

Advanced Project Management APM
Prepared by Dr. Ahmad Al Ghamdi
Lecturer by Waseem Al Tabbaa

جامعة الجميع الذكية

تسعى لتكون الكيان الأول الذي يتبنى مبدأ المجتمع التعليمي
التعاوني ويقدم العلم مقابل العمل لتنمية وبناء المجتمعات.

PMG 506

Advanced Project Management
(APM)



جامعة الجميع الذكية
EVERYONE'S SMART UNIVERSITY

Advanced Project Management
Prepared by Dr. Ahmad Al Ghamdi
Lecturer by Waseem Al Tabbaa
Lecture 6



جامعة الجميع الذكية
EVERYONE'S SMART UNIVERSITY

PMG 506

Project Activity Planning

Project Activity Planning

PMG506 Advanced Project Management (APM)



Introduction:

Lecture 1: Projects in Contemporary Organizations



Project Initiation:

Lecture 2: Strategic Management and Project Selection

Lecture 3: The Project Manager

Lecture 4: Negotiation and the Management of Conflict

Lecture 5: The Project in the Organizational Structure



Project planning

Lecture 6: Project Activity Planning

Lecture 7: Budgeting and Cost Estimation

Lecture 8: Scheduling

Lecture 9: Resource Allocation



Project Execution

Lecture 10: Monitoring and information systems

Lecture 11: Project Control

Lecture 12: Project Auditing

Lecture 13: Project termination



Project Activity Planning

The more time you spend planning, the less time you'll need to spend on implementation. Careful planning is solidly associated with project success. Sensible planners do not kill the plan with overanalysis. This leads to a well-known "paralysis by analysis."

The primary purpose of planning, of course, is to establish a set of directions in sufficient detail to tell the project team exactly what must be done, when it must be done, what resources will be required to produce the deliverables of the project successfully, and when each resource will be needed.

Because the plan is only an estimate of what and when things must be done to achieve the scope or objectives of the project, it is always carried out in an environment of uncertainty. Therefore, the plan must include allowances for risk and features that allow it to be adaptive, i.e., to be responsive to things that might disrupt it while it is being carried out. The plan must include any constraints on activities and input materials proscribed by law and society

Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

It is crucial that the project's objectives be clearly tied to the overall mission, goals, and strategy of the organization, such as might be reflected in the project portfolio process.

Unless all parties to the planning process have a clear understanding of precisely what it is the project is expected to deliver, planning is sure to be inadequate or misguided. The precise nature of the scope statement depends on the nature of the project itself, and because of this, it reflects the fact that all projects are, to some extent, unique.

Whatever the process, the outcome must be that: (1) technical scope is established (though perhaps not “cast in concrete”); (2) basic areas of performance responsibility are accepted by the participants; (3) any tentative delivery dates or budgets set by the parent organization are clearly noted; and (4) a risk management group is created.

Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

Each individual/unit accepting responsibility for a portion of the project should agree to deliver, by the next project meeting, a preliminary but detailed plan about how that responsibility will be accomplished. Such plans should contain descriptions of the required tasks, and estimates of the budgets (labor and resources) and schedules.

Simultaneous with these planning activities, the risk management group develops a risk management plan that includes proposed methodologies for managing risk, the group's budget, schedule, criteria for dealing with risk, and required reports. It must be emphasized that the process of managing risk is not a static process. Rather, it is ongoing, with constant updating as more risks are identified, as some risks vanish, as others are mitigated.

The various parts of the project plan, including the risk management plan, are then scrutinized by the group and combined into a composite project plan. The composite plan, still not completely firm, is approved by each participating group, by the project manager, and then by senior organizational management.

Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

Each subsequent approval hardens the plan somewhat, and when senior management has endorsed it, any further changes in the project's scope must be made by processing a formal change order. If the project is not large or complex, informal written memoranda can substitute for the change order. The main point is that no significant changes in the project are made, without written notice, following top management's approval.

Outside Clients

The fundamental planning process is unchanged except for the fact that the project's scope cannot be altered without the *client's permission*. A common "planning" problem in these cases is that marketing has promised deliverables that engineering may not know how to produce on a schedule that manufacturing may be unable to meet. This problem usually results when the various functional areas are not involved in the planning process at the time the original proposal is made to the potential client. We cannot overstate the importance of a carefully determined set of deliverables, accepted by both project team and client.

