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Research on the Integration and Environmental Enhancement Effects of English Learning Spaces in Green Residential Designs

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Abstract Green residential design is becoming increasingly important in the field of modern architecture, especially in terms of environmental enhancement and English learning space integration. With the promotion of the green residential concept, how to optimize the living space through design to enhance the quality of learning and living of the occupants has become the focus of research. This study adopts a system dynamics approach to explore the integration of English learning space and the effect of environmental enhancement in green residential design. The return on investment, cost-effectiveness and market demand of green residences are analyzed by establishing a quantitative model and simulated with Vensim software. The results show that the total supply of green residences has increased year by year since 2018, and the number of green residences has increased significantly and the market demand is on the rise until 2024.After 2021, the supply and demand relationship of green residences is gradually out of balance, and the growth rate of demand exceeds the growth of supply. The financial subsidy policy has a significant impact on the green residential market, and the abolition of subsidies after 2020 leads to a decline in market share. The effectiveness of the integration of English learning space in green residential design for environmental enhancement is verified through model testing. The conclusion suggests that green houses not only enhance environmental quality but also promote market development, but government support and economic environment are key factors for their sustainable development.

Index Terms green house, English learning space, system dynamics, environmental enhancement, simulation, market demand

I. Introduction

In recent years, with the rapid development of China's urbanization construction, residential design from the survival type gradually to the functional, comfort-oriented transformation, began to appear to reflect the humanistic care, energy saving and environmental protection, scientific and technological innovation concept of green housing [1]-[3]. Green houses make full use of environmental natural resources to benefit ecology, health, energy saving for the purpose of ensuring the virtuous cycle of the ecosystem, to ensure that the occupants in the body, spirit, society is completely in a good state, so as to realize the integration of man and nature, built a win-win situation for both man and nature houses [4]-[7]. As for students, the English learning space based on green residential design can effectively improve the quality of learning [8].

As one of the most important subjects in school education, learning English not only promotes students' access to more knowledge and information, improves their individual thinking and learning abilities, but also broadens their social circles and interpersonal networks, and enriches their cultural life and entertainment [9]-[12]. Therefore, learning English has important benefits and roles, and has positive significance for both students and social development. The way to improve students' English learning level not only lies in teachers' excellent teaching methods and the application of information technology, but also the learning environment plays an important role in improving the effect of English learning [13]-[16]. A good learning environment can not only keep students in a positive emotional state, but also increase their interest in learning English [17], [18]. Therefore, in the context of green residential design, families and schools can improve English learning effects by designing good English learning spaces [19].

With the increasing global concern for environmental sustainability, green homes are gradually becoming an important direction in architectural design. Green homes not only focus on energy efficiency and resource conservation, but also emphasize the health and comfort of the occupants. Particularly in the design of learning spaces, green homes regard the integration of English learning spaces and the effect of environmental enhancement as an important part of the design. With the rapid development of the economy and the acceleration of urbanization, the demand for green homes continues to grow, especially among the middle class and families with higher educational backgrounds, and there is a huge market potential for green homes.

In the design of green homes, the integration of English learning spaces not only focuses on the functionality and comfort of the space, but also needs to consider its role in enhancing the learning outcomes and quality of life of the occupants. In order to assess the environmental effects of English learning space in green residential design, this paper adopts a system dynamics approach, combines modeling and simulation analysis with Vensim software, and analyzes in depth the changes in investment benefits, market demand, and supply-demand relationship of green residences under different policy scenarios.

The study analyzes key factors such as market demand, investment return and environmental impact by establishing a quantitative model of green housing, and verifies it through simulation. The article also focuses on the technological, policy, and economic factors in the design of green homes and explores their impact on the development of the green home market. Through this approach, it is hoped to provide decision support for the design optimization of green homes, especially on how to enhance the overall experience of occupants by improving the design of learning spaces.

II. Principles of system dynamics and modeling steps

II. A. Overview of system dynamics

System Dynamics (SD) is a discipline that analyzes and researches information feedback systems based on the theoretical basis of the relevant methods of system engineering, and utilizes the fusion of system science theory and computer simulation to perceive and solve system problems. For complex higher-order problems, theoretical models can be constructed based on system dynamics, and the problems can be studied by simulating the relevant models through qualitative combined with quantitative methods. System science theory believes that any system has its structural system. The structure of this system will also play a role in its functioning. It will look at a research goal as a system and analyze the interconnection of the elements in the system, which will have an effect on the interconnection of the elements in the system, and the structure of the system is a kind of causal feedback relationship between the elements in the system through interaction. Coupling this method with a computer can greatly simplify the calculation process of the system [20]. The system dynamics method can analyze problems that cannot be solved by traditional mathematical methods, the method can be used to analyze nonlinear, high-order, feedback complex systems, as well as long-term and cyclical complex problems, and due to the low sensitivity to the underlying data, tolerate the values of low accuracy, and the main use of a combination of qualitative and quantitative methods in the study of dealing with this type of system problems. System dynamics is specifically used in the following way: first determine the system variables and system boundaries, then analyze the causal feedback relationship between the variables, determine the system structure, draw the causality diagram of the system under study, and then differentiate the nature of the variables to draw the system flow diagram and establish the system dynamics equations, and the whole process to help the relationship between the variables within the system to complete the transformation from qualitative to quantitative, and finally with the help of computer simulation Finally, the computer simulation platform is used to simulate and analyze the problem.

