INTRODUCTION TO CHOOSING BY ADVANTAGES

Introduction to Choosing By Advantages

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DPR CONSTRUCTION

3/25/2020

Agenda

- Introduction
- Why CBA is useful to construction?
- CBA Basics
- Example
- Case studies
- Questions

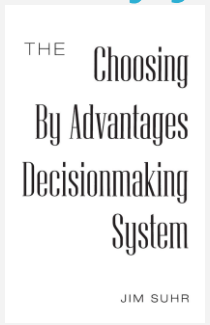
Why Choosing By Advantages (CBA)?

Decision Making is Challenging

- A better way of make group decisions that stick.
  - More collaborative
  - More transparent
  - More value for money
- Making decisions with conflicting interests its hard.
- Most people is not skilled on CBA.
- Projects teams get stuck and waste time waiting for someone else to make decisions.

CBA applicati

My journey using the whee



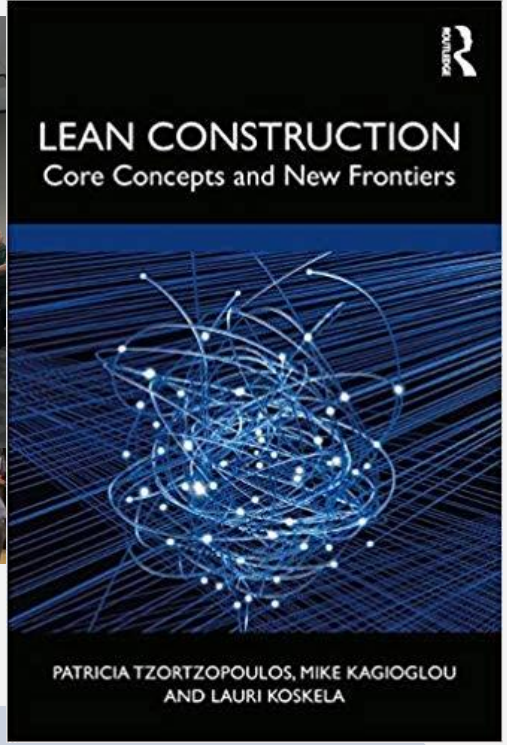
2010
- Read Jim Suhr Book

2012
- Gensler

- PhD, UC Berkeley
- Norway

2016
- Design Project, Chile

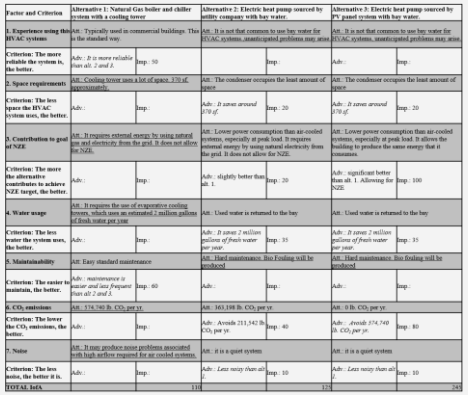
2018
- UK
- Canada
- CollabDecisions

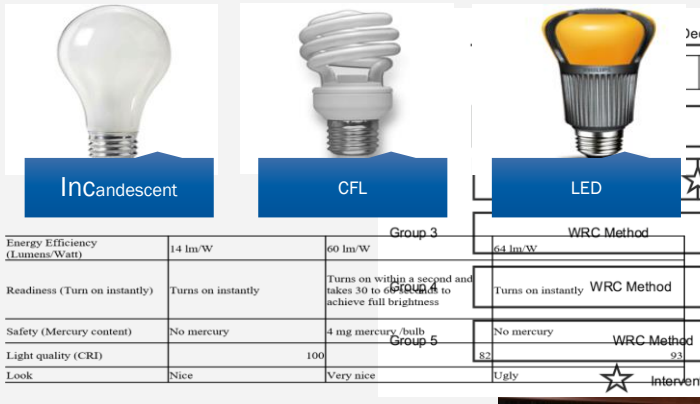


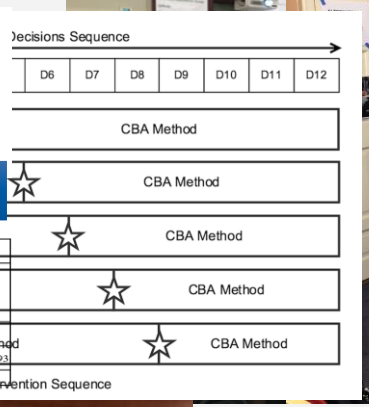
2011
- Research on other methods
- Attended CBA Workshop

2013
HVAC for NZE

2015
- Controlled Experiments - CIFE





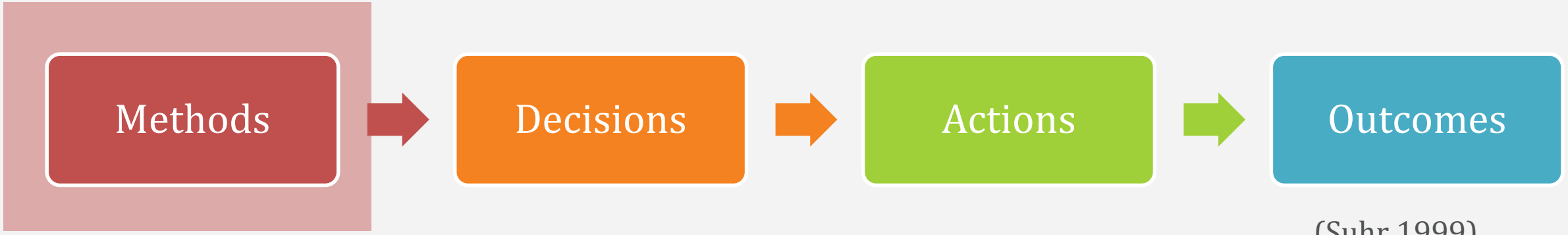


Need in Construction

Decision-making is broken

- Many times teams wait for a decision, instead of leading it.
- Decisions are made too soon or too late.
- Too many specialist, no one looking at the project as a whole.
- No clear methods, whoever has more power or speaks louder makes decisions (not necessarily who knows more).
- Most people do not know rationale behind major decisions.

Why decision-making methods matter?

