Determinants of Managerial Performance on Taiwan Sports Lottery in System Dynamics Modeling of Strategic Management Approach

Day-Yang Liu [1], Wen-Chun Tsai[2], Chung-Yi Fang [3] and Pei-Leen Liu [4]

Abstract

The aim of this study was to identify the factors affecting sports lottery retailers' sales, in the context of strategic management by system dynamics analysis. The internal management subjective factors, internal management objective factors, and external environment factors were determined from the perspective of strategic management. Taking Taiwan as the subject for a case study, this study employed focus-group interviews and system dynamics to establish the causal relationship of the overall interaction. In response to the topic of payout ratio proposed by the governmental authority, the results showed that a higher payout ratio would stimulate the sales amount of sports lottery tickets; however, such measure might affect the revenue of the issuer or retailers. In terms of the subject of payout ratio, which the governmental authority once discussed, the results showed that a higher payout ratio would have minor increase in sports lottery sales revenue, however, such a measure might affect the profits of the issuer or retailers. This is the first study revealed that the driving force behind supply was formed by the subjective and objective factors of the internal environment, whereas the driving force behind market demand was formed by external environmental factors from the perspectives of strategic management and strategic planning.

Keywords: System dynamics analysis, Strategic management, Retailers sale performance, Managerial performance, Internal environment, External environment

1 Introduction

Sports lotteries are rapidly developing worldwide. In 2017, the global sales revenue for sports lotteries was US$304,357 million. The sales revenue in Asia was US$97,473 million, of which US$58,418 million was generated in China, the country with the highest sales revenue in Asia and in the world. Forrest and Simmons (2003) revealed that the purpose of sports lottery was for the lottery sales to be organized and approved by the government, and that the earnings would be given

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to charitable organizations. In Taiwan, retailers undertake the sales of sports lottery tickets, and the earnings are used as sports affairs in general plus going for winning prizes in dynamic games and any other international sports competitions.

For sports lottery sales, management decisions and actions concerning their long-term performance must be made in response to the opportunities and challenges in sight, and necessary tasks and methods to face competition must be determined (Tsai and Chu, 2014). The procedure of strategy management includes the analysis of the external environment and evaluation of internal resources (Delery and Doty, 1996). The external environment of sports lottery sales refers to external variables that are out of the retailers' control, such as the population, social and political condition, per capita discretionary income, and major event effects. The internal resources refer to variables concerning the psychological or cognitive level, including professional level of the retailer and sales ability.

The operating environment of a company is subject to the influences of the politics, economics, technology, and social culture of a country. Therefore, any company engaging in production and operation must consider the environmental variables. For sports lottery retailers, the major factors affecting sales are population, people's consumption capacity, number of major sports events, and approved betting targets, which retailers cannot control.

The more sports lottery tickets that are sold, the greater the return and commission that the operator and retailers receive. The operator may increase the budget for in-service education to enhance the professional level and sales ability of retailers and raise the sales amount of sports lottery tickets. The overall professional level of retailers may be improved by in-service education or instruction by experts provided by the operator. The driving force behind supply formed by subjective and objective factors of the internal environment and the driving force behind market demand formed by external environmental factors affect and interact with each other. Therefore, all of the factors must be considered simultaneously to conduct the research from strategic management approach.

The nature of sports lottery problems is complex, and a causal relationship exists among the numerous variables. Studies have discussed either consumers' behavior (Li, et al., 2012; Shu-zhuang, 2007; ZHOU and ZHOU, 2004) or the performance and sales of the retailer, and the hardware and software of sports lottery services (Farrell et al., 1999; Gilmore and Collucci, 2009; Jawaharlal et al., 2003). Few studies have conducted research on sports lottery from a systemic dynamics analysis integrating the two aforementioned aspects. Systems thinking is a method employed to understand the hidden cause–effect relationship between the system structure and the related actions from a systemic angle, rather than from the perspective of an individual incident or at a particular time. In other words, systems thinking enables researchers to determine effective problem-solving strategies in a complex environment (Hsiao, 2014; Senge and Forrester, 1980).

Sports lottery sales in Taiwan ranked eighth in the world at US$1,114 million (La Fleur Almanac, 2017). The Taiwan Sports Lottery is issued by private organizations selected by the government through competitive bidding process based on their proposals. The operator is responsible for handling the operation, sales, and promotion, as well as announcing the games process and results, awards, and related management affairs.

Overall, because of the complex causal relationships between numerous relevant variables of a sports lottery and the operation of sales system, the present study selected Taiwan as the subject for a case study and analyzed the Taiwan Sports Lottery using systems dynamics analysis in the context

of strategic management. The model comprised three aspects: subjective factors of the internal environment, objective factors of the internal environment, and external environmental factors. Variables related to retailers were collected through compiling literature. Subsequently, key affecting factors were identified by the evaluation and judgment of experts in the field to form the base of the system dynamics model. Finally, a simulated analysis was conducted to obtain data and development trends. This study serves to fill the gap in relevant literature and as a reference for other countries that are interested in retailers' sales of sports lottery.

2 Literature review

2.1 Strategic management approach

Strategic management is a systematic method for responding to strategy changes (Ansoff and McDonnell, 1990). Such a method is applicable to numerous topics, such as marketing, finance, production, human resources, research and development, organization, and decision-making. Moreover, it involves establishing the principle of overall action and resource distribution of a company by integrating the relevant topics and decision-making of a company and its long-term solution for survival and development in the environment (Delery and Doty, 1996). The core of strategic management is for the organization to adapt to a rapidly changing operating environment and establish sustained competitive advantage.

Sports lottery sales has been the subject of numerous academic studies, most of which have focused on the effects on consumer behaviors (Dongfeng, 2008; WANG and WANG, 2004; Zhonglu and Dongmei, 2007) and on the society (BAI et al., 2010; Forrest and Simmons, 2003; Li, et al., 2012; Mao et al., 2015); only a few of the studies discussed the retailer. The environment changes with the times and is dynamic and complex. Supply and demand factors affecting sports lottery sales are numerous. One study revealed that large sales revenue growth is affected by the growing proportion of award distribution; thus, altering the distribution plan of sales revenue may increase the sales revenue (Farrell et al., 1999). In addition, Mikesell (1994) studied lottery sales in the United States and revealed that during a recession, lottery tickets with a low price and a chance to win large prizes were more attractive to people, and when the unemployment rate increased from 4% to 5%, the quarterly lottery sales increased by approximately 4.25%. Moreover, the analysis showed that with the continuous expansion of economics, the per capita real sales amount flattened out. In other words, the lottery sales were subject to the influences of economic prosperity. Borg and Mason (1988) indicated that when the income increased, the demand for lotteries also increased. Additionally, Haisley, Mostafa, and Loewenstein (2008) maintained that lottery sales were subject to per capita disposable income. Lottery purchasers believed that the chance of winning was the same regardless of wealth. Therefore, compared with other income levels, people with a low income or those who believed their income was lower than average were more inclined to purchase lottery tickets. All operating activities of a company occur in the market, and the market is subject to the influences of the politics, economics, technology, and social culture of a country. Mah'd et al. (2013) discuss whether differences exist in performance between those managers who work in universities which maintain a budget participation environment and those who work in universities which centralise budget decisions into the hands of the top management. The results suggest that the performance indicators of the respondents in the participation group are significantly better than

the performance indicators of the respondent in the centralised group. Therefore, any company that engages in production and operation must consider environmental variables. For sports lottery retailers, the major factors affecting sales are the population, people's consumption capacity, number of major sports events, and approved betting targets, which retailers cannot control. Such factors must be considered simultaneously to identify the codependent and interactive dynamic equilibrium relationship under partial and complete basic frameworks.

In addition, in terms of sports lottery management and sales, studies focusing on new lottery tickets or sales channels were achievable through promoting the liaison of different systems, emphasizing the setting of regulations, optimizing the retail environment, enhancing service rationale, and perfecting marketing mechanisms (Nan-yun and Wen-dong, 2004).

When retailers understand the lottery more deeply, they can recognize customers' subjective feelings and interact with them at the appropriate moment; moreover, they are able to introduce an accurate conception concerning the lottery (Ladouceur et al., 2004). In addition, the sales location of the retailer, whether it was physical or virtual, had certain effects on the sales ability of retailers. By setting up a customized website, retailers can not only offer lottery products, but also promote non-lottery products to enhance their sales ability (Amada, 2006). Additionally, in-service training explained the randomness of the lottery to participants, who benefited from the information and resources in posters, brochures, videos, and review classes provided by such training courses (Giroux et al., 2008). As a result, the sales ability was enhanced.