II. B. Components of the system dynamics model

(1) Causality diagrams

Causality diagrams are an important tool for representing system feedback in system dynamics models, sometimes referred to as influence diagrams, and are commonly used to qualitatively aid in the initial stages of conceptualizing a model. A causal loop diagram contains multiple variables connected by arrows, which qualitatively express the logical relationships that exist between the variables. Also, the feedback structure should form a closed loop. The causal chain can be labeled as positive or negative in the nature of the influence between the variables, with a positive sign indicating that the variable to which the arrow points will increase or decrease with the increase or decrease of the variable from which the arrow originates, and a negative sign indicating the opposite relationship between the variables. When a feedback loop contains an even number of negative causal chains, its polarity is positive. When it contains an odd number of negative causal chains, its polarity is negative. Feedback loops Positive feedback loops serve to enhance the deviation of the variables in the loop, while negative feedback loops seek to stabilize the variables in the control loop.

(2) Stock Flow Diagram

A stock flow diagram reflects the quantitative relationship between variables and is based on a cause and effect diagram. It is based on a causality diagram, in which the analyzed variables are analyzed in terms of the strength of their effect on the system, the speed of their change, and whether they are the main object of study in the established system model [21]. The analyzed variables are classified into different types. A sample stock relationship diagram is shown in Figure 1.

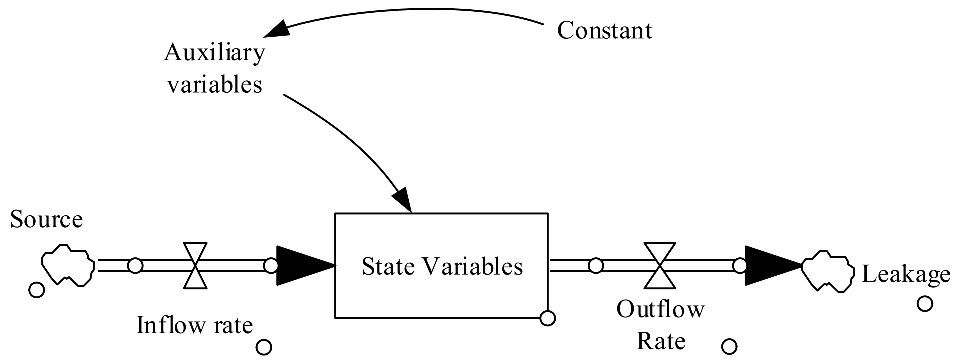

Figure 1: Inventory diagram

The basic elements of a stock flow diagram are as follows:

(1) State variables. State variables, also known as level variables, are variables that respond to the accumulation of the system and express the results of system operation, and in general the variables to be studied are set as state variables as a means of demonstrating changes over time. Its mathematical significance can be characterized by the integral formula, and the calculation formula is shown in Equation (1) and Equation (2):

$$Stock\ (t) = \int_{t_0}^{t} [Inflow(s) - Outflow(s)]ls + Stock(t_0) \tag{1}$$

$$d(stock)/dt = Inflow(t) - Outflow(t) \tag{2}$$

where $Inflow(t)$ denotes the inflow, $Outflow(t)$ denotes the outflow, $Stock(t)$ denotes the stock at moment t, $Stock(t_0)$ denotes the initial stock.

(2) Rate variables. The rate portrays the speed of change of the variable, the rate, also known as the rate of change, accumulates over time, causing the value of the level variable to increase or decrease.

(3) Auxiliary variables. Auxiliary variables are intermediate variables between the state variable and the rate variable, for information transfer and conversion, used to describe the middle of the decision-making process.

(4) Constants. Constants, which generally do not change and have fixed values during the study period, are quantities that are independent of the system and are available for data input but not for data output.

(5) System equations. The system dynamics equations represent the quantitative relationships that exist between the variables within the system, and with the help of model equations, numerical operations between the parameters of the system variables are realized.

II. C.Modeling steps for system dynamics

Rather than proceeding step by step through a linear arrangement, system modeling requires an iterative and continuous process of testing, screening and streamlining to create a relational model that both does not affect the mechanism of action of the system and simplifies it by accounting for the process of causal feedback.

First, the problem is defined, the system boundaries are delineated, the object of study and the main variables are identified, and the starting year of the problem under study is specified.

Then, dynamic hypotheses are formulated based on existing theories, and causal loop diagrams, stock flow diagrams, etc. are established based on the hypotheses and key variables and other data.

