J. Patuakhali Sci. and Tech. Uni. 2016, 7 (1&2): 87-97 ISSN 1996-4501

APPLICATION OF DEA IN MEASURING EFFICIENCY OF REAL ESTATE COMPANIES IN BANGLADESH

Md. Zakir Hosen[1]

Abstract

This paper proposes a measurement to the relative efficiency and identify the challenges that are faced by the Real Estate Companies using a frontier tool viz., Data Envelopment Analysis (DEA). It is observed that 70% of the companies are efficient in this sector on an average. The majority of the companies seem to operate at the optimum scale of operation (economies of scale). In particular two companies namely Amin Mohammad Lands Development Ltd. and Mega Builders Ltd. have presented increasing returns to scale which indicates that their scales of operation have to be increased. Alternatively, one company has exhibited decreasing returns of scale and thus it needs to downsize its scale of operation. The challenges mainly faced are the Government policies, financial difficulties, income level, utility services, and economic stability. Therefore policy reformation needs to be taken immediately in order to mitigate these challenges.

Keyword: Challenges, CCR Model, DEA, DMU's, Economies of Scale, Relative Efficiency.

Introduction

Housing is one of the fundamental needs of human being. It cannot be isolated from other aspects of life. Qualitative accommodation problems have been considered as the main constraint against development of the highly populated developing Bangladesh. Particularly the population of the Mega City Dhaka is increasing day by day. Moreover, the effects of urbanization are also influencing its inhabitants in an increasing rate. In every year, almost 10% population is increasing in Dhaka city (Zaman *et al.,* 2010). However, the total amount of the land in Dhaka City remains constant. Due to incapability of government housing agencies of Dhaka to provide adequate and convenient housing facilities to its inhabitants, some of the Real Estate organizations have come forward to mitigate these problems. This situation creates a new area of investment for private entrepreneurs. There are near about 500 acres of land free to be inhabited in this city and majority are occupied by either park or marked as reserved land. More than ten million people live in Dhaka at present, among them 83% are dwelling in rented house (Zaman *et al.,* 2010). House rent has been increased by 325% in comparison to last 20 years from 1995 and 60% income of mass people is incurred for house rent (Zaman *et al.,* 2010). Everyone wants to have a home in luxurious residential area in Dhaka city and also wants to live in the natural environment with developed communication systems and advanced social facilities. By 2025 population may exceed two cores in Dhaka (World Bank, 2007) majority of those people would have no residence of their own. Thus residence management at that time for these people is truly going to be a big challenge.

[1] Department of Accounting and Information Systems, Patuakhali Science and Technology University, Dumki, Patuakhali - 8602, E-mail- zakiraccdu@yahoo.com

Urbanization is an outcome of both population growth and rural-urban migration. As urbanization increases, more and more people are becoming city dwellers. Bangladesh is not an exception to that picture. In Bangladesh the problem of urbanization is further aggravated due to lack of decentralized economic activities, proper planning and land use policy. As globalization increases, the process of urbanization increases. It has momentum urbanization both in developed and developing countries. The ever-increasing urban population is creating an increasing demand for shelter. The right of shelter is a fundamental right, which is ensured by both UN declaration and constitution of Bangladesh. But being a government of a least developing country, it is almost impossible on the part of the government to ensure housing for all. As public sector failed to ensure peoples' right, they have taken their own initiative to ensure their fundamental need of shelter. Personal initiatives and real estate companies both are working together hand in hand to quench the ever-increasing thirst of people for shelter. It is a recognized fact that the health of the real estate development sector is the barometer of the National economy. In Bangladesh real estate Business started in Dhaka at late seventies. During 1970s there were fewer than five companies engaged in this business. In 1988 there were forty two such developers working in Dhaka and in 2004 there were about two hundred fifty companies engaged in this business (REHAB FAIR, 2015). At present the number is near about one thousand.

Dhaka, the capital of Bangladesh, is facing more acute housing problem than any other cities of the country. With the number of companies increasing gradually, various problems concerning this sector cropped up requiring early solution. At this stage it was necessary to form a trade association of the real estate developers to protect the overall interests of the sector. To strengthen the role of real estate sector an umbrella organization namely Real Estate & Housing Association of Bangladesh (REHAB) was formed with only 11 members in 1991. The objective of REHAB was to promote formal private sector Real estate Development in Bangladesh (REHAB FAIR, 2015).

REHAB is the only trade organization of real estate developers with a current membership of near about 1000 developers (REHAB FAIR, 2015). All major institutionalized developers are members of this organization. REHAB is also the "A Class" member of the Federation of Bangladesh Chambers of Commerce and Industry (FBCCI). In the recent years REHAB has played a very significant role in nation building through real estate development through its members. The members of REHAB contribute a large amount of revenue to the government exchequer in terms of registration cost, income tax and utility service charges.