According to the abovementioned studies, the factors that affect the operation and sales of retailers are numerous. The present study selected Taiwan as the subject for a case study and conducted focus-group interviews with the Operations Manager and Chief Executive Officer of the Taiwan Sports Lottery, the Center for the Study of Lottery and Commercial Gaming, and expert scholars in Asia to identify relevant variables. Such variables were related by causation and had a complex relationship with time delay. To fully understand the supply and demand of sports lottery retailers, systems thinking was applied. Mahara et al. (2004) maintained that system thinking is a method employed to understand the hidden cause–effect relationship between the system structure and the related actions from a systemic angle, rather than from the perspective of an individual incident or at a particular time. In other words, systems thinking enables researchers to determine effective problem-solving strategies in a complex environment This study conducted discussions from internal subjective, internal objective, and external objective perspectives in the context of strategic management.

Sports lottery refers to lotteries played by predicting the process and result of a variety of targeted sports and competitions. Problems concerning the sales of such retailers are complex and related by causation (Bowen, 1992; Richardson, 1991; Sterman, 2000); from the point of view of strategic management, such problems can be categorized by the external and internal environment. The external environment of a company refers to the collection of external factors that affect its survival and development. The internal environment is also known as the internal conditions, which refer to the collection of the capabilities and resources within a company. Because sports lotteries are complex and dynamic, a systematic analysis is the optimal method for studying them relationship under partial and complete basic frameworks.

2.2 System dynamics

System dynamics is a methodology of management science developed by Professor Jay W. Forrester

of Massachusetts Institute of Technology in 1956. Jay W Forrester (1961) indicated that system dynamics could use models to improve organizational structures and assist in policy making through its understanding of information feedback from within a system. Hsiao (2014) compiled definitions of system dynamics given by various scholars and elaborated system dynamics in detail, maintaining that the bases of system dynamics were information feedback theory, decision-making theory, and system design, and that the main factor affecting system behavior was system structure. Therefore, a causal loop could be used to describe system structure, which could then be used to simulate system behavior, which served as references for system improvement and decision-making.

Jay Wright Forrester and Forrester (1969) stated that the standard structure of a system dynamics model was a closed causal loop diagram of the information feedback relationship between causal link, level, rate, and auxiliary, as indicated by arrows. The component are elements and symbols. System dynamics focus on the integration of a system and the construction of feedback models (Jay W Forrester, 2007). Sterman (2000) revealed that system dynamics present the complex relationships behind problems in a qualitative causation feedback diagram. To further analyze the components' interaction within the complex system and the information feedback of time delay, the variables of the causation feedback diagram were quantified to establish a dynamic model that could change the function and behavior of a system using simulation results. Such a methodology conducts systematic policy analysis and assists managers in decision-making. Therefore, the modeling procedure of system dynamics is divided into structural problem confirmation, causal loop modeling, system dynamics modeling, scenario modeling, execution, and learning laboratory (Maani and Cavana, 2000).

The present study discussed relevant factors of the sales system of a retailer based on strategic management approach. The discussion was conducted from the aspects of subjective factors of the internal environment, objective factors of the internal environment, and external environmental factors, to establish the system dynamics model. Variables related to retailers were collected through compiling literature. Subsequently, key affecting factors were identified by the evaluation and judgment of experts in the field to form the base of the system dynamics model. Finally, a simulated analysis was conducted to obtain data and development trends.

3 Modeling process

Because the factors affecting sports lotteries are numerous, the present study used Taiwan as its subject for a case study, and employed focus group interviews and system dynamics as its methodology, wherein variables were obtained from the focus group interviews. The modeling process of this study is as follows (Jay W Forrester, 2007; Senge and Forrester, 1980).

3.1 Model building and boundary setting

The factors affecting the operation and sales performance of retailers are numerous, interrelated, and dynamically complex. In accordance with the research objective, the present study employed a system dynamics approach to develop an analysis model and used Taiwan as its subject for a case study. Moreover, the aforementioned system dynamics modeling principle and procedure were followed. The modeling procedure is as follows:

Step 1. Defining research problems

According to the research objective, Taiwan Sports Lottery retailers were selected as the study

subject to determine the subjective and objective factors of the internal environment as well as the external environmental factors. Subsequently, the characteristics of the problems were analyzed and the border of the system was determined. Finally, the research topic was set as determining the critical success factors for sports lottery retailers.

Step 2. Identifying key factors

The complexity of sports lottery operation and relevant studies were discussed in the Literature Review section. The discussion served as a reference for the modeling of the present study. By compiling, organizing, and analyzing literature and conducting interviews and discussions with scholars and experts in the field, the characteristics of sports lottery retailers and possible factors affecting the performance were identified.

Step 3. Qualitative modeling

A qualitative causal loop diagram was developed by determining the causal interactive relationships between the variables. The validity of the qualitative model was tested using triangulation (N. Denzin, 1970; N. K. Denzin, 2017); moreover, scholars and experts were invited to examine, discuss, and participate in the modeling process. The causal loop diagram was drawn using the system dynamics computer simulation software package Vensim DSS 7.3. The system was conceptualized into this diagram to manage the critical variables and elaborate the relationships between these variables.

Step 4. Quantitative modeling

Mathematic functions were introduced to handle the mathematic relationships between the variables, and Vensim DSS 7.3 was employed to convert the aforementioned causal loop feedback model into a quantitative simulation model. The quantitative model was tested using the model verification method proposed by Senge and Forrester (1980) and Sterman (2000), focusing on verifying the model's structure and behavior. Scholars and experts were then invited to examine, discuss, and participate in the modeling process to ensure the validity of the quantitative model. Corrections and redesigns were made based on the shortcomings of the model in order for the model structure and behavior to approach reality and fit the modeling objective.

Step 5. Scenario simulation and analysis

By simulating various scenarios and integrating the intervention of sensitivity analysis into the system, a long-term behavioral development trend was obtained. The result was used to evaluate the effects on the critical success factors for sports lottery retailers. Therefore, such a model could serve as an effective analytical tool and policy laboratory for assisting the evaluation of policies.

3.2 Purpose of the model

The purpose of this study was to recognize and categorize the characteristics of the current sales system of sports lottery retailers by studying and analyzing the current sales model and relevant affecting factors. Subsequently, the qualitative causal model was converted into a dynamic quantitative model to simulate system behavior and conduct policy analysis. The qualitative model in this section was constructed through observing problems, personal practical experiences, mental models, and relevant literature. Mental data were converted to general text descriptions to identify the affecting factors with causal relationships, which served as the basis for qualitative modeling. Finally, Vensim was employed to establish a qualitative causal loop diagram, which served as the basic model for the study.

3.3 Model description

The factors affecting the operation and sales performance of retailers are numerous. The present study discussed relevant factors of the sales system of retailers based on strategic management approach. The discussion was conducted from the aspects of subjective factors of the internal environment, objective factors of the internal environment, and external environmental factors, to establish the system dynamics model. Variables related to retailers were collected by compiling literature. Then, key affecting factors were identified through the evaluation and judgment of experts in the field to form the base of the system dynamics model. Finally, a simulated analysis was conducted to obtain data and development trends.

This study established a complete causal feedback loop by connecting the three subsystems, namely the subjective factors of the internal environment, objective factors of the internal environment, and external environmental factors. The causal relationships and interactions between the variables of each subsystem.

(1) Objective factors of the internal environment

The subsystem modeling of objective factors of the internal environment for the operation of the sports lottery retailer included variables such as the number of retailers, sales personnel, personnel budget, rent and setups, commercials and marketing, in-service training, sales commission, and profits.

The causal loop diagram (Fig. 1) indicated that the more sports lottery tickets sold, the greater the return and commission that the operator and retailers receive. The operator could increase the budget for in-service education to enhance the professional level and sales ability of retailers to raise the sports lottery sales amount. Additionally, the retailer could increase the personnel budget to hire better-qualified sales people and rent a preferable shop with a higher rent budget to improve the sales ability and increase the sports lottery sales amount. As a result, a positive causal feedback loop can be formed.

(2) Subjective factors of the internal environment

The subsystem modeling of subjective factors of the internal environment for the operation of the sports lottery retailer included variables concerning the psychological or cognitive level such as the professional level of retailers, sales ability of retailers, and consumers' desire to buy.

The causal loop diagram (Fig. 1) indicated that the overall professional level of retailers could be improved by the enhanced in-service training provided by the operator or better-qualified personnel hired by the retailer. Moreover, the retailer could invest in the setups or rent a preferable but more expensive shop to improve their sales ability. The consumers' desire to buy, which also affected the sports lottery sales amount, was subject to influences such as the number of major sports events, approved betting targets, and commercials and marketing. The variables concerning the psychological or cognitive level, such as the professional level of retailers, sales ability of retailers, and consumers' desire to buy, were difficult to be quantified. Therefore, further investigation is required to obtain relevant information.

(3) External environmental factors

The subsystem modeling of external environmental factors for the operation of the sports lottery retailer included external variables that are out of the retailers' control, such as the population, per capita disposable income, major event effects, and betting targets.