Next, system equations are developed, a step that clarifies the behavioral relationships between the parameters and variables. Third, testing, which usually includes intuitive, operational, and historical tests, to test whether the model is consistent with past behavioral patterns compared to the reference model.

Finally, different policy scenarios design and evaluation, this step involves the design of different path scenarios to analyze what effects the implementation of the said policies will produce. The steps of system dynamics modeling are shown in Figure 2.

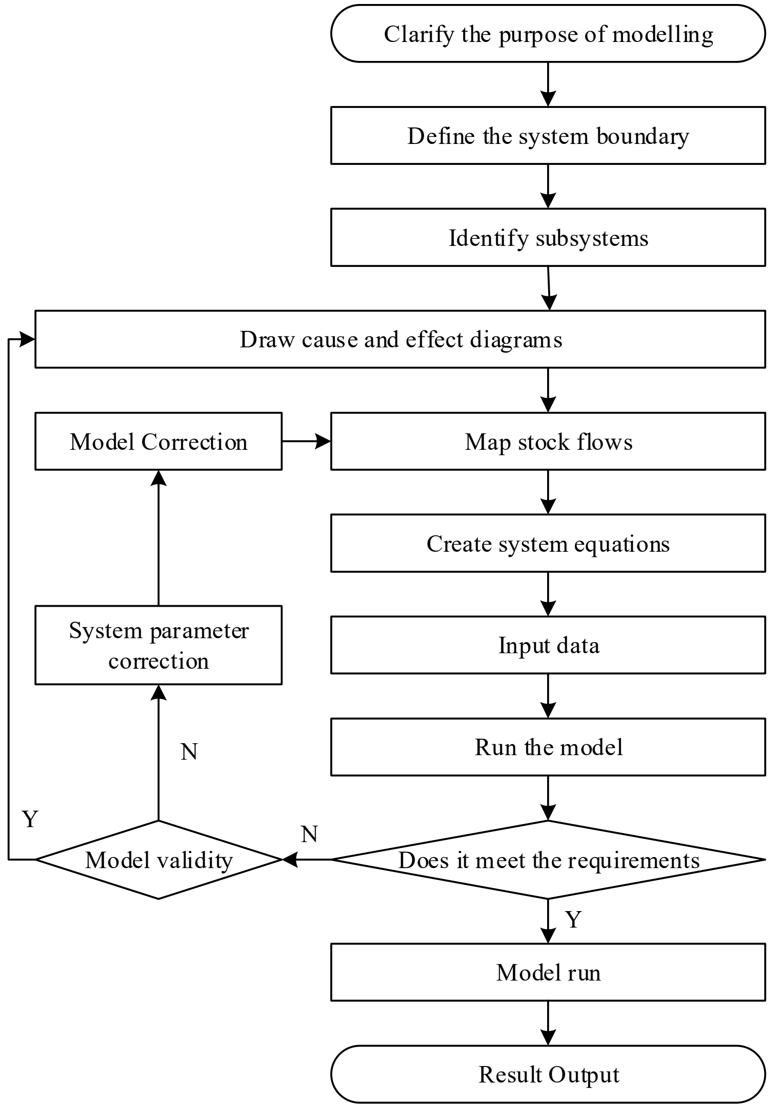

Figure 2: System dynamic model construction steps

III. Modeling the effects of integration and environmental enhancement of English learning spaces

III. A. Conceptual Modeling

Although the English learning space in green residential design has been promoted for many years, the lack of unification of residential real estate investors and beneficiaries, and the change of the main body in the early development and later use and operation and maintenance have led to deficiencies in the implementation and enforcement of various standards for green housing. The commercial real estate "self-holding" model unifies the developer and the final use manager, bringing new impetus to the development of green housing. For commercial real estate developers, green real estate, as an emerging mode of operation, will bring tangible benefits such as lower operating costs, intangible benefits such as brand quality enhancement and auxiliary publicity in the later operation process, so the establishment of the incremental benefit model of green housing provides commercial real estate developers with decision-making for investing in green housing.

In order to study the integration of English learning space and environmental enhancement effects in green residential design, it is necessary to put it into the system for research. English learning space and environmental enhancement in green residential design is a systematic project, and in order to better understand the system structure and characteristics, the conceptual model should be constructed first in order to have a clearer understanding of the research problem, which will help to carry out exploratory research on the nature of the problem. The investment is made in the preliminary development and construction stage, and after the project is completed, the rental income is obtained through leasing to recover the preliminary development and construction investment and the operational and promotional investment during the operation of the project [22]. In order to construct the model, the basic construction investment and the incremental investment in green housing are discounted to each period within the payback period, so as to dynamically analyze the impact of the incremental cost-effectiveness of green housing on the return on investment. From this assumption, it can be seen that the total investment in each phase of the project is divided into the development and construction of the basic investment, green residential investment, operational energy input, and promotional input, and the total return of each phase is equal to the rental income of each phase minus the operational input, promotional input, development and construction of the basic investment and green residential investment.

