SCHEDULE E

Form of Completion Report for Studies

Please do not hesitate to contact your project officer to receive an electronic copy of the template of the Completion Report for Studies.

Upon completion of the Feasibility Study, a copy of the Final Study must be submitted along with this Completion Report for Studies.

FCM will post your report on the Green Municipal Fund™ (GMF) website.[1] This is because one of FCM's mandates is to help municipal governments share their knowledge and expertise regarding municipal environmental projects, plans and studies. Before you submit a report to FCM, make sure you hold the copyright for the report (you own all the rights to the content and can decide who is allowed to reproduce and distribute the report) and that it does not contain any confidential information.

If the report contains confidential information, you need to submit two versions: one containing confidential information, to be read by FCM staff, and one that does not contain confidential information, which can be posted on the GMF website. Please contact FCM if you have any questions about copyright and confidentiality.

How to complete the Completion Report for Studies

The purpose of the Completion Report for Studies is simple: to share the story of your community's experience in undertaking a Feasibility Study with others seeking to address similar issues in their own communities.

Please write the report in plain language that can be understood by people who are not specialists on the subject. A Completion Report for Studies is typically in the range of 5–10 pages, but may be longer or shorter, depending on the complexity of the Feasibility Study.

GMF grant recipients must enclose **final** copies of the Completion Report for Studies and the Final Study, both in electronic format, with their final Request for Contribution. The reports, including all attachments and appendices, must be submitted in PDF format with searchable text functionality. Reports that are not clearly identifiable as final reports, such as those displaying headers, footers, titles or watermarks containing terms like "draft" or "for internal use only," will not be accepted by GMF. Additionally, reports must be dated. If you have questions about completing this report, please consult GMF staff.

[1] http://www.fcm.ca/home/programs/green-municipal-fund.htm

Completion Report for Studies

GMF number	15827
Name of lead applicant (municipality or other partner)	City of Saskatoon
Name, title, full address, phone, fax and e-mail address of lead technical contact for this study	Katie Burns Manager, Community Leadership and Program Development 222 3rd Avenue N Saskatoon, Saskatchewan S7K 0J5 Katie.burns@saskatoon.ca 306-975-8318
Date of the report	April 30, 2020

1. Introduction

a) Who was involved in doing the Feasibility Study, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineers and other consultants, a representative from a non-governmental organization, and others.

City of Saskatoon

- Amber Weckworth, Manager, Education and Environmental Performance Section; amber.weckworth@saskatoon.ca
- Katie Burns, Special Project Manager; Katie.burns@saskatoon.ca
- Chris Richards, Manager of Energy and Sustainability
- Josh Quintal, Project Engineer
- Anna Hopkins, Engagement specialist
- Michael Klein, Communications specialist
- Alan Krieger, Senior Project Manager
- Michelle Jelinski, Manager of Environmental Operations
- Mike Khouri, Director of Management
- Cindy Yelland, Director of Planning & Development Law
- Chelsey Bartlett, Performance Improvement Coordinator
- Hazel Fernandez, Project Manager
- Daniel Mireault, Environmental Coordinator
- Pam Groat, Project Engineer
- Barret Froc, Operations Engineer
- Russ Munro, Director of Water and Waste Operations
- Brenda Wallace, Director of Environmental & Corporate Initiatives

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Dillion Consulting Limited
334 – 11th Avenue SE, Suite 200
Calgary, AB T2G 0Y2
403-215-8880

2. The Feasibility Study

a) Describe the process that you undertook to make this feasibility study a reality, from concept, to council approval, to RFP, to final deliverable.

The study looked primarily at options for food and yard waste collection, but also assessed related programs affected by the organics program including a pay-as-you-throw garbage collection and changes to recycling. The options were analyzed through research, a feasibility assessment, and public engagement. They were compared through a Choosing by Advantages Decision making process.

The study was completed in six steps:

1. Research
2. Waste diversion estimates
3. GHG emission estimates
4. Public engagement
5. Program analysis

6. Recommendation

Implementation of a curbside organics program is planned for 2023 and work is on hold until 2021.

b) What were the objectives of the Feasibility Study (what was it seeking to determine)?

The objectives of the organics feasibility study were two fold. First was to analyze collection, processing and funding options for a residential organic waste collection program through a combination of research and public engagement. The second objective was to provide a preferred organics program and provide a detailed implementation plan.

c) What approach (or methodology) was used in the Feasibility Study to meet these objectives?

After significant research, modeling and public engagement, City staff undertook a Choosing by Advantages (CBA) decision making process (Lean Construction Institute) to determine future program details. The CBA system is intended to focus decision makers on the value proposition and the importance of advantage based decision making. This process included a full day workshop with key decision makers from operations and environmental performance groups.

d) Please describe any public consultations conducted as part of the Feasibility Study and their impact on the Study.

Between February 12 and March 6, 2018, the City of Saskatoon engaged residents on curbside waste collections. Over 5,000 residents participated in the community engagement which included an online survey, a series of six Pop-Up events, two community workshops, and an accessible waste collection workshop. Two further "Sensemaking" engagement sessions were held in late April and early May to share and discuss draft recommendations with groups of residents and stakeholders.

Between June 3 and June 22 2018, the City engaged with multi-unit residents and property managers. The results indicated that the majority of multi-unit residents were supportive of organics, while property manager support was more mixed.

Public consultation and communication was undertaken as part of the Curbside Collection Program Redesign. Preliminary results were considered in the process in consultation with Community Engagement and used as criterion for ranking option advantages.

3. Feasibility Study Findings and Recommendations

a) What were the environmental findings related to the options explored in the Feasibility Study? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The 2019 Waste Characterization Study found that an average of 18.19 kilograms of waste was collected per household per week. Of that, 21% of the waste was diverted through the City's curbside recycling and voluntary organics programs. The other 79% was disposed of and was made up of 6.4% recyclables, 43.9% organics, and 28.5% garbage (no existing diversion programs). The Curbside Organics Program option that was chosen (food and yard waste in a green cart) is expected to have a capture rate of 51%, meaning that, the projected residential diversion rate is expected to increase from its current 21% in 2019 to 58% once the program is fully implemented.