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

Project Plan Elements

The PM is authorized to direct activities, spend monies, request resources and personnel, and start the project on its way. Senior management's approval not only signals its willingness to fund and support the project, but also notifies subunits in the organization that they may commit resources to the project. Any project plan must contain the following elements:

- **Overview** This is a short summary of the objectives and scope of the project. It is directed to top management and contains a statement of the goals of the project, a brief explanation of their relationship to the firm's objectives, a description of the managerial structure that will be used for the project, and a list of the major milestones in the project schedule.
- **Objectives or Scope** This contains a more detailed statement of the general goals noted in the overview section. The statement should include profit and competitive aims as well as technical goals.

Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

- General Approach This section describes both the managerial and the technical approaches to the work. The technical discussion describes the relationship of the project to available technologies. For example, it might note that this project is an extension of work done by the company for an earlier project. The subsection on the managerial approach takes note of any deviation from routine procedure—for instance, the use of subcontractors for some parts of the work.

- Contractual Aspects This critical section of the plan includes a complete list and description of all reporting requirements, customer-supplied resources, liaison arrangements, advisory committees, project review and cancellation procedures, proprietary requirements, any specific management agreements (e.g., use of subcontractors), as well as the technical deliverables and their specifications, delivery schedules, and a specific procedure for changing any of the above. Completeness is a necessity in this section. If in doubt about whether an item should be included or not, the wise planner will include it.



6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

- Schedules This section outlines the various schedules and lists all milestone events. Each task is listed, and the estimated time for each task should be obtained from those who will do the work. The projected baseline schedule is constructed from these inputs. The responsible person or department head should sign off on the final, agreed-on schedule.
- Resources There are two primary aspects to this section. *The first* is the budget. Both capital and expense requirements are detailed by task, which makes this a project budget. One-time costs are separated from recurring project costs. *Second*, cost monitoring and control procedures should be described. In addition to the usual routine elements, the monitoring and control procedures must be designed to cover special resource requirements for the project, such as special machines, test equipment, laboratory usage or construction, logistics, field facilities, and special materials.
- Personnel This section lists the expected personnel requirements of the project. Special skills, types of training needed, possible recruiting problems, legal or policy restrictions on work force composition, and any other special requirements, such as security clearances, should be noted here. It is helpful to time-phase personnel needs to the project schedule.

Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

This makes clear when the various types of contributors are needed and in what numbers. These projections are an important element of the budget, so the personnel, schedule, and resources sections can be cross-checked with one another to ensure consistency.

- *Risk Management Plans* This covers potential problems as well as potential lucky breaks that could affect the project. Sometimes it is difficult to convince planners to make a serious attempt to anticipate potential difficulties or benefits. One or more issues such as subcontractor default, unexpected technical breakthroughs, strikes, hurricanes, new markets for our technology, tight deadlines and budgets, and sudden moves by a competitor are certain to occur—the only uncertainties are which, when, and their impact. In fact, the timing of these disasters and benefits is not random. There are times in the life of every project when progress depends on subcontractors, the weather, or timely technical successes. Plans to deal with favorable or unfavorable contingencies should be developed early in the project's life. Some PMs avoid dealing with risk because “Trying to list everything that can go wrong gets everyone in a negative state of mind. I want my people to be positive!”



Project Activity Planning

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

Some PMs disdain this section of the plan on the grounds that crises and lucky breaks cannot be predicted. Further, they claim to be very effective firefighters. No amount of current planning can solve the current crisis, but preplanning may avert or mitigate some. As Zwikael et al. (2007) report, in high-risk projects better project planning improved success on four measures: schedule overrun, cost overrun, technical performance, and customer satisfaction. They conclude that improving the project plan is a more effective risk management approach than using the usual risk management tools.

- Evaluation Methods Every project should be evaluated against standards and by methods established at the project's inception, allowing for both the direct and ancillary goals of the project. This section contains a brief description of the procedure to be followed in monitoring, collecting, storing, and evaluating the history of the project.

