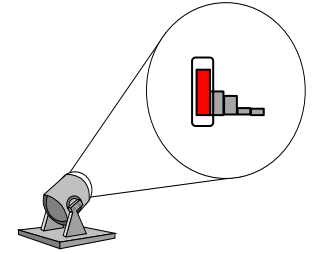


Prioritization Techniques

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Prioritization Techniques



- In this session, we will discuss:
 - Purpose and Use of Prioritization
 - Best way to prioritize and make decisions
 - Quick Tools and Techniques when data is limited
 - Team voting
 - Nominal group technique (ranking)
 - Effort Impact analysis
 - Pairwise comparisons
 - IPO (prioritization) matrix
 - Pugh concept selection (decision matrix)

Take
Note

- A list of supplemental material and additional practice/review questions for this session are provided at the end of this presentation
- You can download the pdf of this presentation, along with any supporting data files, on the site where you are accessing this course

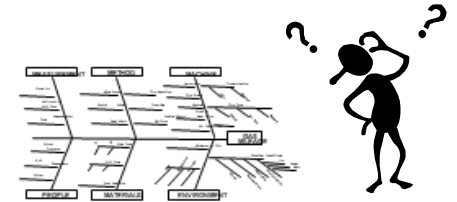
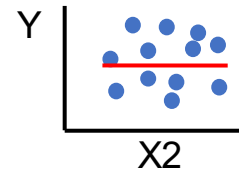
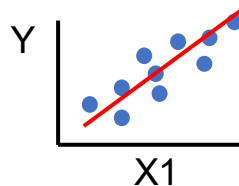
Purpose of Prioritization

- Prioritization is used to help narrow the focus or determine the relative importance of a list of items
- In Lean Six Sigma or Design for Six Sigma, some potential applications include:
 - Reaching consensus on which variables (causes) on the fishbone the team should focus on
 - Deciding which of several solution alternatives provide the best path forward
 - Determining the relative importance of a list of customer requirements
- Using a structured approach for prioritization allows us to:
 - Document the rationale for decisions
 - Help maintain focus
 - Provide opportunity for effective team collaboration
 - Reduce emotion and bias from the decision-making process

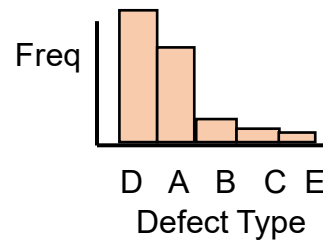
Best Way to Prioritize (Data . . . Data . . . Data)

- Graphical and statistical analysis of data

- Scatter plots

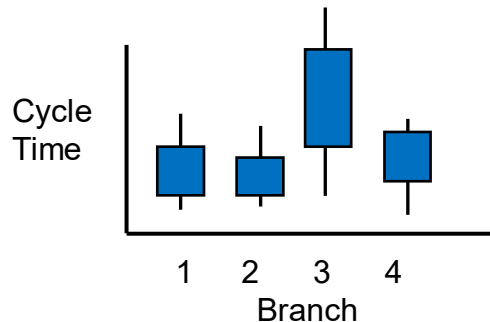


- Pareto charts



“Show me the Data”

- Box Plots



For video instruction on generating various graphical analyses, go to:
<https://airacad.com/our-insights/training-videos/spc-xl/>

- Statistical analysis such as hypothesis tests, multiple regression, and design of experiments (DOE)