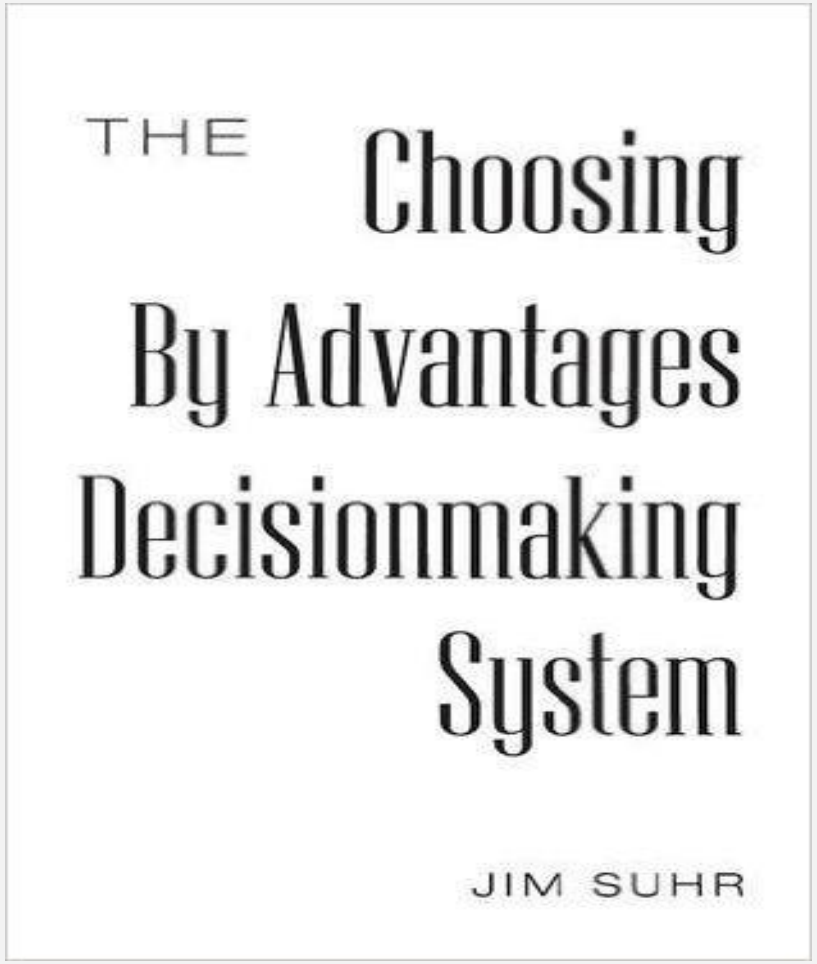


(Suhr 1999)

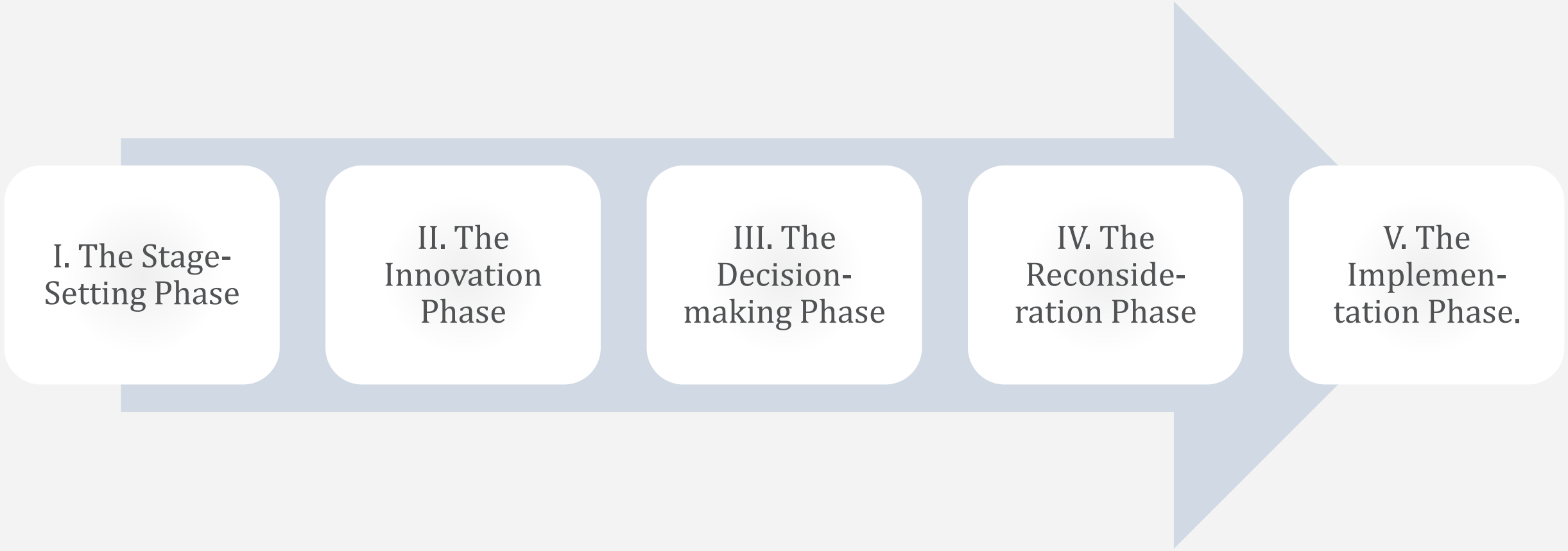
Improving Group Decision-Making

Providing Transparency	• Create a clear and shared rationale for a decision. • Compare the 'value' vs. the cost of the alternatives.
Building Consensus	• Optimize the whole not the pieces. • Avoid conflicts and unnecessary iterations.
Continuous Learning	• Document decisions • Help future iterations, when adding information. • Save time, resources, and result in a better overall decision.

CBA Developed by Jim Suhr (1999)



CBA Process for Complex Decisions



Jim Suhr (1999)

CBA Endorsement

- "I believe CBA is the most powerful and effective approach for making decisions available. I am most impressed with the way it uses both objective and subjective data. Once you can understand and apply CBA, I challenge you to find a decision making process that offers a more important advantage. We use the approach informally for all manner of daily choices and more formally when the stakes are large."

