How can school districts in shrinking regions remake themselves to support their communities? Policy and operations analysis for a Massachusetts school district

Michael P Johnson, Jr.
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Municipal shrinkage and associated declines in public school resources require school districts to reassess operations and strategy to ensure continued vitality.

Current consulting projects in western MA provide an opportunity to apply education and public policy principles to address structural challenges.

Community-engaged operations research can help stakeholders design evidence-based responses.

An adaptation of Keeney’s value-focused thinking provides a basis for an OR intervention.
Acknowledgements

Funding:
- Consulting engagement paid by Adams-Cheshire Regional School District and Quabbin Regional School District

Collaborators:
- Monica Lamboy, MCP, Associate, Collins Center (lead)
- Rachel Drew, PhD ’14, Analyst
- Rick Kingsley, Associate, Collins Center
- Bill Lupini, EdD, Superintendent at Essex Agricultural & Technical School District
- Ray Shurtleff, EdD, Educational Administration Program Manager and Adjunct Faculty, College of Education and Human Development
INTRODUCTION
Motivation

- Many cities and regions in the U.S. and in other countries face sustained declines in population, housing and economic activity
- Causes include deindustrialization, foreclosed housing crisis and the Great Recession (Popper and Popper 2002, Hollander et al. 2009)
- School districts across the country face declining enrollments, aging infrastructure and low performance
- Results of shrinking districts include school closings, consolidations and cutbacks (National Center for Education Statistics 2010)
- Effects of school closings and student reassignments on student outcomes is ambiguous (Engberg, et al. 2012), but impacts on rural communities could be negative (Tyson 2005)
Current projects

- The Edward J. Collins, Jr. Center for Public Management was contracted by the Quabbin Regional School District and the Adams-Cheshire RSD to assess the current environment within which the districts operate, and to make recommendations for improvements.
- Project deliverables - Trends Report, Community Conversations, Alternatives Analysis.
- This presentation will focus on the Adams-Cheshire district (ACRSD).
Projects are situated in Western Massachusetts

Adams-Cheshire Regional School District

Quabbin Regional School District

Both districts face declining enrollments and limited flexibility for financial support
Research questions

- How can decision modeling support school district revitalization?
- How can decision modeling principles, particularly community-based operations research, help education professionals make recommendations for change?
- What are the prospects for systems change in rural MA districts on the basis of decision modeling?
PRELIMINARIES:
COMMUNITY-ENGAGED OPERATIONS RESEARCH
When is public-sector OR relevant? What are its characteristics?

- Operations research seeks to improve individual and group decisions and decision-making, and to redesign organization and process operations and strategy.

- Public-sector OR is relevant when:
  - Benefits are not always measured in dollars
  - Goods and services are not always traded in markets
  - Beneficiaries lack influence to set policy priorities

- Characteristics of public-sector OR include:
  - Multiple stakeholders
  - Multiple objectives
  - Substantive engagement
  - Need for evidence of policy impact
Public-sector OR has had many successes…

- Design of policies for drug distribution to anticipate epidemic and pandemics
- Emergency management vehicle dispatch and scheduling
- Preservation of public safety against threats of terrorism
- Distribution of donated food to communities facing food insecurity
- Air transport management
- Hazardous materials distribution and storage
- Reserve management design

(and many others, see Pollock, Rothkopf and Barnett 1994, Larson and Odoni 2007, Kaplan 2016)
But many important public problems are not as well-understood

- What measures of ‘resiliency’ are important to the well-being of vulnerable communities?
- How can low-income communities choose redevelopment strategies that balance opportunity and protection?
- What mix of energy development options are affordable to a wide range of populations?
- How can a school district design a lottery system for public schools that balances desires for local access and academic excellence?

Problems that are hard to define (see e.g. Rosenhead and Mingers 2001), that require a deep understanding of local needs, and whose solutions depend on active community participation can be addressed using methods referred to in this talk as community-engaged operations research.
What distinguishes community-engaged OR?

- Emphasis on ‘intervention’ as opposed to observational science or methodological innovations
- Local engagement and impact
- Focus on disadvantaged and underserved populations
- Interest in problem-solving processes as well as outcomes
- Critical approach and concern for ethics
- Use of qualitative and mixed-method analytics (e.g. ‘soft OR’)
- Aim for community empowerment and social change

‘Community operational research’ (Midgley and Ochoa-Arias 2004) places greater emphasis on understanding and empowerment; ‘community-based operations research’ (Johnson 2012) places greater emphasis on analytic methods for policy, planning and operations prescriptions
The process of Community-Based Operations Research

Decision modeling process could stop at any of these steps

- Place/neighborhood
- Community/social group
- Institutions/organizations

Problem identification
Problem formulation
Problem solution

Multiple research frameworks
Multiple solution methods

- Multiple stakeholders
- Collaborative
- Evidence-based
- Social welfare/Equity emphasis
The process of CBOR, continued
What are challenges of community-engaged OR?

