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A SYSTEMATIC APPROACH TO EXAMINING THE MODEL OF INTRODUCING AN INFORMATION SYSTEM BY SOCIAL INSURANCE SUPERVISORY BODIES IN TAIWAN

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Abstract

Social insurance is highly relevant to the rights of the insured and the economic security of senior citizens. While a robust supervisory mechanism is in order, social insurance supervisory bodies are often limited to resources and manpower. It is hence necessary to introduce an information system to assist in the oversight. This paper conducted a literature review and expert interviews to generalize potential problems and key success factors regarding the introduction of information systems by social insurance supervisors in the case study. A systematic thinking based on system dynamics was provided for the construction of a system dynamic model of information systems in social insurance supervision and as a reference to social insurance supervisory bodies.

Key words: Social Insurance, Insurance Supervision, Information System, System Dynamics.

Introduction

Social insurance is not-for-profiting and mandatory under a government's authority. It is the combination of economic power by the majority of the people who help themselves, help each other, and help others. Through wealth redistribution, social insurance shares risks for the vast majority and helps to cover losses for few people. Insurance covers seven incidents, including birth, aging, sickness, death, injury, disability, and unemployment, in order to protect nationals with the minimum income security, balance the development of the society and ensure the life and livelihood of all.

As the social insurance system is highly relevant to the right of the insured and the economic security of senior citizens, governments establish supervisory bodies to oversee the safekeeping and utilization of insurance reserves. However, the non-profit nature of social insurance often leads to insufficient manpower due to limited resources. The introduction of information systems to boost supervisory efficiency is hence an important issue.

In the vibrant development of the knowledge economy and the highly competitive society, companies need to make real-time and accurate decisions to respond to rapid changes in the environment. They need to stay on top of internal operations and external market contexts and trends. The introduction of an information system can integrate and analyze complicated information in a database such as operational data, financial reports, and market analysis, in order to extract the critical information required for decision making, enhance decision-making efficiency, and reduce decision-making risks to respond to market competition. As far as not-for-profit social insurance supervisors are concerned, information integration with the use of an information system can help to provide effective oversight.

Past experiences indicate a long list of considerations before the introduction of information systems. Among the issues to consider are key success factors, system deployment procedures, potential problems, and performance indicators for subsequent assessments. Information quality, system quality, and service quality collectively or independently affect utilization and users' satisfaction (DeLone & McLean, 2003; Roky & Meriouh, 2015). Key success factors include system flexibility, software vendors' experiences, system accuracy, understanding of the corporate environment where the system is introduced, and the support and participation of senior managers. Potential problems include the internal operating pressure. The introduction of the system would inevitably replace certain manpower; this puts an organization to the test whether it can rapidly adopt responding measures.

External pressures may also come from industry competition, rapid change of the environment, and changes in policy and supervisory schemes. If prior planning is not well made and there is no

clear understanding of the company's directions going forward, the introduced system may not achieve the anticipated results. Under this circumstance, the system cannot enhance efficiency or boost capacity, and the time and cost spent on the system introduction would be in vain. Therefore, careful assessment and evaluation before the system introduction and constant communication during the system introduction are essential tasks for the company.

This paper conducted a literature review in order to generalize the key success factors that may influence the introduction of information systems by social insurance supervisors. Given a large number of factors, their mutual influence, and the causal relation among these factors, a holistic view is necessary for examination and research. Therefore, this study sought to construct a qualitative analytical model with system dynamics by describing factors relevant to the introduction of information systems and the interactive relations among such factors. The purpose is to draw a reference to social insurance supervisory bodies in system introductions going forward.

Literature Review

Social Insurance and Supervision.

The social insurance system is a social policy driven by the government. It is a mandatory system based on the technical principles of insurance and the risk diversification so that minimum income security is protected with insurance payouts for nationals encountering certain insured events. Currently, the social insurance system in Taiwan includes insurance for public servants and teachers, insurance for laborers, insurance for military personnel, National Health Insurance, and National Pension Insurance. As social insurance affects the rights of the insured and one's life at an old age, it is necessary to establish a supervisory regime to ensure the sustainability and development of the social insurance system. In other words, the healthy development of social insurance and its financial system is achieved with operational supervision and financial oversight.