REHAB organizes its most colorful annual event REHAB Housing Fair each year in Bangladesh for its members, prospective customers, financial institutions and building material providers. To foster the growth of real estate sector REHAB plans to organize Housing Fair abroad. The overall objective of this study is to measure the efficiency of

this sector with special reference to Dhaka mega city. As Bangladeshi companies cannot compete with the developed countries due to lacking in efficiencies, efficiency analysis can help them make progress on their way. In another way, scale efficiency can help them analyze what is their position in economies of scale. The specific objectives are as follows:

- To measure the efficiency or inefficiency of decision making unit i.e. real estate company
- To suggest the possible way of improving the overall efficiency, scale efficiency, return to scale inefficient DMU
- To identify the challenges, problems and provide some guidelines for sustainable development of this sector

Formal research relating to efficiency of this sector is not so much available. A very few columns are found in different magazines. The Eastern housing Ltd., the pioneer one in this sector, had dramatically changed this industry by building both commercial housings and residential apartments (Rahman, 2005). Benjamin (2003) observed that unwillingness of individual to spend time, money and energy for constructing house is increasing awareness of apartment concept. The apartment business is not only beneficial for individual but also ensures optimum usage of natural gifts i.e. land and space. It also generates employments and develops linked specialized industries such as security services. Malpezzi (2000) found that the rapid growth of urban population has led to unique increase in housing demand. The National Housing Policy (NHP, 1993) directs the government to take initiatives to provide housing shelter for weaker section of the people and as a facilitator all housing initiatives in Bangladesh. People both low and middle income class try to buy land and build house for own uses. Nadler (2006) argued that the availability of finance is crucial for overall development of this sector and improve household as well as qualitative living.

Michael (1999) opined that even after the growth of real estate business in a country, there is ample opportunity to grow further because people living in the city are increasing day by day and thus the housing demand increases. It does not mean housing is used for physical shelter but also used for other reason such as income generation, increased security, self-confidence and human dignity. Hossain (2001) concluded that Bangladesh has acute shortage of shelter both in the urban and rural area. It is estimated in 1991 that there are 3.10 million units demand in Bangladesh of which 2.15 million units in rural areas and 0.95 million in urban areas. Nordberg (2000) clearly demonstrated that in all over the world, real estate has the potentiality to be an engine of economic growth because of its higher returns on invested resources, a high multiplier effect and its linkages both forward and backward industry to the economy. From the above discussion, it is apparent that real estate business is one of the potential industrial sectors in Bangladesh not only for business but also for shelter.

Methodology

The collected data are processed by using MS Excel and DEA software with its online solution (OS). DEA is a nonparametric method in operating research and economics for the estimation of production frontiers. It is used to empirically measure productive efficiency of decision making units (DMUs) by the interaction of selected inputs and outputs. Non-parametric approaches have the benefit of not assuming a particular functional form/shape for the frontier; however they do not provide a general relationship (equation) between output and input. There are also parametric approaches which are used for the estimation of production frontiers. These require that the shape of the frontier can be guessed beforehand by specifying a particular function relating to output to input. One can combine the relative strengths from each of these approaches in a hybrid method where the frontier units are first identified by DEA and then a smooth surface is fitted to these. This allows the best-practice relationship between multiple outputs and multiple inputs.

"The framework has been adapted from multi-input, multi-output production functions and applied in many industries. DEA develops a function whose form is determined by the most efficient producers (Charnes A, Cooper W.W. and Rhodes E. 1978). This method differs from the Ordinary Least Squares (OLS) statistical technique that bases comparisons relative to an average producer. Like Stochastic Frontier Analysis (SFA), DEA identifies a "frontier" on which the relative performance of all units in the sample can be compared. It can be characterized as an extreme point method that assumes that if a firm can produce a certain level of output utilizing specific input levels, another firm of equal scale should be capable of doing the same. The most efficient producers can form a 'composite producer', allowing the computation of an efficient solution for every level of input or output. Where there is no actual corresponding firm, 'virtual producers' are identified to make comparisons".

In analyzing data, two different DEA models are applied to evaluate the relative efficiency of real estate companies in Bangladesh. The DEA methods are applied to find out the overall efficiency, and Scale Efficiency. The results and discussions of this paper can be used to assist the authorities to pave the way for the improvement in technical and scale efficiency with benchmarks of performance.

