Towards a General Theory of Public and Private Facility Location

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Abstract

Theories of public facility locations have followed a rather haphazard pattern. The prevailing "emptiness" reflects the varying kinds of public facilities requiring location. It also reflects the personal-social behavioral basis which underscores selection of public facility locations. The present paper sets forth a new approach along the lines of welfare economics towards the end of determining the factors (such as demand, cost, welfare (or utility), etc.) which underscore public facility location patterns. In the process of developing our model, the approach is shown to dovetail with that applicable to locations of private enterprises. What in many respects is a general theory of facility location is thereby established herein.

I. Introduction

The locational problem for any facility, whether it be private or public, involves matching the purpose and operational aspects of the facility (such as its basic objectives, budgeting practices, and information channels to be used) with the locational (demand-cost) characteristics of the facility. In the case of a private enterprise facility, the location procedure reduces to a search for the site which offers maximum profits. This location is typically influenced by the type of competition that prevails among rival firms for market areas and the pricing strategies employed by the firms [6]. In sharp contrast, public facilities are not subject to a spatial competition even between the facilities which provide the same set of services to their users. The location process of public facilities reduces to the search for a site which minimizes "guestimated" costs of production and/or maximizes the user's accessibility to the facility.

Notable advances have taken place in recent years in relating private facility location theory to empirical findings. On the other hand, actual case examples of public facility locations have generally been associated with rather disjoint theoretical

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explanations about them. Tietz [18], in a pioneering paper on the problem of locating urban public facilities, stressed the "system character" of the individual units and their public decision making basis. He constructed a rather complete set of objective functions and constraints. However, the scope of the location problem is so great that Tietz actually evaded the essence of such locations by imposing overly restrictive assumptions. More recent attempts to derive public facility location theories [3, 11, 12] have centered, in somewhat corresponding form, on developing operational-optimization models. But they were based, in turn, on the excessively restrictive least-cost location theory of Weber [5].

The Tietz and related theories of public facility locations are basically structured along programming lines. The locational objective generally specified is the distribution of m central facilities among n communities towards the end of minimizing total people transport miles. Unfortunately, the models and resulting theories have failed to contain economically significant and sufficient constraints.

Smolensky, Burton, and Tiedman [16] endeavored to rectify the problem of limited arbitrary constraints by conceiving of a Löschian market space. They emphasized the importance of combining market area theory with the problem of consumer surplus towards the end of determining optimal size public service areas. They failed however to specify the conditions for measuring individual consumer surplus, and simply pointed out that "some" income-compensating scheme would be required in order to obtain a true measure of benefits.¹

Schramm [13] followed the comparatively recent "maximum-profit" industrial location theory rather closely by presenting an analysis of public facility locations which included both the cost of establishing the facility and the benefits stemming therefrom. But he combined them in too general a manner, failing actually to account for the wide variety of functions and facilities that exist. He presumed, in a sense, that all public activities involve identical goal-related behavior.

Actual public facility locations appear to deviate considerably from those conceived of in the theoretical frameworks referred to above. Those frameworks dealt essentially, if not exclusively, with efficiency factors. They ignored the distributional equity factors included in political decision-making that are so integral to

¹Schultz [15] followed essentially the same approach in determining the optimal scale and service area for health care facilities. His main concern, however, was with the optimal service area and the location of an hierarchy of health services: a low level facility (neighborhood health facility); an intermediate level facility (general hospital); and a high level facility (medical center). He proposed that the optimal service radius could be obtained by maximizing the net user benefits if the service cost, distance (or spatial) demand, and benefit functions accurately describe the public location decision problem. He failed, however, to follow through with any determination of the optimal size of the service area.