Economic Evaluation of Project Site Using Cardinal Numbers Approach

Gul, Ejaz

Bahauddin Zakariya University, Multan, Pakistan

12 July 2013

Pakistan Journal of Social Sciences (PJSS)
Vol. 32, No. 2 (2012), pp. 489-499

Economic Evaluation of Project Site Using Cardinal Numbers Approach

Ejaz Gul
Ph.D Scholar, Department of Economics,
Bahauddin Zakariya University, Multan, Pakistan
E-mail: ejazjazz@yahoo.com

Imran Sharif Chaudhry, PhD
Professor of Economics,
Bahauddin Zakariya University Multan, Pakistan
E-mail: imran@bzu.edu.pk

Fatima Farooq
Ph.D Scholar/Lecturer, Department of Economics,
Bahauddin Zakariya University, Multan, Pakistan
Email: imran@bzu.edu.pk

Abstract
Selection of suitable site for construction project is essential since it has strong linkage with service life of the project. Recent fast developments in construction technology consider only the technical suitability of the project site but ignore the economic suitability. There can be many instances when a site may be suitable from technical point but not from economic point of view and vice versa. This research is about finding economic suitability of three different project sites located in Liberia. Cardinal approach was used for the study. A multi-prong comprehensive research methodology was adopted to accomplish the task. Detail economic features of each site were studied and thorough economic evaluation was carried out. Finally, based on economic factors, an economic suitability map was created for the area with the latest and state of the art computer software. The research is first of its kind to map the features of economic evaluation.

Keywords: Economic ssuitability; Project Site; Cardinal aapproach; Evaluation; Economic factors; Suitability map

I. Introduction

Economic suitability of the project site is its worthiness in terms of economic considerations. Over the years, this has been overlooked to find out a relationship between the technical and economical suitability, rather, it is always the technical feasibility which is given the preference (Baumol, 1977). In the same context, economic suitability of three selected project sites located in Liberia was determined to ascertain whether the sites already declared technically feasible were suitable from economics point of view or not. Basing on tangible factors like cost of material, soil improvement, labour and transportation of material to the site, an economic model was developed to carry out an economic evaluation of the project sites. Surprisingly, not all of the technically feasible sites were completely suitable from economics point of view, which indicates that besides the technical suitability, economic suitability of project site should also be considered. Simple cardinal approach was used for this research. Cardinal

approach is also called classical approach is economics. It measures the utility or prevalence of a factor in cardinal numbers such as 1, 2, 3, 4 & 5. For example, if a user feel that the cost of material is more in a town, his view point can be represented by cardinal numbers 1, 2, 3, 4 & 5 relative to opinion of other people. Economic feasibility is a lengthy process involving multiple procedures, consuming time and effort. Creation of economic feasibility maps is one solution of this problem as these maps may be helpful for handy and quick economic evaluation of the project site (Gul, 2010). In this research, an economic feasibility map was drawn for the three project sites in the three towns (Tubmanburg, Kle and Senjie) of Liberia. The results of the study may not be applicable to construction projects sites located in other regions of the globe with different economic conditions.

1I. Location and Current Situation of Research Area

Three projects sites were selected in Kle, Tubmenburg and Sanjie which are the three closely located towns approximately 50 kilometers north of Monrovia, the capital of Liberia. Location map of the three towns is shown in Figure 1. All the three towns have the average population of 0.20 million. These development projects are part of the many steps to rehabilitate the infrastructure and basic facilities in Liberia, especially around Monrovia. The Liberian Civil War (1989-98) destroyed much of its economy. Richly endowed with water, mineral resources, forests, and a climate favorable to agriculture, Liberia had been struggling even for basic products, while local manufacturing, had been small in scope (Wikipedia, 2010). The restoration of infrastructure and the raising of incomes in this ravaged economy required the implementation of sound economic policies, including the encouragement of foreign and local investment. Presently, construction activities are in progress to redevelop the facilities through local construction firms. Local investors (though small scale) have been encouraged to invest money in the development process (Wikipedia, 2010). Besides, local labour is employed for all the developmental projects. With these efforts in place, economy is getting pace in Liberia. Economic feasibility of the following three selected ongoing construction projects is the focus of this study.

i. Construction of a shopping plaza at Tubmanburg.
ii. Construction of houses complex at Kle.
iii. Construction of modern private hospital at Senjie.

