

University of Massachusetts Boston

From the Selected Works of Michael P. Johnson

July 5, 2019

From Data to Decisions in Local Government

Michael P Johnson, Jr.



Available at: https://works.bepress.com/michael_johnson/115/

From Data to Decisions in Local Government

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Lead for America Summer Training Institute

July 5, 2019



McCORMACK GRADUATE SCHOOL OF POLICY STUDIES
UNIVERSITY OF MASSACHUSETTS BOSTON

Agenda

- Overview of data, analytics and decision-making: 40 minutes
- Break
- Break-out session – case studies: 40 minutes
- Break
- Report-out – what we've learned: 30 minutes
- Wrap-up

Michael's bio

Education:

- PhD, Northwestern University, Evanston, IL
- M.S., University of California, Berkeley
- M.S., Georgia Institute of Technology, Atlanta, GA
- B.S., Morehouse College, Atlanta, GA

Teaching career:

- John W. McCormack Graduate School of Policy and Global Studies, University of Massachusetts Boston, 2007 – present
- H. John Heinz III School for Public Policy and Management, Carnegie Mellon University, 1997 – 2007

Research interests:

- Community data analytics: data collection, analysis and sharing for community and economic development
- Community-based operations research: participatory, values-driven decision modeling for social impact
- Planning support for vacant property management and neighborhood redevelopment
- Decision models and case studies in foreclosed housing redevelopment and community revitalization

Courses taught:

- Geographic information systems
- Research methods
- Urban housing policy
- Analytic methods for urban planning and community development

Community and professional service:

- Institute for Operations Research and the Management Sciences (Pro Bono Analytics, Committee on Diversity, Equity and Inclusion)
- Urban Research-Based Action Network
- Association of Collegiate Schools of Planning
- National Forum for Black Public Administrators

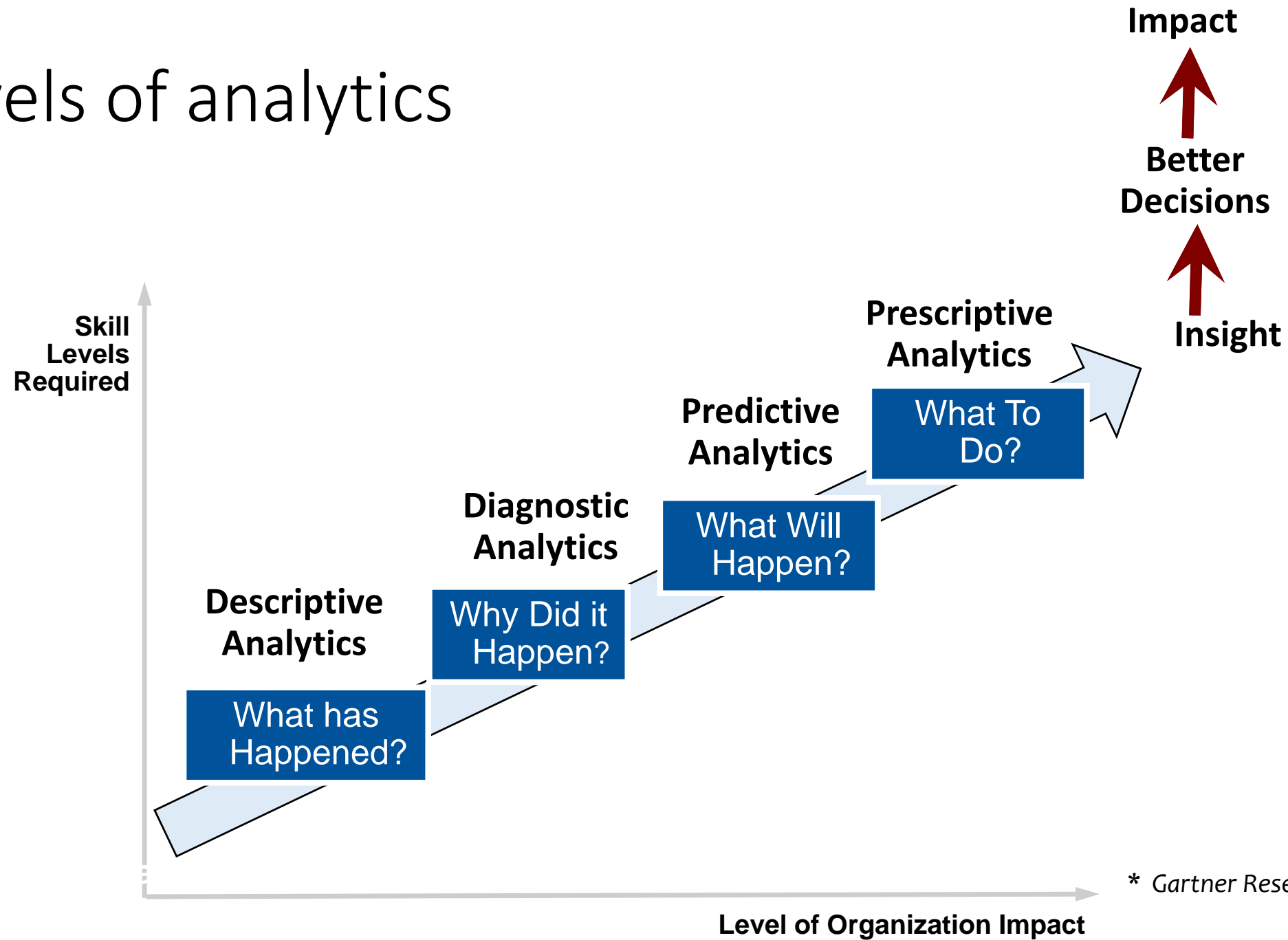
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Analytics and decision-making

- Running organizations requires
 - Data
 - Expertise
 - Analytics
- Analytics can be understood in three ways:
 - Descriptive analytics
 - Predictive analytics
 - Prescriptive analytics

‘Decision science’, ‘decision modeling’ and ‘operations research’ have traditionally been seen as equivalent to prescriptive analytics. Here, we are interested in *any* aspects of analytics that can improve individual and organizational decision-making

Levels of analytics



* Gartner Research - Modified

What is special about public-sector decision-making?

