

IAMC Toolkit

Innovative approaches for the Sound Management of Chemicals and
Chemical Waste

PHASE IV SELECT OPTIONS

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Company guide

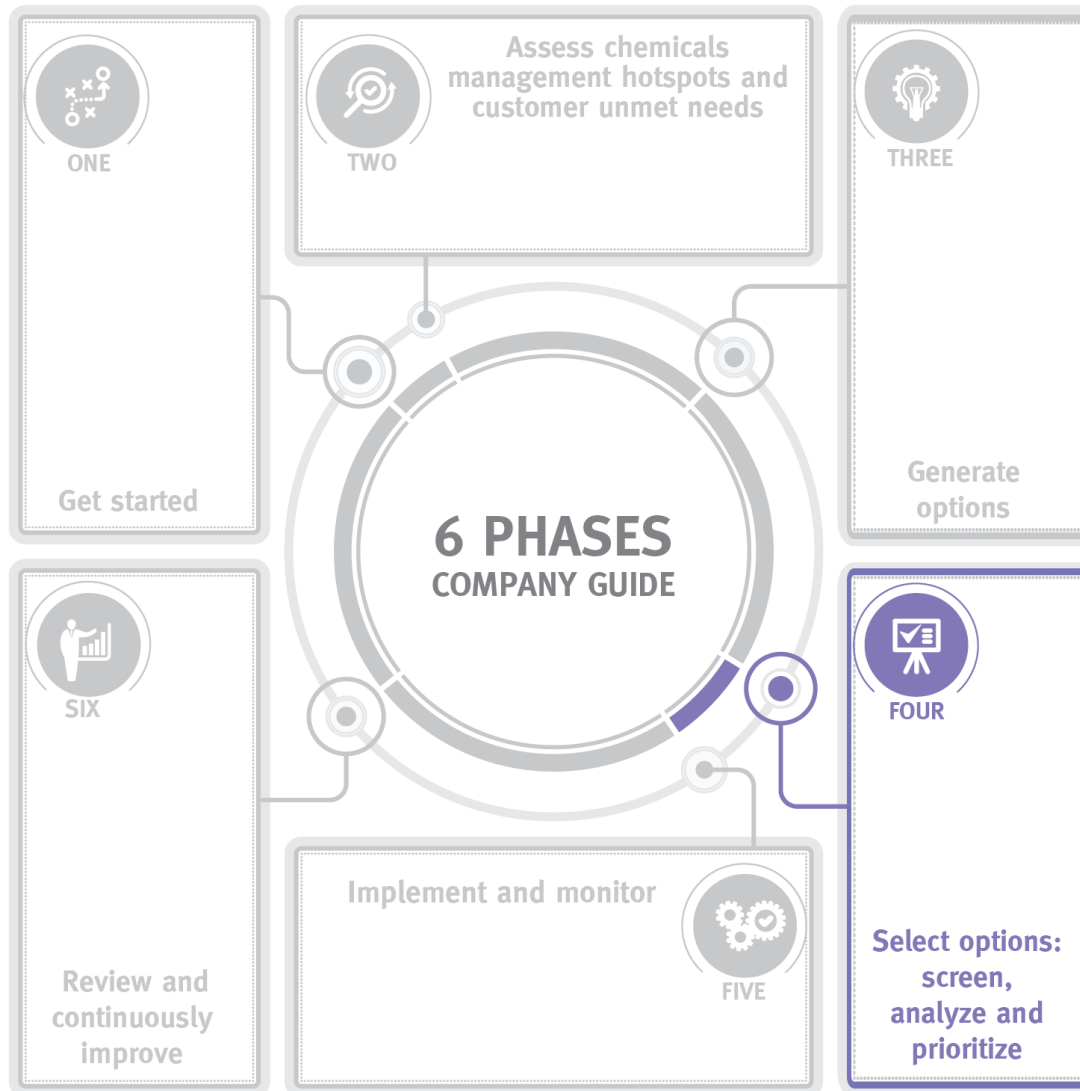
