



اجرا و مدیریت پروژه به روش اصول ناب (Lean Project Management)

فصل اول: مفاهیم، اصول و ابزارهای روش ناب (Lean)
بخش هفتم: انتخاب بر اساس سیستم تصمیم گیری مزایا (CBA)

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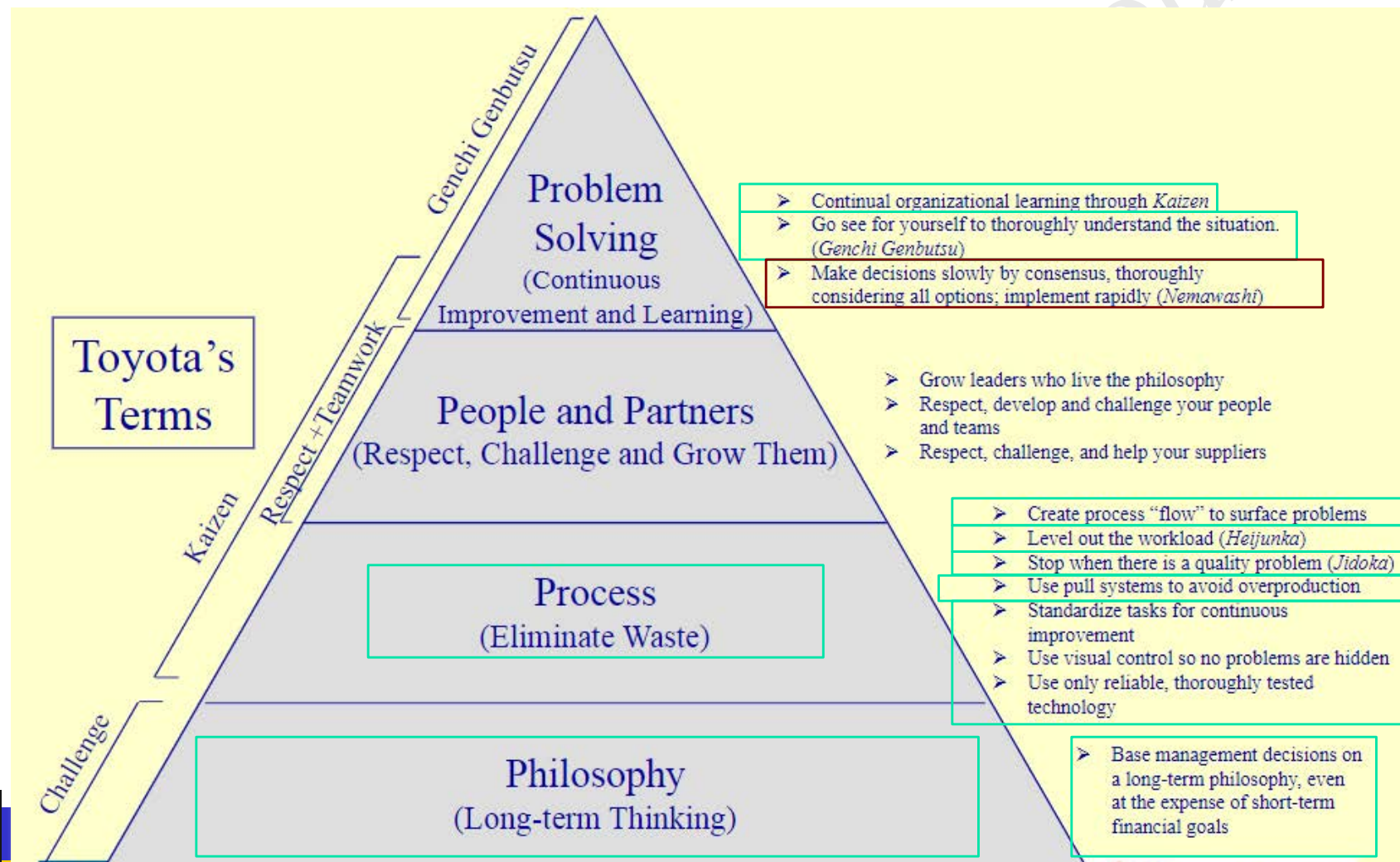
کامبیز کردانی

(M.Sc., PMP)

What we will learn?

- ☐ Decision Making
- ☐ Equal money decision
 - ❖ Two-list method
 - ❖ Complex decisions
- ☐ Unequal money decision
 - ❖ Concept
 - ❖ Mutually exclusive
 - ❖ Non-mutually exclusive

Lean – Principles (4P Model of the Toyota way)

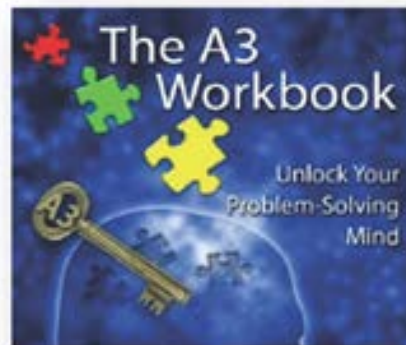


Principle 13

❑ **Term: Make decisions slowly by consensus and implement rapidly**

- ❖ Considers alternatives
- ❖ Discuss problems and potential solutions

❑ **Tool: CBA, A3, and *Nemawashi***



Decision Making

(Introduction)

The pivotal cornerstone principle

**Decisionmakers must learn
and skillfully use sound methods**

The fundamental rule

**Decisions must be based
on the importance of advantages.**

Discovered by Jim Suhr in 1981

Choosing by advantages (CBA)

❑ CBA is ...

❖ A decision making system made holistic by:

✓ Definitions

○ The **definitions** enable **explaining** the principles

✓ Principles

✓ Models

○ The **models** **demonstrate** the principles

✓ Methods

○ The **methods** **apply** the principles

Definitions used in CBA

1. Alternatives:

- ☐ Two or more mutually exclusive plans

2. Factor:

- ☐ Criteria, attributes, advantages, and other types of data.
- ☐ An element of a decision.

3. Criterion:

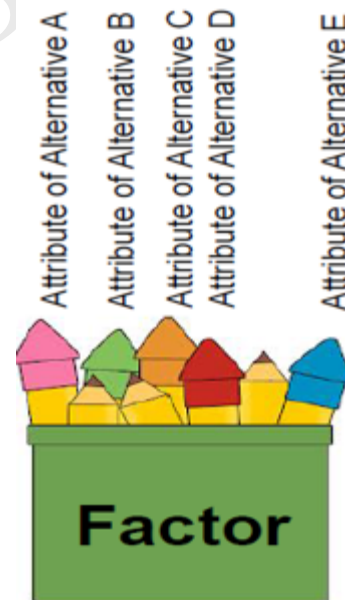
- ☐ A requirement (a must or a want).

4. Attribute:

- ☐ A characteristic, quality, or consequence of one alternative.
- ☐ A fact

5. Advantage:

- ☐ A beneficial difference between alternatives.



Examples used in CBA

1. Alternatives:

- ☐ Orange safety vest or yellow safety vest

2. Factor:

- ☐ Reflectance

3. Criterion:

- ☐ Must reflect maximum light

4. Attribute:

- ☐ Orange has a retroreflected Luminance of 500 while Yellow has Retroreflected Luminance of 300

❖ **Difference in Luminance:** 200 Retroreflected Luminance

5. Advantage:

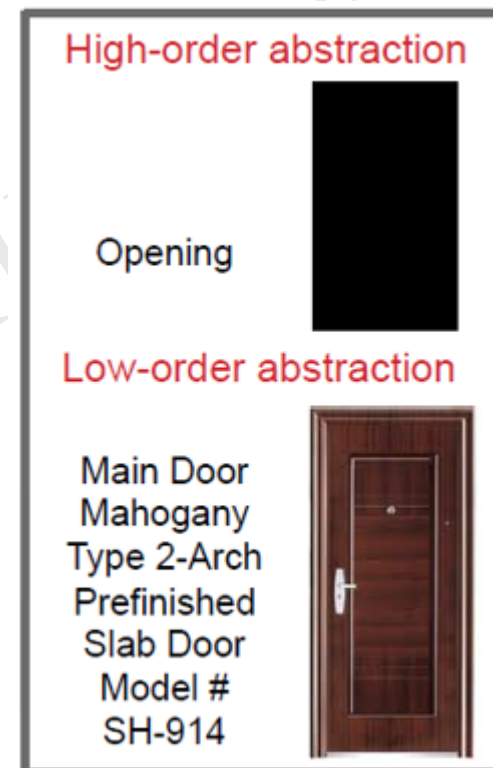
- ☐ Orange has 200 more retroreflected luminance than yellow



A sound decision method will...

❑ Encourage thinking skills:

- ❖ Specifying versus **generalizing**
- ❖ Use of **low-order** versus high-order **abstractions**
- ❖ Use of **relevant facts** rather than **assumptions**
- ❖ Use of **anchored** versus **unanchored** questions and judgements



Example of unsound method

❑ Alternatives X and Y each total 10

❖ Are they equivalent solutions?

❑ Is the **difference in factors** considered?

❑ What do the numbers mean?

❖ Attributes

❖ Percentages

❖ Advantages

❖ Something else?

❑ Is this information **soundly connected** to the facts?

	Alt. X	Alt. Y
Factor A	6	4
Factor B	4	6
Total	10	10

This is an UNSOUND method as shown.

How to make sound decision?

Sound decision

1. Equal money decision

- ☐ Mutually exclusive

2. Unequal money decision

- ☐ Mutually exclusive
- ☐ Non-Mutually exclusive

Equal Money Decision

(Two List Method)

CBA Steps

The CBA is one of the superiors decision-making methods

Why?

See Vide #15

CBA Steps

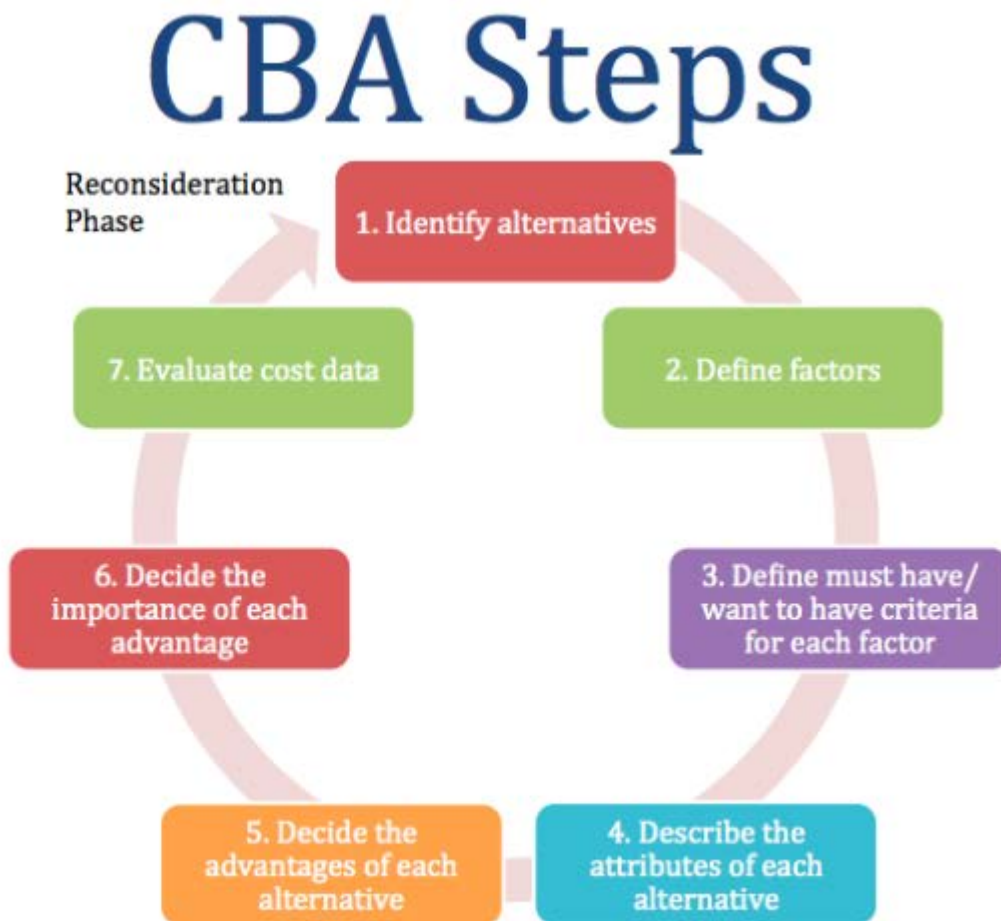
The CBA is one of the superiors decision-making methods

Why?

Read also:

<https://leanconstructionblog.com/why-choosing-by-advantages-is-the-best-available-decision-making-method.html>

CBA Steps



Let's try it...

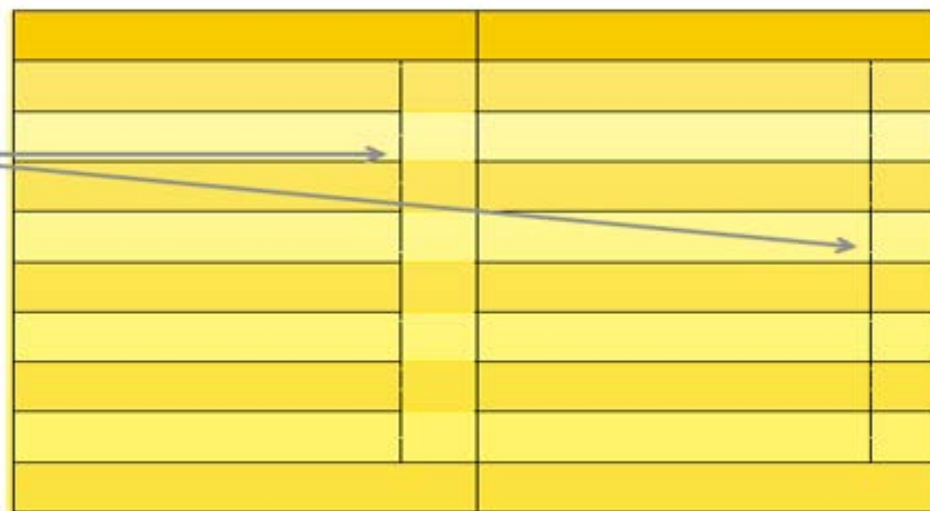
Two list method: Let's try it...

1. Draw the CBA two list format

Two list method: Let's try it...

1. Draw the CBA two list format

Note these lines



Two list method: Identify alternatives

1. Draw the CBA two list format
2. State the alternatives

Orange Safety Vest		Yellow Safety Vest	

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance			

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance		200 less reflective luminance	

You may be tempted to write this phrase also. Should you?

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance		200 less reflective luminance	
No. This is double counting because it states the same difference in luminance from two viewpoints (differing criteria): the viewpoint of "more" and the viewpoint of "less." This is a critical mistake. Since "maximum reflectance" is the criterion, only use a <u>beneficial</u> difference statement that uses the "more" viewpoint.			

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance			
Much more softer mesh		Much more softer mesh	
Again, this is double counting. Only use the <u>beneficial</u> difference statement.			

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance			
		Much more softer mesh	
Much shorter in length			

Two list method: Write all advantages

1. Draw the CBA two list format
2. State the alternatives
3. Perceive
 - i. **Comparable attribute** of each alternative
 - ii. Decide the **least preferred**
 - iii. Write the **beneficial difference** (advantage)
Under the associated alternative

much shorter in length

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance			
		Much more softer mesh	
M		The decision-maker decided a shorter vest was safer and preferred. Advantages are not always increases. Another decision-maker might have preferred a longer vest. It's important to represent the preferences of the <i>correct</i> decision-maker.	
le			

Two list method: Write all advantages

- ☐ Which alternative has the more important set of advantages.
- ☐ Either alternative is possible depending on the decision-maker's preference.
- ☐ The **quantity** of advantages does **not** matter.
 - ❖ Numbers and math do not decide, **people decide.**

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance			
		Much more softer mesh	
Much shorter in length			

So, how to decide?

Two list method: Decide importance of each advantage

5. Decide the **IMPORTANCE** of each advantage by first selecting the paramount advantages to **establish a scale of importance.**

6. **Weight** all advantages on the same scale

Orange Safety Vest		Yellow Safety Vest	
200 more reflect. luminance	10		
		Much more softer mesh	2
Much shorter in length	5		
		1 more pocket	7
15		9	

Let's see how...

Two list method: Weighing importance of advantages

- ❑ This chart is called a **Preference Chart**.
 - ❖ It is useful for **non-numeric quality-based factors**.
- ❑ Assign the **paramount advantage** a weight of **10**.
- ❑ Then, select the **next most important** advantage, and assign it a **weight relative** to the importance of the paramount advantage.
- ❑ Assign a **weight to all advantages**.
 - ❖ It is **possible** to **assign the same weight** to **more than one advantage**.

Scale of Importance	
10	200 more reflective luminance
9	
8	
7	One more pocket
6	
5	Much shorter length
4	
3	
2	Much more softer mesh
1	
0	

Two list method: Example

Example: The following table illustrates an evaluation of two different heating systems in the renovation of an office building:

Attributes	Fan coils only (larger if necessary)	Ceiling Radiant heating (9 to 20 ft high) with fan coils to meet peak demand
Comfort level felt by occupants	Hot air blows throughout the heating period	Radiation first and hot air blow if necessary
		<i>More comfortable</i>
Stability	Hot air heating varies a lot in temperature	Radiant heating keeps the temperature more constant
		<i>More comfortable</i>
Maintenance	At a person's height	At or above a person's height
	<i>Easier</i>	
Installation	At a person's height	At or above a person's height
	<i>Easier</i>	
Noise	Fan noise all the time	Less noise, Fan runs only to meet peak demand
		<i>More pleasant</i>
Risks	Presence of water on the ceiling	Presence of water on the ceiling
	No advantage	No advantage
Architectural integration	In the current volumes on the walls or a little more	In current volumes and on the ceiling
		<i>A little easier to integrate</i>
Cost	1 system to install	2 systems to install
	<i>Cheaper</i>	More expensive

Example by Lucie Parrot, P. Eng. M.Eng., CVS-life, FSA

Equal Money Decision

(Complex Decisions)

Tabular method for complex decisions

☐ Phase 1: Stage Setting Phase

- ❖ Define purpose, circumstances, root cause, appropriate viewpoints, relevant facts, factors, must and want criteria

☐ Phase 2: Innovation Phase

- ❖ Formulate range of alternatives and determine attributes

☐ Phase 3: Decision-Making Phase (Thoughtfully Choosing)

- ❖ Summarize attributes, decide advantages, importance, and total importance

☐ Phase 4: Reconsideration Phase (Emotionally Choosing)

- ❖ Review the decision basis; Form clear, accurate, sensory-rich, motivational perceptions; make commitment to implement

☐ Phase 5: Implementation Phase (Physically Choosing)

- ❖ Implement, check, adjust, evaluate process, learn and share

Tabular method for complex decisions

☐ Use this method when you have ...

