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Industrial Land use and Land Value Pattern in Karachi City

S. AKHTAR[1] AND M.R.DAHNANI[2]

[1]Department of Geology ,University of Karachi, Karachi
[2]Department of Geology. University of Sindh, Jamshoro, Pakistan

*Corresponding author. M. R. Dhanani, E-mail: mrdhanani@gmail.com Cell,No.03453541162

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Abstract: Karachi is the largest industrial centre of Pakistan. Industrial land use occupies about 75sq. km area of the city, located in 12 scattered areas. Most of them were originally developed in the suburbs and at the outskirts of the city, but with the growth of city some of them are now surrounded by residential areas.

In the general pattern of land value distribution in cities business and commercial land uses posses highest land value followed by industrial land uses. The bid-rent curve exhibits that industrial land prices decline with increasing distance from the city centre. This is also true in Karachi City. However, industrial areas in Karachi City show marked variation in land values. Industrial areas near to the city centre have higher land values than industrial areas located at peripheries. Price of land within an industrial area also varies depending upon several factors like road frontage, width of road, distance from main thoroughfare.

Key Words: industries, land value, spatial variation, land use, city centre, Karachi port

INTRODUCTION

Karachi in the British Period. A few small industries were established at Nishter Road (Lawrence Road). Dalmia cement industry was established in 1924 in the suburb (Pithawalla, 1946). Industrial activity took momentum after the creation of Pakistan. Adjacent to Karachi Port at the West Warf an industrial area was established in 1947 known as Karachi Port Trust Industrial Area. The location of port and proximity to the city centre was considered important incentives to attract investors in this area where infrastructure like roads, railways, electricity etc. were available. Offices of traders, shipping companies and Government offices were located near to the industrial area. The area was also accessible to the industrial workers. As a result the industrial area was soon occupied by large and medium size industries. In 1948 Sindh Industrial and Trading Estate (SITE) was established which is now the largest industrial estate of Karachi (K.D.A, 1964).

In 1958 under Greater Karachi Resettlement Schemes (GKRS) Government planned to develop industrial areas at Landhi and Korangi to provide employment to the newly developed satellite towns. The progress remained very slow in early years. Infrastructure problem, flood of Malir River and nationalization policy of Government (1973-1977) was the causes of slow growth. The Government policy of denationalization and privatization in 1980s, completion of Malir River Embankment Project in 1987 and improvement in infrastructure have accelerated industrial development in the Korangi and Landhi Industrial Areas (K.D.A, 1974). The small industrial areas of Mansoora (Federal B Area) and North Karachi were developed in 1960s and 1970s as part of residential schemes located along the Layari River. In 1980s Government established three new industrial areas, Karachi Export Processing Zone, Bin Qasim Industrial Area and Super Highway Industrial Estate at the periphery of the city (K.D.A, 1990).

Industries of all major categories are located in the city. Textile is the most dominant. Other important industries are food processing, tannery and leather goods, chemical and pharmaceutical, auto industries, shipyard, oil refineries, metal industries and printing. The present study is an attempt to examine:

i) the pattern of industrial land use in Karachi City.
ii) probe out the land value distribution in the industrial areas of Karachi City.
iii) investigate the land value pattern within an industrial area.

MATERIALS AND METHODS

To study the industrial land use and land value pattern collection of data are essential. Unfortunately no published data on industrial land use and land value are available. Therefore collection of data directly from field survey was done during 2005-6. Large scale maps of different industrial areas were used to record land use and land values. Real estates offices and offices of industrial areas were found good sources of information about the industrial land use and land value data. They provided help in understanding of industrial land values variation. Mill's model is used to explain industrial land values distribution in the city. Cartographic techniques have been used to analyse spatial variation intra-industrial land values. Multiple Regression and correlation analysis as well as partial correlation have been used to examine controlling factors of land values within an industrial area.

