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Teaching module 6. Environmental projects management

Unit 6.1. Phases of environmental projects. Time management and cost management in environmental projects

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Topics

- Management of environmental projects;
- Phases of environmental projects;
- Time management;
- Cost management.

Environmental Projects

They are series of activities aimed at achieving clearly specified environmental objectives over a defined period of time and with a limited budget

Environmental Projects Characteristics

- Their objectives are specific to the environment field;
- Their results aim (at least partly) the sustainability issue;
- They usually take place outside the organizations that undertake them;
- They involve important changes both at the level of the organizations that implement them but also in the area where the results of the projects are obtained.

Sources of funding for environmental projects in Romania

- Sustainable Development Operational Program 2021-2027
- National Recovery and Resilience Plan
- National programs financed by the Ministry of Environment, Water and Forests
- Other programs funded by ministries, government agencies, companies, NGOs

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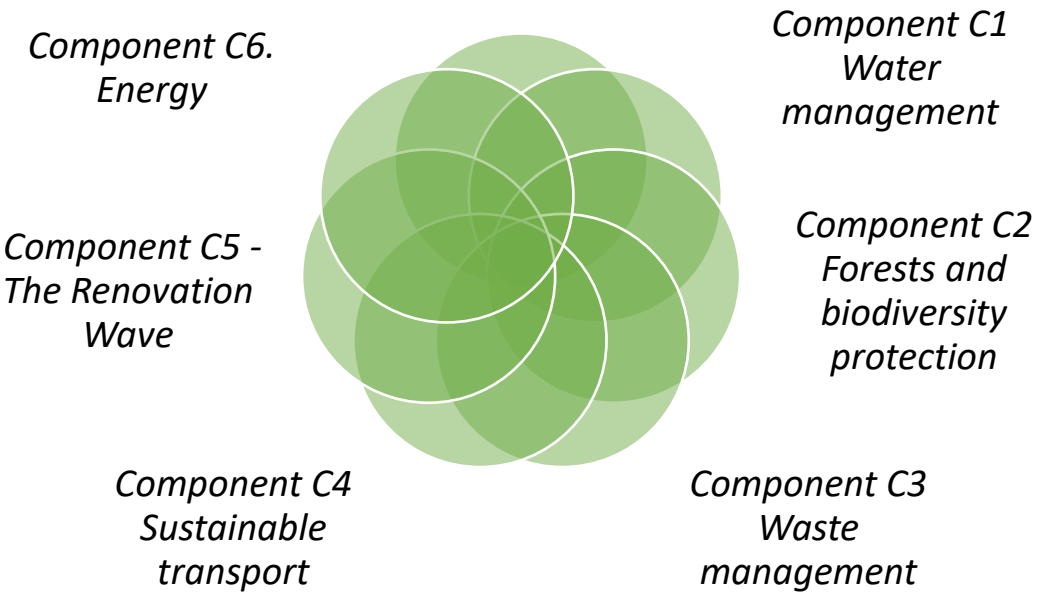
Sustainable Development Operational Program 2021-2027

- Investments in the water and wastewater sector to meet the requirements of environmental directives
- Efficient waste management in order to accelerate the transition to the circular economy
- Conserving biodiversity to meet the requirements of environmental directives
- Improving air quality monitoring
- Reducing greenhouse gas emissions and increasing energy efficiency in thermal energy production systems
- Improving energy efficiency
- Promoting the use of renewable energy sources

National Recovery and Resilience Plan Pillar I Green Transition



National programs financed by the Ministry of Environment, Water and Forests

- The program to improve the quality of the environment by afforestation of degraded agricultural lands, ecological reconstruction and sustainable management of forests
- The national program for improving the quality of the environment by creating green spaces in localities
- The program regarding the production of energy from renewable sources: wind, geothermal, solar, biomass, hydro
- The program regarding education and public awareness regarding environmental protection
- The program aimed at the protection of water resources, integrated water supply systems, treatment stations, sewerage and purification stations

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In Iceland, the Environment Agency finances projects dedicated to :

- environmental quality monitoring;
- biodiversity conservation and management of protected natural areas;
- waste management;
- collaboration with other Scandinavian and European countries in the field of the environment.

Environmental Projects Management

- Represents the use of project management principles, methods and processes to improve an element of the ecosystem (water, air, plants, soil or other living organisms) to achieve a sustainable outcome (Sholarin & Awange, 2015);

- It involves planning, organizing, coordinating and controlling the project from start to finish, in order to achieve the objectives and results in the field of environment according to the quality specifications, costs and deadlines assumed in relation to the client / funder of the project .