Waste diversion was estimated for each of the options by completing a municipal scan which referenced work done by Simcoe County[2], SWANA[3], and commissioned research and analysis by Dillon consulting. The following table summarizes the results of that research including capture rate, contamination rate, and amounts of materials collected from single-family households in other municipal programs for each of the options.

	Average Capture Rate (%)	Average Contamination (%)	Food Waste (kg/SFHH)	Yard Waste (kg/SFHH)	Commingled (kg/SFHH)	Self-Haul L&YW (kg/SFHH)	Self-Haul Branches / Logs (kg/SFHH)	Total (tonnes)	Difference (tonnes)	Higher Error (plus)	Lower Error (minus)
Optibag + Depots	46%	6.5%	93	48		30	88	17,509	(8,717)	5,829	5,567
Optibag + Seasonal Yard Waste Program + Depots	46%	6.5%	93	120		30	88	22,228	(3,999)	9,490	8,895
Commingled Cart + Depots	51%	7.3%			310		88	26,227	-	11,399	9,346
Food Waste Cart + Seasonal Yard Waste Program + Depots	51%	6.7%	124	120		30	88	24,234	(1,993)	10,061	10,736

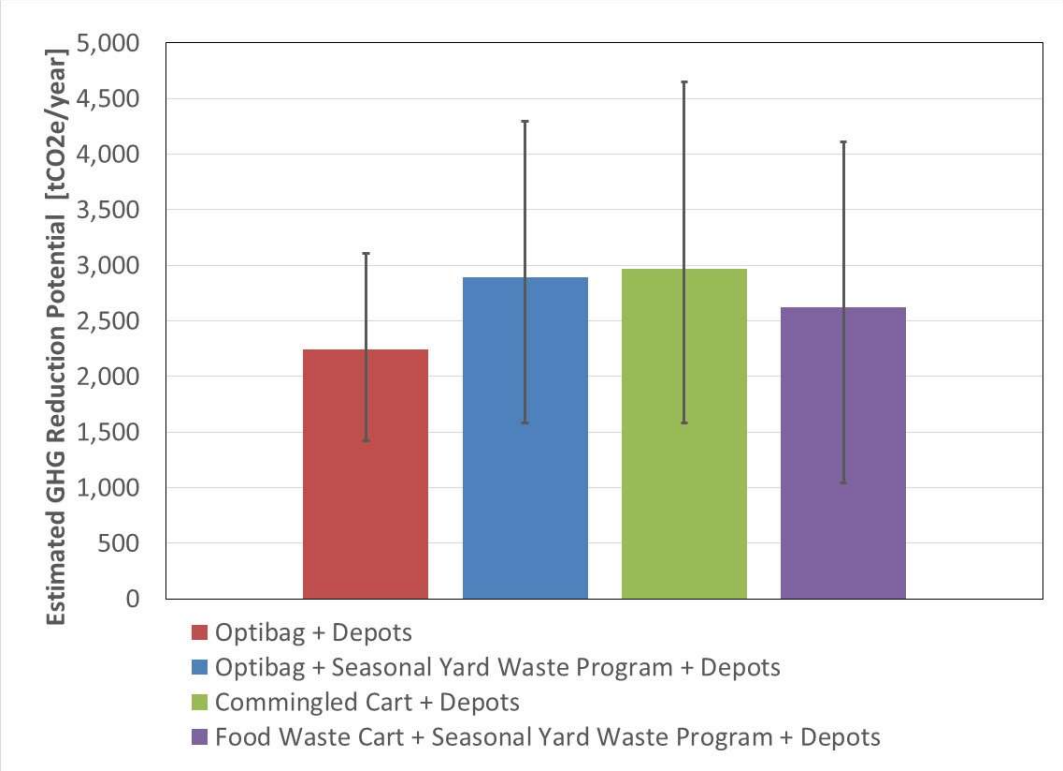
Organic waste generates greenhouse gas (GHG) emissions. A city-wide curbside organics service will contribute positively to climate change mitigation and aligns with the City's Performance Target for greenhouse gas reduction. Composting associated with the new program will reduce greenhouse gas emissions by 6,000 to 9,000 tonnes of carbon dioxide equivalents by reducing the methane generated by organics when landfilled. By reducing passenger vehicle trips to depots, there will be an additional impact to emissions reduction (which will be calculated at a later date). Due to having the highest potential for diverting organics, this service design has the largest potential for GHG reductions.

The greenhouse gas emissions (GHG) were calculated based on total emissions avoided by not sending the organics to the landfill minus the increase in emissions due to operating impacts (electricity use for optical sorting, optical sorting building operational utilities, diesel consumed by garbage trucks and hauling trucks, etc.). The following figure shows the net GHG emissions for each of the options:

[2]County of Simcoe SWMS 5-Year Update Current Status Report. 2015. https://www.simcoe.ca/SolidWasteManagement/Documents/2016%20Strategy%20Update%20-%20Appendicies.pdf

3 Food Waste Diversion Programs & Their Impacts on MSW Systems. 2016. Solid Waste Association of North America.

. 2016



Note that the previous figure assumed use of diesel collection trucks. If the City were to require natural gas collection trucks (which could be converted to biogas at a future date) the emissions of the cart based systems would drop. The following figure shows the net emissions if the collections trucks emitted 15% less GHGs (approximate emissions savings from using natural gas vs. diesel).

b) What were the financial findings related to the options explored in the Feasibility Study (for example, results of a cost-benefit analysis, financial savings identified, and so on)? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

Costs were considered in the evaluation of each option, during evaluation, the focus was on cost differences between the options. However, in order to ensure that the total cost of the recommended option was reasonable, the costs of similar programs in other communities in North American were also looked at to identify a range of acceptable costs. The cost of the recommended option fell within this range.

To further understand the cost comparisons used in the organics decision making model, it is important to understand that $/tonne was considered for processing. The options that achieve higher diversion rates, will have higher tonnes being processed, and therefore, will have higher overall costs than options that achieve lower diversion rates. The organics costs did not include savings in landfill airspace.