- Public-serving organizations and citizens may lack expertise for data-driven problem-solving
- Understanding problem context and identifying problem opportunities may be as (or more) important than model-building
- Stakeholders may not recognize multi-objective, resource-constrained and contingent nature of important problems
- Community engagement is expensive, difficult and time-consuming
- Many problems are situated in social and political contexts that may be confusing, contentious or alienating

Good community-engaged OR requires skills not traditionally taught in many graduate programs!
Shrinking rural school districts is an important public policy problem

Rural schools caught in ‘death spiral’
Enrollment changes can have big impact in sparsely populated districts

Commonwealth Magazine, January 2017
Operations research has addressed the shrinking school district problem

- OR has focused generally on three types of models: planning models, efficiency and performance measurement models, and routing and scheduling models (Johnes 2015)
- A school district can be consolidated into ‘clusters’ of schools to minimize distance between schools and clusters (Bruno et al. 2014)
- A school superintendent can choose particular schools to close, and parents can choose educational options, as a game theory problem (Epple et al. 2014)

There are no applications known to us that use community-engaged approaches to identify decision modeling components, or to formulate or solve models.
Our analytic approach adapts OR & CBOR principles

- **Values analysis** (Keeney 1992) - identify important goals and objectives to determine:
  - What actions most-closely-align with organization values
  - What metrics, or attributes can best capture progress towards important goals

- **Decision modeling** (Albright, Winston and Zappe 2010; Johnson et al. 2015) – develop a short- or longer-term plan that:
  - Reflects organization values
  - Generates greatest benefit using values-based metrics
  - Respect constraints on resources or organizational rules and priorities
PORTRAIT OF ADAMS-CHESTERHIRE REGIONAL SCHOOL DISTRICT
Public school enrollments have declined

Source: Massachusetts Department of Elementary and Secondary Education.
Aging of region population continues recent trends

![ACRSD Area Population Projections by Age (2010-2035)](image)

Source: UMass Donohue Institute, Population Projections of Massachusetts Municipalities.
School facilities are over-capacity

<table>
<thead>
<tr>
<th></th>
<th>Gross SF/student</th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Square Footage</td>
<td>10/2016</td>
<td>MSBA sf per student</td>
<td>SF needed (MSBA)</td>
<td>SF above measure</td>
<td>Actual SF as % of SF needed</td>
</tr>
<tr>
<td>CE</td>
<td>61,600</td>
<td>243</td>
<td>180</td>
<td>43,740</td>
<td>17,860</td>
<td>141%</td>
</tr>
<tr>
<td>PE</td>
<td>88,300</td>
<td>451</td>
<td>163</td>
<td>73,513</td>
<td>14,787</td>
<td>120%</td>
</tr>
<tr>
<td>MHS</td>
<td>174,370</td>
<td>624</td>
<td>See below</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle School**</td>
<td>69,748</td>
<td>301</td>
<td>190</td>
<td>57,190</td>
<td>12,558</td>
<td>122%</td>
</tr>
<tr>
<td>High School**</td>
<td>104,622</td>
<td>323</td>
<td>226*</td>
<td>72,998</td>
<td>31,624</td>
<td>143%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>324,270</td>
<td>1,318</td>
<td>247,441</td>
<td>76,829</td>
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<td></td>
</tr>
</tbody>
</table>

*MSBA standard for HS with less than 600 students is “TBD”. For 600-619 students is 226 sf.
**Square footage in the middle and high schools have been estimated proportionate to the number of grades.

Based upon square footage, all 3 buildings have capacity for 1,655 students, but have 1,318 in 2016.
Academic performance lags state averages
Local funding fills gaps in a difficult economic environment

- 5.4% decrease in state funding
- 52.8% increase in local funding (incl. debt for HVMSHS)
Educational expenditures below state average

State average of $14,440 per pupil in-district; ACRSD is $13,244
Elementary buildings are in need of repairs

- **CE (Statement of intent)**
  - Roof, electrical, heating, windows, insulation
  - ADA lifts ($100,000)
  - Small classrooms in old section (692 sf)

- **PE (no Statement of intent)**
  - Roof of boiler room (TBD)
  - Slate roof of gym/auditorium (TBD)
  - Rubber roof on main building (TBD)
  - Replace ADA lift ($38,000)
  - School cafeteria

**60% MSBA reimbursement for roofs, windows, boilers.**

**HVMSHS renovation received 78% reimbursement.**
VALUES ANALYSIS VIA COMMUNITY CONVERSATIONS
Community conversations provided data for values analysis

- Saturday, October 22\textsuperscript{nd}
- Thursday, November 3\textsuperscript{rd}
- Friday, November 4\textsuperscript{th} (students)

- 4 conversations
- 2 report outs
- Recorded on table and wall graphics
- Adaptation of ‘World Café’ methodology
Key participant questions

“Given the fact that hard decisions will have to be made, what do we Value? How might those values guide us?”