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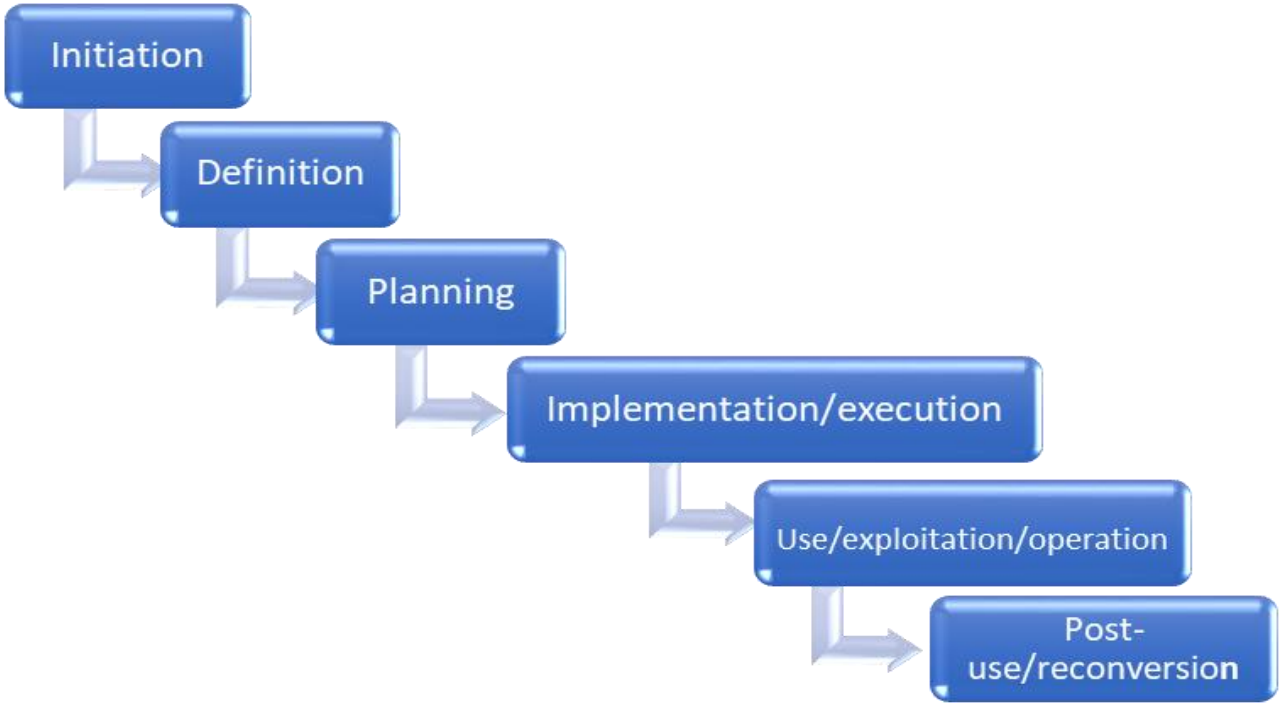
Life cycle of environmental projects (Havranek, 1999)

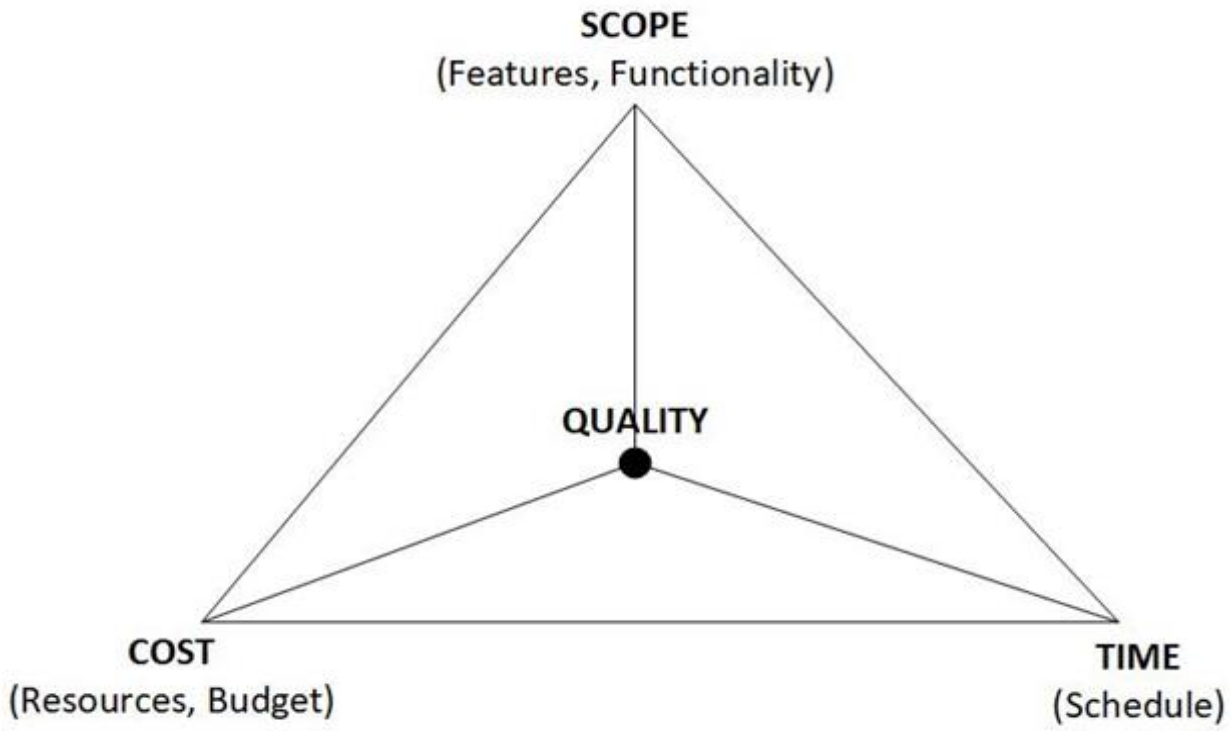
Project life cycle			
Planning phases		Implementation phases	
Phase 1 **Concept**	**Phase 2 –** **Development**	**Phase 3** **Implementation**	**Phase 4** **Closure**
• Initial investigations • Extensive investigations	• Risk analyses; • Feasibility studies • Negotiation; • Design	• Installation; • Operation; • Monitoring; • Maintenance.	• Final reports; • Negotiations.

