management as well as to their team members. Regular meetings with the team will reinforce the team notion as will clearly defined tasks, roles, and responsibilities. Also, visibility in memos and other forms of written media as well as senior management and client participation can unify the team.

- Project personnel selection

  To overcome this barrier, attempt to negotiate the project assignments with potential team members. Clearly discuss with potential team members the importance of the project, their role in it, what rewards might result upon completion, and the general “rules-of-the-road” of project management. Finally, if team members remain uninterested in the project, then replacement should be considered.

- Credibility of the project leader

  To overcome this barrier, Credibility of the project leader among team members is crucial. It grows with the image of a sound decision maker in both general management and relevant technical expertise. Credibility can be enhanced by the project leaders' relationship to other key managers who support the team's efforts.

- Lack of team member commitment

  To overcome this barrier, try to determine lack of team member commitment early in the life of his project and attempt to change possible negative views toward the project. Often, insecurity is a major reason for the Jack of commitment; try to determine why insecurity exists, then work on reducing the team members' fears. Conflicts with other team members may be another reason for lack of commitment. It is important for the project leader to intervene and mediate the conflict quickly. Finally, if a team member's professional interests lie elsewhere, the project leader should examine ways to satisfy part of the team member's interests or consider replacement.

- Communication problems

  To overcome this problem, the project leader should devote considerable time communicating with individual team members about their needs and concerns. In addition, the leader should provide a vehicle for timely sessions to encourage communications among the individual team contributors. Tools for enhancing communications are status meetings, reviews, schedules, reporting system, and colocation. Similarly, the project leader should establish regular and thorough communications with the client and senior management. Emphasis is placed on written and oral communications with key issues and agreements in writing.

- Lack of senior management support

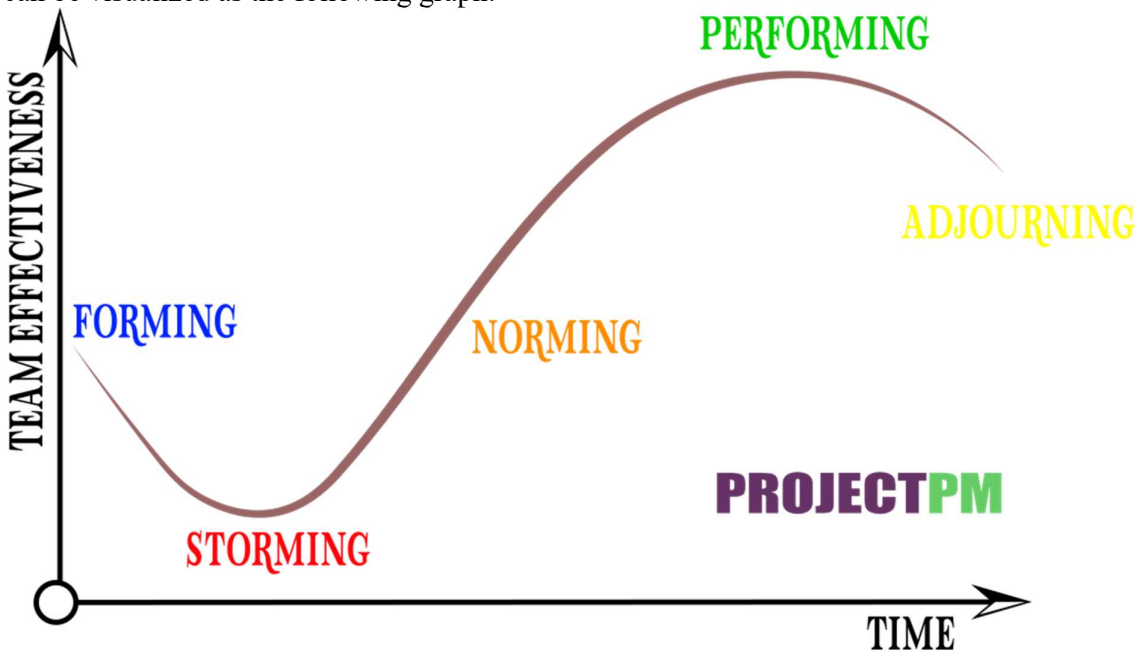
  To overcome this problem, Senior management support is an absolute necessity for dealing effectively with interface groups and proper resource commitment. Therefore, a major goal for project leaders is to maintain the continued interest and commitment of senior management in their projects. We suggest that senior management become an integral part of project reviews. Equally important, it is critical for senior management to provide the proper environment for the project to function effectively. Here the project leader needs to tell management at the onset of the program what resources are needed. The project manager's relationship with senior management and ability to develop senior management support is critically affected by his own credibility and the visibility and priority of his project.

Effective team building can be a critical determinant of project success. While the process of team building can entail frustrations and energy on the part of all concerned, the rewards can be great.

Foundational Reading: 5 Stages of team development

Dr. Bruce W. Tuckman, a psychologist at Ohio State University, published a theory in 1965 called 'Tuckman's Stages of Group Development'. Initially, it was a 4-stage model, Forming, Storming, Norming, and Performing, but later in 1977, a fifth stage of Adjourning was included by Mary Ann Jensen and Dr. Bruce Tuckman, both jointly worked on the last stage. It is also known as the Tuckman ladder model.

Most of the teams follow these stages on the way to deliver high performance. These stages start when a group first meets and are then separated as the project ends. This process can be visualized as the following graph:



- Forming stage

  Here the team members meet for the first time and are usually positive, polite, anxious and a little excited. In this stage, the team members are like independent entities; no bond with others, and responsibilities are clear. A

project manager's role as a leader is to make efforts and let them mingle and introduce with frequent meetings.

- Storming stage

  Any team's effectiveness is drastically dropped in this storming stage. Storming is the stage where most teams fail. As a leader, one needs to make sure to discuss the about each member's skills, background, interests and even set ground rules. Set proper ground rules to follow as soon as possible. This is the stage when the team members might challenge the authority of the project manager. Define the responsibilities clearly with proper authority for everyone. This will reduce the chaos among all. Some members may resist taking a task that is not clearly defined in their domain; hence make sure to identify and assign to a related one as soon as possible.

- Norming stage

  This is the stage where team effectiveness should go up exponentially. In this stage, the behaviour of team members completely changes. They appreciate each other's strengths, socialize together, ask one another for help, provide constructive feedback, develop a more substantial commitment to the project and the project manager receives more respect.

- Performing stage

  Almost maximum possible effects on the team is seen at this stage. All the issues are resolved, and the team is fully involved in the project goals and organizational objectives. Work leads without friction, no resistance. It is easy to be part of the team in this stage, accommodate new people and make no difference if someone leaves at this point.

- Adjourning stage

  This is the final stage wherein the project is completed and the team which has been built is disbanded. The team could now be permanently disbanded or merged with another team.

Foundational Reading: Critical success factors in project management

Every Project Manager would like to run a project that finishes with success but only the minority do. According to research, majority of the projects run out of budget or time significantly. To determine the factors that lead to project failure, a study was carried out on a group of project managers who have had successful projects and asked them to review their past projects.

The study was divided into 3 parts. The first part ranked the factors affecting the project on their influence on the success or failure of the project. The second part collected information about the knowledge and experience of the project managers and finally the third part collected information about the successful project based on the time and budget.

According to the study every project manager knew at least one project management methodology. The highest rating was for PMBOK followed by PRINCE 2. The project manager had varied experiences, but the median was around 7 years with around 20 projects on average with an average budget of 2 million dollars. 80% of these project managers managed the project scope, resources, budget, communication, and time. And of these experts, only 50% managed the project integration, risk, quality, and procurement.

Based on the research carried out the following was noted:

- Formally establishing a project manager increased the chances of project success.

- Project manager's competency and high authority is directly related to the project success.
- Formally establishing a project team, clear and measurable project goals also have a direct impact on the project success.

Foundational Reading: Project failures – 10 reasons why projects fail

The top 10 reasons why projects fail are as follows:

- Scope creep

  Project scope is everything that you are going to do and conversely, not going to do. So, once the objectives of project work are defined, usually via a Work Breakdown Structure, you need to freeze it and zealously guard against unplanned changes.

- Overallocated resources

  Going hand in hand with scope creep, often there are too few resources working on too many failed projects at the same time. In conjunction with that, many managers don't seem to have a grip on what their resources are doing all the time. Project team members are left to figure out for themselves what projects they should be working on and when.

- Poor communication

  Many team members on a project will know the project manager only through their communication. Teams will know them by how their voice comes across over the Zoom call, or by how well-written their emails are. By striving to define unclear objectives and communicate goals and processes to teams, the project manager strengthens team collaboration. If the project manager, and other organization leadership, are not clear, unambiguous communicators, then chaos, confusion, and failure will ensue.

- Bad stakeholder management

  Stakeholders and company leadership have a vested interest in the project — for the good or ill of the project. It is the project manager's job to not only identify all stakeholders but know how to manage and communicate with them in a timely fashion. Therefore, developing a communication plan is an integral part of avoiding project management failure.

- Unreliable estimates

  Project managers rely on work estimates in their planning, but estimates are very often just guesstimates by project team members who are trying to calculate duration of tasks based on how long it took them last time. This may turn out to be totally accurate or may be completely wrong. If they're wrong, poor estimation leads to a flawed schedule, unachievable objectives, and increased risk — and ultimately, project failure. Historical records kept between projects help project teams to refine their goals.

- No risk management

  Every project is unique and hence, project management is full of uncertainty. When we try to qualify and quantify that uncertainty, we call it risk. It is incumbent upon the project manager to proactively anticipate things that might go wrong; therefore, proper risk management leads to success. Once they have identified risks, then the project manager and the team can decide during project planning on how to mitigate and avoid those specific risks, should they occur.

- Unsupported project culture

  This form of failure is not easily solvable, because it requires education of senior management and a cultural shift.
- Accidental project manager

  Improper or lack of education of project management and the lack of social and leadership skills might cause the downfall of the project. At the very least, all new PMs should be familiar with setting accurate project goals and objectives, developing project schedules, people management, and proper project implementation. And they should first be assigned small projects to better hone their skills.
- Lack of team planning sessions

  This failure scenario is easily avoided, as there is no more effective way to kick off a project than to have the entire team come together for a planning session. This enables everyone to not only work together on project artifacts — such as project schedules and WBS — but also to develop teamwork and buy into the project management process.
- Monitoring and controlling

  Many project managers will create a schedule and never (or rarely) update it. Or if they do, they'll just fill in percent done, which is an arbitrary number often picked out of the air by team members. Avoid this failure by recording project management actuals, such as date started, work accomplished, and estimate of remaining work. This is another area where project management software is a lifesaver.

Given below are a few projects management software which can help in the management of projects:

- Monday
- LiquidPlanner
- Wrike
- ClickUp
- Gantt Pro
- Rocketlane
- Resource Guru
- Jira
- Nifty
- Zoho projects

Foundational Reading: Project failures – 12 mistakes to avoid

A successful project is any initiative that satisfies all 5 of these criteria:

- Completed at or under the budget.
- Completed on schedule.
- Meets sponsor objectives.
- Meets defined requirements of features and functions.
- Customers score the product as satisfactory or better.

The top 12 IT Project mistakes to avoid are given below:

- Project is nor part of the strategic plan

  A strategic plan identifies your company's business goals and the solutions needed to support those business goals. If a project does not line up with one of the items on the strategic plan, you should not do the project.
- No executive sponsorship

  Executive sponsorship of your project is vital for project success. Active sponsor participation has historically ensured a project will be on-time, within budget, and meet the business goals. When there is an executive sponsor sitting in status meetings, reviewing plans, meeting with team members, etc. the

project team stays focused on the project objectives, roadblocks are removed immediately, and morale is up.

- Poor technology evaluation

  Many project failures start at the beginning. The evaluation team is knowledgeable on some aspects of the technology, but they do not spend enough time researching solutions and they believe all the hype from vendors and industry media.

- No customer involvement

  Successful projects need input from the people who will be affected most by the project. The customers should be consulted on the value they will receive from a product. Successful projects have the best and brightest customers on the team. These individuals make the best decisions in a timelier manner.

- Scope creep

  Adding additional scope without testing it against the business case and evaluating the impact on the cost, schedule, and risks is the easiest way to sink a project. Modifying products is risky and the most common form of scope creep. The project best practice is to implement quickly, get the benefit quickly, and modify later.

- Invalid pilots

  Pilot phases of a project can be very enlightening. What a great tool, test the product in a smaller real-life environment. Failure occurs when the pilot does not simulate reality.

- Inadequate testing

  Limiting your testing of a solution will increase the chance of system failure or unknown bugs that can cripple your business. Do not skimp on testing to save time or money. Eliminate features first. To limit project failure, the testing phase should consist of system test, customer acceptance testing, volume testing, and stress testing to test scalability.

- Poor planning

  Rolling out a product to one location is simple. Multiple location deployments are more of a challenge to do quickly and cost effectively. Larger deployments require more planning due to greater chances of conflicts and timing issues. Proper planning of equipment and resources will make or break the project.

- Rolling out at the wrong time

  Proper timing of a project "Go Live" is an important success factor that is often challenged by missed milestone dates. Business sponsors want solutions implemented before peak times where it will provide the greatest benefit. However, pilots and testing cannot be sacrificed. Pressing your luck on the timing of a rollout can be disastrous.

- Limited training

  Training is the first thing cut from a project when funding is low or over budget. You get the product released and the sponsors will not spend additional money on training. Without proper training, the new system will not provide the expected return on investment. Additionally, poor or no training will lead to low customer acceptance resulting in a failed project. To receive value, the customer must know how to use the new product.

- Underestimating change to the business

  Change management involves the business process changes necessary to succeed. When implementing software, failure occurs most of the time when the project sponsors do not understand that they must change the business to work with the software or change the software to work like the business.
- Avoiding risk analysis

  It is human nature to think positive, that nothing will go wrong. Sometimes success or failure is determined by how well prepared a project team is when disaster occurs. If they project team or organization is not prepared, the project may stop unexpectedly until a new plan can be executed.

Week 5

Foundational Reading: How do you know what information source to trust

Whenever a person shares information, they become an information source. It's important to ask critical questions about an information source before we decide that it's trustworthy. There are three key critical question to ask to make sure to trust on an information source:

- Who made this claim?

  To work out who is making a claim, it's important to first identify if they are a named source or an unknown or anonymous source. When you encounter an anonymous or unknown source online, it's important to recognise that, while a claim they are making might be true, without knowing who they are, it's impossible to know if they have the relevant expertise or experience to make the claim, or if they have something to gain from making the claim. Knowing how people are connected to a claim helps us to decide if their claim could be biased or motivated by self-interest.
- What is the evidence to support this claim?

