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**Goals and Objectives**

- 1. Develop a structured decision-making process for sustainable agriculture.
- 2. Identify the key stakeholders and their interests.
- 3. Assess the current state of the system.
- 4. Develop alternative scenarios.
- 5. Evaluate the scenarios against the goals and objectives.
- 6. Select the best alternative scenario.
- 7. Implement the selected scenario.
- 8. Monitor and evaluate the results.

**Key Findings**

- 1. The current state of the system is unsustainable.
- 2. The key stakeholders have conflicting interests.
- 3. The alternative scenarios offer different trade-offs.
- 4. The selected scenario is the most sustainable.

**Structured Decision Making for Sustainable Agriculture**

Marco Turco, Rich Gottschall, Curt Gervich

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# Structured Decision Making for Sustainable Agriculture

Marco Turco, Rich Gottschall, Curt Gervich

**Structured Decision Making...**

- Is a step-by-step process for making decisions;
- Integrates personal values and empirical data;
- Adaptable to many contexts;
- As lengthy, involved, analytical as you want to be.

## Agenda and Objectives

By the end of our workshop we hope you:

- Can describe Structured Decision Making (SDM);
- Feel more comfortable carrying out the steps of SDM at home;
- Have made progress on a decision-process that is important to you;
- Will contact us for support.

Agenda
5:45-5:55 Introduction and Welcome
6:00-6:30 Introduction
6:35-6:45 Decision Objectives
6:45-7:30 Choosing Reference Points
7:30-7:50 Break
7:55-8:15 Understanding Objectives
8:15-8:30 Objectives
8:30-8:45 Choosing Reference Points
8:45-9:00 Lunch and Break

# Structured Decision Making for Sustainable Agriculture

Marco Turco, Rich Gottschall,  
Curt Gervich



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- 5:40-5:55 Introductions and Objectives**
- 5:55-6:20 Decision Context**
- 6:20-6:45 Defining Objectives**
- 6:45-7:10 Creating Performance Measures**
- 7:10-7:20 Break**
- 7:20-7:45 Constructing Alternatives**
- 7:45-8:10 Uncertainties**
- 8:10-8:35 Consequence Analysis**
- 8:35-9:00 Closure and Follow-up**



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## *Structured Decision Making...*

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# Decision Context

- Describe the decision;
- Why is this decision important?
- What will this decision help you accomplish?
- What are the choices at the core of this decision?
- What assumptions are you making?
- How will this decision influence other areas of your operation?

**Decision Context**

**Decision (What's this decision about? What's the choice you're trying to make?):**

Should Campus Garden purchase a bio-digester to produce energy from dining hall and garden compost?

**Vision Statement (Why is this decision important? What will it help you achieve?):**

A bio-digester will help us demonstrate sustainability, reduce campus waste stream, streamline processes (no waste contract?), engage in research, educate students, achieve experiential learning.

**A few important factors to consider (how will this decision influence other elements your farm?)**

Human/Social	Financial/Economic	On-Farm Resources (equipment, staff, time...)	Other
Students would collect waste food scraps, transfer to composter, feed digester and clean; provides a research opportunity- food/ water/energy nexus; Could conduct field trips for Coop Extension, local groups, prospective student tours;	cost of digester; paid student labor like compost crew?; Cost savings on waste collection contract; Cost savings on energy? Maintenance costs?	Compost crew requires little faculty/staff assistance; already own much of the equipment for compost crew;	There is little new infrastructure needed on top of what compost crew currently has; this could be a natural next step; likely energy production is small given campus needs (30MW)- though could supplement the microgrid requirements (13MW); Admin/CCER questions viability of paying student labor for composting.

**Challenges you face in making this decision:**

CCER will not fund the entire purchase (\$8000 limit); It's nearly impossible to get O&F and VP Admin, to commit to any expenditure they don't think of themselves.

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# Objectives

- Fundamental: ultimate goals you will not compromise;
- Means: methods/ways of meeting your fundamental objectives;
- Strategic: secondary, external plans;
- Procedural: who should be involved, how will decisions be made.



