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**Application of MCA Methods: A seven
step process**

Asia LEDS Forum, November 12, 2014



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Learning Objectives

MCA steps
overview

Study design

Conducting
MCA

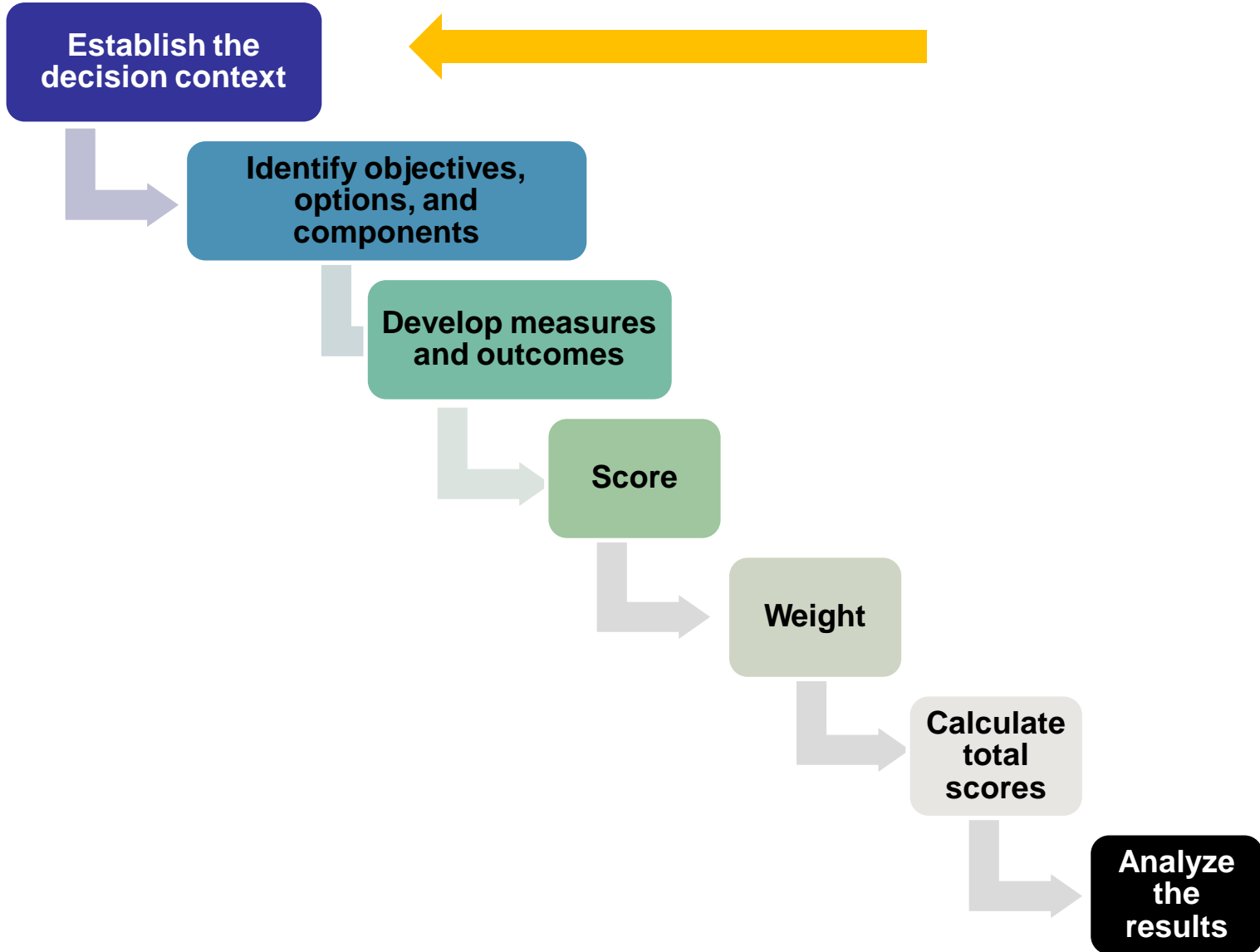
Analyzing
results



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MCA Steps Overview





Establish **decision context** for MCA

- Start the process by learning the context for the decision
- What? Why? Who?





Understanding **decision context** is important for:

- Setting up the MCA
- Collecting data
- Analyzing the results





What and why?



- **What** is the decision?
- **Why** is the decision necessary?
- What is the **overall goal**?
- What **social** and **political forces** affect the decision?



Who?

- Who are the **decision makers**?
- Who is affected by the decision (**stakeholders**)?
- **Who else** can provide information needed for the MCA?