Project duration

Phases of an environmental project



Triple constraint theory



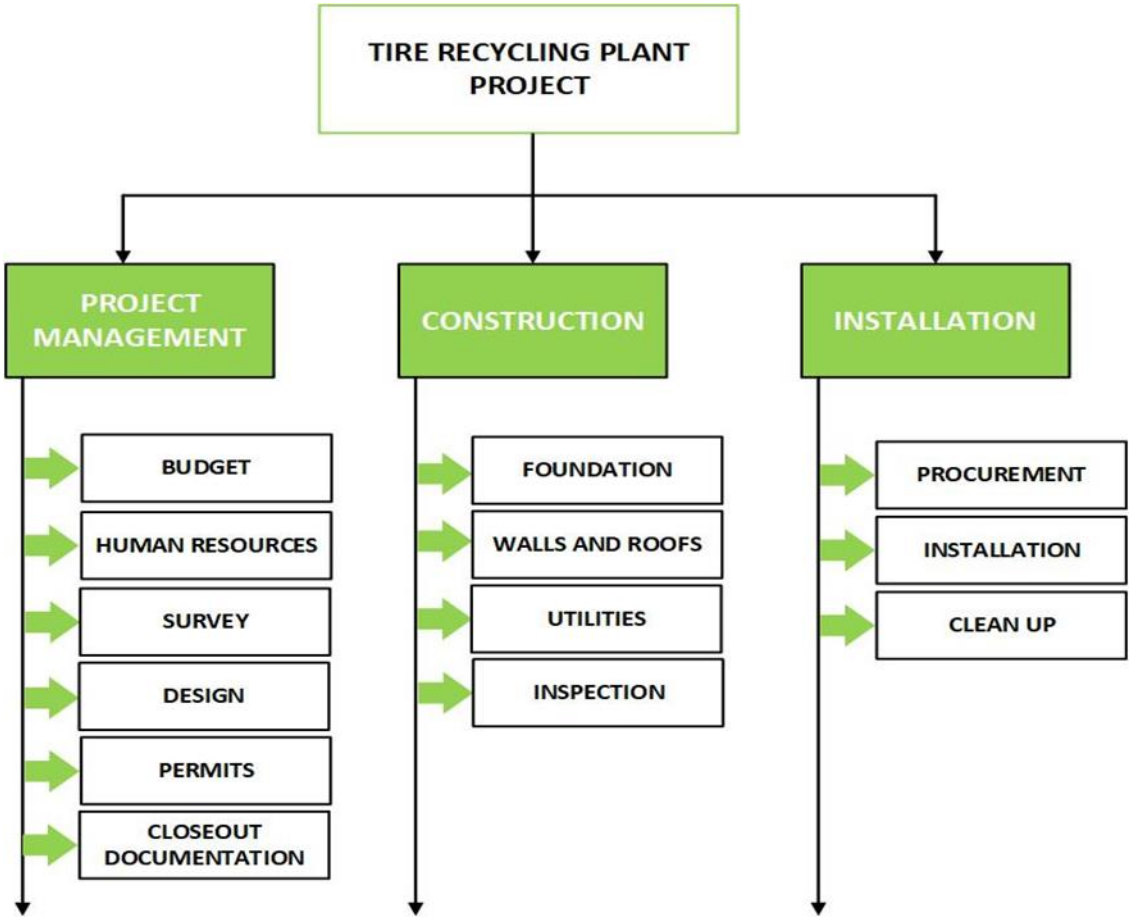
Defining Environmental Projects Tasks/Activities

- Defining environmental project activities involves identifying and documenting the specific activities that the project team needs to undertake in order to deliver the project scope.
- In order to be able to identify the activities in your project and build a project estimate regarding time and/or costs, you will need to build **a work breakdown structure – or a WBS.**

WBS

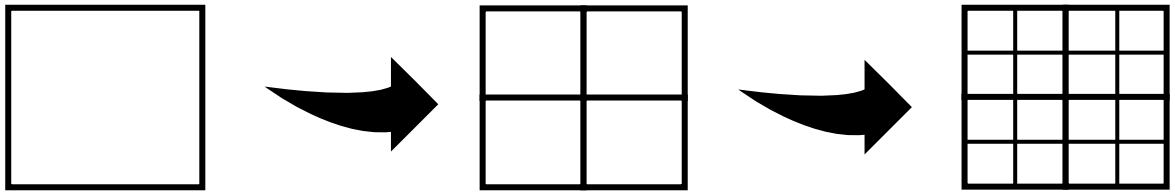
Definition: A work breakdown structure (WBS) is a logically structured hierarchical decomposition of the work to be executed by the project team in order to accomplish the project objectives

(Haugan, 2002), (Project Management Institute, 2006).

