Chapter 4
System Dynamics Modeling for Public Health Bed Capacity Planning

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ABSTRACT

The system dynamics approach was developed by Jay Forrester from MIT during 1950s to analyze the complex behavior in administration with computer simulation in social sciences. System dynamics is a form of the systems approach as a methodology to understand the dynamic behavior of complex systems. The basis of system dynamics is to understand how system structures cause system behavior and system events. This chapter aims to develop a system dynamic model. System dynamics approach was adopted to build a bed capacity management model using a software package, Vensim.
INTRODUCTION

System dynamics approach was developed by Jay Forrester from MIT during the 1950’s to analyze especially the complex behavior in administration with computer simulation in the social sciences. System dynamics is a form of the systems approach as a methodology to understand the dynamic behavior of complex systems. The basis of system dynamics is to understand how system structures cause system behavior and system events (Sezen, 2009: 298).

Jay Forrester initially constructed his first dynamic model during his meeting with the management of General Electric Corporation. Big fluctuations in production, inventory, labor force and profitability were compelling GE management. Despite the hard efforts of the management, these fluctuations were mostly associated with external factors. Especially, the fluctuations in the business were related to received orders. Forrester interacted with the management to observe the system operations in other departments. In the first model he developed, he observed that simulations were necessary since the system could not be monitored analytically. He demonstrated that the corporation could experience serious fluctuations due to management policies even when the demand is considered constant with the weekly simulation he ran. Later on, he designed the computer simulation for the same problem. In his later studies, Forrester demonstrated how the feedback control theory could be adapted for complex administration and human systems. He published his initial findings in an article in Harvard Business Review. Later on, he developed this study to write his famous work “Industrial Dynamics” (Lane & Sterman, 2011; Ramage & Shipp, 2009: 100-101).

SYSTEM DYNAMICS

System dynamics deals with how things change over time. Almost all are interested in how the past formed the present moment and how today’s actions determine the future. System dynamics is designed to model, analyze and improve socio-economic and administrative systems using a feedback perspective. Dynamic structured administrative problems are modeled by mathematical equations and using computer software. Dynamic constructions of model variables are obtained using computer simulations (Forrester, 1995; Forrester, 1962; Ford 1999; Sterman, 2000).

The main principle of system dynamics is that the ongoing accumulation of the complex behavior of organizational and social systems (human, material, financial
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