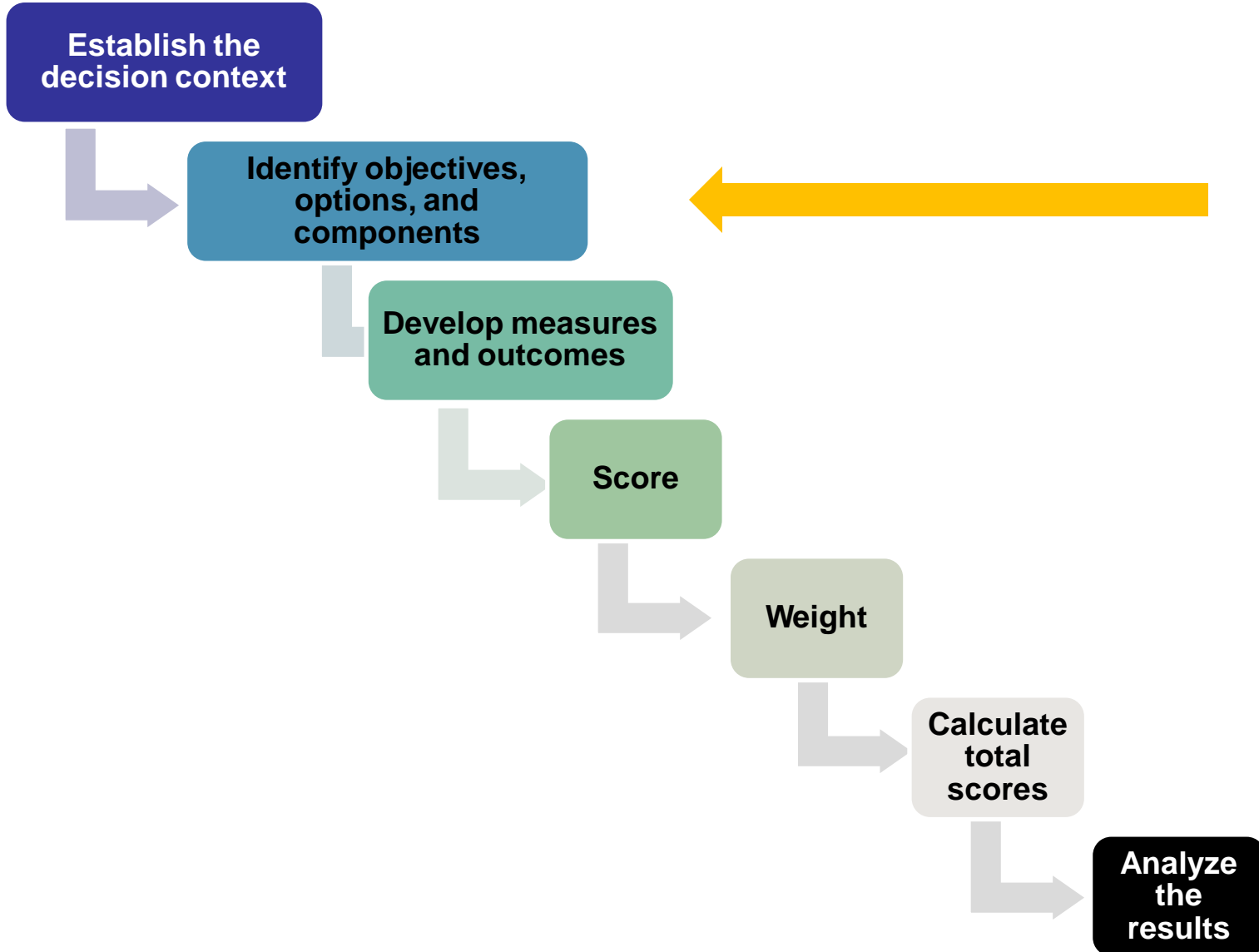




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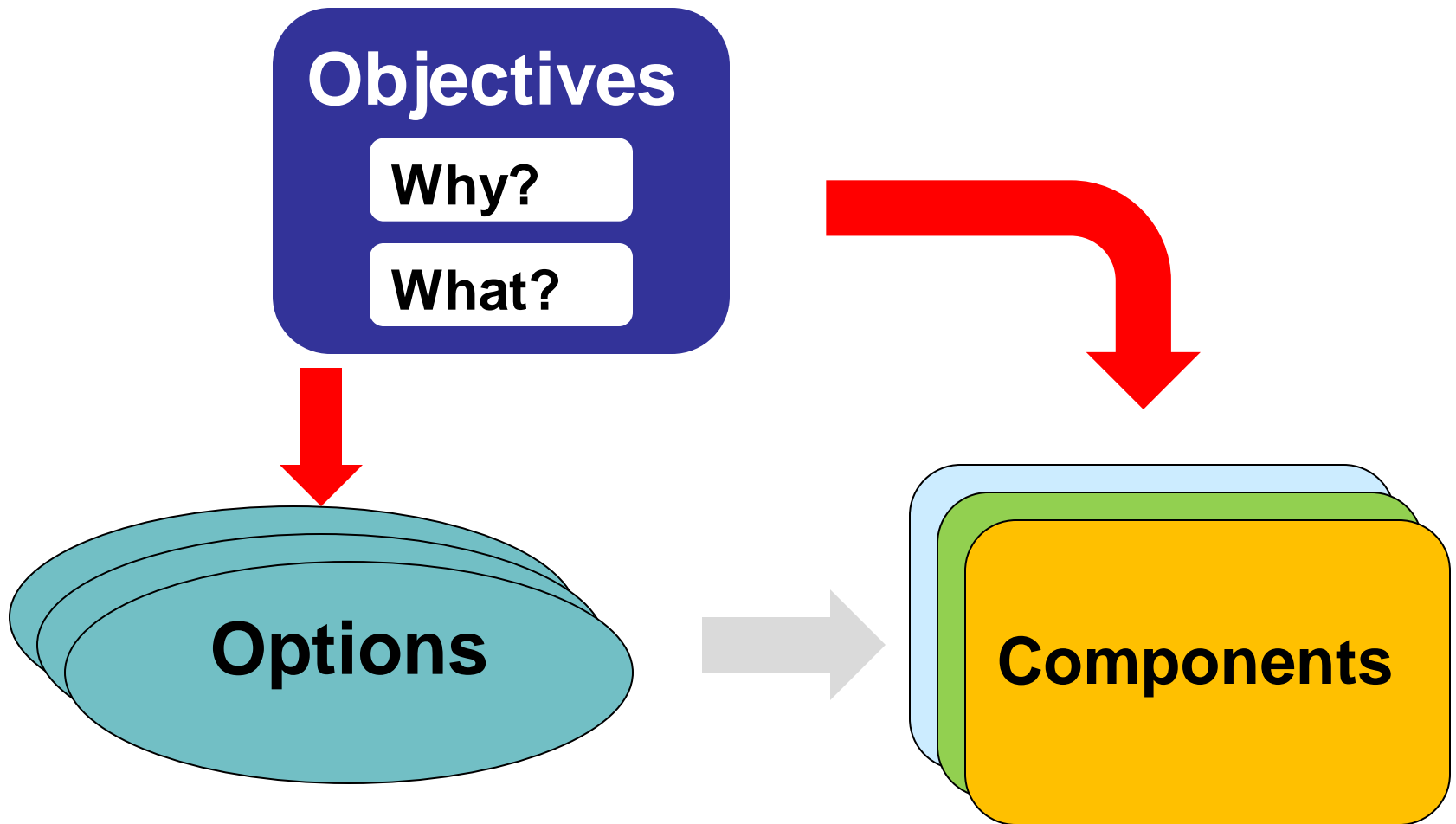
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MCA Steps





Identify **objectives**, **options**, and **components**





How to **identify** the **objectives** of a MCA

- Two major questions:
 - ♦ **What** is important (to me) about this decision?
 - ♦ **Why** is it important?
- Ask these questions until all important objectives have been identified





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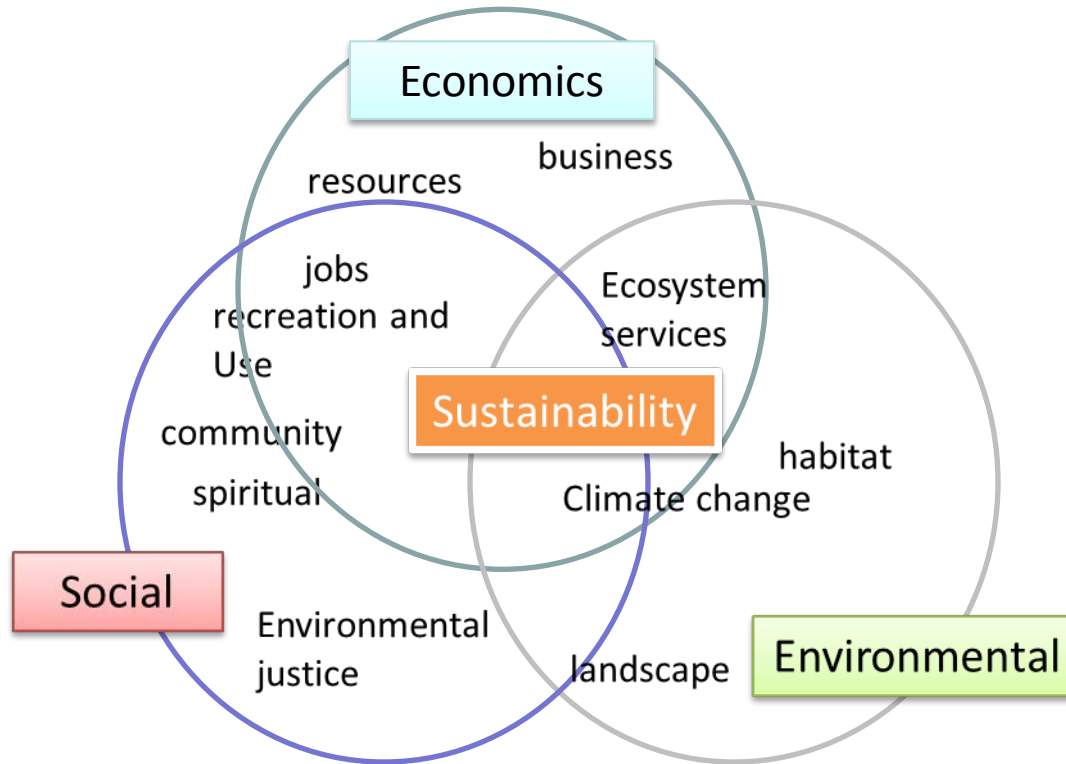
Conducting MCA

Who should **identify** the **objectives** of a MCA?

