Ecodesign of Electronic Devices

UNIT 5: Management of the Ecodesign process

Managing device development process

- After the initial phase in developing electronic devices, the main tasks are determination of device functionalities, targeted customers, and market, consideration of customer requirements, market and execution methods, etc. The following questions can arise: »How will the device function?« or »What functions will it have?« and later can develop questions on project management that is crucial for execution and achieving of the set timeframes.

- Management also has to optimally distribute workload between employees and departments for achieving high quality of products and the fastest possible execution. The inevitable question here is »How much will the development process cost?« and »How long will development take?«.

- Lately, project management has become an advanced and efficient research discipline. The importance of discipline is visible in a quick increase of manager associations, research journals, and new educational programs.

Project definition

- Project definition can be presented in a simplified way as quantitative part of the whole process where beginning and end are clearly determined, as well as expected results and outcomes.

- The attributes that are often related to project definition are:

    - Unique product or service, small sized production.

    - Measuring instruments and values.

    - Use of resources (people, materials, equipment).

    - Work is mostly complex, uncertain and/or urgent.

Approaches to project management

- The effort that we put into designing is quantitative part of project work and reflects all attributes of the project structure.

- Project management varies among manufacturers, but company organizations have very similar structures and patterns. In the broader sense of the word, there is always an individual or a person who is responsible for running a business or project. We personally call this a project manager.

- The project manager determines a group of individuals called a project or development team. The development team within the company has access, to various structures inside or outside the company.

- Synergy between the group and good communication and the way of designing leads to competitive and high quality products.

Approaches to project management

- The project management structure:

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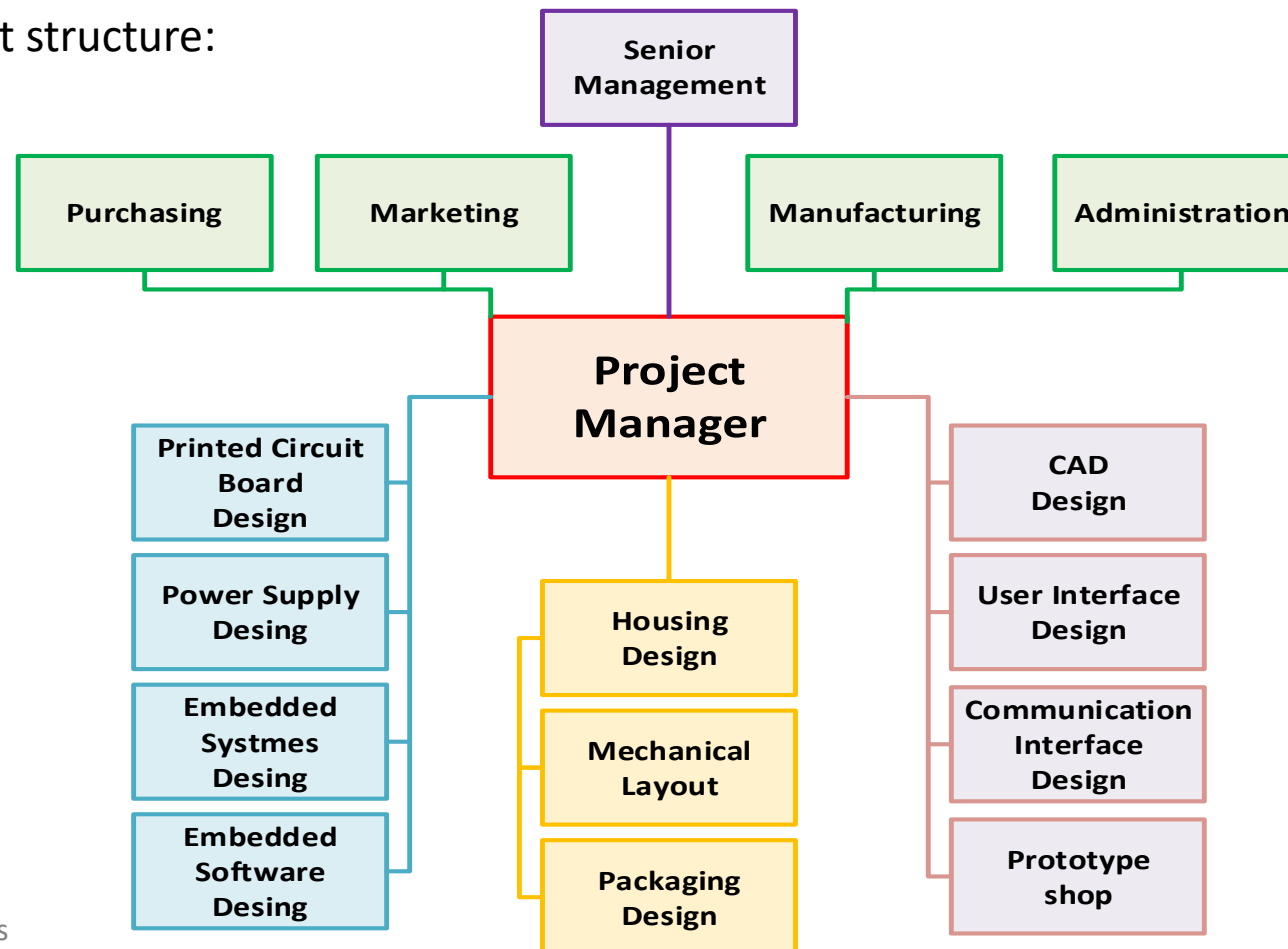
Elements of project management