Figure 1: Map showing locations of the three towns, Tubmanburg, Kle and Senjie

(Taken from Google, 2011).

II1. Research Methodology

A multi prong comprehensive methodology was adopted to conduct this research. Specific steps followed during the research are explained below.

i. Economic evaluation process was studied and pertinent economic factors influencing the project site were selected.
ii. Field visits of the area were conducted to study the prevailing economic conditions of the three towns. Subjective evaluation was carried out as a result of these filed visits.
iii. Field survey was conducted for gathering people opinion about particular economic factor through questionnaire.
iv. Data analysis was done to draw specific conclusions about the economic suitability.
v. Economic suitability of the project sites was ascertained and an economic suitability map was drawn for the three selected sites.

IV. Economic Evaluation Process

It is evident that economic factors impact the overall cost and life of the project. Ignorance to economic factors may be disadvantageous in the long run (Tang, 1986). However, traditionally investors in Liberia are more bothered about technical feasibility and pay very less attention to economic feasibility of the project site. Attitude of the investors notwithstanding, there can be project site which may be technically feasible but may not be economically feasible, fully or partially. Therefore, significance of economic feasibility of a project site is well established. Economic feasibility process comprised two steps; selection of economic factors for economic evaluation and deciding about the scale for evaluation of these factors. The factors which were considered for evaluation of economic feasibility are as under.

i. Cost of material at the three project sites; though closely located, there was variation in the cost of construction material.
ii. Unskilled labour charges; unskilled labour was mostly local; however, the charges were different at the three locations.
iii. Material availability; some of the construction material was not available at the three locations; such type of material was required to be shifted from Monrovia.
iv. Cost of adverse weather effects; the rains round the year have some negative effects on the buildings.
v. Cost of maintenance required; the weather in Liberia with predominant precipitation round the year makes the building structures prone to maintenance cost.
vi. Cost of soil treatment required; soil in Liberia requires technical treatment to make it strong enough to sustain the load of building structure.
vii. Labour hours; day light hours are slightly different at the three locations. Moreover, the labour hours were also dependent on the fact whether the labour was local or it was living in the suburbs, jungles etc. Those living out of the town would leave early than those living in the town.
viii. Skilled labour charges; skilled labour was hardly available at the three locations. It had to be brought from Monrovia.

ix. Transportation charges; these charges were incurred on transportation of non-available material to the sites.
x. Availability of local labour; this was different at the three locations.

After selection of the economic factors, the scale of assessment for these factors was selected in terms of cardinal number 1, 2, 3, 4 and 5 depending upon the opinion of the people. For example if a user feel that the cost of material is more in a town, his view point can be represented by cardinal numbers 1, 2, 3, 4 & 5 relative to opinion of other people. Depending on the nature of factor, the higher number will be allocated to more or less prevalence. This is shown in Table 1.

Table 1: Scale of Assessment for the People's Choice & Opinion

Economic Factor	People's Opinion / Choice				
Cost of material *(less gets higher number)*	1	2	3	4	5
Unskilled labour charges *(less gets higher number)*	1	2	3	4	5
Material availability *(more get higher number)*	1	2	3	4	5
Cost of adverse weather effects *(less gets higher number)*	1	2	3	4	5
Cost of maintenance required *(less gets higher number)*	1	2	3	4	5
Cost of soil treatment required *(less gets higher number)*	1	2	3	4	5
Labour hours *(more gets higher number)*	1	2	3	4	5
Skilled labour charges *(less gets higher number)*	1	2	3	4	5
Transportation charges *(less gets higher number)*	1	2	3	4	5
Availability of local labour *(more gets higher number)*	1	2	3	4	5

V. Field Visits for Study of Economic Conditions

Spot visits were carried out to ascertain the prevailing economic conditions around the three project sites. This assessment was done in subjective terms and no mathematics was involved. In order to make more meaningful and result oriented, a compressive plan of more than a month was conceived at the start of the research. The plan was having all the components; interview of common people, school teachers, investors and community leaders and visit of construction and development projects. This all provided a detailed picture of social and economic conditions in the three towns. An interactive interview form was designed comprising few simple questions about the prevailing economic conditions around the project sites in the three towns. Specimen form is shown in Figure 2.