“What Creative Ideas do we have to strengthen the District financially and help students get a great education?”
Analysis process

- **Steps included:**
  - Initial categories of values
  - Bar charts that captured level of interest in values categories
  - Aggregations into value categories

- **Values structures:**
  - Relationship between fundamental values, means objectives and alternative courses of action (‘Means-ends network’)
  - Relationship between fundamental values, dimensions of impact and performance metrics (‘Fundamental values hierarchy’)

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Public-sector and community-engaged applications of VFT are limited (Bond, Carlson and Keeney 2008; Siebert and Keeney 2015)
Initial tabulations were based on transcripts of actual participant comments, grouped into initial categories on the basis of similarity in statements.
Analysis example: Values aggregation (October 22, 2016)

Aggregation was done by answering the question, “Achieving this value could enable us to achieve what more “fundamental’ value?”
Analysis example: Means-Ends Network (October 22, 2016)

Values Harvest

Maximize school district’s contribution to community well-being

Strengthen the community (15)

- (Max) Community engagement (5)
  - (Max) Community values (1)
    - (Max) Business and finance [impacts] (3)

- (Max) Community and family values (2)
  - (Max) Community impacts (1)

Improve in-school experience (9)

- (Max) Faculty and student engagement (3)

Improve district operations (6)

- (Max) Building utilization (1)
  - (Max) Administrative innovations (5)

Improve educational outcomes (9)

- (Max) Extracurricular activities (1)

Make district financially sustainable (9)

- (Max) Curricular innovations (5)
  - (Max) Educational quality (3)

This begins to link types of actions to particular values
Analysis example: Fundamental Values Hierarchy, October 22, 2016

Maximize school district’s contribution to community well-being

To students
- Level of safety
- Educational outcomes
  - Level of extracurricular activities
- Level of community engagement

To residents
- Perceived quality

To businesses
- Level of educator engagement
- Budget surplus

To teachers
- To administrators
- To financial resources

To schools
- To financial resources
- Building utilization

Potential performance metrics can be identified (not all in dollars)
Fundamental Values Hierarchy, November 4, 2016 - Students

Values Conversations and Harvest

Maximize student contribution to families and communities in the future

To students

- Student outcomes
  - Student satisfaction with classes and activities

To community

- Community cohesion
- Level of student involvement

To schools

- Educational quality
- Breadth of offerings
- Class sizes

To district

- Savings from school consolidation
- Funding levels
## Values analysis summary

<table>
<thead>
<tr>
<th>‘Core’ Fundamental Value</th>
<th>‘Core’ Fundamental Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximize contribution of ACRSD to community sustainability</td>
<td>Maximize student preparedness for the next phase of life</td>
</tr>
</tbody>
</table>

### General Community Values
- Strengthen local community
- Improve educational outcomes
- Increase district financial sustainability
- Improve in-school experience
- Increase system enrollment
- Improve district administration and operations
- Improve community image

### Student Values
- Strengthen community connections and values
- Improve educational outcomes
- Improve district financial sustainability
- Improve in-school experience
- Maximize community impacts

### Community Performance Metrics
- Student safety
- Level of satisfaction with curriculum and programming
- Educational quality
- Level of engagement with the district
- Level of satisfaction with the community
- Perceived community quality
- Building usage
- Alternative sources of revenue
- Budget surplus
- Alternative district configurations
- Level of employer-community engagement
- Attractiveness of district for employer relocation/expansion

### Student-generated Performance Metrics
- Educational outcomes
- Student satisfaction with classes and activities
- Community cohesion
- Town population levels
- Level of student involvement with the community
- Educational quality
- Class sizes
- Breadth of offerings
- Savings from school consolidation
- Funding levels
USING VALUES TO DESIGN AN IMPLEMENTATION STRATEGY
Collins Center principles

- Acknowledge that change needs to occur
- Maximize funding spent in classroom
- Use space efficiently and use the best space first
- Place students at the center of all decisions
- Rigor, transparency, and accountability in decisions
- Consider a new concept of ‘small-town’ that involves collaboration, and does not emphasize autonomy
- Provide 3+ classrooms per grade per school
How can values support decisionmaking?