RESULTS AND DISCUSSION

Industrial Land use and Land Values Distribution

The general pattern of industrial land use in Karachi is that industrial areas are located far away from the high class industrial areas and close to the low class residential areas**.** Industrial land use occupies about 75 sq. km. area, which is about 4.6 per cent of the total city area. Industries are located in 12 scattered areas **(Fig 1)**. Most of them were originally developed in the suburbs and at the outskirts of the city, but with the growth of city some of them are now surrounded by residential areas.

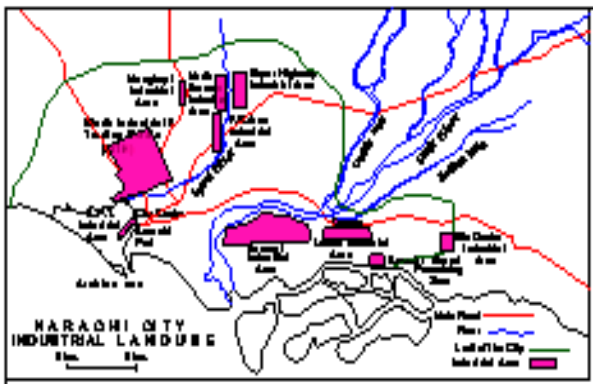

Fig.1 Industrial Land use of Karachi city

Industrial areas in Karachi City exhibit marked variation in land values. They vary from Rupees 15000 per sq.metre in Karachi Port Trust Industrial Area to Rupees 200 per sq. metre in Super Highway Industrial Area. It is possible to classify them into groups. For that break-point method was applied. According to which the following groups were recognized.

a) High Land Value Industrial Areas
b) Medium Land Value Industrial Areas
c) Low Land Value Industrial Areas
d) Very Low Land Value Industrial Areas.

High Land Value Industrial Areas

Land values in Karachi Port Trust Industrial Area are about Rupees 15000 per sq metre, which is highest among the industrial areas of the city. The area has no problem of infrastructure. It is a small industrial area occupying about 2 sq km. There are 20 industrial units. Two large size industries, Karachi Shipyard and Engineering and Naval Dockyard are located there. Oil depots and oil processing plant, ghee edible oil, pharmaceutical, chemical and motor vehicle assembling factories are located in this area.

Medium Land Value Industrial Areas

Sindh Industrial and Trading Estate (SITE), Korangi Industrial Area, Mansoora (Federal B Area) Industrial Area has land values next to that of Karachi Port Trust Industrial Area. In those areas the land value is Rupees 4500 per sq. metre. These industrial areas can be classified as medium land value industrial areas. SITE was established in 1948 just after the creation of Pakistan. It is located about 5 kms north west of the city centre. It is spread over about 18 sq. km. area. In term of industrial establishments it is the largest industrial area of the city (SITE, 1995). Textiles, chemical, re-rolling mills, pharmaceutical, food, beverage auto vehicle assembling plants are the main industries (Table1).

Korangi Industrial Area was established in 1960.It is located about 14 kms south-east of the city centre along the Malir River. Its total area is about 34 sq. kms. Major industries are tannery and leather products, textile, chemical, food, engineering etc. Two large size oil refineries are also located in this industrial area (Korangi Industrial Area, 2000). The average land value in the industrial area is Rupees 4300 per sq. metre.

Federal B Industrial Area (Mansoora) was established in 1960 by Karachi Development Authority as a part of Federal B Area (Mansoora) Housing Scheme. Two blocks (21 and 22) were allocated for industries. It is located about 15 kms from the city centre. At the time of establishment it was located at the periphery but now it is within populated area. It is a small industrial area occupying about 2 sq. km. area. Textile, pharmaceutical, food and chemical are the main type of industries located there. The industrial area is dominated by cottage industries (Federal B Industrial Area, 2000). The average price of industrial plot is about Rupees 4000 per sq metre **(Table1)**.