Gregory A. Howell, MSCE Stanford

President, Lean Construction Institute

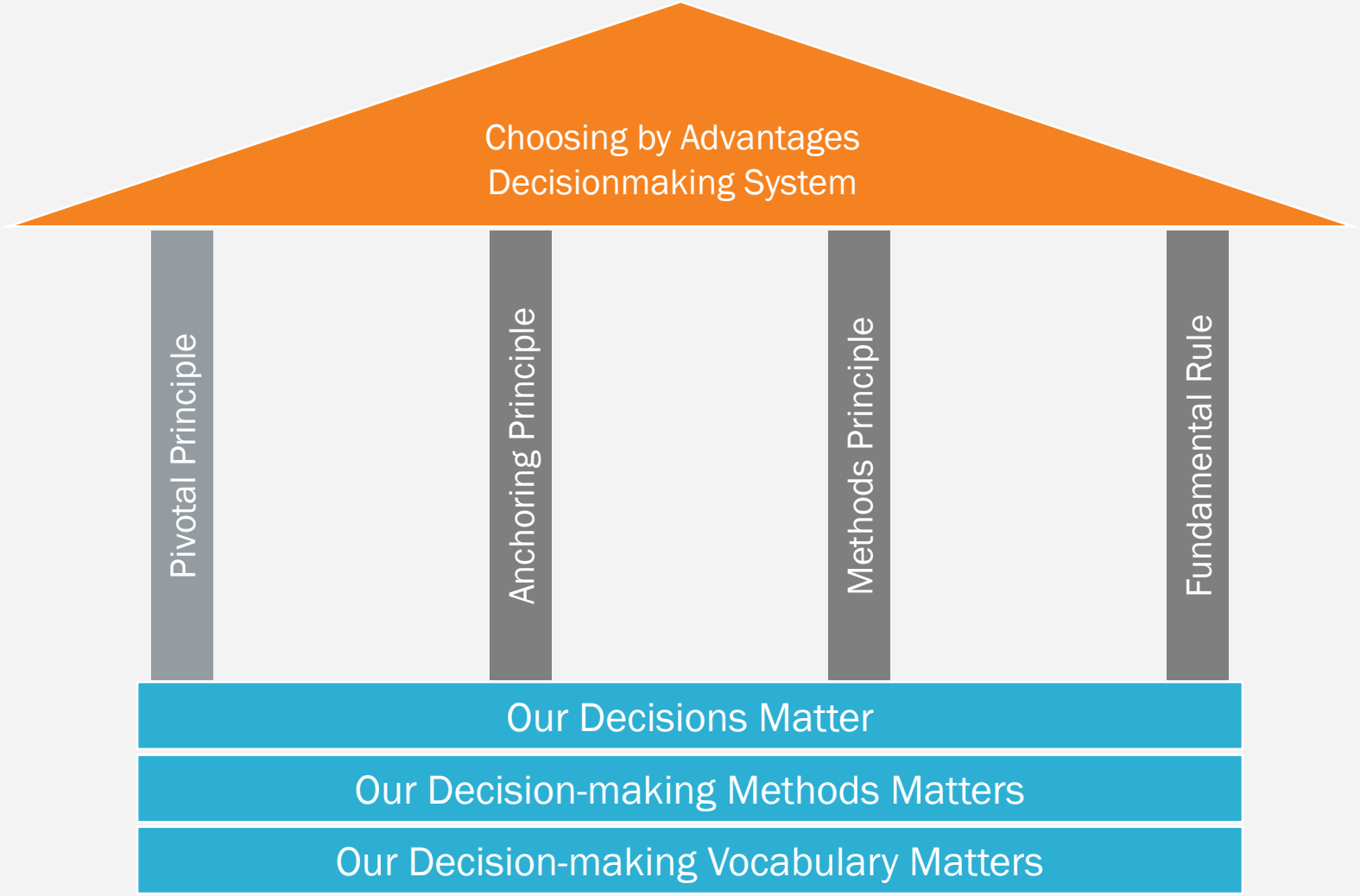
Feb 8, 2011

Choosing By Advantages

- A decision-making system unified by:
  - Definitions
  - Principles
  - Models
  - Methods

- A decision-making process (Not a tool) that produces improvements in decision making.
- A set of skills to make better decisions than with other methods.

CBA Principles



Jim Suhr (1999)

Cornerstone Principles

- Pivotal Principle

  Decision-makers must LEARN and skillfully use sound methods of decision-making.

- Fundamental Rule

  Decisions must be based on the importance of advantages.

- Anchoring Principle

  Decisions must be anchored to the relevant facts.

- Methods Principle

  Different types of decisions call for different sound methods of decision-making.

Jim Suhr (1999)

CBA Definitions

Alternative:	• Two or more people, things, or plans from which one is to be chosen
Factor:	• Element, part, or component of a decision
Criterion:	• Any standard in which a judgment is based – must have or want to have
Attribute:	• Characteristic, quantity, or quality of one alternative
Advantage:	• The beneficial difference between the attributes of two alternatives (one of which is the least preferred)