- Generate operations and strategy alternatives
- For each alternative, identify values, metrics and constraints
- Set priorities for (evaluate tradeoffs associated with) values
- Quantify performance of alternatives according to metrics
- Alternatives may be ranked (multi-criteria decision models) (Bisdorff et al. 2015) and sequenced (decision analysis; planning and scheduling) (Edwards, Miles and von Winterfeldt 2007; Pinedo 2009)
‘Best practice’ recommendations

13 recommendations, many with sub-actions

- $905,000 in savings
- $350,000 in reinvestments

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>Transfer health benefits for current employees and retirees from the Berkshire Health Group to the Massachusetts Group Insurance Commission (GIC)</td>
</tr>
<tr>
<td>2.</td>
<td>Transfer pension system assets from the Town of Adams’ retirement system to a system with a better rate of return such as the State’s Pension Reserves Investment Trust (PRIT)</td>
</tr>
<tr>
<td>3.</td>
<td>Undertake steps to reduce special education enrollment and costs to approach the state average</td>
</tr>
<tr>
<td>4.</td>
<td>Increase enrollment in the high school by increasing offerings and incenting students/parents to choose HVHS</td>
</tr>
<tr>
<td>5.</td>
<td>Increase District-wide funding for professional learning to support District goals</td>
</tr>
<tr>
<td>6.</td>
<td>Reduce teacher absenteeism and funding teacher substitutes as needed</td>
</tr>
<tr>
<td>7.</td>
<td>Control / moderate fiscal impact of future teachers’ cost of living and annual step increases on the budget</td>
</tr>
<tr>
<td>8.</td>
<td>Reduce number and value of stipends</td>
</tr>
<tr>
<td>9.</td>
<td>Develop or enhance the District nepotism policy.</td>
</tr>
<tr>
<td>10.</td>
<td>To address the District’s Level 3 status, develop and implement a plan of Turnaround practices</td>
</tr>
<tr>
<td>11.</td>
<td>Engage with surrounding communities around joining the district</td>
</tr>
<tr>
<td>12.</td>
<td>Improve communication with students and parents</td>
</tr>
<tr>
<td>13.</td>
<td>Create a Feasibility Study Committee to determine the District’s elementary school space needs and evaluate at least three scenarios</td>
</tr>
</tbody>
</table>
Specific space usage alternatives

- **Local middle/high school:**
  - A1: Transfer 8th graders to the high school and relocate 4th and 5th grade to the middle school portion of the building
  - A2: Transfer 8th graders to the high school; relocate kindergarten and 1st grade to the middle school and pre-K to an early childhood education room

- **Elementary schools:**
  - B1: Move pre-K to 3rd grade to school CE, and close PE
  - B2: Move pre-K to 3rd grade to PE, and close CE
  - B3: Move 2nd to 5th to CE, and close PE
  - B4: Move 2nd to 5th to PE, and close CE

- **Other options:**
  - C: Move pre-K through 7th to MHS and move 8th to 12th to PE
  - D: Create three separate districts with a superintendency union for oversight

Requires extensive discussion of financial, space, and education-related impacts and tradeoffs according to objectives
A framework for implementing project recommendations