Table 1: High, Medium, Low and Very Low Land Value Industrial Areas in Karachi

	Industrial Areas	Land Values (Rupees per sq.metre)	Total Area (sq. km)	Major Types of Industries
High Land Value Industrial Areas	Karachi Port Trust Industrial Area	15000	1.92	Shipyard, Automobile, Oil Depots
Medium Land Value Industrial Areas	Sindh Industrial and Trading Estate Korangi Industrial Area Federal B (Mansoora) Industrial Area	4500 4300 4000	17.81 34.00 2.20	Textile, Oil and Ghee, Chemical Beverage, Paint, Tannery, Leather Food, Engineering Pharmaceutical
Low Land Value Industrial Areas	North Karachi Industrial Area Karachi Export Processing Zone Landhi Industrial Area	2500 2000 2000	1.20 2.00 2.88	Textile Pharmaceutical Floor Mills Paint, Chemical Gemstone
Very Low Value Industrial Areas	Super Highway Industrial Area (I) Bin Qasim Industrial Area Manghopir Industrial Area Super Highway Industrial Area (II)	1200 600 500 200	1.20 3.0 1.1 4.0	Textile, Oil and Ghee, Chemical, Floor Mills Automobile, Cement, Re-rolling steel, Food, Paint, Engineering

Source: Field survey 2005-6

Low Land Values Industrial Areas

Landhi Industrial Area, New Karachi Industrial Area and Karachi Export Processing Zone have low land values range from Rupees 2000 to 2500 per sq. metre. These industrial areas are located at the outskirts of the city.

Landhi Industrial Area was established in 1958. It is located at a distance of 21 kms from the city centre. Its total area including extension of Landhi Industrial Area is about 5 sq kms. There are 300 industrial units of different categories mainly textile, food, chemical, pharmaceutical, engineering. The price of industrial plot is about rupees 2000 per sq.metre.

North Karachi Industrial Area is located at a distance of about 21 kms. from the city centre. It was established in 1973.It occupies an area of about 2 sq km. It is a small industrial area with small size industries. The size of industrial plots range from 120 to 2000 sq. meters. It is part of North Karachi housing scheme in which sectors 6 and 12 are allocated for industries. In the beginning a poultry farm and poultry feed manufacturing plant were established. Industrial activity was started in this area in 1987 replacing poultry farms. About 600 small and medium size industries are in operation belonging to textile, pharmaceutical etc. The area is known for cottage industries. Price of land in this area is about Rupees 2500 per sq. meter. Karachi Export Processing Zone was established in 1984 to encourage foreign investment. It occupies an area of 2 sq kms located about 26 kms from the city centre. It is near the newly developed Port Bin Qasim and National Highway It offers incentives to investors like free import of machinery, relaxation on custom duties etc. Industrial plots are offered on annual rent basis for a period of 30 years. This is US$ 2.5 per square meter. Out of 309 plots 166 have been utilized. Textile, chemical, engineering and gemstones are the main types of industries.

Very Low Land Values Industrial Area

Super Highway Industrial Area, Bin Qasim Industrial Area and Manghopir Industrial Area are very low land values areas. In these industrial areas land values range from Rupees 200 to1200 per sq. meter. These industrial areas are located at the outer skirts of the city (Fig 1).Karachi Development Authority planned super Highway Industrial Estate in 1983 with the name of North Karachi Industrial and Trading Estate in Scheme 33. It is located near Super Highway on the right bank of the Layari River at a distance of about 25 kms from the city centre. Its total area is about 1.2 sq kms. At present 120 industries of medium size have been established. The size of industrial plots range from 2000 to 4000 sq. metre. Food, chemical, textile and pharmaceutical are the main types of industries (Super Highway Industrial Area, 1999). Price of industrial plots is about Rupees 1200 per sq.metre. The phase 2 of the Super Highway Industrial Area was established in 1992. It occupies an area of about 4 sq. kms. The area has yet no infrastructure. As a result price of plot is very low about Rupees 200

per sq metres. Only two industries are under construction. Bin Qasim Industrial Estate is a part of port Bin Qasim located at the edge of the city near National Highway at a distance of 30 kms from the city centre. The industrial estate was established in 1980. Industrial activity started in 1990. The area is largely vacant and only 20 industries are in operation. Motor assembling, chemical, oil depot and pharmaceuticals are the important industries. The price of plot is about rupees 500 per sq.metre. Manghopir Industrial Area is a small industrial area located at the outskirts of the city. It was developed in late 1960s at the fringe of the city. Cement industry, steel industry and marble cutting and polishing industries are located there. The average land value in the area is about Rupees 500per sq metre.