The International Organization of Pension Supervisors (IOPS, 2010) came up with the concept of risk-based supervision (RBS). In social insurance and annuity systems, RBS focuses on the liquidity and financing capabilities of governments and public funds. The RBS model enhances the effectiveness and efficiency of supervisory oversight, strengthens the control of internal operations, adapts to change in the external and economic environments, ensures compliance with laws and regulations, and gives flexible adjustments to financial risk exposure (Linder & Ronkainen, 2004; IOPS, 2010; Adams et al., 2011). In sum, the supervisory goal is to ensure the liquidity of social insurance funds (Scobie, 2006; IOPS, 2010).

To achieve the above objective, social insurance supervisors need to invest a certain amount of manpower and resources to supervise social insurance. As social insurance is not-for-profit, there is a limitation on the available human resources and budgets. To boost supervi-

sory efficacy, the introduction of information systems is essential.

Success Factors For Information Systems

The rapid development of information systems over recent years has prompted companies to widely deploy information systems to assist in the creation of competitive advantages. Therefore, the evaluation of information systems has always been an important issue in the research on information systems. According to the Technology Acceptance Model (TAM) developed by Davis et al. (1989), users' perceived usefulness and perceived ease-of-use, after the maneuver with the information system, affect their subsequent attitude and behavioral intention (Joo et al., 2018). TAM seeks to understand and interpret the deciding factors of users' acceptance of information technology and to provide a theoretic foundation for the behavior of end users of information systems (Joo et al., 2018; Verma et al., 2018). Organizations can apply TAM to explain user behavior regarding information technology and explore ways to encourage users' behavioral intention so that the information system can fulfill its utility. DeLone and McLean (1992, 2003) developed the information system success model to measure users' perceived information quality, system quality, and service quality at the system level. System success factors have been used to examine whether information systems satisfy users and to assess the benefits that the information systems create (Pai & Huang, 2011; Roky & Meriouh, (2015).

The information system success model provides research directions and causal relation modeling for both academics and practitioners in the success and performance assessment of information systems, in order to interpret information quality, system quality, and service quality reviews and the effects on users' satisfaction levels (Roky & Meriouh, 2015). The overall information system quality consists of information quality, system quality, and service quality (DeLone &McLean, 2003). Past studies suggested that the perception of users in information quality, system quality, and service quality affects their perception of system usefulness and system ease-of-use (Pai & Huang, 2011; Verma et al., 2018).

A friendly operational interface of the information system reduces the barrier in learning and operation of users. When the output data from the system meet users' needs, it enhances users' perceived ease-of-use and usefulness of the information system. Pai and Huang (2011) combined the information system success model and TAM in their examination of the use of healthcare information systems in a hospital by nursing and administrative personnel. The research findings indicated that information quality and service quality have a significant and positive influence on perceived usefulness. At the same time, system quality and service quality have a significant and positive influence on the perceived ease-of-use. Verma et al. (2018) reviewed the literature on TAM and examined management's attitude and behavioral intention in adopting big data analytics systems. The results showed that the information quality and system qual-

ity of big data analytics systems help to enhance users' perceived usefulness and ease-of-use, which in turn have a positive influence on users' attitudes and behavioral intentions.

The assessment by users after they have operated the information system, due to varying perceptions of the information system's usefulness and ease of use, affects their satisfaction levels (Joo et al., 2018). Joo et al. (2018) employed the TAM framework in a survey on massive open online courses (MOOCs). The results suggested that university students' perceived usefulness and perceived ease-of-use of online learning systems have positive impacts on their levels of satisfaction. When determining whether to continue using an online learning system, users' satisfaction is an important mediating influencer.