  People who promote misinformation are often motivated by financial, political, or psychological interests, such as feeling superior or finding a community that shares outsider perspectives. One way they may try to gain interest and attention is to evoke a strong emotional response from people. If information evokes a strong emotional response from us, it's important to take a moment to untangle our emotional response and ask some critical questions about the claims being made.
- What do trusted sources say about this claim?

  By paying attention to the source of claims and by asking the same critical questions professional fact-checkers use, we can all play a role in stopping the spread of misinformation.

Foundational Reading: Tools for trusting information

The internet has vastly increased the speed and spread of information, connecting the world in ways never thought possible. One of the main advantages of developing technology is that a wealth of information and data is freely available to anyone with an internet connection. One downside to this increase in speed and communication is the ease with which misinformation can be disguised and accepted as fact. Following are a few steps that can be taken to better understand the information:

- Facts and what it means for something to be true
- Not everything is either true or false
- Be sceptical and ask questions
- Consider the sources

- Check the dates
- Analyse the language clues
- Fact checks the sources
- Use the google research tools
- Research and use the reading studies
- Consider the size of study and participants of the source
- Explore the methods and outcomes
- Be mindful of the emotional appeals and confirmation bias

Foundational Reading: Six reasons why research is important

The primary goal of the research is to guide action, gather evidence for theories, and contribute to the growth of knowledge in data analysis. Research skills are an important component of the writing process because they allow authors to discover information and build an outline for their writing project, whether creative or academic. By building systematic and effective research techniques, you will become knowledgeable about any topic that you need to write about. Given below are the reasons for the importance of research:

- Acquire knowledge effectively
- Research helps in problem solving
- Provides the latest information
- Builds credibility
- Helps in business successes
- Discover and seize opportunities

To improve research skills, one can use the following steps:

- Start with the big picture and work your way down
- Identify a reliable source
- Validate the information from various sources
- Take in new information
- Facilitates learning processes
- Stay organised
- Make use of library resources

Foundational Reading: What is qualitative vs quantitative study

There are two distinct types of data collection and study—qualitative and quantitative. While both provide an analysis of data, they differ in their approach and the type of data they collect. Awareness of these approaches can help researchers construct their study and data collection methods.

As qualitative and quantitative studies collect different data, their data collection methods differ considerably. Quantitative studies rely on numerical or measurable data. In contrast, qualitative studies rely on personal accounts or documents that illustrate in detail how people think or respond within society.

Qualitative research methods include gathering and interpreting non-numerical data. It may use sources such as interviews, focus groups, documents, cultural records, observations, etc. Quantitative studies, in contrast, require different data collection methods. These methods include compiling numerical data to test causal relationships among variables. Some sources of this research method are experiments, questionnaires, surveys, database reports, etc.

The qualitative method allows for creativity, varied interpretations, and flexibility. The scope of the research project can change as more information is gathered. However, qualitative studies are more subjective in their results and interpretation than are quantitative studies. The expertise and perspective of the researcher may strongly influence the interpretation of results and the conclusions reached, as personal bias can be hard to manage. In addition, qualitative studies often test a smaller sample size because of the costs and efforts associated with qualitative data collection methods.

Quantitative studies produce objective data, free from the subjectivity of a qualitative study. Results can be clearly communicated through statistics and numbers. Quantitative studies can be quickly produced with the benefit of data computing software. Yet, while the objectivity is a benefit of the quantitative method, it can be viewed as a more restrictive form of study. Participants cannot tailor their responses or add context. Further, statistical analysis requires a large data sample, which calls for a large pool of participants.

Foundational Reading: Research methods – What are research methods

Research methods are the strategies, processes or techniques utilized in the collection of data or evidence for analysis to uncover new information or create better understanding of a topic. There are different types of research methods which use different tools for data collection. Following are the different types of research:

- Qualitative research

  Qualitative Research gathers data about lived experiences, emotions or behaviours, and the meanings individuals attach to them. It assists in enabling researchers to gain a better understanding of complex concepts, social interactions, or cultural phenomena. This type of research is useful in the exploration of how or why things have occurred, interpreting events and describing actions.

- Quantitative research

  Quantitative Research gathers numerical data which can be ranked, measured, or categorised through statistical analysis. It assists with uncovering patterns or relationships, and for making generalisations. This type of research is useful for finding out how many, how much, how often, or to what extent.

- Mixed methods research

  Mixed Methods Research integrates both Qualitative and Quantitative Research. It provides a holistic approach combining and analysing the statistical data with deeper contextualised insights. Using Mixed Methods also enables Triangulation, or verification, of the data from two or more sources.

Data for the research methods can be collected using various methods, a few of them are as follows:

Qualitative Techniques or Tools	Quantitative Techniques or Tools
Interviews: these can be structured, semi-structured or unstructured in-depth sessions with the researcher and a participant.	**Surveys or questionnaires**: which ask the same questions to large numbers of participants or use Likert scales which measure opinions as numerical data.
Focus groups: with several participants discussing a particular topic or a set of questions. Researchers can be facilitators or observers.	**Observation**: which can either involve counting the number of times a specific phenomenon occurs, or the coding of observational data in order to translate it into numbers.
Observations: On-site, in-context or role-play options.	**Document screening**: sourcing numerical data from financial reports or counting word occurrences.
Document analysis: Interrogation of correspondence (letters, diaries, emails etc) or reports.	**Experiments**: testing hypotheses in laboratories, testing cause and effect relationships, through field experiments, or via quasi- or natural experiments.
Oral history or life stories: Remembrances or memories of experiences told to the researcher.	

Week 6

Foundational Reading: The ultimate guide to project tracking

Project Tracking is a method of project management for following the progress (or lack thereof) of activities involved in projects. Potential issues can be spotted and solved by team members and leaders. Tracking projects from the beginning, dealing with problems quickly, and proactively making decisions is what successful project managers do. Project tracking begins early in the project with planning and goes on until the completion of a project. Monitoring project progress to identify potential problems in a timely manner and take corrective action. Measuring project performance regularly to identify variances from the project management plan to make sure projects are on track.

There are multiple benefits and many reasons to engage with project tracking, from increased chances of project success to creating a united team. Keeping up to date on the progress of the project and awareness of project status, it is easy to spot any potential issues that could prevent project success. Complete transparency is essential for accurate decision-making. Project tracking keeps all team members and stakeholders in touch with deadlines and goals, enabling the project led to manage with confidence. There are four key benefits that effective project tracking should deliver:

- Real time information
- Problem identifiers
- Team motivation
- Easy and accurate reporting

The foundation for effective project management tracking and status reporting is laid during project planning. That is where the project manager and executives define clear deliverables and checkpoints for measuring progress. Team leaders, for the benefit of the whole team, should direct project tracking. Poor decision-making from senior executives is an issue created from a lack of transparency and up-to-date information. With effective project tracking

this problem is eliminated, allowing for informed and accurate decision-making. Following are the 6 top tips for project tracking:

- Plan your project before it starts
- Look for warning signs and resolve issues
- Monitor work schedule
- Only count tasks as complete when complete
- Be realistic with the actuals and estimates
- Look to the future

Foundational Reading: The benefits of business analytics

Business analytics is the process of looking at and assessing the wealth of data your company already has at its disposal and using it to make data-driven decisions. It moves beyond just looking at numbers to see what happened. Instead, business analytics also endeavours to give insight into why things happened and suggests what steps to take next. A few benefits of business analytics are:

- Keeps the company on budget
- Better decision making
- Gives the ability to measure accomplishments against overall goals
- Can provide with trends to make sure you are knowledgeable
- Builds efficiency

There are different types of business analytics. These are:

- Descriptive analytics

  Digs into your data and uses KPIs to show you the current state of your business. Descriptive analytics doesn't try to establish cause and effect relationships. It's essentially cold, hard numbers.

- Predictive analytics

  This type of analytics goes one step further. It tries to predict future actions based on trending historical data.

- Prescriptive analytics

  This form of business analytics can show you the best course of action for a given situation. While descriptive analytics shows what has already happened, and predictive analytics tries to forecast what might happen next, prescriptive uses that information to give you potential solutions based on similar situations

Foundational Reading: What is project scope?

Project scope is a detailed outline of all aspects of a project, including all related activities, resources, timelines, and deliverables, as well as the project's boundaries. A project scope also outlines key stakeholders, processes, assumptions, and constraints, as well as what the project is about, what is included, and what isn't. All of this essential information is documented in a scope statement.

The project scope statement is a key document that provides all stakeholders with a clear understanding of why the project was initiated and defines its key goals. Most project scope statements will include these elements:

- Project statement of work
- Project constraints
- Scope exclusions
- Project Milestones

- The final deliverables
- Acceptance criteria for success
- Final approval of customer to assure everything is covered in the scope statement

Properly defining the scope of a project is the key to successfully managing your project. Here are the steps you can follow to define your project scope:

- Work with key stakeholders to define and create scope statement
- Identify, document, and communicate assumptions
- Gain buy-in for the scope statement with the stakeholders who are most impacted

Scope creep refers to a scenario whereby changes occur after the project has been started and the changes are not defined or anticipated within the scope statement. When scope creep occurs, it can negatively impact the project timeline, deliverable quality, resources, budget, and other aspects. Managing the scope of your project can help avoid unwelcome surprises. In addition to the ongoing review and monitoring of project activities, there are steps that should be undertaken to manage the scope of the project to avoid scope creep:

- Identify whether there are any changes to the requirements for your project.
- Identify how the changes will impact the project.
- Gain approval for changes before proceeding with a change in activities or direction.
- Implement the approved changes in a timely manner to reduce delays and risks.

Foundational Reading: Project estimating

Any Project will have constraints, and it is the responsibility of the project manager to manage those constraints effectively for successful project execution. To manage project constraints effectively and efficiently, project needs should be properly estimated. The various techniques employed in Project Estimating are:

- Analogous estimating (Top-down estimating)

  A technique for estimating duration or cost of an activity or a project using historical data from a similar activity or a project. Analogous estimating uses parameters from previous similar projects such as duration, budget, weight, size, complexity etc as a basis for estimating the same parameter or measure of the project in question. The accuracy of the analogous estimation depends on the degree of similarity between your current project and the project you are comparing it with. A few important points to remember:

  - Can be used to estimate duration and cost
  - Makes use of historical data of similar projects
  - Fastest technique to calculate estimate
  - Done when no detailed information about the project is available
  - Less accurate, less time consuming, and less costly
  - Can be done on the entire project or part of the project
  - Can be used along with other estimation methods

- Bottom-up estimating

  Bottom-up estimating is a method of estimating project duration or cost by aggregating the estimates of the lower-level components of the WBS. When an activity cannot be estimated with a reasonable degree of confidence, the work within the activity is decomposed into more detail. The resource needs are estimated. These estimates are then aggregated into a total quantity for each of the activity's resources. A few important points to remember:

- Can be used to estimate both duration and cost
- Can be used to estimate resources for activities
- Are more accurate
- Requires maximum amount of time to estimate compared to others

- Parametric estimating

  Parametric Estimating uses Project parameters along with historical data to calculate the cost or duration estimates. Parametric Estimating uses a statistical relationship between historical data and other variables to calculate an estimate for activity parameters such as cost, duration. The accuracy of parametric estimates is less but better than Analogous estimates. However, higher levels of accuracy can be achieved depending upon the sophistication and the underlying data built into the model. There are 2 ways of doing parametric testing: regression analysis and learning curve. Some important points to remember are:

  - Can be used to estimate cost, duration, and resources
  - Uses historical data and project parameters
  - Accuracy is better than analogous estimates
  - Can be applied to the entire project or parts of it
  - Can be used with other estimation methods

- Three-point estimating

  A technique used to estimate cost or duration by applying an average or weighted average of optimistic, pessimistic, and most likely estimates when there is uncertainty with the individual activity estimates. Three-Point Estimating can be used to estimate both duration and cost. The 3 estimates are Optimistic, Pessimistic and Most likely. The final 3-point average is calculated by calculating the average of the 3 estimates. Some important points to remember:

  - Can be used to estimate duration and cost but not resources
  - More accurate than analogous and parametric estimation
  - Allows more consideration for risk and uncertainty
  - Used when historical data is insufficient

There are 3 major parts of scope estimation: effort estimation, cost estimation and resource estimation. There are 3 different types of project estimates: rough order of magnitude (ROM) estimates or Ball Park estimates, budget estimates and definitive estimates.

Week 7

Foundational Reading: The difference between quality assurance and quality control

It is important for an organisation to agree on what the meanings of Quality Assurance (QA) and Quality Control (QC). Both form an integral part of the organisation's quality management plan, and the effectiveness of delivery teams relies on the differences being well understood by all stakeholders, including management.

Although QA and QC are closely related concepts, and are both aspects of quality management, they are fundamentally different in their focus:

- QC is used to verify the quality of the output.
- QA is the process of managing for quality.

The ISO 9000 family of standards relate to quality management systems and are designed to help organisations meet the needs of customers and other stakeholders. In terms of this standard, A part of quality management focused on fulfilling quality requirements is Quality Control whereas a part of quality management focused on providing confidence that quality requirements will be fulfilled is Quality Assurance. Simply put, Quality Assurance focuses on the process of quality, while Quality Control focuses on the quality of output.

QA is focused on planning, documenting, and agreeing on a set of guidelines that are necessary to assure quality. QA planning is undertaken at the beginning of a project and draws on both software specifications and industry or company standards. The typical outcomes of the QA planning activities are quality plans, inspection and test plans, the selection of defect tracking tools and the training of people in the selected methods and processes. The purpose of QA is to prevent defects from entering the solution in the first place. Undertaking QA at the beginning of a project is a key tool to mitigate the risks that have been identified during the specification phases. Communication plays a pivotal role in managing project risk and is crucial for realising effective QA. Part of any risk mitigation strategy is the clear communication of both the risks, and their associated remedies to the team or teams involved in the project.

Quality Control, on the other hand, includes all activities that are designed to determine the level of quality of the delivered ICT solutions. QC is a reactive means by which quality is gauged and monitored, and QC includes all operational techniques and activities used to fulfil requirements for quality. These techniques and activities are agreed with customers and/or stakeholders before project work is commenced. QC involves verification of output conformance to desired quality levels. This means that the ICT solution is checked against customer requirements.