# Objectives

<p><b>Fundamental</b> <i>(What ultimate outcomes do you hope this decision achieves? Under no circumstances can you violate these objectives!)</i></p> <p>Provide educational (experiential) opportunities for students;</p> <p>Demonstrate principles of Sustainability;</p> <p>Integrate empirical data and rationality into campus decision making.</p> <p><i>Once you've listed your objectives and categorized them, rank them by priority.</i></p>	<p><b>Means</b> <i>(Preferred methods, ideas, activities, ways of meeting fundamental objectives)</i></p> <p>Encourage students to write CCER grants for student money;</p>
<p><b>Strategic</b> <i>(Off-farm objectives; those that involve external organizations; secondary objectives; things you'd like to accomplish as you work to meet your fundamental objectives)</i></p> <p>Keep sustainability on RADAR screen of VP Administration and others;</p> <p>Use CCER funds as matching funds for larger grants and other projects;</p>	<p><b>Procedural</b> <i>(Objectives for the individuals, groups, organizations involved &amp; their role in decision-making)</i></p> <p>Reduce personal time investment in student projects;</p> <p>Institutionalize sustainability thinking into campus decision making.***</p> <p><i>This may be interpreted, perhaps it's a fundamental objective? Use the categories as they are helpful, but don't get bogged down. You can return to any step at any point and modify as needed. This is an iterative process.</i></p>

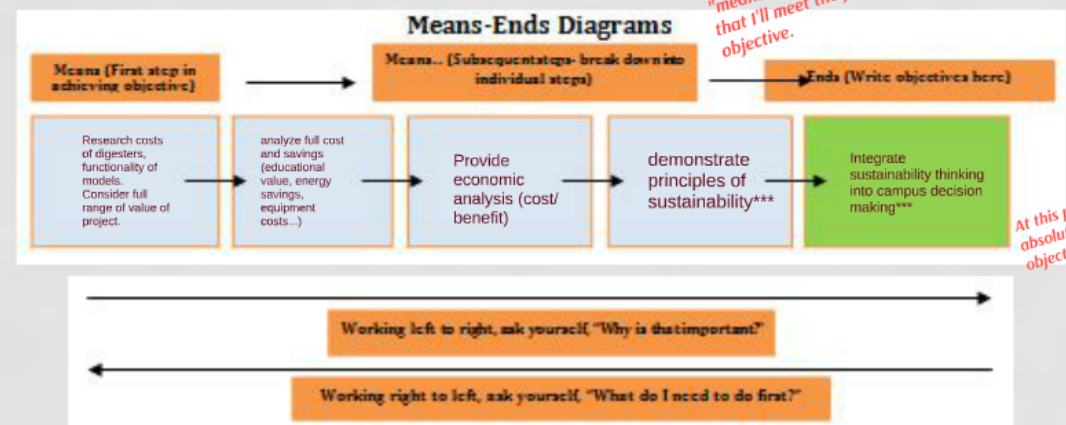
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# Meeting Objectives through Means-Ends Diagrams

- Transfer objectives to the green boxes on right;
- use the guiding questions to work forward/backward and complete the pathway to fulfilling each objective;
- add/skip intermediate boxes as necessary;
- be as detailed as possible



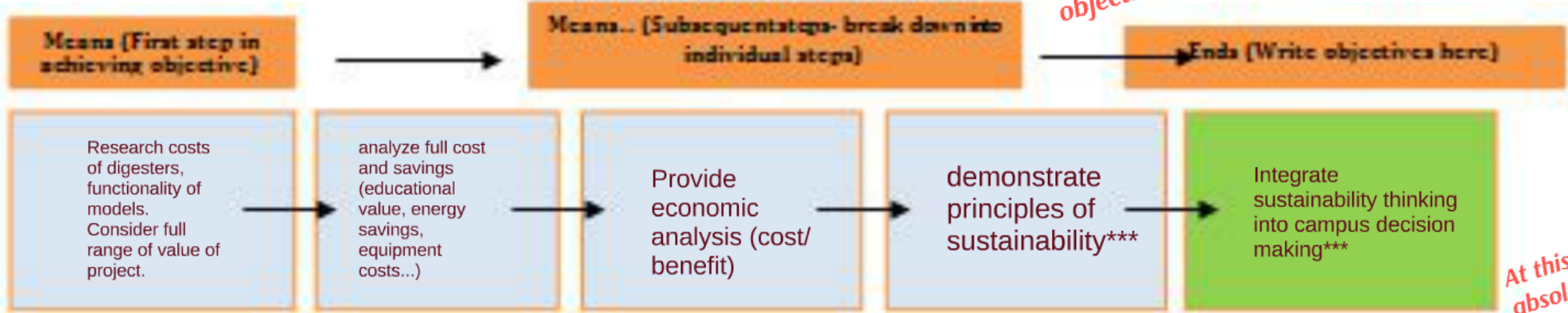
"demonstrating" sounds like a "means" objective. The way that I'll meet the fundamental objective.