Information quality, system quality, and service quality can independently or jointly influence utilization and users' satisfaction (Roky & Meriouh, 2015). When users have a positive experience with information systems, they report greater user satisfaction. Better user satisfaction feeds positively into higher usage intention. User satisfaction also affects the benefits of information systems (DeLone & McLean, 2003). The benefits of information systems refer to the impact on the performance of individuals or organizations, which includes the influence or benefits of information systems on users' behaviors and on organizations. Such influence or benefits may be savings in cost and time. To social insurance supervisory personnel, a good information system enhances their professional capability and reduces workload.

Research Method

System dynamics (SD) is a research methodology developed in 1956. An SD model's structure is expressed with an arrow for the causal link, level, rate, and auxiliary variables. These elements consist of an information feedback system, represented as a closed causal loop diagram (Forrester, 1961). The feedback structure, causal relation, and delayed effects of systematic complex issues are expressed with first-order functions or multiple-order functions, in order to interpret system characteristics and dynamic development trends (Milling, 1996).

Causal link

The causal link is illustrated in Figure 1, with the arrow between variables indicating the causal relation. If the variables change in the same direction, it is expressed with "+". If the variables change in the opposite direction, it is expressed with "--".

Figure1. Causal link.

Level

Level refers to the accumulated volume in the process of system functioning and to the objects in the real world that gradually increase or decrease in quantity over time. This indicates the status of an environmental variable at a certain point in time. It is the source of information for the model and expressed in a rectangular square as shown in Figure 2.

Figure 2. Level.

Rate

Rate refers to the change in a stock over a unit of time. It can either increase or decrease due to different directions. Rate is the rate of change in the level of stock within the time unit. It is where information is processed and transformed into action. The symbol of rate is shown in Figure 3.

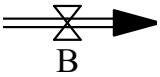

Figure 3. Rate.

Auxiliary Variables

Auxiliary variables are the parameter values that support the description of a model or represent the course of information processing. They can be any entity variable or an information variable of an input or output. It has three implications in the model: the intermediary stage of information processing, parameter values, and the input test function of the model. As shown in Figure 4, variables A, B, C, and D are all auxiliary variables.

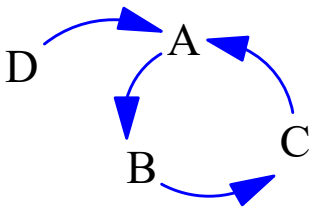

Figure 4. Auxiliary variable.

Stock Flow Diagram.

Variables are quantified into levels and rates and interconnected into dynamic relations, as shown in the stock flow diagram (Figure 5). This can be used for simulation and analysis.

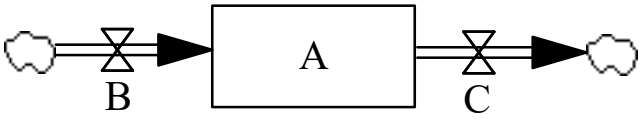

Figure 5. Stock flow diagram.

The symbols in system dynamics explain the chain of causal effects and directions for system variables. The loop of causal variables and the mutual influence among variables are visualized into a model structure, so as to quickly grasp the structural characteristics and facilitate communication with others (Sterman, 2000). The modeling of system dynamics emphasizes system structures as the structures determine system behaviors (trends). To change system behaviors, the structures need to be changed first. If structures stay the same, then the system will maintain the consistent and fixed patterns. System dynamics are currently in use mostly for the analysis of behavioral characteristics or structures such as industrial development, corporate management, defense technology, and policy development (Hsiao, 2014). The development of information systems for social insurance is limited by budgets, and the system quality is subject to the influence of internal and external factors. It is a dynamic and changing process. Therefore, this study uses system dynamics as the theoretical tool for model construction.

Model Construction

Based on a literature review, this study generalizes many key factors that influence the introduction of information systems. Interviews addressing these factors are conducted with experts in the social insurance supervisory committee of the case study. Key factors are summarized regarding the information system for social insurance supervision. Moreover, an understanding of the organizational structure, operational methods, and information system requirements is established for the case study. All these contribute to a systematic thinking and research from a holistic perspective. Once the overall picture and contexts are clarified, the simulation software VENSIM is used to produce the model diagram of system dynamics. Research findings can help the case study entity go through the issues of attention in the introduction of an information system. This insight and knowledge allow the case study entity to plan and prepare early.