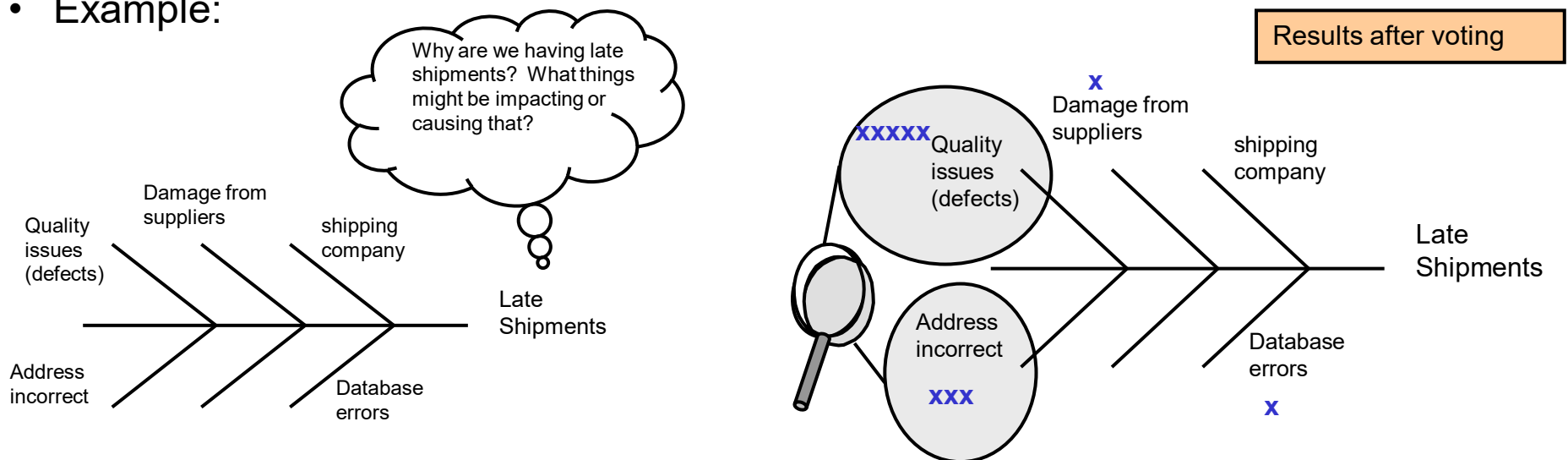
- When data is unavailable, or limited, there are several quick tools that can be used. These can provide a jump start and help organize information gathered.



Multi-Voting

- Helps to separate the “vital few” from the “trivial many” on a large list of items
- How it's done:
 - Give all team members a certain number of votes
 - Rule of Thumb: $\# \text{ votes} = \frac{n}{3}$ (where n is the number of items to be voted on; round up)
 - Voting is done individually for the items, based on process knowledge and experience, that should have the highest priority for attention
 - Focus on the items (variables, causes, etc.) with the highest number of votes

- Example:



Nominal Group Technique (Ranking)

- This technique can be applied on its own, or sometimes after voting is used to pare a list down to a more manageable starting number
- How it's done:
 - Each person in the group rank orders the set of causes (or items), from 1 to n where n is the number of items in the list
 - 1 is the first choice, 2 is the second choice, and so on
 - When finished, sum the rank orders for each item and rank by the total sums
 - The lowest overall total represents the highest ranked item

- Example:

Nominal Group (Ranking)		Your Name:	
		Project Name/Date: Late Shipments	

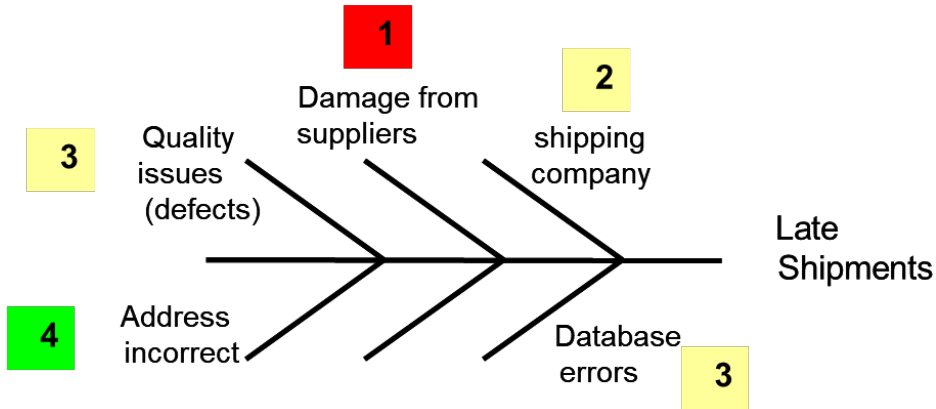
Effort / Impact Analysis

- Effort / Impact Analysis is another tool to help rapidly identify causes or ideas to help with prioritization
- How it's done:

- For each cause or idea, assess
 - the level of effort required to address or implement (low, high)
 - the impact on the desired result (low, high)
- Summarize using a 4 quadrant grid
 - 1 = Low Impact, High Effort
 - 2 = Low Impact, Low Effort
 - 3 = High Impact, High Effort
 - 4 = High Impact, Low Effort

		Impact	
		Low	High
Effort Required	Low	2	4
	High	1	3

Examples



		Impact	
		Low	High
Effort Required	Low	ball type base stability hold time	operator variation (SOPs) meas process pull back angle
	High	statapult supplier	operator eyesight

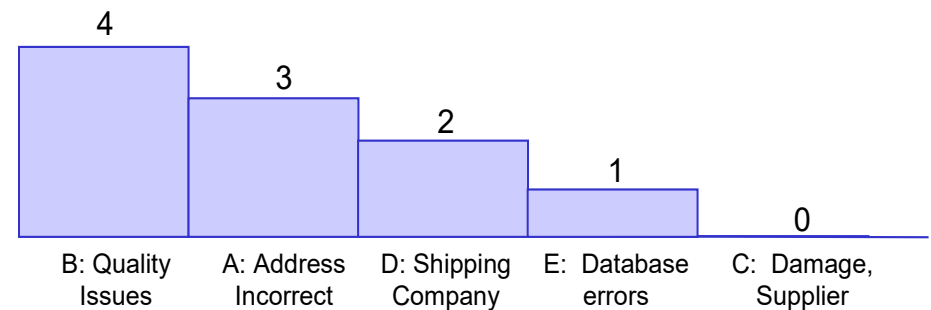


Pairwise Comparison

- Pairwise comparison is another tool to help rapidly identify causes or ideas to help with prioritization
- How it's done:
 - List each item in the first column and the first row of a table (as shown below)
 - For each "pair" of items, identify which item takes priority and record the letter of the "winner".
 - Ask: "If we could only work on one or the other, which would it be? Which has higher priority?"
 - For comparing customer requirements, ask: "Of these two requirements, which is more important to you?"
 - Sum the number of occurrences of each letter (item) in the matrix and display as a Pareto chart

Example:

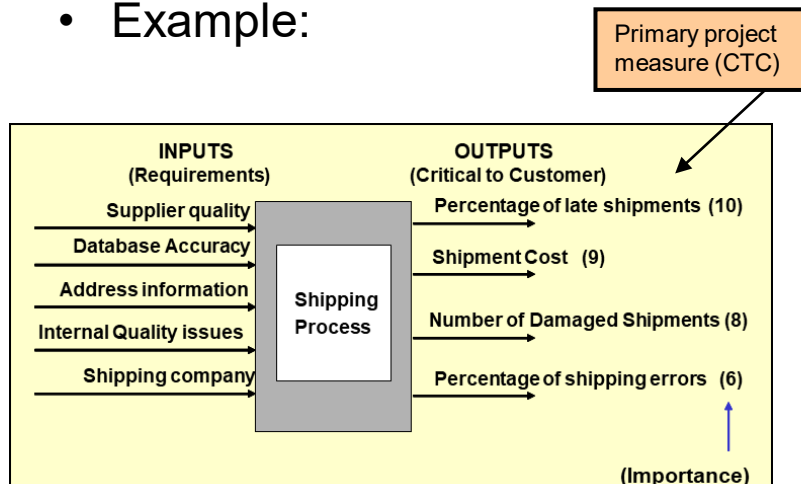
	A: Address Incorrect	B: Quality Issues	C: Damage, Supplier	D: Shipping Company	E: Database errors
A: Address Incorrect	×	×	×	×	×
B: Quality Issues	B	×	×	×	×
C: Damage, Supplier	A	B	×	×	×
D: Shipping Company	A	B	D	×	×
E: Database errors	A	B	E	D	×



