The Performance Indicator of Industrial Property Market based on the Location Factors

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Abstract

The theoretical model of this study predicts that the values of typical industrial sites are a function of economics factors and location factors. The industrial land values of typical industrial sites in Sydney region between 1976 and 2003 were collected from the New South Wales Valuer General's Office (VGO). In order to control the economic factors, series of the regression analysis within same year (snap–shot analysis) were used. The study used the regression analysis with the dependent variable of industrial land value and the independent variable of distance from CBD in terms of the location factors, in order to estimate the Central Industrial Land Value (CILV) and industrial land value reduction per kilometre (Slope). There are higher CILV and steep Slope during the growing market, while there are lower CILV and soft Slope during the decreasing market. After comparison with other performance indicators, the movement of the CILV based on the location factors may predict the turning points of the performance of Sydney industrial land values.

Keywords: Industrial property market, land values, location factors, performance indicator

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1. Introduction

This study formulates a regression model of industrial land values in order to investigate the performance indicator of the Sydney industrial market. It consists of the four parts: (i) location theory in the property market, (ii) Sydney industrial property market, (iii) An analysis of the regression model formulation of industrial land values in the Sydney region, and (iv) the performance indicators of the Sydney industrial land values.

The theoretical model of the study is that the way in which the values of typical industrial properties perform is a function of economic conditions (economics factors) and location aspects (location factors). The data were collected from organisations such as the New South Wales Valuer General's Office (VGO), the Australian Bureau of Statistics (ABS), and the Australian Institute of Urban Studies (AIUS). From the data, a regression model was formulated by the use of least-square regression analysis.

2. Location Theory in the Property Market

A good location is very important whether a property is purchased for investment or occupation (Goodall, 1972; Haggett *et al*., 1977; Barlowe, 1986; Barrett and Blair, 1988; Harvey, 1992; Guy, 1994). Cities are the most important locations in the property market, and are composed of distinct land use areas. The property market is thus concerned with the pattern of land use in cities. Land uses are not determined randomly, but are a function of underlying economic forces. Cities have similar patterns of land use that suggest regularity. Furthermore, the patterns of land use areas may change over time in response to these underlying forces or new areas. It is as important to understand the general principles that result in the emergence of land use patterns, as it is to describe those patterns.

Based on land use principles, several theories have been developed, which are the concentric circle theory (Burgess, 1925), the sector theory (Hoyt, 1939), and the concept of multiple nuclei (Harris and Ullman, 1945)[1]. Each theory suggests that cities will have a particular segregation of land use. In spite of the fact that the models provide different pictures of land use, they should not be viewed as competitive. Rather, they all provide insights into land use patterns, and they differ mainly in the degree to which complexities that more accurately reflect actual situations are introduced. Those theories eventually lead to the urban bid-rent theory (Alonso, 1964).

Both the concentric circle theory (Burgess, 1925) and the urban bid-rent theory (Alonso, 1964) present urban development as expansion outward from the urban centre[2]. Alonso (1964) adopted

[1] Barlowe (1986) referred Harris, C.D. and Ullmann, E.L. (1945) 'The Nature of Cities', Building the Future City, Annals of the American Academy of Political and Social Science, No. 242, Nov., pp. 7-17.

[2] According to Burgess (1925), the primary cause of changes in land use was urban growth.

the bid-rent curve to explain how variations in both costs and revenues, according to distance from the city centre, could be used to predict the location that would offer the greatest profit for any particular firm. While the concentric circle formed by the urban bid-rent theory is an abstraction that fits no city exactly, it provides a foundation for understanding the forces that influence the property market.

The reason for the format of bid-rent curves is that some activities will outbid other activities for land in a particular area. Similar activities will have similar preferences for access; then, homogeneous land use districts will be formed. Suppose there are three types of land use as commercial, industrial, and residential. Each use has a bid-rent curve that indicated preference for central business district locations because these are the most accessible and therefore generate most revenue. A consistent prediction is that commercial activities such as retail and financial services dominate near the central part of the city. This is mainly because these uses need to be at the most accessible part of the city, like the city centre; only in this location would revenues be sufficiently high for the operation to be profitable and outbid other land uses. But because other uses such as industrial and residential also want a central location, the commercial users have to bid higher prices to obtain these essential city centre locations. In contrast, commercial users have low valuations of land located away from the centre; thus other users, who value them more highly, will obtain them. (Barrett and Blair, 1988; Guy, 1994)

