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Study on Cash Flow of Volunteer Soldiers Retirement & Compensation Fund – From System Dynamics Perspective

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Abstract: Countries around the world use various forms of retirement systems to reduce elderly's economic risks. The military retirement system is one of the most important welfare measures of Taiwanese military. Facing strong military threats, Taiwan has implemented a volunteer recruitment policy. With the increasing number of volunteer soldiers every year, the ratio of volunteer soldiers over entire miliary population has risen continuously. Volunteer soldiers can retire and start to receive pensions after they have served for 4 years. Therefore, the amount of pension contributions for volunteer soldiers is small, and the short payment time cannot allow the pension fund to obtain long-term compound interest effects. The impact on the pension fund cannot be ignored. Thus, the impact of volunteer soldiers' pension on the overall cash flow of the pension fund has become the issue to be discussed in this study. The study uses systematic dynamics to explore the relevant factors that affect the cash flow of volunteer soldiers' retirement funds and the causal interaction between the factors; construct a dynamic model of the cash flow evaluation of volunteer soldiers' retirement funds; simulate and quantitatively analyze the results; and propose policy recommendations for improving the pension system for volunteer soldiers.

Keywords: Retirement Fund, Volunteer Soldiers, System Dynamics

1. Introduction

The main purpose of the social security system is to prevent or safeguard the dangers that may occur in the economic life at older age. It is not only for individual support, but also an important policy in stabilizing social harmony [1]. The protection of the economic security of the elderly should take into account the three functions of savings, risk sharing, and income redistribution [2]. Countries around the world use various forms of retirement systems to reduce the economic risks of old age [3]. Taiwan's retirement system is differentiated by occupation, such as the labor retirement system, civil servants retirement system, and the military retirement system, among which the military retirement system is one of the most important welfare measures for Taiwanese military.

Due to a strong military threat, Taiwan has adjusted its national defense force structure for strategic needs by gradually increasing the number of recruits and adjusting its military service system to be mainly volunteer recruitment, recruiting from three different channels including young adults, new recruits, and soldiers in service. To recruit more soldiers, the miliary promotes various welfare measures, including salary adjustments, increasing dormitories, improvement of the retirement system, and encouraging extracurricular education, etc. These measures seek to improve the effectiveness of volunteer recruitment, and successfully attract more aspiring young people to join the military, thus achieving the goal of national defense force.

As the number of volunteer soldiers increases year after year, the welfare and retirement system have become more and more important. The military has set up a military retirement fund which is jointly funded by the military and the government. They make low-risk investments to obtain interest or investment income, so soldiers can be paid by the fund when the they retire. A volunteer soldiers can retire and start to receive pension after serving for 4 years. Therefore, volunteer soldiers contribute less pension, and the payment time is too short for the fund to gain enough long-term compound interest. As the number of volunteer soldiers increases yearly and the ratio of volunteer soldiers over entire military population rises continuously, the impact on the pension fund cannot be overlooked. Therefore, the effect of volunteer soldiers' pensions on the overall cash flow of military retirement funds has become the issue that this study aimed to explore.

Since there are many factors that affect the cash flow of the volunteer soldier's retirement fund, in order to clearly understand the full picture of the cash flow of the volunteer soldier's retirement fund, this study would deem the cash flow of the volunteer soldier's retirement fund as a system, and explored the relevant influencing factors from a systematic point of view and the causal interaction between factors, extracted the key variables from the qualitative description, constructed a causal feedback loop, and then developed it into a systematic dynamic model of the cash flow of the volunteer soldier's retirement fund. Various aspects of the volunteer soldier's retirement pension were considered and simulation analysis was carried out, thus policy recommendations for improving the pension system for volunteer soldiers would be proposed.

2. Literature Review

A country's system of recruiting soldiers has a huge impact on the foundation of the military system, and indirectly has a huge impact on national defense. The recruiting system refers to the enlistment of soldiers to serve is completely voluntary and not subject to state coercion [4]. Taiwan has long faced a special cross-strait situation. To improve the professionalism of military personnel, reduce training costs, economize national defense expenditures, and maintain military strength, Taiwan has promoted the recruitment system and recruited a large number of volunteer soldiers.