III. B. Quantitative modeling

For commercial real estate developers, the proportion of green residential investment means an increase in cost, so developers are cautious about green residential investment. Qualitative analysis can only establish the interrelationships within the system, and the results of quantitative analysis can provide a more intuitive basis for the developer's decision-making. The above model is only a preliminary model based on the causal relationship between the variables, due to the lack of measurement and time significance, the model can not be directly simulated, need to use the language of system dynamics to further improve the model, that is, the establishment of a quantitative model, the main purpose of this section is to analyze the variables in the model in detail and express the relationship between the different variables with equations. System dynamics need to be simulated with the help of specialized simulation language, with the popularity of windows system, system dynamics software from the original writing language (such as SIMPLE, DYNAMO) to the development of graphical application software, this study uses the United States Ventana Division launched the Vensim software, Vensim pieces have several versions: There are several versions of Vensim: VensimDSS, Vensim Professional, and Vensim PLE (Venple for short), Venple, as a kind of Vensim software, is the personal learning version of Vensim software, and also the version used in this study. Venple is an easy way to build dynamic models by graphically connecting the variables with arrows, and connecting the variables with the arrows of the arrows. Venple is an easy way to build a dynamic model by connecting variables with graphical arrows and using the polar direction of the arrows to indicate the causal relationship between the variables. The quantitative relationships between the variables and parameters are written into the model in the form of equations, and then the software can be run and the model can be simulated. The model after adjusting and perfecting by using Venple software is as follows:

The stock flow diagram is based on the former causal loop diagram and adjusted according to the needs of model simulation and equation editing, with two main changes: first, the stock flow diagram adds some variables, such as the city GDP, residential demand, residential supply, etc., in order to increase the understanding of the model for the purpose of running the model. In the following, the model will be further analyzed in terms of the meaning of the variables and the relationship between them:

(1) Market influencing factors

a) City GDP

City GDP is often used to measure the overall economic status of a region. The higher the value of a city's GDP, the better the city's development, and the more demand there is for English learning spaces designed with green housing.

b) New demand for green housing

Demand for housing refers to the area of housing purchased by those who are willing and able to purchase housing in the urban population. New green residential demand refers to the increase in green residential demand compared to the previous year. From the system flow diagram, it is easy to find that its size is influenced by the cost of purchasing green homes, the cost of purchasing traditional homes, consumer perceptions, per capita disposable income, and the nature of the product.

c) Total supply of green houses

Total supply is the stream level variable of new green residential supply.

d) New Residential Area

New residential space refers to the sum of new conventional residential space and new green residential space per year.

e) As green homes require new technology, new materials and new management methods, this leads to an increase in their cost and hence the sales price. The sales price of green homes is a direct factor affecting supply and is a yardstick to measure the willingness of consumers in the market to accept and pay for the increase in construction costs or even pay a premium.

(2) Technological influences

a) Intelligent light environment regulation system

By adopting LED full-spectrum lighting and automatically adjusting the color temperature, it provides a comfortable English learning environment.

b)Dynamic management of indoor air quality

The circulation and freshness of indoor air affects people's experience inside the space, and the purifying effect of air can be realized by selecting specific plants and linking them with the HVAC system in the design of green housing.

(3) Policy Influences

Government intervention is an effective means to compensate for market failure. At present, the government's incentives for green housing are mainly financial incentives, with corresponding subsidies for different levels of green housing.

IV. Simulation experiment analysis

IV. A. Model testing

The model test is to verify the degree of agreement between the constructed model and the real system. Therefore, in order to test whether the model can effectively represent the actual situation of the integration and environmental enhancement effect of the English learning space in the green residential design, the validity test of the model is carried out before the simulation analysis. Firstly, the structure test and gauge consistency test were completed by using the own function of Vensim software. Secondly, historical test, realism test and limit test are carried out.

The structural test is mainly used to verify the reasonableness of the relationship between the model variables in order to exclude unreasonable factors and causal relationships, and this test has been carried out throughout the construction of the system flow diagram and equations. Measurement consistency test refers to the measurements in the basis of having realistic significance, to ensure the consistency of the measurements of the left and right sides of the equations, the paper on the original data between the situation of inconsistency of the measurements, but also according to the mathematical relationship between the measurements of the standard conversion.

IV. A. 1) Historical tests

Through the historical test method, comparing the simulation data of the model with the historical data, the degree of coincidence between the model and the real system can be judged, and only the model that can faithfully reflect the real system can provide a correct and reliable reference basis for the subsequent simulation. The paper selects the data from 2018-2024 for the historical test, and the comparison between the real data and the simulation data from 2018-2024 is shown in Table 1. From the table, it can be seen that the simulation results of urban GDP, total urban population, and traditional residential sales price have an error of less than 10% for each variable, which indicates that the structure of the model and the selection of variables are reasonable, so it can be assumed that the model's simulation and prediction effects are better.