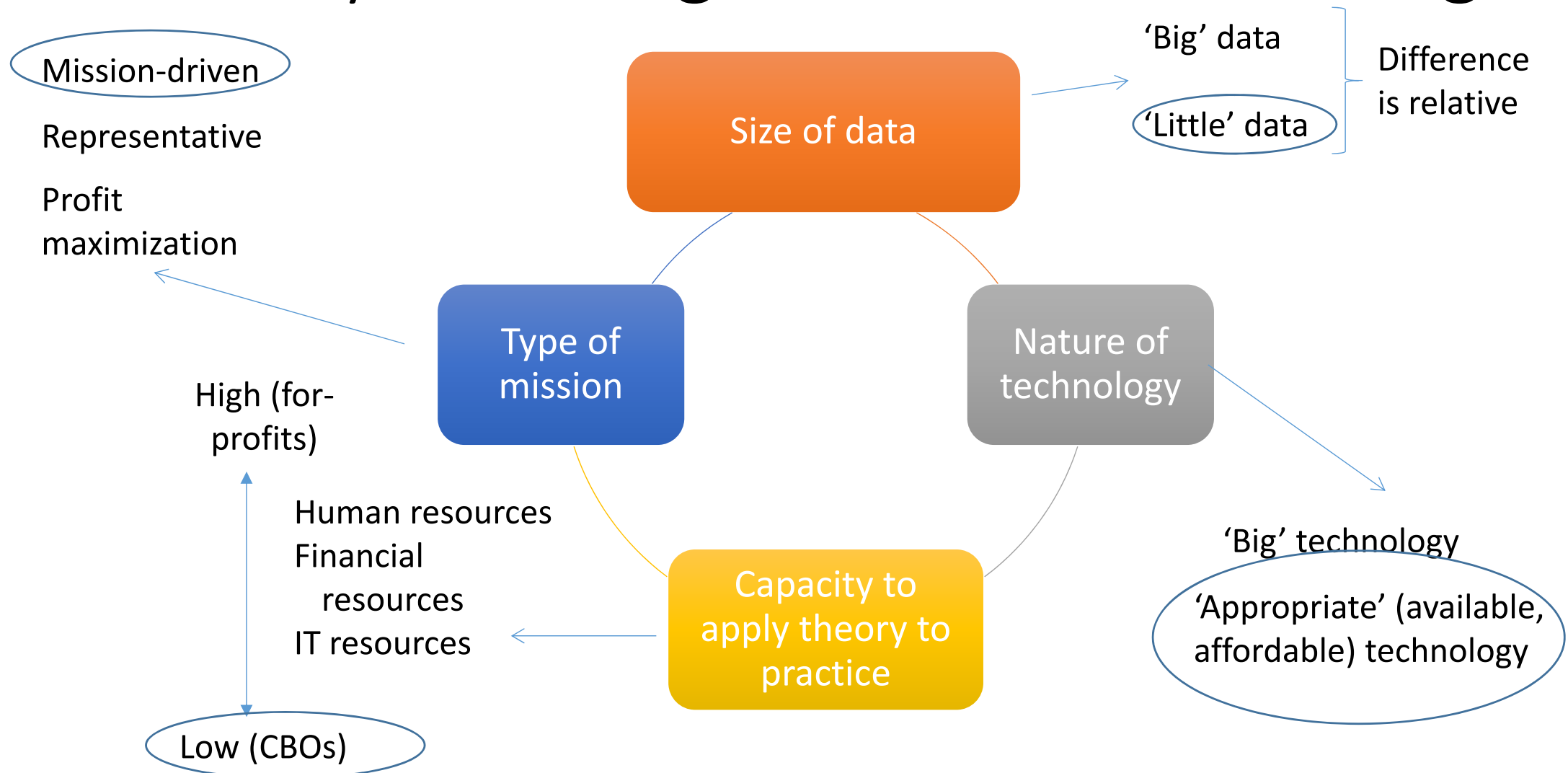
- Private-sector decision-making usually assumes:
 - Impacts measured in dollars
 - Well-defined markets
 - Shareholders are primary stakeholder group
- Characteristics of public-sector OR include:
 - Multiple stakeholders (including less-powerful groups)
 - Multiple objectives (often including economic efficiency)
 - Substantive engagement (at many stages of problem-solving process)
 - Evidence of public/social impact

Some kinds of public problems require a special approach to decision modeling

- What measures of ‘resiliency’ are important to the well-being of communities vulnerable to impacts from climate change?
- How can low-income communities choose redevelopment strategies that balance social & economic opportunity and protection from gentrification?
- How can a school district design a student assignment process that balances local access, equity and academic excellence?

Problems that are hard to define (see e.g. Rosenhead and Mingers 2001), that use qualitative and quantitative data and analytic methods, and whose solutions depend on active community participation can be addressed using *community-engaged operations research*

Organization characteristics influence data availability and usage for decision-making



Where are the data? What if the data don't exist?

Traditional data sources:

Existing	To be generated
Administrative records Publicly-accessible databases Organization archives	Surveys Focus groups Interviews Participant observation

Newer data sources:

Existing	To be generated
Social media Data portals and aggregators 'Internet of things'	Values conversations Community data collection

Data and analytics can assist local government and NGOs in a variety of ways

Analytic tools must be adapted to enable:

- Discussions among diverse stakeholders

- Consensus building

- Resident and community empowerment (Ferreira 1998)

Data's greatest contribution may not be in finding solutions, but better understanding:

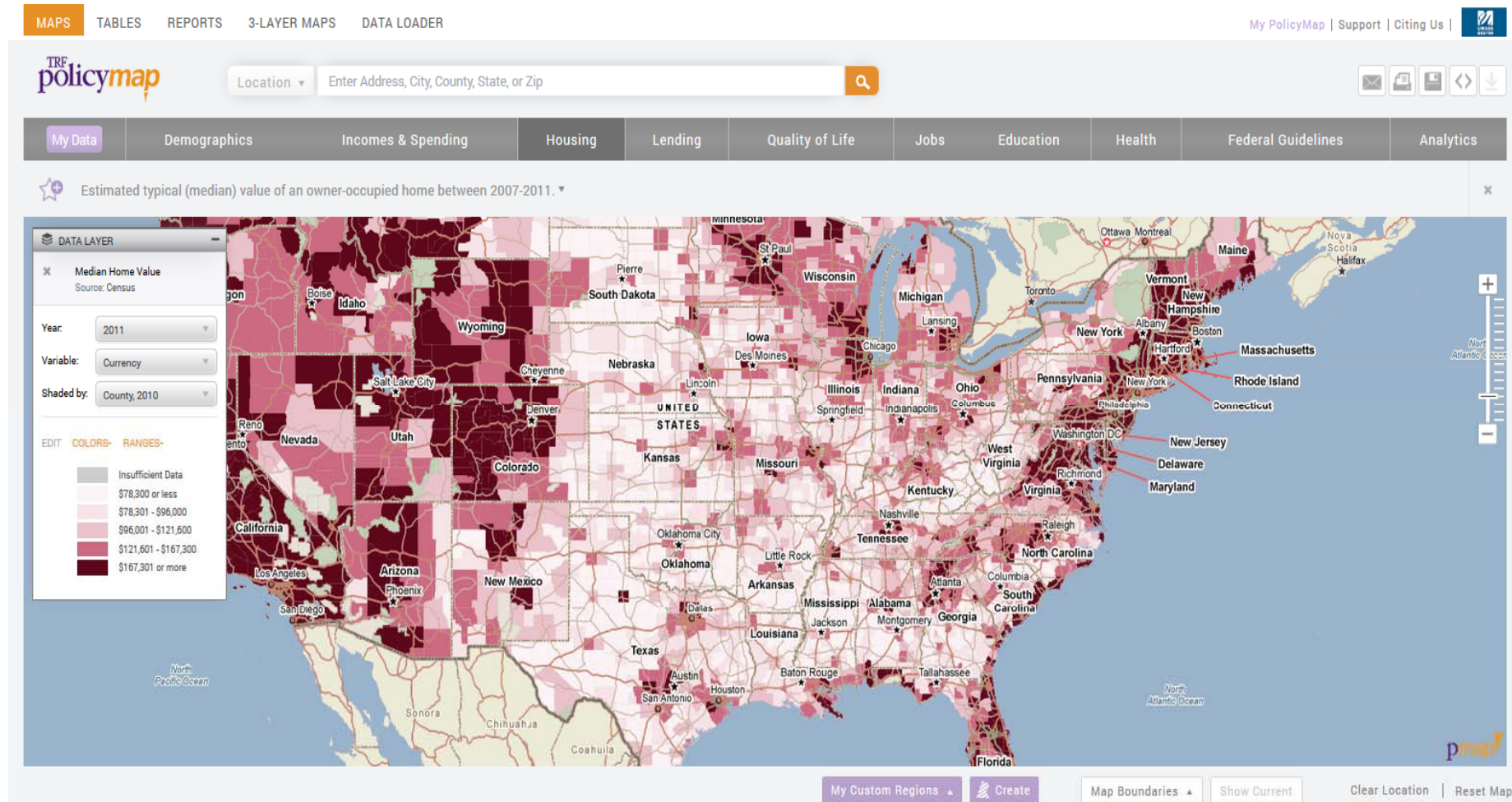
- Missions

- Communities served

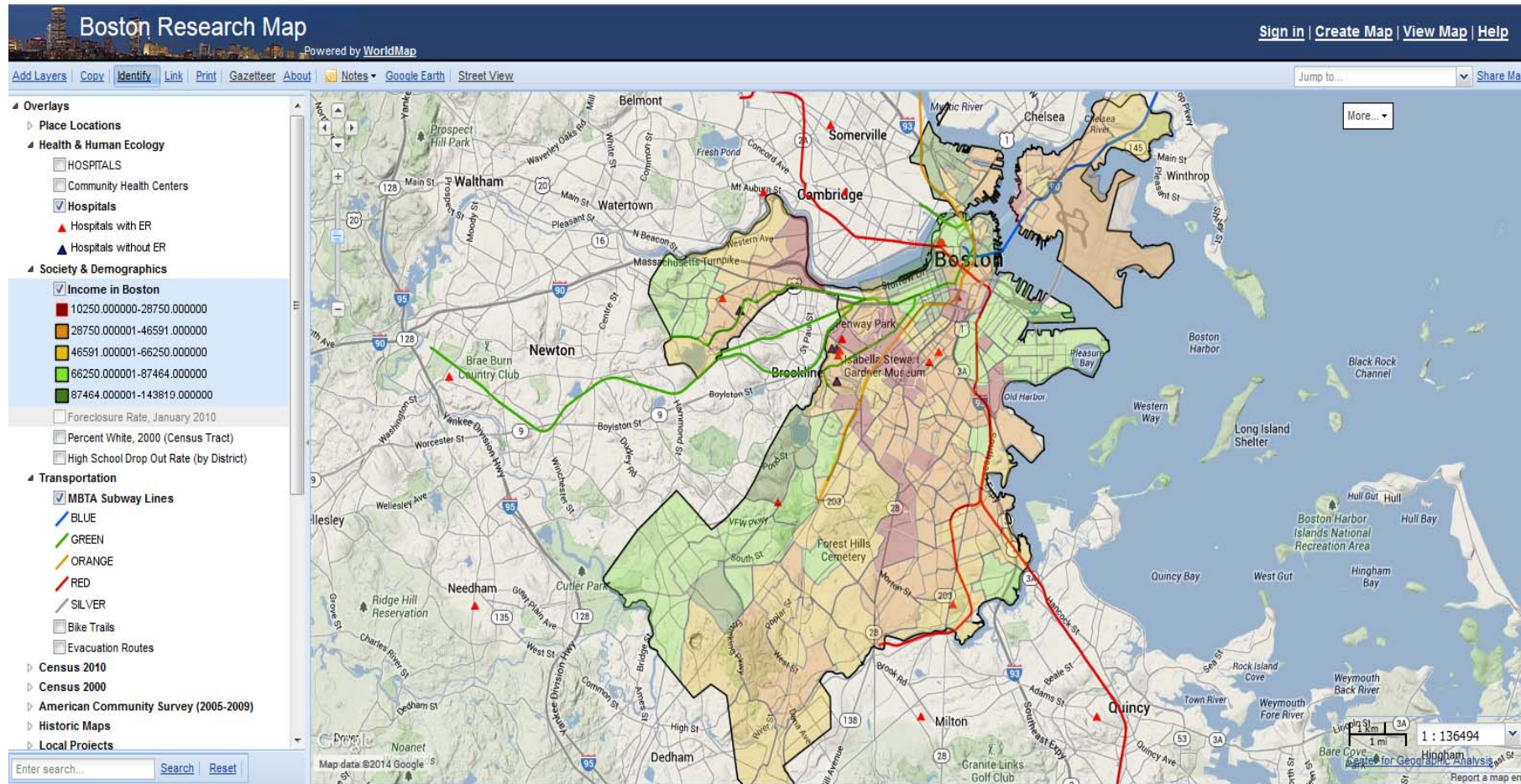
- Organization capabilities

- Stories they wish to tell to the world (Taylor, 2014)

Visualization technology for data acquisition: PolicyMap



Visualization technology for data acquisition: Boston Research Map



Source: <http://worldmap.harvard.edu/boston/>

Database technology for data acquisition: American FactFinder

U.S. Department of Commerce
United States Census Bureau

AMERICAN FactFinder

Feedback FAQs Glossary Help

MAIN COMMUNITY FACTS GUIDED SEARCH ADVANCED SEARCH DOWNLOAD OPTIONS

Guided Search - Step-by-step access to Census Information Dataset - guided search

1 Start 2 Dataset 3 Topics 4 Geographies 5 Race/Ethnic Groups 6 Industry Codes 7 Search Results 8 Table Viewer

B25004 VACANCY STATUS
Universe: Vacant housing units
2008-2012 American Community Survey 5-Year Estimates