Research on retirement funds include the following: proposed the impact of retirement pension replacement rate on economic growth and suggested that the retirement income replacement rate should maintain an appropriate ratio to the economic growth rate. Karl studied the reform of German annuity policy with a multi-level system. Studied the impact of population aging on the retirement security system and on the financial market [5].

Working capital management aims to ensure that there are sufficient funds to keep the company operating. It is a routine business activity to avoid losses caused by interruption of operations. Regardless of the size or nature of the industry, whether for-profit or non-profit organizations, daily operations all require sufficient working capital [6].

Cash flow management has a significant impact on many random factors in the external and internal environment, which increases risk and uncertainty. It is possible to consider the possibility of simulating many deterministic and random factors of the internal and external environment of the enterprise in the process of system dynamics research, so it is appropriate to use this simulation method. The degree of process aggregation provided by this method is sufficient to solve the problem [7].

System dynamics is currently applied in many industries, and many scholars are also applying it to the banking industry to establish system dynamics models for the banking industry, explore the issues of cash flow management, and simulate the risks and profit levels encountered by bank cash flow in various situations.

Peng, Hsiao and Yao [8] used system dynamics to construct a retirement fund model for primary school teachers in Taiwan and simulated the changing payment rate and operating performance policy reforms of the system. The study, considering the phenomenon of today's aging population and the declining birth rate have a major impact on the pension systems of various countries, provide government policy recommendations to avoid bankruptcy crises.

In summary, after discussing the relevant literature on retirement funds, most of the past studies have focused on the two major aspects of retirement fund, "system" and "management", and the impact of fund cash flow is mostly discussed only for soldiers and non-commissioned officers. Less studies are focused on "the impact of volunteer soldiers on the cash flow of retirement funds". This study can supplement the deficiencies of the existing literature and can also conduct policy analysis and provide recommendations on the current system of volunteer soldiers.

3. Research Method

A system is defined as including two or more components, working together in a certain relationship or rule [9-11]. Maani and Mahara pointed out that system thinking is a way of conceiving the hidden system structure and interrelated behavioral causality behind the problem from the perspective of holistic thinking, rather than just understanding from a single event or phenomenon at a single point in time. In other words, system thinking can assist researchers in finding effective solutions to problems in a complex environment [12].

3.1. System Dynamics

System dynamics (SD) is mainly applied to problems with complex dynamics, information feedback (feedback), and time delay (delay). It has the characteristics of quantifiable simulation and analysis of system behavior and uses the simulation of the long-term development trend of various policies to improve system performance [13-15]. System dynamics can define problems and system boundaries from a macroscopic and holistic perspective, and then perform logical analysis and use mathematical equations to set the relationship between variables in the system, qualitatively describe complex problems, interpret the causal structure of variables, and then simulate it by computer. It can observe different variables and situations to find the best solution to the problem [4].

System dynamics has been widely used in the field of public policy in the past, because system dynamics can make a systematic and overall consideration of public policy issues and can help in-depth thinking about the nature of complex issues. By studying the characteristics of information feedback within the system, it can improve organizational structure or organizational decision-making [13, 16, 17].

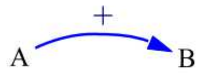
Many scholars also use system dynamics to study social insurance and pension systems. Viehweger and Jagalski constructed a dynamic model of the German pension system, constructed human flow and cash flow according to age groups and salary classes, and simulated changes in the number of people and incomes of various age groups, so as to estimate the size of pension funds under different pension systems Changing trends [18]; Chaim combined system dynamics and asset and liability management (asset and liability management, ALM) concepts to analyze the risk management of Brazilian pension funds from a financial point of view [19, 20]; Chaim and Streit combined agent theory, Fuzzy theory, asset-liability management, and other concepts to construct a population dynamics model, discuss the issues of pension fund governance and dynamic asset-liability management issues, and simulate the trend of the retirement fund system considering the complexity of the risks and uncertainties of the retirement fund [21]. Sapiri, Ahmad, Aziz, Nik, and Yusoff established a system dynamics model of pension financial activities, described the relevant factors affecting the financial activities of pension funds, and constructed pension assets to invest in government bonds, bank deposits and other investments [22]. The system dynamic mode simulates the changes of various assets to facilitate decision-makers to formulate pension financial plans. Lychkina and Morozova constructed a dynamic model of the Russian pension system, focusing on the macro-level socio-economic system, and interpreting the dynamics and non-linear characteristics of the Russian pension system and its overall system operation [23, 24]. Peng, Hsiao and Yao (2014) constructed a Taiwanese teacher pension model based on system dynamics. The model construction can be divided into cash flow and human flow, and it conducted policy simulations such as changing the contribution rate and the performance of the pension system [8].