The recommendation was within the acceptable range set by other North American communities, even when considering the higher processing costs associated with additional tonnes achieved through the greater diversion.

c) Based on the environmental and financial findings above, what does the Feasibility Study recommend?

Consensus was reached through the CBA process and the chosen alternative was organics collected year-round in a commingled medium to large green cart for both food and yard waste streams (bagged or loose). The top three factors included diversion potential, ability to co-mingle food and yard waste and receive consistent service, and convenience associated with not requiring specialized bags (and potentially allowing loose materials).

4. Lead Applicant's Next Steps

a) Taking the Feasibility Study's recommendations into account, what next steps do you as the municipality plan to take? What potential benefits or internal municipal improvements would result from these next steps?

The City of Saskatoon is expected to begin program implementation planning in 2021. With procurement and delivery time for carts and trucks, plus implementation time for a new organics processing facility, it is anticipated that at minimum 14 to 18 months would be required to implement a city-wide curbside organics program.

Program planning will include all operational components such as:

- Procurement and deployment of green carts for all curbside households.
- An approved Service Level including a performance reporting program and an identified service line.
- Program Eligibility Plan including a definition for curbside customers and exceptions. Includes a transition plan for non-eligible customers, subscription green carts and compost depots.
- Operations program including required administration activities and operational processes to establish administrative and operational capacity and processes to manage the curbside organics program and new level of services. This includes a Health & Safety Management Plan and a staffing plan complete with organizational chart, job description review, and trained staff.
- Design and construction of a site plan for new and damaged carts.
- Collections and processor interface plan and procedure for unloading at the processing facility.
- Regulatory compliance program, including bylaws and policies to support the new curbside organics program and level of service.
- A communication program to support both internal and external project and program needs.
- Customer service program and knowledge base that incorporates an education plan.

5. Lessons Learned

In answering the questions in this section, please consider all aspects of undertaking the Study — from the initial planning through each essential task until the Final Study was prepared.

a) What would you recommend to other municipalities interested in doing a similar Feasibility Study?

- Conduct extensive public engagement to inform the decision making process
- Use a diverse project team to add legitimacy to the decision making process
- Have a chosen methodology for assessing options
    - Choosing By Advantage (CBA) process – Lean Methodology
- Have a facilitated workshop to complete the assessment
    - Ensure many voices are at the table

    - Have external stakeholders and subject matter experts for different perspectives – Saskatchewan Waste Reduction Council
- Create a compelling story/narrative and stick to it
    - Tell the right story – diversion and service to citizens

b) What would you do differently if you were to do this again?

Ensure governance is well defined
- Reports to Council came from too many sources and were not aligned
- Decision making and approval process was not well defined
- Governance structure had two decision makers at times and many personnel changes were made to the steering committee

Change project delivery
- Hire project manager early to plan work/research before the project team is assembled
- Deliver as a program or change in service as opposed to a project (ex. bridge construction)

Reduce scope

Reduce the number of topics in the project – we tried to implement a new organics program and switch to utility funding while eliminating a chronic operating deficit which made each issue seem bigger than it was, and put a negative light on the organics program (which most were essentially in favour of). Should have kept messages/issues separate from each other and focused on organics – tried to fix too many problems at once.

Improve communication with City Council
- Think strategically about the communications with City Council:
    - Consider having more dialog with council earlier in the process
    - Consider other ways to communicate with Council, since Council reports have limitations
    - Don't have too many reports over too much time – Council forgot what was previously reported to them – could have used a communications schedule or project plan
- Maintain focus; too much on landfill and cost

Include external experts earlier in the process
- Additional impartial industry expertise would have been helpful – expert third party opinion/presentation may have been good for Council
- SERA report was finalized too late in the process to be fully considered in the CBA and estimates did not match internal models

c) What barriers or challenges (if any) did you encounter in doing this Feasibility Study? How did you overcome them?

Challenge: Messaging to Council
- Lengthy reports
- Long process: reporting over multiple years

Solution: Adjust the message
- Provided background info in reports summarizing decision already made
- Understanding our audience and providing information in a way that made sense
    - Simple communications/soundbites that can be easily digested by Council and public
- Responding to Council questions and inquiries
- People thought it was a costly project; changed communications to discuss future cost savings

6. Knowledge Sharing

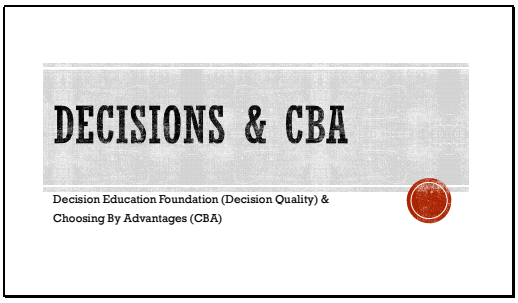
a) Is there a website where more information about the Feasibility Study can be found? If so, please provide the relevant URL.

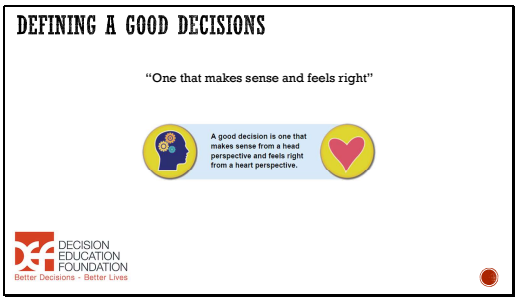
https://www.saskatoon.ca/engage/saskatoon-talks-trash-curbside

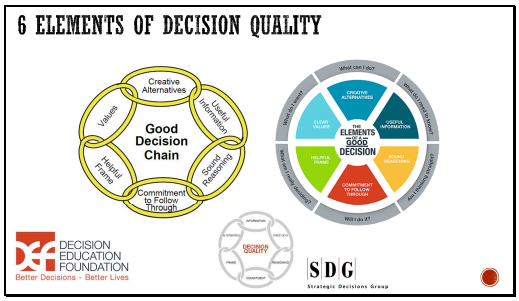
b) In addition to the Feasibility Study results, has your Feasibility Study led to other activities that could be of interest to another municipality (for example, a new policy for sustainable community development, a series of model by-laws, the design of a new operating practice, a manual on public consultation or a measurement tool to assess progress in moving toward greater sustainability)? If so, please list these outcomes, and include copies of the relevant documents (or website links).