3. Sydney Industrial Property Market

This urban bid-rent theory cannot apply only to the land use pattern for different sectors such as, commercial, industrial, and residential sectors, but also to the location aspects within a particular sector when land use is determined by urban planning. Within the industrial property market especially, this urban bid-rent theory can be applied because the industrial areas are scattered over the urban areas with a pronounced clustering tendency. The concentric circle theory can be easily applied in the Sydney industrial property market, as the main airport and seaport are located closed from the centre of the city in the Sydney region. Based on this theory, the industrial area near centre of the city has a steeper bid-rent curve than the area farther from the city centre.

Modern industrial buildings are situated in planned industrial areas, where they provide support for industrial purposes. These planned industrial areas have generally similar conditions in terms of accessibility to appropriate transport routes, sources of raw materials, labour and a market for the products, which have been the traditional factors governing the location of industrial areas (Boykin, 1973; Cardew, 1981; Fothergill *et at*., 1987). Therefore, prime quality industrial buildings in planned industrial areas have generally similar conditions in terms of location aspects, with the exception of distance from the centre of the city in the Sydney industrial property market. The distance from the centre of the city can then be the main factor in the changes of the land values in the Sydney industrial property market.

The Australian Institute of Urban Studies (AIUS, 1975) classifies the Sydney industrial areas by sub-regional aggregation of Local Government Areas (LGA), according to the distance from the CBD. Table 1 shows a classification of the Sydney industrial areas based on the location classification according to the distance from the CBD.

This classification of AIUS is based on the concentric circle theory (Burgess, 1925) and the urban bid-rent theory (Alonso, 1964). The concentric circle theory presents urban development as expansion outward from the urban centre. The urban bid-rent theory looks at land prices as a

function of accessibility assuming maximum accessibility in CBD. The reason for the formation of urban bid-rent curves is that some activities will outbid other activities for land in a particular area (Alonso, 1964; Goodall, 1972; Barrett and Blair, 1988). Because the distance from the CBD is a greater influence than direction upon the Sydney industrial property market (AIUS, 1975), analyses for this study are based on the location classification according to distance from the CBD.

Table 1: Location Classification of the Sydney Industrial Areas

Sub-region	Distance from CBD	Local Government Areas (Distance* in kilometres)
Centre Region	below 8.1 km	Sydney (2.7), North Sydney (4.0), South Sydney (5.2), Leichhardt (5.8), Ashfield (7.1), Drummoyne (7.1), Botany (7.2), Marrickville (7.2), Willoughby (7.2), Lane Cove (8.1)
Inner Region	from 8.2 to 16.2 km	Randwick (8.7), Burwood (9.8), Strathfield (12.1), Concord (12.1), Manly (13.0), Canterbury (13.2), Ryde (13.3), Rockdale (13.5), Kogarah (15.5), Auburn (15.6), Warringah (15.9), Hurstville (16.1)
Middle Region	from 16.3 to 24.3 km	Parramatta (16.4), Bankstown (18.5), Sutherland (20.1), Pittwater (22.5), Holroyd (22.9), Hornsby (24.2)
Outer Region	from 24.4 to 32.4 km	Fairfield (25.4), Liverpool (26.9), Baulkham Hills (28.2), Blacktown (28.3)
Fringe Region	over 32.5 km	Campbelltown (37.0), Penrith (44.3), Camden (47.5), Wollondilly, Hawkesbury, Blue Mountains, Gosford, Wyong

* Distance based on the centroid position of industrial development in each respective LGA, measured in a straight line to the CBD.

The industrial land values of typical industrial sites between 1976 and 2003 were collected from the New South Wales Valuer General's Office (VGO). These land values are not the mathematical average values within a particular area; they are estimates made by the valuers (VGO) of the market values at 30th June for typical industrial properties in the area. The collected industrial land values were changed to the land values per square metre in the sample areas. The selected sample areas are 17 (Centre region: 4, Inner region: 4, Middle region: 4, Outer region: 3, Fringe region: 2). Table 2 shows the suburb, typical site area, distance from CBD, and collected years of the industrial land values in the sample areas.