3.2. Application of System Dynamics

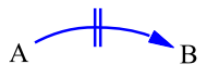
On the representation of system dynamics, pointed out that his interpretation of the problem is to use the mathematical language of the first-order or multi-order derivative function to present the feedback structure, causality, and delay effect of complex problems in the system; and the system basis of the dynamics model is to express the causal relationship between system variables in the Causal-Loop Diagram; the dynamic model modeling elements include auxiliary variables, rate, and level, etc. The descriptions are as follows:

3.2.1. Causal Link

If variable A (cause) increases, variable B (effect) increases in the same direction, the arrow represented by "+" is called a positive causal link; the arrow represented by "-" is the negative causal link.



Marking "||" on the causal chain indicates that the system is delayed over time.



3.2.2. Positive Causal Feedback Loop

A closed loop structure formed by two or more causally related variables connected to each other by causal keys. When the negative key "-" is an "even number" in the causal feedback loop, the loop is a positive causal feedback loop, which has the effect of self-reinforcing changes and will produce a virtuous cycle or a vicious cycle, producing the phenomenon of divergence that deviates from the target; when the negative key "-" in the causal loop is "odd", it is a negative causal feedback loop, which has the effect of self-regulation. This means that the system can follow the time lag to produce convergence, narrow the gap, and gradually reach a stable state toward the goal.

3.2.3. Auxiliary Variable

The type of auxiliary variable is defined by the situation of the problem. It is an information flow of product and rate. It may be an input value, or a certain output value that can be converted into a certain output. It can also be used as a part of the description of the rate. That auxiliary variables mainly have three meanings: (1) as an intermediary of information transfer between different products and rates in the process of information processing; (2) some specific environmental parameter values are a constant or conversion value of some units; (3) The input test function or value of the system, expressed by a constant or FUNCTION.

3.2.4. Rate and Level

Forrester expressed the conversion between rate and level in water pipes and water tanks. "Level" refers to the accumulation of the difference between water inflow and outflow at any point in time. Level and rate are the two core concepts that constitute the system dynamic model. Level represents the cumulative state of behavior changes over a certain period of time. For the change caused by the inflow or outflow of the main transmittance quantity, the "rate" is the change in quantity of the accumulated quantity per unit time (unit quantity/unit time) [13, 25, 26].

The rate and quantity variables in a decision-making feedback loop must include four concepts: (1) a clear goal; (2) observations of the status of the system; (3) the gap between the system target and the status; (4) taking actions based on the gap to improve the state of the system. Variables such as current situation, goals, gaps, and actions are all auxiliary variables, which can be used as an information flow between accumulation and rate.

3.3. System Dynamics Model Construction Program

System dynamics is a method for analyzing system policies and providing managers with decision-making methods. By presenting the complex relationships behind the problems as qualitative causal feedback diagrams, the variables of the causal feedback diagrams are quantified into dynamic patterns to analyze complexities. The interaction of the internal components of the system and the time-delayed information feedback, and the simulation results are used to change the functions and behaviors in the system [15, 27].

The process of constructing the model is as follows:

3.3.1. Defining the Problem

Defines the problem as "the gap between the ideal state and the actual state." Through the researcher's practical experience, he uses What, Where, When, Who and How Much to interpret the full picture of the problem and define the boundary of the problem. The insight of the research method of system dynamics is: how to deal with the problem or the way to deal with it completely depends on the quality of how the problem is defined.

3.3.2. System Characterization

System dynamics is to gain insight into the structure behind the behavior of the system, understand the dynamics of its constituent groups and the characteristics of intelligence feedback, and describe the behavior of the system in a flowing causal chain. This method of system description is called a causal feedback loop. Therefore, it is necessary to comprehensively understand the current status of the system and the influencing variables of related issues, and to observe the system behavior in depth, explain the interaction between each variable and the variable, to understand the causal relationship and information feedback of the system components, as the construction of the dynamic model of the system Base.