The Basic Radial Model (BRM) used through OS of DEA. An analysis can be conducted for each inefficient DMU which can be made efficient by improving the use of their existing resources efficiently. In case of improvement, the actual and the targeted values of inputs and outputs are compared in order to measure relative efficiency. Weights assigned for each variable by following the model for efficiency calculation, show the tradeoff of increments or decrease in inputs or outputs to DEA efficiency.

Data have been collected from both primary and secondary sources. Primary data have been collected from practical work exposure i.e. direct interview and secondary data have been collected form internet, daily newspapers, journals and websites of the concerned companies. Ten real estate companies referred to as decision making units (DMU) operating their business in Bangladesh. They are selected by following convenient sampling approach. They are as follows:

Sl	DMU	Inputs	Out puts
1.	Asset Developments & Holdings Ltd.	Projects Expense	Sales revenue Net income
2.	Assurance Developments Ltd.		
3.	Navana Real Estate Ltd.		
4.	Premier Homes Limited		
5.	Amin Mohammad Lands Development Ltd.		
6.	Rupayan Real Estate Limited		
7.	Mega Builders Limited		
8.	Mission Developers Ltd.		
9.	Genetic Limited		
10.	Green Shadow Properties Ltd.		

Results and discussion

Output Oriented CCR Model (Charnes et al., 1978):

Firstly the CCR model (Basic model) is used to analyze the information gathered from different sources. According to CCR model, it has tendency to Constant returns to scale (CRS), variable returns to scale (VRS), increasing return to scale and decreasing returns to scale based on single period. The following table delineates the efficiencies on the basis of constants returns to scale:

Table 1 Efficiencies on the basis of constants returns to scale

Sl	DMU	Efficiency score
1.	Asset Developments & Holdings Ltd.	1.0000
2.	Assurance Developments Ltd.	1.0000
3.	Navana Real Estate Ltd.	1.0000
4.	Premier Homes Limited	1.0000
5.	Amin Mohammad Lands Development Ltd.	0.3548
6.	Rupayan Real Estate Limited	1.0000
7.	Mega Builders Limited	0.3925
8.	Mission Developers Ltd.	1.0000
9.	Genetic Limited	0.8731
10.	Green Shadow Properties Ltd.	1.0000

From the table 1, it is observed that all companies except three are on the efficient frontier because their efficiency scores are equal to one. Thus these companies have no chance of showing potentiality for increasing their output. But Amin Mohammad Lands Development Ltd., Mega Builders Limited and Genetic Limited are inefficient and they have the chance of increasing their output. For example, Amin Mohammad Lands Development Limited has 64.52% (1- 0.3548) chance of increasing its output.

Input oriented BCC Model (Banker et al., 1984):

Secondly, the BCC model is used in analyzing the information gathered from the companies and measuring the efficiency of the companies. Their efficiency scores according to this mode are presented in table 2.

Table 2 Efficiencies on the basis of variable returns to scale

Sl	DMU	Overall score	Scale efficiency	Returns to Scale
1.	Asset Developments & Holdings Ltd.	1.0000	1.0000	constant
2.	Assurance Developments Ltd.	1.0000	1.0000	constant
3.	Navana Real Estate Ltd.	1.0000	1.0000	constant
4.	Premier Homes Limited	1.0000	1.0000	constant
5.	Amin Mohammad Lands Development Ltd.	0.4830	0.7347	increasing
6.	Rupayan Real Estate Limited	1.0000	1.0000	constant
7.	Mega Builders Limited	0.4074	0.9634	increasing
8.	Mission Developers Ltd.	1.0000	1.0000	constant
9.	Genetic Limited	0.8897	0.9814	decreasing
10.	Green Shadow Properties Ltd.	1.0000	1.0000	constant

Similar trend is evident from table 2 that 70% of the companies are efficient according to the scale efficiency and 30% companies namely Amin Mohammad Lands Development Ltd., Mega Builders Limited and Genetic Limited are inefficient. As a result they have chance to increase or decrease output depending on returns to scale showing increasing, decreasing and constant. This implies that companies having constant return to scale are in economies of scale and have no chance to increase the output. Companies which have the efficiency score less than one; could try to reach in the economies of scale because by optimizing combination of inputs and outputs, so it can be technically efficient. In this regard increasing return to scale means they can increase output by using existing input more efficiently and decreasing return to scale means they have to decrease output to reach optimum scale of operation. For example, Amin Mohammad Lands Development Ltd.'s efficiency score is 0.7347 and return to scale is increasing. However, the company has a chance to (1-0.7347) enjoy 26.53% free space that are inefficient in their operation. In case of Genetic Limited, efficiency score is 0.9814 and return to scale is decreasing.