- The person who is designing a new device is responsible that the device meets the functional requirements and all other criteria.

- Project management includes three key elements:

  - **Planning:** In the beginning, the project plan defines work that needs to be done, project timeframe, budget, required ecological standards and description of the needed resources (people, equipment, and materials).

  - **Control:** When the project starts, its progress is controlled depending on the set plan. The project manager has to routinely control the progress, budget, used resources and how much work still needs to be finished according to the given plan.

  - **Management:** Just like the designer can plan to optimize designing, so can the project manager create a plan that optimizes project execution. The project manager also has to determine which skills are needed for certain tasks. Management goal is a realized project within the as short timeframe as possible with the lower possible costs.
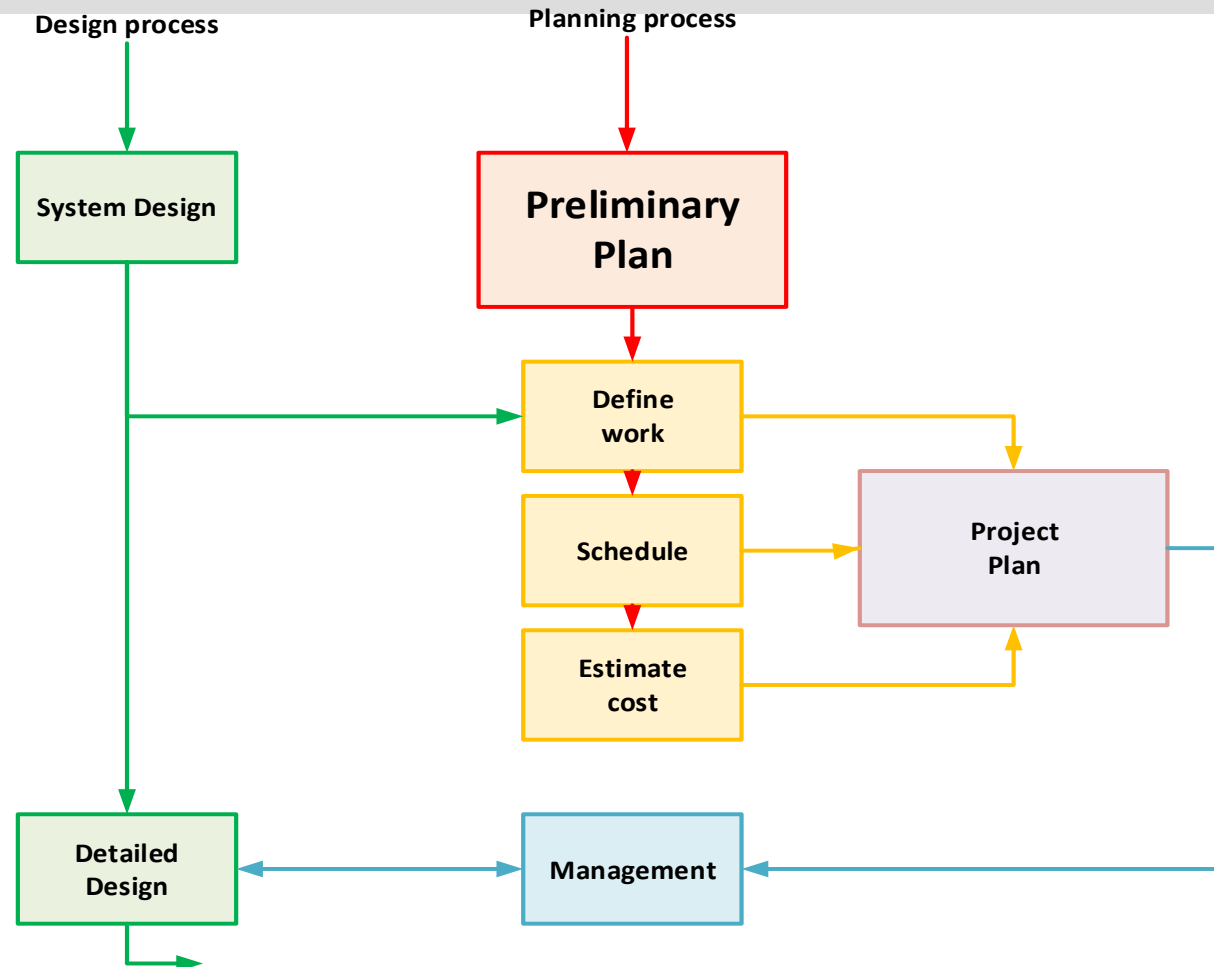
Project plan