3.3.3. Construction Mode and Simulation

With dependent causal feedback diagram as the basis, the relationship between system goals and various variables is expressed by mathematical functions, and then quantified as a dynamic simulation model. The system contains many variables and a nonlinear dynamic relationship. To effectively deal with this kind of complex system behavior that exceeds the burden of humans, it is necessary to use computer simulations of high-speed data processing capabilities and models established by rigorous mathematical logic to clearly understand the problem instead of the real system. Only in this way can we understand the dynamic interaction between the delay state and the steady state of each variable in the system.

3.3.4. Interpretation and Correction of Results

Comparing the simulation results with the expected state of the real-world system, the lack of the above-mentioned construction principles can be implemented to modify or design the system structure to formulate improvement policies, as a simulation of the dynamic behavior of the real-world system, and then close to the real state in line with the purpose of modeling.

3.3.5. Optimization and Policy Design

This procedure must be repeatedly tested, revised, and analyzed with policy. Different policies can be used to test the impact of long-term behavioral development, promote the system model to have simulation capabilities close to the real system, and become an analysis tool that assists senior managers in effectively evaluating policy recommendation.

It can be seen from the above literature that system dynamics is applied to the supply and demand of teachers, sightseeing, willingness to participate in service learning, manpower supply and demand, retirement funds, and other related issues. However, it is rare that system dynamics is used to discuss the cash flow of volunteer soldiers' retirement funds, the dynamic model of the cash flow of the volunteer soldier's retirement fund constructed in this study is complex and changeable, so it is suitable for discussion and analysis using system dynamics.

This study takes the cash flow of the volunteer soldiers' retirement fund as the research object. The research structure is as follows: First, through the observation of the problem, the literature discussion, and the expert discussion, the thoughts are transformed into a general description through text, and the variables are extracted by integrated analysis. By collecting relevant literature, we can construct a dynamic quantitative model; test and simulate the key variables of the dynamic quantitative model to analyze the impact of volunteer soldiers on the cash flow of retirement funds; and finally, conduct policy analysis and forming conclusions and recommendations.

4. Model Construction and Analysis

4.1. Model Construction

This research aims to explore the impact of Taiwan's volunteer soldier pension system on the cash flow of military retirement funds. Through literature research and field experts' interview opinions, we will find out the key factors that affect Taiwan's volunteer soldier pension system and explore how the various factors are influencing it. We use the system dynamics computer simulation software Vensim to construct the system dynamic mode, set various equations and parameters, perform policy analysis (Figure 1), and observe the changes in the balance of the retirement pension personal account.

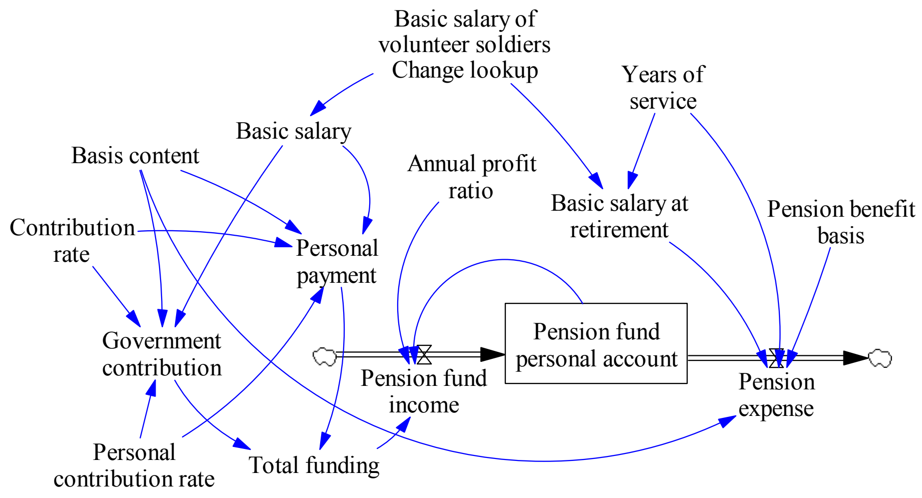


Figure 1. *The Cash Flow Model of the Retirement Fund of Volunteer Soldiers.*

The model constructed in this study mainly includes the amount of individual volunteers' monthly contributions to the retirement fund, the annual rate of return of the retirement fund, the individual account of the retirement fund, the retirement time, and the retirement pension expenditure. The above variables have a causal relationship, and their mutual relationship is complicated and has a time-delayed relationship. This study also aims at the four scenarios that may occur during the process of volunteer soldiers from enlistment to retirement. The model constructed in this article simulates the impact of volunteer soldiers' pensions on the cash flow of military retirement funds in the four scenarios. The four scenarios set conditions as follows:

1. Scenario 1: Volunteer soldiers will be discharged after serving the minimum number of 4 years.
2. Scenario 2: Volunteer soldiers will be discharged after serving for the maximum number of 11.5 years.
3. Scenario 3: Volunteer soldiers are promoted to non-commissioned officers during the period of service and are discharged from the military after serving up to the maximum number of non-commissioned officers for 16 years in accordance with regulations.
4. Scenario 4: Volunteer soldiers are promoted to chief sergeant during their service, and the maximum number of years of service until the sergeant chief is 19 years after being discharged from the army.

The voluntary soldier retirement fund cash flow model construction and simulation scenario design will simulate the results of the current system, and then conduct policy adjustment simulations for three variables, including fund rate, fund return rate, and pension payment unit, and discuss and compare them separately under different policy combinations, four scenarios of the profit and loss situation of individual retirement fund accounts.

4.2. Simulation and Analysis

4.2.1. Simulation of the Current System

The simulation results found that the balances of individual pension funds in Scenario 1 to Scenario 4 are all negative after retirement, and all show losses (see Table 1). Since volunteer soldiers have different years of service in each scenario, only the retirement benefits are compared. The balance after the fund is less extensive. To make the comparison benchmarks of each situation consistent, this research calculates the internal rate of return (IRR) separately. It is found that for the retirement fund, Scenario 2 is the most favorable, and the Scenario 1 is the most unfavorable for the retirement fund. The reason is that volunteer soldiers can retire to receive their pension after serving 4 years. Due to the small amount of pension and the short time, the long-term compounding effect of fund investment cannot be used. Therefore, the short period of service in Scenario 1 causes the greatest impact on retirement fund.

Table 1. *Current system simulation results and internal rate of return analysis table.*

Item	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Balance after pension payment	-15,171	-7,342	-209,287	-280,430
IRR	7.41%	2.25%	4.43%	4.10%

4.2.2. Simulation of the Rate Adjustment

First, we used the system simulation to find out the contribution rate that can balance the profit and loss of the retirement fund account under each situation, and then we simulated the rate of the profit and loss balance point of each scenario to obtain the balance after the retirement pension is paid in each scenario (see Table 2) When the fee rate is adjusted to 14.6%, the balance of individual pension fund accounts from Scenario 1 to Scenario 4 are all positive after retirement. It is learned that this policy can reduce voluntary service by increasing the pension fund rate. The impact of soldiers on retirement funds. Based on the minimum adjustment of the current system, the fee rate was adjusted to 12.2%, and the internal rate of return (IRR) was calculated separately. It was found that for the retirement fund, Scenario 2 was the most beneficial.

Table 2. *Simulation results of rate adjustment and internal rate of return analysis.*

Item	Rate	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Balance after pension payment	13.4%	Breakeven	46,178	-89,392	-124,054
	12.2%	-13,003	Breakeven	-192,159	-258,091
	14.5%	11,930	88,231	Breakeven	-1,187
	14.6%	13,014	92,054	13,375	Breakeven
IRR under rate of 12.2%		6.6%	1.96%	4.22%	3.92%

4.2.3. Simulation of Fund Return Rate

First, we used system simulation to find out the annual rate of return for each scenario, and then simulated the annual rate of return for each scenario's profit and loss to get the balance of pension payments in each scenario (see Table 3). The current year's rate of return is adjusted to 7.8% and the balances of the individual accounts of the retirement fund in Scenario 1 to Scenario 4 are all positive after retirement. It is learned that by strengthening the investment of the retirement fund and increasing the return on investment of the fund, the contribution of volunteer soldiers to the retirement fund can be reduced in impact based on the minimum adjustment of the current system. The annual rate of return is adjusted to 2.3%, and the internal rate of return (IRR) is calculated separately. It can be found that Scenario 2 is more beneficial to the retirement fund.