Because of formulating and executing a quality management plan the company can expect:

- Greater levels of customer satisfaction
- A motivated team that not only understand the policy objectives of the quality management plan, but who also actively participate in executing the plan

- Elimination of waste by eliminating rework arising from either the need to address bugs, or to address gaps in the solution's ability to meet customer requirements
- Higher levels of confidence in planning
- Financial rewards for the company

Foundational Reading: What is auditing?

Auditing is defined as the on-site verification activity, such as inspection or examination, of a process or quality system, to ensure compliance to requirements. An audit can apply to an entire organization or might be specific to a function, process, or production step. Some audits have special administrative purposes, such as auditing documents, risk, or performance, or following up on completed corrective actions. There are three main types of audits:

- Process audit

  This type of audit verifies that processes are working within established limits. It evaluates an operation or method against predetermined instructions or standards to measure conformance to these standards and the effectiveness of the instructions.
- Product audit

  This type of audit is an examination of a particular product or service, such as hardware, processed material, or software, to evaluate whether it conforms to requirements
- System audit

  An audit conducted on a management system. It can be described as a documented activity performed to verify, by examination and evaluation of objective evidence, that applicable elements of the system are appropriate and effective and have been developed, documented, and implemented in accordance and in conjunction with specified requirements.

An audit may also be classified as internal or external, depending on the interrelationships among participants. Internal audits are performed by employees of your organization. External audits are performed by an outside agent. Internal audits are often referred to as first-party audits, while external audits can be either second-party or third-party. A few more details about the different types of audits:

- First party audit

  A first-party audit is an internal audit conducted by auditors who are employed by the organization being audited but who have no vested interest in the audit results of the area being audited.
- Second party audit

  A second-party audit is an external audit performed on a supplier by a customer or by a contracted organization on behalf of a customer. Second-party audits tend to be more formal than first-party audits because audit results could influence the customer's purchasing decisions.
- Third party audit

  A third-party audit is performed by an audit organization independent of the customer-supplier relationship and is free of any conflict of interest. Independence of the audit organization is a key component of a third-party audit. Third-party audits may result in certification, registration, recognition, an award, license approval, a citation, a fine, or a penalty issued by the third-party organization or an interested party.

Value-added assessments, management audits, added value auditing, and continual improvement assessment are terms used to describe an audit purpose beyond compliance and conformance. The purpose of these audits relates to organization performance. A key difference between compliance audits, conformance audits, and improvement audits is the collection of evidence related to organization performance versus evidence to verify conformance or compliance to a standard or procedure.

A product, process, or system audit may have findings that require correction and corrective action. Since most corrective actions cannot be performed at the time of the audit, the audit program manager may require a follow-up audit to verify that corrections were made, and corrective actions were taken. Due to the high cost of a single-purpose follow-up audit, it is normally combined with the next scheduled audit of the area.

There are 4 phases to an audit cycle:

- Audit planning and preparation

  Audit preparation consists of planning everything that is done in advance by interested parties, such as the auditor, the lead auditor, the client, and the audit program manager, to ensure that the audit complies with the client's objective. This stage of an audit begins with the decision to conduct the audit and ends when the audit itself begins.
- Audit execution

  The execution phase of an audit is often called the fieldwork. It is the data-gathering portion of the audit and covers the time from arrival at the audit location up to the exit meeting. It consists of multiple activities including on-site audit management, meeting with the auditee, understanding the process and system controls and verifying that these controls work, communicating among team members, and communicating with the auditee.
- Audit reporting

  The purpose of the audit report is to communicate the results of the investigation. The report should provide correct and clear data that will be effective as a management aid in addressing important organizational issues. The audit process may end when the report is issued by the lead auditor or after follow-up actions are completed.
- Audit follow up and closure

  The audit is completed when all the planned audit activities have been carried out, or otherwise agreed with the audit client.

Foundational Reading: IT Risk management

Information technology or IT risk is basically any threat to your business data, critical systems, and business processes. It is the risk associated with the use, ownership, operation, involvement, influence, and adoption of IT within an organisation. There are many types of IT risks, a few are:

- Security
- Availability
- Performance
- Compliance

IT risks can threaten systems. These threats can be external, internal, deliberate, and unintentional. Most IT risks affect one or more of the following:

- business or project goals
- service continuity
- bottom-line results
- business reputation
- security
- infrastructure

If technology is enabling your connection to customers, suppliers, partners, and business information, managing IT risks in your business should always be a core concern. IT risks should be carefully assessed and measured.

Managing various types of IT risks begins with identifying exactly:

- the type of threats affecting your business
- the assets that may be at risks
- the ways of securing your IT systems

In business, IT risk management entails a process of identifying, monitoring, and managing potential information security or technology risks with the goal of mitigating or minimising their negative impact. To manage IT risks effectively, there are 6 steps one could follow. These are:

- Identify risks
- Assess risks
- Mitigate risks
- Develop an incident response
- Develop contingency plans
- Review processes and procedures

Week 8

Foundational Reading: The different types of software testing

There are numerous types of software testing techniques that one can use to ensure changes to the code work as expected. It's important to make the distinction between manual and automated tests. Manual testing is done in person, by clicking through the application or interacting with the software and APIs with the appropriate tooling. This is very expensive since it requires someone to setup an environment and execute the tests themselves, and it can be prone to human error. Automated tests, on the other hand, are performed by a machine that executes a test script that was written in advance. These tests can vary in complexity, from checking a single method in a class to making sure that performing a sequence of complex actions in the UI leads to the same results. It's much more robust and reliable than manual tests

– but the quality of your automated tests depends on how well your test scripts have been written. There are different types of tests, a few of them are:

- Unit test

  Unit tests are very low level and close to the source of an application. They consist in testing individual methods and functions of the classes, components, or modules used by your software. Unit tests are generally quite cheap to automate and can run very quickly by a continuous integration server.
- Integration test

  Integration tests verify that different modules or services used by your application work well together. These types of tests are more expensive to run as they require multiple parts of the application to be up and running.
- Functional test

  Functional tests focus on the business requirements of an application. They only verify the output of an action and do not check the intermediate states of the system when performing that action.
- End to end test

  End-to-end testing replicates a user behaviour with the software in a complete application environment. It verifies that various user flows work as expected. End-to-end tests are very useful, but they're expensive to perform and can be hard to maintain when they're automated.
- Acceptance test

  Acceptance tests are formal tests that verify if a system satisfies business requirements. They require the entire application to be running while testing and focus on replicating user behaviours. But they can also go further and measure the performance of the system and reject changes if certain goals are not met.
- Performance test

  Performance tests evaluate how a system performs under a particular workload. These tests help to measure the reliability, speed, scalability, and responsiveness of an application.
- Smoke test

  Smoke tests are basic tests that check the basic functionality of an application. They are meant to be quick to execute, and their goal is to give you the assurance that the major features of your system are working as expected. Smoke tests can be useful right after a new build is made to decide whether you can run more expensive tests, or right after a deployment to make sure that they application is running properly in the newly deployed environment.

To automate tests, one will first need to write them programmatically using a testing framework that suits your application. PHPUnit for PHP, Mocha for JavaScript, RSpec for Ruby, Junit for Java, etc. When the tests can be executed via script from the terminal, one can have them be automatically executed by a continuous integration server like Bamboo or use a cloud service like Bitbucket Pipelines. These tools will monitor your repositories and execute your test suite whenever new changes are pushed to the main repository.

Foundational Reading: QA roles and responsibilities

The key QA roles and responsibilities:

- QA Engineer

  Tests software to detect bugs and errors. Checks whether a product complies with the requirements. A detective who knows where the bugs can

hide, even where no one expects them to. Tests the system using attention, deduction, and sometimes special software.

A QA engineer carries out different tests. Some of the main responsibilities of a manual QA engineer include:

- Analysis of requirements
- Writing and executing test cases
- Conducting exploratory testing
- Verification of multidevice and cross-platform consistency
- Creating detailed reports and listing improvements
- Participation in test planning meetings and providing feedback

Some of the main responsibilities of an automation QA engineer include:

- Writing test scripts
- Carry out automated regression tests
- Run performance tests
- Set the priorities for automation scenario
- Write documentation on automated testing

- Test analyst

  Guru of project documentation. The first one to decide what to test and how. Knows exactly what the product should do. Systemizes the information to ease the QA engineer's life.

  The test analyst focuses more on business tasks and less on technical aspects. Their main responsibilities include:

  - Study and clarify testing requirements
  - Determine what to test, prioritize and monitor test coverage
  - Define specific tests, design test cases, etc.
  - Develop test documentation
  - Compare actual and expected results

- Test architect

  Looks for ultimate solutions that will meet the client's demands and align with the team's resources. Has a complete vision of the software system. Knows every little feature and how it interacts with other features.

  A test architect helps to maintain a well-designed and sustainable test architecture in complex cases. Their main responsibilities include:

  - Work out ways to optimize testing process at high level
  - Identify tools and technologies that align with business goals
  - Monitor the effective of testing, provide mentoring and suggestions

- Test manager

  Takes full responsibility for the project's success (or fail). Prepares test strategy, defines the scope of work for other members, controls test execution.

  A test manager is the first to find out how teamwork affects the outcome of a project. A test manager controls analysts, architects, and QA engineers to make sure they deliver the result a client expects. Their main responsibilities include:

- Preparing test strategy for the project
- Set metrics to measure quality of work
- Keep track of everyone's performance
- Calculate testing budget, estimate efforts, etc.
- Supervise the testing part of the working process.

- QA Team lead

  The Supervisor. May take part in any process mentioned above, but usually just checks the status and manages the team. Conducts interviews. Hires and mentor's new members. Deals mostly with managerial tasks rather than tech tasks.

  QA team lead handles the administrative part and communication with all the parties. Their main responsibilities include:
  - Hiring the staff
  - Supervising the team
  - Accepting requirements from the clients and clarifying them to the team
  - Setting quality metrics for the team
  - Representing the team in cross functional meetings
  - Constantly improving the quality of testing and working environment

A full-stack QA engineer can handle all of those tasks single-handedly. Full-stack QA engineers cannot test big products because it is very time-consuming. A full-stack QA engineer helps to build a more agile testing process. They are familiar with all parts of software functionality. They know the product from both the development and user point of view. They think up-front about what to test and how to test at the beginning of the sprint.

Development phases don't have a strict order. They can overlap and repeat. An Agile team prefers short iterations with frequent releases instead of handing a final product over to a QA team. In this case, development and testing processes are simultaneous, flexible, and more efficient. The life cycle of QA goes like:

- Requirement elicitation
- Planning and analysis
- Implementation
- Stabilization
- Support

Foundational Reading: Types of software testing

Software testing is about checking if the software works properly and if it meets the written requirements specifications. The basic goals of software tests are to eliminate bugs and to enhance various aspects of the software, such as performance, user experience, security, and so on. A great deal of testing can amazingly improve the overall quality of the software, which will lead to great customer satisfaction. Software testing can be classified into 2 main broad categories:

- Functional testing

  Functional testing involves the testing of the functional aspects of a software application. When you're performing functional tests, you have to test each and every functionality. You need to see whether you're getting the desired results or not.

- Non-functional testing

  Non-functional testing is the testing of non-functional aspects of an application, such as performance, reliability, usability, security, and so on. Non-functional tests are performed after the functional tests. With non-functional testing, you can improve your software's quality to a great extent.

Following are a few types of software testing:

- Unit testing (F)

  Testing each component or module of your software project is known as unit testing. To perform this kind of testing, knowledge of programming is necessary. So only programmers do this kind of tests, not testers.
- Integration testing (F)

  After integrating the modules, you need to see if the combined modules work together or not. This type of testing is known as integration testing. You need to perform fewer integration tests than unit tests.
- End to end testing (F)

  End-to-end testing is the functional testing of the entire software system. When you test the complete software system, such testing is called end-to-end testing. You need to perform fewer end-to-end tests than integration tests.
- User interface testing (F)

  User interface testing involves the testing of the application's user interface. The aim of UI tests is to check whether the user interfaces have been developed according to what is described in the requirements specifications document.
- Accessibility testing

  Testing whether your software is accessible to disabled people or not is termed as accessible testing. For this type of tests, you need to check if disabled people such as those who are colour blind, blind, and deaf can use your application.
- Alpha testing

  Alpha testing is a kind of testing to look for all the errors and issues in the entire software. This kind of test is done at the last phase of app development and is performed at the place of the developers, before launching the product or before delivering it to the client to ensure that the user/client gets an error-free software application. Alpha testing is run before the beta testing, which means that after performing alpha testing, you need to run beta testing. Alpha testing is not performed in the real environment. Rather, this kind of tests is done by creating a virtual environment that resembles a real environment.
- Beta testing

  Beta testing takes place after alpha testing. Beta testing is done before the launch of the product. It is carried out in a real user environment by a limited number of actual customers or users, to be certain that the software is completely error-free, and it functions smoothly. After collecting feedback and constructive criticism from those users, some changes are made to make the software better.
- Ad-hoc testing

  Ad-hoc testing is a kind of testing that is performed in an ad-hoc manner, without using any test cases, plans, documentation, or systems. Unlike all other types of testing, this kind of testing is not carried out in a systematic manner.

- Compatibility testing (NF)

  Compatibility testing involves compatibility checking of the software with different operating systems, web browsers, network environments, hardware, and so on. It checks whether the developed software application is working fine with different configurations.
- Backward compatibility testing (NF)

  Backward compatibility testing is carried out to test if a brand new or an updated version of an application is compatible with the previous versions of the environments (such as operating systems and web browsers) on which the software runs.
- Browser compatibility testing (NF)

  Browser compatibility testing checks a web application for browser compatibility. More specifically, it is tested whether the web app can easily be accessed from all versions of the major web browsers.
- Performance testing (NF)

  Performance tests are run to check if the software's performance is good or not. There are performance testing tools that analyse your app's performance and show you the performance issues. By fixing those issues, you'll be able to increase the performance of your software application.
- Load testing (NF)

  Load testing is one kind of performance testing that tests how much load a system can take before the software performance begins to degrade. By running load tests, we can know the capacity of taking load of a system.
- Recovery testing (NF)

  Recovery testing involves the checking of whether the application can recover from crashes and how well it recovers. In this kind of tests, testers observe how well the software can come back to the normal flow of execution.
- Regression testing (F)

  If you need to make changes in any component, module, or function, you must see if the whole system functions properly after those modifications. Testing of the whole system after such modifications is known as regression testing.
- Agile testing

  Carried out by the QA team, Agile testing is a type of testing that is conducted according to the rules of agile methodology. This kind of testing is done from the actual customers' viewpoint.
- API testing

  Just like unit testing, API testing is also a code-level testing type. The basic difference between unit testing and API testing is that unit testing is performed by the development team whereas API testing is handled by the QA team.
- Black box testing (F)

  Performed by the QA team of a company, black box testing is a testing technique that involves the checking of the application's functionality without having any technical knowledge of the application.
- White box testing (F)

  Performed by the development team, white box testing is a testing method that requires a good understanding of the application's code. It requires great knowledge of the app's internal logic.

