



***Using Matrices to Solve Difficult Problems  
in Utility Operations***

Kim Riddell-Furry, Alloway

Thanks to Jason Tincu for the presentation!

# Session Agenda

Item 1

**Personal Background**

Item 2

**Decision Making and Matrices**

Item 3

**When to Use and How to Develop**

Item 4

**Practical Application Examples**

Item 5

**Lessons Learned**

Item 6

**Session Summary**



# Kim Riddell-Furry

- **Laboratory Technician (City of Van Wert)**
  - **Class I Laboratory Analyst License**
  - **Class III Wastewater Operator License**
  - **Bachelor of Science in Biology (University of Toledo)**
- **Laboratory Manager (Allen County)**
  - **Class II Laboratory Analyst License**
- **Chief Plant Operator (Allen County)**
- **Wastewater Superintendent (City of Delphos)**
  - **Class IV Wastewater Operator License**
  - **Master's in Organizational Management (Bluffton)**



# As Utilities Managers, Superintendents and Senior Operators you make decisions...

- Capital Improvement Projects
- Consultant Selections
- Equipment Selection
- Industrial Pretreatment Program Issues
- Operations and Maintenance Issues
- Administrative Decisions
- Personal Decisions



# The New Municipal Business Model

No more business as usual...

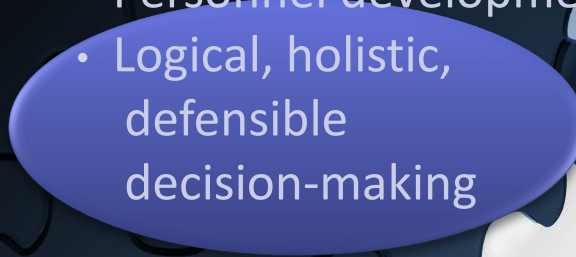
Public sector to incorporate private, for-profit strategies!

## OLD MODEL

- “Use it or lose it.”
- “We’ve always done it this way!”
- “Just good enough to get my raise!”
- “We get paid by the hour, right?”
- “Each PO needs maxed out at \$100 even if we just need some bolts.”
- DOs of 7?—“We keep the blower ramped up to 100% at all times so that we can meet our daily load.”
- “I can’t troubleshoot that, I’m just an Operator.”
- “To decide, just go with the gut.”

## NEW MODEL

- Cost containment
- OTB thinking/Creativity
- Accountability
- Efficiency/Reuse
- Asset management
- Customer service
- Personnel development
- Logical, holistic, defensible decision-making



**In today's social climate and with today's prevalent, anti-government sentiment for all levels...**

...we, as municipal employees and managers, have all got to be more effective, efficient and accountable with our operations, finances and decision-making in order to combat the existing public perception.





# What is a Decision?

- A Choice from two or more alternatives



# “Decision Making...”



can be regarded as the mental processes resulting in the selection of a course of action among several alternatives. Every decision making process produces a final choice. The output can be an action or an opinion of choice.”







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# Decision Making Techniques

- **Chance**

- Quick “roll of the dice” or chance
- Often used in spontaneous situations
- Coin toss, dice roll, draw straws, etc.

- **Intuition**

- Rely on sub-conscious mind or gut
- Also used in spontaneous situations
- Often related to past-experience

- **Analysis**

- Most practical and most used decision-making method for complex issues
- Involves a detailed analysis of all the available info
- Can add time to the process, but also brings value, objectivity and defensibility



# Stages of *Analytical* Decision Making

## 1-Define the Situation

- Develop a good understanding and be very clear about the situation and what you want to achieve.

## 2-Generate Alternatives

- Unless you are choosing from alternatives there is no decision to make!

## 3-Information Gathering

- The information required can be about the alternatives or even about the situation and the required outcome. As alternatives are suggested, it may require further clarification of the situation or the decision to be made.

## 4-Selection

- Selection is the choosing of one of the alternatives.