4. The regression model formulation of Sydney industrial land values

A regression analysis is concerned with describing and evaluating the relationship between a dependent variable and one or more independent variables. The dependent variable of the regression analyses herein is the industrial land value. The theoretical model of this study predicts that the values of typical industrial sites are a function of economics factors and

location factors. Within the theoretical model of the study, the independent variables are divided into two categories i.e., economics factors and location factors. The study used the regression analysis with the independent variable of distance from CBD in terms of the location factors. In order to control the economic factors, series of the regression analysis within same year (snap–shot analysis) were used in this study.

The urban bid-rent theory can be applied to location factors within the industrial property market. As industrial areas near the city centre are assumed to have a steeper bid-rent curve than areas farther from the city centre, the distance from the city centre is proposed as one of the main factors in the changes in values of prime quality industrial buildings (Burgess, 1925; Alonso, 1964).

Table 2: Sample areas of Sydney Industrial Sites

Sub-region	Suburb	Area (M^2)	Distance from CBD (km)	Date collected Years
Centre	Alexandria	2,200	5.2	1976 - 2003
Centre	Artarmon	2,305	6.0	1976 - 2003
Centre	Marrickville	1,916	7.2	1976 - 2003
Centre	Botany	2,321	7.2	1976 - 2003
Inner	Brookvale	2,282	13.0	1976 - 2003
Inner	Silverwater	1,853	15.6	1976 - 2003
Inner	Dee Why	2,110	15.9	1976 - 2003
Inner	Riverwood	2,039	16.1	1976 - 2003
Middle	Camellia	2,000	16.4	1976 - 1986
Middle	Teren Point	2,085	20.1	1981 - 2003
Middle	Milperra	2,000	21.0	1976 - 1980
Middle	Honsby	2,088	24.2	1976 - 2003
Outer	Smithfield	1,935	25.4	1976 - 2003
Outer	Moorebank	1,878	26.9	1976 - 2003
Outer	Blacktown	3,142	28.3	1976 - 2003
Fringe	Campbelltown	2,004	37.0	1976 - 2003
Fringe	Penrith	2,149	44.3	1976 - 2003

This section analyses the effects of location factors on the industrial land values. In order to assess the effect of location factors upon the industrial land values, a regression analysis was used with the following equation.

$$ILV_{k,} = Intercept + B \text{ x } D + e \quad (1)$$

where, ILV_k = Industrial land value at distance k
B = Regression Coefficient

D = distance from the CBD
e = error

Table 3 shows the results of series of least-square regression analysis with the independent variable of distance from CBD and the dependent variable of industrial land value (Equation 1) from 1776 to 2003 in the Sydney industrial property market. From Table 3, the independent variable Distance in the regression model is statistically significant at the 0.01 level.

Table 3: Results of Regression Analysis

Year	N	Adjusted R^2	B* (Intercept)	B* (Distance)	p-level (Distance)	Beta** (Distance)
1976	16	0.7450	69.48	-1.51	0.0000	-0.8729
1977	16	0.7587	68.25	-1.44	0.0000	-0.8802
1978	16	0.8077	70.18	-1.43	0.0000	-0.9058
1979	16	0.7943	74.69	-1.50	0.0000	-0.8989
1980	16	0.8196	97.17	-2.07	0.0000	-0.9119
1981	16	0.6856	155.05	-3.54	0.0000	-0.8406
1982	16	0.6740	194.92	-4.43	0.0001	-0.8341
1983	16	0.6489	196.35	-4.65	0.0001	-0.8200
1984	16	0.5020	210.65	-4.86	0.0013	-0.7316
1985	16	0.5024	249.20	-5.89	0.0013	-0.7318
1986	16	0.5026	268.67	-6.26	0.0013	-0.7320
1987	15	0.4557	341.91	-8.46	0.0034	-0.7032
1988	15	0.4679	452.98	-11.04	0.0029	-0.7113
1989	15	0.4780	575.31	-13.65	0.0026	-0.7178
1990	15	0.4296	521.38	-11.62	0.0048	-0.6858
1991	15	0.3859	433.99	-9.46	0.0080	-0.6555
1992	15	0.3715	412.69	-9.65	0.0094	-0.6453
1993	15	0.4512	384.91	-8.83	0.0036	-0.7003
1994	15	0.5388	361.24	-7.99	0.0011	-0.7561
1995	15	0.5137	373.08	-8.11	0.0016	-0.7405
1996	15	0.5447	339.47	-7.39	0.0010	-0.7598
1997	15	0.5346	381.93	-8.45	0.0012	-0.7536
1998	15	0.5880	415.79	-8.95	0.0005	-0.7857
1999	15	0.5906	448.93	-9.55	0.0005	-0.7873
2000	15	0.6057	472.54	-9.94	0.0004	-0.7962
2001	15	0.5911	502.26	-10.41	0.0005	-0.7876
2002	15	0.6218	544.64	-11.20	0.0003	-0.8055
2003	15	0.6699	618.02	-11.95	0.0001	-0.8327