- Security testing (NF)

  Security tests are performed to ensure the security of your application, in order that security breaches can be prevented. Security experts run this kind of tests to see how much your software is secure from attacks and to find security issues so that the app's security can be strengthened.
- Usability testing (NF)

  Testing the user-friendliness of an app is known as usability testing. It involves the checking of how much usable or user-friendly the app is. It is tested whether any user can easily use your software without getting stuck.
- Scalability testing (NF)

  Scalability testing verifies whether the software is scalable or not. In other words, it checks if your app performs well when the number of users, amount of data, or the number of transactions increases significantly. A software application that is not scalable may cause great business loss.
- Reliability testing (NF)

  Reliability testing is a type of software testing that verifies if the software is reliable or not. In other words, it checks whether the software runs error-free, and that one can rely on it.
- Acceptance testing (F)

  The client who will purchase your software will perform acceptance testing (also known as User Acceptance Testing) to see if the software can be accepted or not by checking whether your software meets all the client's requirements and preferences.

Foundational Reading: Seven principles of testing

According to International Software Testing Qualification Board there are seven principles that should be considered when developing the testing strategy for a software project/product. These are:

- Testing shows the presence of defects
- Exhaustive testing is impossible
- Testing has started as early as possible
- Defect clustering
- Pesticide paradox (new test cases need to be developed)
- Testing is context dependent
- Absence of errors fallacy

Week 9

Foundational Reading: Cyber security

Cyber security is the processes and methods that secure computer devices, networks, and data and information against attack, theft, misdirection, misuse, or disruption. The cyber security field also covers issues surrounding public computer policy including network policy, cyber threat awareness, and threat information sharing. Cyber security also encompasses the following aspects:

- Application security:
  - An effort to build robust security features into applications
- Information security:
  - The processes, policies, and tools that secure digital and nondigital data and information from attack and misuse.

- Operational security:
    - The goal of OPSEC is to identify and determine methods to protect assets.
- Disaster recovery and business continuity:
    - Disaster recovery anticipates security events and provides a plan for recovering assets and resuming business.
- End-user education:
    - Good cyber security practice empowers every member of an organization to recognize and resist security threats.

Cyber security has a few synonyms, computer security and IT security, which may sound more approachable for non-technical people. The goal of computer security is to protect hardware, software, and the data they store and transmit from potential damage, disruption, or misappropriated use. We live in a computer-operated, networked world, and as such almost every aspect of our lives can potentially be affected by a cyber-attack. Below is a list of some common security breaches that you should be wary of:

- Conventional crimes
- Remote mayhem
- Financial theft
- Personal infrastructure (Water, electricity, phone, etc.)
- Reputation ruin
- Flight frights
- Mobile mayhem
- Bot armies

The answer for how systems is attacker:

- Software vulnerabilities
- Backdoors
- Denial of service attacks
- Direct access attacks
- Eavesdropping
- Spoofing
- Tampering
- Privilege escalation
- Phishing
- Ransomware
- Clickjacking
- Social engineering
- Botnet

A cyber policy is relevant at many levels in our society. On a national level, cyber policy governs how we approach questions of data privacy, personal privacy, freedom of speech, security, access to the internet, and commodification of the internet. On a local or private level, an organization's cyber policy guides how employees, contractors, and visitors use its computers and network assets. The policy precisely describes those assets, appropriate and acceptable use, potential threats against the devices and network, and how the organization will defend against threats, contain, and repel threats, and repair any damage.

Foundational Reading: Data security 101

Data security refers to measures taken to prevent unauthorized access to the information stored in computers and databases or on the web, and to prevent the modification or corruption of that information. The threats that data security protects again are constantly changing and evolving. But there remain some consistent threats such as security hackers, malwares and computer viruses.

Cyber criminals use a range of methods to infiltrate computers systems. Some have been used for years; others have been developed more recently. A few common methods are:

- Brute password cracking
- Using existing breached data
- Phishing emails
- Voice phishing
- SMS phishing

Data security is difficult for some highly common reasons. Some of the most common challenges are:

- Limited knowledge of their own customer data
- No understanding who routinely accesses that customer data
- No understanding of how the data is protected
- No idea if there are suspicious access to the data

Data security management is the effective oversight and management of an organization's data to ensure the data is not accessed or corrupted by unauthorized users. A data security management plan includes planning, implementation of the plan, and verification and updating of the plan's components. The following are the basics of a data security management plan:

- Backups
- Data masking
- Data erasure
- Encryption
- Authentication
- OTPs
- Electronic security tokens
- Two factor authentication
- Transparent data encryption
- Big data security
- IOT data security

Data security standards are rules that apply to data security within some countries, governmental organizations, and industries. A number of countries, including the US, have enacted various laws that govern data security in certain jurisdictions and within certain industries.

Foundational Reading: The 15 most common types of cyber attacks

Cyber-attacks happen for several different reasons and in several different ways. A cyberattack is where an attacker tries to gain unauthorized access to an IT system for the purpose of theft, extortion, disruption, or other nefarious reasons. Below are some of the most common types of cyber-attacks:

- Malware

  Malware is a type of application that can perform a variety of malicious tasks. The most notable form of malware is ransomware – a program designed to encrypt the victim's files and then ask them to pay a ransom in order to get the decryption key.
- Phishing

  A Phishing attack is where the attacker tries to trick an unsuspecting victim into handing over valuable information, such as passwords, credit card details, intellectual property, and so on. Phishing attacks often arrive in the form of an email pretending to be from a legitimate organization, such as your bank, the tax department, or some other trusted entity.
- Man-in-the-middle attack (MITM)

  A man-in-the-middle attack (MITM) is where an attacker intercepts the communication between two parties in an attempt to spy on the victims, steal personal information or credentials, or perhaps alter the conversation in some way.
- Distributed Denial-of-Service (DDoS) attack

  A DDoS attack is where an attacker essentially floods a target server with traffic to disrupt, and perhaps even bring down the target.
- SQL injection

  SQL injection is a type of attack which is specific to SQL databases. SQL databases use SQL statements to query the data, and these statements are typically executed via an HTML form on a webpage. If the database permissions haven't been set properly, the attacker may be able to exploit the HTML form to execute queries that will create, read, modify, or delete the data stored in the database.
- Zero-day exploit

  A zero-day exploit is where cyber-criminals learn of a vulnerability that has been discovered in certain widely used software applications and operating systems, and then target organizations who are using that software to exploit the vulnerability before a fix becomes available.
- DNS Tunnelling

  DNS tunnelling is a sophisticated attack vector that is designed to provide attackers with persistent access to a given target. The malware is used to create a persistent communication channel that most firewalls are unable to detect.
- Business Email Compromise (BEC)

  A BEC attack is where the attacker targets specific individuals, usually an employee who can authorize financial transactions, to trick them into transferring money into an account controlled by the attacker. BEC attacks usually involve planning and research to be effective.
- Crypto jacking

  Crypto jacking is where cybercriminals compromise a user's computer or device and use it to mine cryptocurrencies, such as Bitcoin.
- Drive-by Attack

  A 'drive-by-download' attack is where an unsuspecting victim visits a website which in turn infects their device with malware.
- Cross-site scripting (XSS) attacks

Cross-site scripting attacks are quite like SQL injection attacks, although instead of extracting data from a database, they are typically used to infect other users who visit the site.

- Password Attack

  A password attack, as you may have already guessed, is a type of cyber-attack where an attacker tries to guess, or "crack" a user's password. Attackers will often try to use Phishing techniques to obtain a user's password.

- Eavesdropping attacks

  Sometimes referred to as "snooping" or "sniffing", an eavesdropping attack is where the attacker looks for unsecured network communications to intercept and access data that is being sent across the network.

- AI-Powered Attacks

  AI-powered software can learn what kinds of approaches work best and adapt their attack methods accordingly. They can use intelligence feeds to quickly identify software vulnerabilities, as well as scan systems themselves for potential vulnerabilities. AI-powered attacks can work around the clock. They are fast, efficient, affordable, and adaptable.

- IoT-Based Attacks

  IoT devices are generally less secure than most modern operating systems, and hackers are keen to exploit their vulnerabilities.

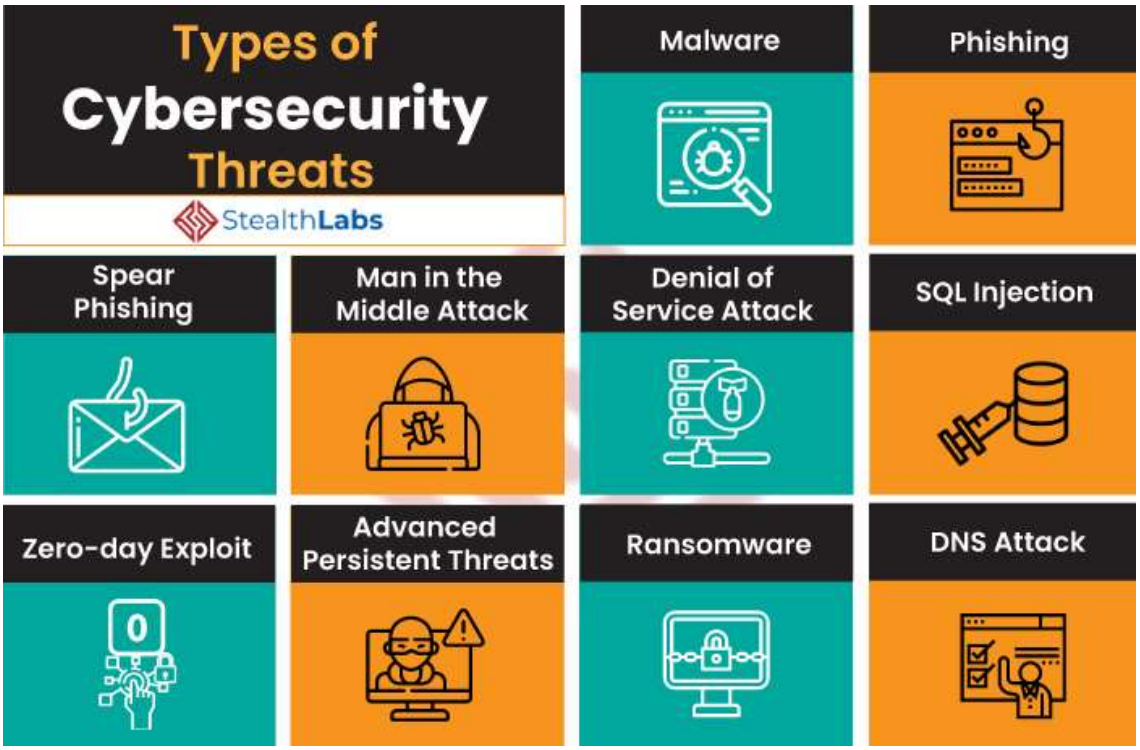
Foundational Reading: Security incidents

Typically used within the medical community, effective triage saves lives by helping emergency medical personnel rapidly assess wound or illness severity and establish the right protocols, in the right order, to reduce trauma and sustain patient health and recovery. All amid crisis, when every second counts. There are 4 stages to an attacker's attack plan:

Stage	Attacker's Goal
1) Reconnaissance & Probing	• Find target • Develop plan of attack based on opportunities for exploit
2) Delivery & Attack	• Place delivery mechanism online • Use social engineering to induce target to access malware or other exploit
3) Exploitation & Installation	• Exploit vulnerabilities on target systems to acquire access • Elevate user privileges and install persistence payload
4) System Compromise	• Ex-filtrate high-value data as quietly and quickly as possible • Use compromised system to gain additional access, "steal" computing resources, and/or use in an attack against someone else

Foundational Reading: Cyber security threats and attacks

A cybersecurity threat is a malicious and deliberate attack by an individual or organization to gain unauthorized access to another individual's or organization's network to damage, disrupt, or steal IT assets, computer networks, intellectual property, or any other form of sensitive data. The top 10 cyber security threats are as follows:



- Malware

  Malware attacks are the most common cyber security threats. Malware is defined as malicious software, including spyware, ransomware, viruses, and worms, which gets installed into the system when the user clicks a dangerous link or email. Once inside the system, malware can block access to critical components of the network, damage the system, and gather confidential information, among others.

- Phishing

  Cybercriminals send malicious emails that seem to come from legitimate resources. The user is then tricked into clicking the malicious link in the email, leading to malware installation or disclosure of sensitive information like credit card details and login credentials.

- Spear phishing

  Spear phishing is a more sophisticated form of a phishing attack in which cybercriminals target only privileged users such as system administrators and C-suite executives.

- Man in the middle attack

  Man in the Middle (MitM) attack occurs when cyber criminals place themselves between a two-party communication. Once the attacker interprets the communication, they may filter and steal sensitive data and return different responses to the user.

- Denial of Service attack

  Denial of Service attacks aims at flooding systems, networks, or servers with massive traffic, thereby making the system unable to fulfill legitimate requests. Attacks can also use several infected devices to launch an attack on the target system. This is known as a Distributed Denial of Service (DDoS) attack.

- SQL injection

  A Structured Query Language (SQL) injection attack occurs when cybercriminals attempt to access the database by uploading malicious SQL scripts. Once successful, the malicious actor can view, change, or delete data stored in the SQL database.
- Zero-day exploit

  A zero-day attack occurs when software or hardware vulnerability is announced, and the cybercriminals exploit the vulnerability before a patch or solution is implemented.
- Advanced persistent threats

  An advanced persistent threat occurs when a malicious actor gains unauthorized access to a system or network and remains undetected for an extended time.
- Ransomware

  Ransomware is a type of malware attack in which the attacker locks or encrypts the victim's data and threatens to publish or block access to data unless a ransom is paid.
- DNS attack
  - A DNS attack is a cyberattack in which cybercriminals exploit vulnerabilities in the Domain Name System (DNS). The attackers leverage the DNS vulnerabilities to divert site visitors to malicious pages (DNS Hijacking) and remove data from compromised systems (DNS Tunnelling).