All operating activities of a company occur in the market, and the market is subject to the influences of the politics, economics, technology, and social culture of a country. Therefore, any company that engages in production and operation must consider environmental variables. For sports

lottery retailers, the major factors affecting sales are population, consumption capacity of the people, number of major sports events, and approved betting targets, which cannot be controlled by the retailers. Such factors must be considered simultaneously to identify the codependent and interactive dynamic equilibrium relationship under partial and complete basic frameworks.

This study connected the aforementioned subsystems to form a complete causal feedback loop in accordance with the interrelationships of the variables of the subsystems and the characteristics of sports lottery retailers in Taiwan. The following section describes the simulation experiments based on the dynamic simulation of system dynamics and conducted under strict logical operation. In these experiments, an effective analysis of system behavior and development trends was achieved by establishing a qualitative model and a quantitative model followed by conducting a scenario simulation.

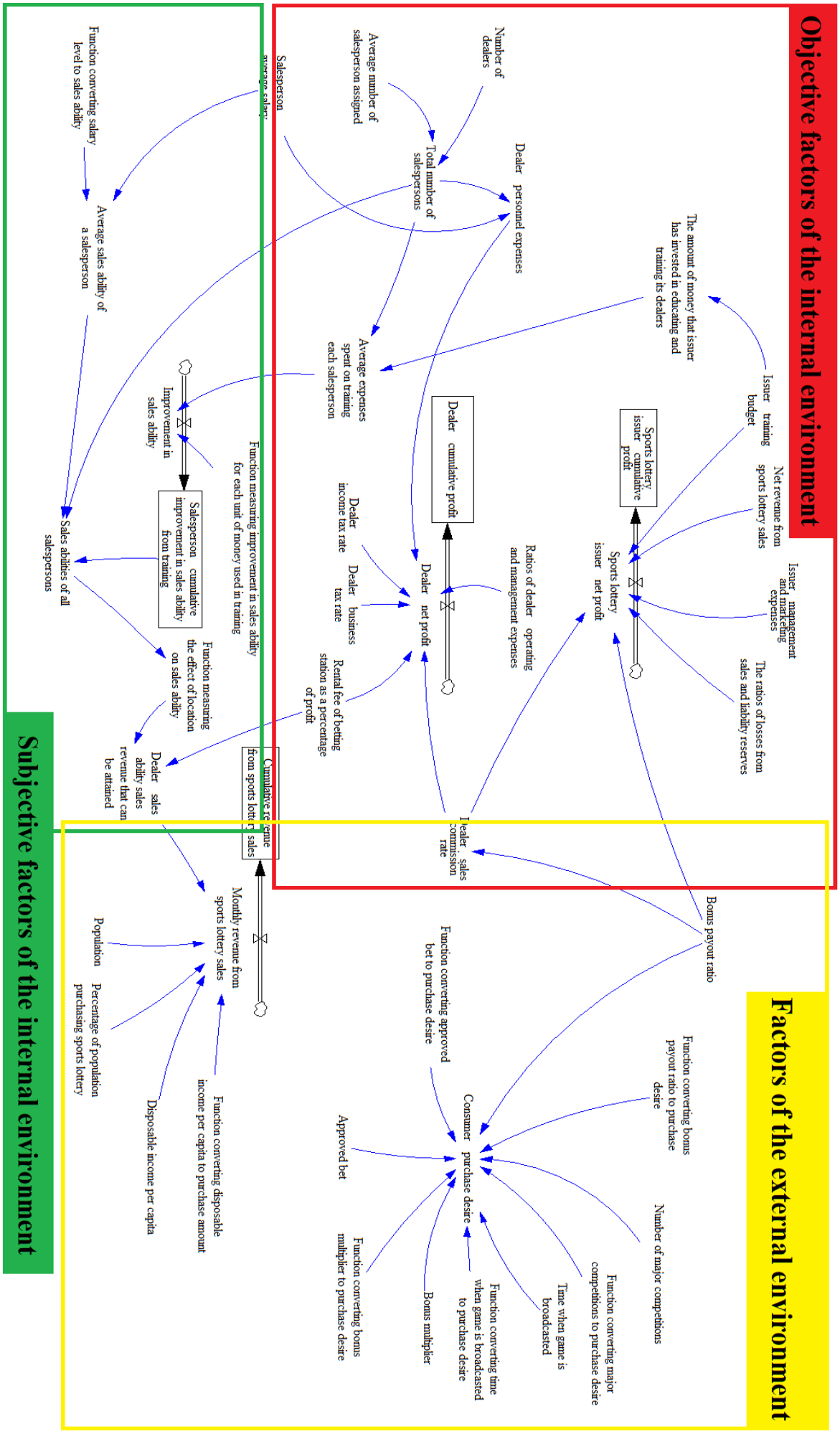

Fig 1. Causal loop diagram of the operation and sales system of Taiwan Sports Lottery retailers

4 Simulation experiments and analyses

The SD model designed previously was implemented through VENSIM© to validate proposed concepts and structures for analyzing problem/system behavioral characteristics, that is the relationship between system inputs (changes at factor level) and outputs (changes at system level), and the sensitivity of decisions with respect to model parameters(M. Zhou et al., 2016).

This study employed a simulation period of 1 month and ran for 73 periods from January 2014 (period 0) to December 2019 (period 72). The experiment was conducted under different hypothetical scenarios and three sets of parameter inputs, namely optimistic, regular, and conservative, to observe the simulated changes of the following: monthly sports lottery sales revenue, cumulative sports lottery sales revenue, cumulative profits of the sports lottery issuer, and cumulative profits of the retailers. The simulation scenario settings and a description of each are presented in Table 1:

Table 1. Simulation scenario settings

Scenario	Adjusted variable	Parameter setting		
		Conservative	Regular	Optimistic
Regular scenario	None	Current situation in Taiwan (system default setting)		
Hypothetical scenario 1	Percentage of sports lottery consumers	4.69% (30% less than the default setting)	6.70% (same as the default setting)	8.71% (30% more than the default setting)
Hypothetical scenario 2	Payout ratio	85.80% (10% more than the default setting)	78.00% (same as the default setting)	70.20% (10% less than the default setting)
Hypothetical scenario 3	Number of events for betting	30% fewer events for betting annually than the previous year starting from the 37th month (i.e., 2017)	The number of events for betting remains the same as in 2016 after the 37th month (i.e., 2017)	30% more events for betting annually than the previous year starting from the 37th month (i.e., 2017)

4.1 Regular scenario

This study conducted policy simulation analysis with three scenarios. The results of the regular scenario simulation are presented in the following figures: Fig. 2 presents the monthly sports lottery sales revenue; Fig. 3 presents the cumulative sports lottery sales revenue; Fig. 4 presents the cumulative profits of the sports lottery issuer; and Fig. 5 presents the cumulative profits of the retailers.