6.1 INITIAL PROJECT COORDINATION AND THE PROJECT PLAN

Project Planning in Action

Project plans are usually constructed by listing the sequence of activities required to carry the project from start to completion. This is not only a natural way to think about a project; it also helps the planner decide the necessary sequence of things, a necessary consideration for determining the project schedule and duration.

The life-cycle events common for software and hardware product can be divide into nine segments:

- Concept evaluation
- Requirements identification
- Design
- Implementation
- Test
- Integration
- Validation
- Customer test and evaluation
- Operations and maintenance

Each segment is made up of activities and milestones (significant events). As the project passes through each of the segments, it is subjected to a series of “quality gates” (also known as “phase gates,” “toll gates,” etc.) that must be successfully passed before proceeding to the next segment.

6.2 SYSTEMS INTEGRATION

Sometimes called (systems engineering or concurrent engineering) is one part of integration management and plays a crucial role in the performance aspect of the project. Systems integration is concerned with three major objectives:

1. Performance

Performance is what a system does. It includes system design, reliability, quality, maintainability, and repairability. Obviously, these are not separate, independent elements of the system, but are highly interrelated qualities. Any of these system performance characteristics are subject to overdesign as well as underdesign but must fall within the design parameters established by the client. If the client approves, we may give the client more than the specifications require simply because we have already designed to some capability, and giving the client an overdesigned system is faster and less expensive than delivering precisely to specification. At times, the aesthetic qualities of a system may be specified, typically through a requirement that the appearance of the system must be acceptable to the client.



6.2 SYSTEMS INTEGRATION

2. Effectiveness

The objective is to design the individual components of a system to achieve the desired performance. This is accomplished through the following guidelines:

- Require no component performance specifications unless necessary to meet one or more systems requirements.
- Every component requirement should be traceable to one or more systems requirements.
- Design components for effective system performance, not the performance of subsystems.

It is not unusual for clients or project teams to violate any or all of these seemingly logical dicta. Tolerances specified to far closer limits than any possible system requirement, superfluous “bells and whistles,” and “off the shelf ” components that do not work well with the rest of the system are so common they seem to be taken for granted by both client and vendor. The causes of these strange occurrences are probably associated with some combination of inherent distrust between buyer and seller, the desire to overspecify in order “to be sure,” and the feeling that “this part will do just as well.”

6.2 SYSTEMS INTEGRATION

3. Cost

Considered to be a design parameter and can be accumulated in several areas. Added design cost may lead to decreased component cost, leaving performance and effectiveness otherwise unchanged. Added design cost may yield decreased production costs, and production cost may be traded off against unit cost for materials. Value engineering (or value analysis) examines all these cost trade-offs and is an important aspect of systems integration (Morris, 1979). It can be used in any project where the relevant cost trade-offs can be estimated. It is simply the consistent and thorough use of cost/effectiveness analysis.

6.3 THE ACTION PLAN

We need to know exactly what is to be done, by whom, and when. All activities required to complete the project must be precisely delineated and coordinated. The necessary resources must be available when and where they are needed, and in the correct amounts. Some activities must be done sequentially, but some may be done simultaneously. If a large project is to come in on time and within cost, a great many things must happen when and how they are supposed to happen. Yet each of these details is uncertain and thus each must be subjected to risk management.

A simple method to assist in sorting out and planning all this detail is a hierarchical planning system—a method of constructing an action plan and a WBS. We have also named it the “level planning process.”

To accomplish any specific project, a number of major activities must be undertaken and completed. Make a list of these activities in the general order in which they would occur. This is Level 1. A reasonable number of activities at this level might be anywhere between 2 and 20. (Two is the minimum possible breakdown, and 20 is about the largest number of interrelated items that can be comfortably sorted and scheduled at a given level of aggregation.)

6.3 THE ACTION PLAN

Now break each of these Level 1 items into 2 to 20 tasks. This is Level 2. In the same way, break each Level 2 task into 2 to 20 subtasks. This is Level 3. Proceed in this way until the detailed tasks at a level are so well understood that there is no reason to continue with the work breakdown.