Therefore, the company should downsize its operation/output by 1.86% to reach its optimum scale of operation. As a result further analysis for improvement is only applicable to Amin Mohammad Lands Development Ltd. and Mega Builders Limited.

Lambdas and Improvement Indices (Constant Return to Scale based on BRM):

Thirdly, the DEA allows to go further and acquire more detailed information for increasing the efficiency through DEAOS. The results are summarized in table below:

Table 3 DEA results for Amin Mohammad Lands Development Ltd

Efficiency score: 0.7347				
Benchmarks	Assurance Developments Ltd.		Green Shadow Properties Ltd.	
Lambdas	0.282		0.055	
Improvements	Projects	Expense	Sales Revenue	Net Income
Actual	33	81996324	193256165	35153144
Target	11.709	29093847.73	193256165	41953380.808
Change %*[2]	64.518	64.518	0	(19.344)
Weights	0.173	0.655	0.577	0

From Table 3, it is evident that efficiency score is 0.7347 which means that this company is able to increase its output by 26.53 % (1- 0.7347) using the current amount of inputs more efficiently. The lambda represents the performance discrepancies of Amin Mohammad Lands Development Ltd. from its close competitors (benchmarks) which are Assurance Developments Ltd. and Green Shadow Properties Ltd. and to compete with these companies, Amin Mohammad Lands Development Ltd. has to increase its outputs by 28.2% and 5.5%, respectively. In case of improvement, this company should increase each input by 64.518% and decrease Net Income by 19.344% keeping Sales Revenue unchanged.

Table 4 DEA results for Mega Builders Limited

Efficiency score: 0.9634				
Benchmarks	Assurance Developments Ltd.		Green Shadow Properties Ltd.	
Lambdas	0.021		0.719	
Improvements	Projects	Expense	Sales Revenue	Net Income
Actual	35	14021500	59500000	9000000
Target	13.738	5503587.902	59500000	10290046.337
Change %*	60.748	60.748	0	(14.33)
Weights	0.311	1.174	1.034	0

[2]Percentage difference between the targeted and actual value (Same for next analysis also)

According to table 4, efficiency score for Mega Builders Limited is 0.9634 which indicates its ability to increase its output by 3.7 % (1- 0.963) using the current amount of inputs more efficiently. The lambda represents the performance discrepancies with its close competitors (benchmarks) such as Assurance Developments Ltd. and Green Shadow Properties Ltd. To compete with its competitors Mega Builders Limited has to increase its output by 2.1% and 71.9%, respectively. For this improvement, it should increase each input by 60.748% and decrease Net Income by 14.33% keeping Sales Revenue unchanged.

Lambdas and Improvement Indices (Variable Return to Scale based on BRM)

The Basic Radial Model used here through online solution of DEA to determine the Variable Return to Scale. The results are summarized in Table 5.

Table 5 DEA results for Amin Mohammad Lands Development Ltd.

Efficiency score: 0.483%				
Benchmarks	Asset Developments & Holdings Limited		Premier Homes Limited	Rupayan Real Estate Limited
Lambdas	0.111		0.809	0.079
Improvements	Projects	Expense	Sales Revenue	Net Income
Actual	33	81996324	193256165	35153144
Target	15.938	39601326.013	193256165	37917439.814
Change %*	52.969	51.703	0	(7.863)
Weights	1.205	0.127	0.43	0

In table 5, it is evident that Amin Mohammad Lands Development Ltd. obtained efficiency score to about 0.483% which signifies its capacity to increase its output by 51.7 % (1- 0.483)% using the current amount of inputs more efficiently i.e. 25.17 % more than the CRS model. The lambda finds the performance discrepancies of Amin Mohammad Lands Development Ltd. from its close competitors (benchmarks) namely Asset Developments & Holdings Limited., Premier Homes Limited and Rupayan Real Estate Limited. To compete with these DMUs, it has to increase its output by 11.1%, 80.9% and 7.9% respectively which are vastly deviant from CRS based on BRM. For this improvement, this company should increase Project by 52.969% and Expense by 51.703 and decrease Net Income by 7.863% keeping Sales Revenue unchanged.