* B: Regression Coefficient

** Beta: Beta Coefficient

As an example, Figure 1 shows an urban bid-rent curve for the Sydney industrial land values in year 2003. This means that for each kilometre increase in the distance from the Sydney city centre, the land values (per square metre) for typical industrial sites decrease by $11.95 in year 2003. The intercept $618.12 could be regraded as a Central Industrial Land Value (CILV) in year 2003.

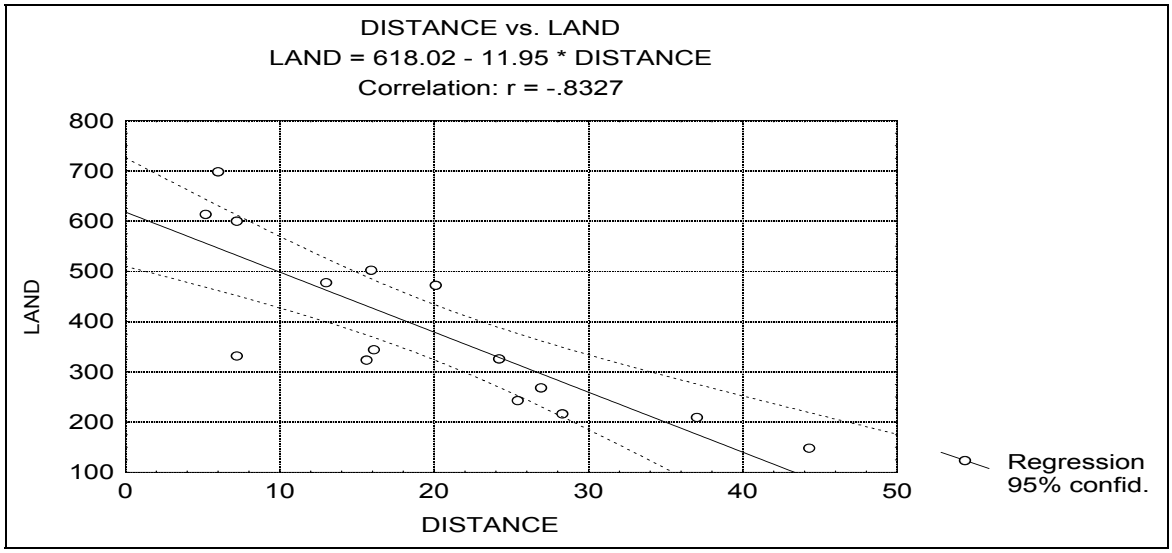

Figure 1: Urban Bid-Rent Curve for Industrial Land Values in Year 2003

When the intercept was regarded as the Central Industrial Land Value (CILV), the equation (1) can be rewritten as follows:

$$ILV_{k,n} = CILV_n - S \text{ x } k + e \qquad (2)$$

where, $ILV_{k,n}$ = Industrial land value at distance k in year n
$CILV_n$ = Intercept (central industrial land value in year n)
S = Slope (industrial land value reduction per kilometre)
k = distance from the CBD (in kilometre)
e = error

Figure 2 shows the real Cental Industrial Land Values (CILV) and the real Slope (industrial land value reduction per kilometre) in the Sydney industrial property market from 1776 and 2003. (The real CILV and Slope was adjusted with the Consumer Price Index in Sydney region, base year = 1990.) As Figure 2 shows, the trends of real CILV and real Slope in the Sydney industrial property market from 1976 to 2003 illustrate a similarity. The movements of CILV and Slope are very closely associated in the study periods (correlation coefficient = 0.9812). As the CILV grows more, the Slope gets steeper. This means that there are higher CILV and steep Slope during the growing market, while there are lower CILV and soft Slope during the decreasing market. Hence, the trend of CILV or Slope can be used as a performance indicator of the industrial land values in the Sydney property market.