Table 1: Real data versus simulation data

Variable	Year	2018	2019	2020	2021	2022	2023	2024
GDP	True value (100 million yuan)	3874.01	4401.33	4929.53	5494.14	5799.16	6256.99	7482.72
	Simulation value (100 million yuan)	3874.01	4499.52	4946.66	5485.94	6016.92	6493.03	7344.42
	Error (%)	0.00	2.18	0.35	-0.15	3.62	3.64	-1.88
Urban population	True value (10,000 person)	598.43	627.9	619.83	630.64	639.2	643.83	711.85
	Simulation value (10,000 person)	598.43	611.16	621.42	638.66	639.52	637.91	719.37
	Error (%)	0.00	-2.74	0.26	1.26	0.05	-0.93	1.05
Traditional residential sales price	True value (yuan/m²)	5828.31	6221.95	6439.7	6113.53	6217.24	6402.32	8176.16
	Simulation value (yuan/m²)	5846.77	6344.01	6341.06	6147.72	6411.06	6538	7966.62
	Error (%)	0.32	1.92	-1.56	0.56	3.02	2.08	-2.63

IV. A. 2) Reality check

The object of the system dynamics model study is mainly the behavioral characteristics of the system, so the realism test is conducted to analyze whether the simulation results can reflect the trend of the real behavior from a qualitative point of view. Test 1: Set the city's GDP growth to increase by 30%. The macroeconomy of the city directly affects the development of green housing. The realism test 1 is shown in Figure 3, the results are in line with reality, this realism test passes.

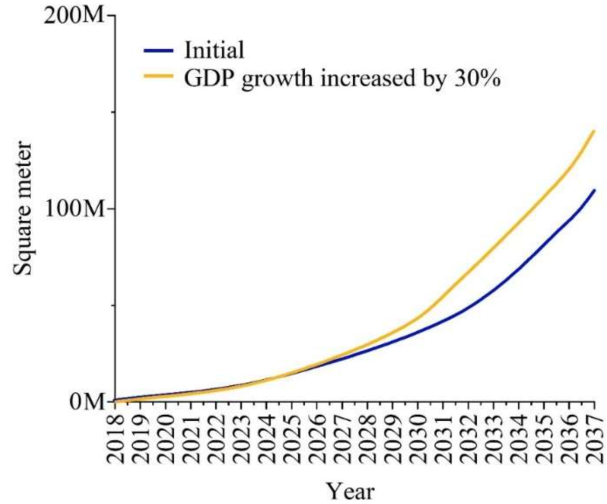

Figure 3: Realistic test 1

Test 2: Setting the sales price of green houses to increase by 30%, realism test 2 is shown in Figure 4. From the figure, it can be seen that when the sales price becomes 1.4 times of the initial state, the sales price increases and the demand for green houses decreases, which is in line with the law of demand, and this realism test passes.

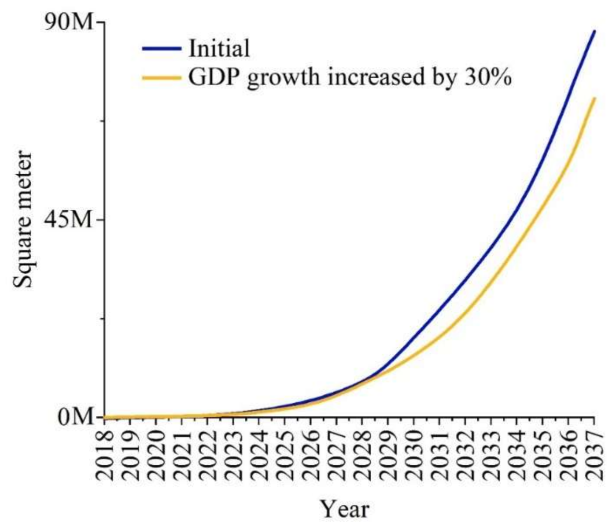

Figure 4: Realistic test 2

IV. A. 3) Limit tests

Extreme case test is usually used to verify whether the equations in the model are reliable or not, an effective model should be able to correctly reflect the changes of the real system in any extreme case, usually take the extreme values of certain variables and observe whether the trend of the output variables is in line with the objective reality. Assuming that the incremental cost of green homes becomes 0 yuan/m² and the development cost of real estate development enterprises decreases, increasing the supply of green homes, the limit test is shown in Figure 5. From the figure, it can be seen that the total supply of green homes can achieve a reasonable value, indicating that the model has stability and passes the limit test.