- Solid Waste Reduction Plan
  - Available June 2020
- City of Saskatoon Public Engagement Policy
  - Effective September 2019
  - https://www.saskatoon.ca/sites/default/files/documents/city-clerk/civic-policies/c02-046.pdf
- Choosing by Advantages
  - Decision & CBA - Microsoft Power Point presentation (Appendix A)
  - Utilized in recent projects - The Industrial, Commercial and Institutional Sector Waste Diversion Strategy
  - Used as a case study in an Academic Paper entitled: *Designing Municipal Waste Management Programs Using Choosing by Advantages and Design Structure Matrix*. Found at: https://www.researchgate.net/publication/334282540_Designing_Municipal_Waste_Management_Programs_Using_Choosing_by_Advantages_and_Design_Structure_Matrix

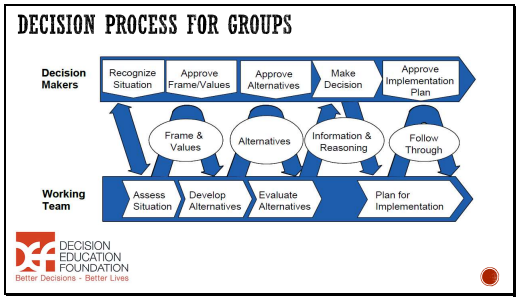
Appendix 1. CBA Presentation

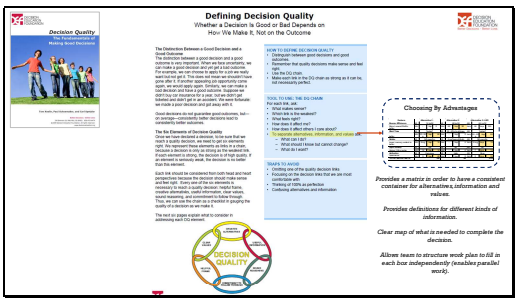


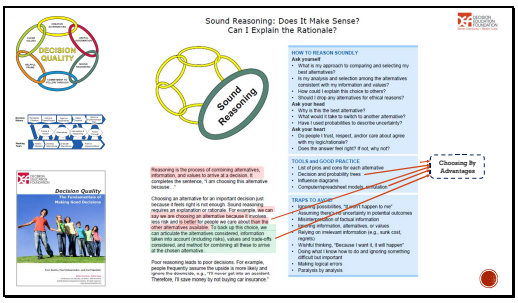




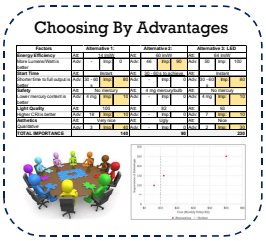
Helpful Frame	Clarifying the situation we are trying to solve. What is it that we are deciding? What is it that we are not? What **factors** are involved? Who needs to be involved in making the decision? (**stakeholders**) **1. Purpose 2. Scope 3. Perspective**
Values	What is it that I care about? Wants, needs, dislikes, etc. What is more **important** to me? How much of one want am I willing to give up to get more of another? Can I explain why the potential futures associated with each alternative are attractive or not? Can I explain how much of something I would give up in order to get more of something else? They cause us to prefer one alternative over another. Tip: *Avoid overreacting to risks.*
Creative Alternatives	Recognizable qualities of good alternatives are that they are under my control, significantly different, potentially attractive, and can be acted on. Do my **alternatives** feel like a complete set? What other alternatives might I consider, if I were not afraid? Tools: **Decision Tables, Decision Trees**
Useful Information	Anything I know, would like to know, or should know that might influence my decision—but that is not under my control. Information upon which I base my decisions should be useful in the sense that it could influence my choice of alternatives. Useful information should come from a credible and unbiased source, be timely, and acknowledge uncertainty.
Sound Reasoning	Reasoning is how I combine my alternatives, information, and values to arrive at a decision. It is my answer to: "I am choosing this alternative because…." What is my approach to comparing and selecting my best alternatives? Is my analysis and selection among the alternatives consistent with my information and values? How could I explain this choice to others?
Commitment to Follow Through	Commitment to follow through means I am set to follow through and have the ability to do so in a purposeful manner. If we are only halfhearted about our commitment, our follow-through is usually less intense and may not achieve the best results.

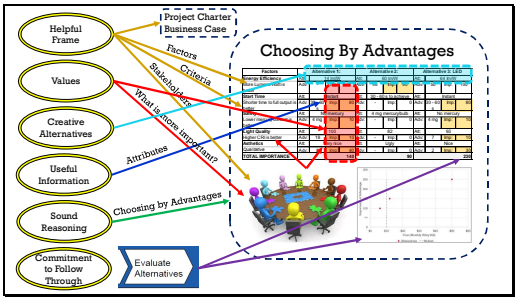






1. **Vocabulary**
2. **Matrix:**
   - Sort and Store Information
   - Consistent Comparison
3. **Decision Maker Workshop**
   - Stakeholders
   - Decide Importance (Values)
4. **Decision Dashboard**
   - Money Decisions
   - Compare to Budget
   - Affordability and Money trade offs

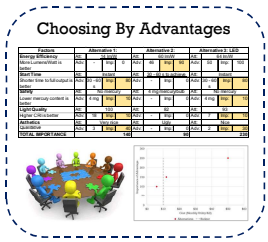




DECISION-MAKERS: An individual, or decision body, that is responsible for making the decision and allocating the resources needed to pursue the chosen course. By definition, they have the responsibility for overall decision quality.

WORKING TEAM: These individuals enable decision-makers to make well-informed choices more efficiently. They assist in framing the situation, gathering information, generating alternatives, and analyzing the value of potential outcomes. They facilitate the process by achieving commitment to action from the decision-makers and by providing clear direction to those designated to implement the decision.