- Input from stakeholders can be an important part of identifying objectives
 - ◆ Helps to make sure that **all** important **objectives** are being **considered**
 - ◆ Helps **gain support** for the MCA and participation in the analysis



To integrate with triple bottom line (TBL)





Identify options (options are your alternatives or choices)

Options are **ranked** and **prioritized** in a MCA

- Some options may **already** be **defined**
- Try to identify **new** possible options
- **Objectives** can guide development of options



Option A



Option B



Option C



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Option A

Option B

Option C

Choosing between projects

Implementing management actions

Evaluating alternative policies

Allocating resources



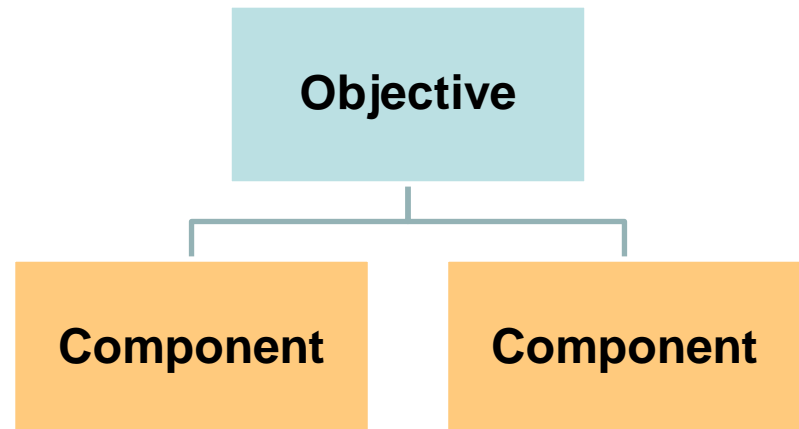
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How to **identify components** of MCA objectives

- Components are identified for **each objective**
- Components break objectives down into things that can be **more easily measured**
- Helps determine what is **important** within each objective





How to identify components....

- For each objective, ask “What is important to me about this objective?”
- Generate a list of components in this way





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How to identify components (continued)...

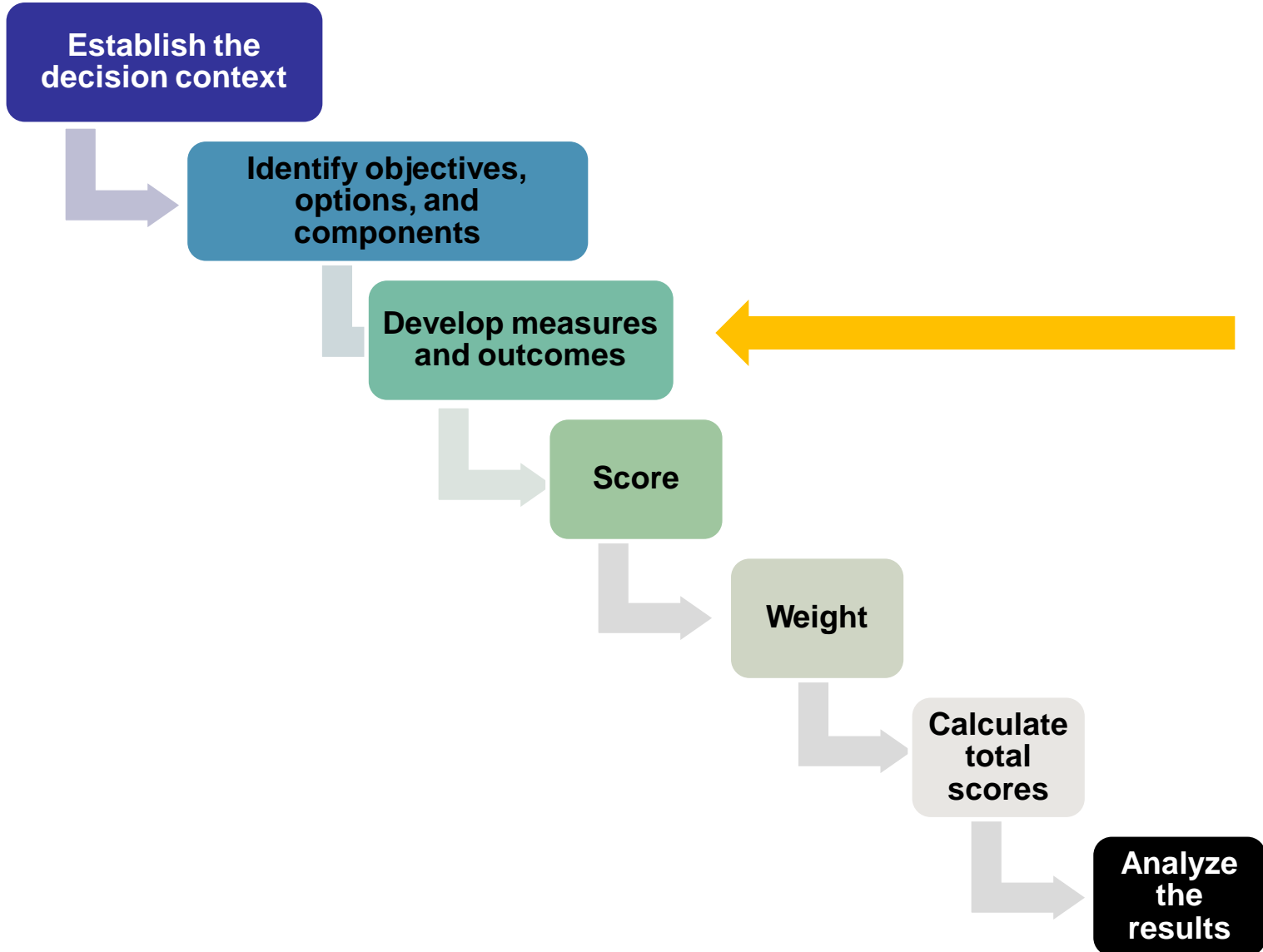
- Once you have a list of components, look to see if any can be **removed** from the list
 - ♦ Are there components that measure the same thing?
 - ♦ Are there any components that cannot be measured?
 - ♦ Are there any components that are the same across all options?



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How do we **develop measures** for components?

- Break component down into **measurable value**
- Focus on measures that **contribute** to the objectives
- Focus on measures that can be **assessed** quantitatively or qualitatively





Who should **develop measures** in a MCA?

