

Adventures in policy modeling! Operations research in the community and beyond[☆]

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Abstract

The literature describing operations research in the community is somewhat of a puzzle. On the one hand, several authors have denigrated the use of traditional operations approaches in addressing community problems, yet several studies document successful applications. Arguing that the operations research mindset is itself a great strength, we will review several examples where operations research methods have been employed creatively to the benefit of the community and beyond.

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The theme of the 2003 INFORMS meeting was “OR/MS in the Community.” Since that is the subject of this address as well, and the meeting program was on-line, I thought it would be interesting to see what was being presented around the theme of OR in the community at the world’s largest gathering of operations researchers. I began by searching for any talks with the word “community” in the title or abstract. I found an interesting presentation addressing the location of community corrections centers, and another project linking the University of Warwick to the community, but also learned that “multi-agent simulations are of great interest to the military modeling and

simulation community.” Undeterred, I keyed in the word “neighborhood.” I was rewarded with a presentation on neighborhood effects and drug-treatment outcomes, but also found a talk on “very large neighborhood search” (and learned that I should be more careful as such search might be tabu!).

I need not have searched the program to note that operations research applications in the community have been rare relative to other areas of endeavor. Nonetheless, there is a history of operations research and the community that is somewhat contentious and worth reviewing, while there are past and present examples that reveal the potential for applying OR in the community and beyond.

In a 1970 article in *Operations Research* [1], Russell Ackoff of the University of Pennsylvania reported a project whereby community planners from the disadvantaged Mantua neighborhood of Philadelphia turned to Penn faculty and students for assistance in various local development initiatives. These included

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developing an industrial complex housing several manufacturing firms, provision of employment services, establishment of a credit union, design of a community service station, and a community school. These are all good things, but as Ackoff stated, “Little of what we have done is OR, or even research in the conventional sense.” Indeed, Ackoff argued that operations researchers “. . . should want to help create a world in which the capabilities of OR are considerably extended but in which the need for OR is diminished.”

This does not sound like a recipe for growing a discipline. No, Ackoff gave up on operations research, as indicated in his 1979 tirade “The future of operational research is past” [2]. He was wrong, of course—the past 20+ years of achievements in operations research—in revenue management, transportation, logistics, supply chains, and computing, information systems and telecommunications, to name only a few—combined with so many advances in our theories and methodologies suggest that for OR, the future remains rather bright.

But I digress—even while Ackoff used his Mantua experience to formulate a more general complaint against OR, other operations researchers were using modeling methods to investigate a host of urban problems, notably the New York City Rand Institute, incorporated in mid-1969. The community problems addressed included housing for the poor, health, policing, corrections, economic development, and fire protection among others. The journal *Operations Research* published a special issue in 1972 devoted to urban problems. The articles provided progress reports from research conducted at NYC Rand as well as the Urban Institute in Washington, DC, and original models for districting/determining service area boundaries, allocating ambulances, and integrating schools.

1972 saw the publication of Dick Larson’s *Urban Police Patrol Analysis* [3], which received the Lanchester Prize for the best publication in operations research, while the results of the NYC Rand Fire project were published in book form in 1979 [4]. The fire project received several accolades, including the 1974 Lanchester Prize for Peter Kolesar’s and Warren Walker’s paper on the dynamic relocation of fire companies [5], and the 1976 NATO System Science Prize for research by Edward Ignall and numerous colleagues for improving the deployment of New York City’s Fire Companies [6]. Surely improving the performance of police and fire departments counts as an application of OR in the community.

Another creative example occurred in the mid-1970s. In re-thinking traditional approaches to policing, the

forward-thinking Police Foundation conducted a series of field experiments, with the Kansas City Preventive Patrol Experiment being the best known [7]. The basic idea was simple: five police beats received the normal level of preventive patrol (meaning one patrol car per beat), five beats received 2-to-3 times the level of routine patrol (so-called proactive beats), and five beats received no patrol (reactive beats, where patrol was confined to the beat’s boundary). The main findings from this experiment were null findings—that is, there were no significant differences across the different experimental conditions for major variables such as crimes, citizen’s perceptions of safety, and so forth.

Dick Larson was asked to review this study, and did so with the aid of simple OR models [8]. Unlike an agricultural field experiment, outcomes in different beats in this study are not independent. One way to see this is to note that the majority of incident data collected come from busy periods—and during busy periods, all the patrol cars are, well, busy—so the identification of patrol units with individual beats is lost. Dick showed that this and similar problems served to effectively destroy the experimental design.

Much of the work in urban OR conducted during the 1970s was summarized and extended in the book *Urban Operations Research* by Dick Larson and Amadeo Odoni [9], now available online at http://web.mit.edu/urban_or_book/www/ for anyone interested.

Not everyone was as impressed as I am when I look back at urban OR. In the same year that *Urban Operations Research* was published, Jonathan Rosenhead of the London School of Economics issued a blistering attack on the use of OR in urban planning [10]. He stated that “. . . the mainstream OR contribution does violence to the nature of the system under study.” In a manner similarly spirited to Ackoff’s earlier missive [2], Rosenhead advocated “anti-OR,” an approach that, among other things would “. . . be non-optimising, and multi-dimensional without resort to trade-offs.” In Rosenhead’s view, “. . . operations research, through its insistence on precise definition and quantification, limits itself to handling only ‘second rate’ problems” [10].

Similarly, in another 1981 article titled “OR in the Community,” Sue Jones and Colin Eden wrote of the “. . . inadequacy of traditional OR techniques for helping their clients” in the community [11]. With reference to a project meant to assist unemployed youth in their community, Jones and Eden complained that “During the total life of the project until now, we have used two decision trees, one multi-criteria analysis and critical path analysis from the body of textbook techniques” [11].

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