- ❖ Two or more alternatives of equal cost
- ❖ Multiple alternatives in **Phase 3** decision-making
- ❖ Too much information to juggle mentally
- ❖ To document a large amount of data
- ❖ Facilitating a complex group decision

Steps of tabular method

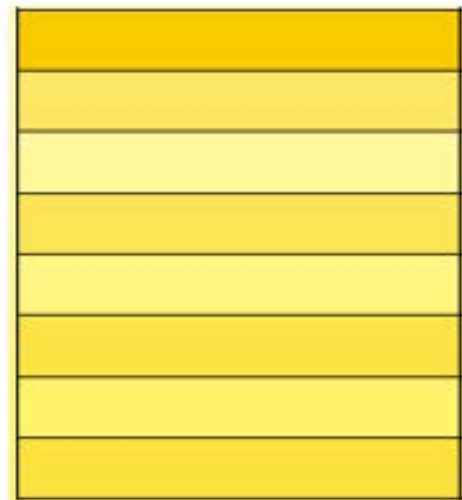
1. Complete **Phases 1 & 2** to identify factors, criteria, etc.
2. Summarize the **attributes**.
 - ☐ Underline the least preferred attribute to decide the **advantage**.
3. Decide the **importance**.
 - ☐ Circle most important advantage.
 - ☐ Select paramount advantage.
 - ☐ Weight all advantages on the **same scale** of importance, **starting with most important**.
 - ☐ Decide importance of remaining.
4. Choose the **preferred** alternative
 - ☐ Sum the **Total Importance (TI)**
 - ☐ Use money data correctly
 1. If **equal cost**, choose greatest TI
 2. If **unequal cost**, chart increments.

	Alternative A		Alternative B	
Factor:				
Criterion:				
Factor:				
Criterion:				
Factor:				
Criterion:				
Total Imp.				

Let's try it...

Steps of tabular method: Let's try it...

- ☐ Draw the CBA tabular format
- ☐ There will be **more to draw** than in the two list format
- ☐ A **spreadsheet works** well
- ☐ Begin by **drawing the rows**.



Steps of tabular method: Let's try it...

- ☐ Next draw the columns.
- ☐ Add the word "Factors" in the first column.

Factors						

Steps of tabular method: Let's try it...

- ☐ Note the dashed lines



Factors						

Steps of tabular method: Let's try it...

1. List the factors.
2. State the “want” & “must” criteria
3. List the alternatives

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style						
Criterion: Want a traditional style						
Factor: Energy						
Criterion: Want energy-efficiency						
Factor: Material						
Criterion: Want wooden mantel						
Total Importance						

Steps of tabular method: Let's try it...

1. List the factors.
2. State the “want” & “must” criteria
3. List the alternatives
4. List the attributes

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	Modern		Traditional		Semi-Traditional	
Criterion: Want a traditional style						
Factor: Energy	6 Therms/year		8 Therms/year		7 Therms/Year	
Criterion: Want energy-efficiency						
Factor: Material	Granite		Wood		Wood + Granite	
Criterion: Want wooden mantel						
Total Importance						

Steps of tabular method: Let's try it...

1. List the factors.
2. State the “want” & “must” criteria
3. List the alternatives
4. List the attributes
5. **Underline the least preferred attribute in each factor**

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style						
Factor: Energy	6 Therms/year		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency						
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel						
Total Importance						

**Why we need
number 5?**

Steps of tabular method: Let's try it...

6. Anchoring always to the least preferred attribute, write the beneficial difference (advantage)

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style			Much more traditional		More Traditional	
Factor: Energy	6 Therms/year		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency	2 fewer Therms/ year				1 fewer Therm/ year	
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel			Much more wood material		More wood material	
Total Importance						

Steps of tabular method: Let's try it...

7. Highlight or circle the most important advantage within each factor row.

NOTE: if you have more than two alternatives, you may have two or more advantages per row

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style			Much more traditional		More Traditional	
Factor: Energy	6 Therms/year		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency	2 fewer Therms/year				1 fewer Therm/year	
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel			Much more wood material		More wood material	
Total Importance						

Steps of tabular method: Let's try it...

8. Decide on the paramount advantage from those highlighted.

❖ When highlighting cells, we use the **circle** to designate the **paramount advantage**.

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style			Much more traditional		More Traditional	
Factor: Energy	6 Therms/year		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency	2 fewer Therms/year				1 fewer Therm/year	
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel			Much more wood material		More wood material	
Total Importance						

Steps of tabular method: Let's try it...

8. Decide on the paramount advantage from those highlighted.

❑ To establish a scale of importance

Assign the **paramount advantage** of an importance score of 10

❖ You can use 100 or 1000

❑ Compare each highlighted most important advantage to the paramount advantage and assign a relative weight

Scale of Importance	
10	2 fewer Therms / Year
9	
8	Much more traditional
7	
6	
5	
4	Much more wood material
3	
2	
1	
0	

Steps of tabular method: Let's try it...

8. Decide on the paramount advantage from those highlighted.

- ☐ Decide the **importance of each remaining advantage** and assign a weight.

Scale of Importance	
10	2 fewer Therms / Year
9	
8	Much more traditional
7	
6	1 fewer Therm / Year
5	More Traditional
4	Much more wood material
3	
2	More wood material
1	
0	

Steps of tabular method: Let's try it...

8. Enter the number representing the relative weight of importance.
9. Sum up the Total Importance (TI)
10. Choose the largest TI

Do you know why some items do not
have numbers?

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style			Much more traditional	8	More Traditional	5
Factor: Energy	<u>6 Therms/year</u>		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency	2 fewer Therms/year	10			1 fewer Therm/year	6
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel			Much more wood material	4	More wood material	2
Total Importance	10		12		13	

Steps of tabular method: Let's try it...

- ❑ The **alternative** having the **greatest Total Importance** **may or may not** contain the **paramount advantage**.

- ❑ The **decision-maker** should **participate** in establishing

1. Factors,
2. Criteria, and
3. Importance

of advantages.

Comparing three fireplace mantels



Factors	Fireplace A		Fireplace B		Fireplace C	
Factor: Style	<u>Modern</u>		Traditional		Semi-Traditional	
Criterion: Want a traditional style			Much more traditional	8	More Traditional	5
Factor: Energy	6 Therms/year		<u>8 Therms/year</u>		7 Therms/Year	
Criterion: Want energy-efficiency	2 fewer Therms/year	10			1 fewer Therm/year	6
Factor: Material	<u>Granite</u>		Wood		Wood + Granite	
Criterion: Want wooden mantel			Much more wood material	4	More wood material	2
Total Importance	10		12		13	

Advantage statement examples

CBA is the elements of communication and organization how document and deliver this to others by message

- | | |
|--|---|
| ▪ Very much more**
_____ | ▪ Very large improvement in
_____ |
| ▪ Much more _____ | ▪ Large Improvement in
_____ |
| ▪ More _____ | ▪ Small improvement in
_____ |
| ▪ Somewhat more _____ | |
| ▪ Much more _____
(quantity difference) | ▪ Large beneficial difference
in _____ |
| ▪ More _____ (quantity
difference) | ▪ Small beneficial difference
in _____ |
| | ▪ Large difference in _____ |
| | ▪ Small difference in _____ |

**NOTE that the word less can be substituted for more if it describes an advantage

Unequal Money Decision

(Concept)

Introduction

- ❑ Previously, we learned about **mutually exclusive alternatives with equal cost**
- ❑ In this section, we will learn about
 1. **Mutually exclusive decisions with unequal costs**
 2. **Non-mutually exclusive decisions with unequal costs**

We will use the tabular method

Unequal Money Decision

(Mutually Exclusive)

Tabular method for unequal money decisions

- ❑ We first consider **mutually exclusive alternatives**
 - ❖ In this scenario, you **must select one or the other**
- ❑ Chart the **Total Importance of Advantages** to Cost for these mutually exclusive alternatives
 - ❖ Do not show **cost** as a factor when establishing advantages



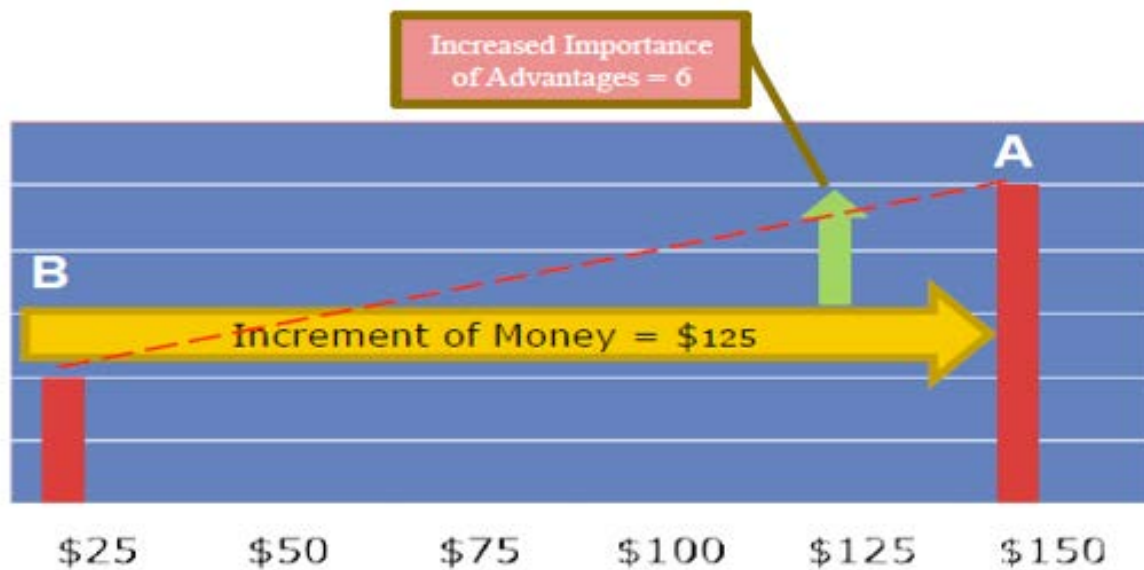
A = \$150



B = \$25

Tabular method for unequal money decisions

- ❑ If you consider **cost at an earlier stage**,
a **different decision** might occur.
- ❑ The **decision-maker decides** whether to
spend the **additional increment of money** to
gain the incremental difference in importance of advantages



Example CBA for mutually exclusive money decisions

- ❑ Our **design team** and the **owner** are concerned about
appearance and **maintainability** of a proposed customer service **seating area**
- ❑ We have three mutually exclusive alternatives:
 1. **Develop detailed drawings and sketches only**
 - ❖ This alternative costs \$0 extra
 2. **Construct a partial physical full-sized model** of the most important details, such as a few different seats and tables
 - ❖ This alternative costs \$25,000 extra
 3. **Construct a complete physical full-sized model** of the seating area, including all types of seats, tables, carpet, and finishes
 - ❖ This alternative costs \$50,000 extra

Example CBA for mutually exclusive money decisions

❑ We will consider three **factors**:

1. Visual appeal

❖ Criterion: Want a modern style

2. Seat physical comfort

❖ Criterion: Want the seats to feel comfortable for 30 minutes

3. Furniture durability

❖ Criterion: Want highly durable furniture

Let's solve it!

Example CBA for mutually exclusive money decisions

1. Draw the table

Example CBA for mutually exclusive money decisions

2. Fill in

- Factors
- Criteria, and
- Alternatives

Factors	Drawings Only		Partial Model		Complete Model	
Factor: Visual Appeal						
Criterion: Want a modern style						
Factor: Seat comfort						
Criterion: Want 30-min seat comfort						
Factor: Durability						
Criterion: Want highly durable furniture						

Example CBA for mutually exclusive money decisions

3. Fill in the attributes of each alternative
4. Underline the least preferred attribute

Factors	Drawings Only		Partial Model		Complete Model	
Factor: Visual Appeal	<u>Judged on paper only</u>		Visual judging of some details		Visual judging of all details	
Criterion: Want a modern style						
Factor: Seat comfort	<u>Cannot be physically tested</u>		Can physically test two seats		Can physically test 10 seats	
Criterion: Want 30-min seat comfort						
Factor: Durability	<u>Judged by specifications</u>		Can physically test 10% of details		Can physically test 75% of details	
Criterion: Want highly durable furniture						

Example CBA for mutually exclusive money decisions

5. Compare other attributes in each factor to the least preferred attribute to decide the advantages and write these into the table.

Factors	Drawings Only	Partial Model	Complete Model
Factor: Visual Appeal	<u>Judged on paper only</u>	Visual judging of some details	Visual judging of all details
Criterion: Want a modern style		Greater ability to judge	Much greater ability to judge
Factor: Seat comfort	<u>Cannot be physically tested</u>	Can physically test two seats	Can physically test 10 seats
Criterion: Want 30-min seat comfort		More extensive test of comfort	Much more extensive test of comfort
Factor: Durability	<u>Judged by specifications</u>	Can physically test 10% of details	Can physically test 75% of details
Criterion: Want highly durable furniture		More extensive test of durability	Much more extensive test of durability

Example CBA for mutually exclusive money decisions

6. Highlight the most important advantage in each factor
7. Circle the paramount advantage

Factors	Drawings Only	Partial Model	Complete Model
Factor: Visual Appeal	<u>Judged on paper only</u>	Visual judging of some details	Visual judging of all details
Criterion: Want a modern style		Greater ability to judge	Much greater ability to judge
Factor: Seat comfort	<u>Cannot be physically tested</u>	Can physically test two seats	Can physically test 10 seats
Criterion: Want 30-min seat comfort		More extensive test of comfort	Much more extensive test of comfort
Factor: Durability	<u>Judged by specifications</u>	Can physically test 10% of details	Can physically test 75% of details
Criterion: Want highly durable furniture		More extensive test of durability	Much more extensive test of durability

Example CBA for mutually exclusive money decisions

8. Assign the paramount advantage of an importance score of 10 (Or 100 or 1000)
9. Compare each highlighted most important advantage to the paramount advantage and assign a relative weight

Scale of Importance	
10	Much more extensive test of comfort
9	
8	
7	Much more extensive test of durability
6	
5	Much greater ability to judge style
4	
3	
2	
1	
0	

Example CBA for mutually exclusive money decisions

10. Decide the importance of each remaining advantage and assign a weight.

Scale of Importance	
10	Much more extensive test of comfort
9	
8	
7	Much more extensive test of durability
6	More extensive test of comfort
5	Much greater ability to judge style
4	
3	
2	More extensive test of durability
1	Greater ability to judge style
0	

Example CBA for mutually exclusive money decisions

11. Sum the Total Importance for each alternative

Factors	Drawings Only		Partial Model		Complete Model	
Factor: Visual Appeal	<u>Judged on paper only</u>		Visual judging of some details		Visual judging of all details	
Criterion: Want a modern style			Greater ability to judge	1	Much greater ability to judge	5
Factor: Seat comfort	<u>Cannot be physically tested</u>		Can physically test two seats		Can physically test 10 seats	
Criterion: Want 30-min seat comfort			More extensive test of comfort	6	Much more extensive test of comfort	10
Factor: Durability	<u>Judged by specifications</u>		Can physically test 10% of details		Can physically test 75% of details	
Criterion: Want highly durable furniture			More extensive test of durability	2	Much more extensive test of durability	7
Total Importance	0		9		22	

Example CBA for mutually exclusive money decisions

12. Develop a **chart** that compares

- ❖ Total Importance of Advantages (Y-Axis)

to

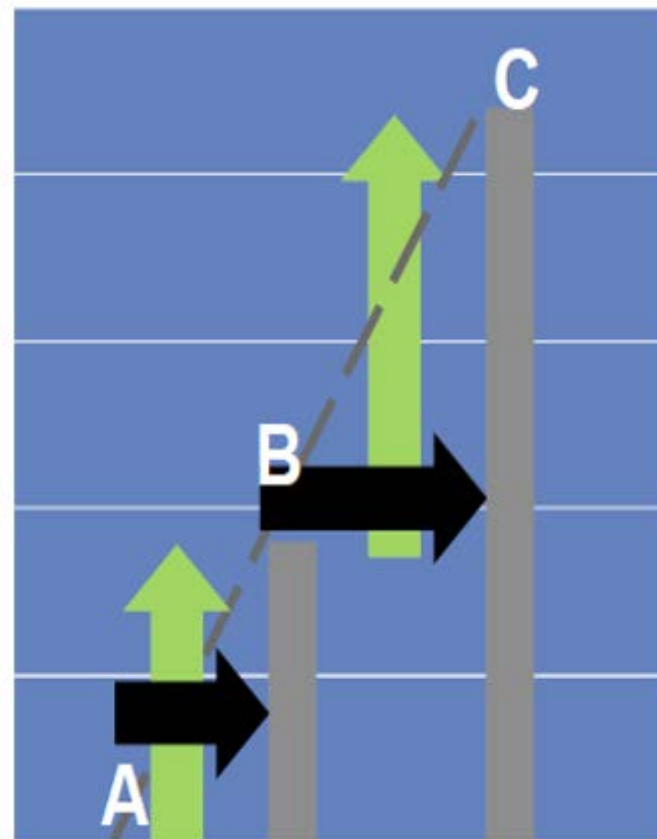
- ❖ Initial Cost (X-Axis)

13. The decision-maker must **decide whether** to

spend the difference in cost (\$25,000) to

achieve the increased importance of advantages (9 or 13)

In CBA, an increment is defined as an increase in cost coupled with an increase, decrease, or no change in total importance of advantages



Unequal Money Decision
(Non-Mutually Exclusive)

CBA methods for non-exclusive proposals

☐ Alternatives:

1. Factor:

- ❖ A container for criteria, attributes, advantages, and other types of data
- ❖ An element of a decision
- ❖ A consideration

2. Criterion:

- ❖ A requirement (a must or a want)
- ❖ A standard on which a judgement is based

3. Attribute:

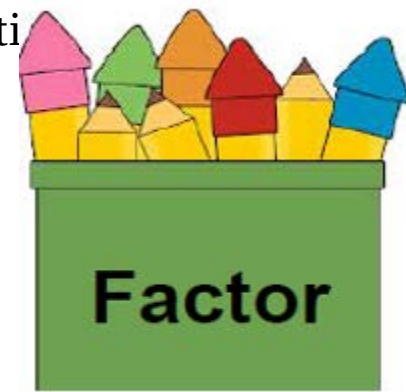
- ❖ A characteristic, quality, or consequence of one alternative
- ❖ A fact

4. Advantage:

- ❖ A beneficial difference between alternatives

5. Proposal

- ❖ Two or more non-exclusive plans



CBA methods for non-exclusive proposals

- ❑ **Non-exclusive** means that proposal can **co-exist**
 - ❖ Ex: You want more square feet but you also want energy-saving features
 - ❖ Ex: You want durability but you also want a pleasant environment
- ❑ CBA methods for **deciding** among **non-exclusive proposals**...
 - ❖ ...do not violate rules as do many other decision-making methods
 - ❖ ...enable sound allocation of **limited funding** when applicable

CBA methods for non-exclusive proposals

- **Example:** You are the owner of a small construction business, and you have a fixed monthly office expenses budget of \$500. You need the following items but cannot afford to purchase them all, so you must prioritize the items.