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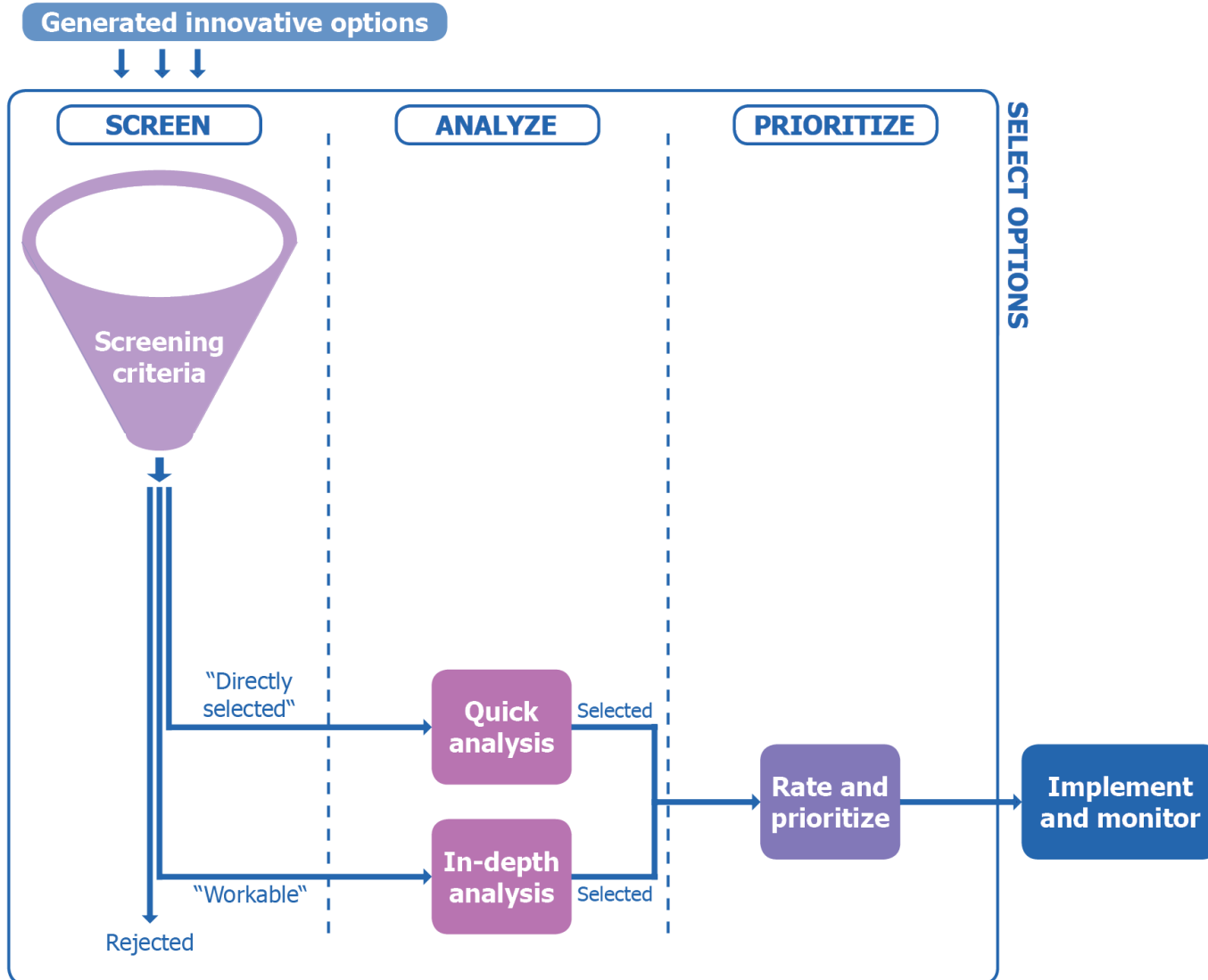
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1. Screen Options
2. Analyze Options
3. Prioritize Options
4. Schedule Options