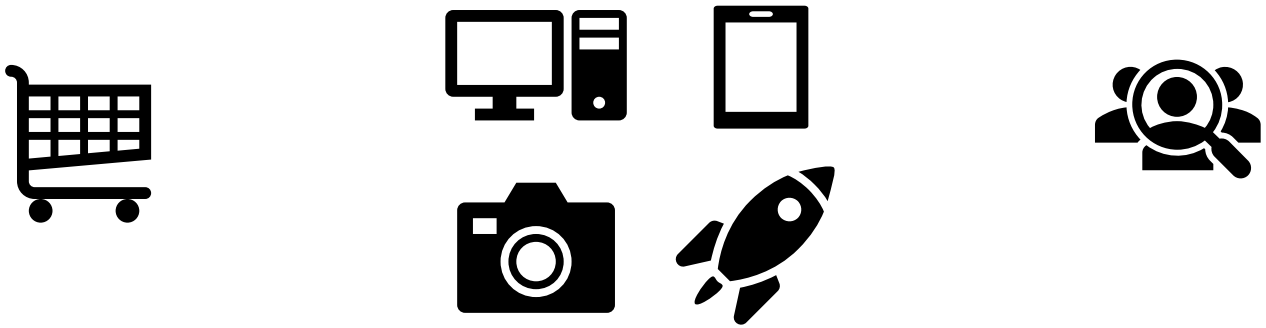


Steps for building a WBS

1. list the items in which the activity will split, in increasingly finer detail



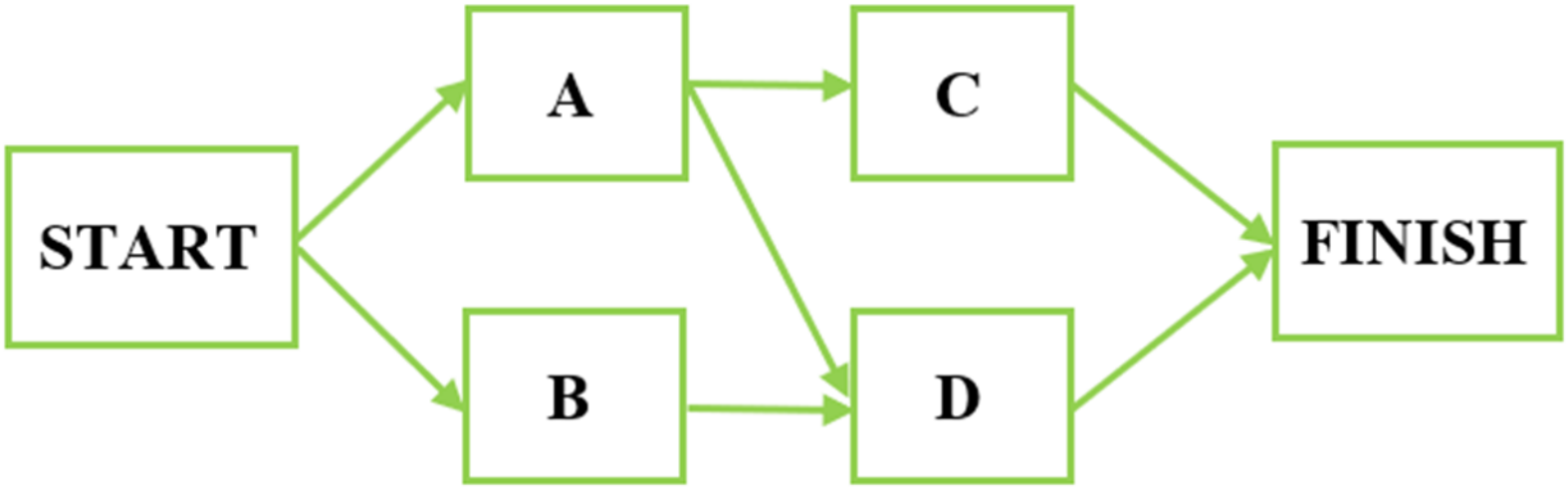
2. identify relevant data for WBS



Sequencing Environmental Projects Tasks/Activities

- Sequencing environmental projects activities involves identifying and documenting interdependencies among activities that the project team needs to undertake in order to deliver the project scope.
- A common method for constructing a sequence of project activities is the precedence diagramming method (Project Management Institute, 2013).