A. Color inkjet printer
= \$100



B. New window shades to cut down energy bills
= \$200



C. Conference room table for client meetings
= \$400



CBA methods for non-exclusive proposals



- Within any one of the proposals, consider the mutually-exclusive alternatives first
 - ▶ Various brands and features of printers
 - ▶ Various energy ratings for window shades
 - ▶ Various size and quality of conference tables
- CBA methods for non-exclusive proposals help allocate funds so the proposals can co-exist

How do we soundly sequence the selection?

CBA methods for non-exclusive proposals

How do we soundly sequence the selection?

"...arranging the proposals according to importance, with the greatest total importance at the top of the list, would create an irrational bias in favor of large, high cost proposals."

Suhr, Jim (1999). The Choosing By Advantages Decisionmaking System. Westport, CT: Quorum Books, p. 254.



CBA methods for non-exclusive proposals

How do we soundly sequence the selection?

"...arranging them according to cost, with the least cost at the top of the list, would create an irrational bias in favor of small, unimportant proposals."

Suhr, Jim (1999). The Choosing By Advantages Decisionmaking System. Westport, CT: Quorum Books, p. 254.

\$
\$\$
\$\$\$
\$\$\$\$
\$\$\$\$\$

CBA methods for non-exclusive proposals

How do we soundly sequence the selection?

"...the increments must be arranged, within each category, according to their *incremental-importance-to-incremental-cost ratios* ...it maximizes individual and organization performance."

Suhr, Jim (1999). The Choosing By Advantages Decisionmaking System. Westport, CT: Quorum Books, p. 254.

CBA defines this ratio as "**Priority**."

$$\Delta! \quad \Delta\$ \Rightarrow \frac{\text{Change in Importance}}{\text{Change in Cost}}$$

CBA methods for non-exclusive proposals

How do we soundly sequence the selection?

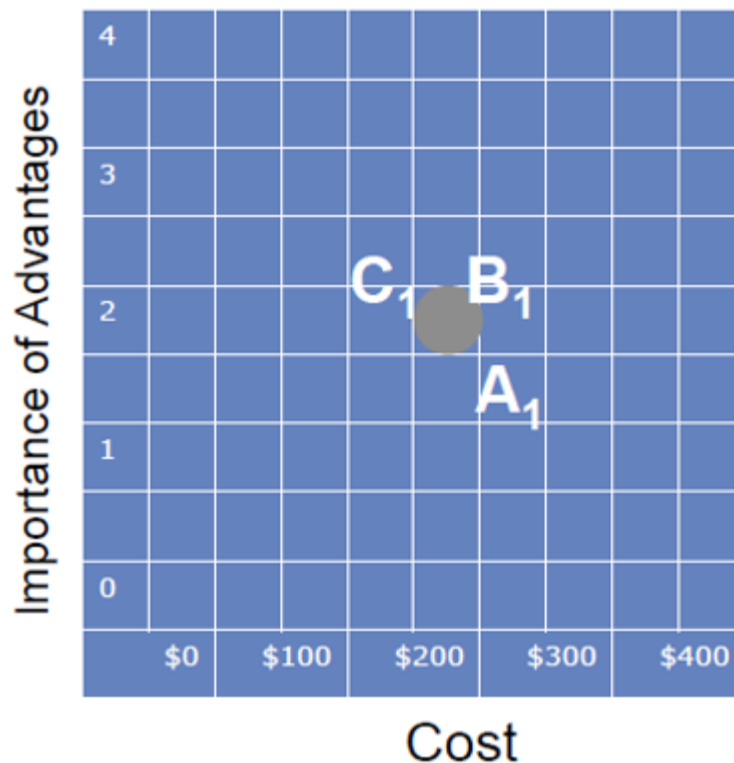
❑ **Two ways:**

1. Graphically showing the map
2. Tabular format by calculating ratios

Graphical format

1. No difference in the importance of advantages
2. No difference in cost

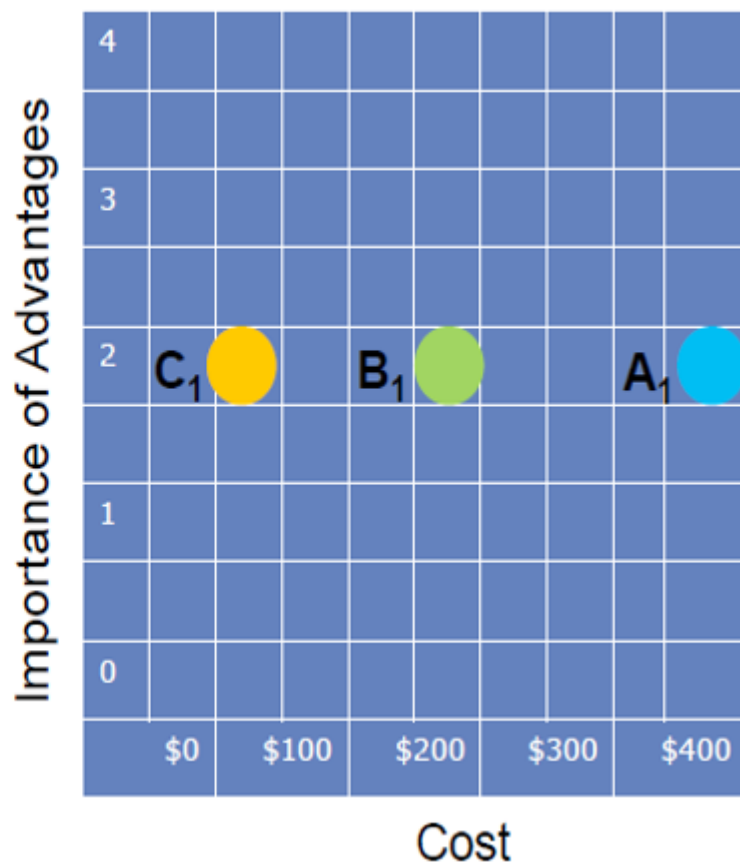
If you had to select **one** from three proposals containing alternatives that had **no difference** in the importance of the advantages or **no difference** in the cost, it wouldn't matter which you chose. *Flip a coin.*



Graphical format

1. No difference in the importance of advantages
2. Difference in cost

If you had to select some of several proposals (they must co-exist) containing alternatives whose every advantage had equal importance to you, but different costs, *you should select based on cost and available funding.*

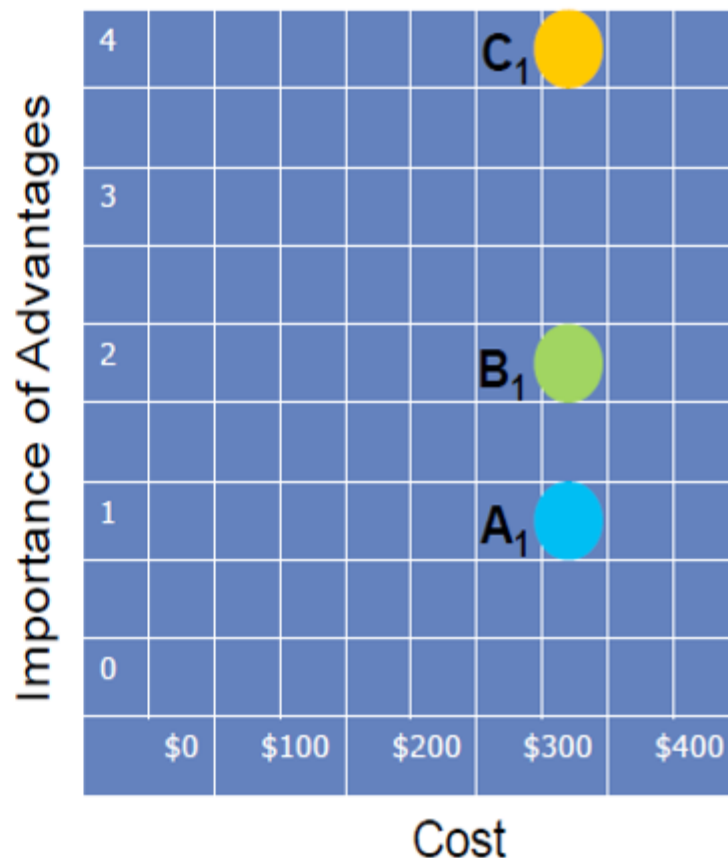


Graphical format

1. Difference in the importance of advantages
2. No difference in cost

If you had to select some of several proposals (they must co-exist) containing alternatives having different Importance of Advantages, but equal costs, you should select based on Total Importance of Advantages and available funding.

Let's see how to solve it!



Graphical format

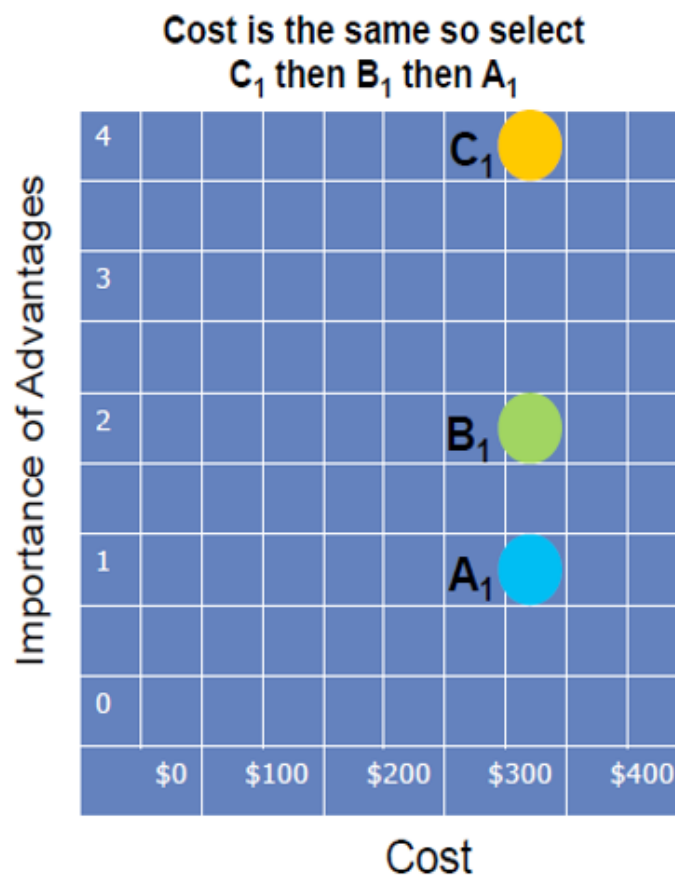
1. Difference in the importance of advantages
2. No difference in cost

STEP 1

Example: Items of Equal Cost

Item	Importance	Cost
C_1	4	\$300
B_1	2	\$300
A_1	1	\$300

The **Priority** of Proposals having equal cost is decided based on the decrease in Total Importance of Advantages



Graphical format

1. Difference in the importance of advantages
2. No difference in cost

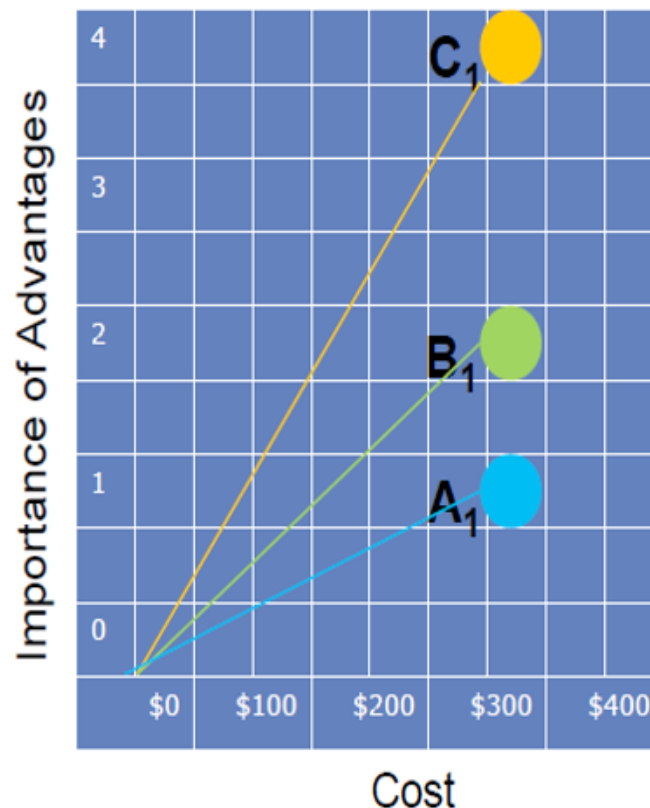
STEP 2

Example: Items of Equal Cost

Note: Subscript 0 means "without item"

Item	Importance	Cost
C_0	0	\$0
C_1	4	\$300
B_0	0	\$0
B_1	2	\$300
A_0	0	\$0
A_1	1	\$300

A characteristic of the increment between "without item" and "with item" is a line whose slope is the ratio of Total Importance to Cost



Graphical format

1. Difference in the importance of advantages
2. No difference in cost

STEP 3

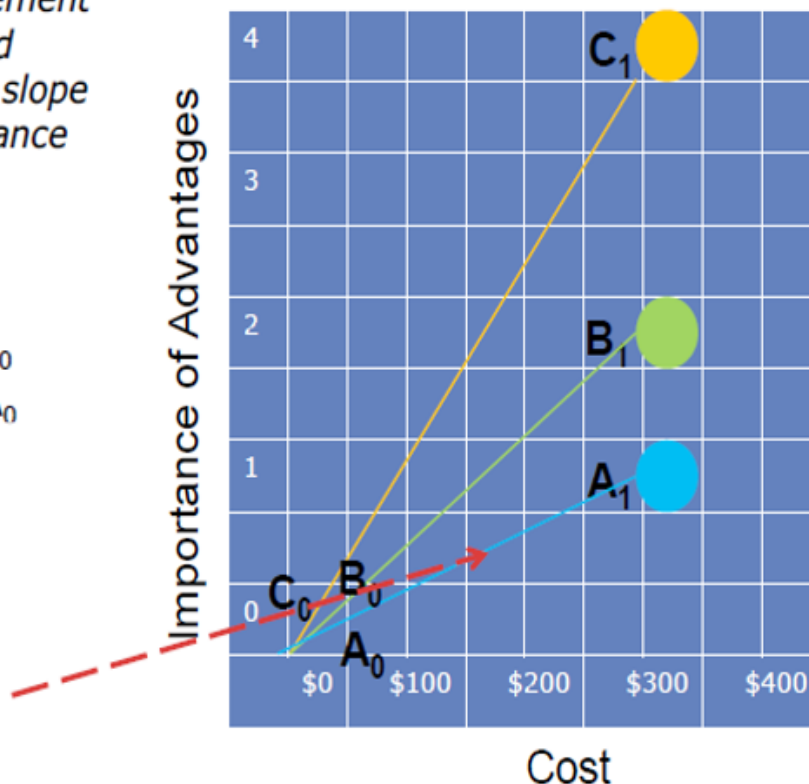
A characteristic of the increment between "without item" and "with item" is a line whose slope is the ratio of Total Importance to Cost

Example:

$$A_1 = \frac{\text{TI of } A_1 - \text{TI of } A_0}{\text{Cost of } A_1 - \text{Cost of } A_0}$$

$$A_1 = \frac{1 - 0}{\$300 - \$0} = \frac{1}{300}$$

Slope of the Line is 1/300



Graphical format

WHAT DO YOU DO IF YOU HAVE UNEQUAL
IMPORTANCE AND UNEQUAL COST?