- The project plan describes how the project will be implemented.

- The project plan sets the price of development, the final price of the design, and what resources we will need and use.

- The project plan can be defined and presented in different forms, depending on its complexity and purpose.

- Nevertheless, almost every project plan includes the following steps:

  - **Determining tasks:** Includes clear description of different tasks that need to be executed. The tasks have to be clearly defined and easy to understand.

  - **Schedule:** Dates and timeframes have to be defined for each task.

  - **Resources and requirements:** Evaluation of personnel by experience, knowledge, and skills, used materials and needed equipment.

  - **Costs evaluation:** The costs are evaluated depending on the used resources and equipment. It is also important to foresee a crisis budget in case some costs cannot be evaluated precisely or in case of unexpected circumstances.

Project plan

- Project plan can be completely developed, when device requirements are clearly defined and set, and until then a more downgraded plan needs to be in use that in the end matches to the final plan or even significantly deviates from it. During many iterations of requirements definition, we can see a journey on how to achieve the final goal and successfully finish the project more or less clearly through every repetition.

Design process

Planning process

System Design

Preliminary Plan

Define work

Schedule

Estimate cost

Project Plan

Detailed Design

Management

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Tasks determination

- The first step to the determination of project plan is determination of tasks and work that needs to be finished during device development. Many information on task determination can be found in the block diagram of the new device.

- The device's block diagram shows the final version of functionality, where all requirements are specified. From this we can develop a project plan.

Description of required tasks in device design	
Schedule	
Activities	*Date*
Completion of system design	June 19
Designing primary board	August 18
Designing power supply	August 20
Designing interface	September 10
Validation and testing	September 20
Final design revision	September 25
Production prototype	October 5
Personel	
System designer and manager	J. Moge
PCB designer	J. Moge and D. Steyer
Packaging designer	K. Janovec
Technical support	H. Glover
Budget	
Material	2300€
Equipment	700€
Total	3000€
Project beginning: 9. May	

Work planning - schedule

■ For example, if we take more complex designs for which we need to prepare a more detailed overview of the work to be done, we can look at the following examples of tables.

