

An Assessment of the Technical Efficiency of Construction Firms

R Gnanasigamani¹ Amrutha Parveen²

^{1,2}PG Scholar

^{1,2}Department of Civil Engineering

^{1,2}Shree Venkateshwara Hi-Tech Engineering College, Gobi, India

Abstract— This paper evaluates the technical efficiency ratios (ER) using data envelopment analysis (DEA) technique of construction industry. The analysis is based on input-output data over the observation period. The results show an overall increasing trend of the technical efficiency at the average annual rate of 0.83% in the subperiods. Furthermore, the factors affecting the technical efficiency level and its growth have been identified. The higher technical efficiency ratios would come from the construction firms with less intensive capital, larger size, lower degree of subcontracting and lower proportion of intermediate input consumption.

Keywords: Efficiency Ratios (ER), Data Envelopment Analysis (DEA)

I. INTRODUCTION

The construction industry of India is an important indicator of the development as it creates investment opportunities across various related sectors. With a share of around 8.2%, the construction industry has contributed an estimated 670,778 crores (US\$ 131 billion) to the national GDP at ₹ factor cost in 2011–12. The industry is fragmented, with a handful of major companies involved in the construction activities across all segments; medium-sized companies specializing in niche activities; and small and medium contractors who work on the subcontractor basis and carry out the work in the field. In 2011, there were slightly over 500 construction equipment manufacturing companies in all of India.

The sector is labour intensive and, including indirect jobs, provides employment to more than 49.5 million people. The construction sector is visualized to play a powerful role in economic growth, in addition to producing structures that adds to productivity and quality of life. economic development is a term that economics politician and other have used frequently in the 20th century, modernization westernization and specially industrialization are other terms people have used while discussing economic development. Economic development has a direct relationship with the environment. Government undertaking to meet go abroad economic objectives such as price stability, high employment and sustainable growth, such efforts include financial and economic policies, regulations of financial industry trade and tax policies. The period from 1970 to mid 60's witnessed the government playing an active role in the development of these services and most of construction activities during this period were carried out by state owned enterprises and supported by government departments.

A. Objective

The overall objective is to study the terms “Technical Efficiency” and “Data Envelopment Analysis” through literature review. To gather information about existing technical efficiency based on input-output data in construction industry. To identify future increasing trend of

the technical efficiency. To examine factors affecting the technical efficiency level. To identify solutions to improve technical efficiency of construction firms.

B. Scope

To evaluate the technical efficiency of construction firms, through the application of Data Envelopment Analysis (DEA) technique.

II. LITERATURE REVIEW

Farrell (1957) suggested a method of measuring the TE of a firm in an industry, by estimating the production function of firms which are “fully efficient”. Many subsequent papers have applied and reviewed Farrell’s ideas. The TE literature can be divided into two principal groups according to the method chosen to estimate the frontier production function: deterministic frontier and stochastic frontier. Debate continues over which approach is the most appropriate one to use. On one hand we have the Data Envelopment Analysis (DEA) that is a deterministic and non-parametric approach it does not require any assumption about the functional form of the production or cost frontier introduced by Charnes, Cooper and Rhodes to measure efficiency under the assumption of constant returns to scale, and extended by Banker, Charnes and Cooper to allow variable returns to scale.

Ruggiero (2007) demonstrates that the major advantages of the DEA approach are its nonparametric nature and its ability to handle multiple outputs and multiple inputs. On the DEA down side, econometricians have argued that the approach produces biased estimates in the presence of measurement error and other statistical noise. Deterministic approaches are based on cross-sectional models; however, as Ruggiero (2004) argued, they can be extended to panel data models by averaging the data across time. On the other hand, we have the stochastic production frontier. This approach is motivated by the idea that deviations from the production ‘frontier’ might not be entirely under the firm’s control. Under the interpretation of the deterministic frontier, for example, an unusually high number of random equipment failures, or even bad weather, might ultimately appear, to the analyst, as inefficiency.

You and Zi (2007) approximating the effect of an economic crisis on the efficiency of the construction industry. Globally, country studies focused on the whole construction sector, report a wide range of efficiency levels from a low of around 50% for Canadian firms approximately 60% for Portuguese firms, to higher estimates of 83% for Norwegian firms, 84% for Chinese firms and 93% for Greek firms. Regarding the factors which affect efficiency determinants.

Chau and Wang (2003) used the DEA method to evaluate the efficiency of construction firms in Hong Kong. The results showed that (i) larger firms could produce more efficiency than smaller firms, (ii) companies used mechanization to improve the growth efficiency, and (iii)

companies used subcontracting and outsourcing to improve productivity efficiency. Sueyoshi and Goto (2009) used the DEA method to evaluate the construction industry policies in Japan. The research indicated that Japanese construction companies have high amounts of labour and that the industry was the main support to local economy. Li et al. find that the efficiency of Hong Kong contractors is associated with their managerial ability to control business costs and financial ability to manage both short-term and long-term capital liquidity.

Abdel-Wahab and Vogl (2011) compared Germany, France, UK, USA and Japan construction sectors over the period 1990-2005, using a growth accounting approach with country level data. These analyses suggested that this sector growth lags behind the growth in all industries, with Germany and Japan presenting negative growth rates in construction.

