Applying Economic Theories to Build Land Bank Model and Evaluate Land Use Efficiency: A Case Study of Vinh Long, Vietnam

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10.18805/ag.DF-708

ABSTRACT

Background: The paper explores core factors that positive influencing on land bank policy in Vinh Long, Viet Nam. Based on applying economic theories, it draws on hypotheses tested and a research model with explaining and analyzing the relationship between factors affecting land price, land bank and land use efficiency.

Methods: The quantitative research method used the measurement model and PLS-SEM structure to test hypotheses due to the relationship complication in the conceptual model. 216 valid respondents working in the land discipline in Vinh Long were surveyed for data analysis from 2020 to 2023.

Result: The results show that only geographical variable positively affects land price, whereas economic and urban factors influence on both land price and land bank. When land price also positively impact on land bank and policy factors also positively moderated two relations between land price-land bank and land bank-land efficiency. The research demonstrates the connection between economic, urban, land price factors and land bank by the land managenment of governmental role. Through those relations, Land bank model would be employed to evaluate land use efficiency in Vinh Long. Taking advantage of the result, managers and governments need to adjust land use policy for economic promotion in Vinh Long, Vietnam.

Key words: Efficiency, Land bank, Land price, Legal policy.

INTRODUCTION

El-Barmelgy *et al.* (2014) have applied economic theories to determine variables affecting land use, land value and other variables classified into geographic, environmental, economic, social, urban, public interest, laws and legislation, demographic, political variables. They suggested the land use and land value model.

European good practices on land banking (Veršinskas *et al.,* 2022) analyzes and identifies European good practices on land bank formation, as well as studies on the establishment of land bank for land development and policy recommendations based on institutions, legal instruments and financial resource.

In the research “Land-use change and its drivers in rural Henan province between 1995 and 2015” (Liu *et al.,* 2022) suggested that both natural factors (precipitation, temperature, soil type, landforms) and human factors (population, urbanization, economy, management, policy) play crucial roles in influencing land use changes in rural China from 1995 to 2015. Policy framework of land resources management influencing on land productivity (Abiyot, 2024) and non-agricultural use of land considered as the main factor for land changes in common (Ahmad, 2018). Land characteristics are essential factors affecting the crop cultivation (Nasruddin *et al.,* 2023).

From 2013 to 2020, Vinh Long in the Mekong Delta region of Vietnam had a limited natural area spanning 152,573 hectares attracting 162 projects utilized land of almost 1.3 billion USD. However, 25 of these projects were unable to proceed due to a lack of available land (Vinh Long Department of Planning and Investment, 2022). In the Vietnam Land Law, the government must either reclaim land or allow investors to purchase land from current users in order to secure land for project implementation. Nonetheless, land users often hesitant to agree to these arrangements as the compensation offered is below the market value. Additionally, investors encounter challenges in navigating procedures for land planning adjustments, construction permits and other procedures. Consequently, these obstacles result in missed investment opportunities, ineffective land utilization by the government and wastage of land resources (Land Law, 2013; Land Law, 2024).

In light of numerous deficiencies in the land reserves in Vinh Long within the existing framework, employing economic theories and models related to land utilization, land valuation and land bank above, the article will study the impact of factors on land price, land bank and land use efficiency through the following research model: Based on the land value model from Fig 1 and Fig 2, the authors

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How to cite this article: Bao, L.T. and Phuong, N.N.D. (2025). Applying Economic Theories to Build Land Bank Model and Evaluate Land Use Efficiency: A Case Study of Vinh Long, Vietnam. *Agricultural Science Digest.* **45 (Special Issue):** 159-168. doi: 10.18805/ag.DF-708.

Submitted: 08-01-2025 **Accepted:** 17-03-2025 **Online:** 13-05-2025

build the land price and land bank in the relationship with four factors: geography, economy, urbanisation, society (Fig 3).

MATERIALS AND METHODS

The study was conducted from 2020 to 2023 in the Vinh Long province included the following contents.