Factors that should be associated with success in implementation projects:

1. *Project mission.* It is important to spell out clearly defined and agreed-upon objectives in the project plan.
2. *Top management support.* It is necessary for top managers to get behind the project at the outset and make clear to all personnel involved that they support successful completion.
3. *Project's action plan.* A detailed, scheduled plan of the required steps in the implementation process needs to be developed, including all resource requirements (money, raw materials, staff, etc.).



6.4 THE WORK BREAKDOWN STRUCTURE AND LINEAR RESPONSIBILITY CHART

The Work Breakdown Structure (WBS) is not one thing. It can take a wide variety of forms that, in turn, serve a wide variety of purposes. The WBS often appears as an outline with the Level 1 tasks on the left and successive levels appropriately indented. The WBS may also picture a project subdivided into hierarchical units of tasks, subtasks, work packages, etc. as a type of tree constructed directly from the project's action plan. Another type of WBS shows the organizational elements associated with specific categories of tasks.

The WBS is an important document and can be tailored for use in a number of different ways. It may illustrate how each piece of the project contributes to the whole in terms of performance, responsibility, budget, and schedule. It may list the vendors or subcontractors associated with specific tasks. It may be used to document that all parties have signed off on their various commitments to the project. It may note detailed specifications for any work package, establish account numbers, specify hardware/software to be used, and identify resource needs. It may serve as the basis for making cost estimates or estimates of task duration. Its uses are limited only by the needs of the project and the imagination of the PM.

6.4 THE WORK BREAKDOWN STRUCTURE AND LINEAR RESPONSIBILITY CHART

The following general steps explain the procedure for designing and using the WBS:

1. Using information from the action plan, list the task breakdown in successively finer levels of detail. Continue until all meaningful tasks or work packages have been identified and each task or package can be individually planned, budgeted, scheduled, monitored, and controlled.
2. For each such work package, identify the data relevant to the WBS (e.g., vendors, durations, equipment, materials, special specifications). List the personnel and organizations responsible for each task. It is helpful to construct a linear responsibility chart (sometimes called a responsibility matrix) to show who is responsible for what. This chart also shows critical interfaces between units that may require special managerial coordination.
3. All work package information should be reviewed with the individuals or organizations who have responsibility for doing or supporting the work in order to verify the WBS's accuracy. Resource requirements, schedules, and subtask relationships can now be aggregated to form the next higher level of the WBS, continuing on to each succeeding level of the hierarchy.



6.4 THE WORK BREAKDOWN STRUCTURE AND LINEAR RESPONSIBILITY CHART

4. For the purpose of pricing a proposal, or determining profit and loss, the total project budget should consist of four elements: direct budgets from each task as just described; an indirect cost budget for the project, which includes general and administrative overhead costs (G&A), marketing costs, potential penalty charges, and other expenses not attributable to particular tasks; a project “contingency” reserve for unexpected emergencies; and any residual, which includes the profit derived from the project, which may, on occasion, be intentionally negative.
5. Similarly, schedule information and milestone events can be aggregated into a projected baseline schedule. The projected baseline schedule integrates the many different schedules relevant to the various parts of the project. It is comprehensive and may include contractual commitments, key interfaces and sequencing, milestone events, and progress reports. In addition, a time contingency reserve for unforeseeable delays might be included.
6. The PM can continually examine actual resource use, by work element, work package, task, and so on up to the full project level. By comparing actual against planned resource usage at a given time, the PM can identify problems, harden the estimates of final cost, and make sure that relevant corrective actions have been designed and are ready to implement if needed.

6.4 THE WORK BREAKDOWN STRUCTURE AND LINEAR RESPONSIBILITY CHART

7. Finally, the project schedule may be subjected to the same comparisons as the project budget. Actual progress is compared to scheduled progress by work element, package, task, and complete project, to identify problems and take corrective action.

6.5 INTERFACE COORDINATION THROUGH INTEGRATION MANAGEMENT

The most difficult aspect of implementing the plan for a complex project is the coordination and integration of the various elements of the project so that they meet their joint goals of performance, schedule, and budget in such a way that the total project meets its goals.

The intricate process of coordinating the work and timing of the different groups is called *integration management*. The term *interface coordination* is used to denote the process of managing this work across multiple groups.