- Develop independently
or
- Get input from key players

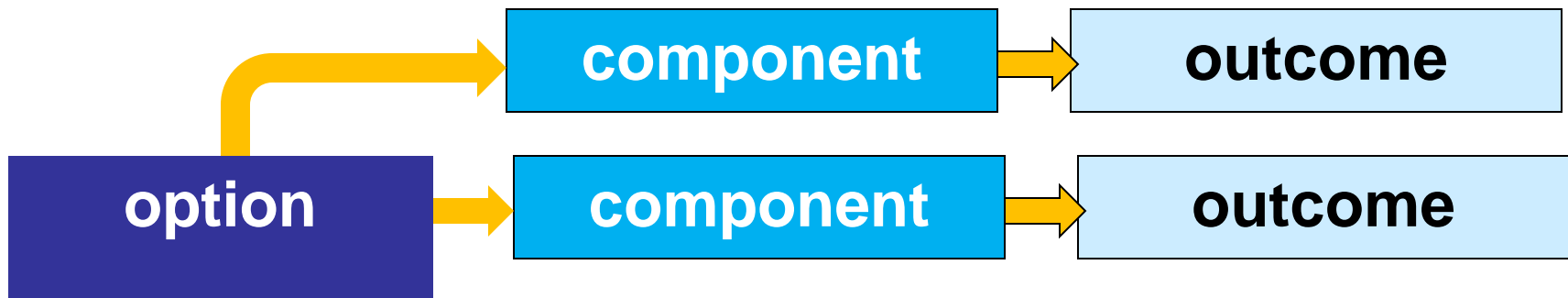


- ◆ **Stakeholders** may have ideas about how the components should be measured
- ◆ **Other key players** may be able to provide useful information for developing measures



How to **determine** the **outcomes**....

- For each component, define what the **result** will be under each option
- Also define the result for the component if no decision is made (the **“no action”** option)





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Example

Objective = Environmental

Component = Greenhouse gas mitigation

Outcome 1 = No change (status quo)