Data collection

Secondary data source collected by utilizing data from published domestic and international studies, periodicals and statistical reports from governmental agencies. For the primary data source, eight essential factors would be qualitatively designed to randomly question 216 officials working in the land domain by the Google Forms. The data result collected to form the research model after rejecting variables not satisfying the criteria.

Nguyen (2014) stated that the minimum sample size should be n≥50 + 8*p, with p representing the number of independent variables. Therefore, the minimum sample size should be n≥8*5 + 50, resulting in n≥90. It is worth noting that in this particular research paper, the author conducted a survey involving all 216 participants. The detail results would be in Table 1.

Implement a 5-point Likert scale using the following corresponding levels: 1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree and 5 = Strongly agree.

The main scale below for research involves 8 factors and 42 observed variables from regulations on land and in -depth interview of 51 cadastral and land experts that measure land bank factors and have been adjusted according to local practice. Land price and land bank are

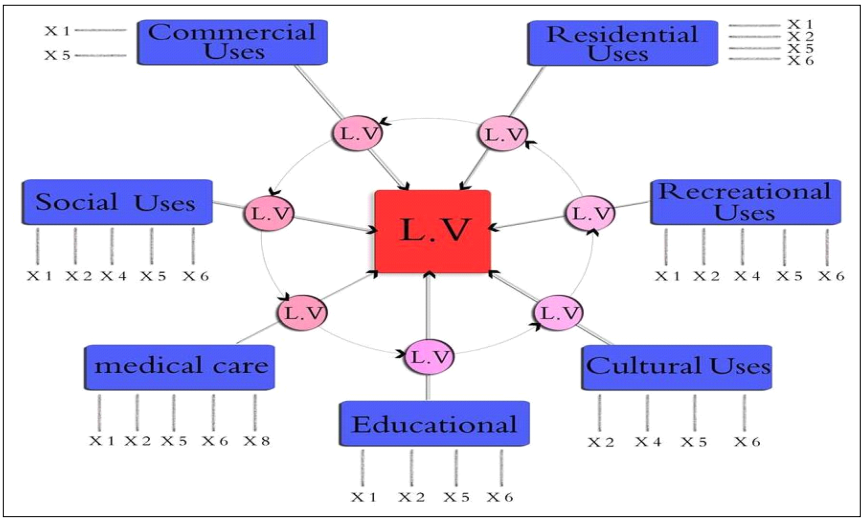


Fig 1: Land use change and land value model (El-Barmelgy *et al.,* 2014).

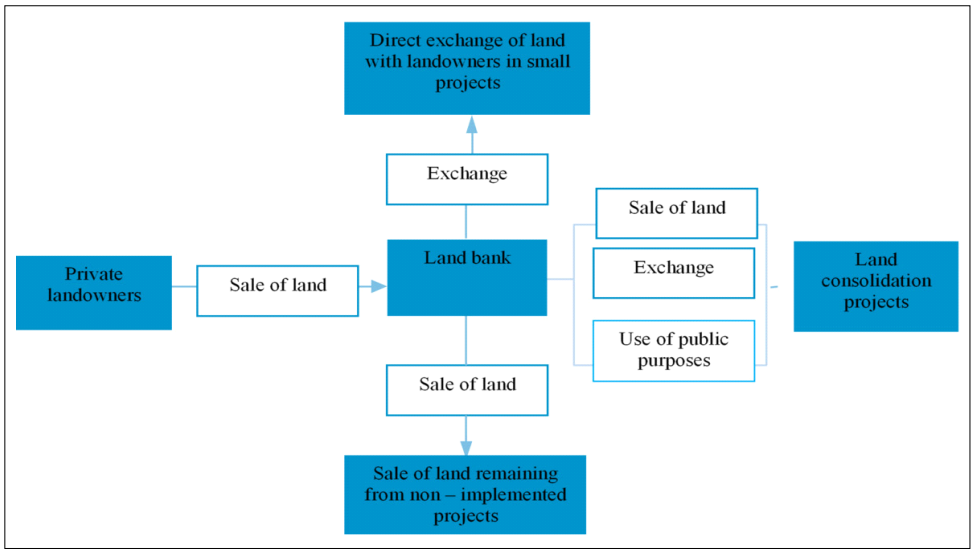


Fig 2: Land banking process in Denmark (Veršinskas *et al.,* 2022).