Some of the most common sources of cybersecurity threats are Nation states, criminal groups, hackers, terrorist groups, hacktivists, malicious insiders, or even corporate spies. Some of the best practices to practice protecting from cyber security attacks are given below:

- Create an insider threat program
- Train employees
- Maintain compliance
- Build a cyber incident response plan
- Regularly update systems and software
- Backup data
- Initiate phishing simulations
- Secure site with https

Foundational Reading: Top 5 most common incident response scenarios

- Phishing
  - Protect
    - Security Awareness Training & testing employees.
    - Email authentication, policy, and reporting protocol.
    - Email Sandboxing.
    - Multi-Factor Authentication (MFA).
  - Detect
    - Unexpected emails from known or unknown individuals.
    - Emails that contain links and/or attachments.
    - If any email is trying to persuade or rush you into doing an action.
  - Response
    - Quarantine the malicious email from all accounts on the system.
    - Watch network alerts for Indicators for Compromise

- Malware
  - Protect
    - Application Whitelisting.
    - AV scans and Endpoint protection.
    - Multi-Factor Authentication (MFA).
  - Detect
    - Slow computer & Blue Screen of Death (BSOD).
    - Dwindling storage space.
    - Pop-ups or unwanted applications.
  - Response
    - Key Risk Indicators.
    - Contain and eradicate.
- Ransomware
  - Protect
    - AV scans and Endpoint protect.
    - Multi-Factor Authentication (MFA).
    - Be wary of email attachments.
  - Detect
    - Unusual pop-ups on the device and encrypted files.
    - Firewall logs.
    - Define Key Risk Indicators
  - Response
    - Detect a network intrusion before ransomware encrypts files.
    - Monitor Key Risk Indicators and Indicators of Compromise vigilantly.
    - Containment is a top priority to any
    - Incident Response scenario.
- Internet facing vulnerabilities
  - Protect
    - AV Scans and Endpoint protect.
    - Only whitelist the scripts your web apps use and block everything else.
    - Implement a DMZ for anything you host locally that requires someone from the internet to access.
  - Detect
    - Audit your webservers, routers, and firewalls with penetration tests and vulnerability assessments regularly.
    - Use a web application firewall (WAF).
  - Response
    - Know your organization's Indicators of Compromise (IOCs)
    - Contain and eradicate.
- Business email account takeover
  - Protect
    - Multi-Factor Authentication (MFA).
    - Only enable external (outside your network) email access for the specific countries in which your employees work.
  - Detect
    - User Behaviour Analytics (UEBA) in the SIEM.
    - Email logging

- Response
  - Contain.
  - Change passwords of all accounts and block email access from countries where employees won't be logging in.
  - Examine what is in your email that got compromised.

Week 10

Foundational Reading: What is effective written communication

The purpose of written communication is to capture your reader's attention and get your point across clearly. Good written communication depends on the audience, the topic, your purpose in communicating, and other factors. There are 5 C's of effective written communication which needs to be noted:

- Connection
- Clarity
- Cause
- Conciseness
- Correctness

Effective writing allows the reader to thoroughly understand everything you are saying. A few tips to help in effective writing:

- Know your goal and state it clearly
- Use the correct tone for your purpose
- Keep the language simple
- Stay on topic and keep it concise
- Use active voice
- Have someone proofread your writing

Foundational Reading: Essential skills for written communication

Written communication is making use of the written word to deliver information. Of all communication channels, businesses rely the most on written communication. Emails, memos, company newsletters, meeting recaps, scribbled notes – the list goes on and on. A great advantage of written communication is that the message can be referred to later, making it the best option for sending a lot of important information at once. There are many different written communication channels in business. But no matter the channel, the content of the message sent is either:

- Transactional

  A transactional message is sent to get results. It can be a quick clarification, a request for a meeting, or asking for a favour. When sending a transactional message, it's best to use an online form of written communication. The point of asking a question is to get a response, and preferably ASAP.

- Instructional

  Instructional written communication gives receivers directions for a specific task. If the receiver is required to act, it is important to make these messages detailed and easy to understand. The goal is to educate the audience about something they need to know and might have to apply later. When distributing instructional information, the format is more important than the method. Typically, instructions involve a step-by-step process. Using bullet points or numbering phrases can visually break down the directions and make the process easier to understand.

- Informational

  Informational written communication includes the sender delivering a message for the receiver's benefit. Since this is less dependent on the receiver, there is no response needed. If the receiver has questions or concerns, that will bring the conversation back to transactional communication. Informational messages can be sent to an individual or a group with the help of online and offline channels.

A few key skills for written communication are:

- Planning and preparation
- Word choice
- Formatting
- Editing

Foundational Reading: Practical guide to effective written communication

A project manager spends a large portion of their time communicating to ensure the success of the project. They require the cooperation of others to make the decisions and complete tasks.

Informal verbal communication has its place to build personal relationships and to be able to better read the other person's body language. It allows a less threatening environment to work out troublesome issues. Understanding the audience is the key to effective written communication. A few tips for it are:

- Define the audience
- Understand the audience
- Address the reader's issues

Through written communication one needs to get their message across. This can be done when the writer speaks directly to the reader. It is possible when the writers take their time to write and consider how the reader will see them. The best format for optimal results depends on very limited number of things such as using a proper structure, good English, etc. One can use Microsoft Word or Microsoft Outlook for effective communication.

Foundational Reading: Seven Cs of effective communication

There are 7 Cs of effective communication which are applicable to both written as well as oral communication. These are as follows:

- Completeness
- Conciseness
- Consideration
- Clarity
- Concreteness
- Courtesy
- Correctness

Week 11

Foundational Reading: Different types of Ethical theories

Ethical theories provide part of the decision-making foundation for Decision Making When Ethics Are in Play because these theories represent the viewpoints from which individuals seek guidance as they make decisions. Each theory emphasizes different points – a

different decision-making style or a decision rule. The principle of beneficence guides the decision maker to do what is right and good. This priority to "do good" makes an ethical perspective and possible solution to an ethical dilemma acceptable. This principle is also related to the principle of utility, which states that we should attempt to generate the largest ratio of good over evil possible in the world.

Like beneficence, least harm deals with situations in which no choice appears beneficial. In such cases, decision makers seek to choose to do the least harm possible and to do harm to the fewest people. Principle of autonomy states that decision making should focus on allowing people to be autonomous—to be able to make decisions that apply to their lives. The justice ethical principle states that decision makers should focus on actions that are fair to those involved. Four broad categories of ethical theory include the following:

- Deontology

  The deontological class of ethical theories states that people should adhere to their obligations and duties when engaged in decision making when ethics are in play. This means that a person will follow his or her obligations to another individual or society because upholding one's duty is what is considered ethically correct. One flaw is that there is no rationale or logical basis for deciding an individual's duties.

- Utilitarian

  Utilitarian ethical theories are based on one's ability to predict the consequences of an action. To a utilitarian, the choice that yields the greatest benefit to the most people is the one that is ethically correct. There are two types of utilitarianism, act utilitarianism and rule utilitarianism. Act utilitarianism subscribes precisely to the definition of utilitarianism—a person performs the acts that benefit the most people, regardless of personal feelings or the societal constraints such as laws. Rule utilitarianism considers the law and is concerned with fairness. A rule utilitarian seeks to benefit the most people but through the fairest and most just means available. Both act and rule utilitarianism have disadvantages. Although people can use their life experiences to attempt to predict outcomes, no one can be certain that his/her predictions will be accurate. Uncertainty can lead to unexpected results making the utilitarian decision maker appear unethical as time passes, as the choice made did not benefit the most people as predicted.

- Rights

  In ethical theories based on rights, the rights established by a society are protected and given the highest priority. Rights are ethically correct and valid since a large population endorses them. Individuals may also bestow rights upon others if they have the ability and resources to do so. A major complication of this theory on a larger scale is that one must decipher what the characteristics of a right are in a society. The society must determine what rights it wants to uphold and give to its citizens. For a society to determine what rights it wants to enact; it must decide what the society's goals and ethical priorities are.

- Virtue

  The virtue ethical theory judges a person by his/her character rather than by an action that may deviate from his/her normal behaviour. It takes the person's morals, reputation, and motivation into account when rating an unusual and irregular behaviour that is considered unethical. One weakness of virtue ethical theory is that it does not take into consideration a person's change in moral character.

When individuals find themselves in a decision-making situation when ethics are in play, there are a variety of ethical theories which provide decision-making guidance as individuals strive to make ethically correct answers. Each ethical theory attempts to adhere to the ethical principles that lead to success when trying to reach the best decision. Most individuals adopt a preferred decision-making style but might adjust it depending on decision circumstances. As decision makers, they soon discover that others have adopted different decision rules.

There are three different approaches to examining how ethical theories impact decision making. These are:

- Selected Principles of Ethical Conduct
- A taxonomy of ethical types
- Models of personal and organizational development

Foundational Reading: Ethics in the workplace

Our actions affect not only ourselves, but also those around us. Many of our professional decisions involve ethics. Ethical behaviour is equally important in the workplace as it is in our personal lives. Everywhere business is conducted, ethics matters. Six ethical terms form the foundation of trust upon which ethical business practice is built:

- Ethics

  Ethics refers to a set of rules that describes acceptable conduct in society. Ethics serve as a guide to moral daily living and helps us judge whether our behaviour can be justified. Ethics refers to society's sense of the right way of living our daily lives.

- Values

  Values are defined as the acts, customs, and institutions that a group of people regard in a favourable way. Values are what really matter to us most—what we care about.

- Morals

  Morals are a set of rules or mode of conduct on which society is based. Certain moral elements are universal. With morals serving as the underpinning of society, there are four points we should remember:

  - Moral rules are important
  - Morality consists of universal rules
  - Morals are objective
  - Morality affects other people

- Integrity

  To have integrity is to be honest and sincere. Integrity is defined as adhering to a moral code in daily decision making. When people and businesses possess integrity, it means they can be trusted.

- Character

  Ethics is not just how we think and act. It is also about character. Character drives what we do when no one is looking.

- Laws

  The law is a series of rules and regulations designed to express the needs of the people. Laws protect people from the most blatant and despicable affront to morality, such as murder, rape, and theft. Laws frequently provide us with a sense of right and wrong and guide our behaviour, but not always.

These six concepts—ethics, values, morals, integrity, character, and laws—form the foundation of trust upon which ethical business practice is built. Many professions and corporations have developed codes of ethics to address their unique business situations. By developing a code of ethics, an organization makes it clear that employees and members cannot claim ignorance as a defence for unethical conduct.

Codes of ethics help employees strike a balance between the ends and the means used to obtain them. This balance may be one of the most challenging aspects of being an ethical organization. A professional code of ethics sets a standard for which each member of the profession can be expected to meet. It is a promise to act in a manner that protects the public's well-being. A professional code of ethics informs the public what to expect of one's doctor, lawyer, accountant, or property manager. If professionals adhere to these standards, the public is willing to have their professional associations create and enforce their ethical codes. If senior management does not act ethically and support others who do, an organization's ethical code will have little meaning.

Foundational Reading: Personal Ethics

Personal ethics refers to a person's beliefs about what's right and wrong and guides individuals in the decisions they make both in and out of the workplace. Your unique ethics will determine how you handle certain situations at work as well as how you grow and develop within your career. Personal ethics are ethical principles that a person uses when making decisions and behaving in both personal and professional settings. These ethics influence various aspects of a person's life and help individuals develop their work ethic, personal and professional goals, and values. Individuals use their ethics to determine between right and wrong and influence how someone behaves in challenging situations. Each person's code of ethics varies, but many people share common ethics such as honesty and respect.

A person's personal ethical principles are important for several reasons, including that they:

- Allow leaders to lead their teams more effectively.
- Instill a sense of trust and support in leaders.
- Give individuals a solid basis of which to determine the most appropriate action in any given situation
- Improve the decision-making process
- Set a standard of behaviour
- Support motivation

There are a few key differences between personal and professional ethics. The primary difference is that a personal set of ethics refers to an individual's beliefs and values in any area of life, while professional ethics refers to a person's values within the workplace. The following are examples of a few of the most common personal ethics shared by many professionals:

- Honesty
- Loyalty
- Integrity
- Respect
- Responsibility
- Selflessness

Foundational Reading: Differences and similarities in personal and professional ethics

Some people use the term "personal ethics" to describe their own moral code – the values and standards by which they operate in their daily lives. These can include honesty, accountability, loyalty and treating others fairly or kindly. A few examples of personal ethics are speaking the truth, respect for elders, never hurting anyone intentionally, treating others with kindness, etc. Another definition for "personal ethics" is an individual's code of behaviour

toward the people around him and the efforts he makes to be the best person he can be in his private life.

If personal ethics are the dictates of an individual's conscience, then professional ethics are the individual's commitment to follow a particular code of behaviour that is defined by his profession. A few examples of professional ethics are punctuality, meeting deadlines, not gossiping about colleagues, maintaining company confidentiality and privacy, etc. professional ethics are an individual's efforts to be the best person possible in his work life.

Foundational Reading: Code of ethics

This set of principles has been designed to assist members in sound professional judgement while upholding ethical ideas and obligations. The ITPA code of ethics states the following:

- Fair treatment
- Privacy
- Communication
- System integrity
- Cooperation
- Honesty
- Education
- Social responsibilities
- Workplace quality

Week 12

Foundational Reading: Decision Making Process

Decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions. Using a step-by-step decision-making process can help you make more deliberate, thoughtful decisions by organizing relevant information and defining alternatives. These are the following steps for making decisions:

- Identify the decision
- Gather relevant information
- Identify the alternatives
- Weigh the evidence
- Choose among alternatives
- Act
- Review your decisions and its consequences

Foundational Reading: An overview of decision-making models

Decision-making is the process of selecting the best choices among various options. There are 4 major types of decision-making models. These are:

- Rational decision-making model

  The classic decision-making model is the rational decision-making model, which consists of eight steps that decision-makers need to take to achieve the optimal decision given their goals and constraints. The 8 steps are:

  - Identify the problem
  - Establish decision criteria
  - Weigh decision criteria
  - Generate alternatives
  - Evaluate the alternatives

    - Choose the best alternatives
    - Implement the decisions
    - Evaluate the decision
- Intuitive decision-making model

  The second decision-making model which is utilized frequently by experts and experienced managers is the intuitive decision-making model. First, they intuitively detect a potential problem and use their intuition to investigate its patterns. In this case, intuition means their painstaking years of experience, expertise, education background, insider information and other valuable resources unknown to an average employee. Intuition also helps them to integrate pieces of isolated data, facts and figures to a complete picture of the whole problem. If there is more than one possible solution to the problem, the manager will use their intuition as a check point to eliminate anti-intuitive decision and go with their gut feelings. One distinctive feature of this decision-making model is that acting is a part of the process of defining and analysing the problems.
- Creative decision-making model

  Another decision-making model is the creative decision-making model. This model is applied when the decision maker must come up with an original and unique decision for a situation. In the decision-making process, after gathering information and insights about the problem and generating some initial ideas, the decision maker undergoes a period of incubation, in which he does not actively think about the solutions but lets his unconscious mind take over the process.
- Recognition primed decision-making model

  This model incorporates contextual assessment and mental evaluation to come up with the best reaction to a problem. The characterizing element of this model is that decision makers consider only one option instead of weighing several choices at a time. After recognizing the problem, the manager identifies its characteristics, including the goals, problem cues, expectations, and typical actions to take in the situation. After that, the manager will think through the plan, conducting a mental simulation of the scenario to see if it works and making suitable modifications if necessary. If he thinks the plan is sufficient, he makes it his final decision. An alternative is only assessed if the initial plan does not work out in the manager's opinion. Although this decision-making model can be applied when managers are under time pressure, its success rate correlates with managers' experiences and expertise.