## 5-Action

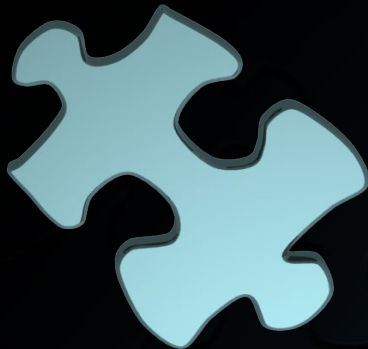
- Great decisions are only great when they are carried into action and the action achieves the desired result.

**“The order of the stages in decision making is important if you want to make quality decisions effortlessly and consistently. You won't know what information to gather unless you know what the situation is and what alternatives are being considered. It's difficult to select an option if you don't know what you are trying to achieve.”**



# Decision Making Matrices...

- Particularly powerful where you have a number of good alternatives to choose from, and many different factors to take into account
- Makes it a great technique to use in almost any important decision where there isn't a clear and obvious preferred option
- Being able to use these matrices means that you can take decisions confidently and rationally, at a time when other people might be struggling to make a decision
- Can provide guidance and support to waiver from an organizational or cultural “norm”



# Decision Making Matrices

**Criteria-Based  
Strategies**

*Grid  
Analysis*

*Pugh  
Matrix  
Analysis*

*Multi-  
Attribute  
Utility  
Theory*





# History of Decision Making Matrices...

- Various versions used in the 1900's
- Developed and defined by Stuart Pugh (engineer)
- Developer of the Total Design methodology
- Pugh Method
  - Quantitative technique used to rank the multi-dimensional options of an option set
  - Implemented by establishing an evaluation team and constructing the matrix which contains evaluation criteria versus alternative concepts
  - Multiple versions have been honed/developed over the years
  - Pugh version compared alternates to baseline





# When to Use Decision Making Matrices...

- When the complexity of the decision increases these decision making tools and techniques can prove useful. Especially as the number of options and criteria increase.
- A decision making matrix is a medium for comparing multiple options when there are also several criteria to consider.
- Not for everyday decision-making...



# Before Setting up the Matrix...

- Gather key players
- Brainstorm on subject and document notes
- Block off plenty of time with no interruptions
- Work off white, chalk or paper boards before transferring to a spreadsheet because working directly off spreadsheet can allow manipulation
- Assign scribe to document and facilitate the process

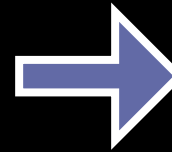
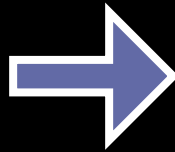


# How to Set up the Matrix...

- Step 1-List attributes considered
- Step 2-For each attribute, assign a relative weight that is greater than zero
- Step 3-“Test” the weights by turning them into sentences
- Step 4-List all of your options and assign score for each attribute
- Step 5-Enter data into spreadsheet



# Steps 1, 2 and 3...



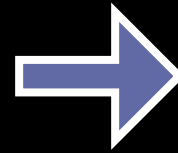
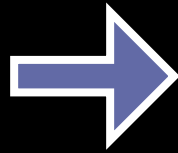
- Step 1-
- Decide which attributes can be used to help make a decision.
- Vendor Selection Theme-i.e. Cost, Reliability, Company Size, Expertise, Process Familiarity, etc.

- Step 2-
- For each attribute, assign a relative weight that is greater than zero.
- The range of numbers doesn't matter; it's the relationship between those numbers that matters.
- For example, if Cost is assigned a weight of 8 and Expertise is assigned a 4, you're saying that Cost is twice as important as Expertise in your decision.

- Step 3-
- "Test" the weights by turning them into sentences.
- "Reliability is really only half as important as Expertise?"



# Steps 4 and 5...



- Step 4-
- List all of your options.
- Then, for each attribute, assign a score from 0-100 to each option.
- 0 can mean bad/low confidence/not applicable/failure/etc. while 100 can mean great/high confidence/guaranteed/etc.

- Step 5-
- Enter your results into the spreadsheet.
- Evaluate the scores and data.

- Off to a few practical examples...