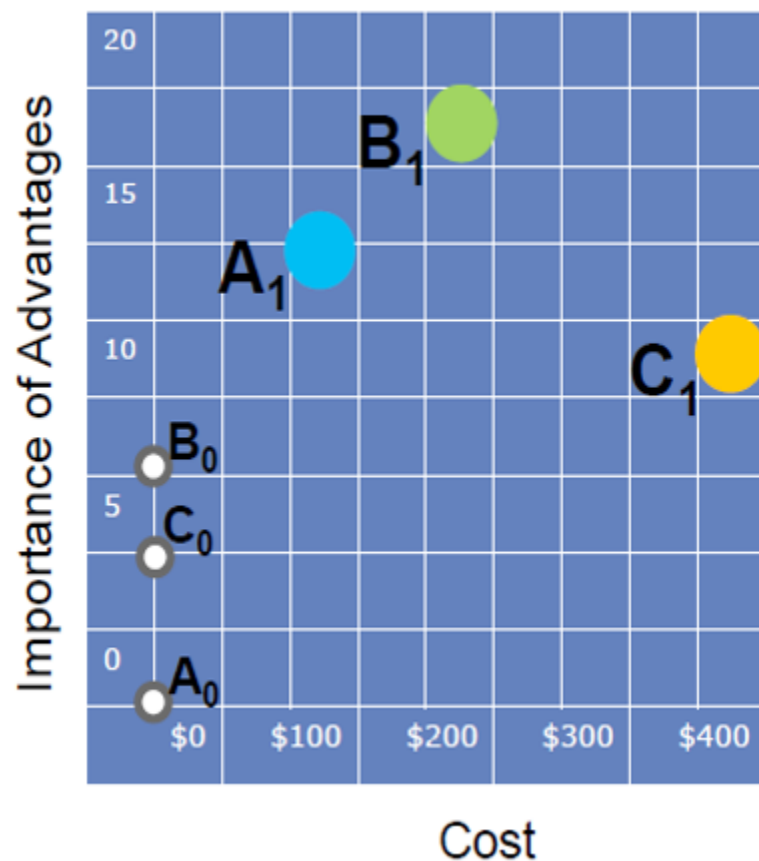


Graphical format

1. Difference in the importance of advantages
2. Difference in cost

If you had to select some of several proposals (they must co-exist) containing alternatives having different Importance of Advantages and unequal costs, you should use a CBA method for Non-Exclusive Proposals having unequal cost.

Let's see how to solve it!



Graphical format

1. Difference in the importance of advantages
2. Difference in cost

STEP 1

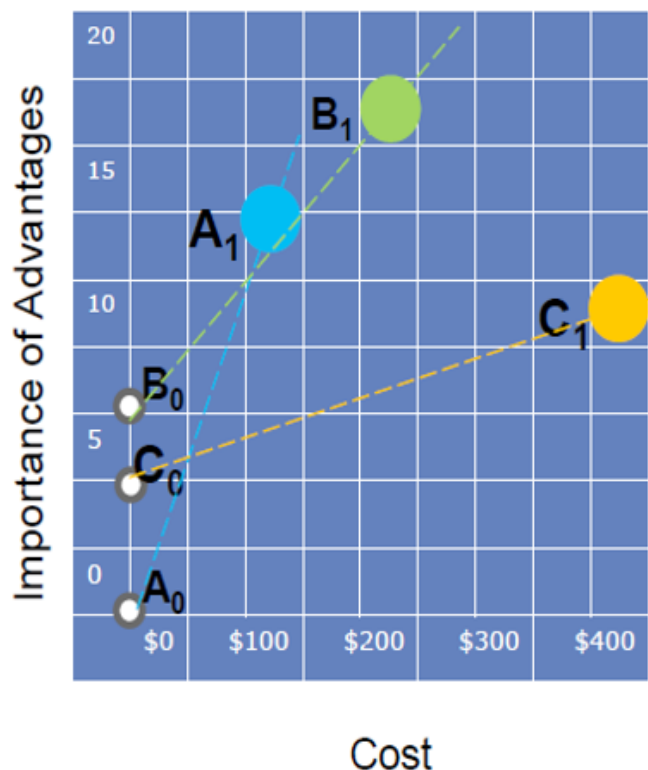
Example: Items of *Unequal* Cost

Note: Subscript 0 means "without item"

Item	Importance	Cost
A ₀	0	\$0
A ₁	13	\$100
B ₀	6	\$0
B ₁	17	\$200
C ₀	4	\$0
C ₁	10	\$400

The slope of each line is the difference in importance ÷ difference in cost. For example:

$$A_1:A_0 \text{ is } (13-0)/(\$100-\$0) = 13/100 = 0.13$$



Graphical format

1. Difference in the importance of advantages
2. Difference in cost

STEP 2

Priority = Incremental

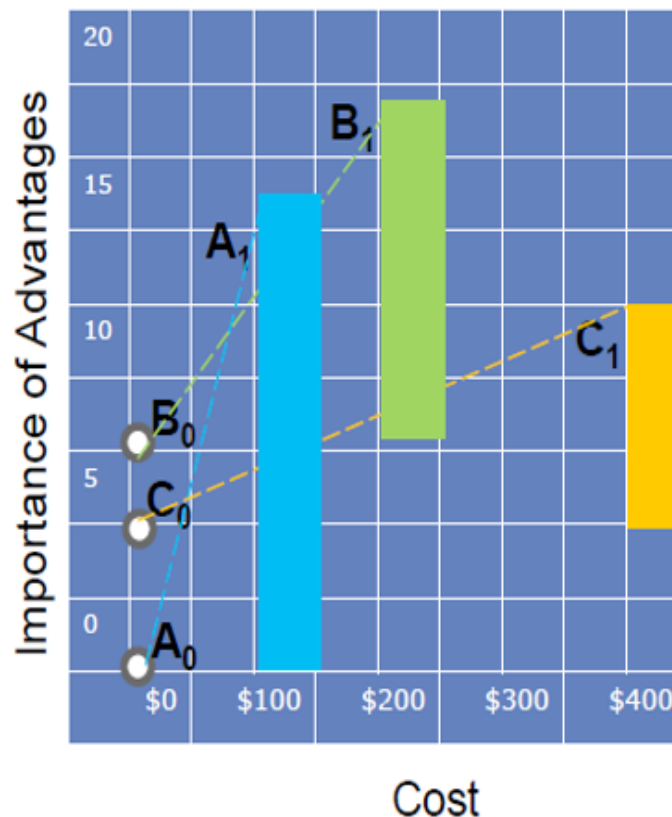
Importance ÷ Incremental Cost

By convention, line slope is $\Delta Y / \Delta X$

Increment	Δ Calculation
Import $A_1 - A_0$	$13 - 0 = 13$
Cost $A_1 - A_0$	$\$100 - \$0 = \$100$
Priority $A_1 - A_0$	$13 / 100 = 0.13$

Import $B_1 - B_0$	$17 - 6 = 11$
Cost $B_1 - B_0$	$\$200 - \$0 = \$200$
Priority $B_1 - B_0$	$11 / 200 = 0.055$

Import $C_1 - C_0$	$10 - 4 = 6$
Cost $C_1 - C_0$	$\$400 - \$0 = \$400$
Priority $C_1 - C_0$	$6 / 400 = 0.015$



Graphical format

1. Difference in the importance of advantages
2. Difference in cost

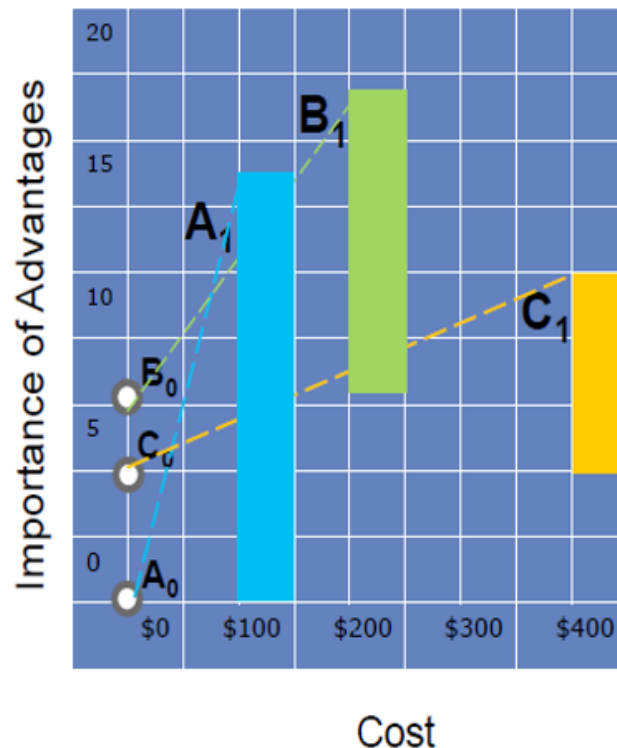
STEP 3

Example: Items of Unequal
Cost

Increment	Priority	Cost Sum
$A_1 - A_0$	0.13	\$100
$B_1 - B_0$	0.055	$\$100 + \$200 =$ \$300
$C_1 - C_0$	0.015	$\$300 + \$400 =$ \$700

1. Order the proposals based on highest priority
2. Accept the proposals from the top down until funds are exhausted

Example: If you have \$500 you can fund A_1 and B_1 ; if you have \$1000, you can fund all three



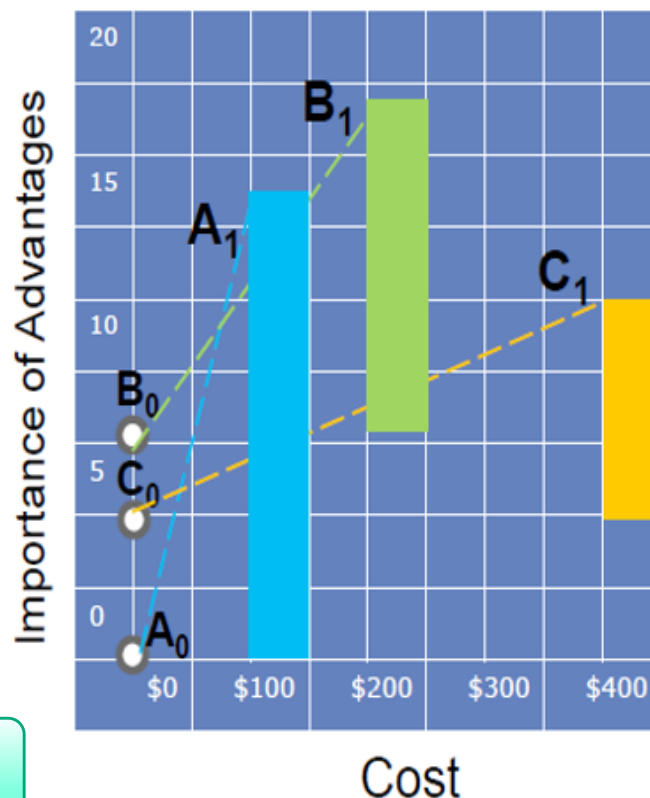
Graphical format

1. Difference in the importance of advantages
2. Difference in cost

STEP 4

(Calculations using "with" minus "without")

Increment	Δ Calculation
Import $A_1 - A_0$	13 (Incremental Importance)
Cost $A_1 - A_0$	\$100 (Incremental Cost)
Priority $A_1 - A_0$	0.13 (Δ Import / Δ Cost)
Import $B_1 - B_0$	11 (Δ Import)
Cost $B_1 - B_0$	\$200 (Δ Cost)
Priority $B_1 - B_0$	0.055 (Δ Import / Δ Cost)
Import $C_1 - C_0$	6 (Δ Import)
Cost $C_1 - C_0$	\$400 (Δ Cost)
Priority $C_1 - C_0$	0.015 (Δ Import / Δ Cost)



Let's solve this with Tabular format!

Tabular format

1. Difference in the importance of advantages
2. Difference in cost

STEP 1

Your Tabular CBA will look like this for each proposal considered
PROPOSAL A: Inkjet printer

Factors	Without Inkjet Printer	With Inkjet Printer
Factor: Print capacity	<u>No print capacity</u>	Prints 25 sheets per minute
Criterion: Want more print capacity		25 more sheets of print capacity
Factor: Print quality	<u>No print quality</u>	Prints 300 DPI quality
Criterion: Want better print quality		Higher print quality
Factor: Convenience	<u>Must go to Fedex Office to print</u>	Can print from my computer
Criterion: Want greater convenience		Much more convenient
Total Importance	0	13
Total Cost	\$0	\$100

Tabular format

1. Difference in the importance of advantages
2. Difference in cost

STEP 2

PROPOSAL B: Window Shades

Factors	Without Window Shades		With Window Shades	
Factor: Comfort	<u>Sun heats up several areas</u>		Shades prevent sun heat gain	
Criterion: Want more physical comfort			Greater physical comfort	10
Factor: Light control	<u>No control over sunlight</u>		Can control sun-light	
Criterion: Want greater control			More control over light	7
Factor: Maintenance	No maintenance required		<u>Monthly maintenance</u>	
Criterion: Want less maintenance	Much lower maintenance	6		
Total Importance	6		17	
Total Cost	\$0		\$200	

Tabular format

1. Difference in the importance of advantages
2. Difference in cost

STEP 3

PROPOSAL C: Conference Table

Factors	Without Conference Table		With Conference Table	
Factor: Material	<u>No wood material</u>		Made of cherry wood	
Criterion: Want a dark wood material			More wood material	1
Factor: Space impact	No space taken		<u>Fills an entire office</u>	
Criterion: Want to limit space impact	Occupies less space	4		
Factor: Convenience	<u>No conference space for clients</u>		Conference space for clients	
Criterion: Want max. convenience			More convenient for meetings	9
Total Importance	4		10	
Total Cost	\$0		\$400	

Tabular format

1. Difference in the importance of advantages
2. Difference in cost

STEP 4

Just like the mutually exclusive proposals, assign the paramount advantage an importance score of 10 (or 100 or 1000)

Compare each highlighted most important advantage to the paramount advantage and assign a relative weight

Scale of Importance	
10	Greater physical comfort (Shades)
9	More convenient for meetings (Table)
8	Much more convenient (Printer)
7	More control over light (Shades)
6	Much less maintenance (Shades)
5	
4	Occupies less space (Table)
3	More print capacity (Printer)
2	Higher print quality (Printer)
1	More wood material (Table)
0	

Tabular format

1. Difference in the importance of advantages
2. Difference in cost

STEP 5

Increment	Δ Calculation
Import A_1-A_0	13 (Incremental Importance)
Cost A_1-A_0	\$100 (Incremental Cost)
Priority A_1-A_0	0.13 (Δ Import / Δ Cost)
Import B_1-B_0	11 (Δ Import)
Cost B_1-B_0	\$200 (Δ Cost)
Priority B_1-B_0	0.055 (Δ Import / Δ Cost)
Import C_1-C_0	6 (Δ Import)
Cost C_1-C_0	\$400 (Δ Cost)
Priority C_1-C_0	0.015 (Δ Import / Δ Cost)

Display of Priorities (sorted by descending priority)					Choose
Increment	Incremental Importance	Incremental Cost	Priority (Δ Imp / Δ \$)	Running Total Cost	
A_1-A_0	13	\$100	$13/100 = 0.13$	\$100	A_1
B_1-B_0	11	\$200	$11/200 = 0.055$	\$300	B_1
C_1-C_0	6	\$400	$6/400 = 0.015$	\$700	C_1

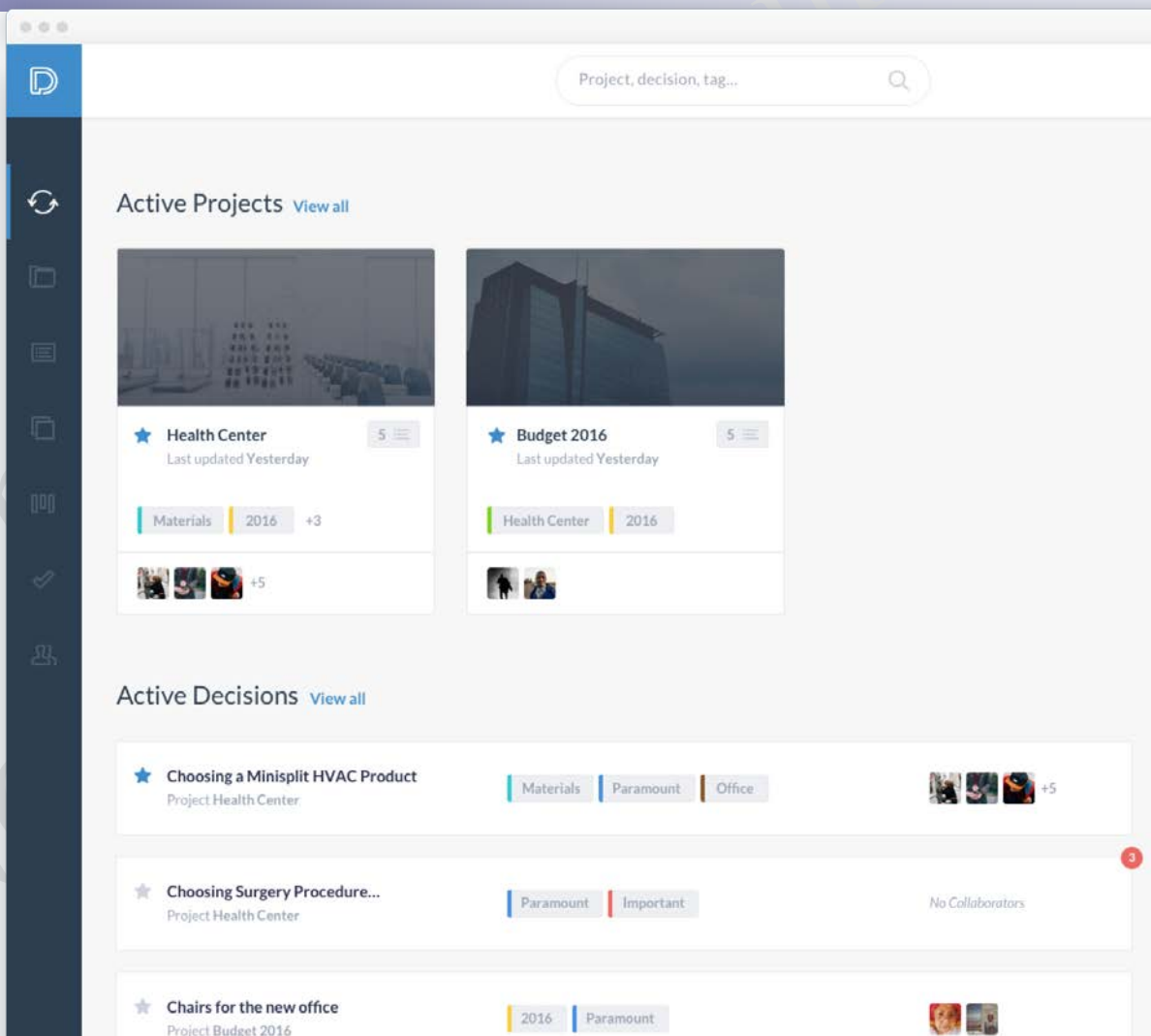
Margin Line



Software

اجرا و مدیریت پروژه به روش اصول ناب (Lean Project Management)
انتخاب بر اساس سیستم تصمیم گیری مزایا (CBA)