influenced by five factors and the land bank affects land use efficiency. Variables and their symbols observed on the scale are summarized as follows:

Legal policy variable (LP)

Regulations on land planning (LP1), Regulations on land division (LP2), Regulations on how to determine land prices (LP3), Policies and laws on auctions, bidding, construction tax (LP4), Expiration date regulations Land utilization (LP5), Legal documents about land (LP6).

Land use efficiency variable (LUE)

Land allocation and land lease procedures are efficient (LUE1), The land has undergone clearance (LUE2), The project has been implemented on schedule and is now operational (LUE3), Contribute to society's economic development (LUE4), The project has developed and utilized the land (LUE5).

Land bank variable (LB)

Land is reclaimed by the government for project implementation. (LB1), Transfer received (LB2) Intruding on rivers, canals and mudflats (LB3), Land voluntarily returned (LB4) and The state reclaims land as a result of violations of land law (LB5).

Land price variable (Price)

Amount of the winning bid (Price 1), The exchange's selling price (Price 2), Land cost as stated in the agreement (Price 3), The State establishes guidelines for land pricing (Price 4), Prices for land are set by the judiciary (Price 5).

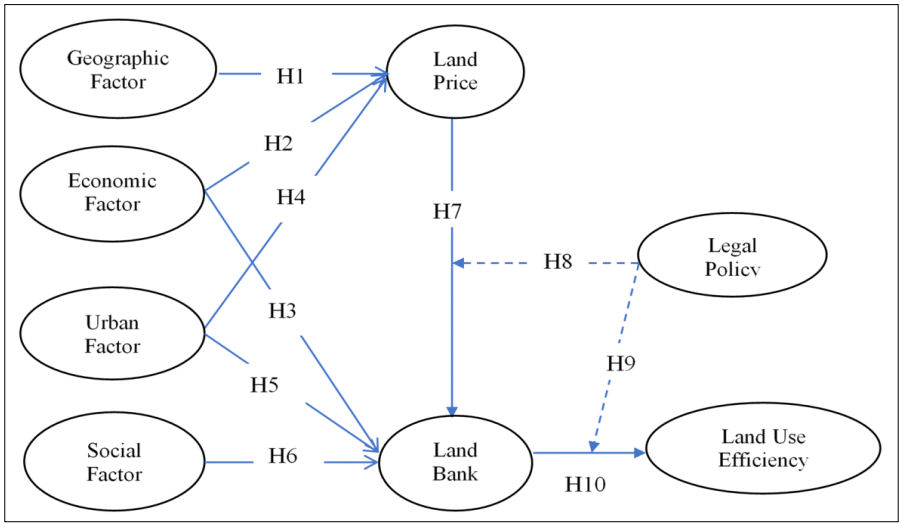


Fig 3: Research model suggested to evaluate land use efficiency through land bank.

Table 1: Sample characteristics (n=216).

Dimenstions	Items	Frequency	Percentage
Age	18-35	34	15.7
	36-45	117	54.2
	46 and above	65	30.1
Professional qualifications	University	137	63.4
	Graduate	79	36.6
Professional work	Natural Resources and Environment and its affiliated units	143	66.2
	Departments, sectors: finance, banking, construction, transportation, project management board, industrial parks, justice	23	10.6
	People's Committees of provinces, districts, towns and Vinh Long city	14	6.5
	People's Committees of communes, wards, towns, land officials	27	12.5
	Legal services	9	12.9
Work experience	Under 5 years	24	11.1
	5-15 years	54	25.0
	16-20 years	54	25.0
	Over 20 years	84	38.9

Economic factor variable (EF)

Investment project scale (E1), Real estate speculation (EF2), Income per capita (EF3), Capital source (EF4), Financial institution interest rate (EF5).