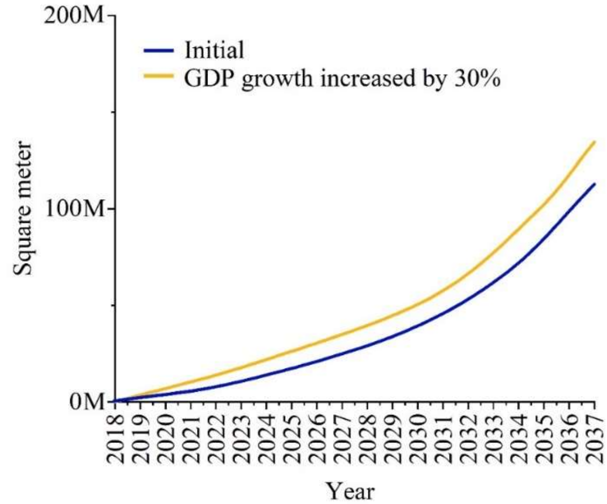

Figure 5: Limit test

IV. B. System dynamics simulation

The experiments in this section take green houses in Province A as the research object and simulate the system dynamics model of green house market in Province A. The premise of the model construction is: ① The simulation running time of this paper is from 2018 to 2024, and the time interval is 1 year. ② It is assumed that the green residential market is in a normal development state from 2018 to 2024, and there will be no major fluctuations. ③ This paper simulates with the usual premium rate of green homes, without considering the conceptual speculation situation.

(1) Trends of new green homes and total green homes

The results of the systematic simulation of new green homes and total green homes are shown in Figure 6. From the figure, it can be seen that the total amount of green residences in province A shows a rising trend. In 2018, the green residence market just started and the green residence market developed slowly. In 2020, the state introduced relevant incentives, and the green residence development and the total amount of green residences show an upward trend. With the integrity of the system and institutions, the number of green homes in Province A will definitely increase greatly by 2024, which shows that there is a lot of room for the development of green homes.

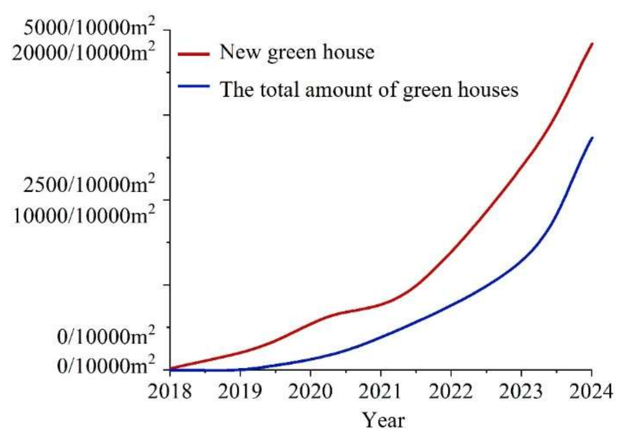

Figure 6: Simulation results of new green residential and green residential total system

(2) Supply and demand analysis

The results of green residential supply and demand simulation are shown in Figure 7. From the figure, it can be seen that the total supply of green residences in Province A is relatively slow, while after 2021, the demand for residences has a substantial rise, and the supply-demand ratio is on a downward trend, which indicates that in the next few years, the rise in demand for residences in Province A will be higher than the rise in the supply of residences.

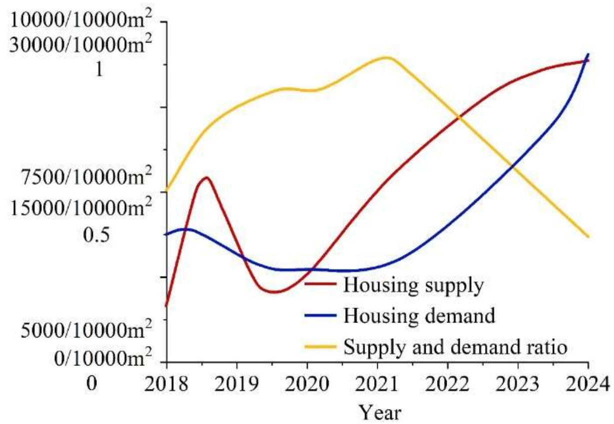

Figure 7: Green house supply and demand simulation results

(3) Market share analysis

The simulation results of green residential market share are shown in Figure 8. From the figure, it can be seen that in the early stage of the development of the green residential market, the premium rate of green homes is higher, indicating that in the residential market, consumers are willing to pay a higher price for the purchase of green homes, and the market acceptance is gradually increasing, and after 2020, the premium rate decreases, indicating that the extra price paid for green homes decreases, the consumer's willingness to buy rises, and the market develops rapidly, which indicates the green residential market's feasibility.