Figure 2: Specimen Interview Form

Sheet Number: _____

INTERVIEW FORM FOR FIELD VISIT

Name	
Address	
Profession	
Date	

Questions	More	Slightly More	Less	Very Less
What do you say about cost of material in the town?				
What about unskilled labour charges?				
What is your opinion about material availability?				
Your opinion about cost of adverse weather effects?				
What about cost of maintenance required?				
What do you say about cost of soil treatment required?				
What is your opinion about labour hours?				
Your opinion about skilled labour charges?				
What about transportation charges?				
Your opinion about availability of local labour?				

Signature of the individual _____ Signature of the Interviewer _____

After conducting the interview process, ground visits were carried out in the three towns to match the recorded opinion with the facts on ground. Markets in the three towns were visited to know about the availability of labour and material, its cost and the charges of transport in case the material was not available locally. Also, the general social and economic conditions were observed. Ongoing development and construction projects were visited to know about the availability of skilled and unskilled labour and their charges. Meteorological conditions were also observed to know about the length of day hours and its effect on the labour hours. Existing buildings were seen / inspected to have an idea and fair estimate of cost of soil treatment and maintenance of buildings required in each town. A personal observation sheet was prepared for these visits. This sheet is shown in Table 2. The observation sheet was filled by asking the people wherever required, but, no formal interview was conducted. Mostly it was filled by observing the facts visually.

Table 2. Specimen Observation Sheet for the Ground Visits by the Author

Economic Factor	Tubmanburg	Kle	Senjie
Market Survey			
Cost of material			
Skilled labour charges			
Unskilled labour charges			
Material availability			
Transportation charges			
Meteorological and Weather Conditions			
Cost of adverse weather effects			
Labour hours			
Construction and Development Projects			
Availability of local labour			
Skilled labour charges			
Unskilled labour charges			
Existing Building			
Cost of maintenance required			
Cost of soil treatment required			

Note that entries in the columns were in subjective form, for example, less and more, low, medium and high, good, slightly good and very good, little and more etc. Subjective evaluation is a process in which no mathematics is involved (Hendrickson, 1985). It is based on the personal judgment of the assessor based on the interviews and ground visits (Dipasquale, 1982). In this research, ground visits were carried out to ascertain the prevailing economic conditions around the three project sites in the three towns and validate the facts obtained through interviews of the people. This assessment was done in subjective terms; no mathematics was used. Results of this assessment are shown in Table 3.

Table 3: Economic Conditions of the Project Sites Determined by Field Visits

Economic Factor	Tubmenburg	Kle	Senjie
Cost of material	Low	Low	Medium
Unskilled labour charges	Low	Low	High
Material availability	Very Good	Slightly Good	Good
Cost of adverse weather effects	Low	High	Low
Cost of maintenance required	More	Little	Little
Cost of soil treatment required	Medium	High	Medium
Labour hours	More	Medium	Less
Skilled labour charges	Less	Medium	Less
Transportation charges	Medium	Medium	Medium
Availability of local labour	Good	Bad	Bad

VI. Field Survey

Field survey was carried out to gather the public opinion about economic conditions in these towns. For this purpose, simple random sampling of 50 individuals comprised of people from all walks of life regardless of gender. Questionnaire for the field survey comprised 10 simple questions about the 10 economic factors. People sample had to answer in terms of cardinal numbers depending on their satisfaction or opinion about a particular economic factor. People were given the choice to fill it on spot or they

may think over it and deposit it the next day. Specimen of the questionnaire is shown in Table 4.

Table 4: Specimen questionnaire for the field survey.

Name:			**Date:**		
Town:			**Age:**		
Please tick suitable box under the number for each economic factor in ascending order. For example give higher number if cost of material is low. Similarly give higher number if material is easily available.					
Economic Factors	**1**	**2**	**3**	**4**	**5**
Cost of material					
Unskilled Labour charges					
Material availability					
Cost of adverse weather effects					
Cost of Maintenance required					
Cost of soil treatment					
Labour hours					
Skilled labour charges					
Transportation charges					
Availability of local labour					

VII. Data Analysis

At all the three locations of the projects sites in three different towns, different percentage of people gave different weightage in terms of cardinal numbers to prevailing economic factors. This data is shown in Table 5. The variation in the people's opinion at the three locations was noted. This tabulation was done for the purpose to know highest percentage of population sample allocating a particular cardinal number at a project site in a town. The maximum percentage of population sample (the coloured cell in the table) allocating a cardinal number to an economic factor actually represents the popular opinion and was taken as the representative value.