Table 3. *Simulation results of fund return adjustment and internal rate of return analysis.*

Item	Rate	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Balance after pension payment	7.8%	Breakeven	179,337	377,825	690,528
	2.3%	-14,429	Breakeven	-186,610	-245,155
	4.5%	-8,811	63,199	Breakeven	55,837
	4.2%	-9,595	54,019	-26,157	Breakeven
IRR under annual rate of return of 2.3%		7.41%	2.25%	4.43%	4.10%

4.2.4. Simulation of Pension Payment Unit

First, we used the system simulation to find the pension payment unit for each scenario, and then simulated based on the pension payment base of each scenario's profit and loss to get the balance of the pension after each scenario (see Table 4), When the pension payment base is adjusted to 1.2, the balance of the individual account of the retirement fund from Scenario 1 to Scenario 4 after paying the pension is all positive. It is learned that the policy of lowering the pension payment base can be used to reduce the impact caused by contribution of volunteer soldiers to the retirement fund. Based on the minimum adjustment of the current system, the pension payment base is adjusted to 1.4, and the internal rate of return (IRR) is calculated separately. It can be found that the second scenario is more beneficial to the retirement fund.

Table 4. *Analysis of simulation results of pension payment base adjustment and internal rate of return.*

Item	Pension payment base	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Balance after pension payment	1.3	Breakeven	54,803	-44,359	-64,323
	1.4	-5,487	Breakeven	-126,823	-172,377
	1.2	13,880	85,876	Breakeven	Breakeven
IRR under 1.4% of pension benefit base		3.99%	1.03%	3.53%	3.34%

1. Scenario 1: Volunteer soldiers will be discharged after serving for the minimum number 4 years.
2. Scenario 2: Volunteer soldiers will be discharged after serving for the maximum number of 11.5 years.
3. Scenario 3: Volunteer soldiers are promoted to non-commissioned officers during the period of service and will be discharged after serving as a non-commissioned officer in accordance with the regulations for the maximum number of 16 years.
4. Scenario 4: Volunteer soldiers are promoted to sergeant chief during the period of service, and the maximum number of years of service to the sergeant chief is 19 years after being discharged from the army.

5. Conclusion and Recommendations

The military retirement system is one of the important welfare measures of the Taiwan military. Taiwan implements a recruitment policy, and the number of volunteer soldiers has been increasing year by year. This study refers to related literature and interviews with experts in the field and uses system dynamics to explore the relationship that affects the cash flow of volunteer soldiers' retirement funds. Factors and the causal interaction between the various factors and construct a dynamic model of the cash flow assessment of the volunteer soldier's retirement fund, simulate and quantitatively analyze it, and put forward policy recommendations for improving the volunteer soldier's pension system. The study found that Scenario 1 "volunteer soldiers retired after serving the required minimum number of 4 years" has the greatest impact on the retirement fund, while scenario 2 "volunteer soldiers retired after serving the required maximum number of 11.5 years" and scenarios 4 "volunteer soldiers are promoted to sergeant chief during their service and serve as required until the maximum number of 19 years as military sergeant chief." have relatively little impact on the retirement fund. It is recommended that future policies can moderately increase the service of volunteer soldiers and the minimum number of years and encourage volunteer soldiers to be promoted to non-commissioned officers, and to extend their service time to reduce their impact on the retirement fund and maintain the military's combat power.

References

[1] Beveridge, W. (1942). Social Insurance and Allied Services. London: His Majesty's Stationery Office.

[2] Holzmann, R., & Hinz, R. (2005). Old-age income support in the 21st century: An international perspective on pension systems and reform. The World Bank.

[3] Simitsi, I., & Kalampouka, K. (2014). A New Proposal in the Public–Social Insurance System. The Case of Greece. Procedia Economics and Finance, 9, 533-538.

[4] Hsiao, C. T. (2014). Industrial development research by systems approach in NICs: The case in Taiwan. Systems Research and Behavioral Science, 31 (2), 258-267.

[5] Karl Hinrichs. (2011). Dissolving the Bismarckian Pension Regime in Germany: An Example of Reforms Leading to a Multi-Pillar System. Taiwan: Taiwanese Journal of Social Welfare, 9 (2), 91-133.

