

## Chapter 2

### Theories and Principles of Design Economics

Herbert Robinson and Barry Symonds

#### 1. INTRODUCTION

Factories, offices, housing, hospitals, schools, roads and airports are all essential for human development, industrial production and productivity to enhance socio-economic development. However, a central problem in economics is scarcity of resources as human needs are unlimited whilst the means or resources for fulfilling them are limited. In the context of the built environment, appropriate design choices have to be made based on the resources available to meet the construction needs of owners and users which have to be balanced against the needs of society. Design decisions affect the built environment as there are economic, social and environmental consequences associated with construction projects, their use and performance. There is therefore a need to evaluate design not only from an economic perspective (incorporating capital and operating costs) but also in terms of the environmental and social costs to clients and other stakeholders (e.g. local people, businesses, communities and special interest groups).

Understanding the theories and principles of design economics is fundamental in addressing the needs of clients in achieving a cost-effective building requiring an optimum trade-off between capital and operating costs, environmental and social costs. Environmental and social costs are important in design due to externalities associated with the construction process, use of buildings, growing resource problems, and carbon emissions causing global warming and climatic disruptions.

This chapter explores the theories and principles of design economics. It starts with an overview of the factors affecting design costs and benefits, followed by a discussion of capital cost theory and the whole life cost theory to ensure that the effects of design decisions are fully considered. Value management theory focusing on maximising the function (or quality) of a design solution whether it is design space, component or materials in relation to its cost is also examined. This is followed by a discussion of the "value of design" theory which helps to understand the relationship between economic cost (wider economic impact of attractive buildings and settings, social cost (enhanced individual, and social well-being or quality of life) and environmental cost (greater adaptability, energy efficiency and environmental sustainability). The chapter concludes with the resource-based theory which argues that construction cost is the sum of resources required but the resources required are a function of resource production coefficients and unit resource costs determined by types of buildings or infrastructure and forces of demand and supply in the resource markets.

#### 2. FACTORS AFFECTING DESIGN COSTS AND BENEFITS

A facility or building's function strongly influences its design which in turn affects the construction *cost*. The *function* is important as it expresses the intended use or benefits of a project and determines the design parameters. As a result, construction costs are often expressed in *functional* units (e.g. cost per beds/seats/places/spaces etc.) for

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