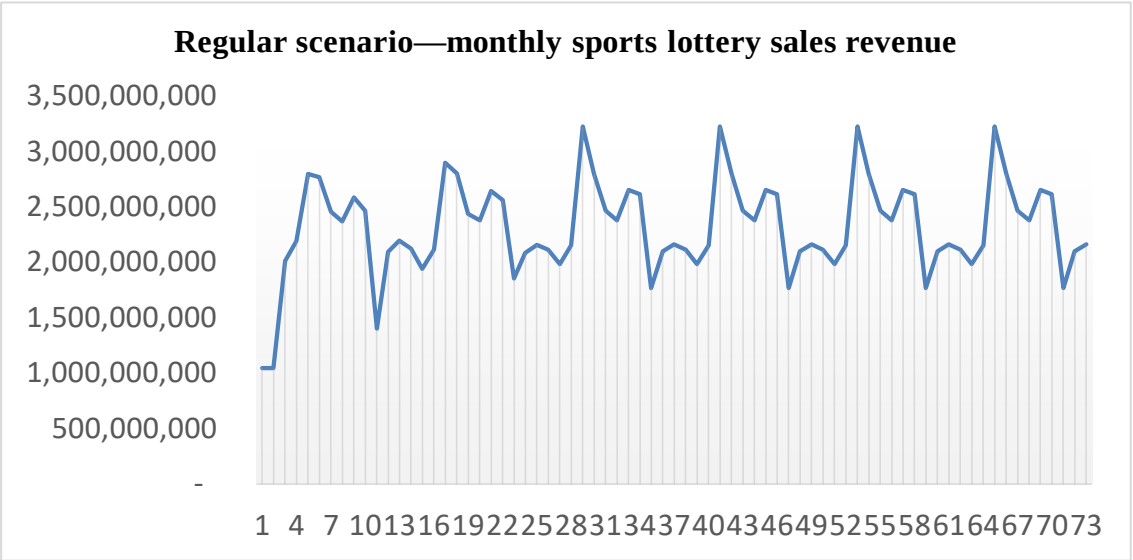

Fig. 2. Regular scenario—monthly sports lottery sales revenue

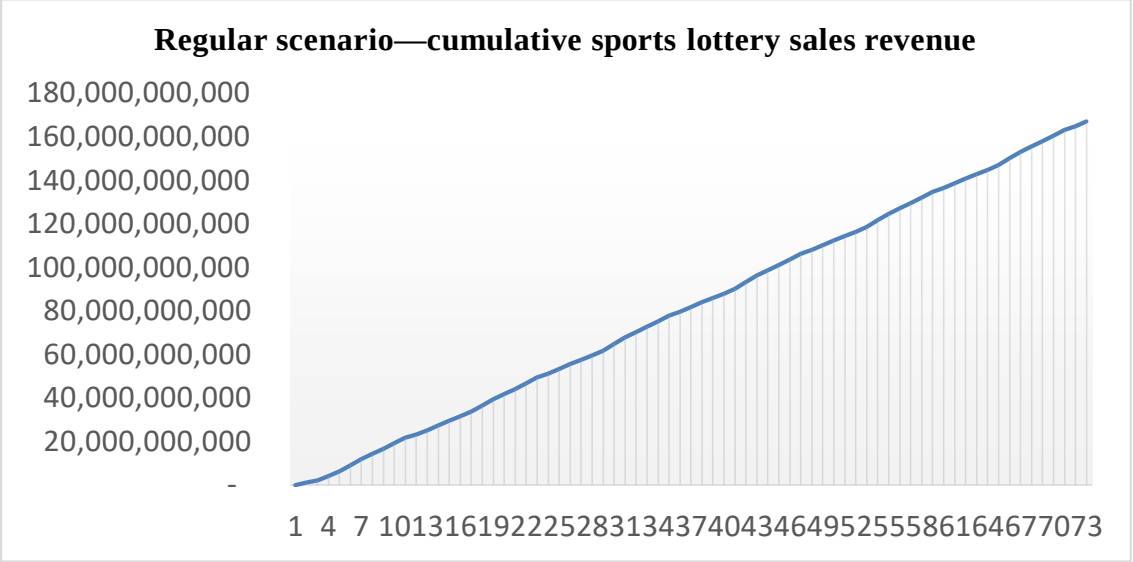

Fig. 3. Regular scenario—cumulative sports lottery sales revenue

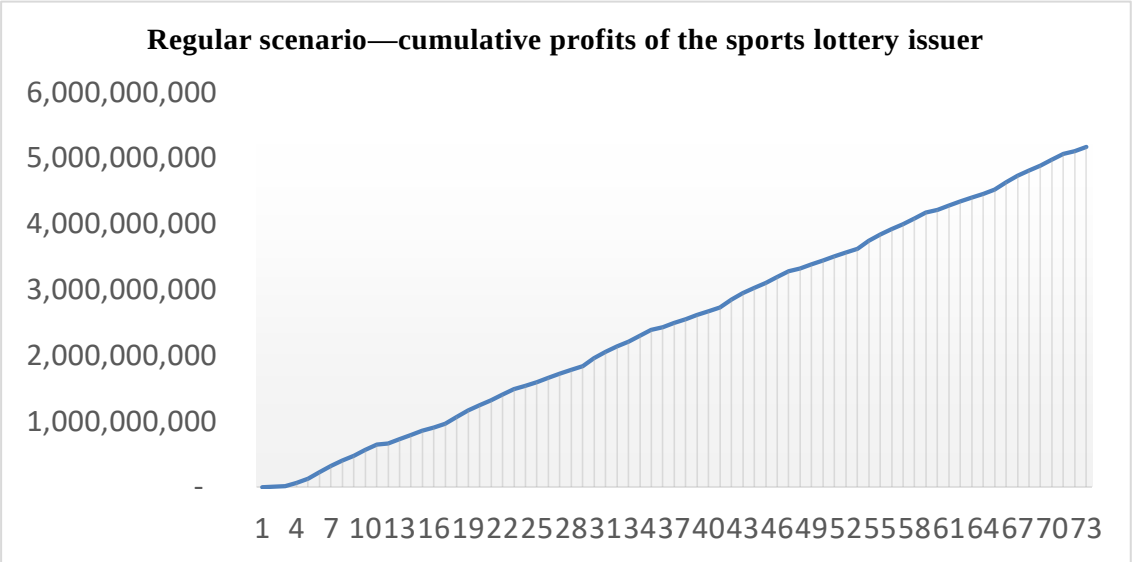

Fig. 4. Regular scenario—cumulative profits of the sports lottery issuer

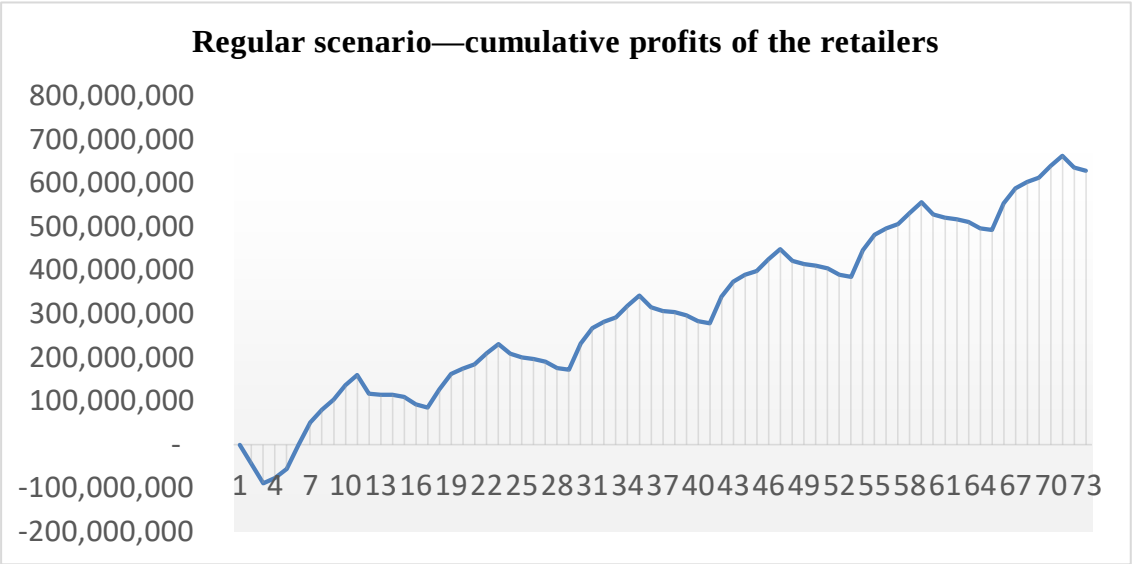

Fig. 5. Regular scenario—cumulative profits of the retailers

4.2 Scenario 1: Change in the percentage of sports lottery consumers

Changes in the percentage of sports lottery consumers are subject to changes in economic prosperity and demand. The demand for sports lotteries changes every year. Because of the great popularity of sports, sports lottery game rules are constantly being renewed to meet consumers' demands. Furthermore, the performance of the lottery program and quality of service change to increase the demand. In this simulation, the monthly sports lottery sales revenue increased or decreased when the percentage of consumers increased or decreased. In terms of the growth trend of accumulative sales revenue, under the conservative setting, the growth became moderate in the later stimulation periods compared with that under the regular setting. Such an observation revealed that the environmental factor of sports lottery consumer percentage affected the overall sales amount. Moreover, under the same degree of increases and decreases of said setting parameter, either to increase or decrease the parameter value by 30%, the conservative setting had greater effects on the sales revenue. In terms of the growth trend of the cumulative profits of the issuer and the cumulative profits of retailers, the conservative setting resulted in a moderate growth in the later period of the simulation and a critical recession, respectively.