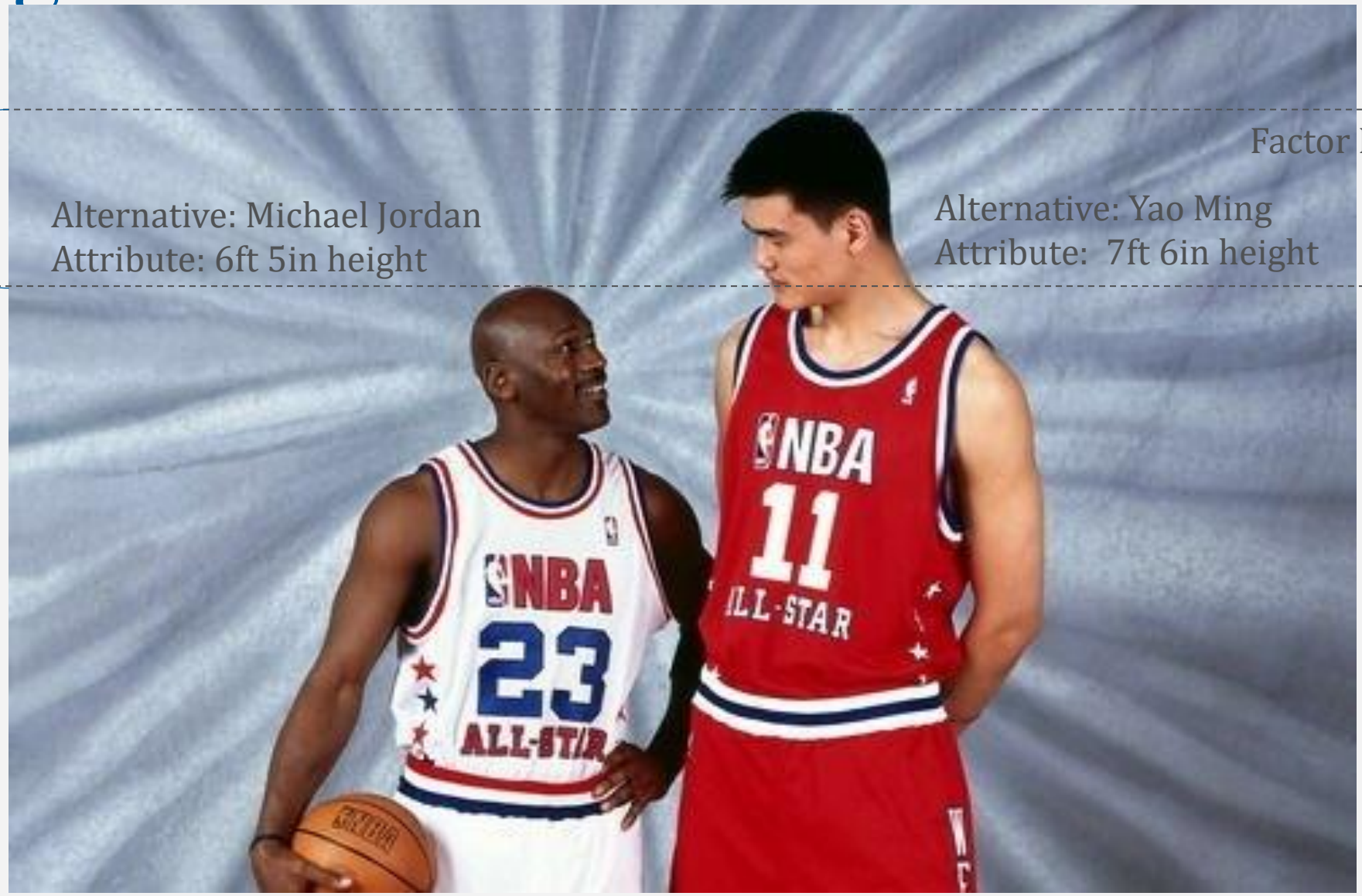
Advantage: A beneficial difference

Difference in height:1ft 1in

Factor Height

Alternative: Michael Jordan
Attribute: 6ft 5in height

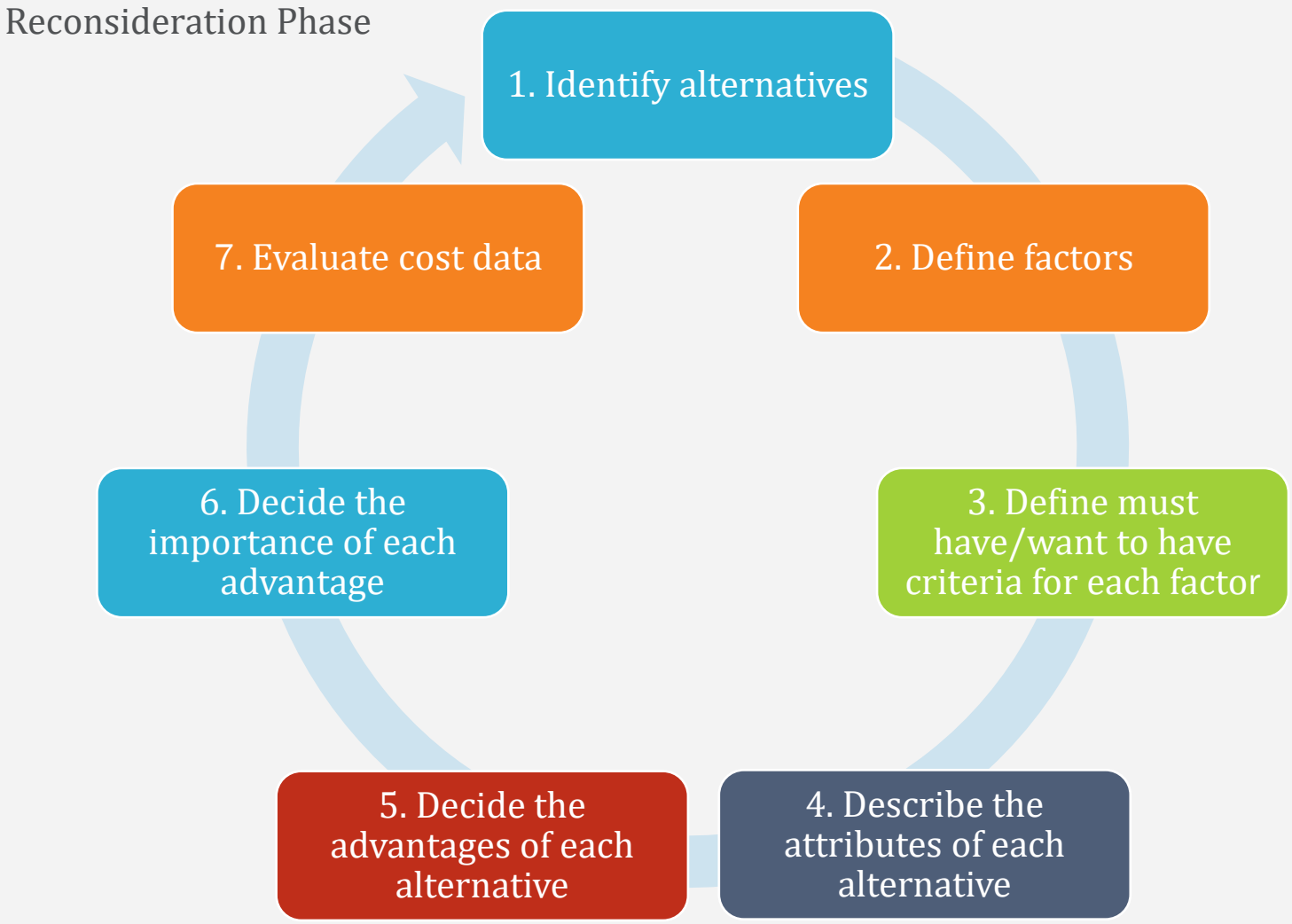
Alternative: Yao Ming
Attribute: 7ft 6in height



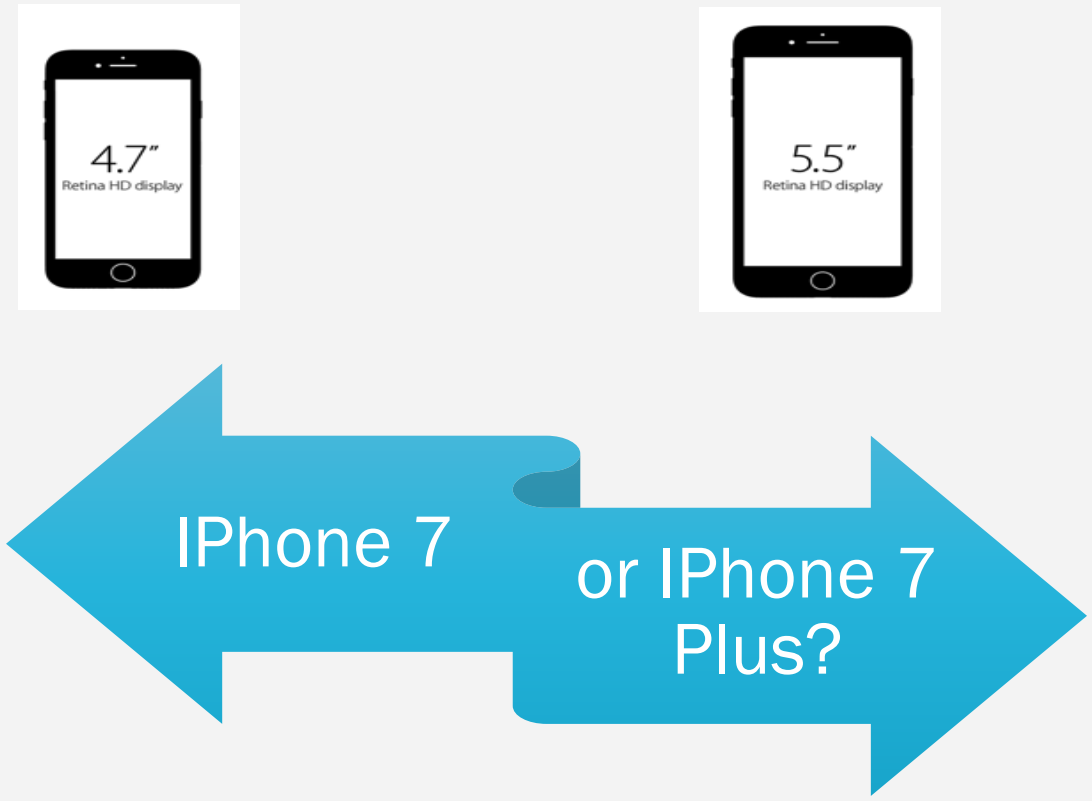
CBA tips

- Do not choose by advantages and disadvantages or you are probably double counting.
- It is not about what factor is more important. It is about what factor will reveal important differences between the attributes of the alternatives.
- Decision making is subjective! Yes, but do the objective part first (What are the advantages of the alternatives?), and then do the subjective part (How do I value those advantages?). It really makes life easier!

CBA Steps for the Tabular Method

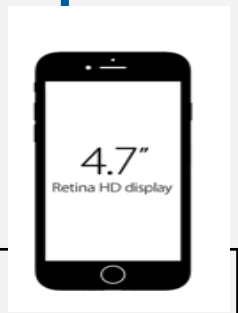


Step 1: Identify alternatives



Step 2: Define factors & Step 3: Define criteria

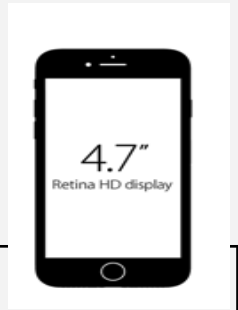
Only consider factors that differentiate alternatives.