Outcome 2 = X tons reduced

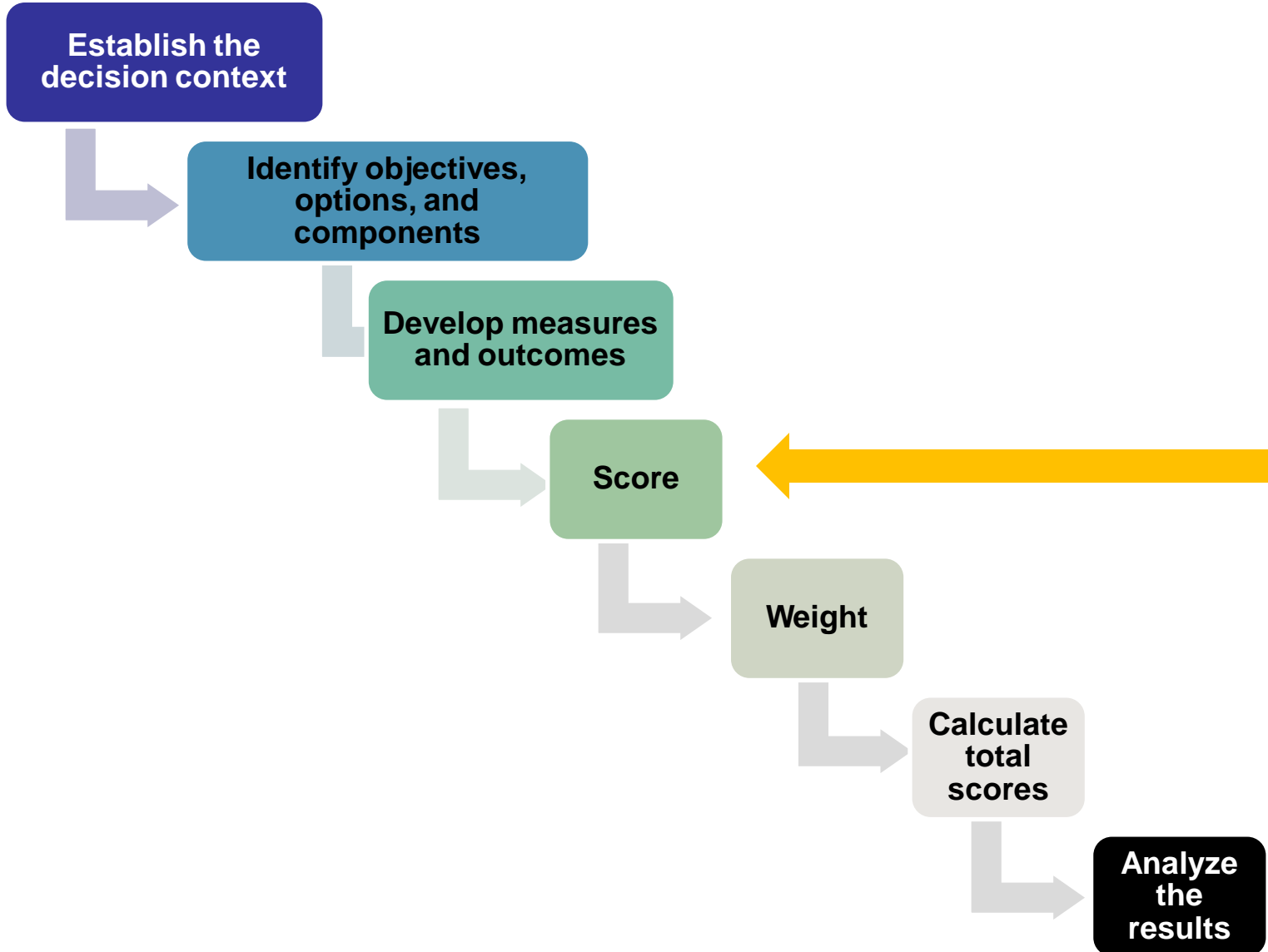
Outcome 3 = Y tons reduced



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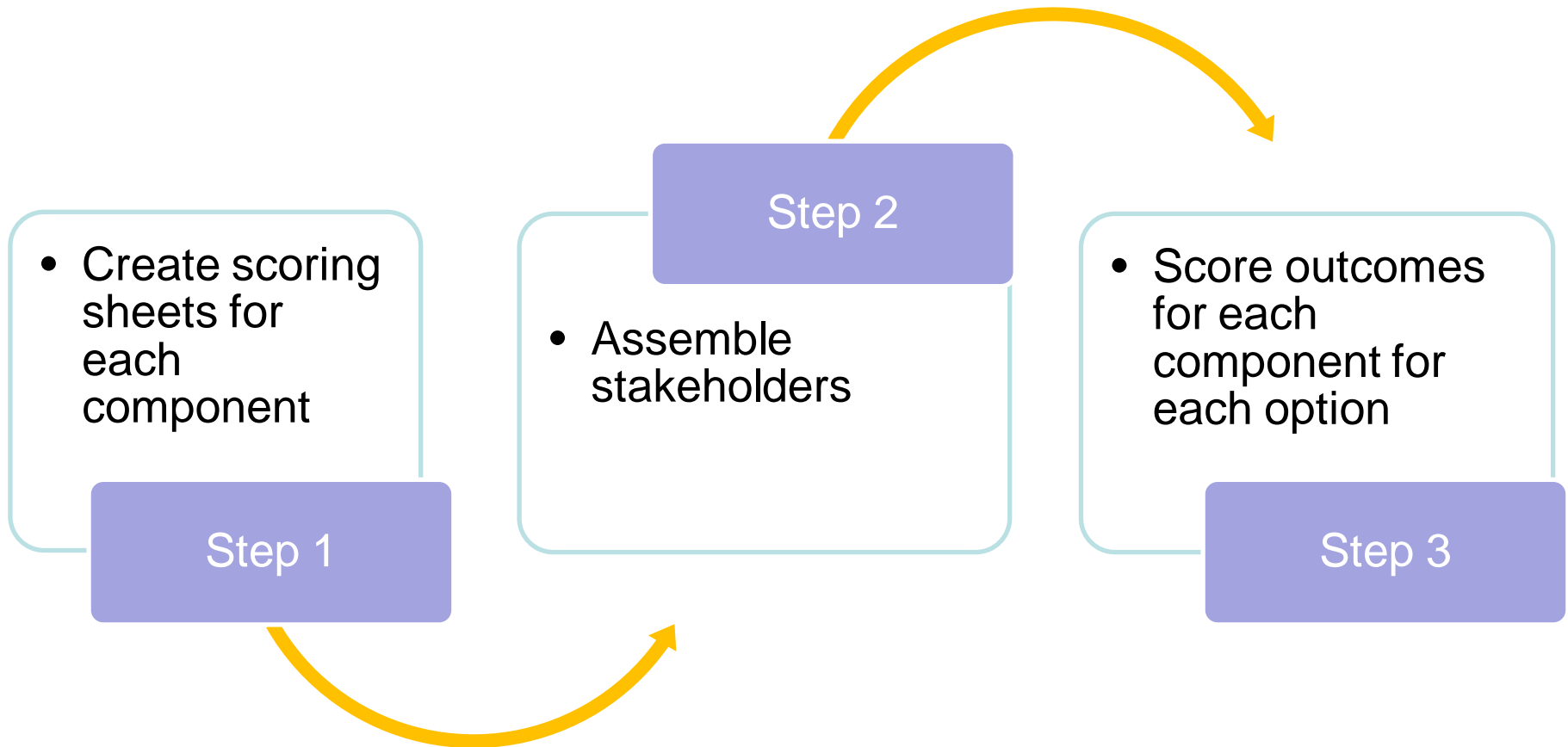
What are benefits of **scoring**?

- Provides a way for options in a MCA to be **prioritized**
- Allows stakeholders to state their **preferences** for the different options
- Allows for multiple objectives to be **compared** on the same scale





Major steps in **scoring** a MCA



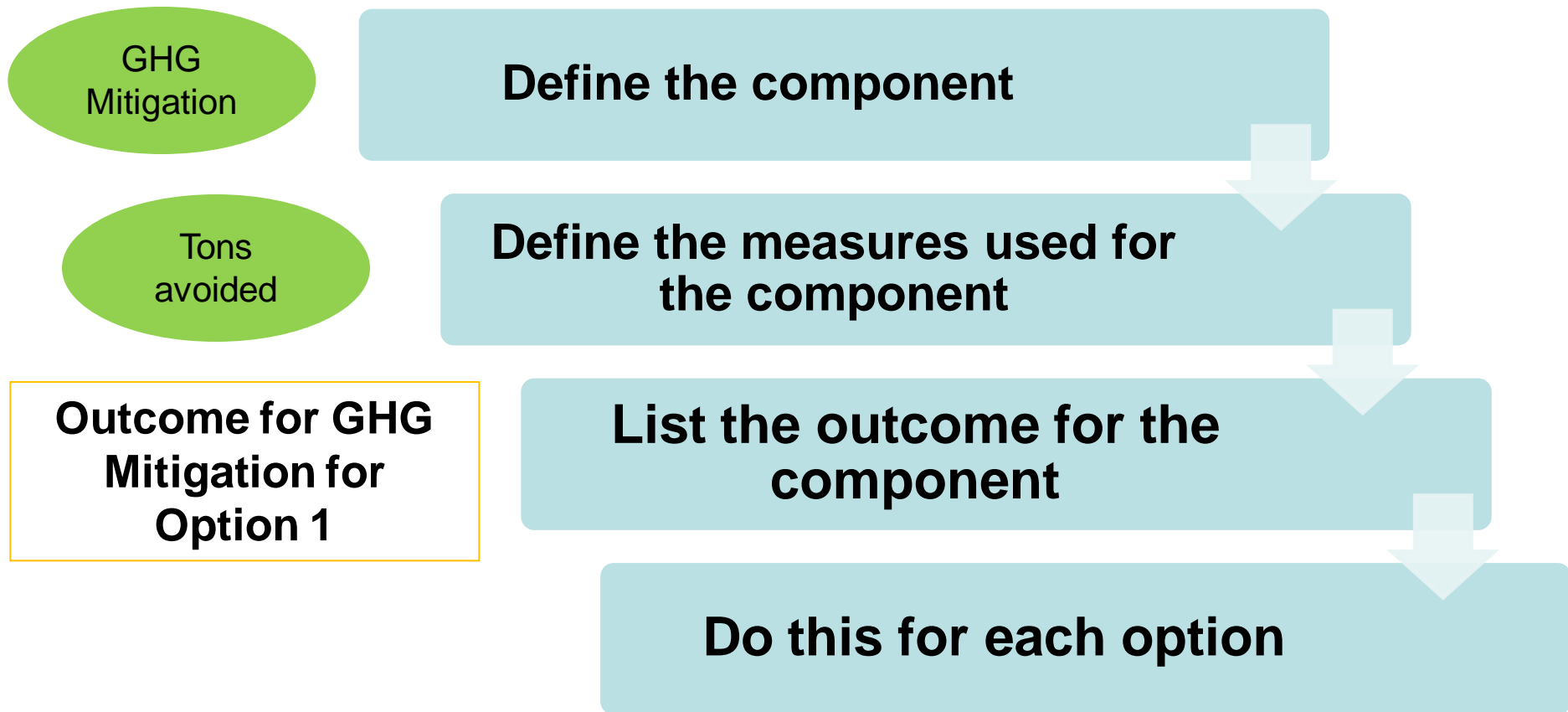


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A scoring sheet guides stakeholders through the process of scoring each component. **From previous steps...**





Tips for creating scoring sheets:

- Measure components in a way that is **easy** for stakeholders to understand
- Make sure all components are measured in the **same direction** (more = better)
- Measures for components may be either **quantitative** or **qualitative**



Example scoring sheet

- **Description** of the **component**
- Definition of **measure** used for component

Climate Regulation

Description: Climate regulation is an important ecosystem service provided by natural areas. Forests provide climate change benefits both by storing carbon that would otherwise be released in the atmosphere and by buffering against natural disasters. Trees absorb carbon dioxide during photosynthesis where some carbon is stored in branches, trunks, and roots, or in the soil and leaves. When trees die or are killed, this carbon is released. Trapping atmospheric carbon, in the form of carbon dioxide, is important because it is the leading greenhouse gas associated with global warming. The amount of vegetation or the hectares of forest in an area are key variables for assessing how a site may trap carbon and help regulate climate. Forests, vegetated areas, and wetlands are also thought to buffer against extreme events. Scientists generally forecast that global warming will lead to an increase in the rate of extreme events (storms, tornadoes, fires, hurricanes, and drought). Vegetated areas (forests and mangroves) and wetlands can help reduce the impacts of these extreme events. This can occur by reducing runoff, buffering storm surge, preventing mudslides, and storing or moving floodwaters. Tree roots can hold soil in place and stabilize stream banks. Coastal forests and forested wetlands absorb the energy from storm surges reducing erosion that protects the coastline.

