

# Advancing Supply Chain Operation and Management Education Through Simulation-Based Teaching Systems

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Received: September 15, 2023 / Revised: October 17, 2023 / Accepted: October 20, 2023

Doi: xxxxxxxxxxxx

## Abstract

For many students studying supply chain management, managing a well-established supply chain is the direction of their efforts. However, the current supply chain education pays more attention to the cultivation of professional skills and lacks training in overall planning. In view of this, this study developed the "Supply Chain Operation Management Simulation Software", which takes supply chain management as the background, presents marketing strategies, manpower planning, price setting, inventory management, promotional activities, and other business management concepts using network software, and cooperates with learning plans to carry out case simulation lesson plans, so as to make classroom learning more lively through games to improve the lack of traditional static teaching and combine theory and practice, so that students can "learn by doing" Under the training, the business management skills of supply chain management are repeatedly practiced, so that students can experience the fun and hardships of supply chain management, and then evaluate whether they have the characteristics and abilities of entrepreneurship.

**Keywords:** Supply Chain Management, Operation Management, Simulation Competition.

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## Introduction

### Creative concept

Due to the impact of the global financial turmoil, the unemployment rate has soared, many graduates have no way to find a job, and Chinese people have always liked to be their own bosses, which has unexpectedly set off a wave of entrepreneurship, among which "supply chain management" is the hottest. For many students studying supply chain management, managing a well-established supply chain is the direction of their efforts. However, operating a supply chain management requires not only professional technology but also high-level management factors. However, the current supply chain management education pays more attention to the cultivation of professional skills and lacks training in overall planning. Therefore, this project attempts to transform the existing ordinary classrooms into supply chain management types, build a supply chain operation and management simulation laboratory, and develop supply chain operation and management simulation software to simulate actual business situations through teaching plan production, situational teaching, role-playing, business competitions, etc., so as to cultivate students' practical management ability.

The learning method of the business simulation competition is to train the participants by simulating the situation of business management and the problems arising from and deriving it, so as to inspire the students' ability to analyze environmental information, deal with group relations, and make decisions. This kind of teaching system that emphasizes interactive learning and self-growth is quite different from most current digital learning products, although combined with multimedia or network applications, its essence is still static teaching content, which is quite different (Crookall et al., 1986).

The business simulation competition teaching system is widely used in a variety of courses, including strategic management, production, marketing, innovation management, supply chain management, financial accounting, and agricultural economics. In the United States, more than at al., quarter of management professors use business simulation competitions in various types of courses; at least more than 60% of large companies use business simulation as an in-house training course; Deloitte & Touché's research shows that business simulation learning can enhance learning outcomes more than traditional business management teaching methods (Van, 2003 ; Thavikulwat, 1990)

### Research Background

After the gradual popularization of online learning (e-learning), the management chain subject course has also kept up with the trend of the times, providing various types of business management learning materials on the Internet, especially the simulation business competition teaching system(Business simulation and gaming system) has the rich connotation, close to the real business environment, can be based on interactive learning and experiential learning without the limitation of time and space conditions, so that teachers and students have more hands-on experience (learning by doing) in the way of learning; compared with the current more used in ERP (enterprise resource planning) Or SCM (supply chain management) process or flat teaching content, simulation management is more evaluated.

The online simulation is an internet-based game that allows students to perform tasks such as overseeing the operational management of a virtual factory serving as CEO of a virtual business and networking with other executives (Raia, 1966). Professors can track students' every move in these online games and use this data to grade students and provide feedback on specific skills. Online simulations tend to be closer to reality than lectures and direct theories and force students to figure out how to put textbook theory into practice (Wolfe, 1978). Some of these simulations take up a day or two in class and replace lectures. Others are assigned homework that can last the entire semester without taking up a lot of class time. Students sign in to make changes and check progress on their clock. Professors have access to in-depth data showing each student's every move. This can then be raised in class discussions to motivate students, show them their mistakes, celebrate their successes, and inspire competition between classmates and teams (Cohen & Rhenman, 1961). The simulation competition system in China is shown in Table 1.