| A detailed description of the required tasks in designing device	
Task description	**Inputs**
1. *System designing:* Overview and revision of the solution. Upgrading of system specifications.	Preliminary system designing
2. *Designing basic board:* Similar design, testing on a test board, debugging.	System specifications
3. *Power supply:* Similar design, testing on a test board, debugging.	System specifications
4. *Housing:* Detailed description of the housing design, designing front plate, testing, and evaluation.	System specifications
5. *Integration and testing:* Device composition, testing depending on system specification.	Basic board, power supply, and chosen housing
6. *Finishing design:* Overview of the test results, overview of documentation.	Integration and testing results
7. *Prototype:* Production of the final prototype and documentation.	Final designing

Project personnel, description and hours per task		
Work description	**Work (days)**	**Needed time (weeks)**
1. Approved plan of design.	SE: 4	3
2. *Basic circuit:* Scheme, components, circuit description.	DE: 13 TE: 10 DO:10	5
3. *Power supply:* Scheme, components, circuit description.	DE:10 TE: 7 DO:4	2
4. *Housing:* Housing design, 3D modeling, materials.	PE:6 TE:4 DO:4 SE:1	3
5. *Integration and testing:* Complete testing, presentation of test results and preparation of documentation.	DE:3 PS:1 TE:2	1.5
6. *Design finish:* Product description, documentation revision.	SE:2 PE:1 DE:1 PS:1 TE:2 DO:3	1.5
7. *Prototype:* Working prototype and test results.	PS:7 TE:3 DE:2	2
8. *Project management:* Reports.	SE:15	13

Project beginning: 9. May
Abbreviations: SE=Senior engineer, DE= design engineer, PE= packaging designer, TE= laboratory technician-engineer, DO= CAD-designer, PS= prototyping department.

Network diagram

- Work planning can be divided into two parts. The first presents use of network diagram and the second use of line diagram.

- etwork diagram structure is used by different methods, such as CPM (Critical Path Method), PERT (Program Evaluation and Review Technique).

- The purpose of network diagram is a graphical presentation of individual tasks. It is also used to determine independence of tasks and their priority.

- With unequivocal presentation of tasks it is possible to optimize these tasks and increase the efficiency of the design process.
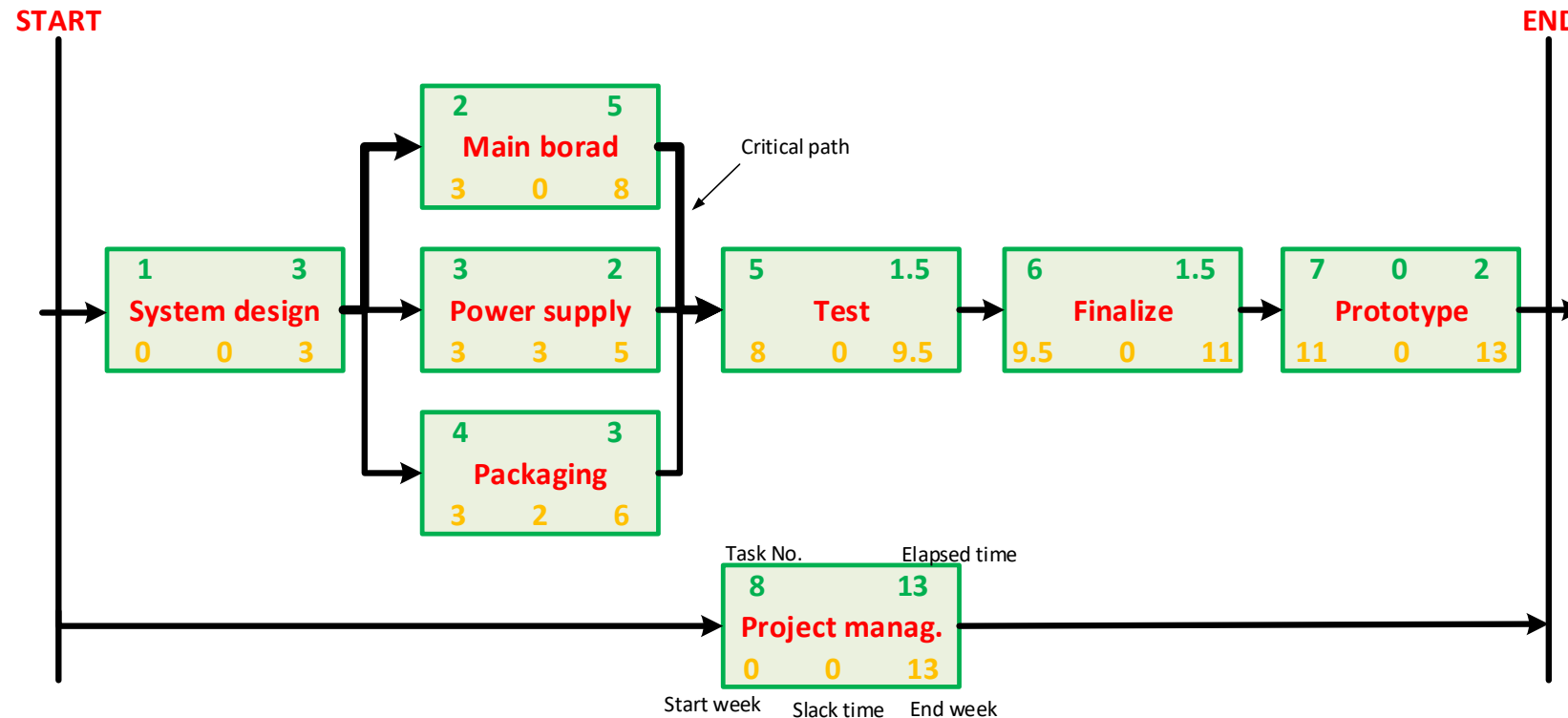
Network diagram