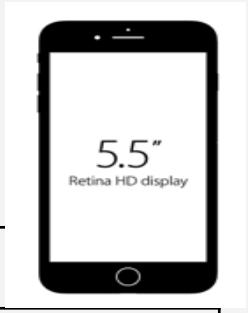


Factor (Criterion)	**IPhone 7**		**IPhone 7 plus**	
Dimensions (Smaller is better*)				
Weigh (Less is better)				
LCD screen resolution (More is better)				
Camara (optical zoom is better)				
Battery life (more is better)				
Total Importance				

Step 4: Describe the attributes of each alternative

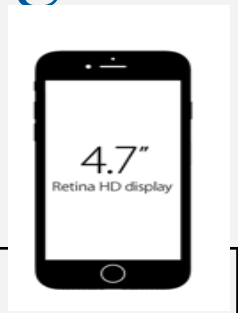
Underline the least preferred attribute in each factor





Factor (Criterion)	**IPhone 7**	**IPhone 7 plus**
Dimensions (Smaller is better*)	Att.: 4.7" /138.3 x 67.1 x 7.1 mm (5.44 x 2.64 x 0.28 in)	Att.: 5.5" /158.2 x 77.9 x 7.3 mm (6.23 x 3.07 x 0.29 in)
Weigh (Less is better)	Att.: 138 g (4.87 oz)	Att.: 188 g (6.63 oz)
LCD screen resolution (More is better)	Att.: 1334 x 750 pixels (326 ppi)	Att.: 1920 x 1080 pixels (401 ppi)
Camara (optical zoom is better)	Att.: 12 pixels	Att.: 12 pixels with 2X optical zoom
Battery life (more is better)	Att.: 14 hours for talk time 3G	Att.: 21 hours for talk time 3G
Total Importance		

Step 5: Decide the advantages of each alternative



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	Adv.: 0.8" smaller	Adv.:
Weigh (Less is better)	Att.: 138 g (4.87 oz)	Att.: 188 g (6.63 oz)
	Adv.: 50 g less (1.76 oz)	Adv.:
LCD screen resolution (More is better)	Att.: 1334 x 750 pixels (326 ppi)	Att.: 1920 x 1080 pixels (401 ppi)
	Adv.:	Adv.: 75 ppi more
Camara (optical zoom is better)	Att.: 12 pixels	Att.: 12 pixels with 2X optical zoom
	Adv.:	Adv.: 2X optical zoom vs. none
Battery life (more is better)	Att.: 14 hours for talk time 3G	Att.: 21 hours for talk time 3G
	Adv.:	Adv.: 7 hours more for tall time 3G
Total Importance		

Weighting Importance of the Advantages

- Decide the Importance of each advantage by first selecting the paramount advantage to establish a scale of importance. Weigh all advantages on the same scale. Always include zero.

- It is possible for more than one advantage to have the same weight of importance (same number on scale)

Scale of Importance

100	7 more hours of talking time with 3G 💚
90	
80	2X optical zoom vs. none
70	0.8” smaller
60	
50	
40	
30	50 g less (1.76 oz)
20	75 ppi more
10	
0	

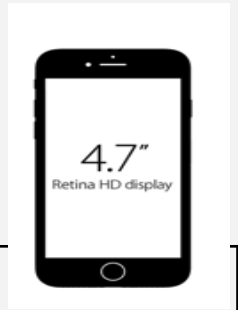
Decide the importance of each advantage.

List the advantages of each alternative

Discuss the importance of each advantage

Step 6: Decide the importance of each advantage

a. Circle (highlight) most important advantage per factor.
b. Select the paramount advantage.
c. Weigh the most important advantages.
d. Weigh importance of remaining advantages.



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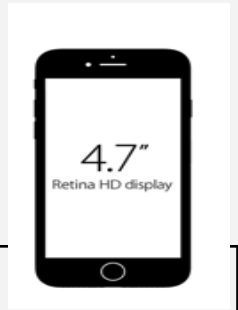
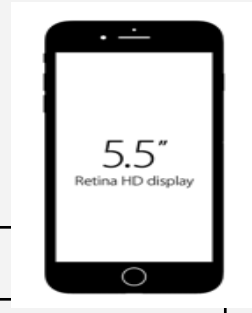
	Adv.: 0.8" smaller	Imp.: 70	Adv.:	Imp.:
Weigh (Less is better)	Att.: 138 g (4.87 oz)		Att.: 188 g (6.63 oz)	
	Adv.: 50 g less (1.76 oz)	Imp.: 30	Adv.:	Imp.:
LCD screen resolution (More is better)	Att.: 1334 x 750 pixels (326 ppi)		Att.: 1920 x 1080 pixels (401 ppi)	
	Adv.:	Imp.:	Adv.: 75 ppi more	Imp.: 20
Camara (optical zoom is better)	Att.: 12 pixels		Att.: 12 pixels with 2X optical zoom	
	Adv.:	Imp.:	Adv.: 2X optical zoom vs. none	Imp.: 80
Battery life (more is better)	Att.: 14 hours for talk time 3G		Att.: 21 hours for talk time 3G	
	Adv.:	Imp.:	Adv.: 7 hours more for talk time 3G	Imp.: 100
Total Importance		100		200

What about Cost?

$749



$849



Factor (Criterion)	**iPhone 7**		**iPhone 7 plus**	
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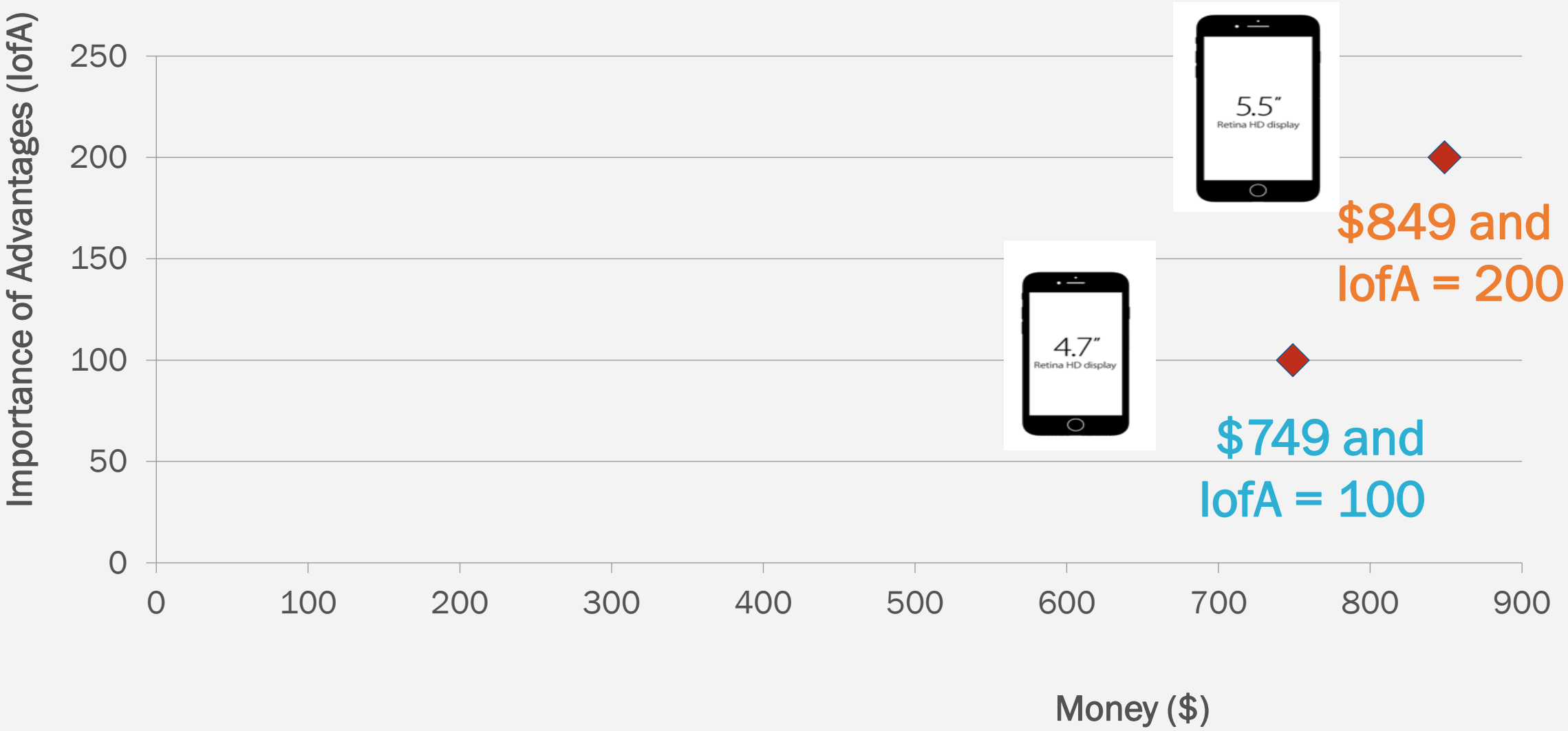
	Adv.:	Imp.:	Adv.: 7 hours more for talk time 3G	Imp.: 100
Total Importance		100		200

Cost is independent of value measured as IOA.