Measures: Amount of land with carbon-storing vegetation and specific actions that help preserve the facets of natural ecosystems that moderate against extreme events.



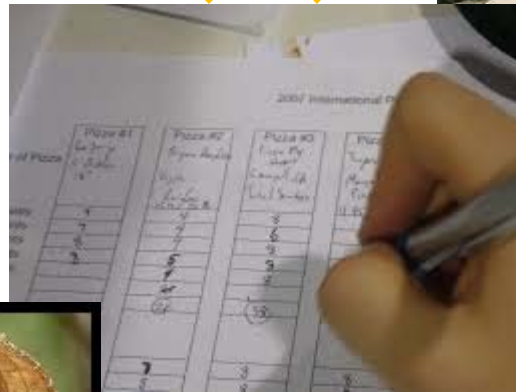
Example scoring sheet

- **List** of **outcomes** of component for each option

Outcome	Rank	Score
Outcome of component for Option #1		
Outcome of component for Option #2		
Outcome of component for Option #3		
Outcome of component for Option #4		
Status quo (no change) outcome for component		



Assemble Stakeholders





To **obtain scores** from stakeholders.....

- First, **introduce** the component and how it is measured
- Have stakeholders **rank** the outcomes for each component
- Define **top-ranked** outcome, then **bottom-ranked** outcome, then rank those in the **middle**

Ranking helps organize choices for scoring

Outcome	Rank
Outcome #1	4
Outcome #2	1
Outcome #3	3
Outcome #4	2
Status quo	5



To **obtain scores** from stakeholders.....(continued)

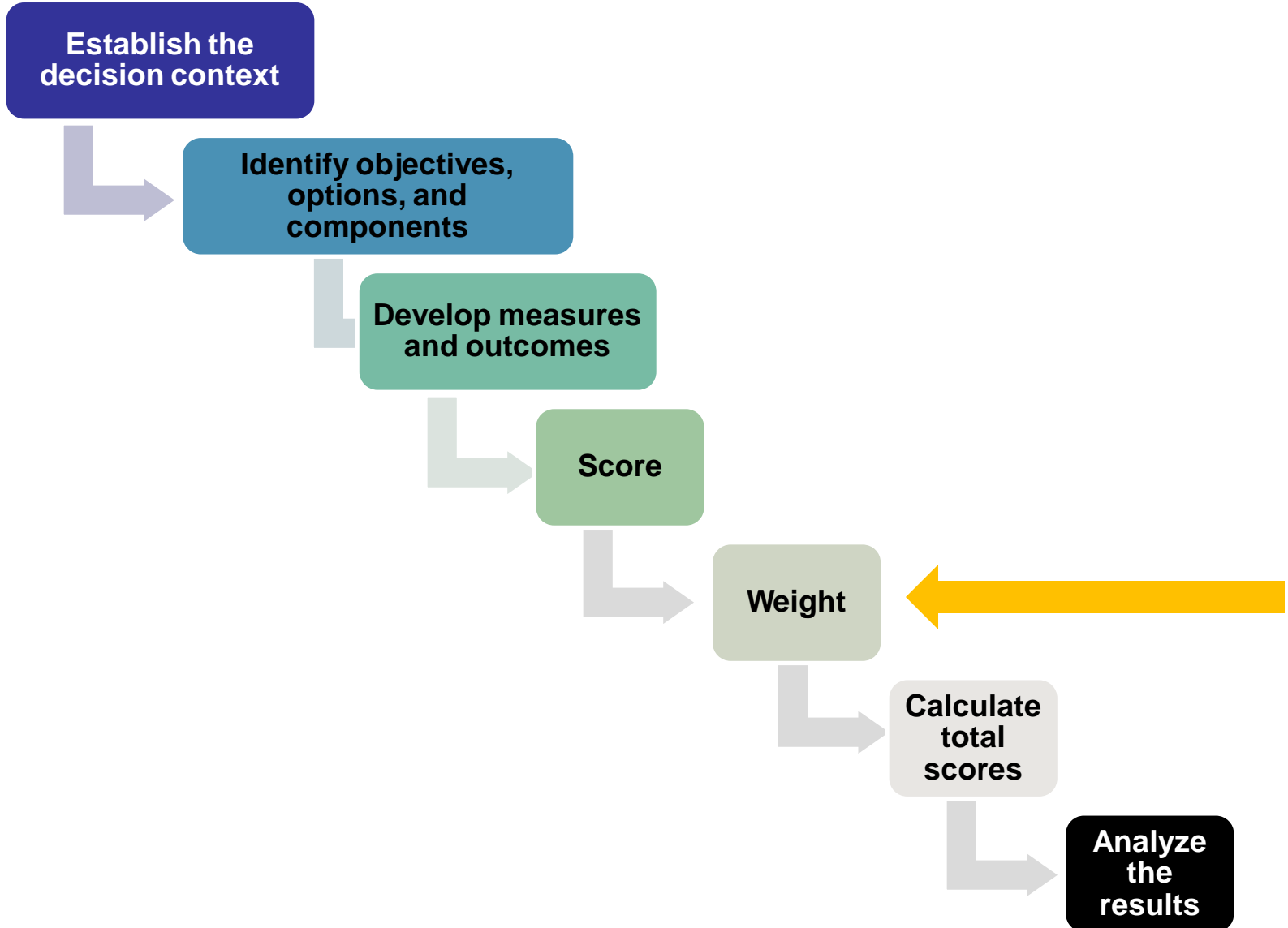
- After ranking outcomes, **assign scores** to them

- Least preferred = 0
- Most preferred = 100
- Score in between

Outcome	Rank	Score
Outcome #1	4	20
Outcome #2	1	100
Outcome #3	3	60
Outcome #4	2	95
Status quo	5	0



MCA Steps





What is **weighting** in an MCA?