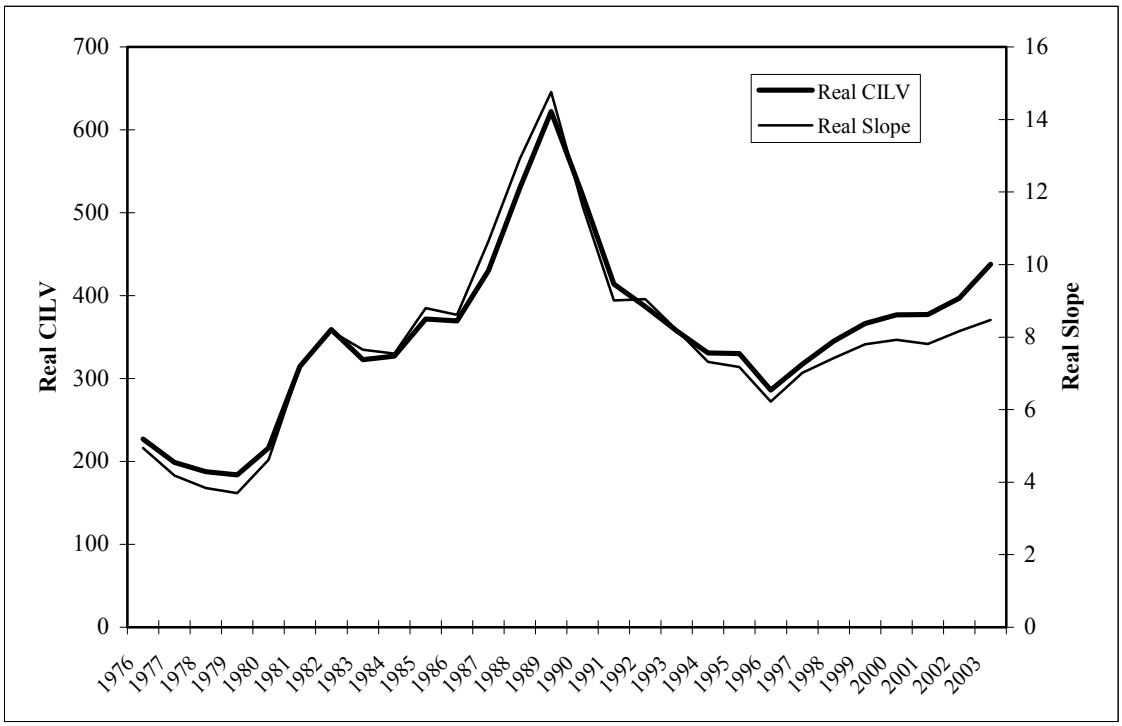

Figure 2: Real CILV and Real Slope in Sydney Industrial Property Market (base year = 1990)

5. The Performance Indicators of Sydney Industrial Land Values

In this study, the movement of the CILV was used as a performance indicator in the Sydney industrial property market. Figure 3 shows the trends of growth of the real CILV in the Sydney industrial property market between 1976 and 2003. The real CILV was compared with two other performance indicators (INLV and PCA performance index) in the Sydney industrial property market.

In order to assess the land values in the Sydney industrial property market, the Industrial Land Value (INLV) was calculated as a weighted average of the land values based on the proportion of the zoned industrial land areas in the sub-region (Kim, 1998). Figure 3 shows the trends of real growth of the INLV in the Sydney property market from 1976 to 1993.

The Investment Performance Index (IPI) by the Property Council of Australia (PCA) was used in order to assess the performances of Australian industrial property market. There are three types of performance index (income, capital, and total) in IPI. Figure 3 shows the trends of the Capital Return Index of the Sydney industrial market from 1986 to 2003 in order to investigate the performance of the industrial land values.

The performance of property market often reflects the state of general business and construction cycles. This property cycle is influenced by demand and supply factors of the economy (Boykin and Ring, 1993). As Figure 3 shows, the trends of growth of the real CILV (1976-2003), INLV (1976-1993), and IPI Capital Return (1986-2003) in the Sydney industrial property market illustrate a similarity. These three performance indicators have a similar frequency of the cycle.