Money Differences

- Money decisions are interdependent decisions
- Money differences are abstract messages, not advantages.
- A money scale is NOT a valid importance scale.
- Do not assign importance scores to money attributes or money differences.

Jim Suhr (1999)

Fundamental Rule for Money Decisions

Different types of decisions, including different types of money decisions, require different methods of decision making.

But for all types of decisions, the fundamental rule of sound decisionmaking is the same:

Decisions must be based on the _____ of _____

not the importance of dollars.

Jim Suhr (1999)

Fundamental Rule for Money Decisions

Different types of decisions, including different types of money decisions, require different methods of decision making.

But for all types of decisions, the fundamental rule of sound decisionmaking is the same:

Decisions must be based on
the IMPORTANCE of ADVANTAGES
not the importance of dollars.

Jim Suhr (1999)

CBA for Mutually-Exclusive Alternatives

CBA has different methods

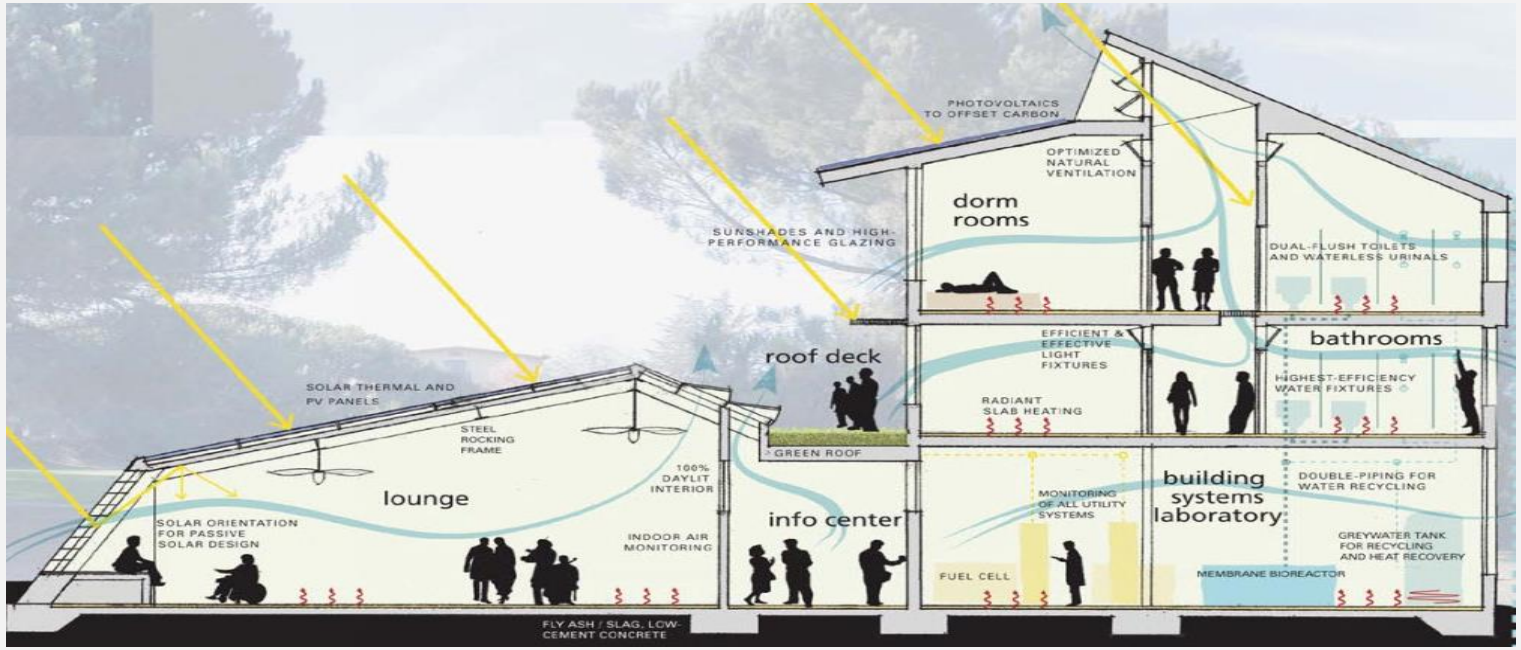
- Very simple methods for very simple decisions
  - Recognition response CBA
  - Instant CBA
  - Simplified two list method
- For complex decisions
  - Two list method
  - Tabular method

CASE STUDY 1

For selecting structural system

Case Study

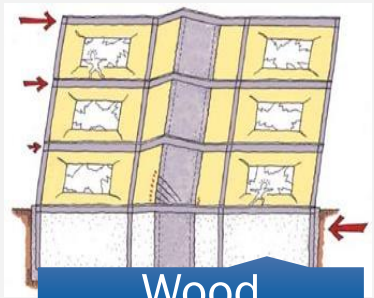
- Context: Choosing a structural system for the Stanford University Green Dorm project.



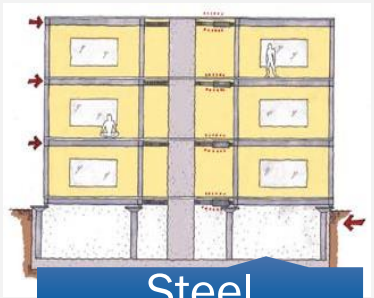
Case Study

- The design team used WRC to evaluate 2 alternatives:
  - wood bearing wall structure
  - steel frame with metallic deck and concrete topping)

- They considered 10 factors and costs.