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Metric 1</th>
<th>Metric 2</th>
<th>Metric 3</th>
<th>Constraint 1</th>
<th>Constraint 2</th>
<th>Constraint 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transfer health benefits for current employees and retirees from the Berkshire Health Group to the Massachusetts Group Insurance Commission (MGIC)</td>
<td>Increase district financial sustainability</td>
<td>Improve district administration and operations</td>
<td>Budget surplus</td>
<td>Funding levels</td>
<td>Merit pay for low-income employees</td>
<td>Town/district reluctance to cadre authority</td>
<td></td>
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</tr>
<tr>
<td>2. Transfer pension assets from the Town of Adams’ retirement system to a system with a better rate of return such as the State’s Pension Reserve Investment Trust (PRIT)</td>
<td>Increase district financial sustainability</td>
<td>Improve district administration and operations</td>
<td>Budget surplus</td>
<td>Funding levels</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Undertake steps to reduce special education enrollment and costs to approach the state average</td>
<td>Improve in-school experience</td>
<td>Increase district financial sustainability</td>
<td>Educational quality</td>
<td>Funding levels</td>
<td>Limited staff for new special education committee</td>
<td>Limited resources to improve special education collection and analysis</td>
<td>Parent and teacher opposition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Increase enrollment in the high school by increasing offerings and enticing students/parents to choose Adams</td>
<td>Improve educational outcomes</td>
<td>Improve community image</td>
<td>Educational quality</td>
<td>Level of satisfaction with the community</td>
<td>Attractiveness of district for employer relocation/ expansion</td>
<td>Administrative time and costs to build and manage partnerships</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Increase district-wide funding for professional learning to support district goals</td>
<td>Improve educational outcomes</td>
<td>Improve in-school experience</td>
<td>Educational quality</td>
<td>Student satisfaction with classes and activities</td>
<td>(Community) satisfaction with curriculum and programming</td>
<td>Need metrics to assess effectiveness</td>
<td>Increased professional support costs must be offset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Reduce teacher absenteeism and provide funding for teacher substitutes as needed</td>
<td>Improve educational outcomes</td>
<td>Improve in-school experience</td>
<td>Educational quality</td>
<td>Student satisfaction with classes and activities</td>
<td>(Community) satisfaction with curriculum and programming</td>
<td>Teacher opposition</td>
<td>Increased costs of hiring substitutes must be offset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Control/moderate fiscal impact of future teachers’ cost of living and annual step increases on the budget</td>
<td>Increase district financial sustainability</td>
<td>Improve district administration and operations</td>
<td>Improve community image</td>
<td>Budget surplus</td>
<td>Funding levels</td>
<td>District may be less attractive to current and potential teachers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UMASS BOSTON
A framework for implementing project recommendations, cont’d

<table>
<thead>
<tr>
<th>Alternatives</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Associated objectives/values from public discussions</th>
<th>Associated metric/attribute from public discussions</th>
<th>Constraints/limitations/concerns from analyst discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Reduce the number and value of stipends</td>
<td>increase district financial sustainability</td>
<td>improve district administration and operations</td>
<td>improve community image</td>
<td>Budget surplus</td>
<td>Funding levels</td>
<td>Teacher opposition</td>
</tr>
<tr>
<td>9. Develop a new compensation policy</td>
<td>improve district administration and operations</td>
<td>improve community image</td>
<td>Budget surplus</td>
<td>Funding levels</td>
<td>District may oppose UMB on per-capita policies</td>
<td>Administrative costs to develop new policies</td>
</tr>
<tr>
<td>10. To address the District's Level 1 status, develop and implement a plan of TPA practices</td>
<td>improve educational outcomes</td>
<td>improve community image</td>
<td>Educational quality</td>
<td>Level of satisfaction with the community</td>
<td>Perceived community quality</td>
<td>Opposition from stakeholders based on perceived stigma</td>
</tr>
<tr>
<td>11. Engage with surrounding communities around joining the district</td>
<td>increase district financial sustainability</td>
<td>improve district administration and operations</td>
<td>increase system enrollment</td>
<td>Level of satisfaction with community</td>
<td>Community cohesion</td>
<td>Town/district resistance to new authority</td>
</tr>
<tr>
<td>12. Improve communication with students and parents</td>
<td>strengthen community connections and values</td>
<td>improve community image</td>
<td>improve district administration and operations</td>
<td>Level of satisfaction with community</td>
<td>Community cohesion</td>
<td>Level of engagement with the district</td>
</tr>
<tr>
<td>13. Create a Feasibility Study Committee and hire a consultant to determine the District's elementary school space needs and evaluate at least three scenarios</td>
<td>increase district financial sustainability</td>
<td>improve district administration and operations</td>
<td>improve community image</td>
<td>Level of satisfaction with community</td>
<td>Community cohesion</td>
<td>Building usage</td>
</tr>
<tr>
<td>14. Space use alternatives</td>
<td>increase district financial sustainability</td>
<td>improve district administration and operations</td>
<td>strengthen local community</td>
<td>Level of satisfaction with community</td>
<td>Community cohesion</td>
<td>Town population level</td>
</tr>
</tbody>
</table>
Local reaction reflected awareness of challenges
Conclusion

- Limitations:
  - Adaptation of value-focused thinking to large-scale community conversation context sacrificed analytic rigor
  - Not much guidance from literature for consolidating multiple values structures within and across cases
  - Alternatives not developed in concert with values analysis

- Strengths:
  - Values analysis added credibility to the project engagement; stakeholders believed that we took their concerns seriously
  - Stakeholders understood complex nature of decision problem; less opposition than if we had simply presented recommendations
Next steps

- Local stakeholders to discuss operations and strategy design with a facilitator
- A formal decision analysis/MCDM project could offer opportunity to support, guide and validate school board decision
- Complete multi-site case study comparing Adams-Cheshire and Quabbin districts experience with reorganization