IPO (Prioritization) Matrix

- The IPO matrix is also sometimes referred to as a “cause and effect” matrix
- How it's done:
 - List inputs (causes, solutions, etc.) in the first column
 - Place outputs (effects, customer CTCs, etc.) across the top row
 - Assign an importance to the outputs using a 1-10 scale (higher numbers are more important)
 - Assess the relationship between each input and output using a 0,1,3,9 scale (0 = none, 1 = weak, 3 = moderate, 9 = strong)
 - Calculate the weighted sum for each input by multiplying across the rows (importance rating x relationship score) and summing across

• Example:



IPO MATRIX						
Example: Where should we focus?						
PROCESS INPUTS		Critical to Customer Outputs				Weighted Sum
		Late Shipments (reduce)	Shipment Cost (reduce)	# of Damaged Shipments (reduce)	% of Shipping Errors (reduce)	
List inputs below:	Importance	10	9	8	6	
Supplier Quality		1			1	16
Database Accuracy		9	1		3	117
Address Information		9	1		3	117
Internal Quality Issues		9	1	1	1	113
Shipping Company Used		3	9	9	1	189

IPO (Prioritization) Matrix (Additional Examples)

- Useful for project selection

Example decision criteria					
	High ROI ()	Doable in 2-4 months ()	Resource Availability ()	Apply across business ()	
Process "Inputs"					Weighted Sum
Project #1					
Project #2					
Project #3					
Project #4					
Total:					

- Useful when deciding between multiple solution options

Example decision criteria					
	Low Cost ()	Use existing resources ()	Easy to Implement ()	Improve Cycle Time ()	
Process "Inputs"					Weighted Sum
Solution #1					
Solution #2					
Solution #3					
Solution #4					
Total:					

Pugh Concept Selection (Decision Matrix)

- Developed by Stuart Pugh in the 1980s
- Used to compare alternative design concepts based on design/customer requirements
- Result can be:
 - “Winning” concept / path forward
 - Reduced number of concepts
 - New, hybrid concept (a combination of the alternatives)
 - Highlight of concept strengths and weaknesses

	(baseline concept)	Alternatives listed across first row		
	0			
1 Requirements / Decision Criteria listed in the first column	0	Alternatives compared to the baseline, using scale such as: -1 = meets rqmts worse than baseline 0 = meets rqmts same as baseline +1 = meets rqmts better than baseline		
	0			
	0			
	0			
	0			
		4 Totals computed for each alternative		



Data file: Prioritization and narrowing focus tools.xlsx
(Pugh Decision matrix tab)

Pugh Concept Selection - Example

Requirements	(Baseline) Use a shovel (myself)	Hire Neighbor Kid	Use Snow- blower	Hire a Service
Low Effort / Exertion	0	+	+	+
Environmentally friendly (low ppm emissions)	0	0	-	-
Convenient (whenever needed)	0	-	0	-
Low Recurring Cost	0	-	-	-
Effectiveness of Clearing	0	-	+	+
Fast (minutes)	0	-	+	+
Total	0	-3	+1	0

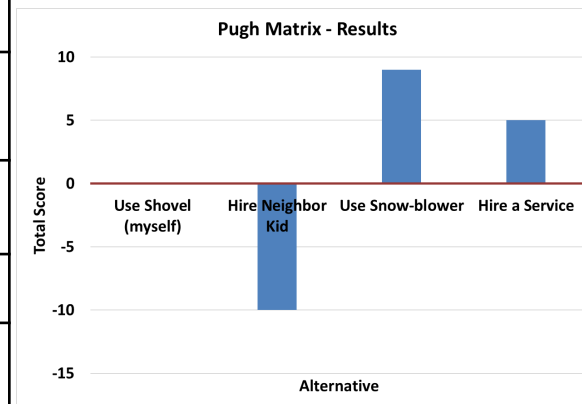
Scale

- + Meets requirement better than baseline
- 0 Meets requirement the same as baseline
- Meets requirement worse than baseline