Industrial land values and Distance Relationship

In Karachi the city centre and Karachi Port are adjacent to each other. The industrial activity in the city has close link with the city centre and the port (Arnold, 2005). Offices of major industries are located in the city centre. Industrialists have to contact the business firms and trade entrepreneurs for purchasing industrial machinery, raw materials, and for import and export of industrial goods and raw materials. Head offices of financial institutions, insurance companies, offices of local, national and international traders are located there **(Table 2)**.

Table 2: Industrial land values and distance from the centre and Karachi port in Karachi.

Distance from the city center and Karachi port (Kms)	Price of industrial plots (Rupees per sq metre)
01	14000
02	10000
04	7000
06	6000
08	5000
10	4500
12	4000
14	3500
16	3000
18	2500
20	2000
22	1500
24	1200
28	800
30	500

Source: Field survey 2005-6

Export and import of industrial goods are carried out mainly through Karachi sea port. In Karachi transportation of 14 industrial goods from port to industrial areas are carried out by trucks. The cost of transportation increases with increasing distance from the port. Therefore, the industrial land values decrease with distance from the city centre and port . The scatter graph and computed result of product moment correlation indicate strong negative correlation **(Fig 2).** The regression equation and regression graph confirm this relationship **(Fig 3)**.

Product moment correlation r = 0.88

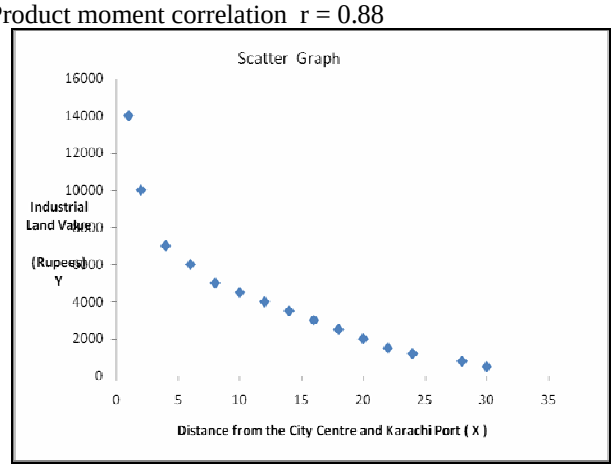

Fig 2. Distance of diagram city center Karachi (x)

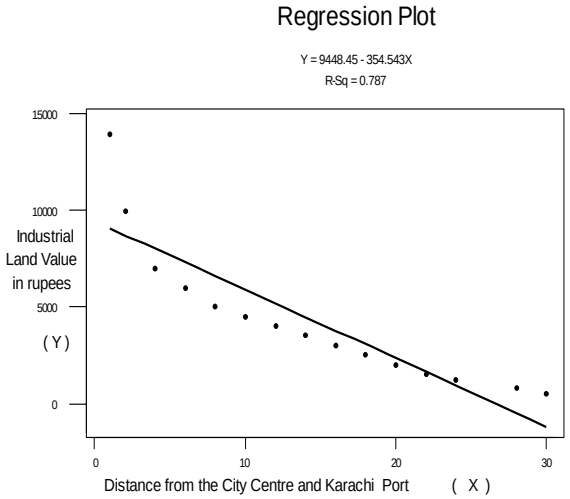

Fig 3. Distance of diagram city center Karachi (x)