Phase 4: Select Options



Option Selection Process



Introduction: Select Options

The aim of this step is to support the company in selecting which innovative options to implement and when.

The Toolkit user will learn how to:

- Screen options to determine which generated options are suitable for further consideration
- Analyze the economic, environmental and social impacts & benefits of each options
- Prioritize options according to benefits and importance to company objectives

Phase 4: Select Options

Key Tasks

- Screen options: determine which options are suitable for further consideration
- Analyze options: determine the economic, environmental and social impacts and benefits
- Prioritize options: determine which options have the highest priority to be implemented
- Schedule options to be implemented



Deliverables

- Table of prioritized options selected for implementation
- General schedule of options selected for implementation

Select Options: Screen, Analyze, Prioritize

Complete the following tasks to select options to be implemented from the pool of innovative options generated in Phase 3 ‘Generate Innovative Options’:

Screen: a quick assessment of the generated options to determine those that are suitable for further consideration

Analyze: estimate the benefits and drawbacks of each project selected for further consideration

- Note: Projects can also be rejected at this stage depending on the results of the evaluation.

Rate and prioritize: Rate and prioritize options in a summary table

Understand Potential Barriers to Innovation

Identifying potential barriers to innovation at the company helps to mitigate problems at later stages of the project. Questions to be addressed include:

Potential financial barriers:

- What is the company's current position to obtain financing?
- How does the company decide whether to implement a project (e.g. if the pay-back period is greater than three years or IRR lower than 15%)?

Potential risks:

- What are the risks of a temporary decrease in product quality?
- What are the risks of introducing new products to the market?

Technological barriers:

- Are there any difficulties in adopting new technologies due to a lack of expertise or insufficient availability of parts and services?
- Is there a lack of in-house knowledge of certain technologies?

Screen Options

Screening: Categorize Options

The first task in selecting innovative options is to screen innovative options from Phase 3 ‘Generate Innovation Options’ and categorize them as:

“Directly selected”: options where benefits and drawbacks are easily assessed and which do not require additional in-depth trials or studies

“Workable”: options which require additional in-depth analysis to determine the benefits and drawbacks

Rejected: options where the drawbacks clearly outweigh the benefits

Screening of Innovative Options: Examples

ID	Option	Type of innovation	Directly selected	Workable	Rejected	Comments/Explanation
1	Substitute lead-based pigments with safer alternatives	Products		x		Replacing lead-based pigments will require a modification of the product formulation and a feasibility study to evaluate the technical, environmental and financial feasibility of alternatives. The collaboration with key account customers is desirable in order to maximize the properties of the new product for end market use.
2	Chemical leasing for surface cleaning of high precision metal parts with organic solvents	Business models		x		A new business model offering customers services for the total management of chemicals and the surface cleaning of high precision parts. Requires a feasibility study and potential collaboration with the equipment supplier of cleaning machines. Accurate customer profiles and a market study will be required.
3	Implement good chemical storage and handling practices	Management practices	x			The risk of explosion or fire can be immediately and significantly reduced with little capital investment. Better practices will also slightly reduce hazardous waste generation by 15 kg/month. Training of staff will be required.
4	Replace the exhaust textile dyeing process by a continuous dyeing process	Production techniques			x	Company throughput is too small to economically justify the purchase and operation of continuous textile processing equipment.
5	Upgrading of fuming HCl to a safer and economically viable product	Products		x		Technical and market research required to determine the “best” upgraded product for the regional market. Lab-scale and pilot tests required before commercial implementation can proceed.
6	Repair condensate return	Management practices	x			This option requires only two working hours to implement and will reduce fuel consumption. Although this alone is not innovative, it can be included as part of an overall maintenance and repair programme.

¹ **Products:** input material change / product modification / upgrading of by-products / new applications

Production techniques: on-site recycling or recovery / process change / equipment modification / optimization of process control and process conditions

Management practices: occupational health and safety / overall improvement / functional improvement

Business models: technological / social / organizational

Analyze Options

Assess the Feasibility of Options

Analyze the innovative options (“directly selected” and “workable”) according to:

- Economic feasibility
- Environmental benefits
- Social benefits such as health and safety
- Technical and organizational viability
- Time required for option implementation: short-term or long-term (0-2 months, 2-6 months, 6-12 months, more than 12 months, etc.)