Social factor variable (SF)

Population density (SF1), Educational attainment (SF2), Social security (SF3), Utilities services (SF4), Employment rate (SF5).

Geographic factor variable (GF)

Land plots adjacent to the road (GF1), Land plot located at intersection (GF2), Size and shape of land parcel (GF3), Type of soil (GF4), Proximity to the urban center (GF5).

Urban factor variable (UF)

Urban construction and architectural planning (UF1), Amount invested in infrastructure (UF2), Pollution level (UF3), Living expenses (UF4), Proportion of immigrants (UF5).

Data analysis conducted by using SMART PLS based on the following criteria:

1. Quality of observed variables of factors: Outer loading has a good meaning of 0.7 or higher. Reliability Cronbach's alpha scale reliability ≥0.7 (DeVellis, 2012), Composite reliability ≥0.7(Hair *et al.,* 2014)
2. AVE convergence (convergence) >0.5 (Hock and Ringle, 2010).
3. Discriminant validity: Discrimination is ensured using the Fornell and Larcker table when a factor's square root of its AVE index is greater than all of its correlation coefficients with other factors in the model.
   - Equal to HTMT table ≤0. 85.

The structural model (SEM) will be assessed by taking into account the subsequent factors:

1. Determine the collinearity of independent variables with inner VIF < 5.
2. Meaning of the model's impact relationships (Path Coefficients): P value <0.05, a relationship is considered statistically significant and P value >0.05 is statistically insignificant. The original sample path coefficient has a positive sign for a positive effect (+) and a negative sign for a negative effect (-).
3. Evaluate the coefficient of determination R square (R square).

When the dependent variable's R-squared value approaches 1, it indicates a high degree of explanation and approaching 0 means the level of explanation for the dependent variable is low. (There is no R-squared threshold for how much is passed or what is not) (Hair *et al.,* 2017).

4. Evaluate the impact coefficient f square (f square).

- f square < 0.02: the impact level is small or insignificant.
- 0.02 ≤ f square < 0.15: small impact level.
- f square < 0.35: average impact level.
- f square ≥ 0.35: large impact level (Cohen, 1988).

RESULTS AND DISCUSSION

Through using SMART PLS 4.0 software, the results demonstrate:

Measurement model test results (Fig 4)

An outer loading value of 0.7 or higher is significant when evaluating the quality of observed variables of the factors (Hair *et al.,* 2014). Through PLS-SEM algorithm analysis, the outer loading coefficients of the variables are shown from 0.538 to 0.889, of which three variables: LUE2 = 0.538, LUE4 = 0.593 and SF1 = 0.632 are in the range of 0.5 to less than 0.7 (Table 2).

The findings of Scale reliability of Cronbach's Alpha, CR, AVE indicate that all factor structures have good reliability when Cronbach's alpha reliability coefficient and

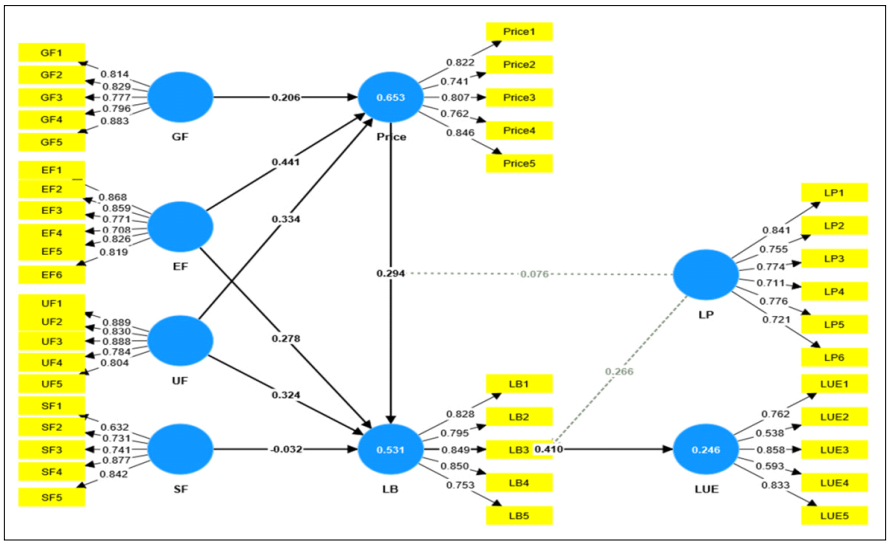


Fig 4: SEM diagram model below tested following PLS-SEM.