The regression equation is

y = 9448 - 355 x

Predictor	Coef.	StDev	T	P
Constant	9448.4	865.8	10.91	0.000
x	-354.54	51.23	-6.92	0.000

S = 1777 R-Sq = 78.7% R-Sq(adj) = 77.0%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	151259835	151259835	47.90	0.000
Error	13	41053499	3157961		
Total	14	192313333			

The industrial land value distribution in Karachi City can be explained through Mills model. Mills in 1972 worked on Chicago City concluded that

land values and distance from the city centre and Karachi port have exponential relationship and it becomes linear when land values of natural log are taken. It can be expressed mathematically as follows

$$Y = a e^{-bx}$$
$$\ln Y = \ln a - b x$$

Where Y is industrial land value
X is distance from the city centre and Karachi port
E is base of natural logarithm
B is land value gradient

Alfred MILL'S MODEL

$$Y = a e^{-bx}$$
$$\ln Y = \ln a - b x$$

Result

$$y = 9.44 - 0.0987 x$$

Predictor	Coef	StDev	T	P
Constant	9.44339	0.07005	134.81	0.000
X	-0.098660	0.004144	-23.81	0.000

S = 0.1438 R-Sq = 97.8% R-Sq (adj) = 97.6%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	11.713	11.713	566.69	0.000
Error	13	0.269	0.021		
Total	14	11.982			

The graph and result of the Mill's model reveal that the model is best fit to explain distribution of industrial land values in relation with distance from the city centre and Karachi Port **(Fig 4)**. Thus it can be said that industrial land values in Karachi City decrease exponentially with increasing distance from the Karachi Port and the City Centre.

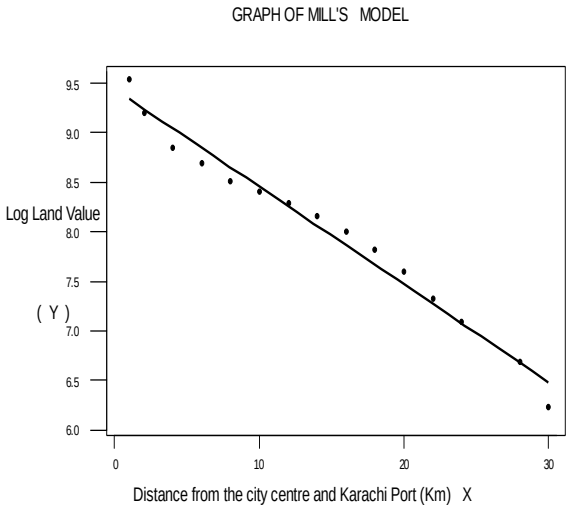

Fig4. Distance of diagram city center Karachi(km)x Land Values Variation within Industrial Areas

Land values vary appreciably within the industrial areas (Hamilton, 1967, Jones, 1999 and Paraskevopoulos, 1990). The following generalization can be made about land values distribution within industrial areas:

1. land values within industrial areas decrease with increasing distance from the office of the industrial areas.
2. land values decrease with increasing distance from the main thoroughfare of the industrial area.
3. land values increase with increasing width of roads.
4. land values increase with increasing road frontage.
5. land values increase with distance from obnoxious industries.
6. Land values within industrial areas decrease with increasing distance from the office of the industrial areas:

Land values within industrial areas decrease with increasing distance from the office of the industrial areas **(Table 3)**.

Table 3: Land values and distance from the office of industrial areas SITE and Korangi Industrial Area.

Distance from the office of industrial Areas (kms.)	Sindh Industrial and Trading Estate (SITE) Land values (Rs per sq metre)	Korangi Industrial Area Land values (Rs per sq metre)
Adjacent to office	6000	5500
0 1	5000	4500
0 2	4500	4000
0 3	4000	3800
0 4	3500	3000
0 5	3000	2800

Source: Field survey 2005-6

The office of an industrial area has very important function. The maintenance and improvement of infrastructure, resolving the problems related to industrial area are the function of that office. Government offices and banks are located there. Industrialists have to keep close contact with the office therefore land values near the office are relatively high.

b) Land values decrease with increasing distance from the main thoroughfare of industrial areas:

Within industrial areas land values are relatively high along the main thoroughfares. Land values at the Estate Avenue of SITE and Korangi Road are relatively higher than in other areas **(Table 4)**. These roads are well connected with sea port and highways. They are the routes of public transport, which are

used by most of the industrial workers. Offices of industrial areas are also located on there. Consequently land values are high on these roads.