**Table 1** Business simulation competition system in China (partial)

Product name	Major topics	Creator/Developer	Country of origin
Capsim	Business operations (Corporate strategy)	CAPSIM	USA
Cesim	Business operations (Corporate strategy)	Cesim	Finland
Decision-making	Business operations (Corporate strategy)	Wang Qiwen	China / USA
GMC	Business operations	GMC	Portugal
Mark Strat	Marketing management	StratX	France
Marketing Winner	Marketing management	IBT	Japan / Taiwan
Marketplace	Marketing management*	Innovative Learning Solutions	USA
MBS	Business operations (Corporate strategy)	Top-BOSS	Singapore
SRM	Chain operation	Li Mengxi	Taiwan

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**Research Objectives**

This study has several objectives, including :

- 1) Management students learn the truly competitive world of international business. In the beginning, students must obtain information about the countries in which they trade, such as environmental and economic data.
- 2) The emphasis is placed on international marketing and logistics, helping students learn concepts and practices in business classes.
- 3) Promote lectures by professors who pay attention to international business education.
- 4) Encourage interaction between professors and students with knowledge and information in the classroom. For example, how to develop an international business strategy and teachers focus on student performance and activities.

**Subject Content**

**Theory contained in the simulation game**

The theory included in the online game should include the following theory from the previous researchers.

The first approach discussed is the five forces analysis introduced by the American scholar Michael Porter, which primarily focuses on market competitiveness (Porter, 2011). The second perspective is the concept of dynamic competition, proposed by American scholar Rebstein as well as Chinese scholar Chen Mingzhe (Rebstein et al., 1993; Hu et al., 2020). Dynamic competition emphasizes adaptive competitive strategies. The third perspective involves the 3C model introduced by Japanese scholar Kenichi Ohmae, which concentrates on corporate consultancy theories (Ward, 2005). Lastly, the business model canvas, proposed by Swiss scholar Alexander Osterwalder, explores the theory of new-generation business models. (Osterwalder et al., 2011)

**Table 2** The important theories should be considered in a business simulation.

No	Indicator Master	Related works	Theory (model)
1	five forces analysis	United States Michael Porter	Competitiveness
2	dynamic competition	United States Rebstein China Chen Mingzhe	dynamic competitive strategy dynamic competition
3	3C model	Japan Kenichi Ohmae	Corporate consultant
4	business model canvas	Switzerland Alexander Osterwalder	New generation of business models

### Build a simulated teaching environment for supply chain operation and management

The existing general teaching classroom was commissioned to be renovated and decorated into a supply chain management real field to create a simulated teaching situation of supply chain operation and management so that students can experience the situation.

This is an online competitive game, so each industry must have at least 3 companies to compete with each other. There is no upper limit. Each team may have 5 members. A company can also have 1 person, but we recommend 5 people per team. A typical class will consist of 10 to 20 teams.

### Supply Chain Management Cycle

There are four cycles in a year, usually 12 cycles per round. We provide quarterly and annual reports, including market share, financial, marketing, and HR reports. Since environmental events occur sequentially, we set variables such as inflation, changes in interest rate exchanges, business cycles, or R&D effects. We provide a default model and a free model that professors can use to change the defaults. Presenters can choose more complex and difficult environments, such as increased utility and transportation costs, poor cash budgets, and higher quality standards. Each month requires a number of important core activities, as described below



Figure 1 Example of the management decision support system in the on-line game

(Source: Top Boss MBS, <https://www.top-boss.com.tw/singapore/products/mbs/>)

### Supply Chain Management Procedures

Supply chain management includes all the movement and storage of raw materials, work-in-process inventory, and finished goods from origin to the point of consumption. Effective supply chain management can provide enterprise marketers with a significant competitive advantage by coordinating operations with all companies involved in the entire supplier sequence.