Table View Map View BACK TO SEARCH RESULTS

Actions: Modify Table Bookmark Print Download Remove Map

View Geography Notes View Table Notes

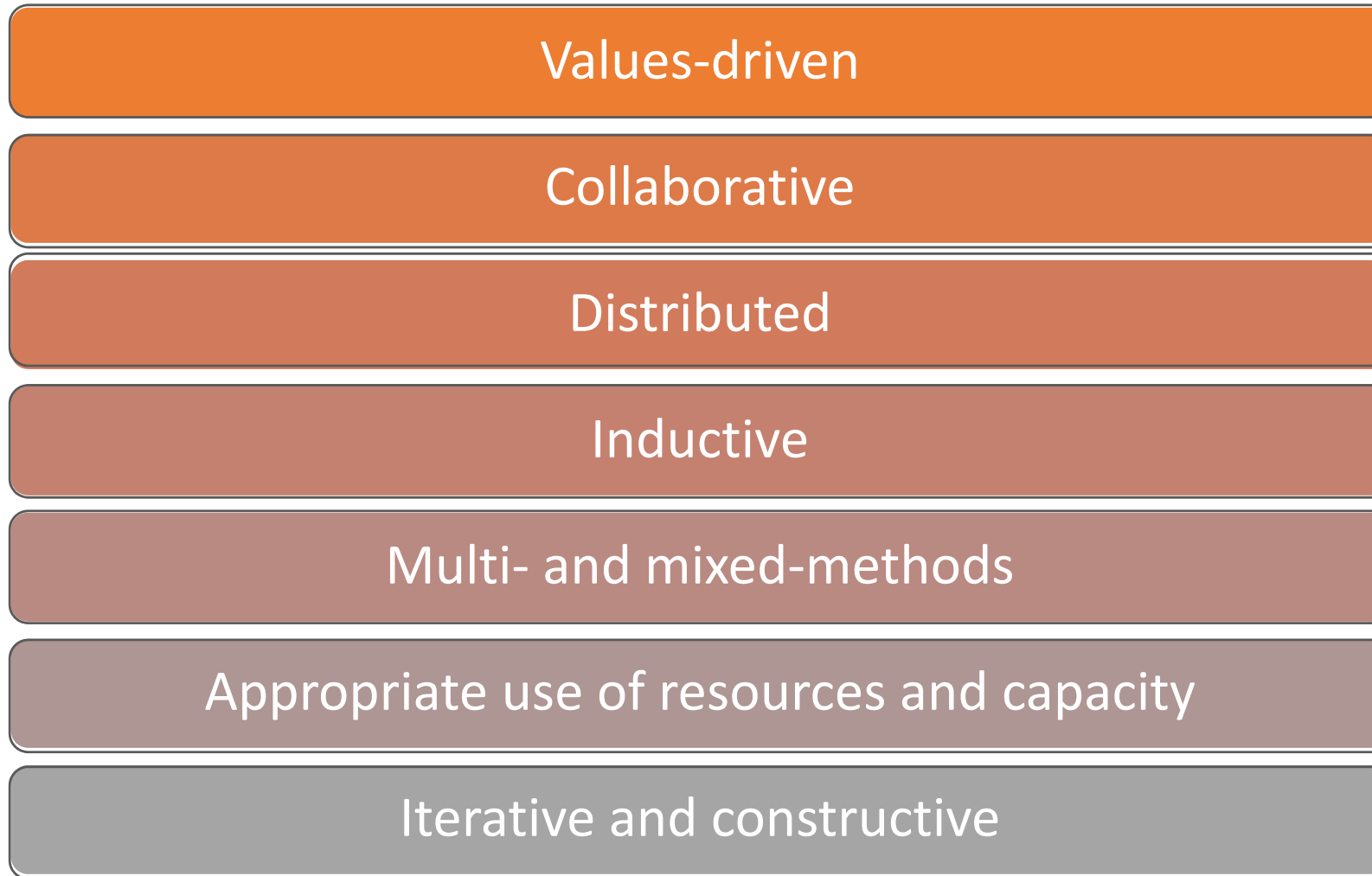
Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

1 - 18 of 28

	Barnstable County, Massachusetts		Berkshire County, Massachusetts		Bristol County, Massachusetts		Dukes County, Massachusetts		Essex County, Massachusetts		Franklin County, Massachusetts		Hampden County, Massachusetts		Hampshire County, Massachusetts		Middlesex County, Massachusetts	
	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
Total:	64,500	+/-1,198	12,837	+/-648	20,737	+/-1,154	11,358	+/-375	21,178	+/-1,242	3,223	+/-351	14,228	+/-738	3,636	+/-445	32,129	+/-1,556
For rent:	1,600	+/-367	1,305	+/-298	5,339	+/-536	82	+/-79	5,323	+/-568	297	+/-132	3,158	+/-508	686	+/-216	9,634	+/-907
Rented, not occupied	239	+/-105	188	+/-103	1,012	+/-278	37	+/-38	830	+/-265	120	+/-103	338	+/-159	320	+/-156	2,680	+/-454
For sale only	1,927	+/-313	719	+/-194	1,841	+/-356	4	+/-5	2,215	+/-401	373	+/-127	1,580	+/-320	618	+/-198	4,481	+/-548
Sold, not occupied	548	+/-201	117	+/-71	435	+/-177	86	+/-101	688	+/-216	41	+/-29	261	+/-141	46	+/-58	1,422	+/-347
For seasonal, recreational, or occasional use	58,111	+/-1,193	8,192	+/-489	3,383	+/-505	10,844	+/-388	4,459	+/-582	1,323	+/-167	1,882	+/-233	1,049	+/-235	3,348	+/-507
For migrant workers	0	+/-29	9	+/-15	0	+/-29	0	+/-19	0	+/-29	0	+/-29	0	+/-29	0	+/-29	26	+/-39
Other vacant	2,075	+/-428	2,307	+/-433	8,727	+/-735	305	+/-129	7,663	+/-728	1,069	+/-225	7,009	+/-557	917	+/-263	10,538	+/-948

Source: <http://factfinder.census.gov/>
(to be replaced by data.census.gov)