Table 4: Land values and distance from the main thoroughfare within Sindh Industrial and Trading Estate and Korangi Industrial Area.

Distance from the main thoroughfare of Industrial areas (kms)	Sindh Industrial and Trading Estate Land values (Rs. per sq. m)	Korangi Industrial Area Land values (Rs. per sq. m)
0.0	4500	4200
0.5	4000	3700
01	3500	3000
1.5	3000	2500
2.0	2500	2000

Source: Field survey 2005-6

a) Land values increase with increasing width of roads:

Width of roads within industrial areas is an important factor in the choice of industrial plots (Kowalski, 1990). In Karachi transportation of industrial raw materials, large size trucks carry out goods and machinery. Large size trucks cannot enter in industries, which are located along narrow roads. Such industries have to use small trucks, which increases the transportation cost. Plots located on the wide roads have also the advantage of extra land, which are used for parking. Therefore lands are highly competitive there. As a consequence price of plots is higher on wide roads and decreases with decreasing width of road **(Table 5)**.

Table 5: Industrial land values and width of roads within Sindh Industrial and Trading Estate and Korangi Industrial Area.

Width of roads (metres)	Sindh Industrial and Trading Estate (SITE) Land values (Rs per sq. m)	Korangi Industrial Area Land values (Rs per sq. m)
100	4500	4200
50	3000	3000
20	2500	2000

Source: Field survey 2005-6

b) Land values increase with increasing road frontage:

Road frontage provides extra land in front foot location of industrial plot. This extra land is utilized as a parking space as well as a lawn. Display centre is also built there. Therefore with increasing road frontage land values also increase **(Table 6)**.

Table 6: Land values and road frontage within Sindh Industrial and Trading Estate and Korangi Industrial Area.

Road Frontage (metres)	Sindh Industrial and Trading Estate Land values (Rs per sq. m)	Korangi Industrial Area Land values (Rs per sq. m)
500	5000	4500
300	4000	3700
70	2500	2000

Source: Field survey 2005-6

c) Land values increase with distance from obnoxious industries:

It comes out from the study that land values within industrial area decrease with decreasing distance from obnoxious industries **(Table 7)**. For example in Korangi Industrial Area land value adjacent to tannery

Table 7: Land values and distance from tannery industries in Korangi Industrial Area.

Distance from tannery industries (metres)	Price of industrial plot (Rs per sq. m)
Adjacent to industrial area	2700
300	2800
600	2900
900	3000
1200	3200

Source: Field survey 2005-6

industries is low i.e. Rupees 2700 per sq.metre. It increases with increasing distance from the tannery industries for example at a distance of 600 metres land value is Rupees 2900 per sq. metre .

Land Values Distribution within SITE

It is possible to quantify the relationship between land values and various factors. For this purpose Sindh Industrial and Trading Estate, which is the largest industrial centre in the city, was selected. The general pattern of land values distribution in SITE is that land values are high ranging from Rupees 4000 to 6000 per sq. metre along the two main roads Estate Avenue and South Avenue. The highest land value point i.e. Rupees 6000 per sq metre is located adjacent to the administrative office of SITE **(Fig .5)**. Land values are low ranging from Rupees 2000 to 2500 per sq.metre in the obnoxious industries area.