[6] Mukhopadhyay, D. (2004). Working capital management in heavy engineering firms-A case study. Management Accountant, 39 (4), 317-323.

[7] Sokolovska, Z. M. (2018). Cash flow modeling of industrial enterprises in conditions of uncertainty in the market. Economics: time realities. Scientific journal, 1 (35), 5-12.

[8] Peng, H. L., Hsiao, C. T., & Yao, M. H. (2014). Systemic Analysis of Pensions: The Case of the Taiwanese Primary School Teacher Pension Fund. Systems Research and Behavioral Science, 33 (1), 159-172.

[9] Ackoff, R. L. (1957). Toward a behavioural throry of communication in modern systems research for the behavioural scientist. W. Buckey. Ed., Aldine.

[10] Churchman, C. W. (1968). The systems approach. Dell Publishing Co., New York.

[11] Coyle, R. G. (1996). System dynamics modeling: A practical approach. New York: Chapman & Hall.

[12] Maani, K. E., & Maharaj, V. (2004). Links between systems thinking and complex decision making. System Dynamics Review, 21-48.

[13] Forrester, J. W. (1961). Industrial Dynamics. Waltham MA: Pegasus Communications Inc.

[14] Forrester, J. W. (1969). Urban Dynamics. The M. I. T. Press.

[15] Stermen, J. D. (2000). Business dynamics: Systems thinking and modeling for a complex world. New York: Mc Graw-Hill.

[16] Hsiao, C. T., Chang, P. L., Chen, C. W., and Huang, H. H. (2011). A Systems View for the High-Tech Industry Development: A Case Study of Large-Area TFT-LCD Industry in Taiwan," Asian Journal of Technology Innovation, 19 (1), 117-132.

[17] Liu, D. Y., Wang, C. K., Fang, C. Y., & Liu, P. L. (2021). A Study of Project Financing on the Defense Industry in Systems Thinking Perspective. Journal of Applied Finance and Banking, 11 (2), 131-149.

[18] Viehweger, B., & Jagalski, T. (2003). The reformed pension system in Germany, a system dynamics model for the next 50 years. In 21st system dynamics conference proceeding, 191 (10).

[19] Chaim, R. M. (2006). Combining System Dynamics and Asset-Liability Management in Pension Funds. In online Proc. of the 24th International Refereed Conference of System Dynamics Society, Netherlands.

[20] Chaim, R. M. (2007). Dynamic stochasticity in the control of liquidity in asset and liability management (ALM) for pension funds. In online Proc. of the 25th International Refereed Conference of System Dynamics Society, Boston.

[21] Chaim, R. M., & Streit, R. E. (2008). Pension funds governance: combining SD, Agent based modeling and fuzzy logic to address Dynamic Asset and Liability Management (ALM) problem. In Proceedings of the 26th International Conference of the System Dynamics Society.

[22] Sapiri, H., Ahmad, N., Aziz, N., Nik, F. Z., & Yusoff, N. N. M. (2018). A simulation model to illustrate financial activities of Malaysian fund. International Journal of Management and Applied Science, 4 (2).

[23] Lychkina, N. N., & Morozova, Y. A. (2015). Agent based modeling of pension system development processes. In SAI Intelligent Systems Conference (IntelliSys), 857-862.

[24] Lychkina, N. N., & Morozova, Y. A. (2014). Dynamic simulation of pension system development processes. In Proceedings of the 32nd International Conference of the System Dynamics Society, 20-24.

[25] Forrester, J. W. (1983). Foreword. In N. Roberts, D. F. Andersen, R. M. Deal, M. S. Garet, & W. A. Shaffer. Introduction to Computer Simulation: The System Dynamics Approach. Reading. MA: Addison-Wesley.

[26] Pagoni, E. G., & Georgiadis, P. (2020). System dynamics approaches to public–private partnerships: A literature review. Systems Research and Behavioral Science, 37 (2), 277-291.

[27] Liu, D. Y., Tsai, W. C., Liu, P. L., & Fang, C. Y. (2021). Determinants of sales revenue in innovation diffusion effects of Taiwan sports lottery during the FIFA World Cup 2018. International Journal of Research in Business and Social Science, 10 (4), 43-58.