Sample Precedence Diagram



Precedence Relations Types

Finish-to-Start

Start-to-Start

Finish-to-Finish

Start-to-Finish

Estimating Environmental Projects Activities Duration

- Estimating environmental project activities duration involves assessing the time most likely needed to complete the activities the project team needs to undertake in order to deliver the project scope.
- In order to estimate project activities duration, one can resort to:
  - **expert judgement** (Project Management Institute, 2013);
  - **critical path method** (CPM);
  - **program evaluation and review technique** (PERT).

Estimating Activities Duration with CPM

The calculation of the activity duration is performed deterministically in the case of the CPM method using the formula:

$$d_i = \frac{Q_i}{PN_i \text{ x } p_i \text{ x } \mathrm{W_i}}$$

Estimating Activities Duration with PERT

- The PERT technique uses an estimate of activity duration calculated as a weighted average of three elements:
  - pessimistic duration of the activity (P);
  - most likely duration of the activity (M);
  - optimistic duration of the activity (O).
- The formula used to calculate the estimated activity duration is:

estimated activity duration = (P + 4 x M + O) / 6

Estimating Activities Duration with PERT

- We use the *standard deviation* from the mean to calculate the chances of finishing the activity in the estimated duration. This standard deviation has a specific formula for PERT:
  - **σ = (P – O)/6**
- **The probability that the duration of the activity is in the [estimated duration of the activity – *n* standard deviations; estimated duration of the activity + *n* standard deviations] is**:
  - ***n*** = one standard deviation → 68%;
  - ***n*** = two standard deviations → 95%;
  - ***n*** = three standard deviations → 99,7%;
  - ***n*** = six standard deviations → 99,9%.

Exercise

Determine using the PERT and the data in the table below the estimated duration of the activities in an environmental project related to the establishment of a domestic wastewater treatment plant undertaken by Scînteiești commune from Galați county, Romania. What is the time interval in which we can estimate that these activities will be completed using a 95% probability?

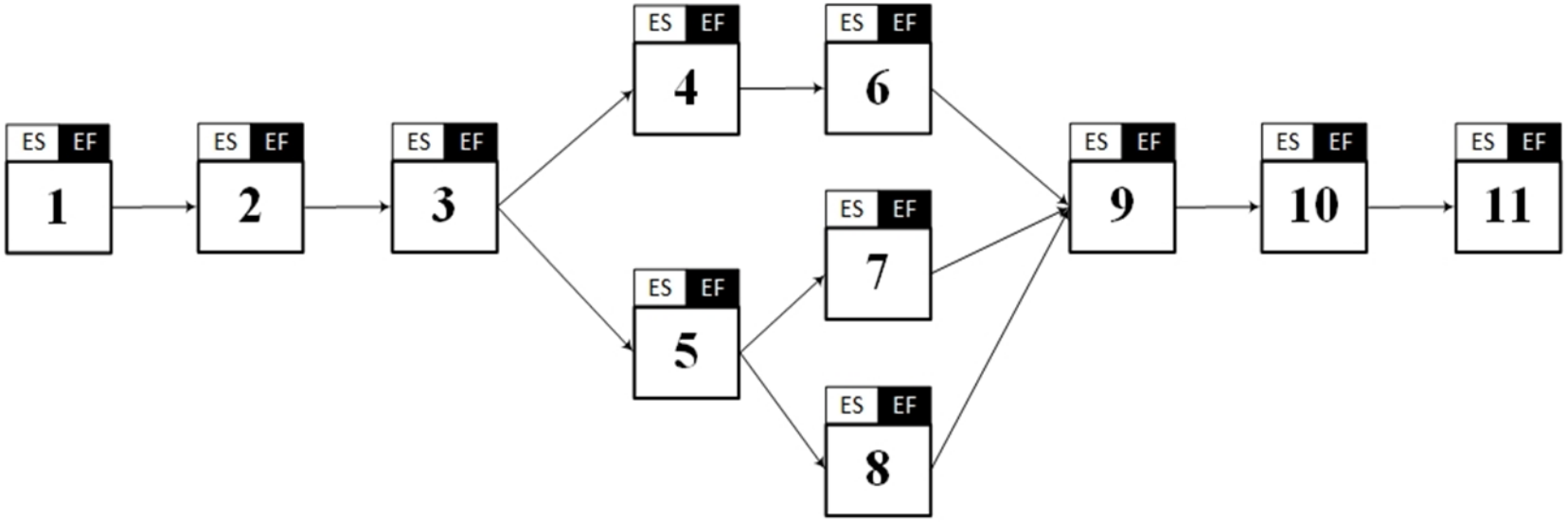
Activity	Pessimistic duration	Optimistic duration	Most likely duration
Documentation for obtaining permits	60 days	30 days	36 days
Installation of the wastewater treatment plant	24 days	10 days	15 days
Installation of a pumping station	4 days	2 days	3 days
Construction of a 15 km collector	14 days	8 days	10 days
Construction of a protective dam	7 days	4 days	3 days