Following are a few common decision-making traps:

- Confidence bias

  If the manager is overconfident, and is blinded by his past success, he can become careless, oversimplify the situation, or miss some key information, and end up making a risky decision or even a costly one for the company.
- Hindsight bias

  Hindsight bias is also likely to obscure decision makers' judgment. After a problem occurs, detecting the person or event at fault that leads to the problem is an important part of finding the right solution.
- Anchoring bias

  Anchoring bias can impede a decision-maker. This bias is very dangerous because it might make the situation appear brighter than it is, and it

conceals other perspectives of the problems from the decision maker. In addition, if the decision maker only focuses on some specific information, he might overlook other possibilities or alternatives to decide on a more effective solution. Framing bias is another related trap when the decision maker is deceived by the way the problem is presented to him.

- Escalation of commitment

  Escalation of commitment is often considered a fatal trap. Nobody wants to admit that his decision is a mistake, and managers are especially defensive of their decisions. Also, some managers believe that the plan does not work out yet just because they haven't spent enough time and efforts, and they want to commit further to it.

Foundational Reading: Problem solving and decision-making

There are many styles of making decisions, ranging from very rational and linear to organic and unfolding. Not all problems can be solved, and decisions made by the following, rather rational approach. Following are guidelines to help in problem solving and decision making:

- Define the problem
- Look at potential causes of the problem
- Identify alternatives for approaches to resolve the problem
- Select and approach to resolve the problem
- Plan the implementation of the best alternative
- Monitor implementation of the plan
- Verify if the problem has been resolved or not

A person with rational preference often prefers using a comprehensive and logical approach like the guidelines in the above section. A major advantage of this approach is that it gives a strong sense of order in an otherwise chaotic situation and provides a common frame of reference from which people can communicate in the situation. A major disadvantage of this approach is that it can take a long time to finish.

Some people assert that the dynamics of organizations and people are not nearly so mechanistic as to be improved by solving one problem after another. For many people it is an approach to organizational consulting. A major advantage of the organic approach is that it is highly adaptable to understanding and explaining the chaotic changes that occur in projects and everyday life. It also suits the nature of people who shun linear and mechanistic approaches to projects. The major disadvantage is that the approach often provides no clear frame of reference around which people can communicate, feel comfortable and measure progress toward solutions to problems.

Foundational Reading: Important decision-making skills that employer's value

Organizational culture and leadership style together determine the process of decision-making in any company. Many organizations use a mixture of centralized and consensus-based styles. A good way to make the most informed decision is to follow a process that assures you are considering all relevant information and considering each of the most probable outcomes. A step-by-step checklist like this is valuable for that purpose:

- Define the problem
- Generate an array of possible solutions
- Evaluate the costs and benefits
- Select a solution or response

- Implement the option chosen
- Assess the impact of decision and modify the course of action

There are different types of decision-making skills. A few of them are:
- Problem solving
- Collaborative
- Emotional intelligence
- Logical reasoning

Foundational Reading: 5 decision making models to try if you are stuck
There are different decision-making models, a few of them are:
- Rational decision-making model
- Bounded rationality decision-making model
  You can use bounded rationality when you don't have enough time or information to follow the full rational decision-making model.
- Vroom-Yetton decision-making model
  The first part of this model uses seven yes-or-no questions. Your answers to the questions then guide you toward one of five decision-making processes to use.
- Intuitive decision-making model
- Recognition-primed decision-making model

Common decision-making biases:
- Confirmation bias
- Availability heuristic
- Survivorship bias
- Anchoring bias
- Halo effect

Lectures

Week 1

Professions are paid occupations, especially those which involves prolonged training and a formal qualification. The professionals are characterized by the following:
- Expertise: Knowledge + Skills
- Qualifications and certifications
- Knowledge and skill standards
- Common body of knowledge
- Ethical standards

The actual application or use of an idea, belief, or a method, as opposed to the theories about it is called practice. A professional has their own practice, for example:
- A chartered account practices accounting
- An IT professional practices their IT skills through their jobs

IT is a major investment for many organisations and is critical to the success of the business. It creates value for the business. Professional practice helps one to do IT well by providing the skills and knowledge to enhance technical skills on an organisational context.

The technical specialists need to understand the organisation to be the driver of the organisation.

IT is a vast field which has various activities contributing to it. A few examples would consist of coding, testing, debugging, designing, prototyping, requirement analysis, data analysis, business analysis, support, hardware, project management, etc. IT is an evolutionary field of studies. Some careers which were very common in 2000 have completely disappeared and replaced by new career fields. Today there are many careers which are immensely popular today, but would go obsolete a few years later, and this is the reason why an IT professional continuously needs to update themselves based on the current trends.

IT in an organisational environment can be used for multiple purposes. A few of them are listed below:

- Administration
- Business, finance, and accounting
- Communication
- Engineering and creative arts
- Wildlife, tourism, and hospitality

IT is something which provides value to an organisation through changing the way in which business functions and processes are carried out and by providing new functions and enabling new business models. IT changes the business landscape. It changes the following 4:

- Business
    - Globalisation, deregulation, and competition
- Technology
    - Power of the web, information and data
- Customers
    - More sophisticated and demanding customers
- Market
    - Fragmented and mass customization is available

Week 2

In the professional world it is important to have certain skillsets. These skillsets include:

- Interpersonal skills
- Teamwork
- Communication
- Trust
- Being direct yet empathetic
- Networking

Stakeholders are individuals or organizations with a vested interest in a company's success. It's important to avoid confusing them with shareholders, who own stock in a company. Stakeholders represent a much broader audience. There are two categories of stakeholders:

- Internal stakeholders

    Internal stakeholders operate within an organization or have a direct relationship with a company. They're directly impacted by a business's activities while their own actions affect its operations. Key internal stakeholders include employees, business owners and investors.

- External stakeholders

  External stakeholders operate outside the company but are still impacted by the organization's actions. Key external stakeholders include the customers and the suppliers.

Finance, at its core, involves value-based decision-making. Business leaders decide which investments to make, how to finance their endeavours, and maximize their return by focusing on creating value. The term "value" is often used subjectively to reflect an individual's priorities. Maximizing it, however, is a central objective of business, so leaders need to understand how to define and create value for their firms. There are two categories of value in business:

- Financial Value

  It is the monetary value typically reported on a company's financial statements. This type of value is particularly important to investors seeking financial gain in return for their capital and for-profit businesses trying to generate revenue.
- Perceived Value

  It is a form of value that's subjective and includes factors like a customer's willingness to pay (WTP) for a good or service and an employee's satisfaction with their work environment. It's difficult to assign numbers to perceived value, as it varies from person to person, but it can directly impact a company's financial value.

Creating value in business is exceeding stakeholders' minimum expectations. The amount expectations are exceeded—financial or perceived—is the amount of value created. There are three sources of financial value creation:

- Beating the cost of capital

  It's often the minimum acceptable rate of return, also known as the hurdle rate, investors expect, so the greater it's exceeded, the more value is created.
- Continuing to beat the cost of capital

  Exceeding expectations for only one year won't produce long-term value. To be financially successful, business initiatives must continue to overcome the discount rate.
- Growing

  The more financial success your company achieves, the more value you create. Growth allows you to reinvest profits back into your business, multiplying your value creation.

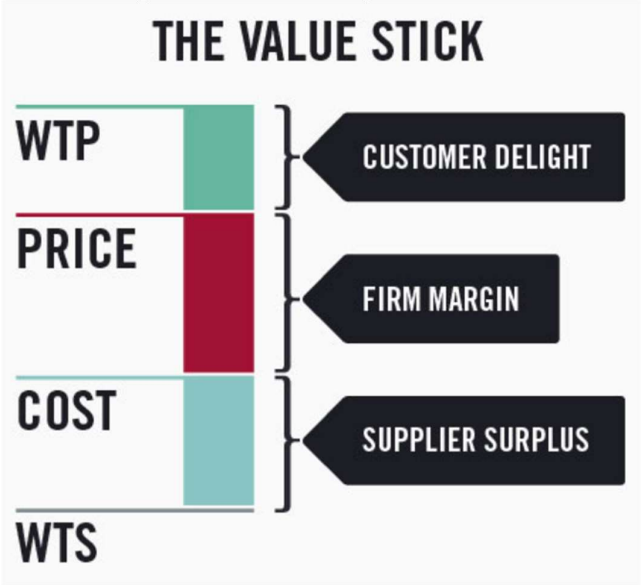
Investors are concerned with risk management—minimizing risk and maximizing returns. For your company to attract viable investors, it must create financial value. This requires an evaluation of discount rates, return on equity, and costs of capital, which is represented by a market-to-book ratio. This ratio considers the relationship between two factors:

- Book value

  The historic accounting value of a company's assets and equity.
- Market value

  The value of a company's assets and equity today.

Financial investors aren't the only important stakeholders. It's also vital to create value for customers, employees, suppliers, and the firm itself. The value stick is a representation of value-based strategy and is comprised of four components:



Value creation seems easy when viewed on paper, but the reality is that it's a difficult process. Beating your cost of capital, sustaining your success, and growing your business are incredibly challenging tasks and can only be accomplished with a comprehensive understanding of financial principles. The first step to creating value for your business is acquiring the skills to inform your decision-making. Financial skills are a must for business leaders, as you can't create value without profit. IT investment means an expenditure on information technology resources to support business processes and functions to create or increase value.

Week 3

A whole IT lifecycle consists of the development/acquisition stage, integration stage and operation stage of IT in the organisations. The IT lifecycle starts with a project. A project is a temporary endeavour undertaken to create a unique result. It is managed by project management techniques and can be inhouse development or outsourced. As a result of the project, one can expect continuous delivery of the required functions to users from the IT infrastructure owned by the organisation. These results are managed by techniques such as IT service management or DevOps.

When building or acquiring a new system to integrate into the organisation, strategic planning needs to be carried out before the project initiation. This strategic planning is carried out for the value, costs, risks, etc. During the project, the system requirements, integration requirements are noted. The design is created, the product built or acquired, customized, tested and then released. After release, there might be a process redesign based on the product delivery and training for the customers for the usage of the product. Followed by the delivery of the project comes the integration of the product in the live environment. The product then operates in the live environment. At all stages, a continuous feedback and improvement to align with organisational goals is appreciated.

The following is the iterative IT life cycle. A cycle which starts with planning, followed by development, deployment and then monitoring. The cycle is given below:

For the development of the project, there are multiple process models or frameworks that can be chose. It ranges from waterfall model, agile, DevOps, etc. The following are the steps for a project's life:

- Project background clarification
- Project requirements gathering
- Project tasks division
- Project completion

A corporate has a structure, and hierarchy. The board of directors is at the apex followed by the CEO. Reporting to the CEO are the various departments of the organisation. Specifically speaking, under the IT department comes a further divide between the IT specialists and IT stack.

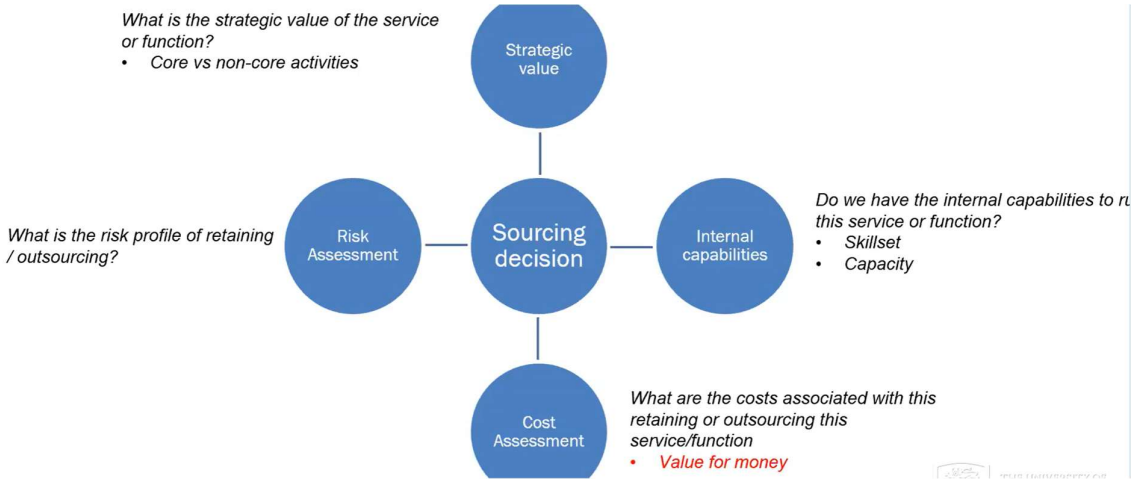
Outsourcing projects is an agreement in which one company hires another company to be responsible for a planned or existing activity that is or could be done internally, and sometimes involves transferring employees and assets from one firm to another. Outsourcing models has its own perks such as:

- Managed services

  Focuses on how and what. Service is a mean of delivering value to customers by facilitating outcomes customers want to achieve it without the ownership of specific costs and risks.
- Projects

  These are time bound once off engagements which needs a defined Objective and are charged as a fixed price or materials
- Staff augmentation
  - These deal with the expansion of workforce with external resource. It is charged as resource/day. This needs to be managed and resources needs to be directed. It allows one to grace up or down a form

A sourcing framework deals with the question of what the strategic value of the service or function is.