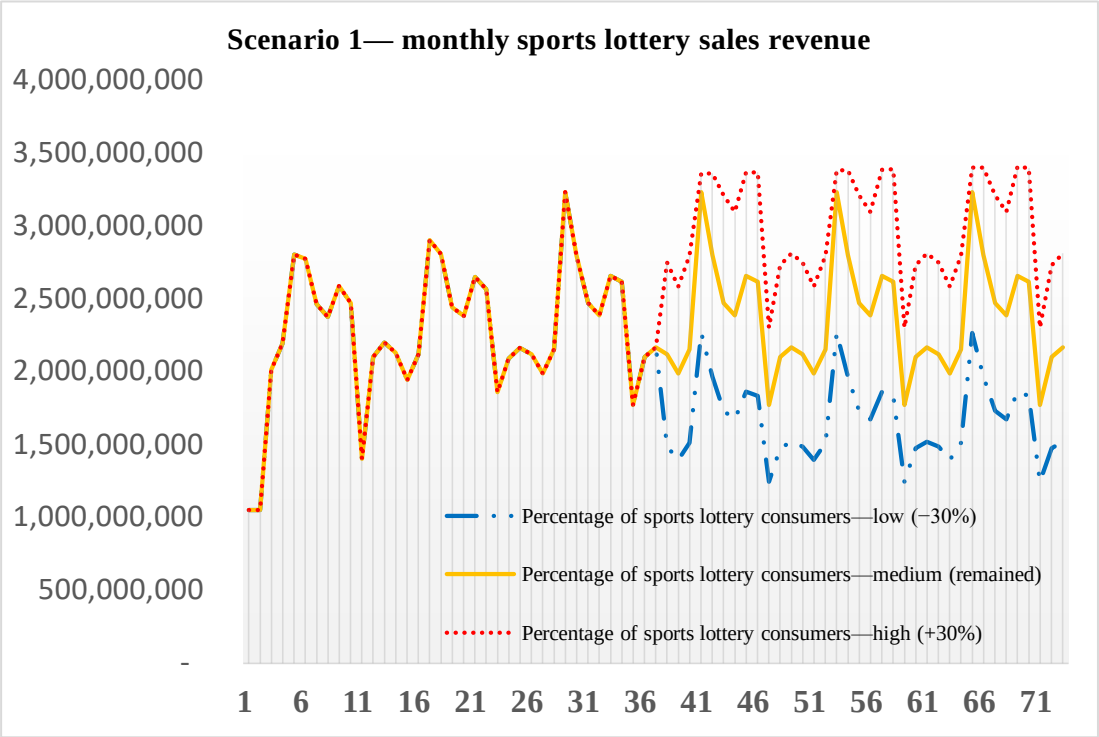

Fig. 6. Scenario 1— monthly sports lottery sales revenue

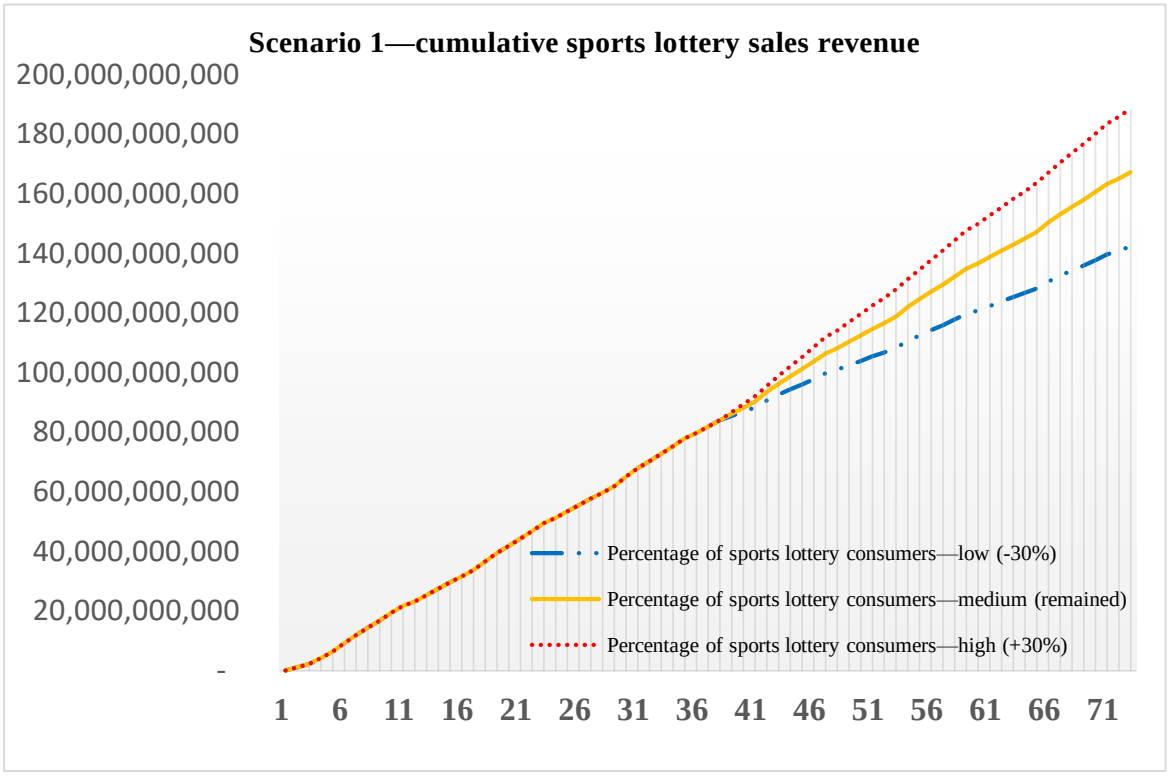

Fig. 7. Scenario 1—cumulative sports lottery sales revenue

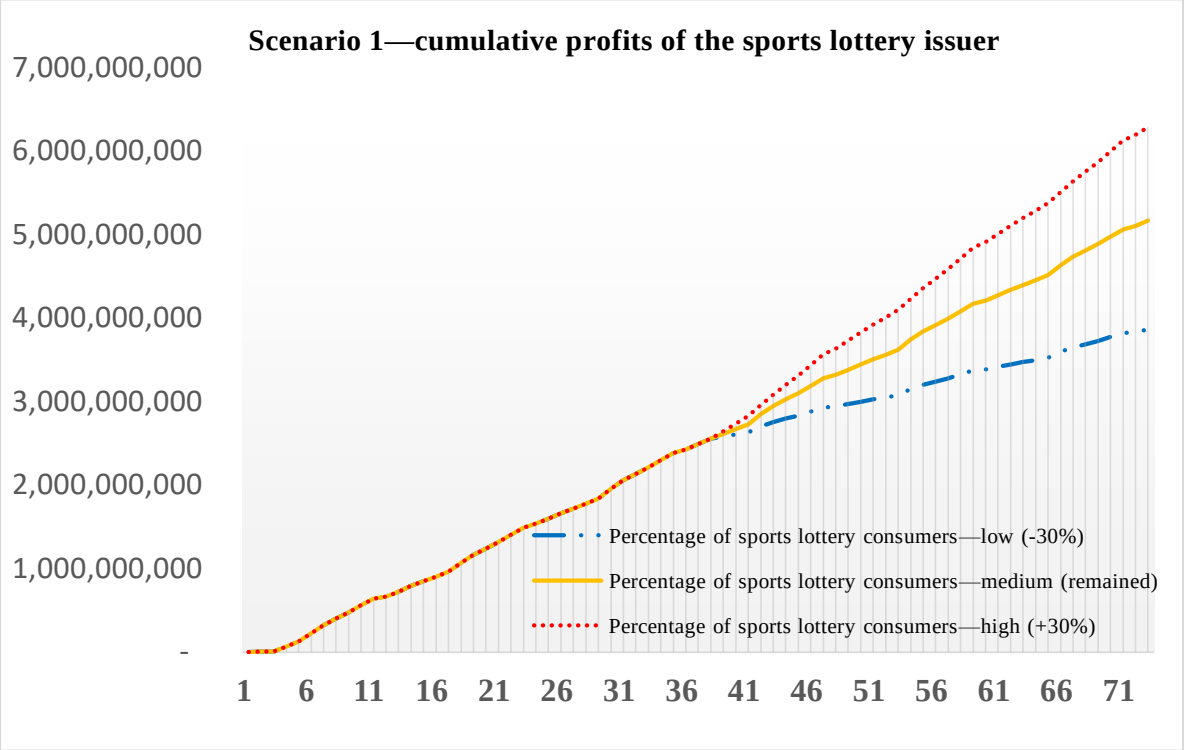

Fig. 8. Scenario 1—cumulative profits of the sports lottery issuer

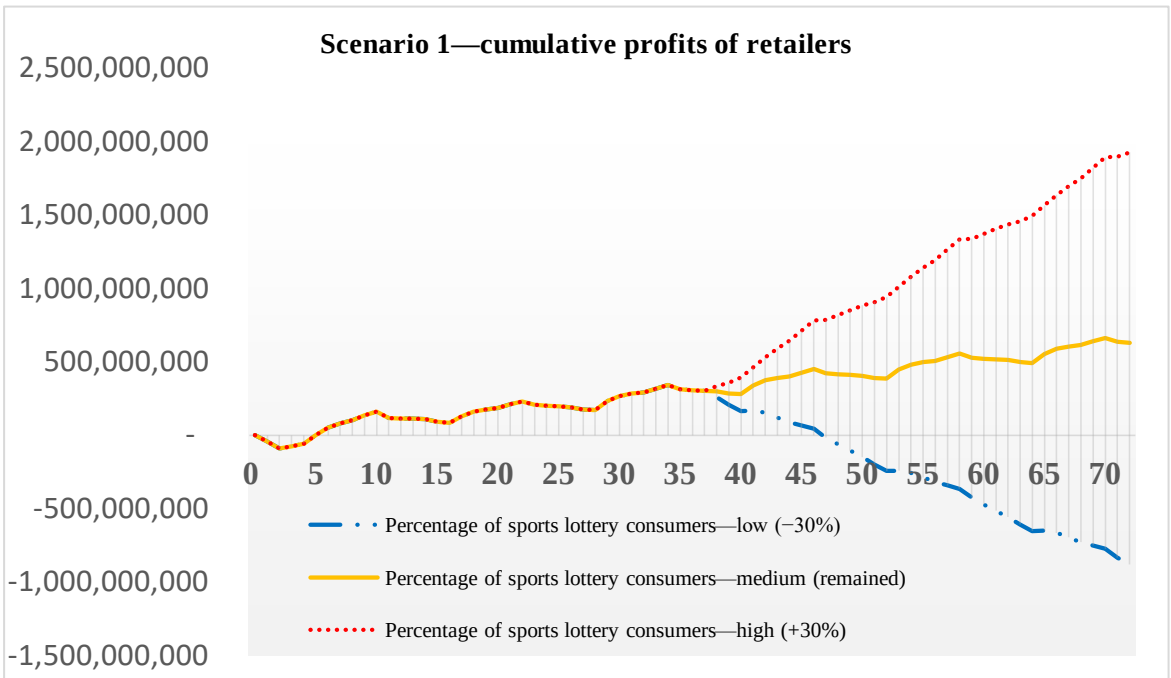

Fig. 9. Scenario 1—cumulative profits of retailers

4.3 Scenario 2: Changes in payout ratio

Generally, increases and decreases in the payout ratio resulted in the increase or decrease of the overall sales amount. Compared with adjusting the percentage of consumers, adjusting the environmental factor of payout ratio had less of an effect on the overall sales amount. In terms of the growth trend, when the payout ratio was increased to 85.8%, the operator would experience loss and the retailers would face substantial loss.