Quick Analysis of “Directly Selected” Options

Perform a quick analysis of “directly selected” options by determining the following for each option:

- Economic feasibility, environmental and social benefits
- Technical and organizational viability including the following factors:
 - Technical changes to be considered, complexity, down-time, maintenance, training
 - Product quality, production capacity, logistics, space requirements

Example Table: Analysis of “Directly Selected” Options

“Directly selected” option	Economic feasibility		Environmental benefit	Social benefit	Technical and organizational viability	Time required for option implementation
	<i>Investment</i>	<i>Savings</i>				
Option 3: Repair condensate return	2 working hours	\$XX per year	XX kg fuel oil per day = XX kg CO ₂ avoided per day	Proper insulation of condensate return piping protects personnel against burns	Technical <ul style="list-style-type: none"> Standard tools and supplies (insulation) required to repair leaks Organizational <ul style="list-style-type: none"> Personnel have necessary skills 	0-2 months
...						

In-Depth Analysis of “Workable” Options

All options which were found to be “workable” but need further consideration are now discussed in terms of:

- Economic feasibility
 - Environmental and social benefits
 - Technical and organizational viability
 - Time required for option implementation
- The purpose of this analysis is to compare the feasibility of the “workable” options in order to set priorities for the implementation of the most feasible ones in the next step (rate and prioritize).

The following elements are determined:

- Problem analysis of “workable” innovative options and observations
- Description of “workable” innovative options

Economic Feasibility, Environmental and Social Benefits

Economic feasibility

- Savings per year
- Simple payback period (ROI)
 - Example formula to calculate return on investment (ROI)

$$ROI = \frac{\text{Profit}}{\text{Investment}} = \frac{\text{Earnings} - \left(\text{Operational cost} + \frac{\text{Investment}}{\text{Lifespan}} + r * \frac{\text{Investment}}{2} \right)}{\text{Investment}}$$

Environmental and social benefits

- Expressed in reduced amounts of resources (material, energy), different waste streams, reduction in hazardous waste
- Type of material (safer chemicals), occupational health and safety aspects, reduced accident risk

Technical and Organizational Viability

Technical and organizational viability

- Technical changes to be considered, complexity, down-time, maintenance, training
- Product quality, production capacity, logistics, space requirements

Time required for option implementation:

- Short-term (0-2 months, 2-6 months)
- Long-term (6-12 months, more than 12 months)

Prioritize Options

General Approach to Rating and Prioritizing Options

The general approach for rating and prioritizing selected options is as follows:

- 1) Rate the **feasibility** of the options according to the expected economic, environmental and social benefits.
 - How does this improve the company's sustainability performance?
- 2) Rate the technical and organizational **viability** of the option.
 - How "easy" will it be for the organization to implement the option?
- 3) Classify options according to **priority**: high, medium, low.

Approach for Rating and Prioritizing Options

The recommended approach for rating and prioritizing selected options is as follows:

1. Assign weighting factors to economic, environmental and social impacts:
 - The sum of all weighting factors should equal 1.
 - Each company should decide on their own weighting system depending on their priorities.
2. Rate economic, environmental and social benefits on a scale of 1 to 5 according to the completed option analysis.
3. Rate the technical and organizational viability of each option.
4. Use the Prioritization Matrix to calculate the total score of each option.
5. Classify each option as either high, medium or low priority.

Note: Examples of rating criteria is shown in the following slides.

Economic Feasibility: Example Rating Scale & Criteria

The following is an example of a rating scale and criteria for **economic feasibility** which can be adapted to company requirements.

Rating	Criteria (illustrative)
5	<ul style="list-style-type: none">• Short-term payback period (< 1 year) or high ROI (> 0.25)• No or minor investment costs < \$1,000• No special operating costs• Expansion into new markets or better penetration of existing markets
4	<ul style="list-style-type: none">• Moderate payback period (1 to 3 years) or moderate to high ROI (0.15-0.25)• Low investment costs < \$10,000• Operating costs equal to present situation
3	<ul style="list-style-type: none">• Moderate to high payback period (3 to 6 years) or moderate ROI (0.05-0.15)• Moderate investment costs < \$50,000• Operating costs equal to present situation
2	<ul style="list-style-type: none">• High payback period (> 6 years) or low ROI (0-0.05)• High investment costs > \$50,000• High operating costs
1	<ul style="list-style-type: none">• Investment not tolerable for the company

Environmental Feasibility (Resource Use and Pollution Intensity): Example Rating Scale & Criteria

The following is an example of a rating scale and criteria for **environmental feasibility** which can be adapted to company requirements.