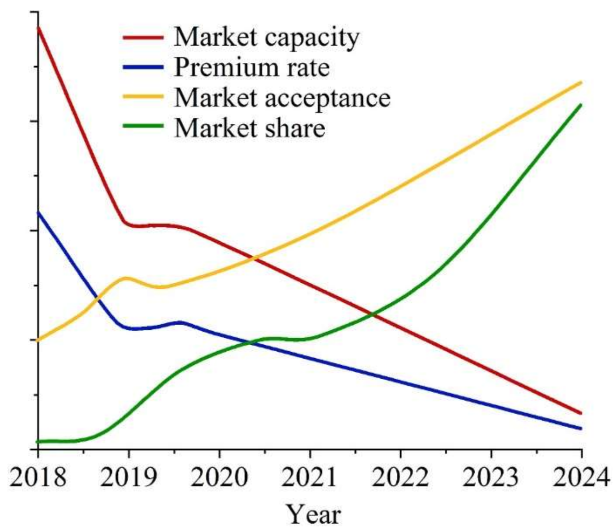

Figure 8: Simulation results of green residential market share

(4) Financial subsidy regulation simulation

The simulation of the total amount of green houses before and after the government subsidy is shown in Figure 9. The simulation of market share change before and after government subsidy is shown in Figure 10. In the text, the government financial subsidy is assumed to be 80 yuan/m², and the government subsidy is assumed to be 0. It can be seen from Fig. 9 and Fig. 10 that, assuming that the government subsidy will be 0 after 2020, the market share of green residential houses will be obviously reduced, and the total amount of green residential houses will be obviously reduced as well, which indicates that the financial subsidy can affect the developer's development enthusiasm, and further affect the scale of green residential houses. However, over time, the market share of green homes before and after the subsidy will tend to be the same, indicating that government subsidies can affect the development speed of the green home market.

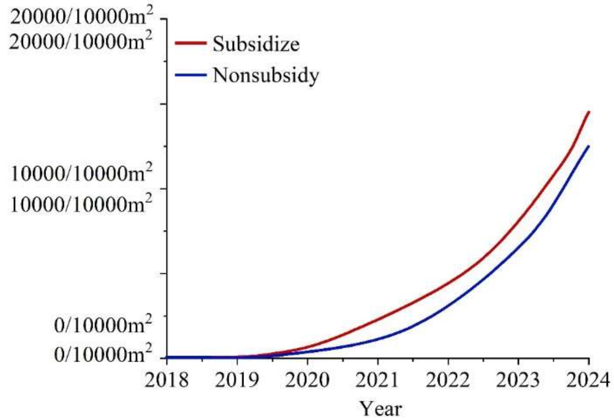

Figure 9: A simulation of the total amount of green housing before and after subsidies

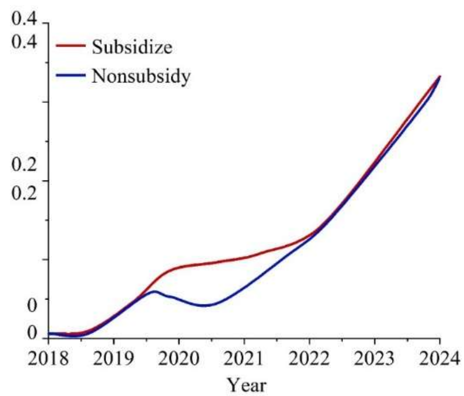

Figure 10: The market share changes simulation simulation after government subsidy

(5) Macroeconomic regulation simulation.

The development of green residential can not be separated from the development of the economy, this paper will reduce the GDP growth rate of 0.03, GDP growth rate before and after the reduction of the total green residential simulation simulation shown in Figure 11. From the figure, it can be seen that reducing the GDP growth rate makes the total construction market drop significantly, which indicates that the urban macroeconomy directly affects the development of the green residential market, which is also the reason for the uneven geographical distribution of green residential. Therefore, the government should pay attention to the status quo of unbalanced regional development and provide different incentive policies for regions with different levels of development.

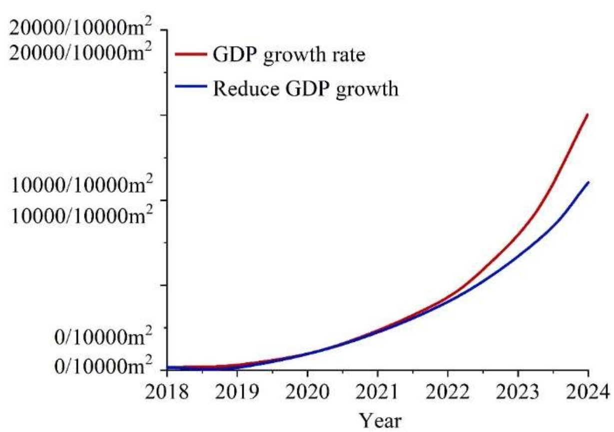

Figure 11: The gross domestic product growth rate is reduced and the total amount

V. Conclusion

In this study, the integration and environmental enhancement effects of English learning spaces in green residential design are analyzed through system dynamics modeling and simulation. The simulation results show that the green residential market has shown a stable growth trend since 2018, and the total number of green residences has continued to increase and the market demand has gradually risen until 2024. Especially after 2020, the government's financial subsidy policy has a significant impact on the market share of green homes.In 2020, after the government abolished the subsidy, the market share of green homes decreased significantly, reflecting the key role of financial subsidies in the development of green homes. However, as the impact of the policy wanes, market demand for green homes still maintains strong growth, indicating that green homes have the potential for sustained development.