Solution

Activity	Estimated duration	Standard deviation	Interval (95%)
Documentation for obtaining permits	(60 + 4 x 36 + 30)/6 = 39 days	(60 – 30)/6 = 5 days	[39-2x5 ; 39+2x5] = [29 ; 49]
Installation of the wastewater treatment plant	(24 + 4 x 15 + 10)/6 = 15,66 days	(24 – 10)/6 = 2,33 days	[15,66-2x2,33 ; 15,66+2x2,33] = [11 ; 20,33]
Installation of a pumping station	(4 + 4 x 3 + 2)/6 = 3 days	(4 – 2)/6 = 0,33 days	[3-2x0,33 ; 3+2x0,33] = [2,33 ; 3,66]
Construction of a 15 km collector	(14 + 4 x 10 + 8)/6 = 10,33 days	(14 – 8)/6 = 1 zi	[10,33-2x1 ; 10,33+2x1] = [8,33 ; 12,33]
Construction of a protective dam	(7 + 4 x 4 + 3)/6 = 4,33 days	(7 – 3)/6 = 0,66 days	[4,33-2x0,66 ; 4,33+2x0,66] = [3 ; 5,66]

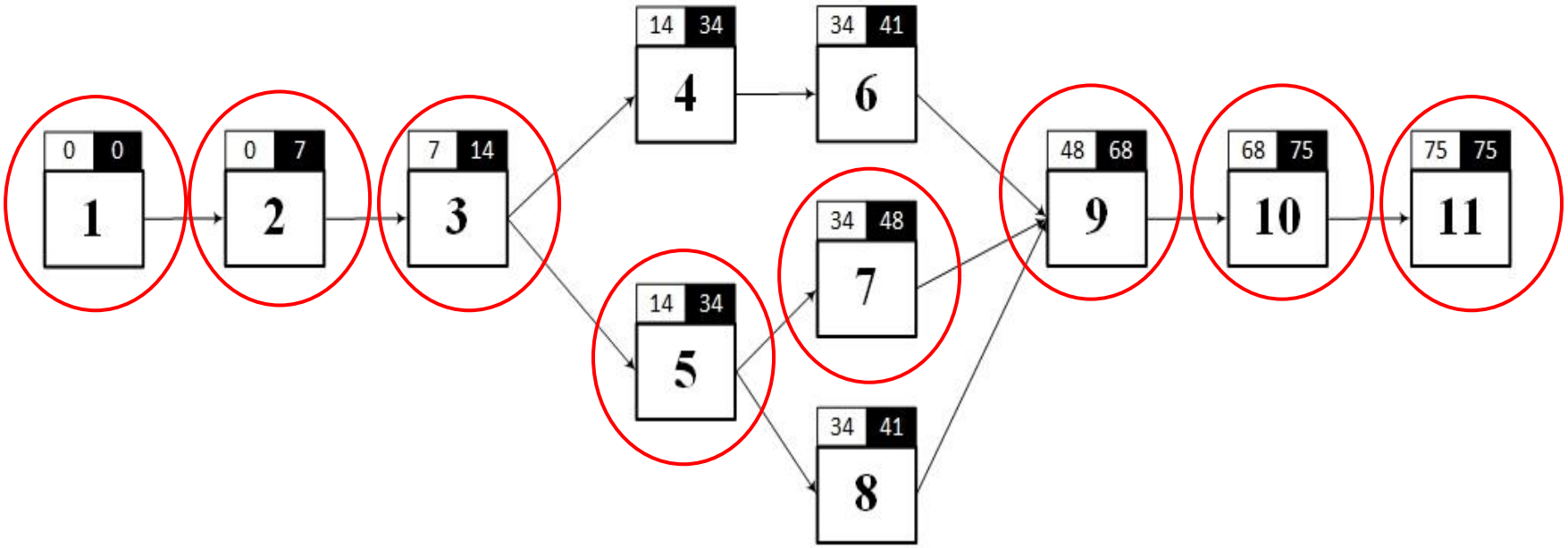
Network Diagram

The path in a network graph is a sequence of activities and phases between the initial phase and the final phase of the network. The length of the path refers, in fact, to its total duration and is calculated by summing the durations of activities that make up that path.