Table 6 DEA results for Mega Builders Limited

Efficiency score: 0.407				
Benchmarks	Assurance Developments Ltd.		Premier Homes Limited	Green Shadow Properties Ltd.
Lambdas	0.026		0.608	0.367
Improvements	Projects	Expense	Sales Revenue	Net Income
Actual	35	14021500	59500000	9000000
Target	14.26	5712616.377	59500000	10469803.575
Change %*	59.257	59.257	0	(16.331)
Weights	0.359	0.999	0.999	0

As per table 6, Mega Builders Limited obtained efficiency score 0.407 which suggests that it is able to increase its output by 59.3% (1- 0.407) using the current amount of inputs more efficiently. The lambda represents the performance discrepancies of Mega Builders Limited with its close competitors (benchmarks) which are Assurance Developments Ltd., Premier Homes Limited and Green Shadow Properties Ltd. To compete with these competitors, it has to increase its output by 2.6%, 60.8% and 36.7% respectively. In order to improve this, the company should increase inputs (projects, Employee,) by 59.257% and decrease Net Income by 16.331% keeping Sales Revenue unchanged.

Conclusion and recommendation

As a developing country, Bangladesh is still facing a huge shortage of housing for the low and middle income people at an affordable price and place. Undoubtedly it is the emerging sector because of rising middle class and shortage of land. Every year, near about 1500 crore taka is added to Government fund in the form of revenue. Government gets revenue of 1400 crore taka every year as a means of importing the materials of this sector from abroad. There are investments of almost 70 thousands crore taka in this sector. In GDP, it has a contribution of more than 24 thousand crore taka. Nonetheless it is a matter of great sorrow that Government is still showing antagonistic behavior with such type of important sector that plays a remarkable contribution to the national economy. Rural areas are not so important for trade and investment and hence, more attention should be given towards the urban area compared to rural areas. Besides, the flat builder faces local hoodlum and they demand illegal subscription. All these limit its scope of doing business. Only ten companies have a large share of total private investment. It is to be decided whether investment should be limited to these 10

companies only. In recent days, more and more companies and many corporate bodies with surplus capacity are entering in the real estate sector. Necessary steps are to be taken to ensure a competitive environment and sustainability to protect this sector. Though only three Real estate Companies show inefficiency but thinking to the fact that the observation consist only 10 of the Real estate companies in Bangladesh among about 1000 listed Real estate companies with REHAB membership, the actual picture may vary. If the government does not look into these facts, it may face an economic disaster. Not only Government is being deprived of huge bulk revenue, but also seeing new problems one of which is unemployment. In many fronts, Government should extend their assistance all out to the entrepreneurs who are revolutionizing our country's housing sector. Though the sample organizations in this study proved to be efficient from mathematical point of view, in reality, it may not be the fact due to the limited number of factors under consideration and vice versa. The performance of this sector is not influenced only by the firms and industry but also macro economic variables as well.

References

1. Banker, R., Charnes A. and Cooper W. 1984. Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. Management Science, 30:1078-1092.
2. Benjamin, D. J. 2003. The Environment and Performance of Real Estate, Journal of Real Estate Literature, 11: 279 - 324.
3. Charnes A, Cooper W W, Rhodes E. 1978. Measuring the efficiency of decision making units. European Journal of Operation Research, 12: 429–444.
4. Hossain, M. 2001. Real Estate Marketing in Bangladesh. Journal of Marketing, London Metropolitan University, 15(2): 15-105.
5. Malpezzi, S. 2000. The role of Speculation in Real Estate Cycles. Journal of Real Estate Literature, 13:141-164.
6. Michael. S. J. 1999. Diversification Issues in Real Estate Investment. Journal of Real Estate Literature, 7: 163-179.
7. Nadler, M. 2006. Evaluating Private Housing Finance System. Paper presented at ENHR Conference 2006 Ljubljana, http://enhr 2006- Ljubljana.
8. NHP. 1993. National Housing Policy. Housing and Public Works Ministry, Bangladesh.
9. Nordberg, R. 2000. Alleviating Poverty through Housing Development. United Center for Human Settlements (Habitat). http://www.unchs.org/unchs/english/hdv6n4/alleviating_poverty.htm date received on October 1, 2006.

10. World Bank (2007) Dhaka: Improving living conditions for the urban poor. Sustainable Development Unit, South Asia Region, Report No. 35824-BD. Available at: http://siteresources.worldbank.org/BANGLADESHEXTN/Resources/295759-1182963268987/dhakaurbanreport.pdf (accessed 10 July 2015).

11. Rahman, M. M. 2005. Role of the NGOs in Urban Housing for the Poor in Dhaka, Bangladesh. GBER, 5(1): 28.

12. REHAB. 2015. REHAB Housing Fair 2015. Available at http://richmondbd.com/rehab-fair/ (accessed on 25 August 2015)

13. Zaman A K H, Alam K M T and Islam M. J. 2010 Urbanization in Bangladesh: Present Status and Policy Implications. ASA University Review 4(2), 1-16. [Cited 27 May 2013]. Available from: www.bbs.gov.bd