At this point I'm thinking of absolutely a fundamental objective.

# Means-Ends Diagrams

"demonstrating" sounds like a "means" objective. The way that I'll meet the fundamental objective.

## Means-Ends Diagrams



At this point absolutely objective.

Working left to right, ask yourself, "Why is that important?"

Working right to left, ask yourself, "What do I need to do first?"

# Performance Measures

- Transfer objectives to first column;
- Indicators: items you can observe that measure progress toward objectives;
- Standard: point at which you consider goal met;
- "Direct" and "indirect";
- Quantitative and qualitative;
- Consider "suites" of indicators to paint a full picture (as a Dr. uses suites of indicators to gauge your health).

	Goals/Criteria	Indicators	Standard
Fundamental	Provide educational experience	Perform qualitative assessment of student before and after project/ semester	Students report improvement in a range of awareness, skill development, confidence and problem solving over life of project.
Strategic	Keep sustainability on RADAR screen of VP, O&F	Individual staff continue to attend meetings, respond to emails, participate in process	Qualitative observational evidence of engagement.
Procedural			
Means			

*This is a "suite" of measures. For each the student is qualitatively assessed.*

*These measures are part of a suite of measures for sustainability.*



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## Performance Measures

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Procedural			
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*This is a "direct" measure. I'm asking the students to qualitatively describe their learning. This is strong.*

*This is quantitative, but indirect. I can count key personnel attendance. However, attendance doesn't necessarily mean engagement.*

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# Creating Alternatives

- Consider a wide range of pathways to meet objectives;
- Select those that are truly different, not variations of a similar model;
- Describe in ways that mention/address all performance measures;
- Organize alternatives in order of: (e.g. cost, complexity, time, labor)

## Creating Alternatives (Alt 1)

Who (list who is involved in this action and what is their role?)	Students- collect waste food from dining halls, transfer to compost, feed digester; conduct research on effectiveness, efficiency; Dining hall staff places waste food in bins at loading docks; Facilities staff maintain digester as necessary, connect digester to campus electric lines.
What & When (what steps, procedures, phases occur in this action?)	Research and analyze digesters; estimate savings and interaction with dining, facilities; food waste moves from dining hall, to loading dock, to trucks, to compost and finally digester; Create a educational curriculum for individual students as well as classes; Outreach to Co-op extension and others for student led tours.
Where (Where do activities occur? What exactly occurs in these locations?)	Students- collect waste food from dining halls, transfer to compost, feed digester; conduct research on effectiveness, efficiency; Dining hall staff places waste food in bins at loading docks; Facilities staff maintain digester as necessary, connect digester to campus electric lines.
Why (Be sure to address all performance measures; Be sure to address all objectives.)	

*It's crucial to make sure descriptions address all performance measures, because later steps we will use your performance measures to estimate the outcomes of each alternative you're descriptions are incomplete this step becomes less useful. I've left a few out...*

### Summary of Alternative:

This alternative focuses on the purchase and operation of a bio-digester to be purchased by the Campus Garden using student Green Fee/CCER funds. F&O would need to supplement the purchase. VP of admin would need to approve the purchase, with full agreement from F&M staff, who might require some training. Students could conduct research on digesters (different models), and recommend models and design. Once installed, the project could be run by student compost crew. This project invites research opportunities for students, class visits, and outreach to Co-op extension and others.

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# Reducing Uncertainty

- Avoid data overload- reduce uncertainties in areas that will help differentiate alternatives;
- Focus on info that is knowable;
- Identify local resources, those in the know;
- Consider broad probabilities and confidence levels.