Social Insurance Income/Expense Subsystem

The number of the insured changes as a result of people signing in and out for social insurance. Organizational downsizing increases the number of retirees and decreases the pool of the socially insured. The size of the insured also affects the scale of social insurance reserves, as shown in Figure 6.

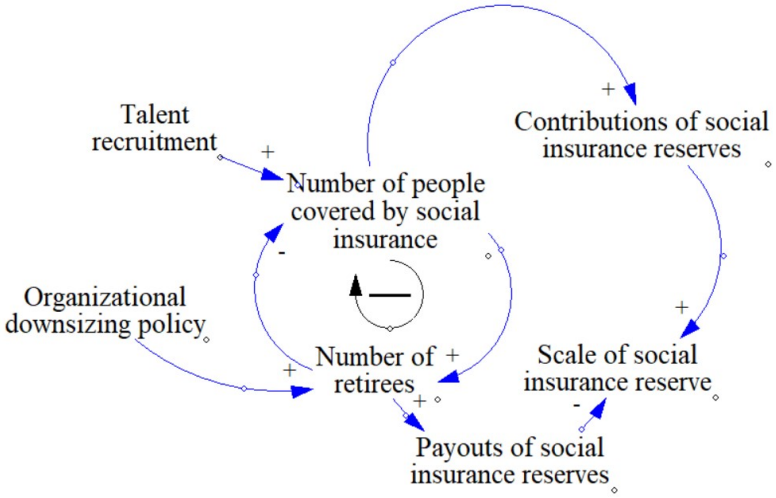

Figure 6. Social insurance income/expense subsystem.

Information System Requirements Subsystem.

When the social insurance reserves grow in scale in the case study, the social insurance supervisory committee needs to step up on their management and oversight. If the return on investment made with the social insurance reserves is not good, then the insured and competent authorities will present a question and review. This also increases the burden of management and oversight. A heavier burden increases the workload of supervisory personnel and hence the requirements for an information system. If additional supervisory manpower can be provided or supervisory personnel's professional capacity can be enhanced, then it will effectively lower the workload, as shown in Figure 7.

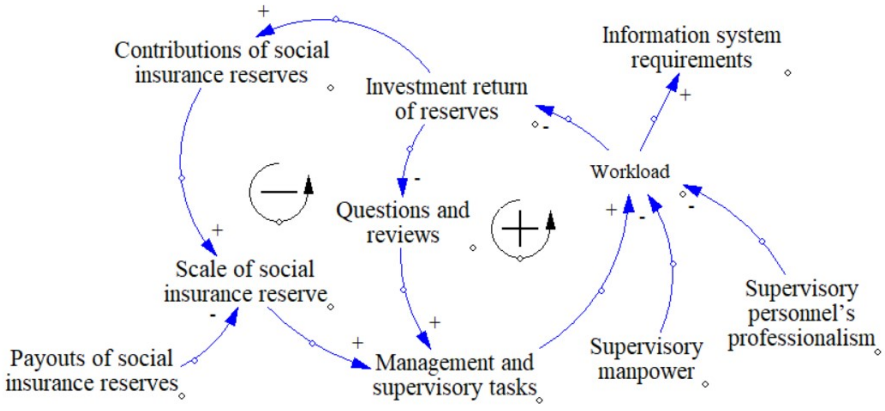

Figure 7. Information system requirements subsystem.

Information System Introduction Subsystem

As the requirements for an information system grow, the information system development should start according to the actual needs of the case study entity. The budget required for the development of an information system is subject to the influence of return on investment with reserves and the support from unit managers. The more supportive the managers are or the greater is the return on investment with reserves, the more budget there is available for system development. There are often many problems arising in the system development process. If unit managers can provide sufficient support, then it can mitigate the problems in the development process of the information system and enhance the overall quality of the system, as illustrated in Figure 8.