CONTENT EXPERTS AND IMPLEMENTERS: Domain experts provide valuable facts and judgments about the consequences of different alternatives. Involving implementers early in the process helps avoid barriers that arise when people must implement decisions made by others. Implementers' involvement and contributions usually translate to improved execution.

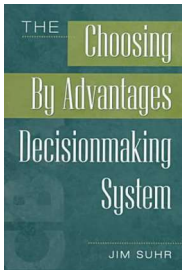


INTEGRATED PROJECT DELIVERY

1. Design-Bid-Build
2. Design-Build
3. Integrated Project Delivery

Lean Construction Institute
Transforming the Built Environment

Documented & transparent decision making process that enables people to move on (Choosing By Advantages)



CBA/JIM SUHR

Eugene Grant, Principles of Engineering Economy
Bruce Bishop, Stanford University
Mac McKee, Utah State University

The **United States Forest Service** (USFS) is an agency of the U.S. Department of Agriculture that administers the nation's 154 national forests and 20 national grasslands, which encompass 193 million acres (780,000 km^2).

Major divisions of the agency include the National Forest System, State and Private Forestry, Business Operations, and the Research and Development branch. It manages approximately 25% of US federal lands.

As of 2009, the Forest Service has a total budget authority of $5.5 billion, of which 42% is spent fighting fires. The Forest Service employs 34,250 employees in 750 locations, including 10,050 firefighters, 737 law enforcement personnel, and 500 scientists.

The everyday work of the Forest Service *balances resource extraction, resource protection, and providing recreation.*

"The most important thing we do in the Forest Service is *make quality decisions – with your participation in the decision making process.*

For every person who wants something from or for their National Forests there is someone else who wants something entirely different."

- Mark Johnson, US Forest Service

CBA: The gift was the basic part of a decisionmaking system that provides an opportunity to focus on the problem and not each other's position.

- Mark Johnson, US Forest Service

- Provides Focus
- Problem vs. Positions
- Creative Alternatives
- Collaborative
- Sound
- Effective

Anchored vs. unanchored questions and judgements.

"How should we respond to an unanchored question? The natural, automatic response is to **assume** a specific meaning of the question, and then to ***answer the assumed question.***

Jim Suhr (engineer)

In many decisionmaking situations, unfortunately, this produces unsound decisions. To make matters worse, it very often ***produces unnecessary, dysfunctional conflicts.***

Several years ago, for example, members of the Forest Service made a very costly mistake - one that they are still paying for. They asked members of the public a number of unanchored questions, such as the following:

"Which is more important, to you, wilderness or development?"

Of course, these unanchored questions produced emotionally charged, unanchored judgements; and the result was polarization – instead of ***effective interactive decisionmaking.***"

Jim Suhr
(engineer)

- How can we consistently make sound decisions?
- How can we show that our decisions are sound?
- How can we simplify sound decisions?
  - *Do not confuse unfamiliarity with complexity.*

HISTORY

- 1871: Carl Menger, *Principles of Economics*, theory of marginal utility
- 1887: Arthur Wellington (U.S. civil engineer, author of *The Economic Theory of the Location of Railways* and editor of *The Engineering News*)
- 1933: Alfred Korzybski (developed general semantics, "The map is not the territory"
- 1938: Eugene Grant, textbook: *Principles of Engineering Economy* (8th edition was published in 1990)
- 1969: Bruce Bishop (Stanford University), Socio-Economic and Community Factors in Planning Urban Freeways (U.S Highway Research Board)
- 1970: Eugene Grant & William Ireson, *Principles of Engineering Economy*, 5th Edition
- 1976: Jim Suhr, Bruce Bishop (Dean of Engineering, Utah State University) & Mac McKee (Graduate Student)
- 1982: Jim Suhr, *Tradeoff Evaluation Process*
  - Workshops
    - People place a disproportionate amount of weight on disadvantages.Therefore you mist do the difference of advantages, not disadvantages
  - Histogram experimentation
  - People listed differences twice, first as advantages and then as disadvantages
  - Point where he changed how money decisions were dealt with
  - Peer reviewed by university professors and professionals
- 1997: Lean Construction Institute (LCI) formed
  - [founded by Glenn Ballard (Engineering Professor, University of California, Berkeley) and Greg Howell (SSCE & MSCE, Stanford, Professor University At New Mexico)]
  - Toyota Way, Last Planner, Etc.
- 1999: Jim Suhr, The Choosing by Advantages Decisionmaking System
- 2017: Curriculum development (LCI, elementary, high school and university)

WHERE HAS CBA BEEN USED?

- USDA Forest Service
  - Wasatch-Cache National Forest – location of a Forest Service Public Lands Information Centre
  - Wasatch-Cache National Forest – Setting Annual Budget Priorities
  - Set national priorities among proposals for both cleaning up hazardous materials sites and for some of the San Dimas Technology & Development Center's programs
  - Snowbasen day lodge construction contractor (2002 Winter Olympics)
- US Federal Highway Administration
- State of Idaho (e.g. transportation priorities)
- State of Montana
- 2002 Winter Olympics (Salt Lake City, Utah) – used to select a new highway location for access to a downhill venue at Snowbasin, then for selecting the contractor to construct the highway
- Environmental analysis for reconstruction of Salt Lake City's Redwood Road
- North Ogden City, Utah – Used CBA to select a new City Manager
- US National Park Service
  - General Management Plans for National Parks and National Monuments
  - Set national priorities for construction programs
- Lean Construction Institute (LCI)
- Sutter Health San Francisco Hospital design
- Design of the Cathedral Hill Hospital, San Francisco
- California Prison Receivership design
- SLC Redwood Road preferred alternative selection

Lean Construction Institute
Transforming the Built Environment

- Formed in 1997 to develop and disseminate new knowledge regarding the management of work in projects.
- 2016: 195 corporate members, 28 communities of practice (3,600 attendees), 1,300 attendees to annual conference (59% were general contractors)

EVALUATING ALTERNATIVES

OPTIONS

- Weighting, Ranking, Calculating (WRC)
  - Also known as a Multi-Criterion/Variable Matrix/Decision Analysis, weighted sum, etc.
  - Multi-Attribute Utility Theory
- Choosing by Advantage (CBA)

WRC / MULTI-VARIABLE MATRIX

Factors	Weight
Quality of Past Work	30
Methodology	30
Price	30
Quality of Proposal	10
Sum	**100**

- Must assign weight to Factors
  - Need to get the Weights right (significant assumptions required)
  - Can be difficult to agree on the Weights
- Mixing cost with Factors
  - What if you can't afford the highest ranked option?
- Making decisions based on valuing Factors and/or Attributes
  - Choosing By Nonspecific Labels
- Places weight on non-differentiating factors
  - e.g. every alternative meets the minimum safety requirements

WRC

"Unanchored" Question:

What is more important, safety or productivity?