Composite reliability coefficient (rho_c) are both greater than 0.7 and the AVE indexes are all 0.5 or higher, all factors ensure convergence and met the requirements (Table 3).

The Discriminant validity demonstrate that each variable's AVE square root value is higher than the latent variables' correlation coefficients and the concepts achieve discriminant value when the HTMT Index is less than 0.85 (Table 4).

Structual model testing results (Fig 5)

The model structure and hypotheses are illustrated in the structural equation model (SEM) and detailed in Table 1. Three paths lack statistical significance, as indicated by p-values exceeding 0.05: LP -> LUE at 0.078, LP -> LB at 0.396 and SF -> LB at 0.498. Conversely, the remaining nine hypotheses demonstrate support for causality, with p-values below 0.05. Specifically, the factors EF, Price and

Table 2: Outer loading.

	EF	GF	LB	LP	LUE	Price	SF	UF	LP × Price	LP × LB
EF1	0.868									
EF2	0.859									
EF3	0.771									
EF4	0.708									
EF5	0.826									
EF6	0.819									
GF1		0.814								
GF2		0.829								
GF3		0.777								
GF4		0.796								
GF5		0.883								
LB1			0.828							
LB2			0.795							
LB3			0.849							
LB4			0.850							
LB5			0.753							
LP1				0.841						
LP2				0.755						
LP3				0.774						
LP4				0.711						
LP5				0.776						
LP6				0.721						
LUE1					0.762					
LUE2					0.538					
LUE3					0.858					
LUE4					0.593					
LUE5					0.833					
Price1						0.822				
Price2						0.741				
Price3						0.807				
Price4						0.762				
Price5						0.846				
SF1							0.632			
SF2							0.731			
SF3							0.741			
SF4							0.877			
SF5							0.842			
UF1								0.889		
UF2								0.830		
UF3								0.888		
UF4								0.784		
UF5								0.804		
LP × Price									1.000	
LP × LB										1.000

UF have a significant impact on LB; EF, GF and UF influence Price; LB images affect LUE; and LP mediates the relationships between Price and LB, as well as LB and LUE.

The LP has significantly influenced on both the relationship of Price - LB and LB - LUE with p values 0.045 - 0.000 respectively (Table 5).

Table 3: Scale reliability of Cronbach's Alpha, CR, AVE.

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
EF	0.894	0.894	0.920	0.657
GF	0.879	0.884	0.911	0.673
LB	0.874	0.876	0.909	0.666
LP	0.857	0.863	0.894	0.584
LUE	0.787	0.820	0.845	0.530
Price	0.855	0.857	0.897	0.635
SF	0.845	0.961	0.878	0.592

Table 4: Discriminant validity.

	EF	GF	LB	LP	LUE	Price	SF	UF	LP × Price	LP × LB
Fornell-Larker criterion										
EF	0.810									
GF	0.409	0.821								
LB	0.602	0.473	0.816							
LP	0.398	0.397	0.437	0.764						
LUE	0.275	0.180	0.314	0.149	0.728					
Price	0.700	0.571	0.652	0.579	0.341	0.797				
SF	0.351	0.265	0.299	0.266	0.150	0.376	0.769			
UF	0.522	0.551	0.617	0.555	0.222	0.678	0.403	0.840		
Heterotrait-Monotrait ratio (HTMT) (<0.85)										
EF										
GF	0.452									
LB	0.680	0.540								
LP	0.451	0.450	0.501							
LUE	0.287	0.199	0.350	0.168						
Price	0.794	0.652	0.751	0.677	0.369					
SF	0.321	0.239	0.284	0.282	0.165	0.368				
UF	0.584	0.624	0.697	0.627	0.247	0.770	0.409			
LP × Price	0.454	0.465	0.331	0.576	0.127	0.577	0.195	0.521		
LP × LB	0.412	0.366	0.429	0.541	0.273	0.398	0.199	0.451	0.806	