In the Sydney industrial property market, the growth of the real CILV has peaks in 1981, 1988, and 1997, while the real growth of the INLV has peaks in 1982 and 1989. The growth of the real CILV has troughs in 1983 and 1991, while the real growth of the INLV has troughs in 1983 and 1992. The growth of the IPI (Sydney Industrial Capital Return) has peak in 1988 and trough in 1992. The peaks and trough of INLV cycle and the trough of IPI (Sydney Industrial Capital Return) lag behind that of CILV cycle. Hence, the movement of the CILV based on the location factors may predict the turning points of the performance of Sydney industrial land values, although use of annual data largely eliminates potential leading role of economic factors.

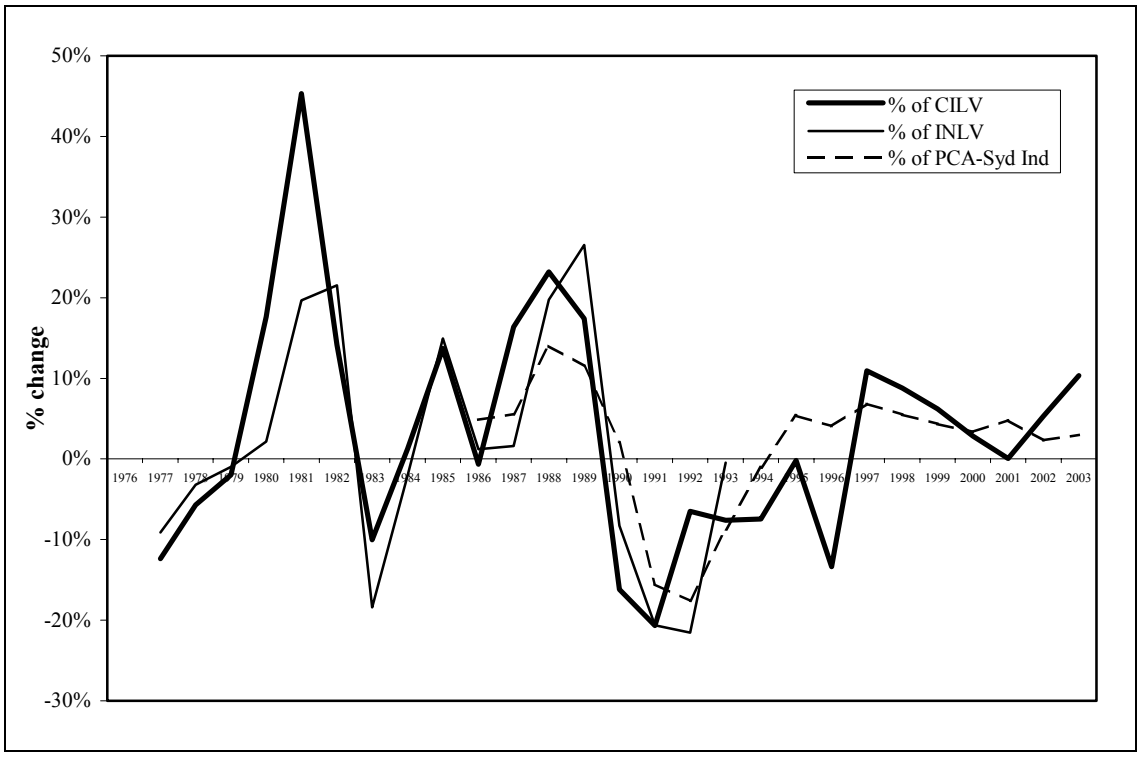

Figure 3: The Growth of real CILV, INLV, and IPI (Sydney industrial Capital Return)

6 Summary

The theoretical model of this study predicts that the values of typical industrial sites are a function of economics factors and location factors. The industrial land values of typical industrial sites between 1976 and 2003 were collected from the New South Wales Valuer General's Office (VGO). In order to control the economic factors, series of the regression analysis within same year (snap–shot analysis) were used. The study used the regression analysis with the dependent variable of industrial land value and the independent variable of distance from CBD in terms of the location factors, in order to estimate the Central Industrial Land Value (CILV) and industrial land value reduction per kilometre (Slope). There are higher CILV and steep Slope during the growing market, while there are lower CILV and soft Slope during the decreasing market. After comparison with other performance indicators, the movement of the CILV based on the location factors may predict the turning points of the performance of Sydney industrial land values.

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