Factors	Weight
Safety	50
Productivity	50
Sum	**100**

"Anchored" Question (CBA):
How important is the extremely small advantage in safety, compared with the very large advantage in productivity?

When people make decisions based on assumptions that can't be/aren't articulated this creates high risk for conflict.

CBA

COMMON LANGUAGE

Alternatives

- Possible outcomes of the decision

COMMON LANGUAGE

Factor

- An element, or a component, of a decision
- A container for Criteria, Attributes, Advantages, and other types of data

CHOOSING BY ADVANTAGES

- Cost is a constraint, not a Factor
- Cost is treated like a budget – Addresses affordability

COMMON LANGUAGE

Attribute

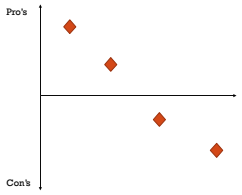
- A characteristic or consequence of one Alternative
  - one person, one thing, one plan, etc.
- An attribute is not a difference and cannot be written as such
- Make sure to be very specific in order to anchor the decision

COMMON LANGUAGE

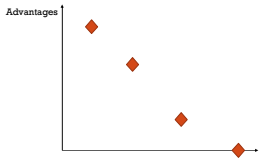
Advantage

- A favourable dissimilarity in quality or difference in quantity between the Attributes of two Alternatives.
- The difference from the least-preferred attribute.
- What is the least-preferred attribute? (ask stakeholders)
- How large are the Advantages?
- How important are the Advantages? (ask stakeholders)

PRO'S AND CONS

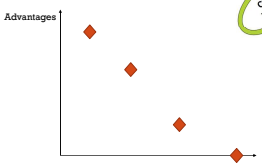


PRO'S AND CONS



Con's are negative advantages, just need to reframe the language
Move the datum so that everything has a common reference point.

PRO'S AND CONS



TRAPS TO AVOID
- Overreacting to risks

Con's are negative advantages, just need to reframe the language
Move the datum so that everything has a common reference point.

COMMON LANGUAGE

Criterion / Criteria

- A decision-rule
- A guideline
- Any standard or test on which a decision or judgement is based
- Any decision that guides further decisionmaking
  - Be careful to not rule out the best alternative

Must's & Want's

COMMON LANGUAGE

Criterion / Criteria

- Must-Criterion: The maximum weight is 80 Pounds
- Want-Criterion: Lighter is better
  - Some people may say that heavier is better (e.g. want to strengthen their muscles)
  - Can denote in brackets (lighter is better) within the Tabular method

ANCHORING

Unanchored Question:
Is weight more important than colour?

Anchored Question:
How important is the difference in weight, compared with the difference in colour?

Anchored Question (Improved):
How important is the advantage in weight, compared with the advantage in colour?

Strongly Anchored Question:
How important is the 10-Pound advantage in weight (65 Pounds vs. 75 Pounds) compared with the very large advantage in colour (our favourite colour vs. a colour that's barely acceptable)?

TABULAR METHOD

Factors	Alternative 1 iPhone SE	Alternative 2 iPhone 8	Must-Criteria
Battery Life *(more hours is better)*	*15 hours*	*20 hours*	Must fit in my pocket.
Available Colours *(more selection is better)*	*Rose, Silver, Black*	*Rose, Silver, Grey, Black*	Must be less than 2 years old.
Weight *(less is better)*	*138 g*	*188 g*	
Camera *(more MP is better)*	*12 megapixels*	*18 megapixels*	

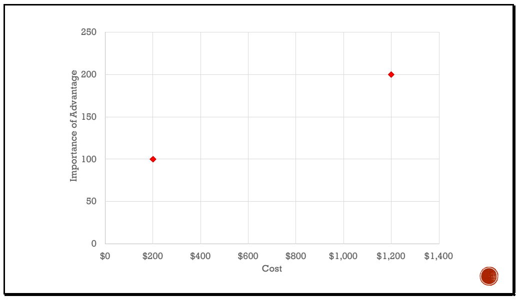
Want-Criteria — **Attributes**

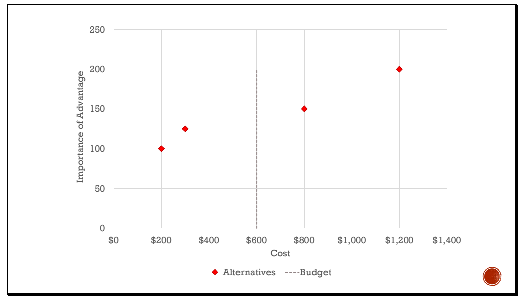
Factors	Alternative 1 iPhone SE	Alternative 2 iPhone 8	Must-Criteria
Battery Life *(more hours is better)*	*15 hours*	*20 hours* +5 hours	Must fit in my pocket.
Available Colours *(more selection is better)*	*Rose, Silver, Black*	*Rose, Silver, Grey, Black* +1 colour	Must be less than 2 years old.
Weight *(less is better)*	*138 g* -50 g	*188 g*	
Camera *(more MP is better)*	*12 megapixels*	*18 megapixels* +6 MP	

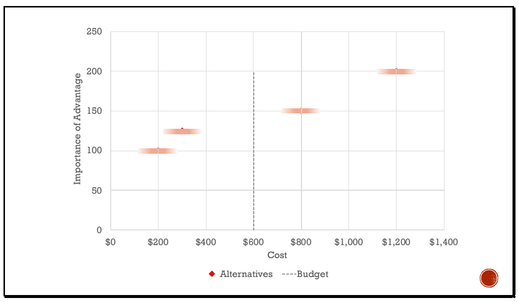
Price is **not** a Factor.
Price is a constraint to the decision and assessed in the final step.