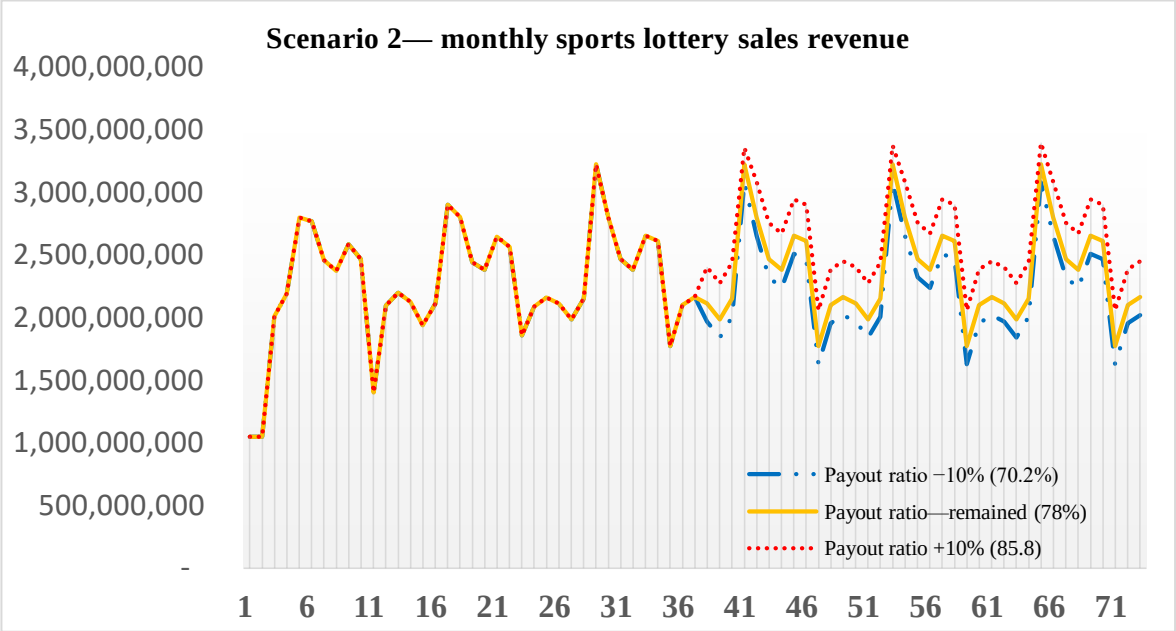

Fig. 10. Scenario 2— monthly sports lottery sales revenue

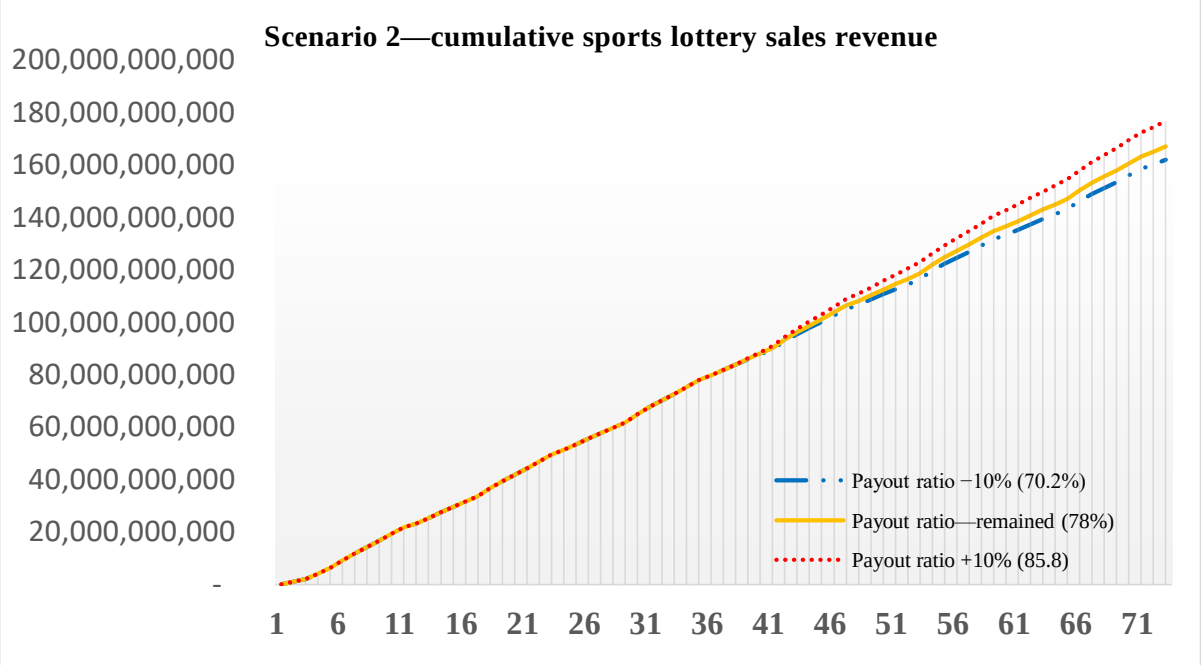

Fig. 11. Scenario 2—cumulative sports lottery sales revenue

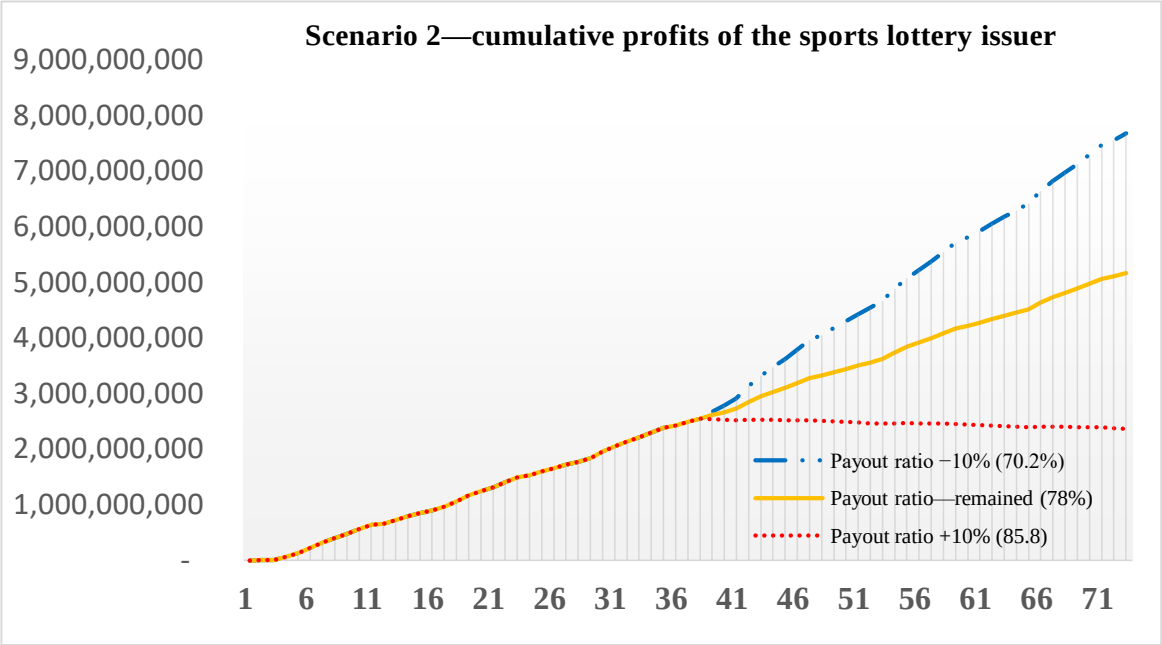

Fig. 12. Scenario 2—cumulative profits of the sports lottery issuer

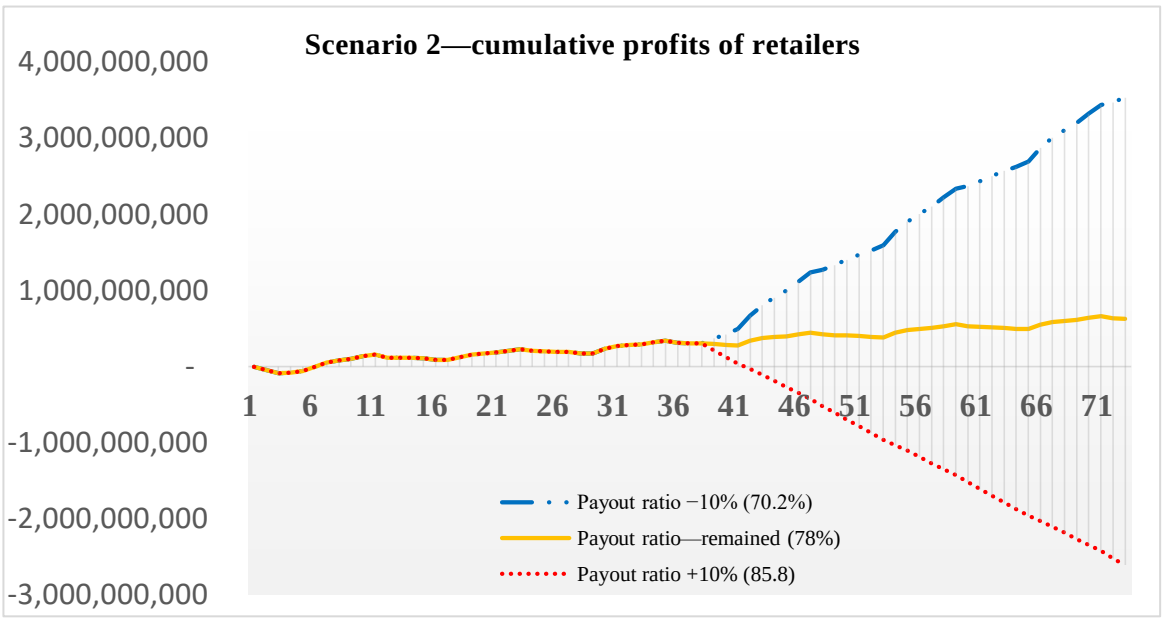

Fig. 13. Scenario 2—cumulative profits of retailers

4.4 Scenario 3: Changes in number of events for betting

The simulation results for the future sports lottery market determined by changing the number of major events for betting revealed that increases and decreases in the number of major events for betting resulted in the increase or decrease of monthly sales revenue. Moreover, even under the optimistic setting, sales revenue could not exceed NT$3,411,000,000, because this amount was the limit of the sales ability of the retailers according to the simulation system. A larger sales amount would require improving retailers' sales ability, including enhancing their software and hardware capabilities. Under the conservative setting, the growth of cumulative sales revenue and the cumulative profits of the operator became moderate in the later periods compared with the regular setting. However, the cumulative profits of retailers resulted in a critical recession under the conservative setting.