Table 5: Results of testing path coefficients.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
EF -> LB	0.278	0.269	0.098	2.837	0.005
EF -> Price	0.441	0.438	0.055	7.968	0.000
GF -> Price	0.206	0.207	0.076	2.705	0.007
LB -> LUE	0.410	0.403	0.098	4.180	0.000
LP -> LB	0.066	0.064	0.078	0.849	0.396
LP -> LUE	0.197	0.200	0.112	1.764	0.078
Price -> LB	0.294	0.309	0.132	2.220	0.026
SF -> LB	-0.032	-0.027	0.046	0.678	0.498
UF -> LB	0.324	0.307	0.110	2.938	0.003
UF -> Price	0.334	0.334	0.091	3.686	0.000
LP × Price -> LB	0.076	0.071	0.038	2.004	0.045
LP × LB -> LUE	0.266	0.258	0.066	4.056	0.000

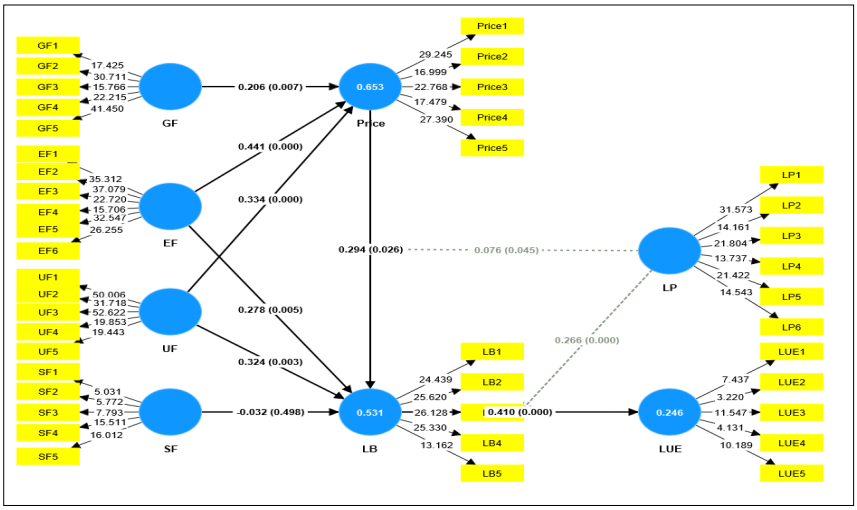


Fig 5: The SEM structural model by processing SMART PLS 4.0 software.

Table 6: VIF value.

	VIF
EF -> LB	2.027
EF -> Price	1.415
GF -> Price	1.479
LB -> LUE	1.307
LP -> LB	1.776
LP -> LUE	1.461
Price -> LB	3.005
SF -> LB	1.253
UF -> LB	2.137
UF -> Price	1.692
LP × Price -> LB	1.614
LP × LB -> LUE	1.408

Table 7: R-square.

	R-square	R-square adjusted
LB	0.531	0.518
LUE	0.246	0.235
Price	0.653	0.648

Table 5 indicates that the Land price is significantly influenced by Economic and Urban factors with coefficients of 0.441 and 0.334, respectively. The urban also possesses an impact factor of 0. 324 on the Land bank. Land price and Economic factors are the second and third variables, with levels of 0.294 and 0.278, correspondingly.

The pricing system for land has begun to enhance urban land productivity in a positive and significant way (Du *et al.,* 2016). Creating a database contains all pieces of land price; Promote real estate values to calculate taxes, fees, other associated financial obligations. In Vinh Long context, to facilitate the creation of land banks in case land prices fluctuate, it is necessary to contribute capital in the form of land use rights to project implementation, harmonizing interests between the State and the investors, private sectors and land users.