- Example of a AOA Network Diagram (Activity on Arrow):
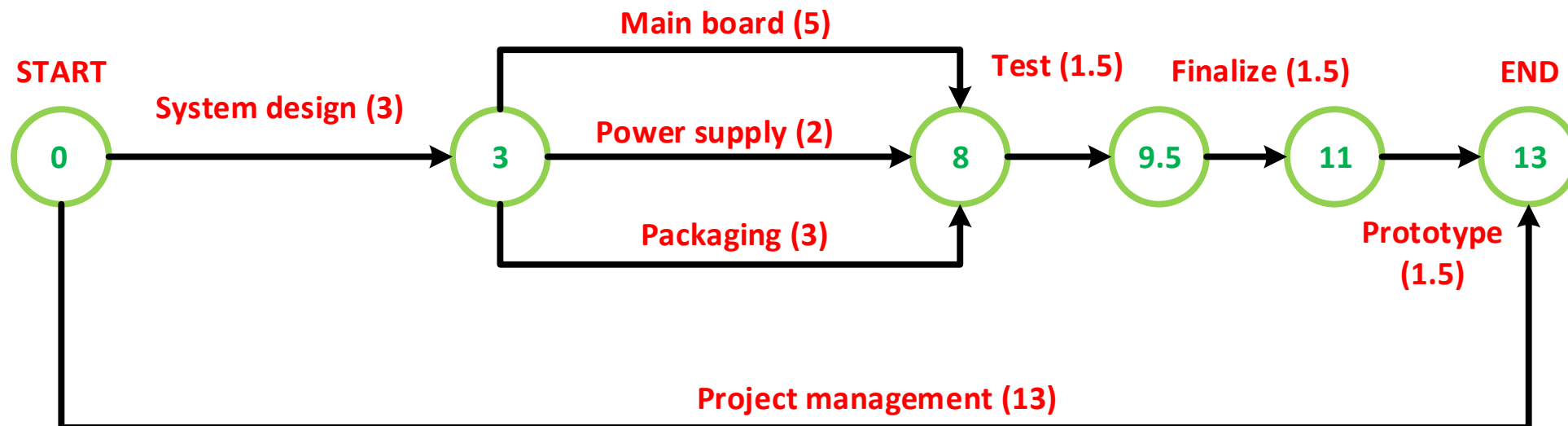
Network diagram

- Example of a AON Network Diagram (Activity on Node):

Network diagram

- No matter which diagram is selected for presentation of project development, it is important that the network diagram presents all tasks, used time and duration of the project. The following attributes present the key elements of the network diagram.

  - **Precedence:** Dependency between task beginning and ending is clearly visible in a well-designed network diagram. The tasks that can be done in parallel or sequentially need to be clearly presented in the network diagram.