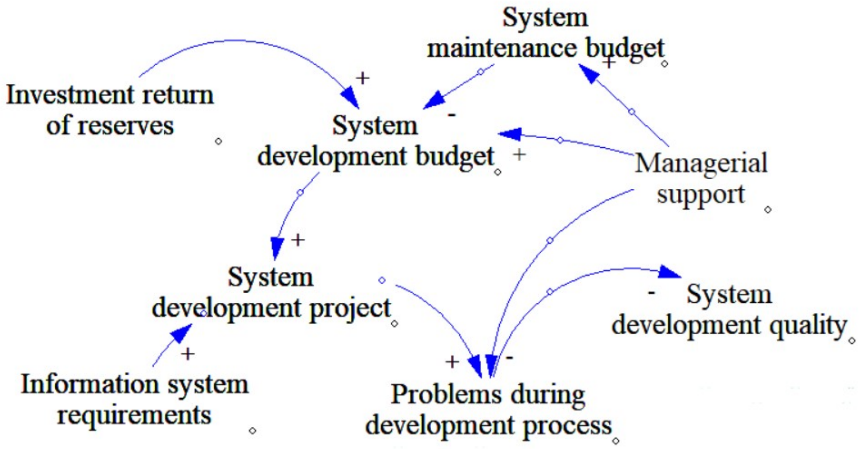

Figure 8. Information system introduction subsystem.

System Success Factor Subsystem

According to the TAM perspective and the information system success model, the higher is the information system quality, the better are the user-friendliness of the interface and the usefulness of the system. The greater the users' perceived system ease-of-use and usefulness are, the higher is the users' level of satisfaction and the better are the benefits of the information system. If the system is adequately beneficial to users, it can help to enhance the professional capacities and reduce the workload of the supervisory personnel, as depicted in Figure 9.

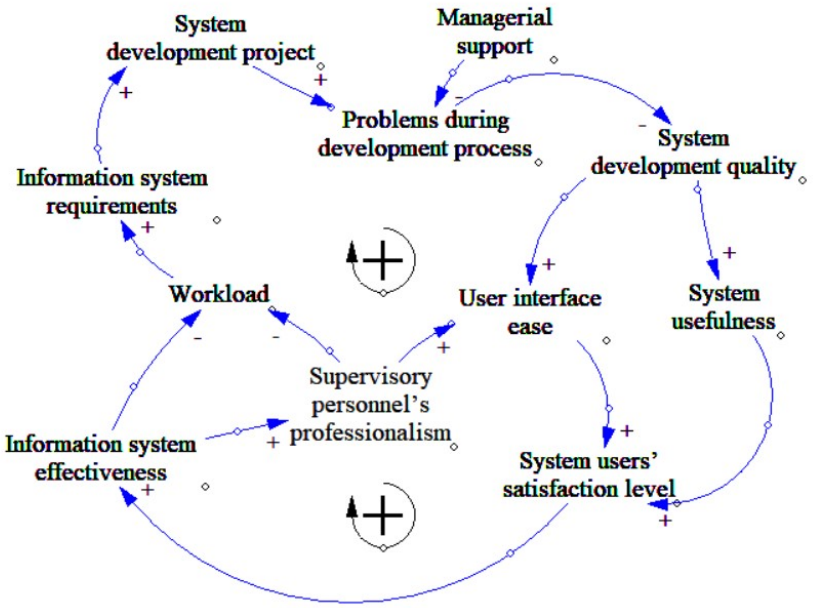

Figure 9. System success factor subsystem.

Social Insurance Supervisory Information System.