## Uncertainty

### What are your fears regarding your decision making?

VP Admin, F&M staff don't take the proposal seriously; student research is poor and analysis is flawed- unrealistic expectations and benefits never realized.

### What risks are you taking?

My reputation, time,

## Reducing Uncertainties of Known Unknowns

Unknown and why important to know	Data/Information you need	How can you collect/find this info?	Steps you can take
What's the generation capacity of each digester?	Manufacturer specifications	Contact manufacturers, talk with users.	Students contact manufacturers and current users.
How much waste can our dining halls supply each day?	Mode volume of waste discarded at each dining hall, each day.	Collect waste at each dining hall for one week	Students collect waste at each hall...

Think of two questions you'd like to ask today that other farmers might be able to help with.

*Think hard about the level of precision that is necessary for making this decision. Do you need an exact number, or is a range acceptable? And, how confident are you in your data? For example, in choosing between two different digesters I would be more important to know that one has a capacity and the other has a 50% chance of being more important to be high capacity and the other has a 90% chance our waste for...*

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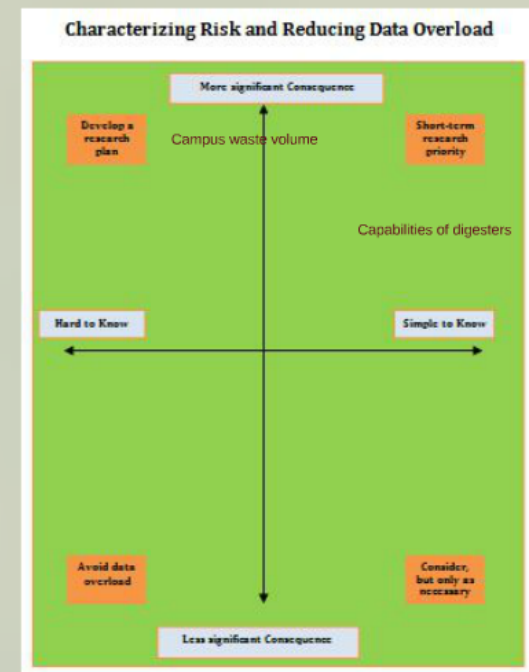
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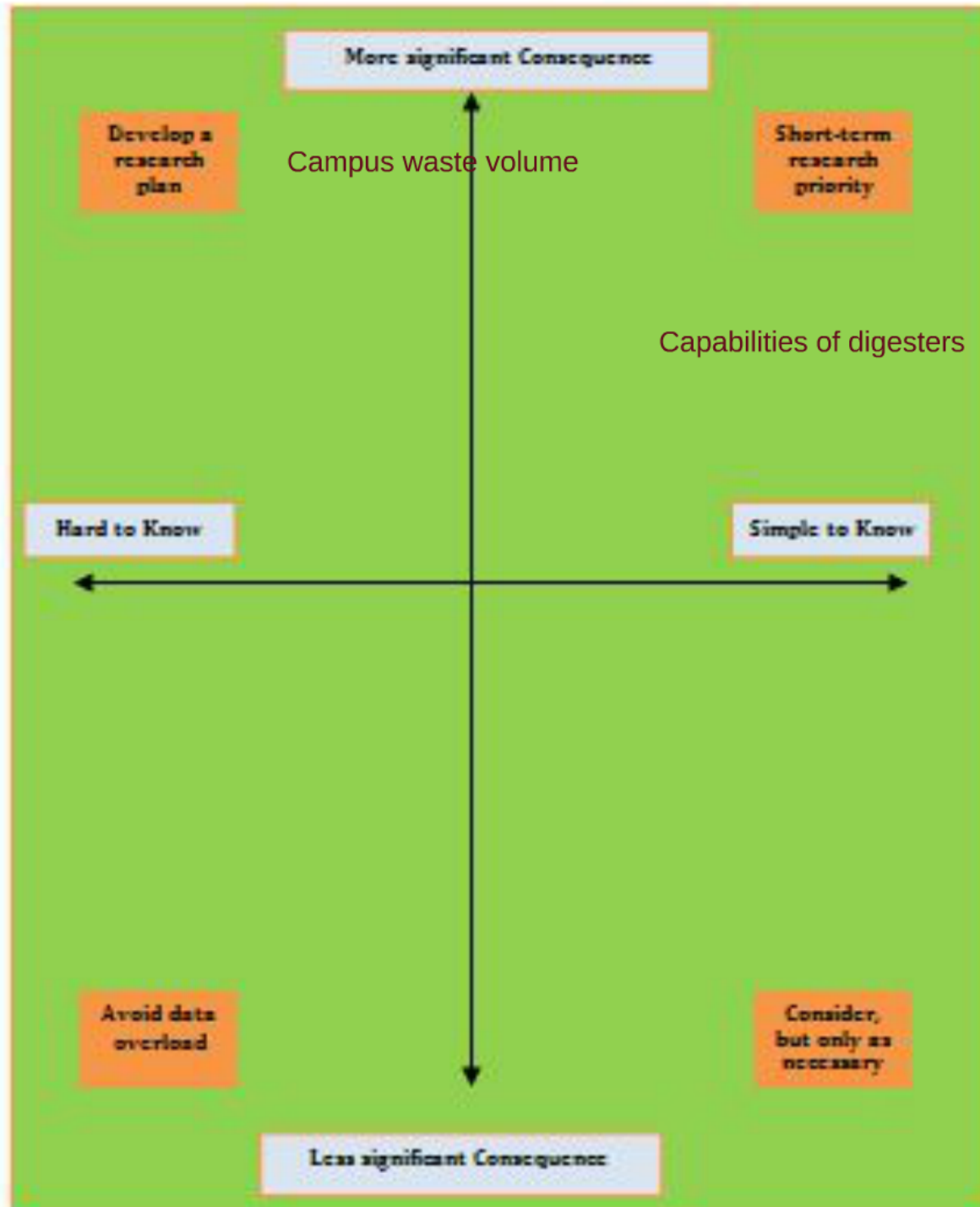
# Analyze Risk