Outsourcing for organisations has evolved a lot from the 1980s. Today the evolution tree looks like:

- Traditional outsourcing (80s to 90s)
  Focused on cost reduction and outsourcing of non-core activities.
- Strategic outsourcing (90s to 00s)
  Focused on enhancing capability and improving. The business processes are outsourced in this period.
- Transformational outsourcing (00s to date)
  This type of outsourcing focusses on adapting and innovating quickly.

Week 4

A group of people with a full set of complementary skills required to complete a task, job, or project is called a team. A team is a group of individuals working together to achieve a goal. There are a few mistaken beliefs regarding teamwork. A few of them are given below:

- Teams that work harmoniously together perform better than those with lots of conflicts.
- Team dynamics are largely caused by the leader's style.
- Larger teams perform better than smaller teams.
- Teams whose membership stays intact gradually deteriorate.

A team is called diverse when it includes different types of people. Each person in the world has a bias. This bias can be implicit, explicit, conscious, unconscious, assumptions, etc. The brain processes vast amounts of information using shortcuts such as background, cultural environment, and personal experience to make almost instantaneous decisions. These, however, are the main cause of personal bias.

Successful teams have 3 common attributes than the ones which fail. These attributes are:

- They satisfy internal and external clients
- They develop capabilities to perform in the future.
- Members find meaning and satisfaction

Further research showed 5 factors that can increase the chance of success of a team. These factors are:

- The team is a real team which shares the task, have clearly defined roles and responsibilities, etc.

- The have a compelling direction or have already issued SMART goals.
- They have an enabling structure, meaning that their skills are balances, they are supportive of each other and cover for each other.
- They have a supportive context, meaning they are driven by rewards, development, information and much more.
- They receive expert coaching in the form of support, mentoring, evaluation, etc.

Organisations search for IT talents which can fit or can fit into the mould of their requirement of a team. They find IT through recruitment companies, direct recruitment, LinkedIn, etc. These companies manage IT talent through various strategies. The top 3 are:

- Performance management
- Leadership development
- Interesting work

Change management is a structured process and set of tools for leading the people side of change to achieve a desired outcome on a project level. On an organisational level, a leadership competency for enabling change within an organisation is what change management is.

Week 5

Sources are the materials from which ideas and information are gathered. Print sources such as books and journals are the most frequently used sources in academic writing. These sources provide us with information. Information is different from knowledge, data and wisdom.

Data are recorded facts. Information is also data, but systematized, organised, and put into context. Knowledge on the other hand is the information that gives you a competitive advantage. Context is required for any information. Context is basically the circumstances that form the setting for an event, statement, idea, and in terms of which it can be fully understood.

Information can be reliable but not valid or it can be unreliable but valid. The way we choose our information is very necessary in any context. Information can be valid on different levels. These levels are primary, secondary, expert opinion and uninformed opinion. To evaluate the information, one needs to evaluate the authority of the source, the suitability of the material to the required context and sufficiency of the material.

Research is very important for IT professionals as it helps to make informed decisions. Research would invariably lead one through statistics. A few common mistakes people do regarding statistics are:

- Data is not insight
- Correlation does not mean it is the cause
- Questions can sometimes be poorly framed
- Sample sizes and statistical significance need to be considered
- Confounding factors play a major role in statistics

There are many types of research methods such as correlational studies, cross-sectional study designs, longitudinal design, survey methods, sampling, business analytics, etc.

Week 6

There are 5 steps for project estimation. These are:

- Determine the size of the project
- Determine the effort of the project
- Decide on the resources of the project
- Calculate the duration of the project
- Calculate the cost of the project

There are 6 approaches to project estimation, these are:

- Function point analysis (Uncommon)

  This is a better medium scale computer systems estimation metric. The components of this estimation method are Input, Output, Inquiries, Master files, and Interfaces. It is a 3-step process. The steps are:

  - Classify each component as simple, average, or complex.
    - Assign number of function points to each.
    - Take the sum of the function point which yields the UFP (Unadjusted Function Points).
  - Compute the technical complexity factor (TCF)
    - Assign value from 0 to 5 to each of the 14 factors.
    - Add 14 numbers to get the degree of influence

      $$TCF = 0.65 + 0.01xDI$$

    - Number of function points is determined by the following:

      $$FP = UFP\ x\ TCF$$

  The formula is given by:

  $$(4 * input) + (5 * output) + (4 * inquiries) + (10 * master\ files) + (7 * interfaces)$$

- Algorithmic cost models (Uncommon)

  Used as input to compute cost and duration. It is unbiased and superior to expert opinion however it is as good as the underlying assumptions. A few examples of algorithmic cost models include SLIM model, Price S model, COCOMO model, etc. A few are given in detail below:

  - Empirical model

    A mathematical function that mimics some trend seen in observed data. It has no underlying theory to help explain the behaviour and is determined from historical data using regression. It can be used to predict but not explain the behaviour of a system.
  - Intermediate COCOMO

    It is used to estimate the length of the product in KDSI, product development mode (organic, semi-detached, embedded). To calculate the nominal effort, we can use the following formula:

    $$Nominal\ Effort = 3.2 * (KDSI)^{1.05}$$

    This estimated effort is then used as an input for additional project estimates such as dollar costs, development schedules, computer costs, etc.
  - COCOMO II

    This model is an extension of the Intermediate COCOMO model. It incorporated object orientation, modern life cycle models, rapid prototyping, fourth generation languages, etc.

- Component matrix (Uncommon)
- Expert judgement

  An expert in software development as well as in the application domain makes an estimate based on previous experience of similar projects. It has its own advantages and disadvantages. Advantages include that it is relatively cheap estimation method, takes relatively less time and effort, can be applied early in the development cycle, and can be successful if experts have direct experience systems. Disadvantages says that it depends on the experience and judgement, can not be used in the absence of the experts, assumes whether the expert have dealt with previous systems, etc.
- Sum of parts

  It makes use of the work breakdown structure, and the total effort estimate is the total estimate for all the tasks in the WBS. Appropriate level of detail is important. The level of detail should not be too much or too little and there must be allowances for overheads and tasks such as testing and documentation.
- Estimation by analogy

  This method focuses on comparing the current project to similar projects already undertaken. It estimated how many times bigger or smaller the current project is in comparison to past successful projects. It has its own set of advantages and disadvantages. Advantages are that it is systematic and fast. It is suitable for use with sufficient historical data and can be applied in early stages of development. The disadvantages are that we need to determine a set of characteristics suitable for classifying systems, requires a database of systematically contained historical size, cost data. It cannot be used if no comparable projects have ever been done before.

The estimation method is chosen based on which one is easiest to apply, which can be applied earliest in the development cycle, assumptions, size of historical data available, etc.

Week 7

Quality is the standard of something as measured against other things of similar kind. Assurance is the certainty of something. Quality Assurance is a process centred approach to ensuring that a company or organisation is providing the best possible products and services.

Quality Control on the other hand is focused on the result such as testing the sample of items from a batch after production. Quality assurance focuses on enhancing and improving the process that is used to create the result rather than focusing on the result itself.

Implementing quality systems requires integrity, ethics, training, trust, leadership, teamwork, communication, and recognition to be present in the organisation. QA standards are a set of standards that a company chooses to implement to show to their customers they are committed to delivering quality products and services to their customers. ISO 9000 is the most recognised standard.

ISO 9000 is a series of standards developed and published by international organisation for standardisation. ISO standards gets reviewed regularly. Each industry has their own ISO 9000 standard. ISO 9000 is based on 7 quality management principles. These principles are:

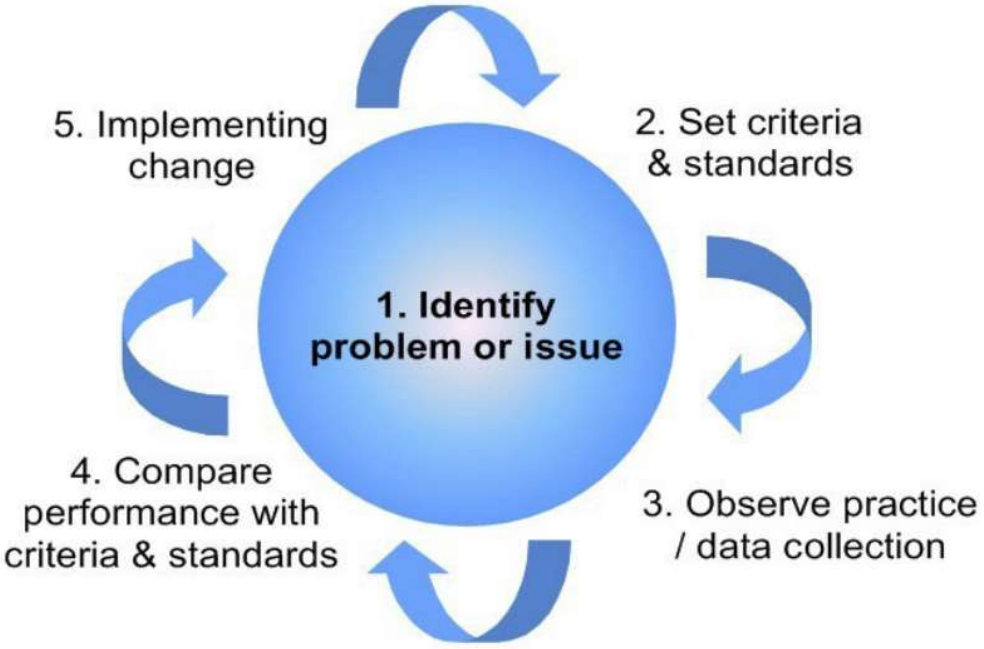
- Customer focus
- Leadership

- Engagement of people
- Process approach
- Improvement
- Evidence based decision-making
- Relationship management

An organisation can take anywhere from 6 to 18 months for an organisation to go through its certification process. The certification is something which is required by the customers, and acts as a powerful marketing tool. It also indirectly results in improvements based on the quality standards. There are many advantages of a quality system:

- Quality is what the customers require.
- Ensures that the products and services satisfy customer demands.
- Ensure consistency in the day-to-day operations.
- Ensure that the process is repeatable and predictable.
- Allows the company to create and retain customers.
- Improve efficiency, reduce operating costs, and minimize unproductive time.

The process of collecting and evaluating evidence to determine whether a computer system safeguards assets, maintains data integrity, achieves organisational goals and effectively and consumes resources efficiently is called as Auditing. The following is the process of auditing:



IT audit is based on 8 principles. These principles are:

- Open-source reflection
- Continuous reviews
- Referencing innovations
- Bibliography
- Analysis of documents
- Scientific referencing and learning
- Financial background reflection
- Elaboration (Quality, scope effectively)

An audit can be done for multiple reasons. A few of the common ones are:

- Corporate governance
- Regulatory requirements
- Asset owner request
- Operations review

An audit covers a large amount of information. The scope includes:

- Physical and environmental review
- System administration review
- Application software review
- Network security review
- Business continuity review
- Data integrity review

The audit processes vary from case to case. Below is the common steps of the audit process:

- Preparation
- Formal kick off
- Audit in progress
- Reporting
- Follow up with corrective actions
- Certification in some cases

A big company would purchase or acquire a smaller company only for a few reasons. These reasons are:

- Technical capabilities
- Intellectual properties
- Financial Health
- Client insight

Week 8

A key part of the development phase is the testing phase. The testing phase is more of a process and especially so in the software testing base. The following are the major testing phases for the software development:

- Component testing

  This test is done to ensure each component functions appropriately. It sues white box testing to check each program function fully.
- Integration testing

  This test is done to test the interaction between related components. This test mainly focuses on interfaces between the components.
- System testing

  This test is done to ensure that the user requirements have been met. The focus is on usual business processes and normal workflow.
- Performance testing

  This test is done to test the system performance under maximum expected load. This test simulates the key processes under maximum load.
- Soak and stress testing

  This test is done to ensure that the system is stable over an extended period. The load is increased until the system fails, and the test checks the effects of the overload.

- Acceptance testing

  This test is done to compare the system functionality against the agreed-on user requirements. It is carried out by client using scenarios supervised by a developer.

There are more types of testing conducted based on necessity. These tests are:

- Load tests

  Load testing is done by modelling the expected usage of a software program by simulating multiple users accessing the program simultaneously. It is a very important test to carry out for multi-user systems such as web servers.
- Soak testing

  Soak testing is testing with a significant load extended over a significant period to discover how the system behaves under sustained use.
- Stress testing

  Stress testing is subjecting a system to unreasonable load while denying the resources it needs to process that load.

Week 9

Cyber attacks are external attacks on the data of the computer and is the greatest threat. Factors which contribute to vulnerability are:

- Unpatched/unprotected software
- Inadequate staff training
- Poor security culture
- Misconfigured software
- More complex systems
- Criminals becoming smarter
- Crimes often not detected until late
- Management unaware of problems
- Benefits hard to quantify

There are multiple security management frameworks such as ITIL, Cobit and NIST. Security management is not an easy task and has certain aspects that are proving to be a challenge, these aspects are:

- Difficulty of changing attitudes of users to security
- Keeping up to date with the security threats
- Configuration management
- Lack of understanding of the senior management
- Lack of commitment of the senior management

Malware is an umbrella term used to refer a variety of forms of hostile or intrusive software, including computer viruses, worms, trojans, ransomware, spywares, adware, scareware, and other malicious programs. There are 5 distinct categories of security threats, namely:

- Unintentional acts
- Natural disasters
- Technical failures
- Management failures
- Deliberate acts

One must protect data for various reasons such as privacy, accuracy, property, and accessibility. Organisation should be able to continue to function during a disaster rather than just recovering after a disaster occurred. Thea aim is to come out with little no dangers without an impact on the clients or business.

Business systems can be classified into 4 categories. These 4 categories are as follows:

- Critical

  Functions cannot be performed unless identical capabilities are found to replace the capabilities affected.
- Vital

  There is some tolerance and lower cost to interruption. Functions may be performed by manual means, but only for brief periods of time.
- Sensitive

  Functions can be performed with difficulty, at tolerable cost, manually. But considerable "catching up" may be required once system is restored.
- Non-critical

  Applications may be interrupted for an extended period, at little or no cost to the organisation, and require little or no "catching up" when restored

One needs to plan for business continuity. This can be achieved by having backup procedures, disaster recovery plan, system audit, etc. There are different types of cyberattacks, the most common of them being malware attacks. Malware attacks are of several types: Denial of Service, Clandestine acquisition of data, zero-day attack, phishing attack, etc. There are even malware softwares such as replicating and non-replicating.