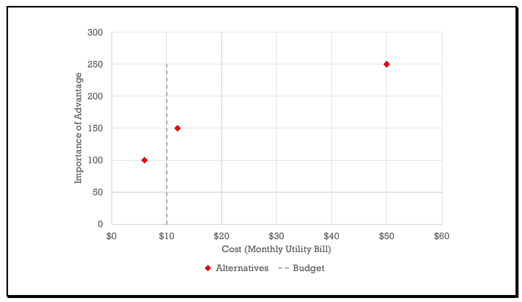
Factors	Alternative 1 iPhone SE	Alternative 2 iPhone 8	Must-Criteria
Battery Life *(more hours is better)*	*15 hours*	*20 hours* +5 hours	Must fit in my pocket.
Available Colours *(more selection is better)*	*Rose, Silver, Black*	*Rose, Silver, Grey, Black* +1 colour	Must be less than 2 years old.
Weight *(less is better)*	*138 g* -50 g	*188 g*	
Camera *(more MP is better)*	*12 megapixels*	*18 megapixels* +6 MP	
Total "Importance of Advantages"	***100***	***200***	

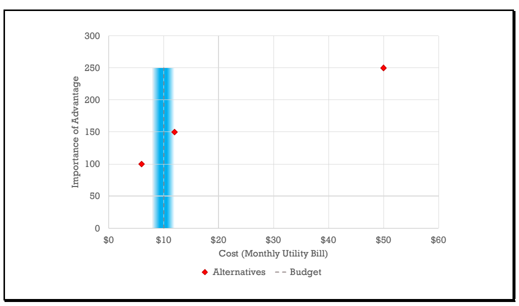
Price
Alternative 1: $200
Alternative 2: $1,200


250
200
150
100
50
0
Importance of Advantage
$0
$200
$400
$600
$800
$1,000
$1,200
$1,400
Cost


250
200
150
100
50
0
Importance of Advantage
$0
$200
$400
$600
$800
$1,000
$1,200
$1,400
Cost
Alternatives
----Budget


250
200
150
100
50
0
Importance of Advantage
$0
$200
$400
$600
$800
$1,000
$1,200
$1,400
Cost
Alternatives
----Budget


300
250
200
150
100
50
0
Importance of Advantage
$0
$10
$20
$30
$40
$50
$60
Cost (Monthly Utility Bill)
Alternatives
-- Budget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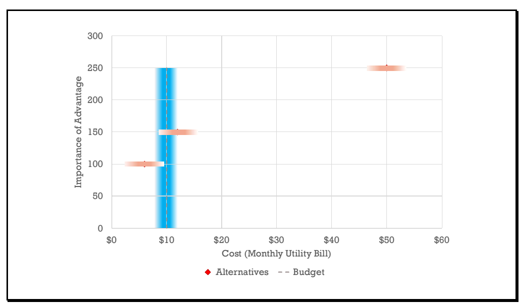
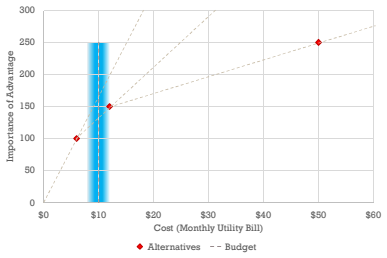
250
200
150
100
50
0
Importance of Advantage
$0
$10
$20
$30
$40
$50
$60
Cost (Monthly Utility Bill)
Alternatives
-- Budget


300
250
200
150
100
50
0
Importance of Advantage
$0
$10
$20
$30
$40
$50
$60
Cost (Monthly Utility Bill)
Alternatives
-- Budget



IMPORTANCE OF ADVANTAGES

TABULAR METHOD

Factors	Alternative 1: Incandescent	Alternative 2: CFL	Alternative 3: LED
Energy Efficiency	14 lm/W	60 lm/W	64 lm/W
Start Time	Instant		Instant

ENSURE CRITERIA IS CLEAR

Factors	Alternative 1: Incandescent		Alternative 2: CFL		Alternative 3: LED	
Energy Effcie						
More Lumens/Watt is better	Adv:	Imp:	Adv:	Imp:	Adv:	Imp:
Start Time	Att:	Instant	Att:	30 - 60 s to achieve	Att:	Instant
Shorter time to full output i_b	Adv:	Imp:	Adv:	Imp:	Adv:	Imp:
Lower mercury content is better	Adv:	Imp:	Adv:	Imp:	Adv:	Imp:
Light Quality	Att:	100	Att:	82	Att:	93
Higher CRI is better	Adv:	Imp:	Adv:	Imp:	Adv:	Imp:
Qualitative						

Criteria for each Factor
Att: Attribute
Adv: Advantage
Imp: Importance

SELECT LEAST PREFERRED

Factors	Alternative 1:		Alternative 2:		Alternative 3: LED	
Energy Efficiency	Att:	14 lm/W	Att:	60 lm/W	Att:	64 lm/W
More Lumens/Watt is better	Adv: -	Imp: 0	Adv:	Imp:	Adv:	Imp:
Start Time	Att:	Instant	Att:	30 - 60 s to achieve	Att:	Instant
Shorter time to full output is better	Adv:	Imp:	Adv: -	Imp: 0	Adv:	Imp:
Safety	Att:	No mercury	Att:	4 mg mercury/bulb	Att:	No mercury
Lower mercury content is better	Adv:	Imp:	Adv: -	Imp: 0	Adv:	Imp:
Light Quality	Att:	100	Att:	82	Att:	93
Higher CRI is better	Adv:	Imp:	Adv: -	Imp: 0	Adv:	Imp:
Asthetics	Att:	Very nice	Att:	Ugly	Att:	Nice
Qualitative	Adv:	Imp:	Adv: -	Imp: 0	Adv:	Imp:

Underline least preferred alternative for each Factor
The least preferred alternative has no advantage and an importance of 0.