A way to determine how important each component is as compared to others

- Weights are used with the scores to calculate the final, **total scores** for each option
- Weights are measured on a scale from 0 to 1





How to **weight components** in a MCA

- Rank and score each component based on how **important** it is to you
- Use a **simple formula** to calculate weights from these scores

$$\left. \begin{aligned}
 & \left(\Omega^2 - \epsilon^2 \bar{q}^2 + \frac{\kappa(k^2 - \epsilon^2 r^2)}{2(1+r)} \right) U - \frac{\kappa \epsilon k r}{1+r} V + \left(\epsilon k q + \frac{\epsilon \kappa k q}{2(1+r)} \right) W - \frac{\epsilon^2 \kappa r}{2(1+r)} A \\
 & - \frac{\epsilon \kappa k}{2(1+r)} B = 0, \\
 & \frac{\kappa \epsilon k r}{1+r} U + \left(\Omega^2 + \frac{\kappa(k^2 - \epsilon^2 r^2)}{2(1+r)} \right) V + \frac{\epsilon^2 \kappa q r}{2(1+r)} W + \frac{\epsilon \kappa k}{2(1+r)} A - \frac{\epsilon^2 \kappa r}{2(1+r)} B = 0, \\
 & - \left(\epsilon k q + \frac{\epsilon \kappa k q}{2(1+r)} \right) U + \frac{\epsilon^2 \kappa q r}{2(1+r)} V + \left(\Omega^2 + k^2 - \frac{\kappa r^2 \bar{q}^2}{2(1+r)} \right) W + \frac{\epsilon^2 \kappa q}{2(1+r)} B = 0, \\
 & - \kappa r U - \kappa k V + \frac{1}{8} \epsilon [-8\kappa + (1+r)\Omega^2 - \epsilon^2 \bar{q}^2 + (1+r)(k^2 - \epsilon^2 r^2)] A - \frac{(1+r)}{4} \epsilon^2 k r B \\
 & + \frac{1}{8} \epsilon (2+r) \epsilon k q \Gamma = 0, \\
 & \kappa k U - \kappa r V + \epsilon \kappa q W + \frac{(1+r)}{4} \epsilon^2 k r A + \frac{1}{8} \epsilon [-8\kappa + (1+r)\Omega^2 + (1+r)(k^2 - \epsilon^2 r^2)] B \\
 & + \frac{1}{8} (1+r) \epsilon^2 q r \Gamma = 0, \\
 & -(2+r) \epsilon k q A + (1+r) \epsilon^2 q r B + [k^2 + 2(1+r)\Omega^2 - (1+r)\epsilon^2 \bar{q}^2] \Gamma = 0.
 \end{aligned} \right\}$$



How to create a **weighting sheet** (continued)

- A weighting sheet guides stakeholders through the weighting process
- List all of the components (and a row for “None”) in a table in rows

This is different from previous scoring efforts

Component	Rank	Rate
Component #1		
Component #2		
Component #3		
None		

Highest=1
Lowest = 4

Highest = 100
Lowest = 0



How to create a **weighting sheet** (continued)

This is different
from previous
scoring efforts

=

Previous sheets
focused on **scoring**
the outcomes of
components

This effort focuses
on **prioritizing** the
components



Major steps in **weighting** a MCA

- Rank the components
- Convert these ranks to ratings (like the scoring sheets)





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Rank (or order) the components based on what's important to YOU...

Think: If you could have only one component, which would you choose?

Rank

Rate

Component		
Component #1	2	90
Component #2	1	100
Component #3	3	25
None	4	0



After components have been rated, use the scores to calculate the weights

- Divide the rate for each component by the total to get the weight

	Rank	Rate	Weight
Component			
Component #1	2	90	$90 \div 215 = 0.42$
Component #2	1	100	$100 \div 215 = 0.46$
Component #3	3	25	$25 \div 215 = 0.12$
None	4	<u>0</u>	$\underline{0} \div 215 = 0.00$

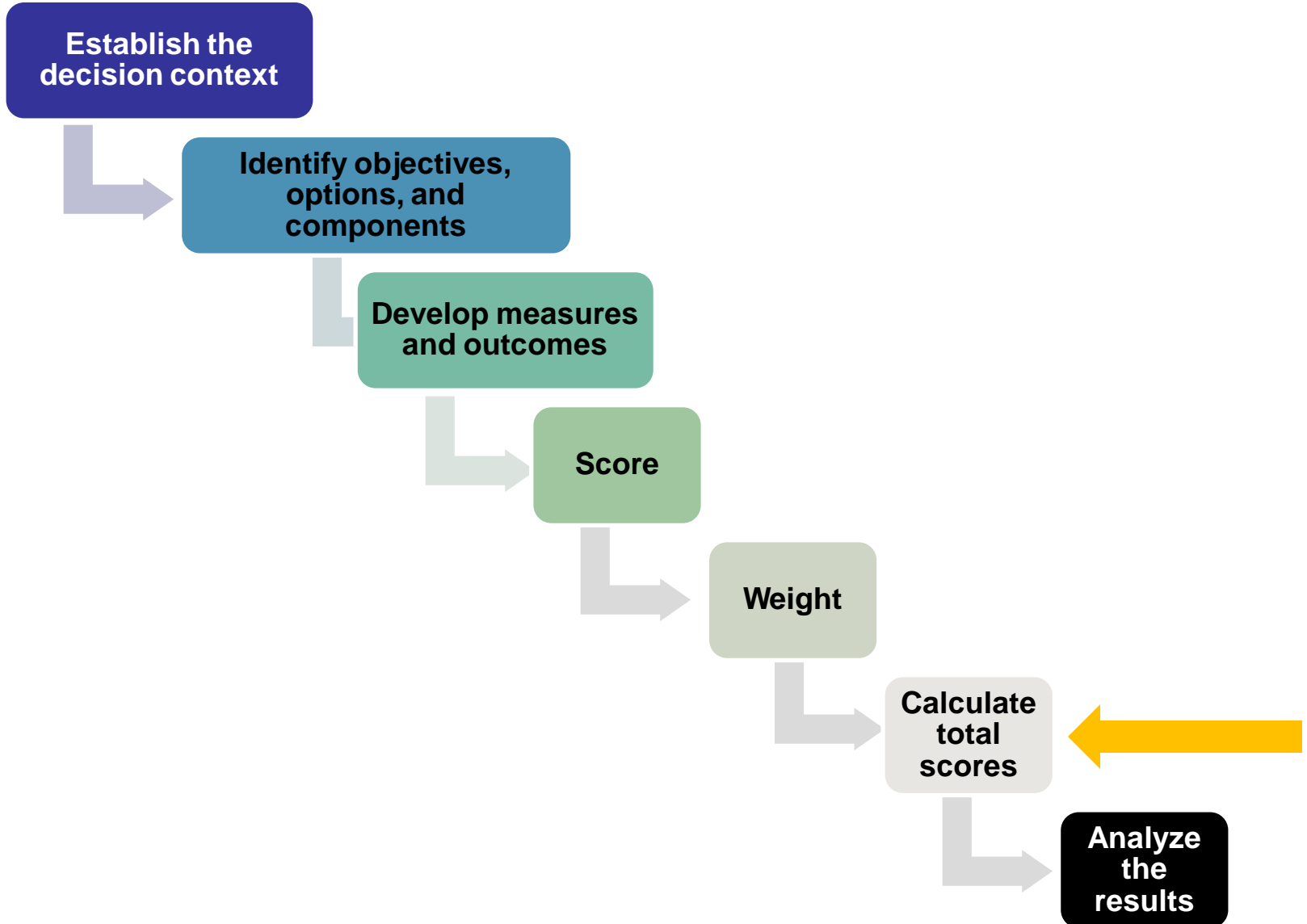
TOTAL = 215



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How to calculate **overall total scores**

- For each option, add the weighted scores for each component to get a total score the option





How to calculate **overall total scores** (continued)