Table 5: Percentage of people giving weightage in terms of cardinal number to specific economic factor.

Economic Factor	Tubmenburg					Kle					Senjie				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Cost of material	5	5	5	10	75	5	5	20	30	40	10	20	30	20	20
Unskilled Labour charges	10	10	10	60	10	20	20	10	30	20	40	15	10	5	30
Material availability	5	5	40	20	30	30	20	5	20	25	20	40	20	10	10
Cost of adverse weather effects	10	5	20	20	45	25	25	35	5	10	5	5	5	10	75
Cost of Maintenance	30	20	20	20	10	5	5	15	30	45	10	10	10	60	10
Cost of soil treatment	25	25	30	5	15	45	10	5	30	10	15	15	20	40	10
Labour hours	15	30	10	10	35	10	50	20	10	10	70	5	5	10	10
Skilled labour charges	45	30	5	15	5	30	20	40	5	5	50	30	5	10	5
Transportation charges	5	40	20	5	30	10	5	65	5	15	3	2	60	5	30
Availability of local labour	1	3	5	1	90	50	10	20	5	15	35	45	5	10	5

People's opinion was very useful in determining the economic suitability of the three project sites. The data was organized to determine which factor has got the highest cardinal number at a particular project site in a town. This is shown in Table 6. Finally, the descriptive statistics were found to decide about the economic suitability.

Table 6: Calculation of average weightage for each town.

Economic Factor	**Tubmenburg**	**Kle**	**Senjie**
Cost of material	5	5	3
Unskilled Labour charges	4	4	1
Material availability	3	1	2
Cost of adverse weather effects	5	3	5
Cost of Maintenance required	1	5	4
Cost of soil treatment	3	1	4
Labour hours	5	2	1
Skilled labour charges	1	3	1
Transportation charges	2	3	3
Availability of local labour	5	1	2
Descriptive statistics			
Average or Mean	**3.4**	**2.8**	**2.6**
Median	3.5	3	2.5
Mode	5	1	1
Standard Deviation	1.65	1.55	1.43
Skewness	-0.43	0.188	0.32
Kurtosis	-1.47	-1.28	-1.16

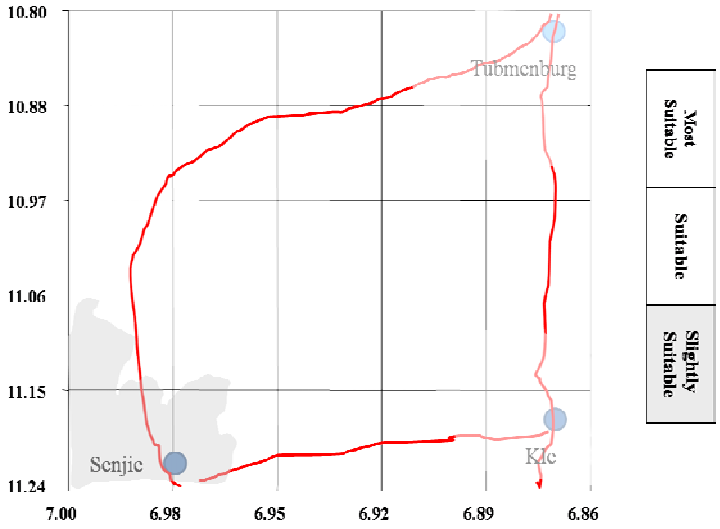
Table 6 shows that the mean or average of the cardinal numbers was bigger for the Tubmanburg than Kle and Senjie which mean that people were comparatively more satisfied with the economic conditions at the project site in Tubmanburg, followed by Kle and Senjie. The difference between mean and median at the three project site was negligible. Mode value for the Tubmanburg was 5, whereas for the Kle and Senjie, it was 1. The maximum cardinal number 5 had the maximum repetition in the data set of Tubmanburg which meant people were generally satisfied with the prevailing economic factors around the project site in Tubmanburg. However, the maximum repetition of the lowest cardinal number in the data set of Kle and Senjie showed clearly that people are not satisfied with the prevailing economic factors around the project sites in these two towns. The standard deviation value for Tubmanburg was high (1.65), followed by Kle (1.55) and then Senjie (1.43). This showed that the data was more scattered around the mean in case of Tubmanburg than the other two towns. The values for all the three towns lied within 68 to 95 % of the area under normal distribution curve (on either side of the mean). Data set of Tubmanburg had negative skewness which meant that its data set contained few small values. This again proved that people are satisfied with the economic factors prevailing in Tubmanburg. On the other hand, Kle and Senjie had positive skewness, which meant that its data set contained few high values of cardinal numbers compare to Tubmanburg. It reflected that people were not happy with the economic conditions in Kle and Senjie. Data set for all the three towns had negative kurtosis value. This showed that the curve represented by these data sets was flatter than normal distribution curve. In other words, fewer observations clustered near the average and more observations populated the extremes. The overall analysis showed that project site at Tubmenburg is most suitable from economics point of view, followed by Kle and Senjie in the same order