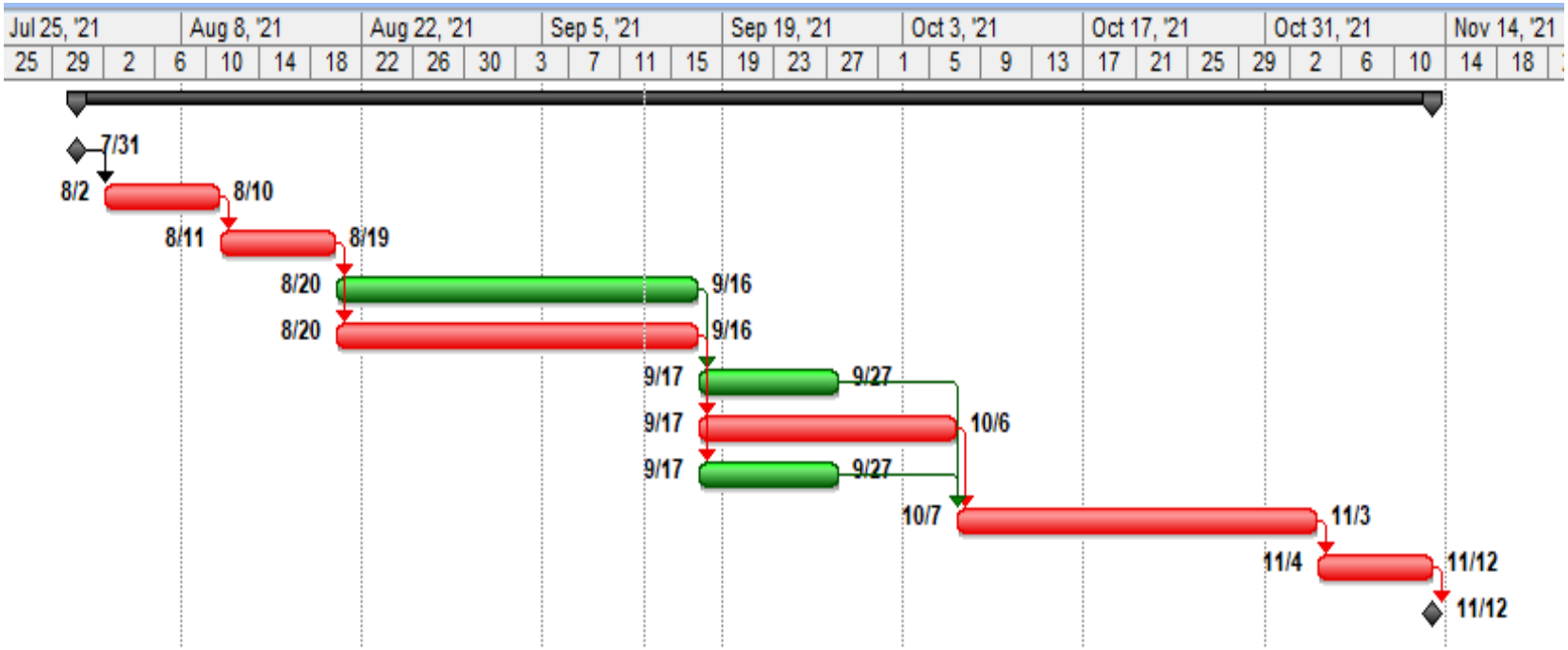


Network Diagram

The critical path in a network diagram is the path with the longest duration, obtained as the sum of the durations of individual activities between the start point and the end point of the network diagram.



Gantt Chart


Jul 25, '21
Aug 8, '21
Aug 22, '21
Sep 5, '21
Sep 19, '21
Oct 3, '21
Oct 17, '21
Oct 31, '21
Nov 14, '21
25 29 2 6 10 14 18 22 26 30 3 7 11 15 19 23 27 1 5 9 13 17 21 25 29 2 6 10 14 18
7/31
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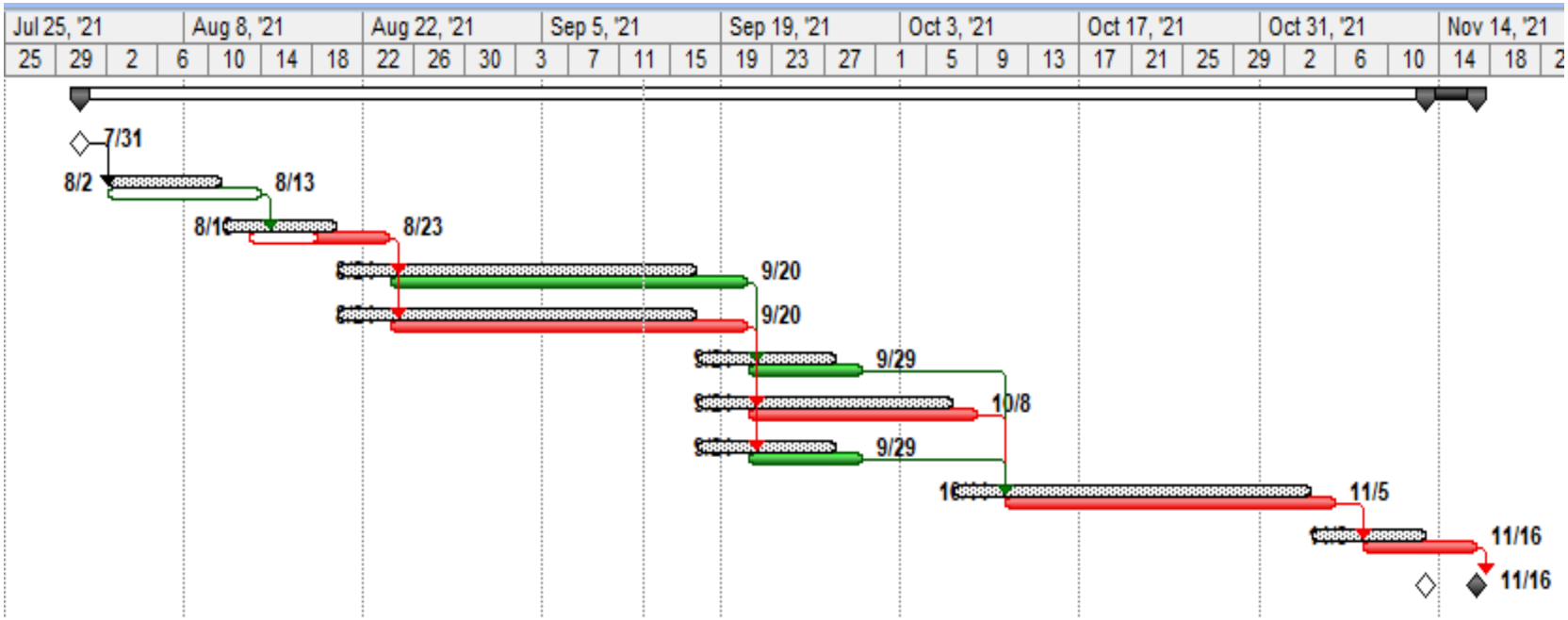
Controlling Environmental Projects Schedule