- Consider the significance of new information in decision making;
- Consider the relative difficulty of gathering new information.





# Characterizing Risk and Reducing Data Overload



# Characterizing Consequences

- Name each alternative;
- Use your performance measures to estimate the outcomes of each alternative;
- Think quantitatively and qualitatively;
- reconsider performance measures- select those that truly differentiate, revisit performance measures that you can't estimate.

Alternatives	Performance Measure 1	Performance Measure 2	Performance Measure 3	Conclusions
Alt 1 DIGESTER	Provides many educational opportunities, research potential for students.	Does keep sustainability on RADAR screen, high priority, PPI opportunities.		Significant upfront resource and time commitments, relatively high cost...
Alt 2				
Alt 3				
Alt 4				

# Characterizing Consequences

Alternatives	Performance Measure 1	Performance Measure 2	Performance Measure 3	Conclusions
Ait 1 DIGESTER	Provides many educational opportunities; research potential for students.	Does keep sustainability on RADAR screen, high profile, PR opportunities.		Significant upfront resource and time commitments, relatively high risk...
Ait 2				
Ait 3				
Ait 4				

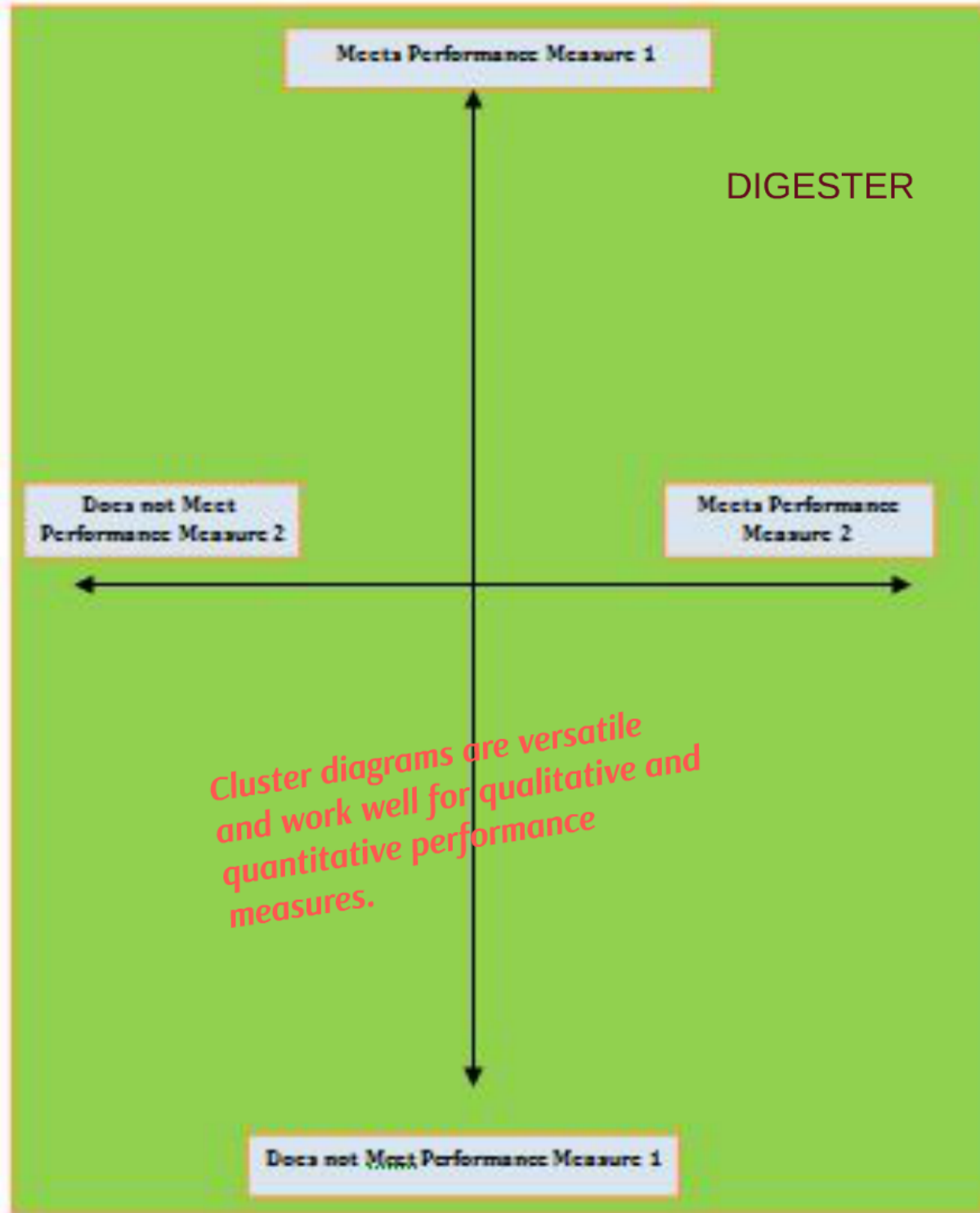


# Characterizing Consequences

- Be creative with the use of cluster diagrams- they are a favorite tool!
- Repeat the process for all combinations of performance indicator, for each alternative;
- Compare the results- which alternatives most often appear in the upper right quarter? Which appear in lower left?



# Consequence Cluster Diagram



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# Characterizing Consequences

- Strengths- list the advantages of an alternative;
- Weaknesses- list the disadvantages of an alternative;
- Opportunities- longer-term, external possibilities that are created by an alternative;
- Threats- longer-term, external vulnerabilities created by an alternative;
- Repeat for all alternatives;
- Compare the results.





# Characterizing Consequences

- List all the advantages and disadvantages of an alternative;
- Avoid double counting;
- Allocate points to those that bring advantages;
- Allocate points to disadvantages;
- Total the points in each group;
- Subtract Pro-Con;
- Repeat for all alternatives;
- Rank the scores.

**Ranked Pro-Con Analysis for Consequence Diagram**

Distribute 100 points among the factors in your Pro and Con categories (you have a total of 100 points to distribute among BOTH sides of the chart).

Pros	Points	Cons	Points
Student research	30	F&M maintenance	20
Class visits	30	Perhaps not significant addition to campus energy needs	10
Experiential Ed			
<b>Total</b>	<b>60</b>	<b>Total</b>	<b>30</b>

*Pro-con tables force you to prioritize. They work well for quantitative and qualitative data.*

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**DECISION!**





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