<https://paramountdecisions.com/>



CBA – Assignment

ASSIGNMENT 1-7-1:

1. Find the information about the following loaders:
 1. Komatsu WA200PZ-6 Wheel Loader, JRB Coupler, 4 & 1 Bucket, Ride Control
 2. 2012 Volvo L70G Wheel Loader
2. Make a decision using CBA (this is non-exclusive decision)
 - ❖ If you need any assumptions, consider them.
 - ❖ You can use either graphical format or tabular format
3. Send your work (in PDF format) to [**ralavipour@gmail.com**](mailto:ralavipour@gmail.com)

Due on the next week (next week with similar day)



اجرا و مدیریت پروژه به روش اصول ناب (Lean Project Management)

فصل اول: مفاهیم، اصول و ابزارهای روش ناب (Lean)
بخش هشتم: حل مشکل و گزارش دهی بر اساس روش A3

ارائه دهندگان:

سید محمدرضا علوی پور

(PhD, PMP, CMIT)

کامبیز کردانی

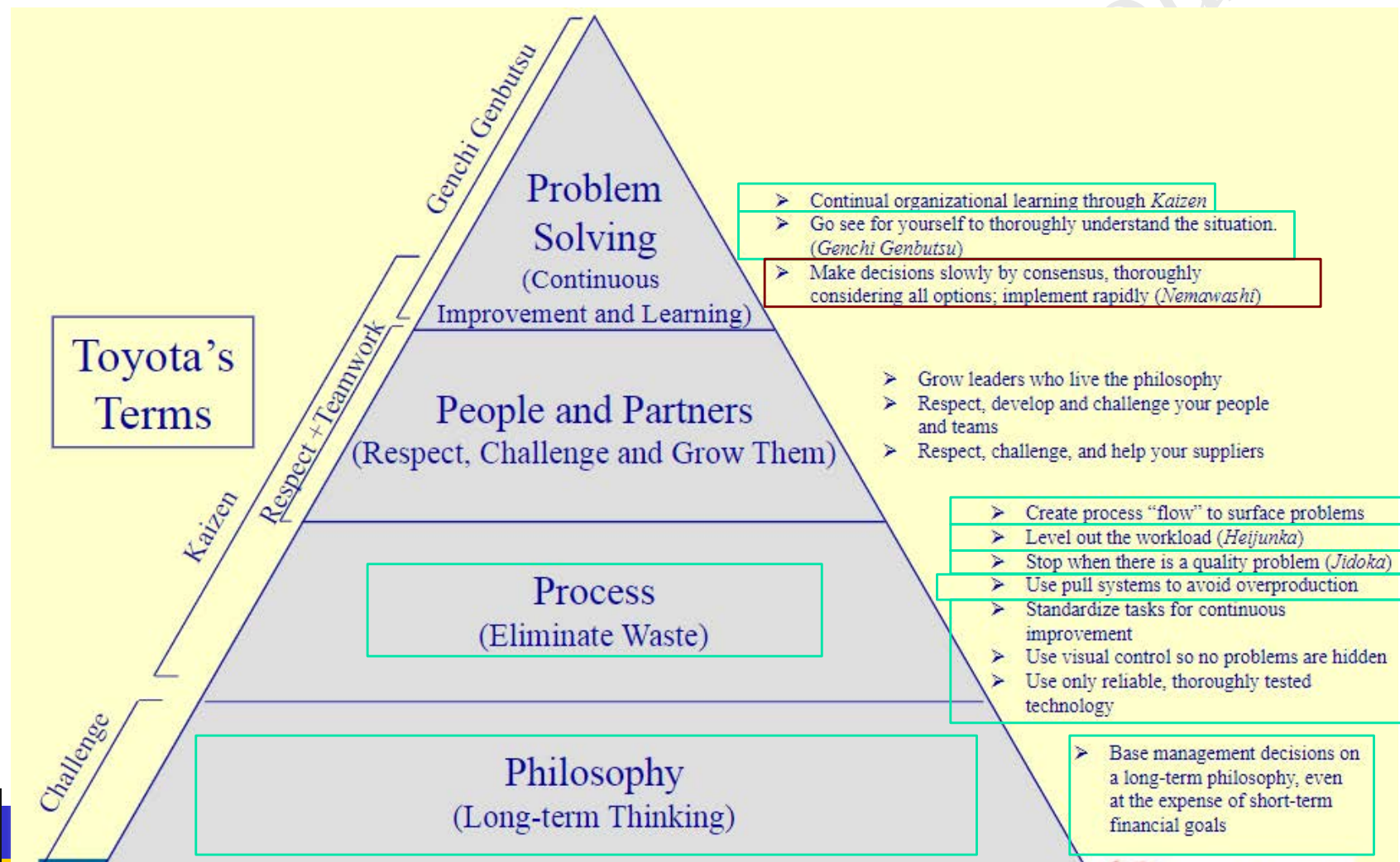
(M.Sc., PMP)

What we will learn?

❑ A3-Decision Making

- ❖ Concept
- ❖ Process understanding
- ❖ Process Implementation – Case Study 1: Format 1
- ❖ Process Implementation – Case Study 2: Format 2

Lean – Principles (4P Model of the Toyota way)

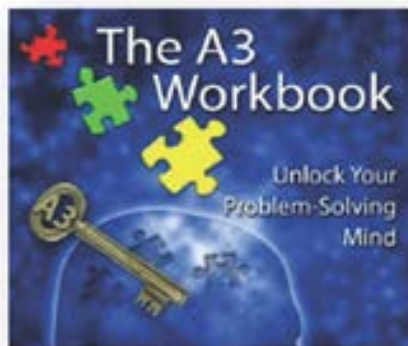


Principle 13

❑ **Term:** Make decisions slowly by consensus and implement rapidly

- ❖ Considers alternatives
- ❖ Discuss problems and potential solutions

❑ **Tool:** CBA, A3, and *Nemawashi*



A3 Decision-Making **(Concept)**

What is an A3 report?

❑ Process used to

relentlessly improve operational performance

❑ Central to this ability is the training of individuals in a **structured problem-solving approach**

❖ The tool used is called the **A3 Problem-Solving Report**

❑ The **A3 report** is a system for **implementing PDCA** management,
which is simple yet **disciplined** and **rigorous**.

❑ The report **used by Toyota** fits on
a **single sheet of A3 paper**,

measuring **approximately 11 × 17 inch**

documents the results of the PDCA cycle in summary form.

What is an A3 report?

- ❑ It has a **template that guides users** in the steps needed to determine the **root causes** of an organization's problems and to **address them systematically**.

*The A3 report **concisely**
describes problems and the available information to*

1. Understand their **ramifications** quickly,
2. Focusing on **improving processes** and
3. Solving the problems

What is an A3 report?

- ❑ The **development of the A3 report** is thought to have been influenced by **Taichi Ohno's** dislike of reports that were **longer than one page**.
- ❑ It must be understood that the **A3 report is not by itself a complete system** for problem solving.

In Toyota's case their success in process improvement **comes from**
collaboration and teamwork.

The A3 report serves as an **information and facilitation tool** to
support a **very practical problem-solving process**.

A3 thinking as practiced by Toyota is based on seven elements (Sobek and Smalley 2008).

Let's see these seven elements!

A3 Decision-Making

(Process Understanding)

Basic steps to the A3 process – Format 1

□ There are 7 basic steps:

1. Step 0: Identify a problem or need
2. Step 1: Conduct research to understand the current situation
3. Step 2: Conduct root cause analysis
4. Step 3: Devise countermeasures to address root causes
5. Step 4: Develop a target state
6. Step 5: Create an implementation plan
7. Step 6: Develop a follow-up plan with predicted outcomes

Basic steps to the A3 process – Format 1

Title of the A3: _____

To: (Approving Person) _____ From: (A3 Author) _____ Date: _____

0. Background and Problem Description				

1. Current Situation				

2. Root Cause Analysis				

3. Countermeasures				
Suspected Cause	Countermeasure	Outcome/Benefit	Action by	Due

4. Target State				

5. Implementation Plan			
What?	Who?	When?	Cost

6. Follow-Up Actions			
Action Item	Responsible	Due	Status / Outcome

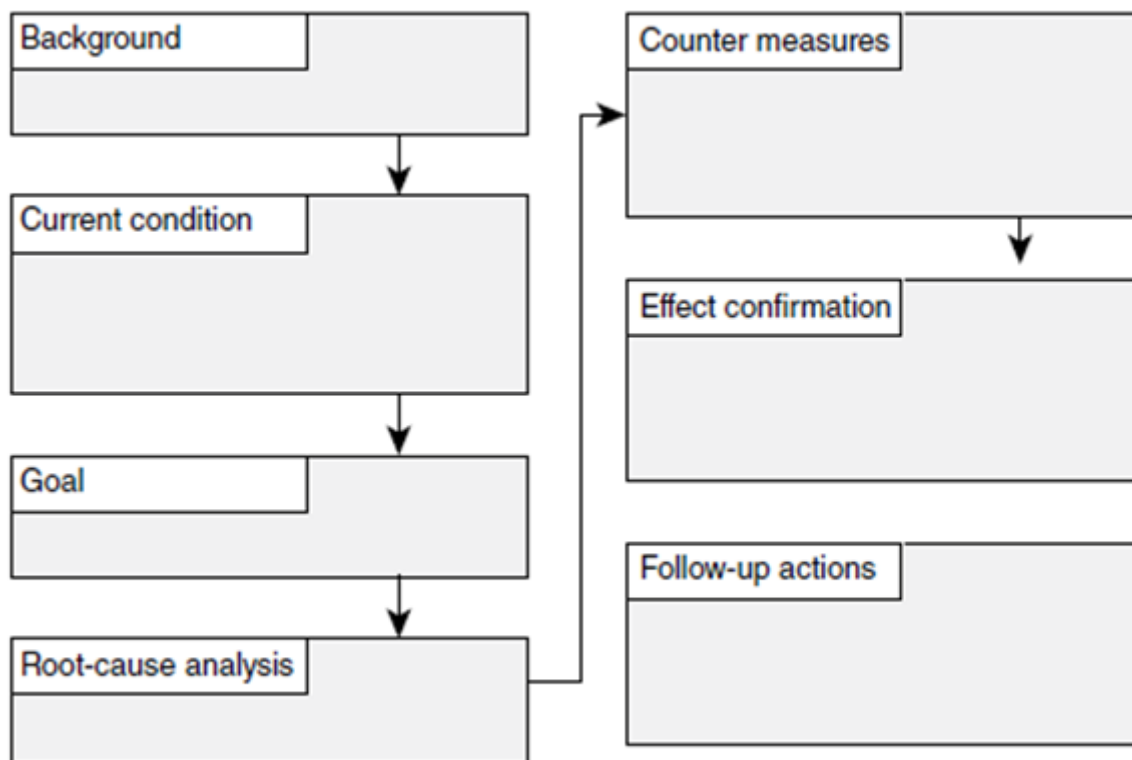
Basic steps to the A3 process – Format 2

❑ Other references may change the process. There can be also the following steps”

1. Background
2. Current condition and problem statement
3. Goal statement
4. Root-cause analysis
5. Countermeasures
6. Check/confirmation of effect (Action plan)
7. Follow-up actions

Basic steps to the A3 process – Format 2

Report theme:



Typical flow of the problem-solving A3 report

Follow-up steps to the A3 process

❑ Four additional steps are followed after developing A3 report:

8. Step 7: Discuss plans with all impacted parties
9. Step 8: Obtain approval for implementation
10. Step 9: Implement plans
11. Step 10: Evaluate the results

What is the difference between A3 and PDCA?

A3 versus PDCA

The A3 process is rooted in the PDCA cycle

- ❑ Overall, the **A3 report** is not considered a **documentation format**,
but really is an **important adjunct** to the informed use of the **PDCA cycle**.
- ❑ **Steps 1-4 and 7-8** of the A3 process incorporate the **Plan** step of PDCA
- ❑ **Steps 5 and 9** of the A3 process incorporate the **Do** step of PDCA
- ❑ **Steps 6 and 10** of the A3 process incorporate the **Check** step of PDCA
- ❑ **Based on the evaluation**
Another problem may be identified and the **A3 process starts again**
Act or Adjust

A3 versus PDCA – Format 1

Title of the A3: _____

0. Background and Problem Description

1. Current Situation

2. Root Cause Analysis

Plan

To: (Approving Person) _____

From: (A3 Author) _____

Date: _____

3. Countermeasures

Suspected Cause	Countermeasure	Outcome/Benefit	Action by	Due

4. Target State

5. Implementation Plan

What?	Who?	When?	Cost

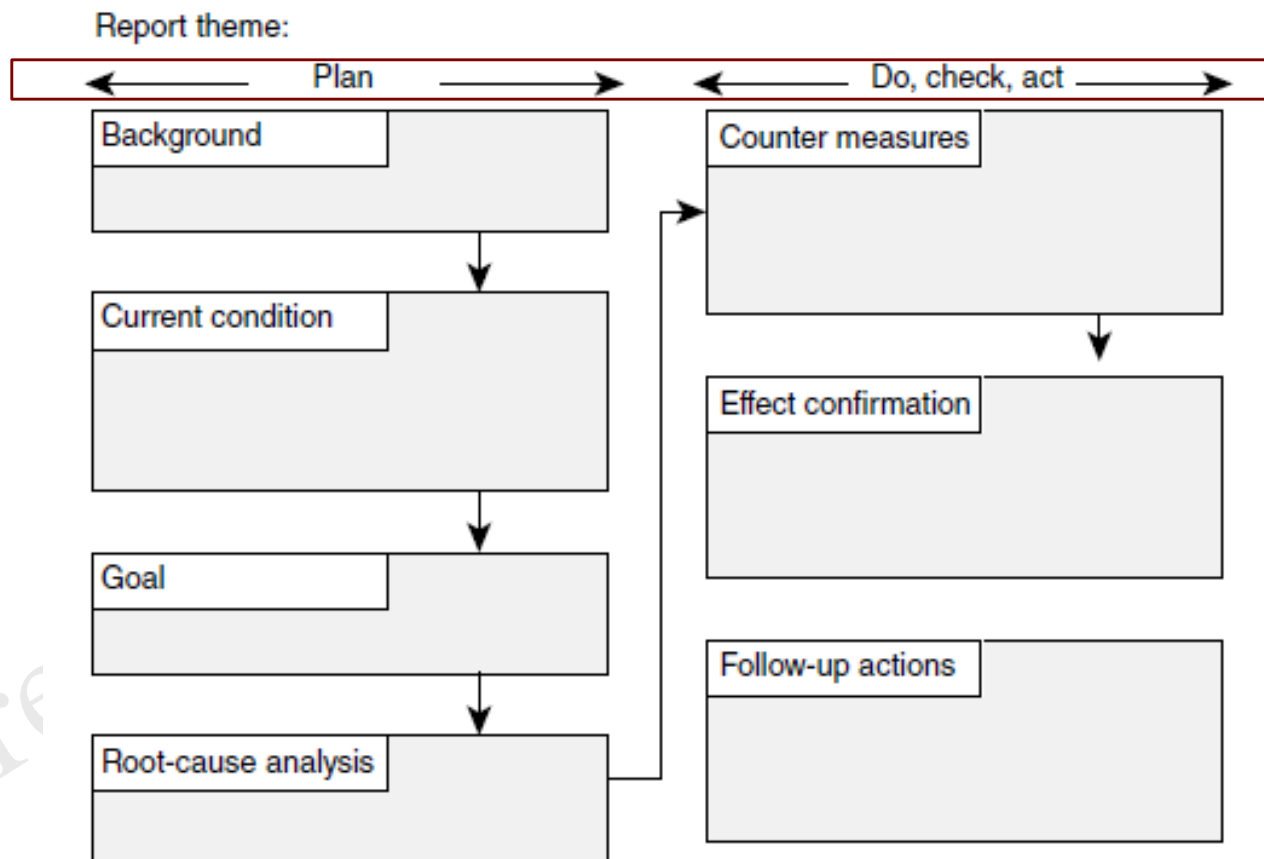
Do

6. Follow-Up Actions

Action Item	Responsible	Due	Status / Outcome

Check

A3 versus PDCA – Format 2



Typical flow of the problem-solving A3 report

Example: Scrap drywall on jobsite



Let's see how to solve it!