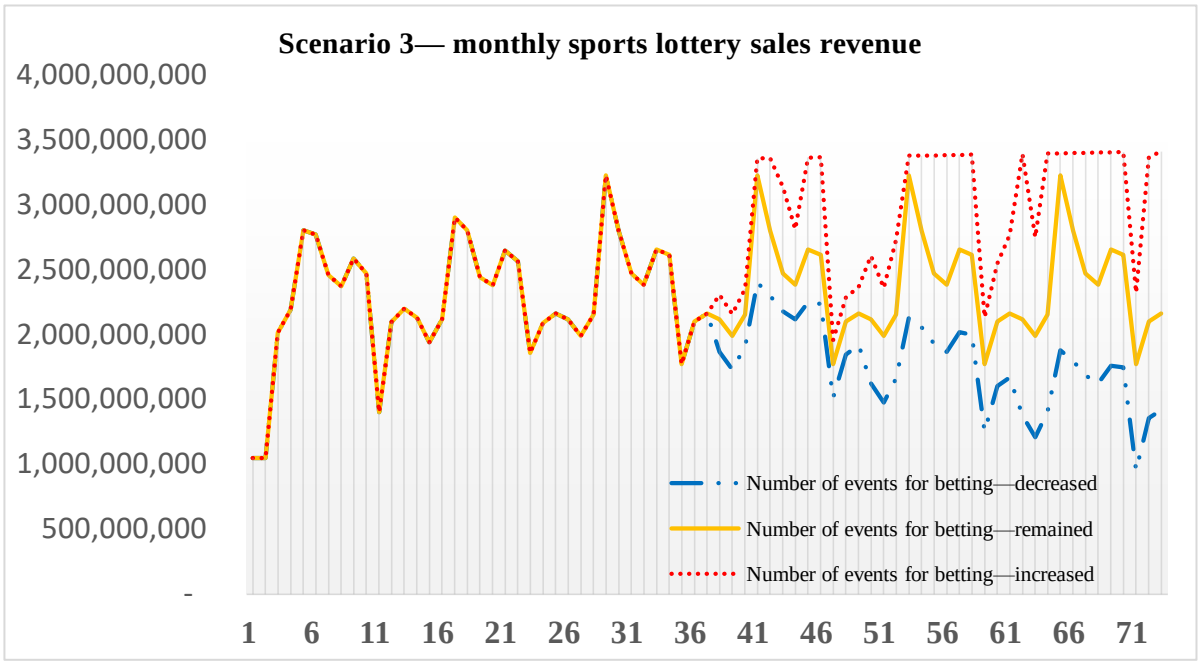

Fig. 14. Scenario 3— monthly sports lottery sales revenue

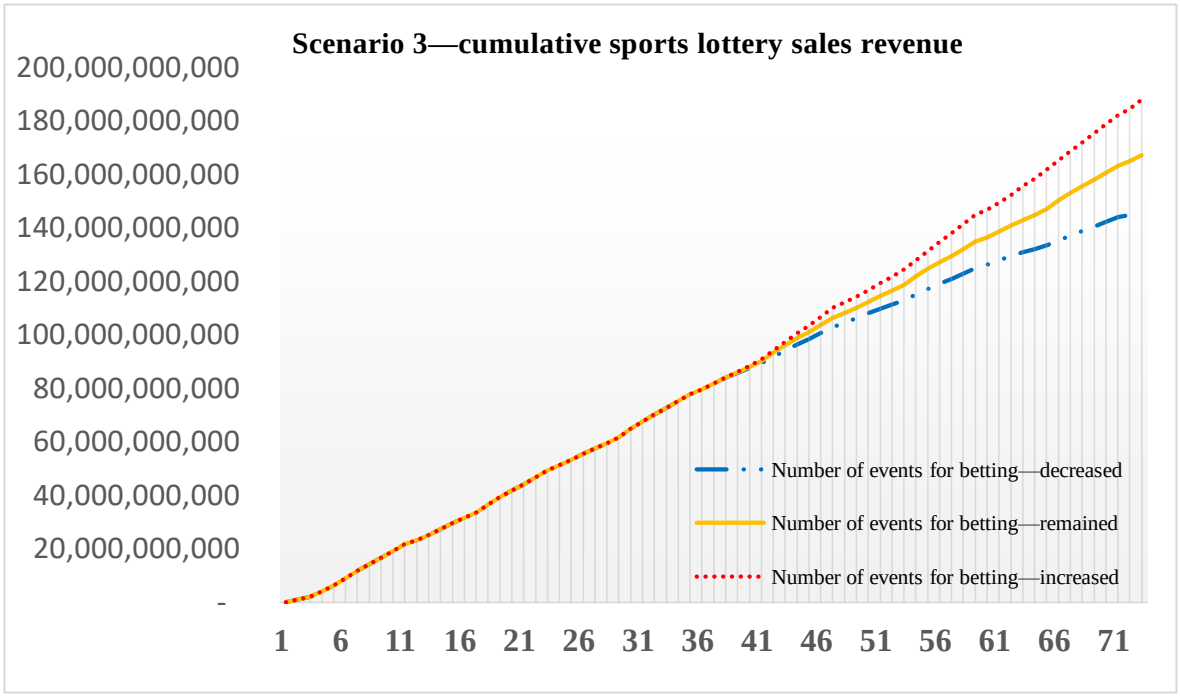

Fig. 15. Scenario 3—cumulative sports lottery sales revenue

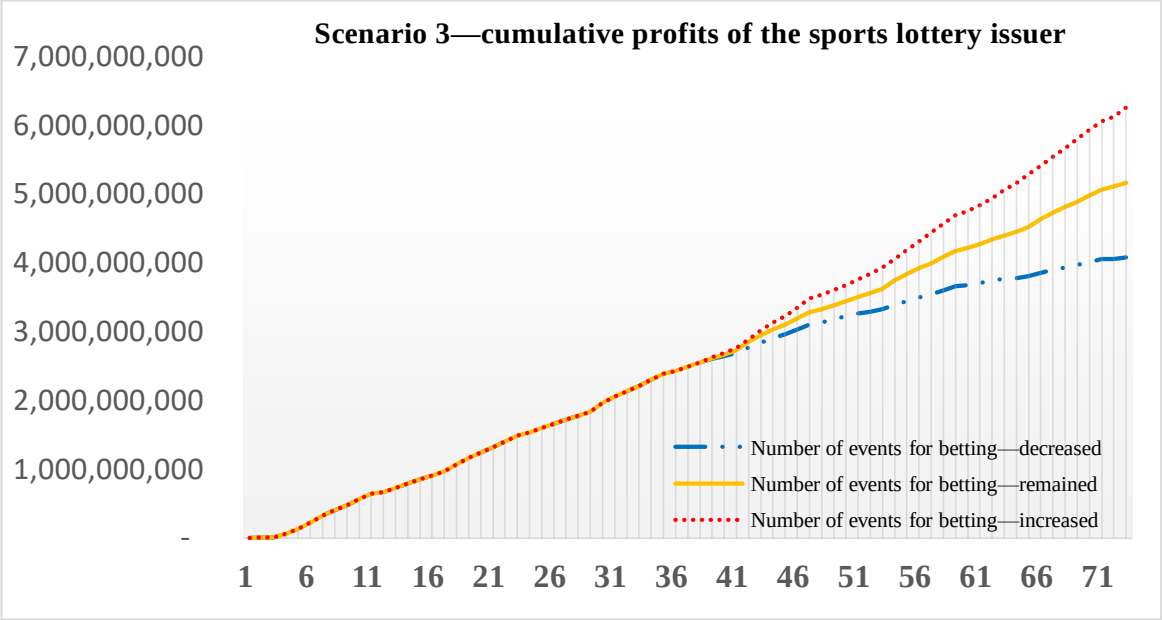

Fig. 16. Scenario 3—cumulative profits of the sports lottery issuer

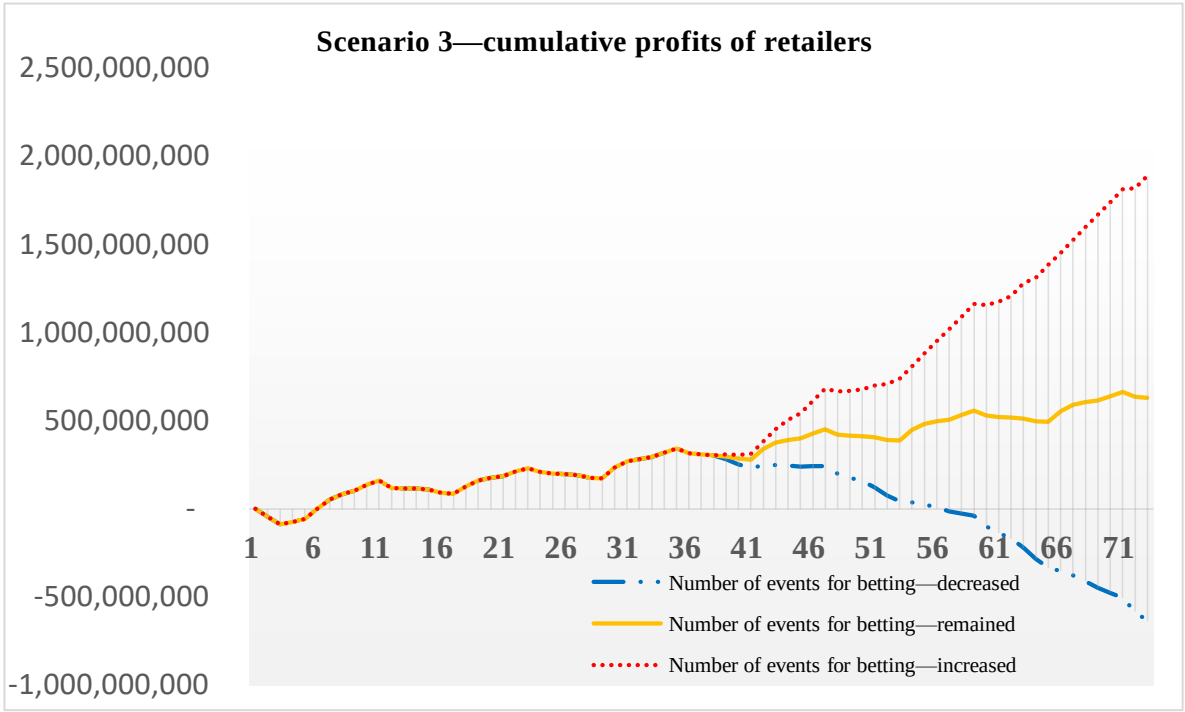

Fig. 17. Scenario 3—cumulative profits of retailers

5 Discussion

The purpose of this study was to understand the critical success factors for sports lottery retailers in Taiwan by using the strategic management approach. This was because numerous factors affect the operation and sales of retailers, such as subjective and objective factors of the internal environment and external environmental factors. Moreover, the factors interacted, interlinked, and had causal relationships. Such dynamically complex problems required a comprehensively and structurally systematic perspective to develop appropriate decisions.

The simulation results revealed that increasing the payout ratio might stimulate the sports lottery sales amount, but simultaneously reduce the profits of the operator and retailers, which was harmful for the long-term development of the sports lottery. Therefore, systems thinking must be employed

for comprehensive consideration.

Several measures for increasing the sports lottery sales amount include expanding the market, raising the percentage of sports lottery consumers, and augmenting the number of events for betting. Moreover, betting through virtual channels is convenient and fast; the number of participants in online betting can be increased by encouraging retailers to promote such betting channels.

This study focused on identifying the main drivers behind the sales performance of retailers. The qualitative causal model established herein focused on identifying critical variables and was used to determine the causation. In this study, several interviews with management personnel of the Taiwan Sports Lottery were conducted, and the model proposed on the basis of the interview results achieved covering the subjective and objective factors that affect the sales performance of the retailer However, several soft variables concerning the subjectivity, such as the effectiveness of in-service training, evaluation of sales ability, and consumers' desire to buy, could not be acquired. Therefore, the aforementioned variables were the limits of the model in this study. Future studies are advised to conduct research on the soft variables in this study's reference model, which may assist the construction of a realistic and effective system model that fits practical requirements.

6 Conclusion