Rating	Criteria (illustrative)
5	Reduction > 25%
4	Reduction 10-25%
3	Reduction 5-10%
2	Reduction 0-5%
1	Not recommended, e.g. because of additional energy consumption, the introduction of more polluting materials or non-compliance with legal requirements

Social Feasibility: Example Rating Scale & Criteria

The following is an example of a rating scale and criteria for **social feasibility** which can be adapted to company requirements.

Rating	Criteria (illustrative)
5	Health and safety risks of all life cycle actors significantly reduced <ul style="list-style-type: none">• Life cycle assessment of chemical products• Community outreach and emergency response initiatives
4	Health and safety risks of company suppliers and customers reduced <ul style="list-style-type: none">• Product stewardship
3	Occupational health and safety risks reduced <ul style="list-style-type: none">• Number of accidents related to unforeseen risks and injuries
2	Monitoring of employee performance <ul style="list-style-type: none">• Lost days and absentee rates
1	Minimum compliance with domestic occupational health and safety standards

Prioritization Matrix: Set Priorities According to Sustainability Performance (1)

The following **prioritization matrix** can be used to prioritize options for implementation based on economic, environmental and social ratings. The criteria for determining priority is illustrative and can be adapted to company requirements.

	Economic	Environmental	Social	Total
Weight	0.3	0.4	0.3	1.0
Option 4: ...	3	3	4	3.3
Option 9: ...	5	2	1	2.6
Option 15: ...	4	5	3	4.1
...				

Range to determine priority (illustrative)			
Priority	High (1)	Medium (2)	Low (3)
Score	4-5	2.75-3.99	1-2.74

Prioritization Matrix: Set Priorities According to Sustainability Performance (2)

Prioritization matrix (illustrative): Option 15 has high priority

	Economic	Environmental	Social	Total
Weight	0.3	0.4	0.3	1.0
Option 4: ...	3	3	4	3.3
Option 9: ...	5	2	1	2.6
Option 15: ...	4	5	3	4.1
...				

Range to determine priority (illustrative)			
Priority	High (1)	Medium (2)	Low (3)
Score	4-5	2.75-3.99	1-2.74

Technical Viability: Example Rating Scale & Criteria

The prioritized options should then be evaluated for technical and organization viability: i.e. how easy or difficult will implementation be.

A technical viability assessment analyses the technical difficulty and the amount of effort required for implementation. An illustrative rating scale and criteria is shown below.

Rating	Criteria (illustrative)
5	<ul style="list-style-type: none">• Organizational measure• Without need of technical changes• Best Available Technology (BAT)
4	<ul style="list-style-type: none">• Easy and well-known technical changes• Unproblematic technical changes• Not causing higher operating or maintenance expenditure
3	<ul style="list-style-type: none">• Approved moderate technology• Technical changes well possible, but not easy• Same operating expenditure as the actual process/periodical maintenance required
2	<ul style="list-style-type: none">• Large-scale, complex technical changes• Causing high operating or maintenance expenditure
1	<ul style="list-style-type: none">• Technically very difficult

Organizational Viability: Example Rating Scale & Criteria

An organizational viability assessment analyses the organizational difficulty and the amount of training required for implementation and subsequent operation of the innovative options. An illustrative rating scale and criteria is shown below.

Rating	Criteria (illustrative)
5	<ul style="list-style-type: none">• Highly applicable, no organizational changes in the process necessary• No process interruption necessary
4	<ul style="list-style-type: none">• Applicable, easy to implement, insignificant organizational changes• Short training of workers• Short interruption of production necessary (1 day)
3	<ul style="list-style-type: none">• Moderate organizational changes• Training of workers required• Moderate interruption of process/production (< 2 weeks)
2	<ul style="list-style-type: none">• Hardly applicable, significant organizational changes• Special training of workers required• Interruption of process/production is longer than the time for annual maintenance stop
1	<ul style="list-style-type: none">• Organizationally very difficult

Viability Matrix: Determine the Technical and Organizational Implementation Effort

The following illustrative **viability matrix** can be used to prioritize options for implementation based on economic, environmental and social ratings.