A3 Decision-Making

(Process Implementation – Case Study 1: Format 1)

Basic steps to the A3 process – Format 1

□ There are 7 basic steps:

1. Step 0: Identify a problem or need
2. Step 1: Conduct research to understand the current situation
3. Step 2: Conduct root cause analysis
4. Step 3: Devise countermeasures to address root causes
5. Step 4: Develop a target state
6. Step 5: Create an implementation plan
7. Step 6: Develop a follow-up plan with predicted outcomes

Follow-up steps to the A3 process

❑ Four additional steps are followed after developing A3 report:

8. Step 7: Discuss plans with all impacted parties
9. Step 8: Obtain approval for implementation
10. Step 9: Implement plans
11. Step 10: Evaluate the results

Step 0: Identify a problem or need

- ❑ When a **goal or objective** is **not being met**,
you have a problem
- ❑ **Best problems** to work on are those that
arise in **day-to-day work** and prevent you from doing your best

0. Background / Problem

- We have too much scrap drywall on our job
- The job is messy and cluttered
- Our problem is: *How do we reduce the amount of scrap drywall on the job?*

Step 1: Understand the current situation

- ❑ Observe the **work processes**, and document **observation**
- ❑ Create a **diagram** that shows how the work is done now.
- ❑ Quantify the **magnitude** of the problem
 - ❖ Example: % of customer deliveries that are late
 - ❖ Example: # of errors reported per quarter

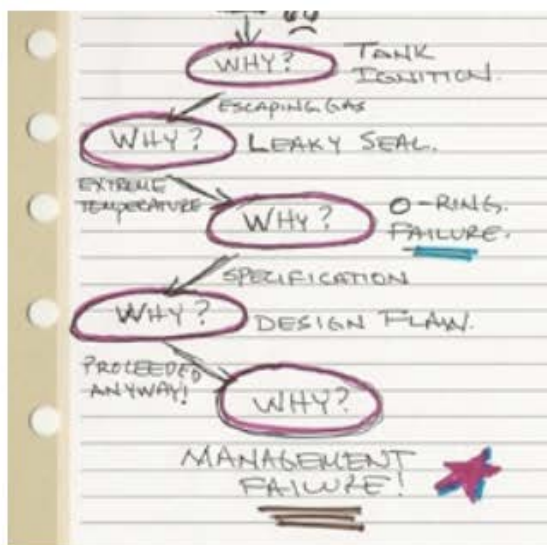
1. Current Situation



Step 2: Conduct root cause analysis

- ❑ Figure out what the **root causes** are to the errors or inefficiency
- ❑ Make a list of the **main problem(s)**
- ❑ Ask the appropriate **“why?” questions** five times or more if needed

2. Cause Analysis



ROOTS

<http://www.fail-safe-network.com/Free/LCA-GoPage/LCA-GoPage.htm>

Respond by freezing evidence	Organize Identify Stakeholders	Order Ask Stakeholders to define the Causes	Translate Learning's	Sustain the LCA Effort
Obtain the "5 Items" • Statement • Schematic • Relationship • Summary Sequence • Oddities List the 3 Ps to Gather • People Evidence • Physical Evidence • Paper Evidence Gather Evidence	Identify Stakeholders by asking "Who needs to see the evidence?" Specific: Measurable Actionable	Share summarized evidence with the Stakeholders. Ask Stakeholders to define: • Physical Causes • Human Causes • Organizational Latent Causes • Personal Latent Causes Ask Stakeholders to define	Construct a WHY Tree to summarize learning's. Write a report, using standard template . Create a summarized translation to share with the remainder of the	Share your effort with the Mother-Source at your site. Trend Latent Causes from Maxi, Midi and Mini-LCA's. Address Common Latent Threads Annually

Step 3: Develop Countermeasures

- ❑ **Specify** the outcome, content, sequence, and tasks
- ❑ **Create** clear and direct connections between requestors and suppliers of goods and services.
- ❑ **Eliminate** loops, workarounds, and delays

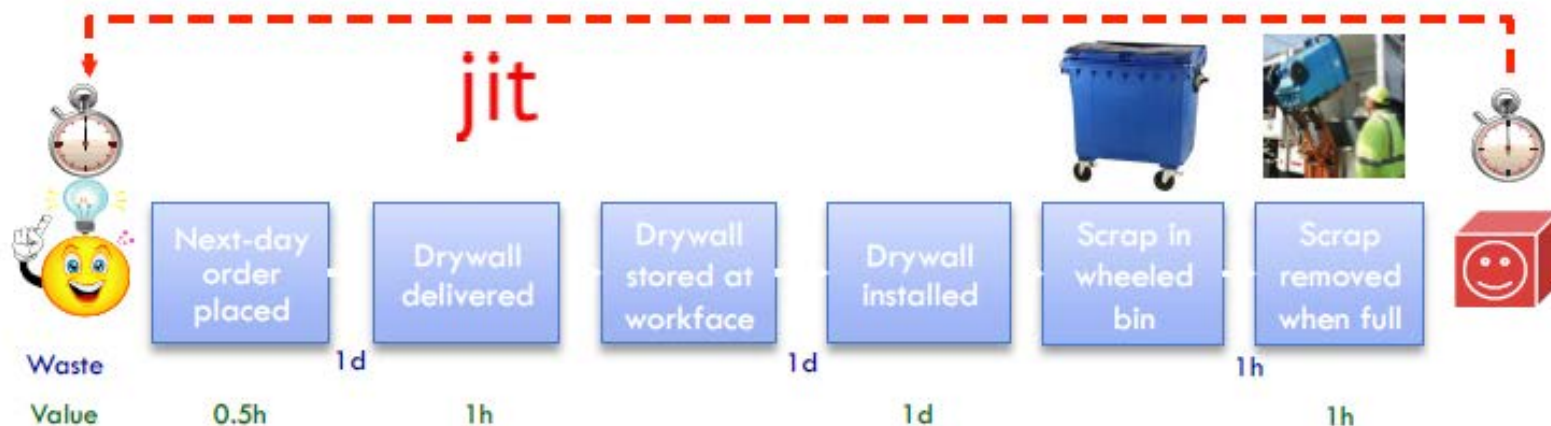
3. Countermeasures

Cause	Countermeasure	Outcome/Benefit	Action By
Must backorder	Find more suppliers	More sources	Foreman
Must store	JIT delivery	Reduce damage	Foreman
No bin for scrap	Scrap in wheeled bin	No piles	Labor
Random clean	Dump bins when full	Save 4h cleanup	Labor

Step 4: Develop a Target State

- ❑ A **target condition** is the new way of getting the work done
 - ❖ It describes **how the work** will **get done** with the **proposed countermeasures** in place.

4. Target State



Step 5: Create an Implementation Plan

- ☐ Should include a **list of the actions** that need to **be done** to get the **countermeasures** in place and realize the **target**.
- ☐ Should identify the **individual responsible** for each task and a **due date**
- ☐ **Other relevant items**, such as cost, may also be added.

5. Implementation Plan

What	Who	When	Cost
Solicit more suppliers	Logistics Manager	Apr. 30, 2012	None
Review JIT proposals	Project Manager	May 15, 2012	None
Approve suppliers	Log/P. Manager	May 30, 2012	Varies
Purchase wheeled bins	Foreman	Apr. 30, 2012	\$1000
Train workers on rules	Foreman	Apr. 30, 2012	None

Check

Step 6: Develop a Follow-up Plan

- ☐ A critical step in **process improvement**
- ☐ Makes sure the implementation plan was **executed**

Target condition **realized**, and
expected results **achieved**.

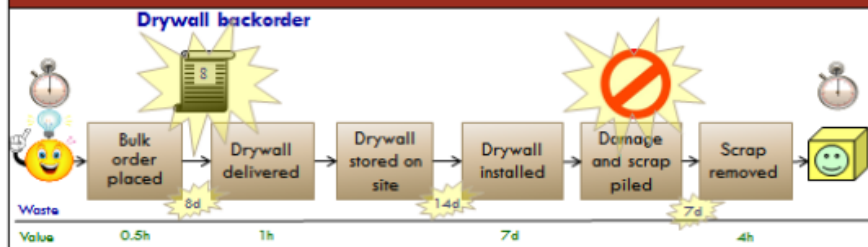
6. Follow-up Plan

PLAN	ACTUAL
Reduce delivery from 8 days to 1 day (next-day delivery)	Next day delivery achieved
Store drywall at the exact location of the next day's work	Location specific storage achieved
Eliminate all piles of scrap drywall	In progress; 85% reduction
Recycle rather than trash drywall	In progress; 50% achieved

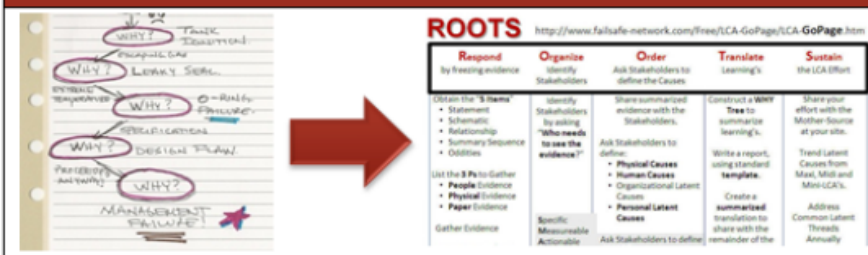
0. Problem / Theme / Background

- We have too much scrap drywall on our job
- The job is messy and cluttered
- Our problem is: *How do we reduce the amount of scrap drywall on the job?*

1. Current Situation



2. Cause Analysis

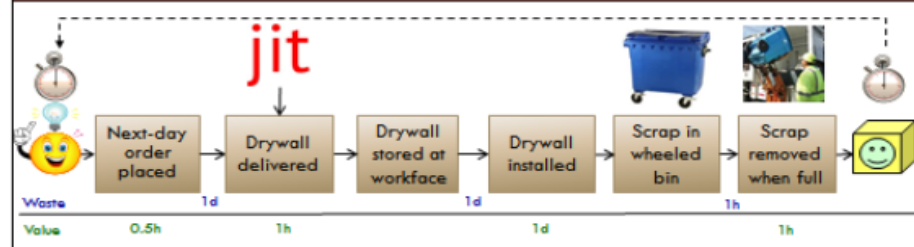


3. Countermeasures

Cause	Countermeasure	Outcome/Benefit	Act By
Backorder	Find more suppliers	More sources	Foreman
Storage	JIT delivery	Reduce damage	Foreman
Scrap piled	Scrap in wheeled bin	No piles	Labor
Scrap removed	Dump bins when full	Save 4h cleanup	Labor

Assembling the A3

4. Target State



5. Implementation Plan

What	Who	When	Cost
Solicit more suppliers	Logistics Manager	Apr. 30, 2012	None
Review JIT proposals	Project Manager	May 15, 2012	None
Approve suppliers	Log/Proj Manager	May 30, 2012	Varies
Purchase wheeled bins	Foreman	Apr. 30, 2012	\$1000
Train workers on rules	Foreman	Apr. 30, 2012	None

6. Follow-up Plan

PLAN	ACTUAL
Reduce delivery from 8 days to 1 day (next-day delivery)	Next day delivery achieved
Store drywall at the exact location of the next day's work	Location specific storage achieved
Eliminate all piles of scrap drywall	In progress; 85% reduction
Recycle rather than trash drywall	In progress; 50% achieved

Check

Every part has a place

Title of the A3: _____

0. Background and Problem Description
1. Current Situation
2. Root Cause Analysis

To: (Approving Person) _____

From: (A3 Author) _____

Date: _____

3. Countermeasures				
Suspected Cause	Countermeasure	Outcome/Benefit	Action By	Due
4. Target State				
5. Implementation Plan				
What?	Who?	When?	Cost	
6. Follow-Up Actions				
Action Item	Responsible	Due	Status / Outcome	

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Follow-up steps to the A3 process

Step 7: Discuss With All Impacted Parties

- ☐ **Communication** with all parties impacted by
 1. Implementation or
 2. Target condition
- ☐ The **most successful process improvement** projects do this step **at each stage**.
- ☐ **Build consensus** throughout the process
- ☐ **Concerns** raised should be **addressed** by:
 - ❖ Studying the problem further
 - ❖ Reworking countermeasures
 - ❖ Changing targets
 - ❖ Changing implementation

Follow-up steps to the A3 process

Step 8: Obtain Approval to Implement

- ☐ It is important to **contain approach** from the problem
(i.e., CEO/VP) to carry out the proposed plan.
- ☐ The **authority figure** should verify that the problem has been **sufficiently studied** and that **all impacted parties** are **“on board”** with the proposal.
- ☐ The authority figure may then **approve** the **change** and **allow implementation**.

Follow-up steps to the A3 process

Step 9: Implement the Plan

- ❑ Complete them by the deadlines



Follow-up steps to the A3 process

Step 10: Evaluate the Results

- ❑ It is very important to measure the **actual results** and compare to **predicted result**.
- ❑ If the actual results **differ** from the predicted ones
research needs to be conducted to figure out **why**
- ❑ Modify the process and repeat the A3 process until the goal is met.



Sample A3

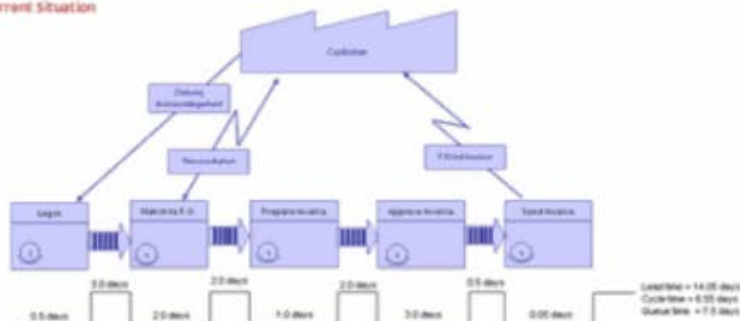
Prepared By: Jess Fixit

Invoice Creation Lead Time Improvement - A3 Report

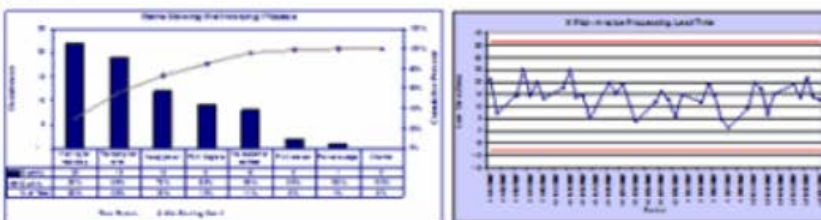
Background

The time between product delivery and invoicing our customers averages 1405 days with a max of 25 days. Our customers pay their invoices on time (<30 days) 99.95% of the time. The invoicing process has, on average, \$22.3 million in invoices in process.

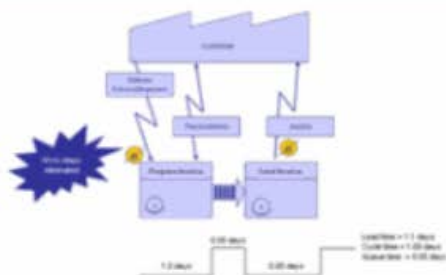
Current Situation



Analysis



Goal



Recommendations

- Eliminate external approval, invoice preparer is responsible for making sure invoice is correct
- Eliminate logging/delivery acknowledgement into the system; system has capability to generate invoices on user authority
- Use electronic delivery acknowledgement which returns our original information, thereby eliminating the need for re-entry of information and minimizing the need for P.O. matching and reconciliation
- Use electronic (EDI) transmittal of invoice to eliminate FAX problems

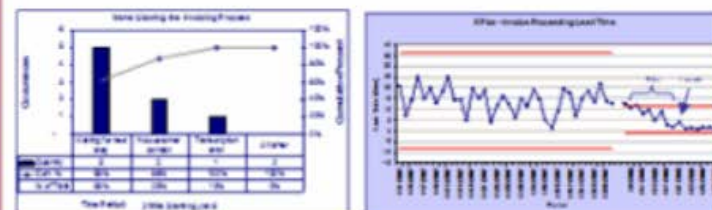
Implementation Plan

#	Description	Week								Who	% Comp
		1	2	3	4	5	6	7	8		
1	Process design									MK	100%
2	Simulation									MK	100%
3	Capital approval									DH	100%
4	Customer input									GF	100%
5	Set up EDI									GF	100%
6	Pilot runs									MK	80%
7	Launch									TJ	50%

Follow Up

- Include section in next 6 customer surveys to determine any negative impact; MK, 03/01.
- Review back-up procedures with IS to ensure data continuity; DH, 03/01.

Results Report



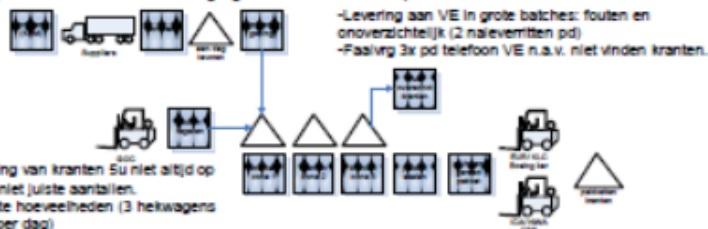
Sample A3

k catering services schiphol bv

Datum 20-23 januari 2009 Onderwerp Levelen en gemiste productie Krantenassemblage

Probleemsituatie

- Start productie = zoeken naar kamers en beladen regalen waardoor niet direct starten assemblage
- Totale cyclustijd assemblage = 33 sec, snelste takt = 17 sec, terwijl 6 medewerkers bij de lijn aanwezig zijn. 2 coördinatoren en 4 medewerkers.
- Er wordt in batches geproduceerd (KIC, Europa en Ica) en de productie kent veel pieken en dalen.
- Opdrachtgeving wordt omgezet i.e. batchproductieplan en gaat met veel overprocessing gepaard (90min).
- Veel fouten op bonnen (bv Europa is KIC vlucht)
- Start productie Su 1e ritten naar vliegtuig Su -> naleverritten 7 x pd.



Doel

- Assemblage direct starten, in kleine batches beladen, levelen, mixen en innegelen op takt zodat capaciteit optimaal wordt benut zonder verhoogde belasting van mw (van 6 mw naar 3 mw)
- Opdrachtgeving versnellen en vereenvoudigen (van 90 min naar 5 min)
- Levering VE in kleine batches heldere en geordende presentatie (faalvraag v. 3 > 0 naleveren v. 2 > 0)
- Levering kranten van 5 naar 4u, op tijd en in juiste aantallen (7 naleverritten l. ochtend naar 0; scrap 1 hekswagn)

Oorzaak analyse

	05:00 - 06:00	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	
EUR KIC	34	16	61	20	
U.A. NVA	87	261	53	244	
Totaal	121	277	114	264	89

Plan



Pieken en dalen worden ook door sommige mw gecreëerd omdat ze dan eerder klaar zijn. Medewerkers staan hierdoor onder druk en worden niet optimaal benut. Spanning en wachten wisselen elkaar af. Dit leidt tot een verdeling van het aantal benodigde medewerkers dan je obv takt tijd (29 sec) en totale cyclustijd (33 sec) zou verwachten (5 ipv 3). Door batching van de opdrachtgeving worden late vluchten geassembleerd en vindt overproductie plaats. Ook moet daardoor in de ochtend tegen de klok gewerkt worden om de vertrektijden distributie te halen. Dit lukt dan ook niet altijd en mede door de chaotische presentatie in de VE ontstaat daardoor faalvraag en 2 extra naleveringen om fouten te hertellen. Oorzaak van de chaotische presentatie is de grote hoeveelheid kranten pakketten die in VE opgeslagen worden zonder visueel management.