The linear responsibility chart is a useful aid to the PM in carrying out this task. It displays the many ways the members of the project team must interact and what the rights, duties, and responsibilities of each will be.

TREND (Transformed Relationships Evolved from Network Data), designed to illustrate important linkages and dependencies between work groups. The aim was to alert the PM to potential problems associated with cross-functional interfaces and to aid in the design of effective ways to avoid or deal with potential interface problems. A key point is that mapping all dependencies in the project can show a complete description of project interfaces.



6.5 INTERFACE COORDINATION THROUGH INTEGRATION MANAGEMENT

Managing Projects by Phases and Phase-Gates

One of the ways to control any process is to break the overall objectives of the process into shorter term subobjectives and to focus the multidisciplinary teams “MT” on achieving the subobjectives, often in a preset sequence. If this could be done, and if multidisciplinary cooperation and coordination were required in order to be successful in accomplishing the project, the level of conflict would surely fall. At least there is evidence that if team members work cooperatively and accomplish their short-term goals, the project will manage to meet its long-term objectives; moreover, the outcome of any conflict that does arise will be creative work on the project.

The quality-gate process here did not allow one phase to begin until the previous phase had been successfully completed, but many of the phase-gate systems allow sequential phases to overlap in an attempt to make sure that the output of one phase is satisfactory as an input to the next. Their primary purpose is to keep senior management informed about the current state of projects being carried out.



6.5 INTERFACE COORDINATION THROUGH INTEGRATION MANAGEMENT

The Design Structure Matrix

While the need to coordinate the flow of information is a challenge that confronts virtually all projects, the use of MTs tends to magnify this challenge. This is particularly serious for new product development projects.

To address the issue of information flows, Steven Eppinger (2001), proposes the development and use of a *Design Structure Matrix (DSM)*. The first step in developing a DSM is to identify all the project's tasks and list them in the order in which they are typically carried out. This list of tasks makes up both the rows and columns of the DSM. Next, moving across one row at a time, all tasks that supply information to the task being evaluated are noted. When the DSM is completed, all the tasks that provide information that is needed to complete a given task can be determined by looking across that particular task's row. Likewise, moving down a particular task's column shows all the other tasks that depend on it for information.

6.5 INTERFACE COORDINATION THROUGH INTEGRATION MANAGEMENT

The Design Structure Matrix

An example DSM corresponding to a project with six activities is shown in Figure 6-13. According to the table, completing activity **c** requires the gathering of information from activities **b** and **f**. Furthermore, the table indicates that activities **c** and **f** both depend on information from activity **b**. As the example illustrates, a key benefit of constructing a DSM is the ability to quickly identify and better understand how information is needed. It can also highlight potential information flow problems even before the project is started. For example, all the X's above the diagonal in Figure 6-13 are related to situations where information obtained from a subsequent task might require the rework of an earlier completed task. To illustrate, in the second row we observe that activity **b** requires information from activity **e**. Since activity **e** is completed after activity **b**, activity **b** may need to be revisited and reworked depending on what is learned after completing activity **e**.

	a	b	c	d	e	f
a						
b	X				X	
c		X				X
d	X		X		X	
e			X			
f	X	X		X		

X—information flow

Figure 6-13 Example DSM for Project with Six Activities

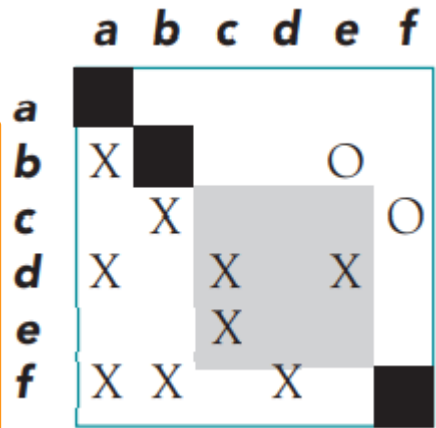
6.5 INTERFACE COORDINATION THROUGH INTEGRATION MANAGEMENT

The Design Structure Matrix

The DSM also helps evaluate how well the need to coordinate information flows has been anticipated in the project's planning stage. To make this assessment, a shaded box is added to the DSM around all tasks that are planned to be executed concurrently. For example, the DSM would appear as shown in Figure 6-14 if it had been planned that tasks **c**, **d**, and **e** were to be done concurrently. Also notice that in Figure 6-14 any remaining entries above the diagonal of the matrix are highlighted as potential

rework by replacing each X with an O.