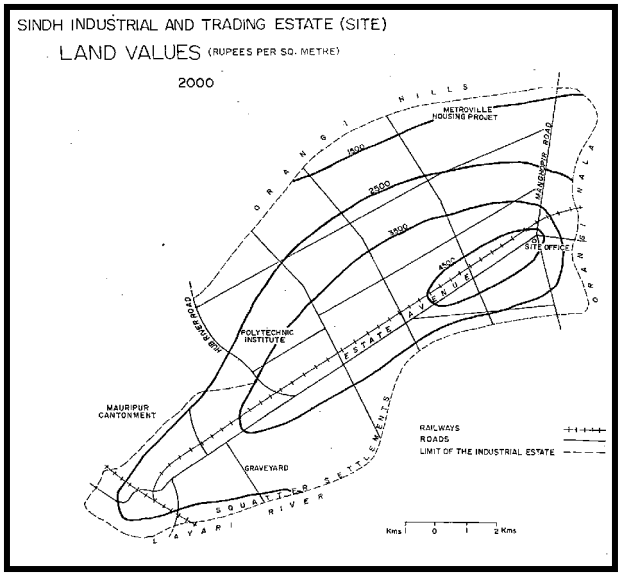

Fig: 5 Land Value per sq.metre

To examine the relationship of factors affecting the land values within the SITE multiple regression model was applied. For this purpose data were collected from 50 industrial plots. Price of industrial plots, distance from the administrative office of the SITE, distance from the main thoroughfare (Estate Avenue) which is the main transport route, width of roads, road frontage and distance from the obnoxious industries, were collected. Kowalski and Paraskevopoulos in1990 used a regression model to explain industrial land values and affecting factors in Prague City. The regression model which fits Karachi City can be expressed mathematically as follows.

$$Y = a - bD -- cZ + dW + eR + fO + se$$

Where:
Y = industrial land value
D = distance from the administrative office of SITE
Z = distance from the Estate Avenue
(main transport route)
W = width of road
R = road frontage
O = distance from the obnoxious industries
se = standard error of estimate
a =constant
b, c, d, e, f are coefficients

The result of the multiple regression analysis shows that the dependent variable industrial land values and independent variables distance from the administrative office of the SITE, distance from the main transport route, width of roads, road frontage and distance from obnoxious industries have significant relationship **(Table 8)**.

Table 8: SITE: Result of multiple regression analysis explaining.

Land value variation within SITE

A (constant)	2410
B (distance from the SITE office)	--- 18..5
c (distance from the route of public transport)	--- 4.3
d (width of road)	29.3
e (Road frontage)	26.0
g (distance from the obnoxious industries)	8.9
r (correlation coefficient)	0.9833
R^2	96.7 %
F-value	70.44
Test of Significant	Significant

SITE: Result of Product moment correlation

r (YD)	---0.933
r (YZ)	--- 0.854
r(YW)	0.955
r(YR)	0.967
r (YO)	0.785

SITE: Result of Partial correlation

r (YD. ZWRO)	-0.785
r (YZ. DWRO)	-0.657
r (YW. DZRO)	0.812
r (YR . DZWO)	0.817
r (YO . DZWR)	0.612

Land values in the Sindh Industrial and Trading Estate decrease with increasing distance from the office of SITE, and distance from the Estate Avenue (the main transport route). Land values increase with increasing distance from obnoxious industries. Land values also increase with increasing road frontage and width of roads.

CONCLUSION

Industrial land uses are scattered in Karachi City in 12 industrial areas. They are located away from the high class residential areas. Industrial land values in Karachi City vary from one industrial area to the other and also within industrial areas. The KPT Industrial Area is the highest land values industrial area located near the city centre and Karachi sea port. The distance from the city center and Karachi Port generally affect on the land values of overall industrial areas of the city.

Land values decline with increasing distance from the city centre and Karachi Port. Land values within industrial areas also vary. The location of plot within an industrial area with reference to the office of industrial area, main thoroughfare of industrial area, width of road, road frontage and distance from obnoxious industries are important. Land values within industrial areas; decline with increasing distance from the office of industrial areas and main thoroughfare, increase with increasing width of road and road frontage and distance from the obnoxious industries.

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