The integration of the above four subsystems can establish the overall system dynamics graph of the social insurance supervisory information system, as shown in Figure 10. As illustrated in the overall system dynamics graph, the variables among subsystems also affect and interconnect with each other. When the number of the socially insured people changes due to new sign-ups and retirements, this affects the scale of the social insurance reserves. As the social insurance reserves grow in size, the workload in reserves management and supervision increases. If the supervisory manpower does not scale up accordingly, the personnel's workload continues to rise. At this juncture, the demand for the information system goes up. However, the introduction of an information system requires a budget for system development and maintenance. If unit managers can offer sufficient support, then they will mitigate the problems during the development of the information system and improve the overall quality of the system. The greater the information system quality is, the better are the interface ease-of-use and system usefulness. The higher the users' perceived system ease-of-use and usefulness are, the higher is the users' satisfaction level and the more beneficial is the information system. When the system is sufficiently beneficial for users, it will boost the professional capabilities and reduce the workload of supervisory personnel.

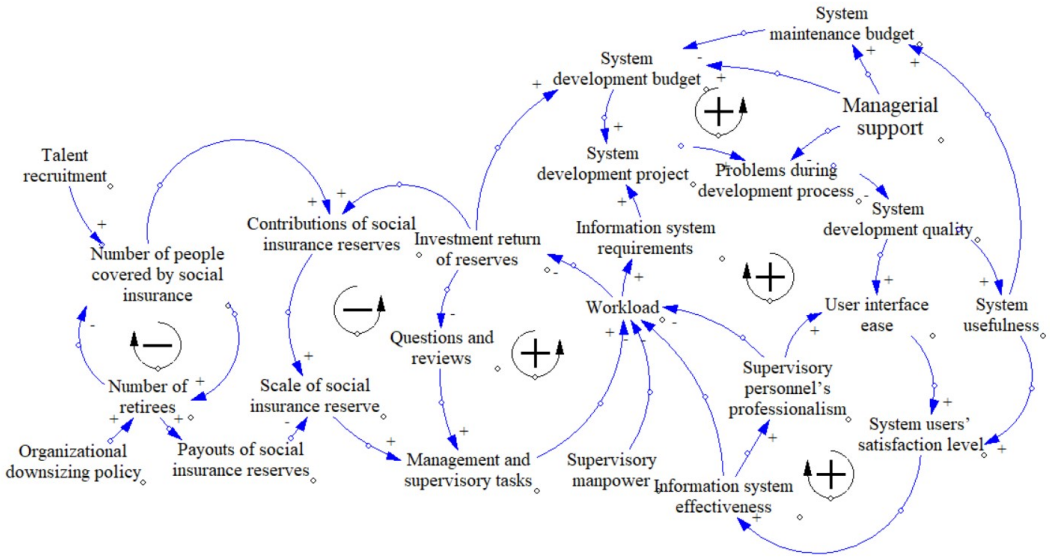

Figure 10. Social insurance supervisory information system.

Conclusion and Suggestions

The quality of social insurance management is critical to the rights of the insured, and a robust supervisory mechanism is needed to support management. However, social insurance organizations are often constrained by limited resources and inadequate manpower. Therefore, the introduction of information systems to assist in supervision is usually necessary.

There are many factors influencing the successful introduction of information systems. A systematic thinking about the causal and feedback relations among factors is warranted. Different influencing factors should be taken into account at different stages. For instance, full support from unit managers is a must in the introduction process of an information system. It is suggested that managers should understand system functions and operational flows during the planning stage, in order to obtain sufficient resources and overcome potential hurdles. In addition, information systems help supervisory personnel to carry out tasks. It is still necessary to enhance personnel's professionalism and strengthen the familiarity with system operation so that personnel can be retained and supervisory effectiveness can be improved.

This study conducted a literature review and interviews with experts to generalize the possible problems and key success factors for the introduction of information systems by the social insurance supervisory committee of the case. A systematic thinking based on system dynamics was used to construct a system dynamic model for information systems in social insurance supervision and to draw a reference for social insurance supervisory bodies. It is suggested that researchers can conduct case studies on different social insurance schemes going forward. Relevant data should be exam-

ined, and the model should be expanded and adjusted before strategic simulation and analysis. This will make research findings more practical and valuable.

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