Principles for community-focused data and analytics

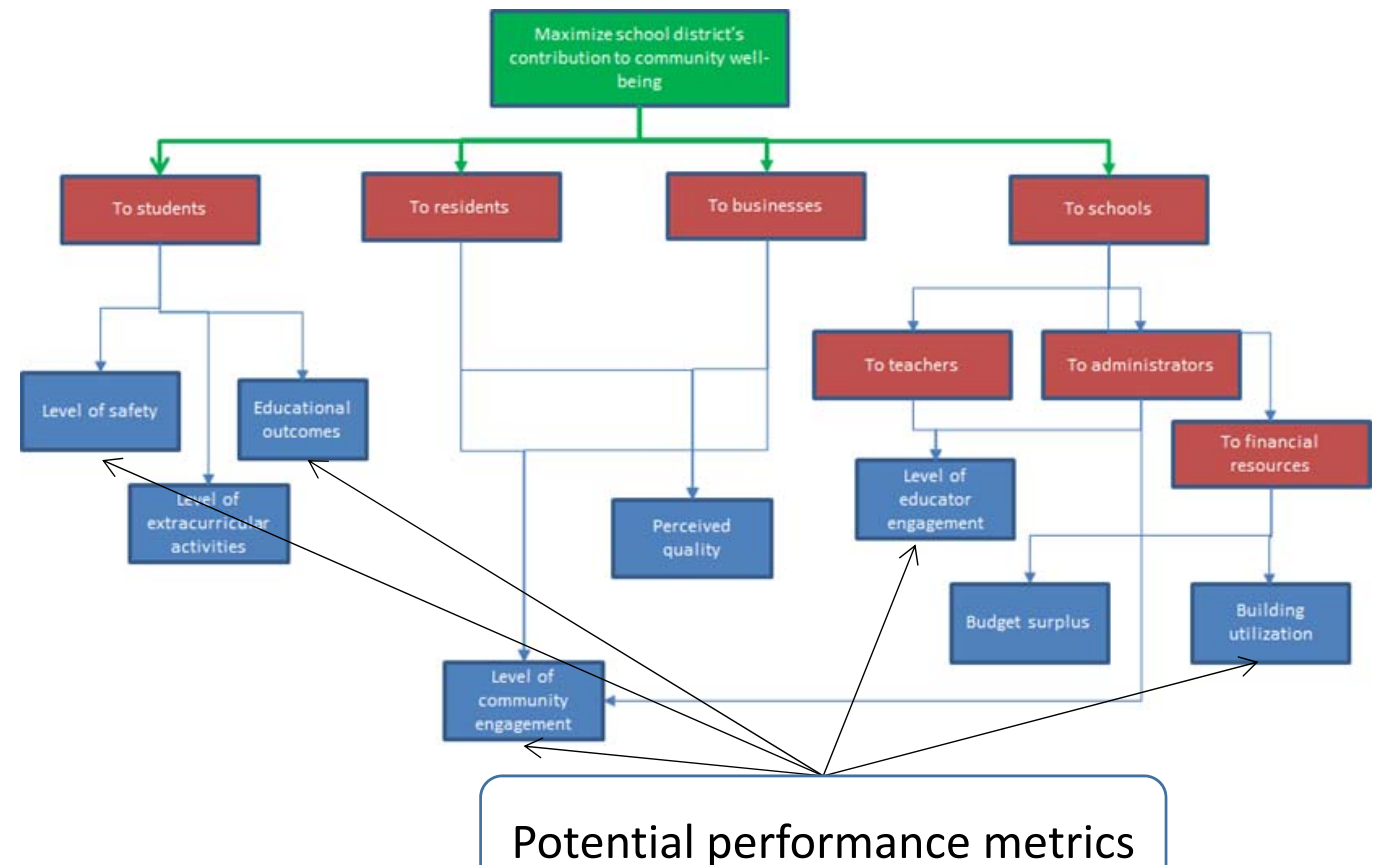
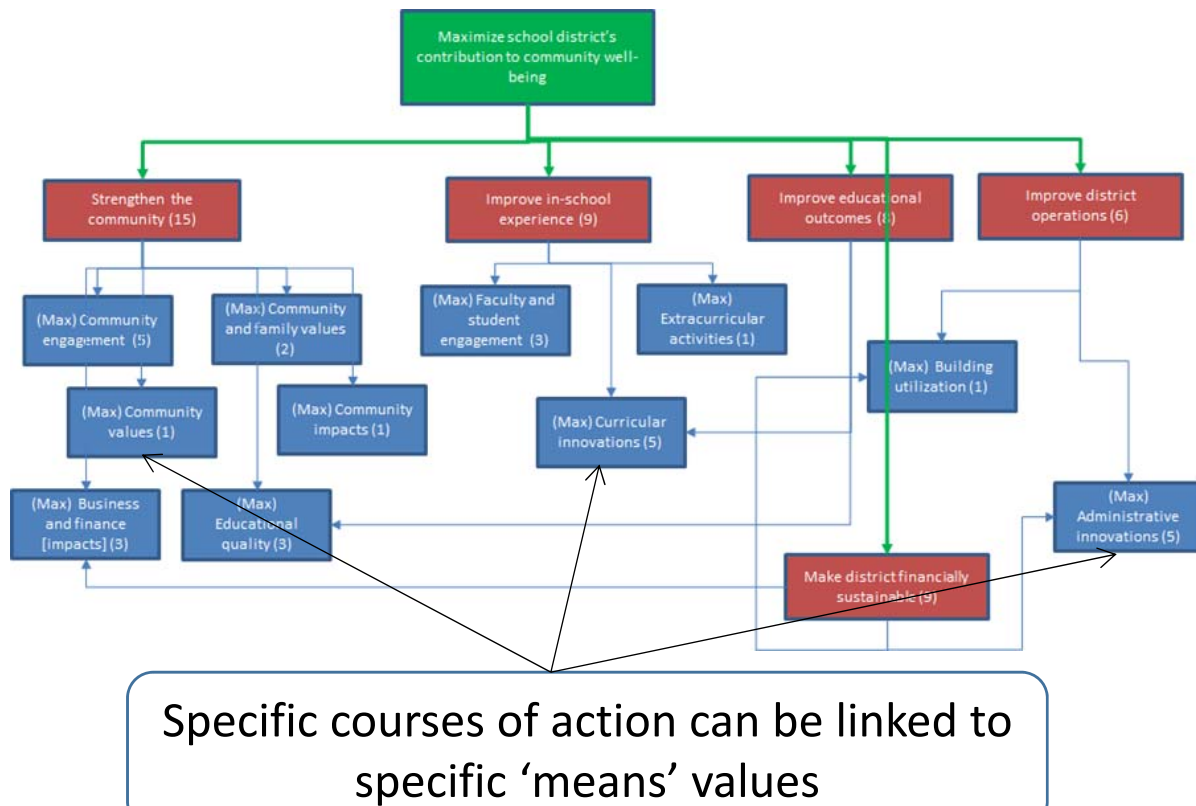


Problem context #1: Community concerns with local schools

A school district faces multiple challenges: low test scores, stagnant funding, parents choosing non-public school options, aging infrastructure. A community conversation has yielded many expressions of values and ideas for improvements. What can we do with these data?

Candidate theme	Values and ideas list						
Community feel and values	small town and close knit	community tight knit	sense of community	small town feel	value-community ties	school is an essential part of each	home values
Sports as an inspiration	make them excited about all	take what is done well (sports)					
Educational values	appreciating the whole child	educating the kids	Children & Families				
Administrative innovation	networking of administrators with other districts in similar situations						
Testing and evaluation	stop state testing	stop ranking us on test scores					
School choice	stop funding school choice and Charter Schools	limit school choice until we fix ourselves	keep students in district/get more students from other districts				
Finance	bigger tax base - state doesn't tie school to property tax;	consultant on budgeting and grant writing	more community partners	grant writers	long term projects that have growth opportunities	attract larger business to Cheshire	major draw to not only people but to add to the tax base
Class size	smaller class sizes	small class sizes	small class size	current structure of classroom -			
Facility usage	close both schools and put 1 on Hoosac grounds	building being used for multiple purposes	concentrate on K-8 and send 9-12 to other districts	bring K-8 back to elementary	regionalizing AP courses	buy farm/busses and build all schools on one campus	
Teacher quality and	faculty & staff	value great teachers	good education/good teachers	personal investment by the			
Data and technology	put data on paper						
Community partnerships &	more community partners	community involvement					
Curricular innovation	explorers programs	STEM program that is cut above the rest	Mentorship program for students who are transitioning (from other students)	virtual classrooms	being known for a specialty i.e. music, art, technology or even something else and no one has	shorten school days and use job studies/internships	special ed.
Education quality	core values-good education	good education	good effective education				
Student outcomes	prepare for next level in life						
Diversity and inclusion	all kids to succeed						
Family and community engagement	strong family support	parents invested	strong communication	Children & Families			