Phishing is the act of sending an e-mail to a user falsely claiming to be an established legitimate enterprise to scam the user into surrendering private information that will be used for identity theft.

Week 10

Good writing skills are essential for professionals in IT. Writing is part of being a professional. One needs to write many project proposals, request letters, documentations, etc. Poor writing can make the professional misunderstood. For example, a badly written specification can lead to flawed outcomes, badly written report can be rejected or ignored, etc.

Structure and cohesion are 2 things which would help making the writing much clearer. This leads us to the characteristics of professional writing which are clarity (clear structure + logical argument), precision (no ambiguity and confusion), objectivity (evidence supported), and brevity (Effective and efficient).

Certain tips for good writings:

- Check spelling and grammar
- Use appropriate words than vague words
- Don't exaggerate and avoid non-exact words
- Avoid bad typography
- Avoid unknown words
- Avoid biased statements
- Avoid acronyms

Oral communication is for making the point. The most common form of oral communication is a presentation. The anatomy of presentation includes the message, structure, timing, physical factors, personal factors, and visuals.

Week 11

Ethics is something which helps decide you to know what is right and what is wrong. It is a basis on which you judge other people, companies, groups. In IT one must consistently maintain their ethics. There might be many situations wherein ethics might be challenged. Certain unethical behaviour in in IT are as follows:

- Copying software illegally
- Disclosing personal information
- Failing to give proper advice to boss
- Using company assets for private purposes
- Using privileged position to gain favour
- Failing to take due care with data security
- Failing to treat peers and seniors with due respect

Ethics have been defined as multiple things which boils down to the same meaning. Following are a few such definitions:

- Etiquettes
    - Codes of behaviour and courtesy
- Law
    - Series of rules that are enforced by the police and the courts
- Morals
    - Standards of right or wrong generally accepted by a culture or society
- Personal ethics
    - The set of individual's own ethical commitments which keep modifying through years of reflection
- Professional ethics
    - A set of standards adopted by the professionals to apply when they are practicing their profession

Ethics is a branch of philosophy. There are multiple frameworks which are used to make decisions based on ethics. These frameworks are:

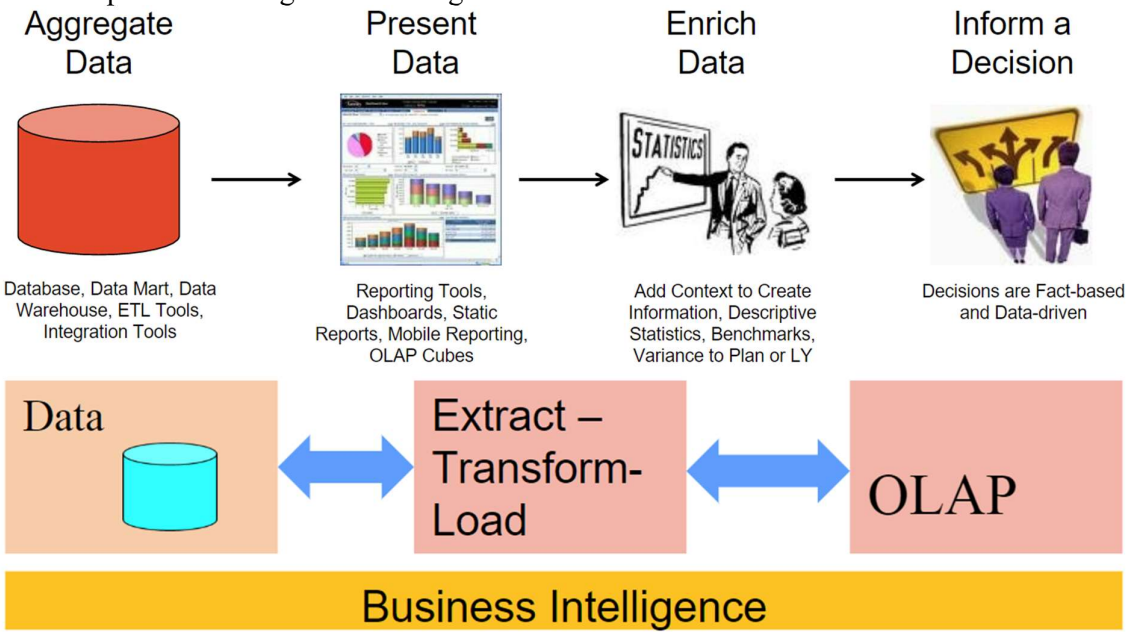
- Ethical pluralism
- Technological ethics
- Deontological ethics
    - Decided on actions based on duty. There are many duties, and they can often conflict, this brings us to the different duties:
        - Fidelity: truthfulness
        - Reparation: recompensation for previous wrongs
        - Gratitude: thankfulness for previous services
        - Justice: happiness should reflect merit
        - Beneficence: help others
        - Non-maleficence: don't harm others
        - Self-improvement
- Egoism
    - Value of a state is based on your individual situation but is also keeping in mind the flow-on effects.

- Utilitarianism
    - Value of a state is based on total situation of all people
- Contractarianism
- Teleology
    - Decide on actions based on the goals irrespective of the outcomes.
- Consequentialism
    - Decide on actions based on outcome.

Most professional associations have "frameworks" guiding professional conduct. These typically include consideration of ethical conduct as it applies in professional activities. Few examples of such frameworks are ACS: Code of ethics and code of professional conduct, ACM/IEEE-CS: Code of Ethics and professional conduct, etc.

Week 12

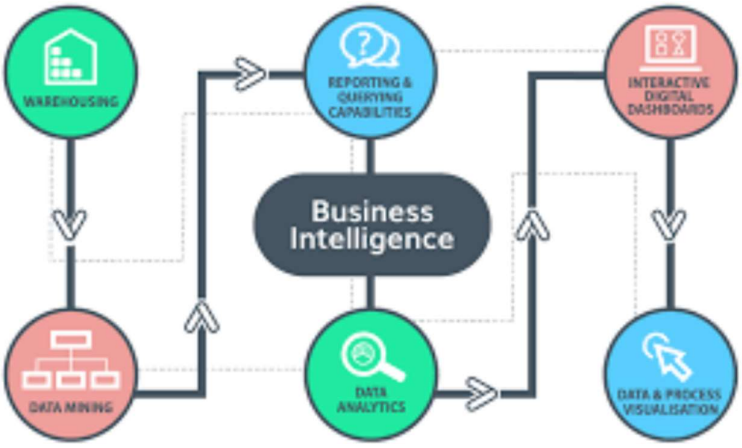
Business intelligence enables businesses to make intelligent, fact-based decisions. It can be represented using the following:



Business Intelligence is very important as we can get data in a timely manner and thus make informed business decisions. There are many tools one can use for business analysis such as IBM Cognos express, Pentaho, Hexarus, Oracle business intelligence, baker hill, etc.

There are 4 key components of Business Intelligence System:

- Data warehouse containing both internal and external data.
- Business analytic tools for manipulating, mining, and analysing data.
- A set of business performance indicators for monitoring and analysing performance.
- User interface.



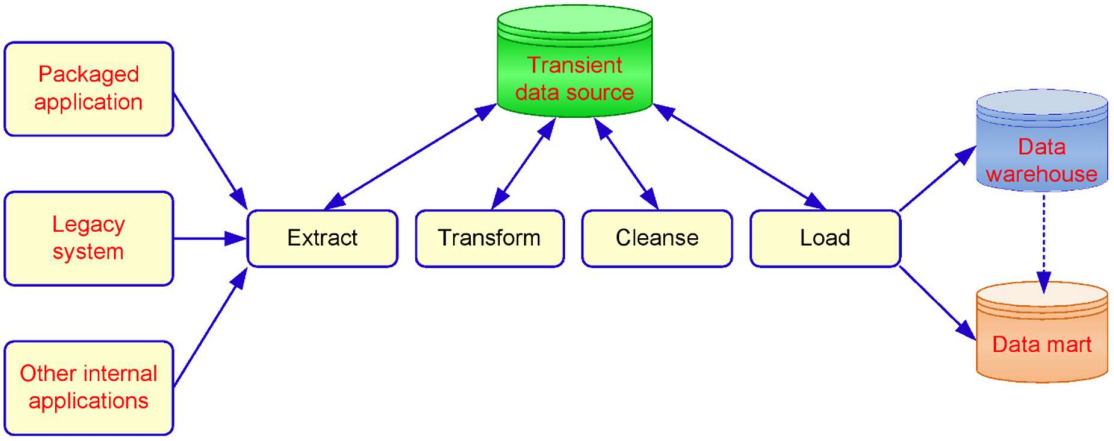
There are several benefits of Business Intelligence, such as:

- A single, reliable presentation of corporate information.
- Alignment of organisation around a consistent set of KPIs and Metrics.
- Integrated access to multiple data sources.
- Faster collection and dissemination of information.
- Simplified graphical representation of KPIs and metrics.
- Quicker, better, and fact-based decision making.

A business intelligence system provides accurate information when needed about the organisation and its environment, including a real time view of corporate status and performance. Business analysis is done using different sets of tools, one such tool category is the ETL tools.

ETL tools or Extract-Transform-Load tools are a set of tools which are used to do the following:

- Extract data from multiple diverse data sources including those outside the organisation.
- Transform data to fit operational needs, including cleansing or increasing the quality of the data.
- Load the data into the target database.



A data warehouse is a physical repository where relational data are specially organized to provide enterprise-wide, cleansed data in a standardized format. Certain characteristics of data warehousing are as follows:

- Subject oriented
- Non-volatile
- Metadata

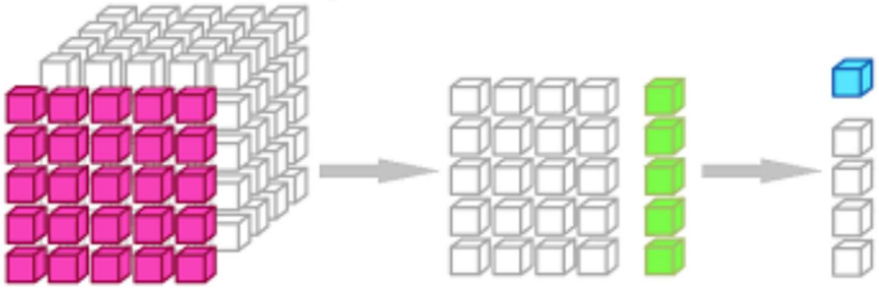
- Integrated
- Summarized
- Web based
- Real time

- Time-variant
- Non-normalized
- Client server based

Some benefits of data warehousing:

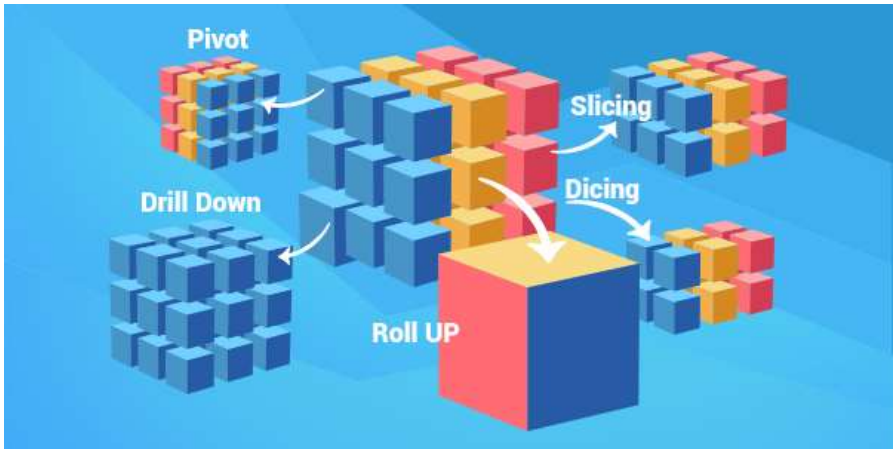
- One view of all corporate data.
- Allows end users to perform extensive analysis more efficiently.
- Allows a consolidated view of corporate data.
- Better quality of data.
- More timely information.
- Enhanced system performance.
- Simplified data access.

Online Analytical Processing (OLAP) provides advanced tools for decision-making. It is an approach to answering ad-hoc multi-dimensional analytical queries. It is part of the broader field of business intelligence. It incorporates reporting as well as data mining. An OLAP cube is a generalisation of 2-dimensional spreadsheet with an array of data of three or more dimensions. It uses a multidimensional dataset and can sometimes be called a hypercube. An OLAP cube looks like the following:



OLAP has 5 basic operations, these are:

- Slicing
- Dicing
- Drill down
- Roll up
- Pivot



85% of all business information exists as unstructured data. This data may be news, reports, letters, emails, memos, chats, surveys, etc.

Exam Paper Pattern

Date: 16/11/2022 **Time: 17:00 hrs**

Length: 2 hours 10 minutes

Section	Question type	Points	Recom.
Section 1 : Human resources, teams, life cycles	1 x Short answer – Analysis (~50-100 words) 3 x Single sentence – Concepts (~5-20 words) 4-8 multiple choice style questions	3 marks 3 marks 4 marks	25 minutes
Section 2 : Information, Research, Project Tracking, and project estimation	1 x Short answer – Analysis (~50-100 words) 3 x Single sentence – Concepts (~5-20 words) 4-8 multiple choice style questions	3 marks 3 marks 4 marks	25 minutes
Section 3 : QA, testing and security management	1 x Short answer – Analysis (~50-100 words) 3 x Single sentence – Concepts (~5-20 words) 4-8 multiple choice style questions	3 marks 3 marks 4 marks	25 minutes
Section 4 : Communication, Ethics and Decision Making	1 x Short answer – Analysis (~50-100 words) 3 x Single sentence – Concepts (~5-20 words) 4-8 multiple choice style questions	3 marks 3 marks 4 marks	25 minutes

Section 1: Week 1, 2, 3, 4
Section 2: Week 5, 6
Section 3: Week 7, 8, 9
Section 4: Week 10, 11, 12

Types of Questions

- Short Answer (SA) – 3 mark per question.
- Single Sentence (SS) – 1 mark per question.
- Multiple Choice Question (MCQ) – 4 marks for entire MCQ section.

Question Distribution

- Section 1: (1 x SA) + (3 x SS) + MCQ (4 to 8)
- Section 2: (1 x SA) + (3 x SS) + MCQ (4 to 8)
- Section 3: (1 x SA) + (3 x SS) + MCQ (4 to 8)
- Section 4: (1 x SA) + (3 x SS) + MCQ (4 to 8)