Controlling Environmental Projects Schedule

- Once we realize we have a problem in terms of schedule, the project management team has a couple of options to take control of the project schedule and bring it back on track:
  - *Fast Tracking;*
  - *Crashing*.

Determining the resources needed by the environmental project

- Estimating a project's time and effort also forms the basis for the project's budget.
- In order to be able to identify an environmental project's costs, first one needs to fully determine the resources needed to undertake it:
  - **Human Resources;** 
  - **Material Resources;** 
  - **Equipment**.   

Environmental Project Cost Estimating

- ***All the resources identified generate costs*** which depend on their **standard rates** and the **quantity of work** they are needed for. So, after identifying all the resources required for completing the environmental project, **cost estimating** is performed as:
  - **analogous estimating** (or top-down estimating);
  - **bottom-up estimating.**

Example

Imagine that writing the feasibility study for your environmental project requires the participation of a consultant and an engineer from the project team. You set the duration of the "writing feasibility study" activity to 7 days based on the opinion of experts (when we talk about "days" in a project, we are actually referring to "standard working days", so we take into account a duration of 8 hours of actual work per day). The standard rates are 200 RON/hour for the consultant and 50 RON/hour for the engineer.

So, the cost of the activity "writing the feasibility study" will be calculated as follows:

(200 RON/hour x 8 hours/day x 7 days) + (50 RON/hour x 8 hours/day x 7 days) = 14,000 RON

Cost control for the environmental project

- Projects should not exceed their budgets in order to use resources as efficiently as possible. Companies do not write blank checks when it comes to projects, so a project manager will always be asked by his superiors "was the project within the approved budget?"
- Methods for cost control include:
  - cash-flow analysis;
  - earned value.

Sample Cash-Flow Report

	7/25/21	8/1/21	8/8/21	8/15/21	8/22/21	8/29/21	9/5/21	9/12/21	9/
COMPOSTING PROJECT									
Initiation									
Staffing		100.00 €	100.00 €						
Planning			71.43 €	357.14 €	71.43 €				
Bins Procurement					700.00 €	875.00 €	875.00 €	875.00 €	
Training Procurement					560.00 €	700.00 €	700.00 €	700.00 €	
Bins Installation									
Teachers Training									
Pupils Training									
Monitoring the composting process									
Closeout documentation									
Hand over									
Total		100.00 €	171.43 €	357.14 €	1,331.43 €	1,575.00 €	1,575.00 €	1,575.00 €	

Earned value analysis

- The earned value system depends on the identification of three project variables (Maylor, 2002):
  - *Budgeted Cost of Work Scheduled (in short BCWS).*
  - *Actual Cost of Work Performed (in short ACWP).*
  - *Budgeted Cost of Work Performed (in short BCWP).*
- **If the project does not deviate from the plan, each of these three parameters has the same value and representation!**

Earned value analysis

- Things you need to understand to be able to perform earned value analysis:
  - *Budget At Completion (BAC);*
  - *Cost Variance (CV);*
  - *Schedule Variance (SV);*
  - *Cost Performance Index (CPI);*
  - *Schedule Performance Index (SPI);*
  - *Estimate At Completion (EAC);*
  - *Estimate to Complete (ETC).*

Earned Value Report

Task Name	Planned Value - PV (BCWS)	Earned Value - EV (BCWP)	AC (ACWP)	SV	CV	EAC	BAC	VAC
COMPOSTING PROJECT	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**
Initiation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Staffing	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Planning	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bins Procurement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Training Procurement	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Bins Installation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Teachers Training	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pupils Training	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Monitoring the compo	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Closeout documentati	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Hand over	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

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THANK YOU FOR YOUR ATTENTION!

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