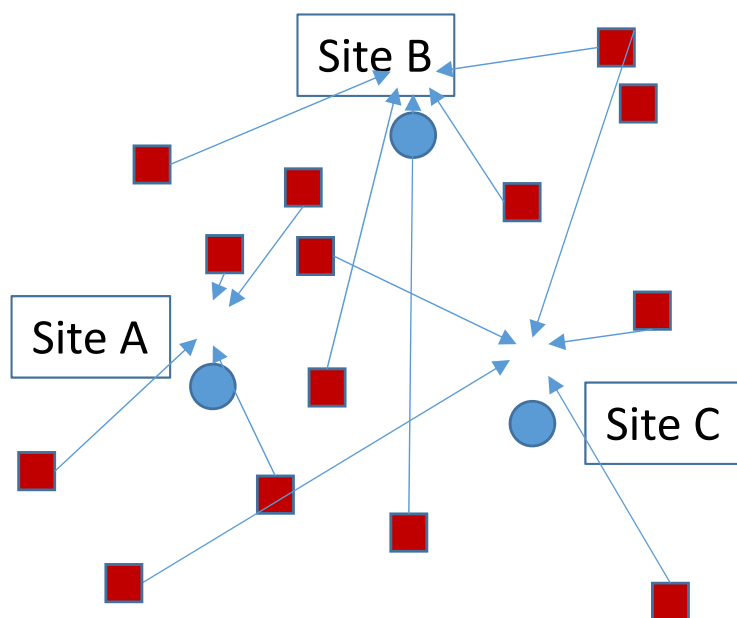
A values analysis can help identify alternative courses of action and candidate performance metrics



Problem context #2: Multi-site service delivery

A community-based nonprofit provides family support services to clients at three sites. The organization has generated a dataset describing these services. What questions can these data help answer?

■ = client locations

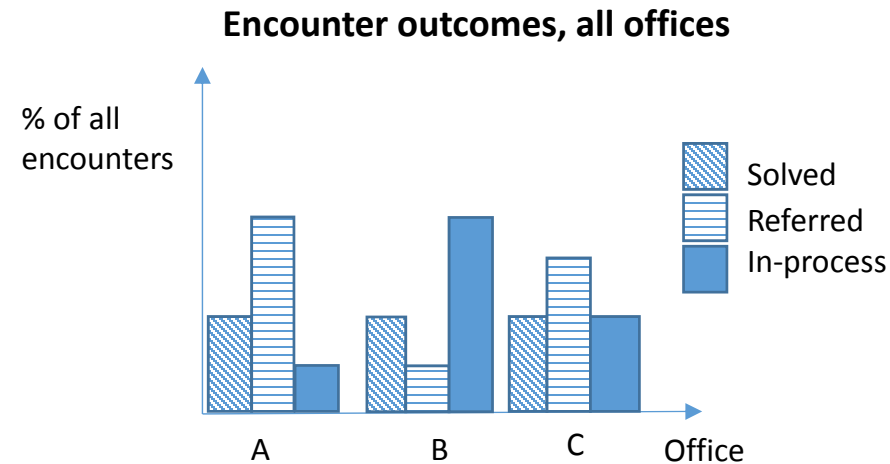
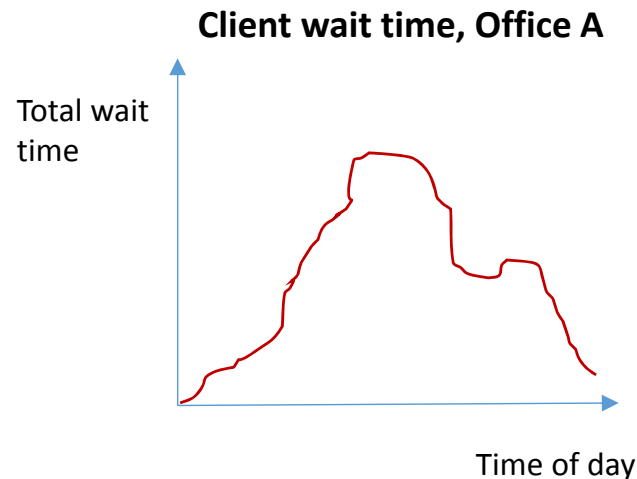


How far do clients travel?	How large are caseloads?	Do clients receive appropriate services?	How long do clients spend at office?
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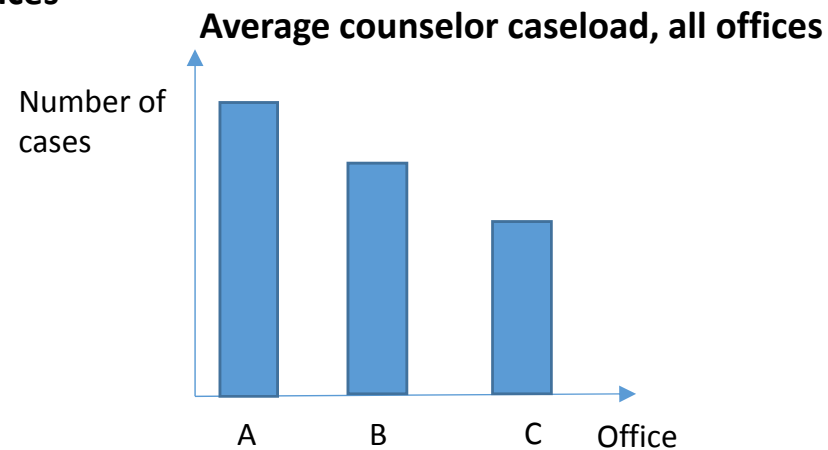
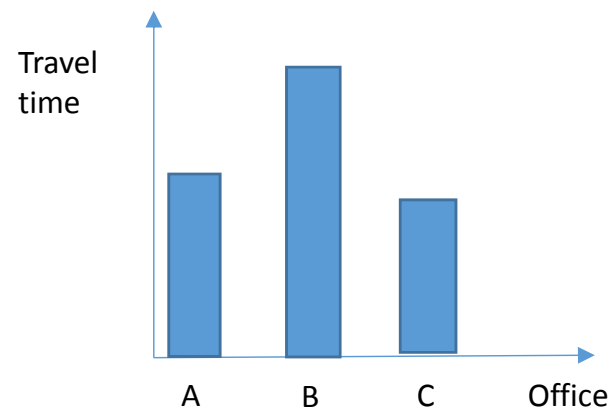
Client ID	Client Address	Service Date	Office Visited	Counselor ID	Service Provided	Outcome Type	Visit Time Start	Visit Time End
C01	143 Main St.	2/21	A	S_A02	Intake	In-system	9:15 AM	10:00 AM
C02	200 Center Ave.	2/21	A	S_A05	Follow-up	Referral	11:15 AM	12:00 PM
C03	53 Morris St.	1/16	C	S_C03	Intake	In-system	2:00 PM	3:30 PM
C04	450 Thomas St.	1/18	B	S_B01	Assessment	Status	8:30 AM	11:30 PM
C05	23 Ashmont St.	2/01	A	S_A02	Intake	Referral	10:30 AM	1:30 PM
C06	315 Fields Ave.	2/09	B	S_B02	Close-out	Success	2:20 PM	2:50 PM
C07	97 Willow Dr.	1/10	B	S_B03	Counseling	Follow-up	1:00 PM	3:00 PM
C08	51 Corner Ct.	1/30	C	S_C02	Close-out	Referral	4:30 PM	5:30 PM
C09	270 Harvard Ave.	2/5	C	S_C03	Counseling	Follow-up	6:00 PM	7:00 PM