DETERMINE THE ADVANTAGE OF EACH ALTERNATIVE

Factors	Alternative 1:		Alternative 2:		Alternative 3: LED	
Energy Efficiency	Att:	14 lm/W	Att:	60 lm/W	Att:	64 lm/W
More Lumens/Watt is better	Adv: -	Imp: 0	Adv: 46	Imp:	Adv: 50	Imp:
Start Time	Att:	Instant	Att:	30 - 60 s to achieve	Att:	Instant
Shorter time to full output is better	Adv: 30 - 60 s	Imp:	Adv: -	Imp: 0	Adv: s	Imp:
Safety	Att:	No mercury	Att:	4 mg mercury/bulb	Att:	No mercury
Lower mercury content is better	Adv: 4 mg	Imp:	Adv: -	Imp: 0	Adv: 4 mg	Imp:
Light Quality	Att:	100	Att:	82	Att:	93
Higher CRI is better	Adv: 18	Imp:	Adv: -	Imp: 0	Adv: 7	Imp:
Asthetics	Att:	Very nice	Att:	Ugly	Att:	Nice
Qualitative	Adv: 3	Imp:	Adv: -	Imp:	Adv: 2	Imp:

DECIDE ON "PARAMOUNT IMPORTANCE" ADVANTAGE

Not the paramount importance Factor.

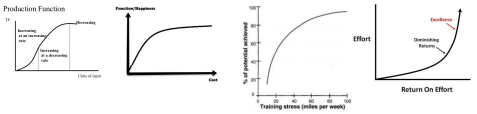
100: most important "Paramount Importance"
0: least advantage

Fit everything else in between (weigh all advantages on the same scale).
It is possible for more than one advantage to have the same weight of importance.
A near zero advantage usually has a near zero importance.

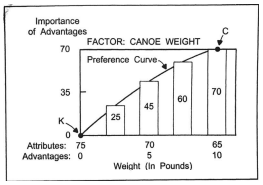
Do not automatically assume importance is linear.

LAW OF DIMINISHING RETURNS

- As you put more effort into something, the increase in productivity decreases until you finally reach a point where incredible amounts of effort result in very small increases in productivity.



PREFERENCE CURVE



PARAMOUNT ADVANTAGE

Factors	Alternative 1:				Alternative 2:				Alternative 3: LED			
Energy Efficiency	Alt:	14 lm/W			Alt:	60 lm/W			Alt:	64 lm/W		
More Lumens/Watt is better	Adv:	-	Imp:	0	Adv:	46	Imp:		Adv:	50	Imp:	100
Start Time												
Shorter time to full output is better	Adv:	30 - 60 s	Imp:		Adv:	-	Imp:	0	Adv:	s	Imp:	
Safety	Alt:	No mercury			Alt:	4 mg mercury/bulb			Att:	No mercury		
Lower mercury content is better	Adv:	4 mg	Imp:		Adv:	-	Imp:	0	Adv:	4 mg	Imp:	
Qualitative												

ASSIGN IMPORTANCE OF ADVANTAGES

Factors	Alternative 1:				Alternative 2:				Alternative 3: LED			
Energy Efficiency	Alt:	14 lm/W			Alt:	60 lm/W			Alt:	64 lm/W		
More Lumens/Watt is better	Adv:	-	Imp:	0	Adv:	46	Imp:	90	Adv:	50	Imp:	100
Start Time	Alt:	Instant			Alt:	30 - 60 s to achieve			Alt:	Instant		
Shorter time to full output is	Adv:	30 - 60	Imp:	80	Adv:	-	Imp:	0	Adv:		Imp:	80
Lower mercury content is better	Adv:	4 mg	Imp:	10	Adv:	-	Imp:	0	Adv:	4 mg	Imp:	10
Light Quality	Alt:	100			Alt:	82			Alt:	93		
Higher CRI is better	Adv:	18	Imp:	10	Adv:	-	Imp:	0	Adv:	7	Imp:	10
Asthetics	Alt:	Very nice			Alt:	Ugly			Alt:	Nice		
Qualitative	Adv:	3	Imp:	40	Adv:	-	Imp:	0	Adv:	2	Imp:	30
TOTAL IMPORTANCE				**140**				**90**				**230**

First, decide on the importance of the most important advantage in each Factor in comparison to the paramount advantage.

IMPORTANCE OF ADVANTAGES

	Advantage	Importance
More Lumens/Watt is better	50	100
More Lumens/Watt is better	46	90
	30 - 60 s	80
Asthetics	3	40
Asthetics	2	30
Lower mercury content is better	4 mg	10
Higher CRI is better	18	10
Higher CRI is better	7	10

TOTAL IMPORTANCE OF ADVANTAGE

Factors	Alternative 1:				Alternative 2:				Alternative 3: LED			
Energy Efficiency	Att:	14 lm/W			Att:	60 lm/W			Att:	64 lm/W		
More Lumens/Watt is better	Adv:	-	Imp:	0	Adv:	46	Imp:	90	Adv:	50	Imp:	100
Start Time	Att:	Instant			Att:	30 - 60 s to achieve			Att:	Instant		
Shorter time to full output is better	Adv:	30 - 60 s	Imp:	80	Adv:	-	Imp:	0	Adv:	30 - 60 s	Imp:	80
Safety	Att:	No mercury			Att:	4 mg mercury/bulb			Att:	No mercury		
Lower mercury content is better	Adv:	4 mg	Imp:	10	Adv:	-	Imp:	0	Adv:	4 mg	Imp:	10
Light Quality	Att:	100			Att:	82			Att:	93		
Higher CRI is better	Adv:	18	Imp:	10	Adv:	-	Imp:	0	Adv:	7	Imp:	10
Asthetics	Att:	Very nice			Att:	Ugly			Att:	Nice		
Qualitative	Adv:	3	Imp:	40	Adv:	-	Imp:	0	Adv:	2	Imp:	30
TOTAL IMPORTANCE				**140**				**90**				**230**