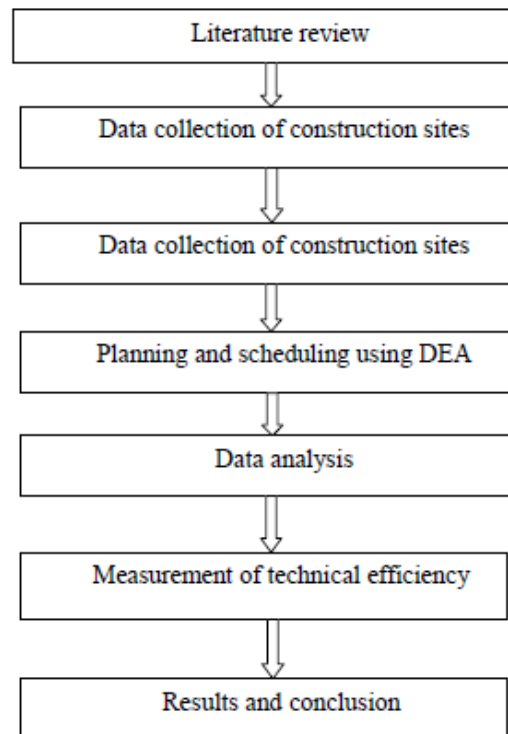
Adekunle J. Idowu (2018) Interesting because of the resemblance to the Spanish case, is the study of You and Zi , which analyzed the case of Korea in the late 1990s. The Korean construction sector was impacted by an economic crisis in November 1997. Using the data envelopment analysis (DEA) approach for the period 1996-2000, the author found leverage ratio, export weight, institutional ownership and asset size as factors impacting all efficiency measures. Other studies that should be emphasized in the construction field are Horta, Camanho and da Costa and El-Mashaleh, Rababeh and Hyari (2011), who used the DEA method to evaluate the safety efficiency of every contractor aiming to transform inefficient contractors into high efficiency contractors.

Walter Briec & stephane Mussard (2020) Policy makers in both developed and developing countries have recently paid attention to the performance efficiency of the construction sector in general, and construction firms in particular, because of the significant contribution to social and economic development in terms of GDP share and job creation. One aspect of concern, however, is that the sector may have negative impacts on the economy due to its extravagance in using resources. Numerous countries have been implementing reform programs to improve the sectors operation efficiency, and there is a variety of criteria for assessments and improvements, such as number of houses built and how efficiently the state and non-state firms are operating.

Aigner, D.; C. A. K. Lovell; and P. Schmidt. (1977) used DEA to evaluate the performance efficiency of 104 construction projects in Sweden in the period 1989–1992. Output was value added (VA), while inputs were costs of staff, workers, and machines. Estimated results showed a significant difference between efficiency scores of construction sites. To find the causes for this difference, the author used a multi-regression method with results from DEA estimates and direct interviews with the managers of the studied construction sites.

III. METHODOLOGY

Information on technical efficiency and data envelopment analysis is collected through various journals and from online websites. Collection of raw data from visiting various sites. Studied the data.



IV. CONCLUSION

This study used both parametric and non-parametric approaches to estimate technical efficiency of 44 construction firms 4 by using data from the 2002 Economic Census for Enterprises by the General Statistical Office (GSO). It was found that results from both approaches were relatively consistent, and they could help explain the efficiency performance of these firms. Estimates from data envelopment analysis (DEA, the non-parametric approach) and stochastic frontier production function (SFPF, the parametric approach) indicated that the average pure technical efficiency of these firms was about 60 percent (58.6% and 57.8% for DEA and SFPF, respectively). In terms of business type, building and civil engineering construction firms usually had the lowest efficiency scores, which reflected the fact that they were operating with many inputs, and construction time was usually long. Moreover, it was shown that state firms were more efficient than non-state ones, possibly because these firms could invest more capital and have better technical capacity. Also, some business location had significant influence on these firms' efficiency scores, and the result could be explained by easier access to resources, such as labor and capital, in these cities. One different finding between the two approaches was that the variable capital-labor ratio had no impact on the efficiency performance of the studied firms in the DEA model, while it had obvious influence in the SFPF model.

REFERENCE

- [1] Walter Briec & stephane Mussard (2020) Improvement of technical efficiency of firmgroups European journal of operational research Volume 283, Issue 3, 16 June 2020, pp. 991-1001.
- [2] Adekunle J. Idowu (African University of Science and Technology) Omowunmi O. Iledare (University of Port Harcourt) Bamidele G. Dada SPE- 194210-PA,2018.
- [3] Hasan A Faruq & David T Yi, The determinants of technical efficiency of manufacturing firms in Ghana, Globa economy journal vol.10,no.3 185-205
- [4] Y.S. WANG1 and K.W. CHAU, An assessment of the technical efficiency of construction firms in Hong Kong, The International Journal of Construction Management (2001) 27 – 29.
- [5] Charnes, A.&Cooper,W.W.and Rhodes,E.(1978) “ Measuring the efficiency of decision making units” European Journal of Operational Reasearch,2,429-444.
- [6] Charnes,A,Cooper,W.W.Lewin,A.Y.and Sieford, L.M.(1994).Data Envelopment Analysis: Theory, Methodology and Application,Kluwer Academic Publishers, Boston.
- [7] Chau,K.W.and Walker A.(1998). The measurement of total factor productivity of the Hong kong construction industry.Construction Management and Economics,6(3),209-224.
- [8] Ferrel,M.J(1957) The Measurement of Productive Efficiency. Journal of the Royal Statistcal Society, Series A,120,253-290.