Analytics can provide valuable insights about a range of potential interventions

Data visualization



Average client travel time, all offices



Candidate decision opportunities

- Re-design the client service process to minimize wait times
- Re-allocate counselor resources to enable improved encounter outcomes
- Develop an assignment scheme to encourage clients to visit the facility that is closest to them
- Re-assign clients across counselors to balance caseloads
- Modify the service area; expand, open or close facilities

Problem context #3: Community development interventions

An economic development organization works with multiple stakeholders to strengthen the local business district. It has identified a set of actions that could benefit the district and reflects the values of the community. How can the organization develop an implementation plan?

Economic Development Best Practices	Associated objectives/values from public discussions		Associated metric/attribute from public discussions		Constraints/limitations/concerns from analyst discussions	
Alternatives	Value 1	Value 2	Metric 1	Metric 2	Constraint 1	Constraint 2
1. Façade renovation	Attractive environment	Business management best practices	Increased patronage	Perceived neighborhood attractiveness	Some businesses won't participate	Difficult for businesses to agree on standards
2. Increased financial capacity	Business health and stability	Support immigrant entrepreneurs	Size of credit line	Size of reserve fund	Cultural competence of analysts	Unwillingness to engage in formal system
3. Community survey on shopping preferences	Diversity of shopping options	Cross-cultural understanding	Percentage of purchases done locally	Percentage of residents who wish to shop locally	Technical and financial resources	Can we get views of non-English-speaking communities?
4. Increase number of community events	Empowerment and viability	Connecting customers and businesses	Number and attendance of events	Increased patronage of event sponsors	Need sponsors	Expense of site management for events

Developing an implementation plan

- Rank alternatives according to:
 - Measures of performance metrics
 - Preferences for metric categories
 - Perceived value (utility) of metrics
- Choose most-preferred sequence of options according to:
 - Decision points
 - Chance nodes, with probabilities of uncertain outcomes
 - Payoffs
- Schedule tasks to minimize one of multiple objectives based on:
 - Task due dates
 - Tasks that must come before or after other tasks
 - Resource constraints that limit number or type of tasks to be performed together

Common challenges in providing operations research and analytics to government and nonprofits

- 1 Limited capacity of community partners to collect and analyze data, and to make productive use of analytically-advanced solutions
- 2 Skepticism among community partners that outside experts really understand their problems
- 3 Need for analysts to move from client-consultant relationship to peer-to-peer relationship to support collaborative problem-solving
- 4 Tension between a specific problem to be solved, and underlying community needs that may not align with funders' immediate priorities
- 5 Acceptance by analysts trained in OR/analytics that qualitative as well as quantitative data and solution methods may be necessary

There are a variety of resources to help nonprofit organizations use analytics to improve operations and strategy design

- Volunteer-driven services of professional societies
- University community service projects
- College and university coursework and short courses
- Research engagements
- Paid consultants



Case studies

Community development

A community development corporation does housing development, community organizing and job training in a struggling small city. It has held an all-day focus group session to learn about values and ideas from its stakeholders. It hopes to use these data to identify objectives, program opportunities and metrics to guide its community revitalization efforts.

Homeless children services

The Sunshine Horizon Foundation, a charitable arm of a for-profit company, provides safe spaces in homeless shelters for children and their caretakers. These “Sunshine Spaces” require agencies to provide spaces within shelters, and programs to provide skilled staff. The Foundation also wants to decide if it should expand into other cities.

Credit union demand

The Northside Credit Union is popular in its North End neighborhood of Boston, and also draws customers from around the city. NCU has had trouble setting the correct staffing levels to match customer arrival patterns. The manager knows there is a problem but doesn’t have the training to find a better staffing solution. To start, they need to develop accurate forecasts of daily customer arrivals.

Case study: Community Development

Excerpt from focus group summary:

The UMass PI leads the session. He starts by asking the group to throw out ideas about the overall mission and ultimate objectives of the work that is done in the organization.

Economic stability of the community – education, jobs, investment in the neighborhood (long term tenants and homeowners versus short-term tenants)

Neighborhood ownership – sense of community, trust, pride, desire to live in the neighborhood, acceptance of low-quality living conditions in exchange for affordability, willingness to improve property

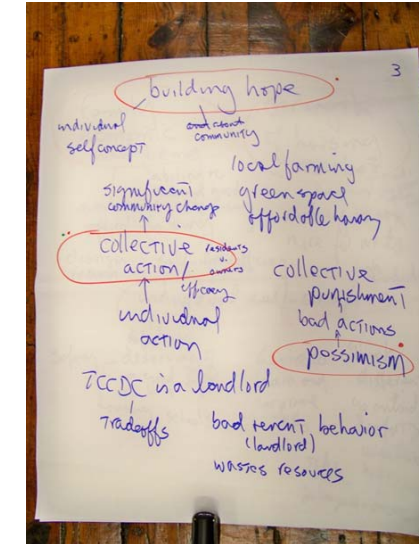
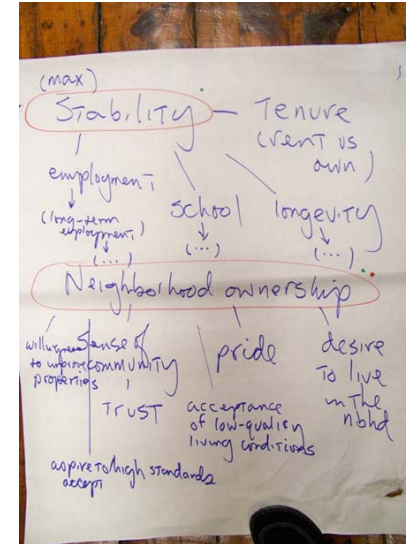
Ability to afford housing (family economic well-being)

Ability to demand good quality housing.

Strength of housing market – ability to ask more for rent.

Improving tenant self-concept - feeling deserving of a good quality life – good housing, schools, safety, desire to learn and improve one's skills/think outside the box, ability or willingness to go outside of one's comfort zone and raise the bar, ability to overcome feeling “beat down”, classism, racism, feeling overwhelmed (even stakeholders) by the amount of work that needs to be done.

Sample focus group photos:



Questions:

1. How can we use these data to determine what values and objectives are most important to the organization?
2. How can we use these data to identify specific action alternatives, if any?
3. How can we use these data to identify performance metrics, if any?