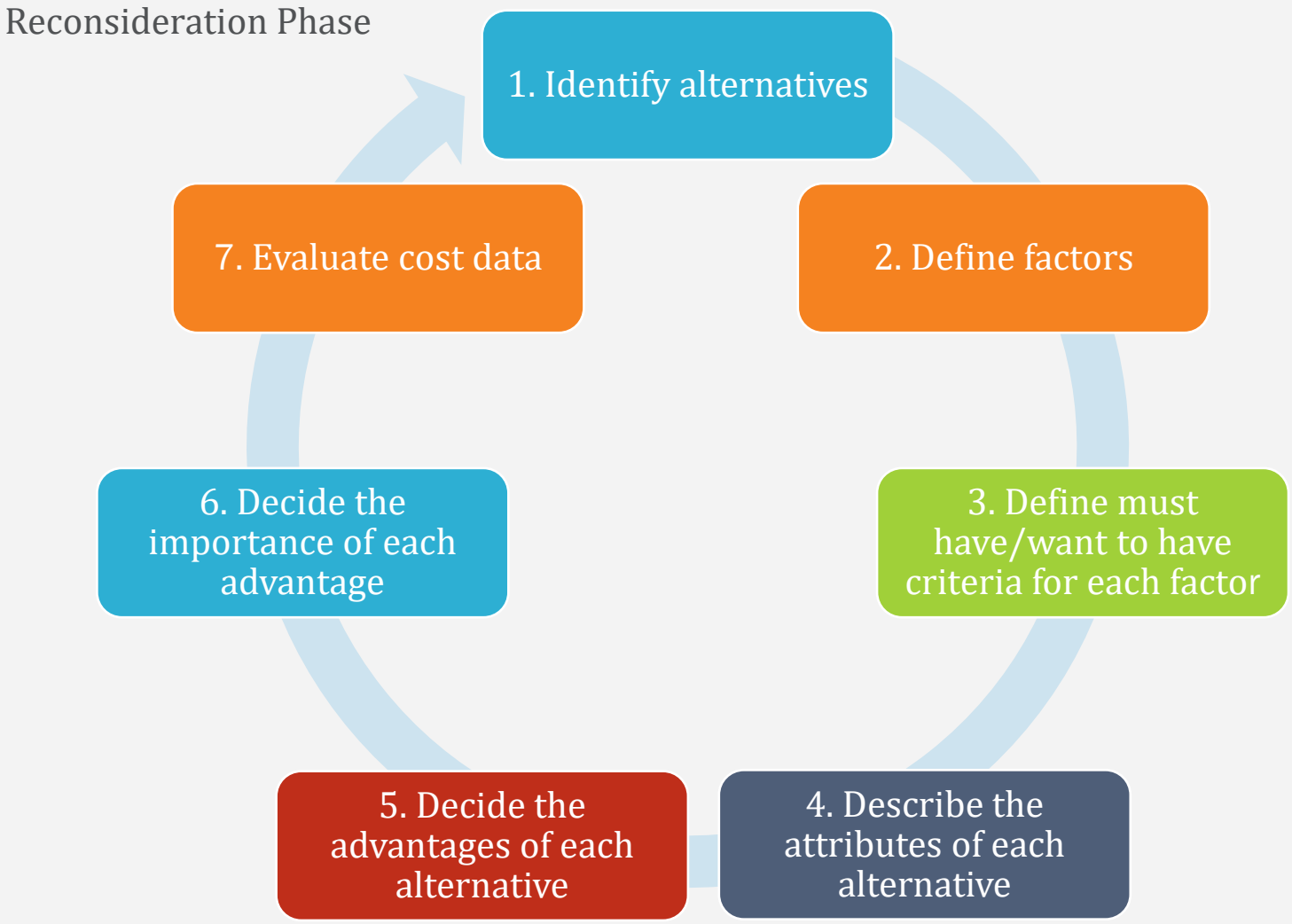


Wood Structure



Steel Structure

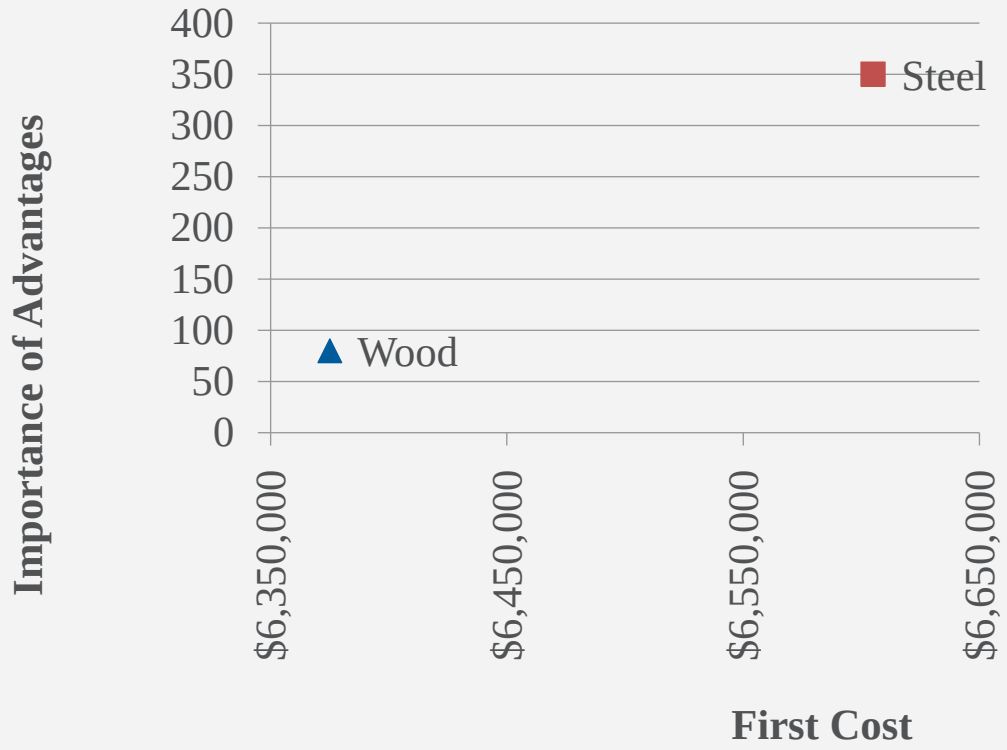
CBA Steps for the Tabular Method



1. Identify alternatives → 2. Define factors → 3. Define must/want have criteria for each factor → 4. Summarize the attributes of each alternative → 5. Decide the advantages of each alternative → 6. Decide the importance of each advantage → 7. Evaluate cost data

Factor (Criterion)	Alternative 1: Wood Bearing Wall Structure		Alternative 2: Steel frame /Metallic Deck/Concrete Topping	
1. Construction Speed	Att.: Slow when constructed on site.		Att.: Fast to construct.	
(The faster, the better)	Adv.:	Imp.:	**Adv.: *Faster to construct***	Imp.: 10
2. Earthquake Losses	Att.: May result in significant architectural, structural, and content damage.		Att.: May result in moderate architectural, structural, and content damage.	
(The lower EQ losses, the better)	Adv.:	Imp.:	**Adv.: *Significantly less EQ losses than wood***	Imp.: 80
3. Maintenance/ Durability	Att.: Requires frequent cleaning and repairs.		Att.: Requires sporadic cleaning and repairs.	
(The less maintenance required, the better)	Adv.:	Imp.:	**Adv.: *Easier to maintain***	Imp.: 30
4. CO_2 Emissions - Embodied energy.	Att.: Wood stores carbon and has a low embodied energy, and it is light.		Att.: Steel and concrete have high embodied carbon.	
(The less CO_2 emissions, the better)	**Adv.: *Emits significantly less CO_2***	Imp.: 80	Adv.:	Imp.:
5. Thermal Mass	Att.: Has only thin concrete or gypcrete topping slabs on the floors providing little thermal mass.		Att.: Exposed concrete over metal deck and floors provides thermal mass.	
(The more thermal mass, the better)	Adv.:	Imp.:	**Adv.: *Higher expected thermal mass***	Imp.: 20
6. Insulation	Att.: Good insulation material		Att.: Good insulation material	
Criterion: The higher insulation, the better	Adv.: -	Imp.:	Adv.: -	Imp.:
7. Research value	Att.: Not so valuable for research.		Att.: Very interesting for research.	
(The more interesting for research, the better)	Adv.:	Imp.:	**Adv.: *More interesting for research***	Imp.: 100
8. Thermal Comfort	Att.: Low thermal mass, which is less effective in reducing overheating.		Att.: High thermal mass, which reduces the likelihood for overheating.	
(The higher thermal mass, the better)	Adv.:	Imp.:	**Adv.: *Reduces the likelihood for overheating***	Imp.: 30
9. Deconstructability	Att.: Difficult to deconstruct because of all the nailing.		Att.: Bolted beams and columns are easy to disassemble. Concrete over metal deck requires down cycling.	
(The easer to deconstruct, the better)	Adv.:	Imp.:	**Adv.: *Slightly easier to deconstruct***	Imp.: 30
10. Flexibility	Att.: Relatively inflexible. Most room walls are bearing walls.		Att.: Has a post and beam system that is extremely flexible.	
(The more flexible, the better)	Adv.:	Imp.:	**Adv.: *Considerably more flexible***	Imp.: 50
Total IofAs		80		350

First Cost & Lifecycle Cost in CBA



Case Study 2

For selecting a series of interiors, MEP, and landscape decisions.