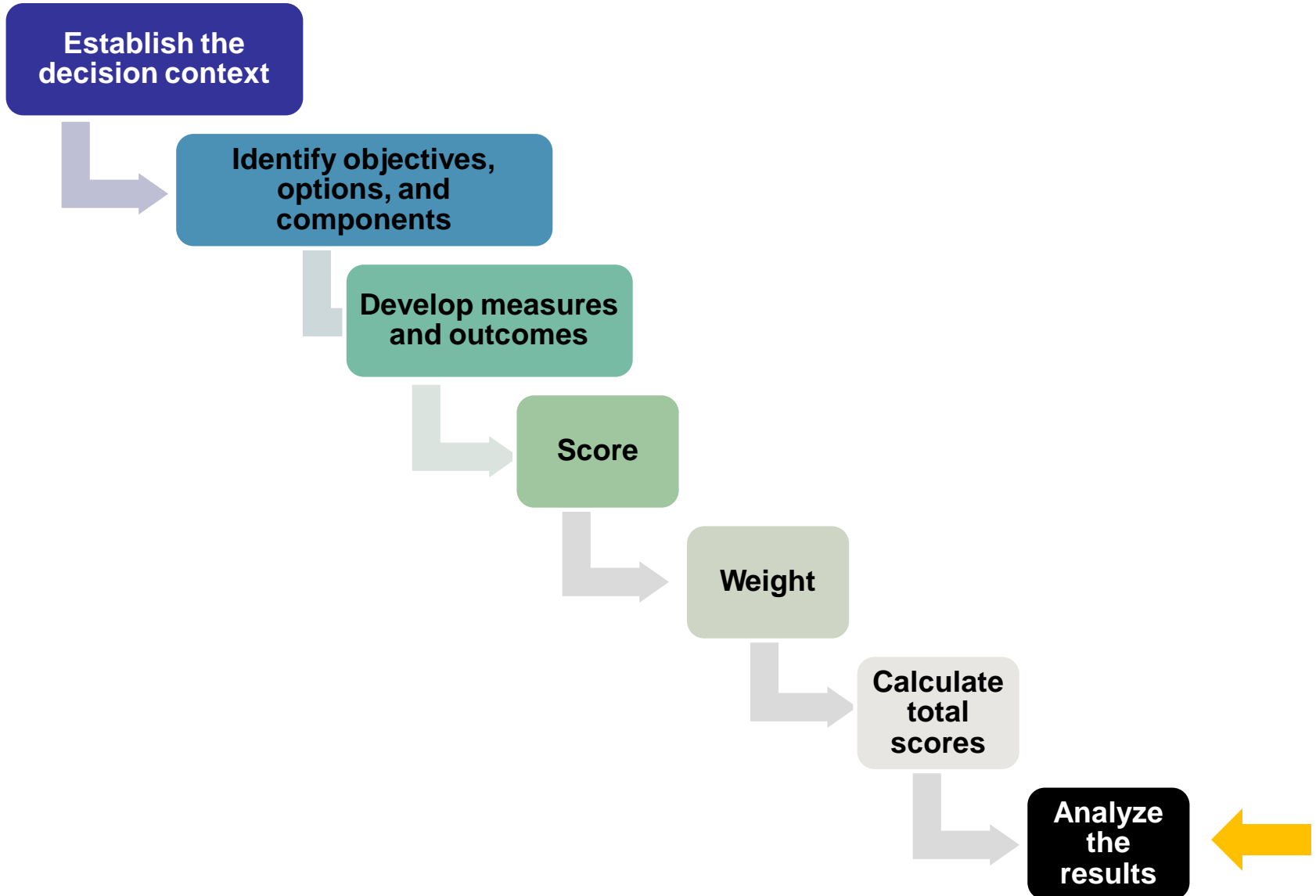
- Average the results for each stakeholder group
- This approach assumes that all stakeholder groups have **equal influence and importance**
- More on this later...



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How to **use results** of an MCA....

- Determine the most-preferred option
- Determine the set of top-ranked options
- Identify all options above a certain score
- Develop a short list of options



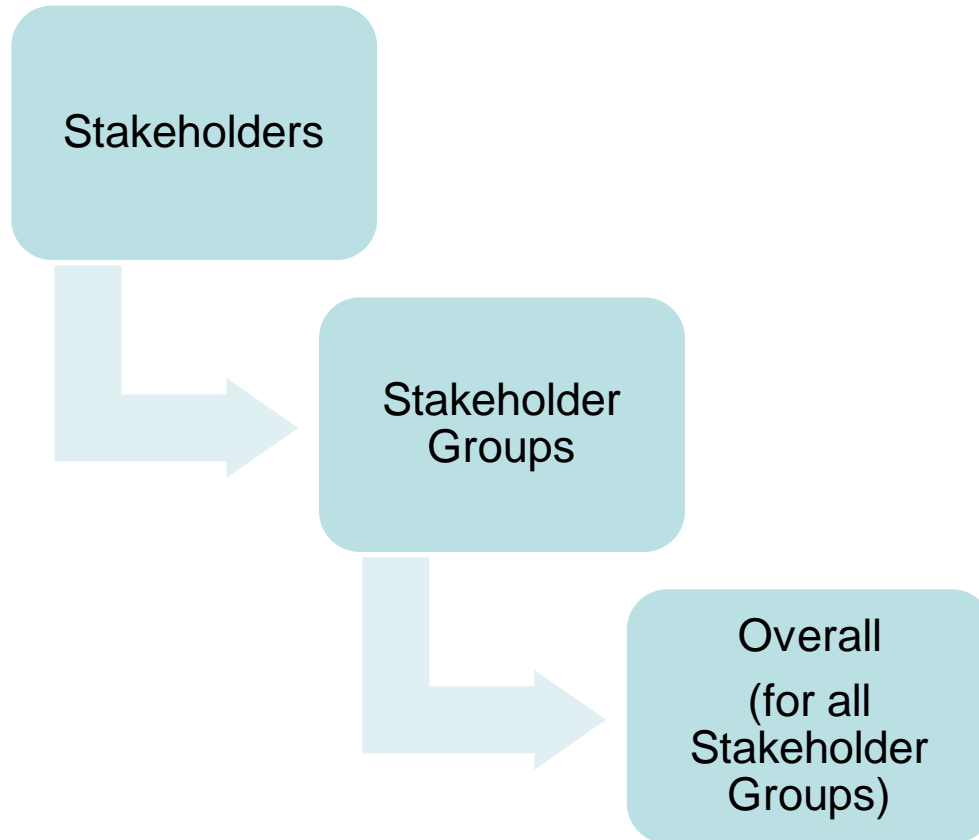


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Analyze Results

Results can be analyzed at different levels





Thing to consider....

- Weighting of individual stakeholders
- Weighting of stakeholder group
 - ♦ Size of stakeholder group
 - ♦ “Importance” of stakeholder group





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Analyze Results

Use **qualitative approaches** to tell the story behind the results

- Consider the highest and lowest ranked options and what was behind the scores they received
- Consider results of stakeholder groups and what these results tell you about what is important to those groups
- Do the results suggest than any additional options should be considered?



Scores obtained from stakeholders provide information on **tradeoffs**

- **Tradeoffs** represent what a stakeholder would be willing to give up of one thing to get something else
- MCA forces stakeholders to **consider and express** their tradeoffs
- Tradeoffs can be evaluated **within** an objective, or **across** objectives



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Any



Questions?