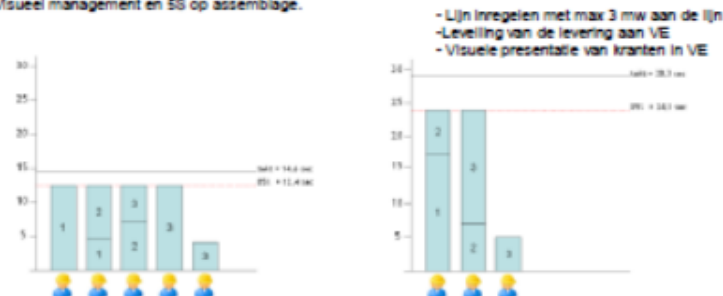
PROBLEM SOLVING A3

Team

João Rabico (KLM) (do-dag), Mevrouw Knott, Mevrouw Catalina, de Heer Bisschop, Leo van Noort, Ton Hodes (Takt), Harold Beek (VE), Frank van Velzen

Tegenmaatregelen

- Leveringen kranten met 1 uur vervoeren naar 4 uur, productie direct starten om 4:30u door Jit belading van de regalen door coördinator en de pakketten met het normale transport meegeven.
- Totale productie gelijkmatig over de dag verdelen volgens een gemixte en Taktproductieplanning van 29sec (ddwk) en 20sec (wkend), gebaseerd op de vertrektijden. Productieplan = geleverde bonnen & taktklok.
- 1 tempobepaler dicteert het tempo aan het begin van een "FIFO-lane".
- Visueel management en SS op assemblage.



Implementatie

Wat	Wanneer	Status
Proces beschrijven, meten CT, etc	di 20.01	gereed
Proces ontwerpen, takt testen	wo 21.01	gereed
Methodiek invoeren, aanpassen	do 22.01	gereed
Standaardiseren Vis Man	vr 23.01	gereed
Report Out	vr 23.01	gereed

Do

Follow Up

Resultaten

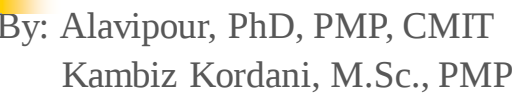
- Capaciteit van 6 mw naar 4 mw
- Opdrachtgeving 90 min naar 5 min
- Faalvraag v. 3 > 0
- Naleveren agv fouten v. 2 > 0
- Naleveren agv late productie v 7 > 0
- Scrap van 3 > 1 hekswagen

Actieplanning

- Arbeidsvoorwaarden vervoering werktijden
- Levering kranten vervoeren van 5 naar 4
- Kamers voor Europa maken
- Borgen van standaardwerk op de afdeling bewaken (3wk)
- Kaizen op de afdeling vormgeven (3wk)
- Gelijkmatige levering VE vormgeven

Check

Act



A3 Decision-Making

(Process Implementation – Case Study 2: Format 2)

Introduction

- ❑ The following case by **Gilles Bélanger**, MPM, PMP, MBB, illustrates the use of the **A3 report** to solve a problem at a **Canadian company** referred to as **GROUPE XYZ**.
- ❑ **Gilles** is an **engineer**, who provides **consulting services** as the President of Gilles Bélanger & Associates Inc.

Basic steps to the A3 process – Format 2

❑ Other references may change the process. There can be also the following steps”

1. Background
2. Current condition and problem statement
3. Goal statement
4. Root-cause analysis
5. Countermeasures
6. Check/confirmation of effect (Action plan)
7. Follow-up actions

Background

- ❑ Based in the **Province of Quebec**, Canada, '**GROUPE XYZ**' is a **major player** in the **commercial and industrial construction field**.
 - ❖ They run their business in a **French-speaking environment**.
- ❑ The company started their **Lean journey** in 2015.

Background

❑ The **A3 report** was first introduced as a **tool to capture**

1. Discussions
2. Decisions

about a problem.

❑ Late in 2016, they observed a **downward trend** in

their **estimating quote rate of success**

which **triggered a problem-solving** project using an A3 report.

Background

- ❑ They first did a **graphical analysis** of their quote **success rate**.

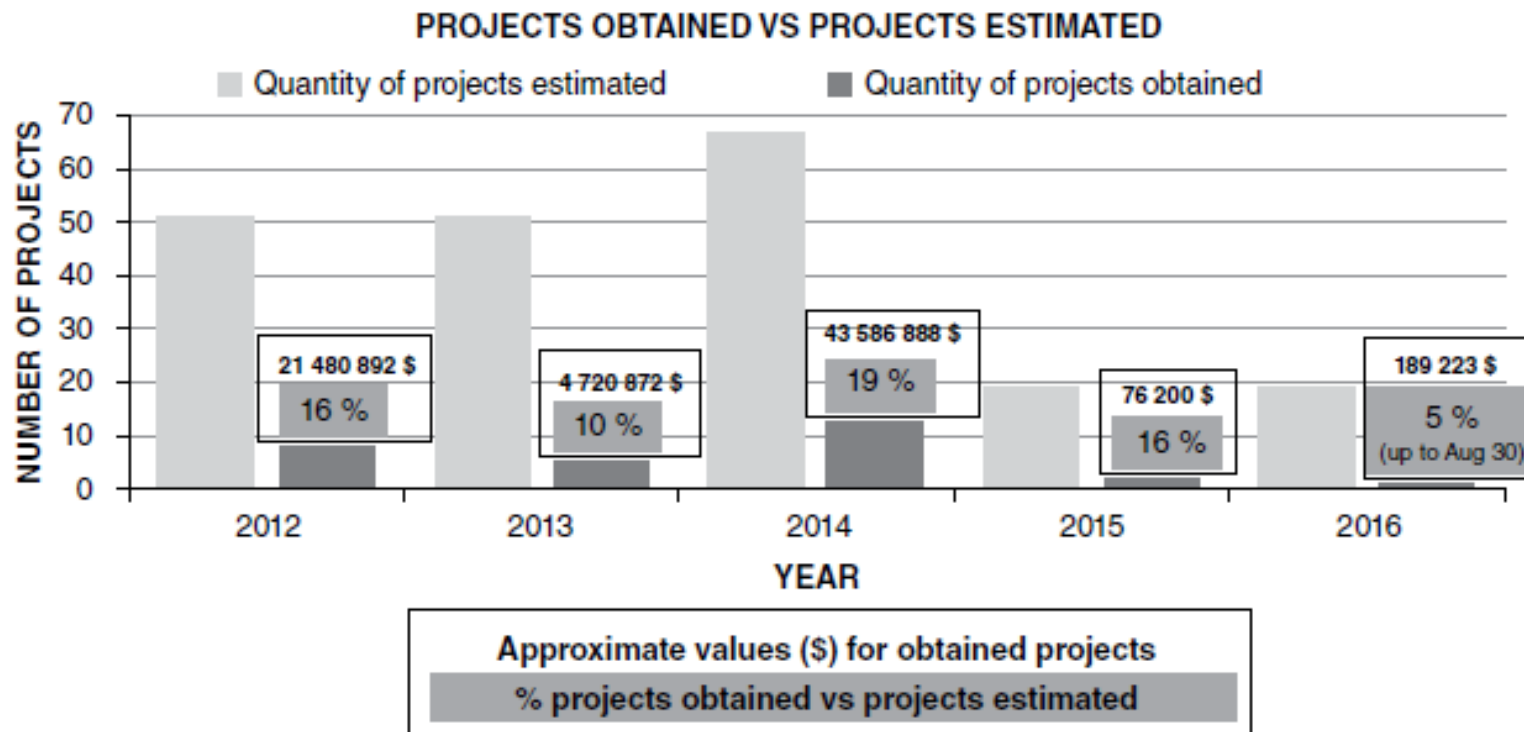
For the *first 8 months of 2016*, it went **down to 5%** as shown on the graph
(NEXT SLIDE).

- ❑ A team was formed to **create an A3 report titled:**

Reverse the downward quote rate of success at 'GROUPE XYZ' (since 2014).

- ❑ Their goal was to **use the A3 format** to capture the current situation,
desired situation and the plan of action that will **fill the gap**.

Background



❑ The team established the **following goal**;

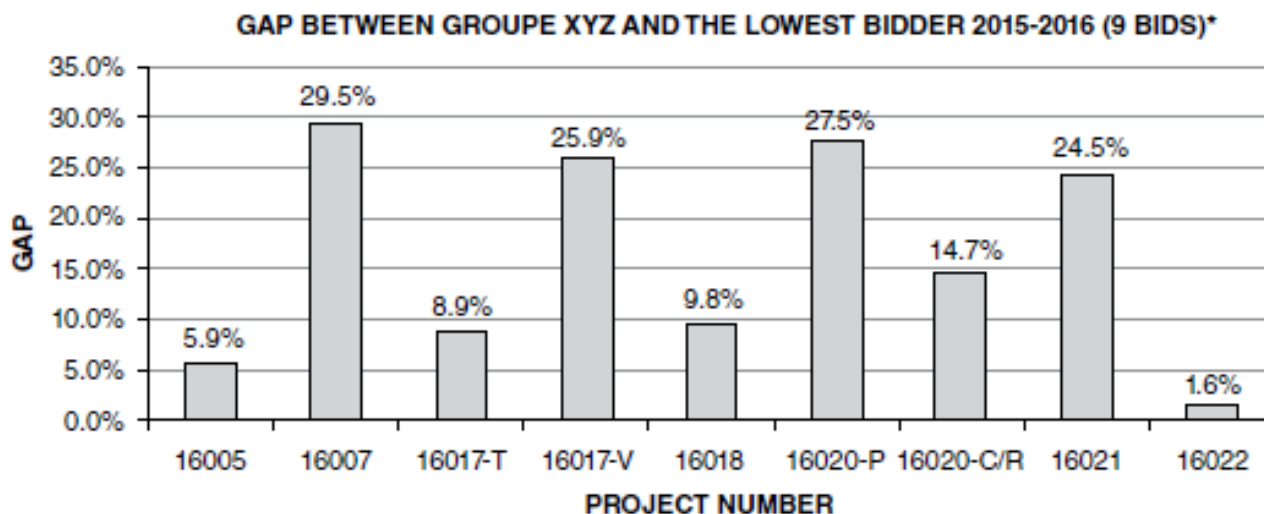
they felt it would be a breakthrough:

“Increase to 20% our success rate for projects obtained compared to those estimated.”

Current conditions

- Then they ran a data search program to understand where they were when they lost a bid.

See the chart below:



*When the gap between the lowest bidder and the 2nd lowest bidder was more than 5%, the second bidder's price was used to calculate the difference.

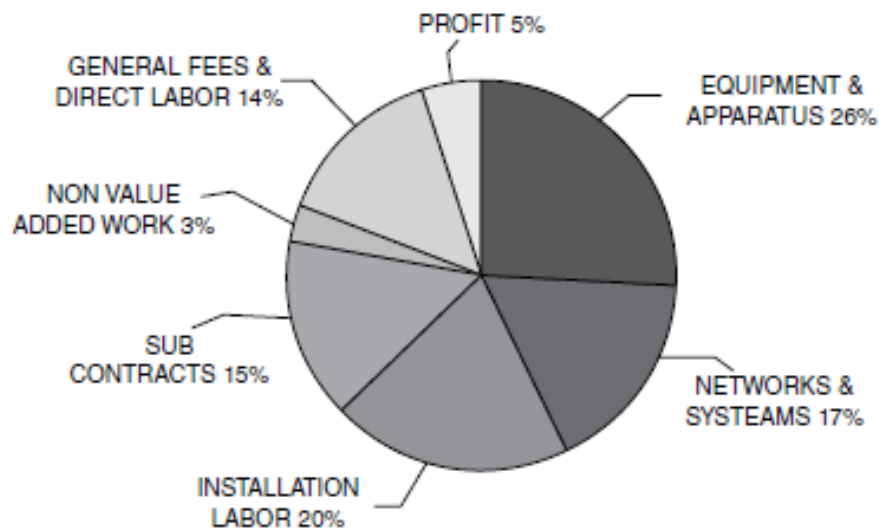
Current conditions

- Once they saw **how much difference** they had with the lowest bidder, they felt the need to see **how they were spreading their \$ values** over a **project bid**.

Seven types of expenses were identified and using that frame they did a thorough analysis of all bids produced in 2015 and the first half of 2016.

See pie chart below:

COSTS BREAKDOWN BY TYPES FOR QUOTES : 2015 TO FIRST HALF OF 2016



Root cause analysis

❑ Using the **knowledge gained** from previous **data collection analysis**, team

1. **Created** cause-and-effect diagram (**Ishikawa**)
2. Used the **5 why's document**

to find the root causes below:

1. **Gaps** in estimating **software proficiency** (how to meet **installation needs** for labor and material: electrical, plumbing, HVAC).
2. **Insufficient knowledge** of estimating software data management **methods**
3. **Incomplete and inaccurate estimates** are produced **due to short lead time**
4. **Knowledge from experienced construction leaders** in the company are **not shared with estimators**

Countermeasures

- ❑ After **several brainstorming sessions** with the stakeholders, they agreed on the list below:

Countermeasures and benefits

CAUSE #	COUNTERMEASURES	BENEFITS
1 & 2	Develop an ongoing training program for our estimation resources.	Cycle time and Lead time ↓, ↑ % for C&A information
3	Creates KPI's for estimates data validation.	↑ Data accuracy make gaps visible
4	Review estimation processes by adding a data review step (by experienced dedicated resources).	↑ Knowledge transfer and data C&A (complete & accurate)

Countermeasures

- ☐ The **team realized** the benefits to the organization in
 1. **Defining** its core business and
 2. Absolute need to **align its offerings** with its core expertise.

Developing the countermeasures led to the action plan.

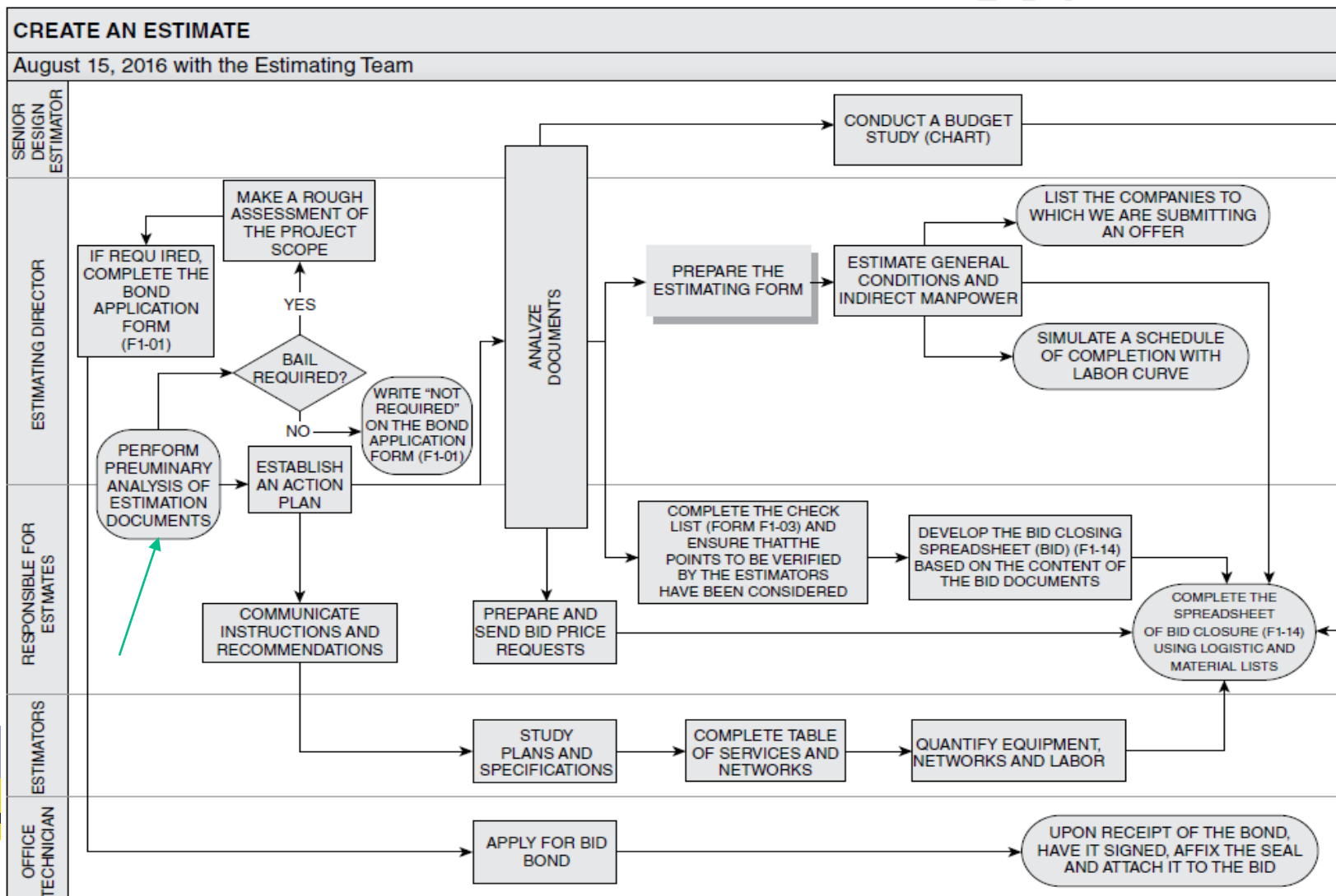
Action plan

- ❑ The **action plan** was rolled out at the **end 2016** and the **first half of 2017**.
- ❑ **One of their actions** was to review the **swim lane flowchart** for
“Create and Estimate”.