  - **Critical path:** a sequence of tasks that need to be executed and determined duration of the project are named critical path. This path is in the diagram presented with a thick line.

  - **Variable time–loose time:** Variable time is calculated at the end of network diagram construction. It presents how much time we have left for a certain task without shortening the duration of the complete project.

Column diagram

- Timing diagram and Gantt diagram are types of column diagrams. Both methods present individual tasks as columns on the timeline axis.

- Colum diagram has evolved from the network diagram. In a normal path of column diagram development, it follows the development of optimal network diagram.

- The advantage of this diagram is that it is easy to understand and transparent.

- The network diagram is used more as a tool for optimization and configuration than the column diagram that is more suitable for presentations of the project plan.

- Network and column diagrams are in management of larger projects supported by many computer programs which can be automatically optimized and continuously monitor project development.

Column diagram

- An example of column diagram:

Task	June					July				August			
	1	8	15	22	29	6	13	20	27	3	10	17	24
1 **System design**	██	██											
2 **Main board**				██	██	██	██	██					
3 **Power supply**				██	██								
4 **Housing**				██	██	██							
5 **Integration and testing**									██	██			
6 **Design finalizing**											██	██	
7 **Prototype**													██
8 **Project management**	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥

Planning resources and evaluation of costs

- Finally, we focus on two key steps in managing the project, namely, assessing resources and preparing the project budget. Both terms are very closely related to each other.

- Staff costs are also very important in estimating project costs. Different qualifications and profiles of people are needed to implement the project. To a large extent, these profiles are distinguished by their experience, knowledge, education and length of working stock.

- It is important to estimate the costs and prepare the budget for the project, what proportion of the costs will be drawn from the cost centers and what proportion will be needed from the directing. Key cost elements:

  - Staff

  - Laboratories and equipment

  - External services
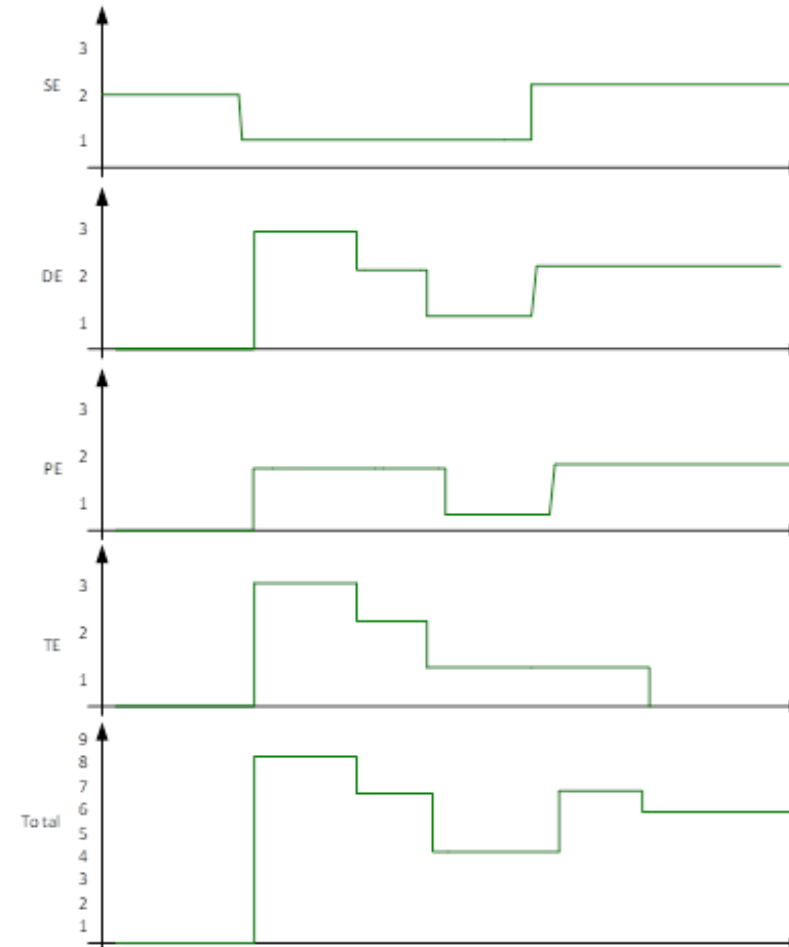
  - Materials and Suppliers

Evaluation of human resources

- For most projects, staff costs are the largest part of the overall project cost. Assessing the appropriate staff profile necessary for the implementation of the project is the basis for the exact cost of the entire cost.