In addition, the study finds that there is a large gap between the growth in supply and demand for green homes, especially after 2021, when the growth in demand significantly exceeds the growth in supply, which suggests that developers need to increase the construction of green homes in the next few years to meet the growing market demand. The model analysis shows that the English learning space in green residential design has a significant effect on enhancing the quality of the living environment, and this enhancement effect is gradually visible with the expansion of the green residential market.

References

[1] Manca, S., Cerina, V., & Fornara, F. (2019). Residential satisfaction, psychological well-being and perceived environmental qualities in high-vs. low-humanized residential facilities for the elderly. Social Psychological Bulletin, 14(2), 1-15.

[2] Zamojski, T. (2023). Humanization of European residential high-rise buildings by designing common zones. Przestrzeń i Forma, (54).

[3] Altarawneh, N. A., & Murtadha, T. K. (2023). Managing engineering challenges in the design and implementation of eco-friendly residential structures. Results in Engineering, 19, 101363.

[4] Liu, Y., Shi, X., Wang, Y. P., & Sun, T. (2019). Promoting green residential buildings in China: bridging the gap between design and operation to improve occupants' residential satisfaction. Sustainability, 11(13), 3590.

[5] Kallaos, J., & Bohne, R. A. (2013). Green residential building tools and efficiency metrics. Journal of Green Building, 8(3), 125-139.

[6] Huo, X., Yu, A. T. W., Zezhou, W., & Jayantha, W. M. (2020). Site planning and design of green residential building projects: case studies in China. Engineering, Construction and Architectural Management, 27(2), 525-543.

[7] Dai, J. (2024). Research on the integration and application of green building concept in fully decorated residential design. Engineering Advances, 4(2).

[8] Closs, L., Mahat, M., & Imms, W. (2022). Learning environments' influence on students' learning experience in an Australian Faculty of Business and Economics. Learning environments research, 25(1), 271-285.

[9] Putra, E., & Nopember, S. (2020). The importance of learning English nowadays. Jurnal Institute of Technology Sepuluh November at Surabaya, 1(7).

[10] Rehman, A., Bilal, H. A., Sheikh, A., Bibi, N., & Nawaz, A. (2014). The role of motivation in learning English language for Pakistani learners. International Journal of Humanities and Social Science, 4(1), 254-258.

[11] Darma, R. N., & Widiastuty, H. (2023). The importance of learning English at school. LANDMARK: Jurnal Pengabdian kepada Masyarakat, 1(1), 23-29.

[12] Riyanti, D. (2019). The role of motivation in learning English as a foreign language. Journal of English Language Teaching Innovations and Materials (JELTIM), 1(1), 29-35.

[13] Rao, P. S. (2019). The importance of English in the modern era. Asian Journal of Multidimensional Research (AJMR), 8(1), 7-19.

[14] La Hanisi, A., Risdiany, R., Dwi Utami, Y., & Sulisworo, D. (2018). The use of WhatsApp in collaborative learning to improve English teaching and learning process. International Journal of Research Studies in Educational Technology, 7(1), 29-35.

[15] Hou, Z. (2021, February). Research on adopting artificial intelligence technology to improve effectiveness of vocational college English learning. In Journal of Physics: Conference Series (Vol. 1744, No. 4, p. 042122). IOP Publishing.

[16] Stadler-Altmann, U. (2015). Learning environment: The influence of school and classroom space on education. In Routledge international handbook of social psychology of the classroom (pp. 252-262). Routledge.

[17] Khansir, A. A., & Dehkordi, F. G. (2017). The role of motivation in the teaching and learning English. Modern Journal of language teaching methods, 7(9), 072-085.

[18] Agarwal, S., & Thakur, R. K. (2014). Influence of environments on the English learning of students in India. International Journal on Arts, Management and Humanities, 3(1), 5-8.

[19] Amin, R. (2018). Learning English Language in Home Environment: A Study. Angloamericanae Journal (AAJ), 3(1), 39-50.

[20] Ryan Roberts,Alan Brent,James (Jim) Hinkley & Robert Y. Cavana. (2025) .Together, taking the next step: using system dynamics modelling to build community renewable energy programmes in Aotearoa New Zealand. Journal of the Royal Society of New Zealand,55(4),1167-1186.

[21] Athanasios (Thanos) N. Papanicolaou,Keshav Basnet,Peter L. O'Brien,Kenneth M. Wacha,Robert W. Malone & David W. Archer. (2025). A system dynamics modeling framework to evaluate impacts on economic, environmental, and social quality components of a U.S. Midwestern agroecosystem transitioning from row crop agriculture to mixed farming systems. Ecological Modelling,506,111142-111142.

[22] Ur Rehman Hafiz Saeed,Raza Muhammad Aamer,Masood Rehan,Khan Muhammad Arif,Alamgir Sabahat,Javed Muhammad Afzal... & Lim James B. P.. (2023). A multi-facet BIM based approach for Green Building design of new multi-family residential building using LEED system. International Journal of Construction Management,23(12),2024-2038.