DESCRIPTION	SCHEDULE (2016-2017)													RESPONSIBLE	STATUS
	9	10	11	12	1	2	3	4	5	6	7	8			
Train estimators in construction installation methods														Estimating Director	100%
One site visit/mth for the next 6 mths (construction site and prefab factories) by estimators														Estimating Director	100%
Train estimators: how data from quantity extractions are processed by the estimating software														Estimating Director	100%
Mapping current and future processes														PA	100%
Create meaningful KPI's to validate bid data														PA	100%

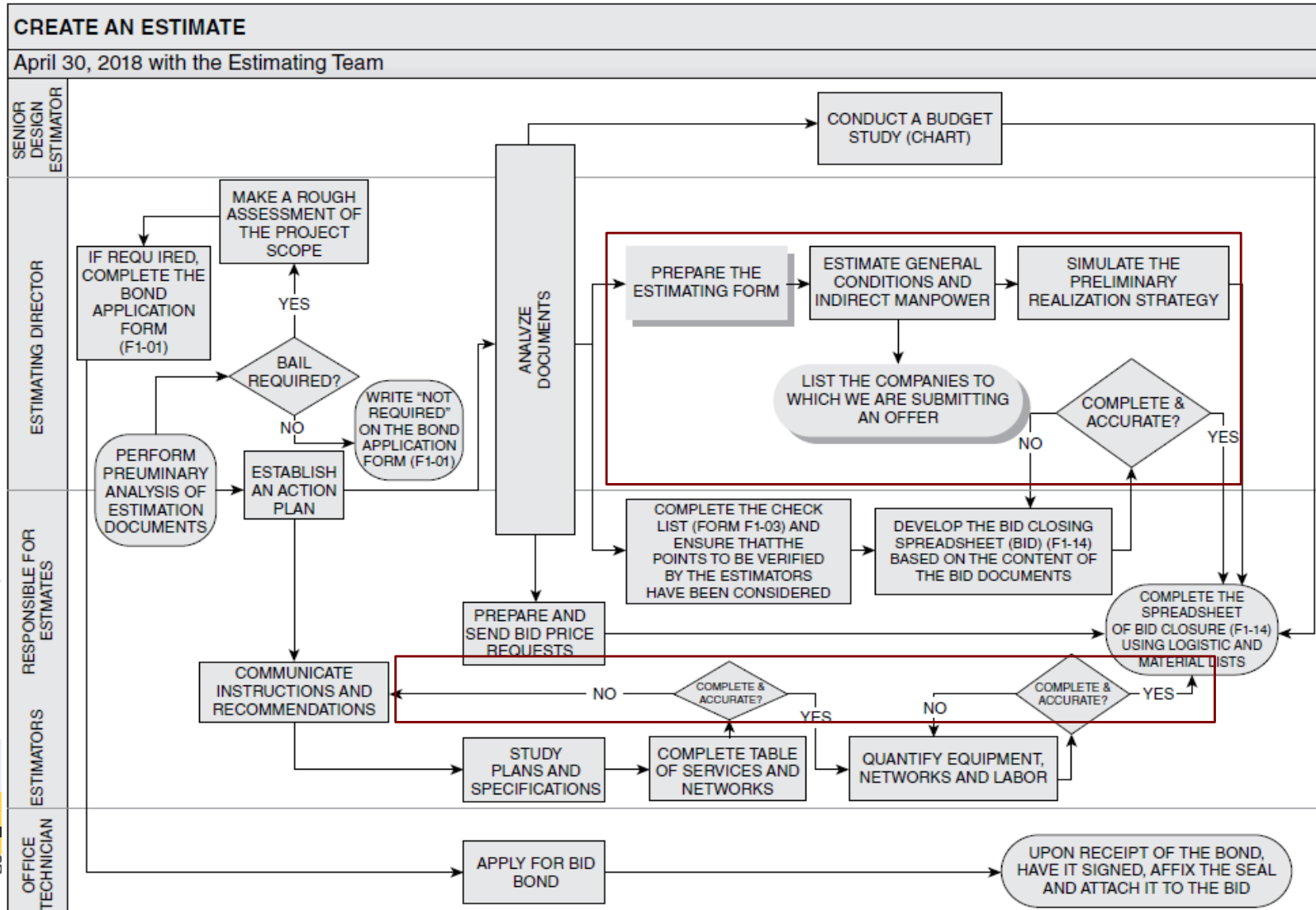
Action plan

Create and estimate before 2016



Action plan

Updated (2018) flowchart reflects the team focus on data completeness and accuracy



Follow-up actions

❑ **Results** were measured, of course.

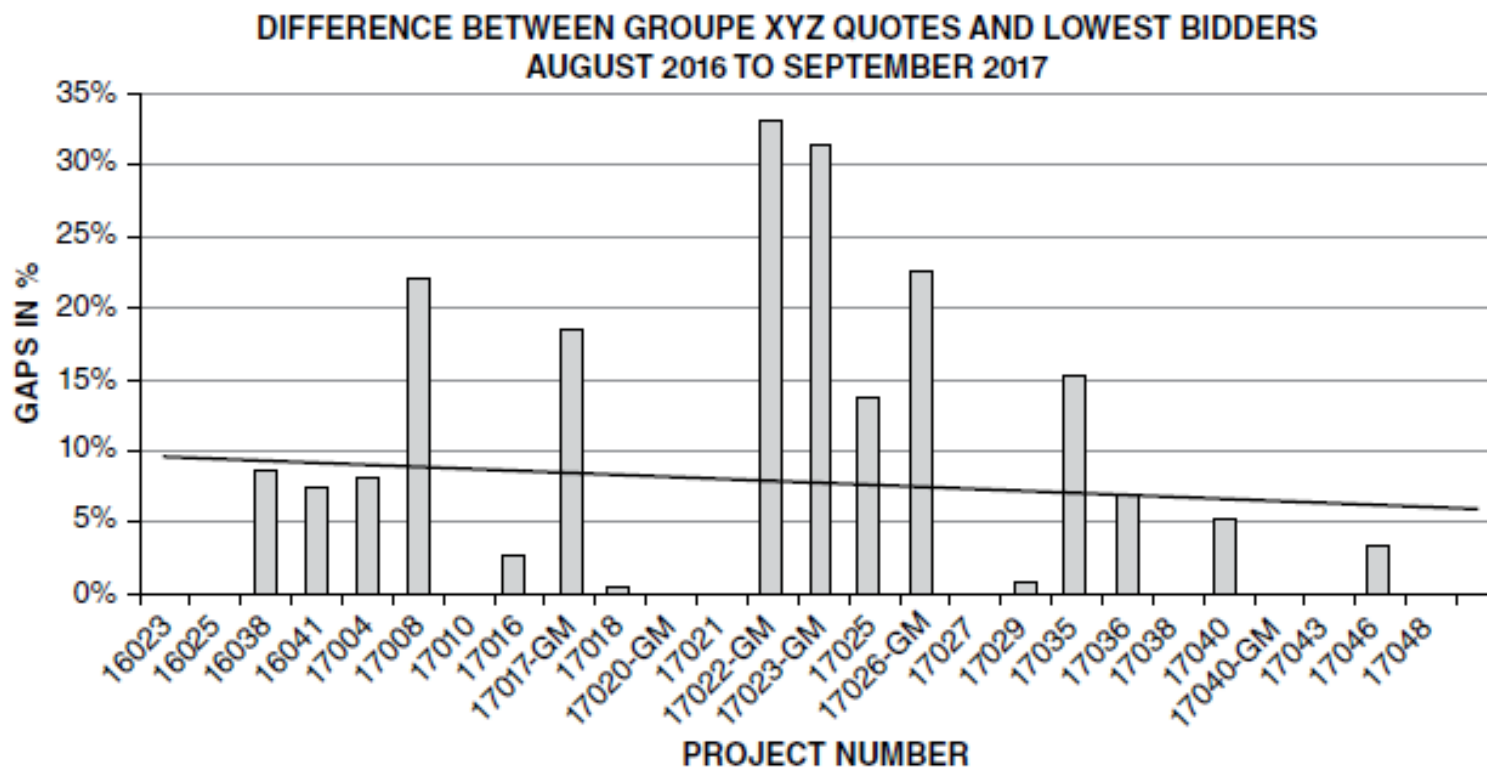
❖ See below the reduction over time of the gap between ‘GROUPE XYZ’ bids and their competitors:

1. This resulted in a **significant improvement** in the **bids rate of success**.
2. The team realized that **even though the 20% success rate** for the quotes original goal was **not achieved**,
result was **interesting**.

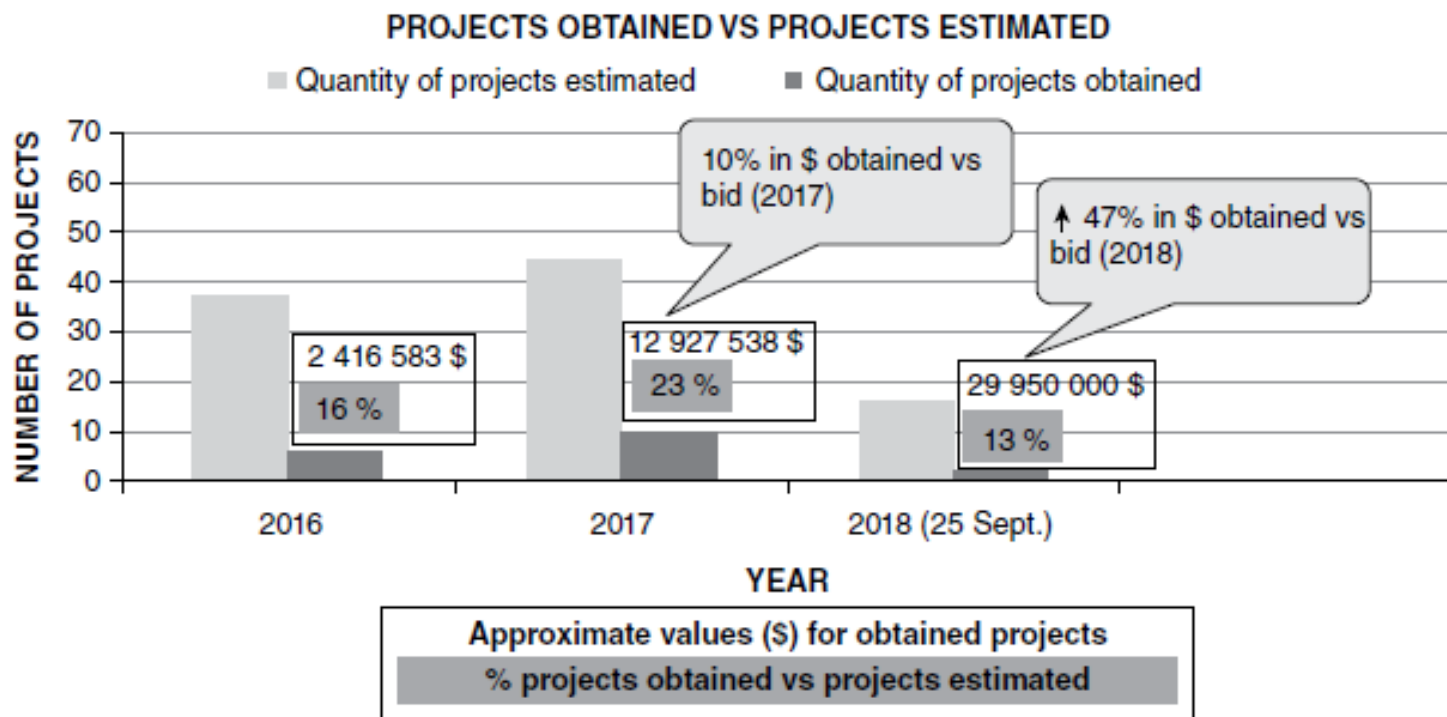
For the first 9 months of 2018, 47% of the dollar value of the quotes was converted into a contract.

*As a result, the **dollar value of the offers** obtained is now a **key performance indicator**.*

Follow-up actions



Follow-up actions



A3 Report

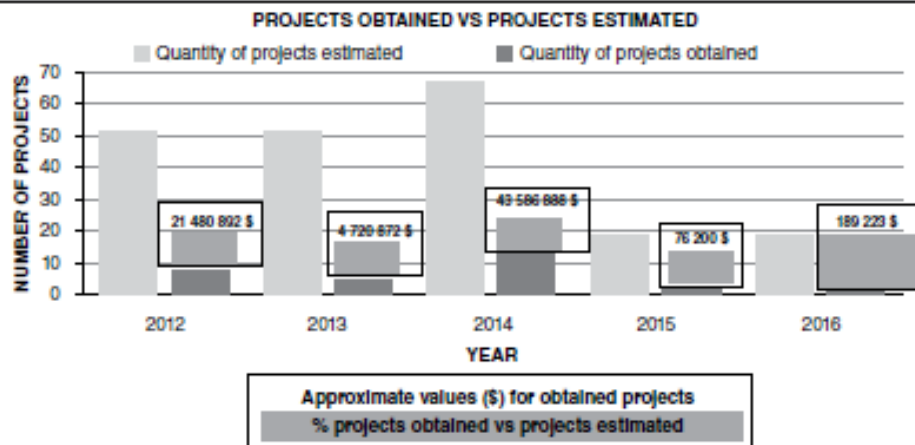
- ❑ Team members learned a lot during this process improvement project.
- ❑ The A3 report proved to be a valuable tool for capturing meeting discussions.

A3

OPPORTUNITY: REVERSE THE DOWNWARD QUOTE RATE OF SUCCESS AT GROUPE XYZ (SINCE 2014)	START: 2016-08-26 END: 2017-04-28
DONE BY (OWNER): PA	APPROVED BY: JPG

BACKGROUND

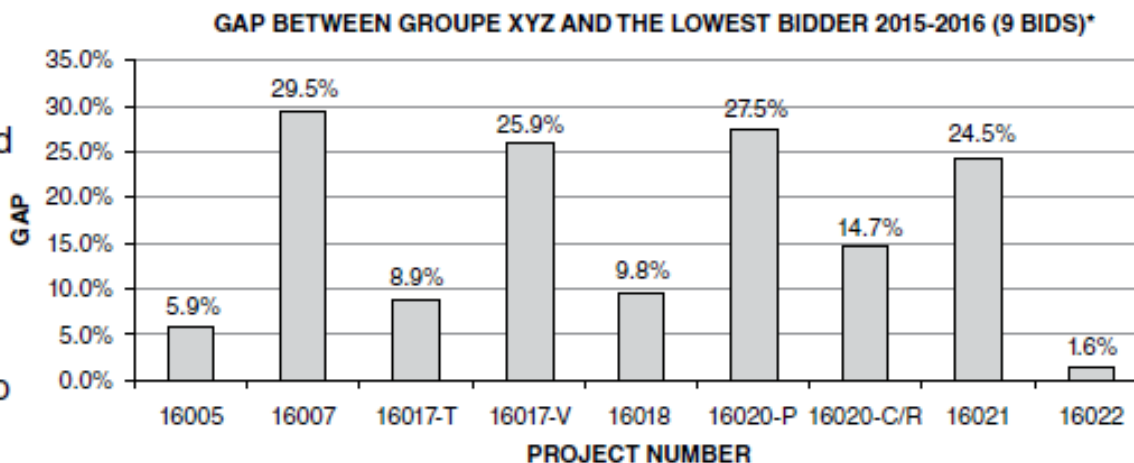
Since 2014, GROUPE XYZ bid results show a decline in our competitiveness.



A3 Report

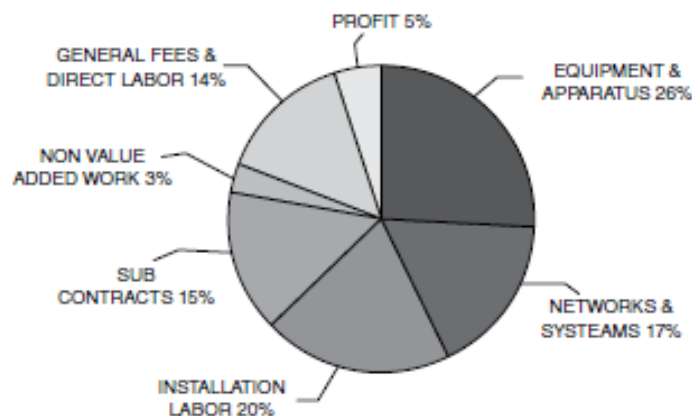
CURRENT CONDITIONS

* When the gap between the lowest bidder and the 2nd lowest bidder was more than 5%, the second bidder's price was used to calculate the difference.



COSTS BREAKDOWN BY TYPES FOR QUOTES : 2015 TO FIRST HALF OF 2016

Cost breakdown analysis: understand how money is spread o estimates.





A3 Report

اجرا و مدیریت پروژه به روش اصول ناب (Lean Project Management)
حل مشکل و گزارش دهی بر اساس روش A3

GOAL

Increase to 20% our success rate for projects obtained compared to those estimated.

A3 Report

ROOT CAUSE ANALYSIS

The following root causes are the results of a Cause and Effect diagram followed by a 5 why:

1. Gaps in estimating software proficiency (how to pull installation needs for labor and material: electrical, plumbing, HVAC).
2. Insufficient knowledge of estimating software data management methods
3. Incomplete and inaccurate estimates are produced due to short lead time
4. Knowledge from experienced construction leaders is not shared with estimators

A3 Report

COUNTERMEASURES		
CAUSE#	COUNTERMEASURES	BENEFITS
1 & 2	Develop an ongoing training program for our estimation resources.	Cycle time and Lead time ↓ , ↑ % for C&A information
3	Creates KP I's for estimates data validation.	↑ Data accuracy, make gaps visible
4	Review estimation processes by adding a data review step (by experienced dedicated resources).	↑ Knowledge transfer and data C&A (complete & accurate)

A3 Report

ACTION PLAN														DATE OF UPDATE : 2017-04-28	
DESCRIPTION	SCHEDULE (2016-2017)												RESPONSIBLE	STATUS	
	9	10	11	12	1	2	3	4	5	6	7	8			
Train estimators in construction installation methods													Estimating Director	100%	
One site visit/mth for the next 6 mths (construction site and prefab factories) by estimators.													Estimating Director	100%	
Train estimators: how data from quantity extractions are processed by the estimating software													Estimating Director	100%	
Mapping current and future processes.													PA	100%	
Create meaningful KPI's to validate bid data.													PA	100%	

FOLLOW-UP ACTIONS

Follow-up by measuring the success rate of the projects obtained vs those estimated, as well as by measuring the differences between GROUPE XYZ estimates and those of the lowest bidders (see the first 2 charts on the left to be updated).

CBA method and A3 Report

Another case that could be very helpful!

<https://leanconstructionblog.com/Applying-Choosing-by-Advantages-Across-the-Design-Process-Spectrum.html>

موسسه مهندسی و مدیریت ساخت علوی پور

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