In examining Figure 6-14, there are two potential rework situations. Fortunately, there are a couple of actions that can be taken to minimize or even eliminate potential rework situations. One option is to investigate whether the sequence of the project activities can be changed so that the potential rework situations are moved below the diagonal. Another option is to investigate ways to complete additional activities concurrently. This later option is a bit more complex and may necessitate changing the physical location of where the tasks are completed.



■ tasks to be completed concurrently
 X—information flow
 O—potential rework situation

Figure 6-14 Modified DSM to Show Activities to Be Completed Concurrently

SUMMARY

In this chapter we initiated planning for the project in terms of identifying and addressing the tasks required for project completion. We emphasized the importance of initial coordination of all parties involved and the smooth integration of the various systems required to achieve the project objectives. Last, we described some tools such as the Work Breakdown Structure (WBS), the linear responsibility chart, the action plan, and the Gozinto chart to aid in the planning process. We also briefly investigated several methods for controlling and reducing conflict in complex projects that use multidisciplinary teams. Specific points made in the chapter are these:

- The preliminary work plans are important because they serve as the basis for personnel selection, budgeting, scheduling, and control.
- Top management should be represented in the initial coordinating meeting where technical objectives are established, participant responsibility is accepted, and preliminary budgets and schedules are defined.
- The approval and change processes are complex and should be handled by the project manager.



SUMMARY

- Common elements of the project plan are the overview, statement of objectives, general approach, contractual requirements, schedules, budget, cost control procedures, evaluation procedures, and potential problems.
- Systems integration concerns the smooth coordination of project systems in terms of cost, performance, and effectiveness.
- The hierarchical approach (level planning process) to project planning is most appropriate and can be aided by a tree diagram of project subsets, called a Gozinto chart, and a Work Breakdown Structure (WBS). The WBS relates the details of each subtask to its task and provides the final basis for the project budget, schedule, personnel, and control.
- A linear responsibility chart is often helpful to illustrate the relationship of personnel to project tasks and to identify where coordination is necessary.
- When multifunctional teams are used to plan complex projects, their work must be integrated and coordinated. Interface maps are a useful way of identifying the interdependencies that must be managed.

SUMMARY

- The use of a Design Structure Matrix can show critical information flows, the need for concurrent tasks, and potential rework situations.

This topic completes our discussion of project activity planning. In the next part of the text, we address the subject of budgeting and look at various budgeting methods. The chapter also addresses the issue of cost estimation and its difficulty.

GLOSSARY

Action Plan The set of activities, their schedules, and the resources needed to complete the project.

Bill of Materials The set of physical elements required to build a product.

Control Chart A graph showing how a statistic is changing over time compared to its average and selected control limits.

Deliverables The physical items to be delivered from a project. This typically includes reports and plans as well as physical objects.

Earned Value A measure of project progress, frequently related to the planned cost of tasks accomplished.

Effectiveness Achieving the objectives set beforehand; to be distinguished from efficiency, which is measured by the output realized for the input used.

Engineering Change Orders Product improvements that engineering has designed after the initial product design was released.

Gozinto Chart A pictorial representation of a product that shows how the elements required to build a product fit together.

Hierarchical Planning A planning approach that breaks the planning task down into the activities that must be done at each managerial level. Typically, the upper level sets the objectives for the next lower level.



GLOSSARY

Interface Management Managing the problems that tend to occur between departments and disciplines, rather than within individual departments.

Material Requirements Planning (MRP) A planning and material ordering approach based on the known or forecast final demand requirements, lead times for each fabricated or purchased item, and existing inventories of all items.

Project Plan The nominal plan to which deviations will be compared.

Systems Engineering The engineering tasks involved in the complete system concerning the project and the integration of all the subsystems into the overall system.

Value Engineering An approach that examines each element of a product or system to determine if there is a better or cheaper way of achieving the same function.

Work Statement A description of a task that defines all the work required to accomplish it, including inputs and desired outputs.

Thank you