Case study: Homeless children services

Decision Data - Selecting a Program Partner			
Decision Alternatives	Program X	Program Y	Program Z
	1	2	3
Criteria	1	2	3
Experience with population served	7	8	1
Compatability	1	10	1
Sources of funding	2	2	9
Program Flexibility	7	8	5
Cost	5	1	10
Responsiveness	8	7	7
Reputation in community	1	3	8
Financial stability	10	1	5
Proximity to BH volunteers	6	6	4
Program Readiness	8	10	5
Staff Qualifications and turnover	1	1	9
Accountability	8	10	5
Volunteer opportunities	3	1	4

Modified March 13, 2017

Ex: Which Philadelphia movement program should we recommend?	
Program X can deliver weekly fitness programs for children and families, facilitated by CrossFit Kids Coaches. Program Y can deliver yoga for adults and children in the evenings, weekly. Facilitator is experienced with Bright Horizons centers. Program Z will provide outdoor movement programming weekly, during good weather.	
Criteria	Definition
Experience with population served	The program has worked with children and families in traumatic situations, has sensitivity to the issues surrounding behavior, and/or is open to training on this topic.
Compatability	Agency and local Sunshine Horizons volunteers feel comfortable with the staff and content of the program.
Sources of funding	Likely client, corporate and Foundation prospects for funding Sunshine Spaces
Program Flexibility	Can tailor to needs of the agency for scheduling, space, style of class
Cost	What is the contract period and cost? Who is funding the program?
Responsiveness	Someone will reply to emails and phone calls promptly, to the Foundation and agency partner. Program schedule is compatible with agency's needs?
Reputation in community	Is the SH team familiar with the organization? Are they known to the agency?
Financial stability	Organization has stable funding sources.
Proximity to BH volunteers	Sunshine Horizons Connectors can easily support agency and programs.
Program Readiness	Organization has opportunity and interest in providing programs in the Bright Space.
Staff Qualifications and turnover	Staff has experience and skills with the population. How long has the director been in place.
Accountability	Has a process in place for gathering data on numbers of children served through the program, stories, and impact.
Volunteer opportunities	Sunshine Horizons volunteers and funders will be able to engage with the program.

Similar data are available for agencies and cities.

Questions:

1. Where would we get actual data to populate the Decision Alternatives matrix?
2. Does it matter how important we think the various criteria are? How could we incorporate this notion into the decision problem?
3. How can we use the Decision Alternatives matrix data to choose which partners, if any, the Sunshine Horizon Foundation should work with?

Case study: Credit union demand

Month	Day of month	Day of week	Staff payday	Faculty payday	After or before holiday	Arrivals
Jan	2	Tue	Yes	Yes	Yes	1825
Jan	3	Wed	No	No	No	1257
Jan	4	Thu	No	No	No	969
Jan	5	Fri	Yes	No	No	1672
Jan	8	Mon	No	No	No	1098
Jan	9	Tue	No	No	No	691
Jan	10	Wed	No	No	No	672
Jan	11	Thu	No	No	No	754
Jan	12	Fri	No	No	No	972
Jan	15	Mon	No	No	No	816
Jan	16	Tue	No	No	No	717
Jan	17	Wed	No	No	No	728
Jan	18	Thu	No	No	No	711
Jan	19	Fri	Yes	No	No	1545
Jan	22	Mon	No	No	No	873
Jan	23	Tue	No	No	No	713
Jan	24	Wed	No	No	No	626
Jan	25	Thu	No	No	No	653
Jan	26	Fri	No	No	No	1080
Jan	29	Mon	No	No	No	650
Jan	30	Tue	No	No	No	644
Jan	31	Wed	No	No	No	803
Feb	1	Thu	No	Yes	No	1282
Feb	2	Fri	Yes	No	No	2043
Feb	5	Mon	No	No	No	1146
Feb	6	Tue	No	No	No	740
Feb	7	Wed	No	No	No	698
Feb	8	Thu	No	No	No	695
Feb	9	Fri	No	No	No	1159
Feb	12	Mon	No	No	No	881
Feb	13	Tue	No	No	No	768

Questions:

1. Some of these data are numeric, others are text. How can we use these data with spreadsheet-type analysis tools?
2. What approach would you use to forecast customer data in the future?
3. What additional data do you think could improve the quality of your forecasts?

Guidelines for case study discussions

- Each table may designate a note-taker, but all members are welcome to share their ideas on the sheet provided
- The sheet contains prompts to motivate discussion, but ideas need not be limited to these:
 - What is the real problem to be solved?
 - What do we know about the data available for this case?
 - What steps or procedures seem best-suited to solve this problem?
 - What insights can we provide, guidance or recommendations can we make?
 - What have we learned about data & community analytics from this problem?
- Every person should contribute one Post-It note idea to the portion of the wall devoted to their case study
- In reflection, consider: what would I need to know that I don't already know to solve problems like this case? How could I collaborate with partners to make best use of data, analytics and decision science?

Additional reading

- Johnson, M.P. 2015. Data, Analytics and Community-Based Organizations: Transforming Data to Decisions for Community Development. *I/S: A Journal of Law and Policy for the Information Society* **11**(1): 49 – 96. Web: <https://kb.osu.edu/handle/1811/75431>.
- Johnson, M.P. (Ed.) 2012. *Community-Based Operations Research: Decision Modeling for Local Impact and Diverse Populations*. New York: Springer.
- Johnson, M.P., Keisler, J., Solak, S., Turcotte, D., Bayram, A. and R.B. Drew. 2016. *Decision Science for Housing and Community Development: Localized and Evidence-Based Responses to Distressed Housing and Blighted Communities*. New York: John Wiley & Sons, Inc.
- Johnson, M.P., Midgley, G. and G. Chichirau. 2018. Emerging Trends and New Frontiers in Community Operational Research. *European Journal of Operational Research* **268**(3): 1178 - 1191. doi: 10.1016/j.ejor.2017.11.032 [open access].
- Kaplan, E. H. 2008. Adventures in policy modeling! Operations research in the community and beyond. *Omega* **36**(1): 1 – 9. doi: 10.1016/j.omega.2005.07.012.
- Midgley, G. and A. Ochoa-Arias (Eds.) 2004. *Community Operational Research: OR and Systems Thinking for Community Development*. New York: Kluwer Academic/Plenum Publishers.
- Pollock, S.M., Rothkopf, M.H. and A. Barnett (Eds.) 1994. *Handbooks in Operations Research and Management Science, Vol. 6: Operations Research and the Public Sector*. Amsterdam: North-Holland.
- Rosenhead, J. and J. Mingers (Eds.) 2001. *Rational Analysis for a Problematic World Revisited: Problem Structuring Methods for Complexity, Uncertainty and Conflict, Second Ed*. Chichester, UK: John Wiley & Sons, Ltd.
- Winston, W.L. and S.C. Albright. 2016. *Practical Management Science, 5th Edition*. Boston: Cengage Learning.