Retailers play a critical role in the success of a sports lottery. This study revealed that the driving force behind supply was formed by the subjective and objective factors of the internal environment, whereas the driving force behind market demand was formed by external environmental factors from the perspectives of strategic management and strategic planning. Moreover, this study observed the interactions and influences of such factors with one another. Therefore, a comprehensive point of view was required for conducting the research. However, relevant studies on sports lotteries have not employed such a systematic perspective. The present study employed a system dynamics methodology to establish a system dynamics model for the sales of sports lottery retailers that comprised subjective factors of the internal environment, objective factors of the internal environment, and external environmental factors. Therefore, this study can serve to fill the research gap.

Additionally, according to the qualitative causal model established herein, the internal subjective factors that comprised variables concerning the psychological or cognitive level, such as the professional level and sales ability of retailers, were difficult to employ in quantitative research but were the critical success factors for the sales of retailers. Most retailers treated the sports lottery as merchandise, resulting in limited effectiveness. In other words, the sales techniques of retailers are critical. Therefore, the critical factor for the success of the sports lottery was the ability of first-line sales personnel to cultivate their professionalism and invest in operations to establish a brand reputation that leads to customer loyalty.

According to the simulation scenario results of this study, the external environment factor of the percentage of sports lottery consumers affected the overall sales amount of the sports lottery. Specifically, when the percentage of consumers increased, the monthly sales revenue significantly increased; when the percentage of consumers decreased, the monthly sales revenue also significantly decreased. Simultaneously, the cumulative profits of the issuer and retailers were affected.

In terms of the subject of payout ratio, which the governmental authority once discussed, the results showed that a higher payout ratio would stimulate the sports lottery sales amount; however, such a measure might affect the profits of the issuer or retailers. According to the simulation results,

although raising the payout ratio would indeed increase the overall sales amount, the increase was not crucial. Nevertheless, such a measure resulted in a decrease of profits or even loss for the issuer or retailers.

This study employed three different settings, namely optimistic, regular, and conservative, for the number of major events for betting to simulate the future sports lottery market. The results revealed that increases and decreases in the number of major events for betting resulted in the increase or decrease of monthly sales revenue, cumulative profits for the issuer, and cumulative profits for the retailers. Moreover, in response to the growth of the sports lottery market, improvements to retailers' sales ability, including their software and hardware capabilities, are required.

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