The Land Bank has a significant influence on Land use efficiency, with an impact coefficient of 0.410. Geographic influence on land price is represented by a coefficient of 0.206 (Fig 5).

Land value is not only depended to the physical characteristics of a building but also it is depended to the built environment surrounds to that building. The streets were chosen as the research scale for measuring the spatial effects of the change process of land values in residential areas (Kubat and Topcu, 2009). Geographic factors (GF) including land plots adjacent to the road, Land plot located at intersection, Size and shape of land parcel, Type of soil, Proximity to the urban center have essentially impacted on land price since it has the potential to be a highly profitable business. As a result, depending on the investor's business goals, consider choosing a suitable location to implement projects in order to save costs and generate long-term returns. Local governments should classify industrial sectors based on geographical advantages to plan industrial land-use arrangement.

The planning allocation rate directly affects the decision to approve investment projects. The local authorities should take consideration of determining planning allocation targets is an important task that needs to be carefully investigated to best suit the reality of the method. If urban development policies fail to include precise location, area, boundary and spatial planning on the map, the likelihood of success is low. That means land allocation, land lease and land use purpose changes must adhere to approved annual land use planning and plans as outlined in the Land Law. Thus, there is a focus on creating and organizing land use plans that can be quickly adapted and are highly feasible.

The VIF quantifies the extent of multi collinearity among independent variables. As presented in Table 6, all VIF

Table 8: f-square.

	f-square
EF -> LB	0.081
EF -> Price	0.396
GF -> Price	0.083
LB -> LUE	0.171
LP -> LB	0.005
LP -> LUE	0.035
Price -> LB	0.061
SF -> LB	0.002
UF -> LB	0.105
UF -> Price	0.190
LP × Price -> LB	0.032
LP × LB -> LUE	0.195

Table 9: Results of the Q^2 coefficient in the model.

	SSO	SSE	Q^2 (=1-SSE/SSO)
EF	1296.000	1296.000	0.000
GF	1080.000	1080.000	0.000
LB	1080.000	719.717	0.334
LP	1296.000	1296.000	0.000
LUE	1080.000	955.920	0.115
Price	1080.000	642.891	0.405
SF	1080.000	1080.000	0.000
UF	1080.000	1080.000	0.000

values are below 3, with the exception of the GD->QD value, which is 3.005. This indicates that the multi collinearity associated with this variable is not substantial, thereby having no significant impact on the testing of the research hypothesis and not constraining the R squared value. (Table 6).

Table 7 R- square illustrates that Price's adjusted R-squared is 0.648, indicating that the independent variables GF, EF and UF account for 64.8% of the variation in the Price variable. With an adjusted R-squared of 0.235 for LUE, LB explains 23.5% of the variation in LUE. The R-squared value for LB is 0.518, signifying that the independent variables EF, UF and Price collectively explain 51.8% of the variation in the LB variable (Table 7).

In Table 8 of f-square, the Economic factor exerts a large impact on the land price variable (0.396), while the Urbanization factor demonstrates a medium impact (0.190). In relation to the Land Bank variable, the Urbanization, Economic and Land Price factors each exhibit a small impact, falling within the range of $0.02 \leq$ f square ≤ 0.15, whereas the Social factor shows no impact (0.002) (Cohen, 1988). Regarding the Land Use Efficiency variable, the Land Bank reflects an average impact level (0.171). The Legal Policy factor influences the relationship between Land Bank and land Use Efficiency with a medium impact (0.195) and has a small impact on the connection between Land Price and Land Bank (0.032) (Table 8).

The Q2 predictive relevance assessment involved employing the cross-validated Predictive (Q2) approach to

Table 10: Hypothesis testing results.