Pugh Matrix Variation (Adding Weights and/or Detailed Scoring)

- Weighted Pugh (use a 1-5 scale to weight the requirements when not equally important)
- Detailed Pugh (use -3 to +3 to add more discrimination to the comparisons)
- Weighted + Detailed
- Example using a weighted and detailed Pugh for the snow clearing example

Requirements	Weight	(Baseline) Use a shovel (myself)	Hire Neighbor Kid	Use Snow- blower	Hire a Service
Low Effort / Exertion	5	0	+2	+2	+3
Environmentally friendly (low ppm emissions)	2	0	0	-2	-3
Convenient (whenever needed)	4	0	-2	0	-1
Low Recurring Cost	5	0	-2	-1	-3
Effectiveness of Clearing	4	0	-2	+2	+3
Fast (minutes)	3	0	-1	+2	+2
Totals		0	-19	+15	+8





Key Takeaways



- As a review, you may want to pause the video at this point and summarize the key learnings from this session, at least from a high-level view. When you are finished, resume the video.

Key Takeaways

- Always use **data**, whenever possible, to help focus attention and prioritize
 - Graphical analysis : scatter plots, pareto charts, box plots
 - Statistical analysis: hypothesis tests, multiple regression, designed experiments (DOE)
- In situations where data is limited, or there are many different options or alternatives, some helpful tools for prioritizing include:
 - Multi-voting
 - Nominal group technique (ranking)
 - Effort Impact analysis
 - Pairwise comparisons
 - IPO (prioritization) matrix
 - Pugh concept selection (decision matrix)
- You won't use all of the tools . . . Pick the 1 (or 2) that make the most sense for your particular application
- Using a structured approach helps:
 - Document the rationale for decisions
 - Provide opportunity for effective team collaboration
 - Reduce emotion and bias from the decision-making process

Supplemental Material



- Suggested Reading:
 - ***Lean Six Sigma: A Tools Guide*** by Adams, Kiemele, Pollock and Quan (pp. 241 - 253)
 - ***Design for Six Sigma: The Tool Guide for Practitioners*** by Reagan and Kiemele (pp. 237 - 242)
 - Air Academy's app: ***Six Sigma Quick Tools***



- SPC XL™ software training tutorials:
 - <https://airacad.com/our-insights/training-videos/spc-xl/>
- The data files for this session can be downloaded from the site where you are accessing this course

Additional Practice / Review Questions



- 1) What are some examples where prioritization is needed?
- 2) When using multi-voting to narrow the focus, what is the rule of thumb for the number of votes that each team member should be given?
- 3) If team members each rank order a list of 5 items from 1 to 5, where 1 represents their highest priority, how do you determine what is overall highest priority item in the list?
- 4) When using an IPO (prioritization) matrix, what scale is used to rate the relationship between the inputs and outputs?
- 5) When using effort/impact analysis, what should be done with items that are “high effort”, “low impact”?

Additional Practice / Review Questions (cont.)



- 6) A Pugh matrix was completed to evaluate the 4 different alternatives (including a baseline concept). Based on the results below, what decision or next steps would you recommend and why?

		concept #1:	concept #2:	concept #3:	concept #4:
Requirements:	Concept Description >>	A (Baseline)	B	C	D
ease of manufacturing		0	-1	1	1
low noise during operation		0	-1	1	1
effective "performance"		0	0	1	1
low maintenance costs		0	1	1	-1
quick to install		0	1	0	1
high reliability		0	-1	1	1
	Count of +1's	0	2	5	5
	Count of 0's	6	1	1	0
	Count of -1's	0	3	0	1
	Total (Sum of Values)	0	-1	5	4

- 7) Suppose you are in the process of buying a new home and have several alternatives you are considering. You plan to use a Pugh decision matrix to help evaluate the alternatives. List at least 10 requirements (decision) criteria you might use. Which of those requirements has higher priority for you/your family?

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