Implementation Example

Project Background:

- Large complex project in Silicon Valley
- Large, multi-disciplinary team in three different countries
- Minimal exposure to Lean principles
- Unique, iconic architecture
- Difficult jurisdiction in the SF Bay Area
- Highly engaged Owner
- Early onboarding of GC / Design Assist
- Aggressive schedule and budget targets

Arroyo & Long (2017)

Early Design Process - No Decisions

- Complex problems with non-traditional solutions
- Initial “spray and pray” approach
  - Numerous system studies, no focus
- Lack of definitive decision strategy:
  - Reinventing the design process
  - Not anchored to project schedule
  - Competing design priorities
  - Poor documentation
  - Lack of accountability
  - Ambiguous scoring methodology
  - Lack of commitment to decisions

Arroyo & Long (2017)

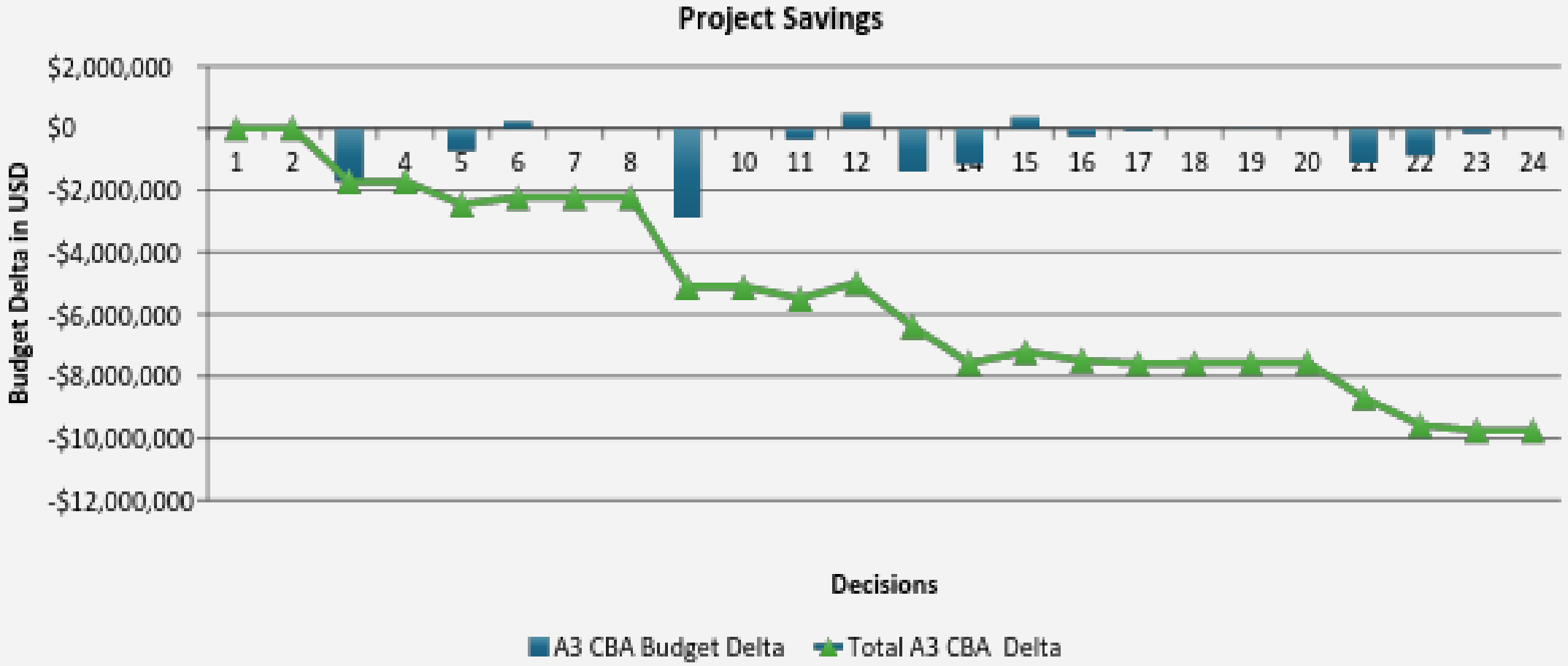
Types of A3 Design Decisions

#	Description
1	Modular vs. Non-modular IDF Closets
2	Single vs. Double Walled Cistern
3	L2 Zoning Requirements for Open Office
4	Modular vs. Non-modular Electrical Rooms
5	Exhaust Locations for Basement AHU's
6	UG Infrastructure Support on SOG
7	Cistern Sizing Evaluation
8	Energy Pile Evaluation
9	Day 1 vs. Day 2 Lab Loads
10	Waterproof Membrane Evaluation
11	Vapor Intrusion Evaluation
12	Vapor Mitigation Strategies

#	Description
13	Soils Management
14	Select of Soil for Settlement Displacement
15	APGD vs. Precast Concrete Piles
16	Access to Basement Bike Storage
17	Security & Maintenance at CUP
18	PG&E Access to Main Electrical Room
19	Location of Outdoor Fitness Area
20	Safety Protection at CUP Opening
21	Return HVAC Shafts at L1 & L2
22	L1 Zoning for Conference Rooms
23	First Flush vs. Pre-filtration for Roof Drains
24	UG Utilities and Settlement Displacement

Arroyo & Long (2017)

Large Project Savings



Arroyo & Long (2017)

Results of Implementing CBA

- Satisfied client
- Paper trail to document facts and decision
- Decisions started to “stick” with the Owner and project stakeholders
- Increased design efficiency (less rework)
- Team developed a level of trust and respect (in the trenches together)
- Project team started working together across contractual lines

Arroyo & Long (2017)

Results of Implementing CBA

- By the numbers:
  - Early A3's averaged 5.3 meetings per decision
  - After initial "break-in" period, meeting efficiencies increased by 37% or 3.3 meetings per decision
  - Studied A3's resulted in $9.7M in savings or 10.93% of the original estimates
  - Resulted in an average of $96,468 per A3 meeting
  - Resulted in an average of $12,596 per hour for all meeting participants

Arroyo & Long (2017)

Case Study 3

Choosing an ERP system

Choosing an ERP System

CBA Implementation Example

- Too much information (6 software vendors, 7 possible combinations, RFP collected 300+ criteria).
- No one alternative complied with everyone's desires and expectations.

Implementing CBA

- Getting everyone on a room / share perspectives
- Seek facts – identify attributes
- Agree on criteria and decide advantages
- Differentiate value and cost

Results

- Getting to a decision that everyone buy-in even if it is not the best for your individual group, you understand it’s the overall best.

Questions

Conclusions

What else did you hear?

- Decisions require proactive action and engagement of stakeholders
- Decision-making methods matter
- CBA provides a transparent way of making decisions, helps build consensus, and allows for learning.
- Paramount Decisions is a resource you can use with your team.

CBA Resources

- Platform to share knowledge about collaborative decision-making, videos, webinars.
  - http://collabdecisions.com

- CBA Papers, case studies and research.
  - http://iglc.net/papers

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