# Lessons Learned...

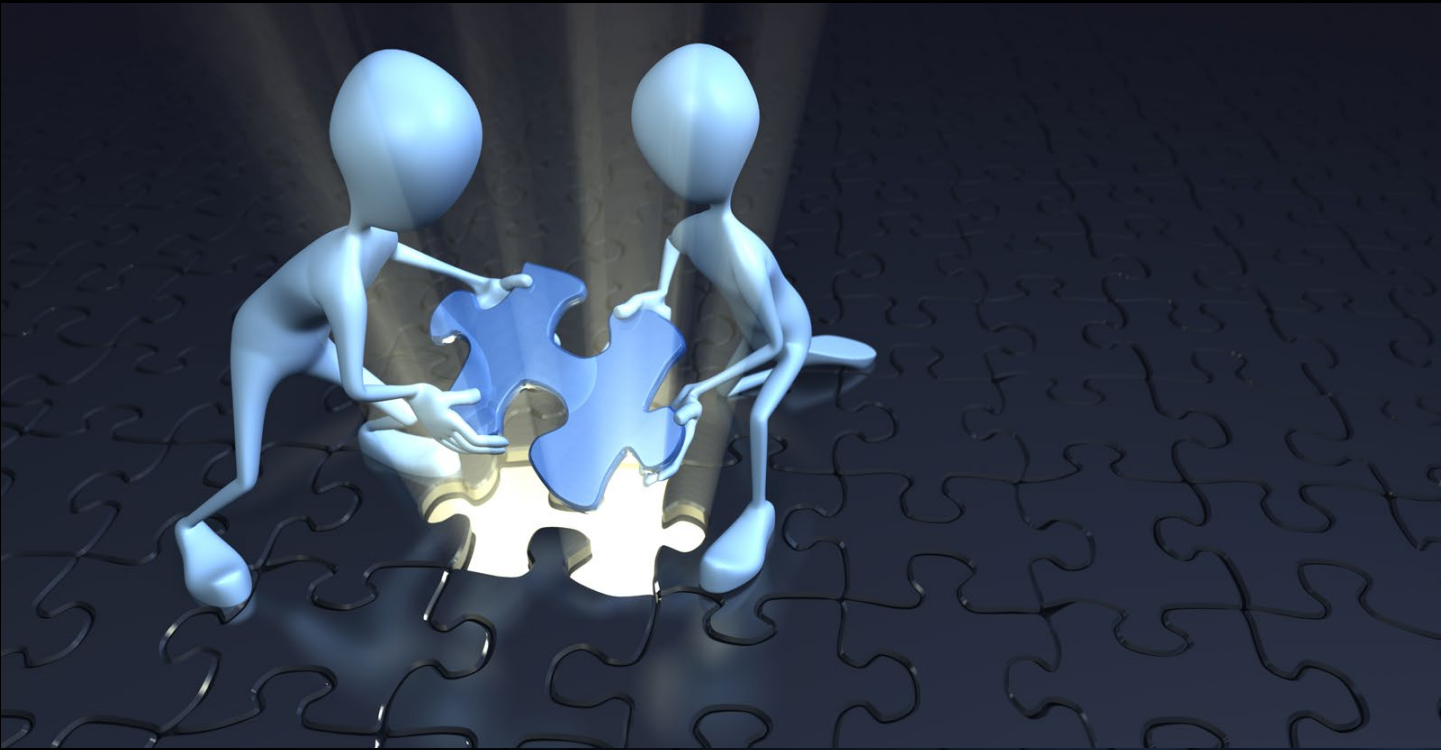
- The best options should be the ones with the highest overall score in the last column.
- Often, there are additional factors that can't easily be included with attributes alone, so the final decision maker should really use this data as good advice.
- Perhaps best of all, you have a defensible document that summarizes which attributes of your decision were important, how they relate to each other, and how each option was scored.



## Lessons Learned (2)...

- When the complexity of the decision increases these decision making tools and techniques can prove useful.
- A decision making matrix is a medium for comparing multiple options when there are also several criteria to consider.
- Not for everyday decision-making...
- Can provide guidance and support to waiver from an organizational or cultural “norm” —use this to open doors change perceptions





**“Standing in the middle of the road is very dangerous; you get knocked down by the traffic from both sides.”**

**Margaret Thatcher**





*Comments or Questions???*  
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