The criteria for determining priority is illustrative and can be adapted to company requirements.

	Technical	Organizational	Total	
Option/ Weight	0.6	0.4	1.0	
Option 4: ...	3	5	3.8	} Moderate implementation effort
Option 9: ...	2	1	1.6	
Option 15: ...	2	3	2.4	} High implementation effort
...				

Range to determine priority (illustrative)			
Effort	Low (1)	Moderate (2)	High (3)
Score	4-5	2.75-3.99	1-2.74

Schedule Options

Summarize and Schedule Options

The final task in this phase is to summarize the prioritized options and prepare a general schedule for implementation.

Prepare a summary table:

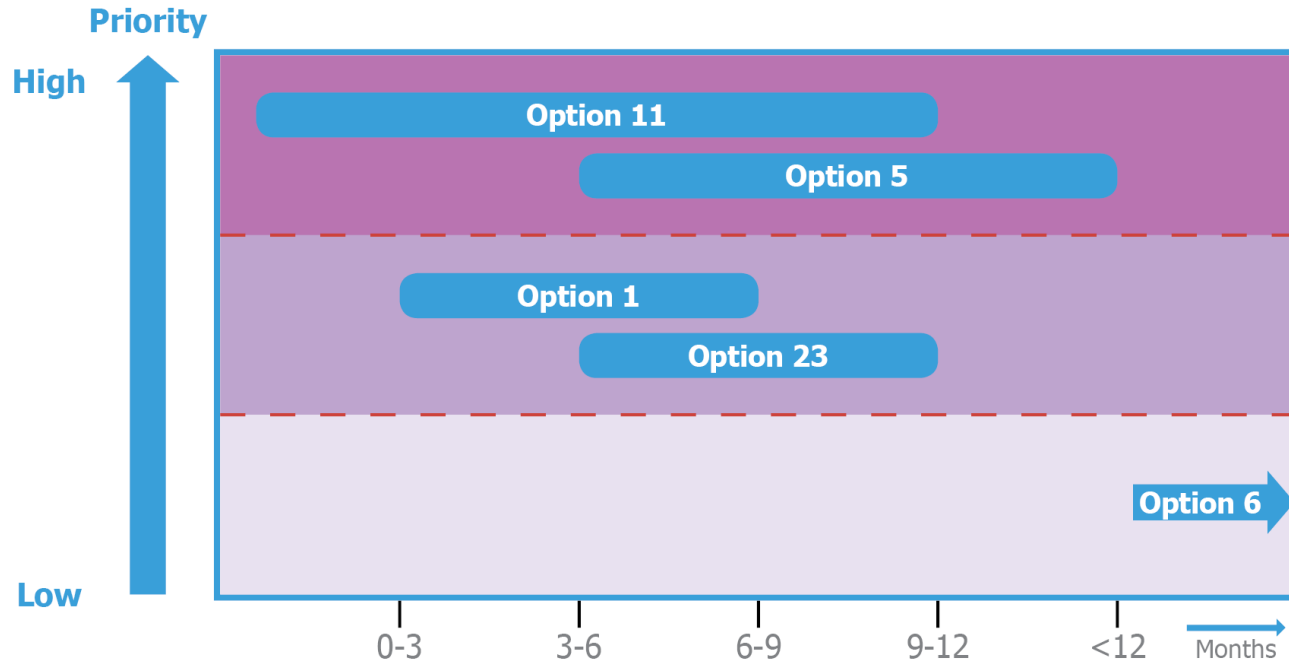
- Summarizes all selected options grouped according to priority
- Includes estimated duration for implementation and technical and organizational requirements (i.e. important requirements necessary to conduct the project)

Prepare a schedule:

- Selected options are included on a time axis with approximate project duration showing interdependencies
- Selected options are divided into options with high priority at the top and low priority at the bottom

Example: Schedule for Implementing Options

An illustrative example how to schedule options to be implemented



Source: ISSPPRO

Sources

Sources

- CSD Engineers, Switzerland/ISSPPRO, Germany, 2015
- UNIDO: Cleaner Production Toolkit, 2010
- Global Reporting Initiative: Sustainability Topics for Sectors, 2013

Images

- ISSPPRO, Germany, 2015

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