VIII. Economic Suitability Map

Economic suitability mapping is a relatively new field which remains unexposed mainly due to large variations in economic conditions and absence of accurate tool to draw correlation between various factors affecting economics of project site (Kleinfeld, 1998). The subject of economic suitability mapping is, however, very important and highly significant as it hold the promise for rapid and relatively inexpensive economic characterization of the site (Raffia, 1997).

Based on the economic evaluation, an economic suitability map was created for the study area with the SURFER software which a versatile software for making the maps (rockware, 2009). This map is shown in Figure 3. Map validates the calculation in Table 4, as it shows that Tubmenburg is the most suitable for construction activities, followed by Kle and Senjie.

Figure 3: Economic suitability map of the three towns.



IX. Conclusions

Though the three sites were technically feasible but those were different as far as economic suitability is concerned. If we have economic suitability maps, we can immediately assess whether construction on a particular site will be economical or not. Economic suitability maps would require effort for its long term improvement and updation since economic factors changes with time. However, a map once made can be updated easily and it seems that economic suitability map shall render essential services for a greater span of time than expected. These maps are easily interpretable / comprehendible (Thuesen, 2002). Since, these maps are based on tangible factors; therefore, these are acceptably reliable and accurate. Owing to its usefulness and wide applicability, there is a need to undertake making of economic suitability maps (like other maps) at large level. These maps will be helpful for planners, designers and builders to select safe / appropriate locations for buildings and infrastructure (Zeleny, 1982). In particular, following aspects can be concluded from this study.

i. Sites preference will be easy from economic point of view with the help of economic suitability maps.
ii. Variation in technical and economic suitability can be there. Therefore, both the suitability should be ascertained before undertaking the project. It should not be taken for granted that technical suitability alone is sufficient to declare a site feasible for construction.
iii. While the suitable site will act as magnet for construction and other development activities, the one less suitable will invite the government attention and intervention for development, therefore, economic suitability maps can act as tool for development

References

Baumol William (1977). Economic theory and operation analysis. 4th Edition. Eaglewood Cliffs, New Jersey, Prentice Hall, Inc.

Gul, E. (2010). Economic Suitability Mapping - A new Trend in Establishing Economic Suitability of Project Site. Second International Conference on Business & Technology (IBCT - 2010), ISSN: 1997-731 X. Iqra University, Islamabad.

Information about Liberia available at www.wikipedia.com

Irvine W., (1995). Surveying for Construction. 4th edition. The Mc Graw-Hill Company, New York.

Kleinfeld, I. (1998). Engineering Economics Analysis for Evaluation of Alternatives, John Wiley and Sons, New York.

Map of Liberia available at www.googlemaps.com

Raffia, H. (1997). Decision Analysis. Mc Graw-Hill, New York.

SURFER Software available at www.rockware.com

Thuesen Gerald J, Fabrycky W.J. (2002). Engineering Economy. 9th edition, Prentice Hall of India, New Delhi, India.

Zeleny, M. (1982). Multiple Criteria Decision Making. McGraw-Hill, New York.