Hypothesis	Stated	Sample average (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Forecast
H1	Geographic factors affect land prices	0.207	0.076	2.705	0.007	Accept
H2	Economic factors have an impact on land prices	0.438	0.055	7.968	0.000	Accept
H3	Economic factors have an impact on land bank	0.269	0.098	2.837	0.005	Accept
H4	Urbanization factors have an impact on land prices	0.334	0.091	3.686	0.000	Accept
H5	Urbanization factors have an impact on land bank	0.307	0.110	2.938	0.003	Accept
H6	Social factors have an impact on land bank	-0.027	0.046	0.678	0.498	Does not accept
H7	Land price factor affects land bank	0.309	0.132	2.220	0.026	Accept
H8	Legal policy factors possitively affect the relationship between land price and land bank	0.071	0.038	2.004	0.045	Accept
H9	Legal policy factors possitively affect the relationship between land bank and land use efficiency	0.258	0.066	4.056	0.000	Accept
H10	Land bank affects land use efficiency	0.403	0.098	4.180	0.000	Accept

evaluate the predictive accuracy of the structural model, as outlined by Hair *et al*. (2014). This serves as a benchmark for determining the cross-validated predictive significance of the PLS path model. The Q2 index is regarded as a measure for assessing the overall quality of the component model. To derive this coefficient, the research will implement Blind folding analysis using Smart PLS, followed by an evaluation based on the specified criteria:
$0 < Q2 < 0.25$: low level of forecasting accuracy.
$0.25 \leq Q2 \leq 0.5$: average level of forecast accuracy.
$Q2 > 0.5$: high level of forecast accuracy.

Table 9 shows the values of the Q2 coefficient for the variables LUE, LB and Price are 0.115, 0.334 and 0.405, respectively, all exceeding the threshold of 0. The research model is of high quality and suitable, demonstrating a correlation between the dependent and independent variables (Table 9).

Hypothesis testing

The outcomes of the hypothesis test, as displayed in Table 10, all factors meet the reliability and validity criteria. Yet, the structural model's significance in testing the study's hypothesis is only confirmed nine hypotheses met the criteria while hypothesis H6 (with P values = 0.498 > 0.05) was not accepted. All hypotheses H1, 2, 3, 4, 5, 7, 8, 9 and 10 show a statistically significant association at the 5% significance level (Table 10).

LB acts as a go-between for Price - LUE, EF - LUE, UF - LUE and SF - LUE pairs, while LP is a moderate factor in the Price - LB and LB - LUE relationships (Fig 3).

The relationship between LP and price on LB is demonstrated by a t-test p-value of 0.045, which is less than 0.05, indicating that Legal Policy has an impact on Land Bank. Therefore, the legal policy governs the connection between the price and land reserves. The recorded regression coefficient (O) of 0.076 indicates that altering the land policy will result in either an increase or decrease in land bank *via* changes in land price.

The t-test p-value of the impact of legal policy on land use efficiency is less than 0.05, indicating that the relationship between LP (legal policy) and LB (land bank) affects LUE (land use effectiveness) significantly. Regression coefficient (O) of 0.266 > 0 indicates that modifications in land policy will affect land use efficiency, either positively or negatively, *via* land bank.

CONCLUSION

The study's essential purpose is to assess land use efficiency through components influencing land bank and land price in Vinh Long, Vietnam based on the economic theories. Investigation comes about appear that 23.5% of the changes in land use efficiency can be clarified by six components in which, economic and urban variables have strong impact on land price (0.396, 0.190) and land bank (0.081, 0.105) separately. Vinh Long government could apply this model to create land bank and promote land use efficiency through adjusting six variables for adapting to local investment conditions.

ACKNOWLEDGEMENT

I would like to express my gratitude in particular to my supervisor, for his great assistance in developing the study questions and methodology. I want to express my gratitude to my coworkers at Vinh Long Natural Resources and Environment for their fantastic teamwork.

Disclaimers

The opinions and findings presented in this article are those of the authors alone and may not be representative of those of the affiliated organizations. Although the writers take responsibility for the quality and correctness of the information they give, they disclaim all liability for any losses, whether direct or indirect, that may arise from using this content.

Informed consent

The University of Animal Care Committee approved handling methods and the Committee of Experimental Animal Care approved all animal procedures for experiments.

Conflict of interest

Regarding the publishing of this work, the authors state that they have no conflicts of interest.

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