- Different methods can be used to evaluate human resources. A very typical approach to very large projects is that we take all the tasks and the assigned schedule and simply determine the number of people to complete the tasks and thus the project.

- A very useful tool for determining human resources is a staff histogram. The staff histogram shall be determined in the context of a column diagram where the number of participants in a given period and their operating time is clearly visible.

- The staff histogram is a useful tool for the designer of the project work, for estimating human resources, determining the performance of tasks and setting the timetable.

Evaluation of human resources

- Employee histogram:

Task		June					July				August			
		1	8	15	22	29	6	13	20	27	3	10	17	24
1	*System design*													
2	*Main board*													
3	**Power supply**													
4	**Housing**													
5	*Integration and testing*													
6	*Design finalizing*													
7	**Prototype**													
8	**Project management**													

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Project management

- In project management are present three basic functions: monitoring, reporting, and ongoing problem-solving. All three functions are closely related.

- Project management requires that during project implementation all three functions are considered and continuously studied.

- Progress and project efficiency are evaluated according to the set plan.

- The project leader tries to answer these four questions while managing the project:

  - Is the project efficiency guaranteed? Does design meet the set criteria)

  - Are the resources used efficiently? Do we need more or fewer resources?

  - Does project implementation follow the schedule?

  - Do the costs correspond to the budget? Will the final price be the same as forecasted?

Project management

- The project management consists of the following points:

  - **Performance monitoring:** Monitoring the effectiveness of the project requires evaluation or project work, following the requirements set forth in the specification of the requirements.

  - **Progress of the tasks:** The progress of the task can be monitored through the members of the group who are responsible and participating in a given task.

  - **Status of the timetable:** The state of the timetable means that we check whether the execution of the task meets the prescribed timetable

	Task	June					July				August			
		1	8	15	22	29	6	13	20	27	3	10	17	24
1	*System design*													
2	*Main board*													
3	**Power supply**													
4	**Housing**													
5	*Integration and testing*													
6	*Design finish*													
7	**Prototype**													
8	**Project management**													

Project management

- **Budget Status:** Checking the state of the budget is carried out at the prescribed time intervals. It is often necessary to list more specific data on the state of the budget than how much we spent on staff, material and equipment.
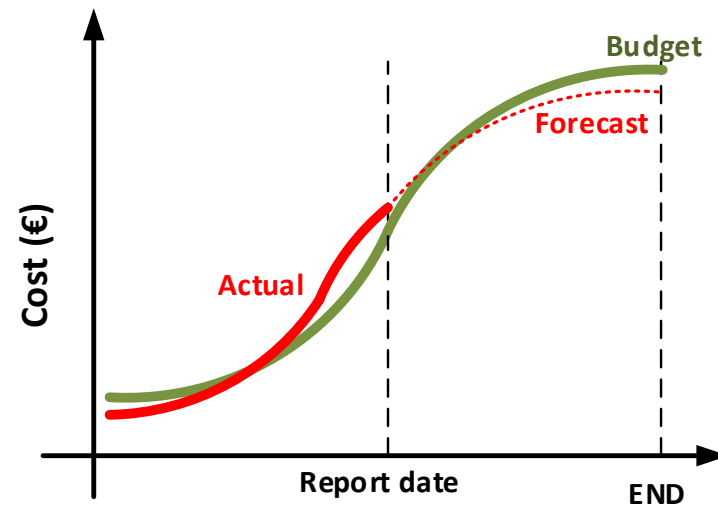
- **Reports:** The report serves many functions and is handled by various people. The report is important for group members, who carry out tasks to get an overview over the entire project and the impact of their work on the overall implementation. The report is also important for the management or client, as it provides an overview of the current implementation and gives a consistent assessment of how to achieve quality and budget spending.

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