- 1) Emerging markets
- 2) Location decisions
- 3) Transaction costs
- 4) Cultural distance
- 5) International Retail
- 6) Emerging markets
- 7) Location decisions
- 8) free trade area

### **Human resource management of the supply line**

Human resource management is also an important matter of supply chain operation and management. Humans and the potential they possess drive an organization. The Human Resources (HR) department will specialize in seven management functions: staffing, performance evaluation, compensation and benefits, training and development, employee and industrial relations, safety and health, and human resources research. In addition, due to the city's international market, special consideration is given to the staffing and recruitment of expatriate managers and international staffing.

### **Financial management of supply chains**

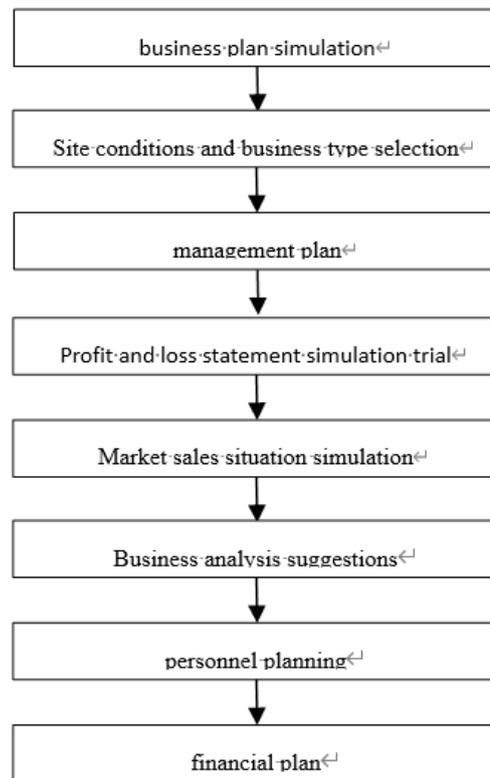
Corporate or business finance is basically the method of allocating financial resources with financial value in the best way to maximize the wealth of a business enterprise. There are three main decisions in this distribution process: capital budgeting, financing, and dividend policy.

- 1) International financial markets
- 2) Foreign exchange management
- 3) Cost of capital and financial structure
- 4) Investment evaluation
- 5) Capital budget
- 6) Transfer pricing
- 7) International financial reporting
- 8) Performance evaluation and control
- 9) International Taxation

### **Programming**

#### **Research and development of supply chain operation and management simulation software**

Cooperate with manufacturers to jointly develop supply chain operation and management simulation software, the main development process is as follows: (Graham & Gray, 1969)



**Figure 2** Flow chart of simulation management system development

1. Business plan simulation

- 1) Set business hours
- 2) Market settings
- 3) Capital amount setting
- 4) Set and calculate the average unit price of each different customer layer
- 5) Set the gross profit margin of visitors according to the fourth point, and then calculate the gross profit amount on a trial basis
- 6) Different business districts will have different consumption suggestions
- 7) Preliminary planning trial calculation of single-day turnover.

2. Site conditions and business district selection

Dozens of different business districts are available for owners to select, and the operating costs are calculated according to the selected business districts; According to the selected business district, further analyze the competitors of the commercial district; According to the above two points, the system automatically produces analysis data and business district selection suggestions.

### 3. Business plan

After selecting the above business districts, you can set up the trial calculation of fees in different regions, and after selection, the system will automatically calculate the monthly fixed costs and expenses, as well as the cost analysis of different regions.

### 4. Profit and loss statement simulation trial

According to the previous settings and selection, run out of the corresponding business circle profit and loss statement simulation; In addition to the existing profit and loss table simulation, the system can respond to the resulting values generated by different settings in a timely manner.

### 5. Simulation of market sales conditions

According to the business plan, site area, supply chain type, competitor status, and other conditions, the daily sales status analysis table is simulated, and the market sales-related charts are further depicted according to the sales status analysis table.

### 6. Business analysis suggestions

In view of the above conditions, make business analysis and suggestions.

### 7. Personnel plans

According to the manpower hired by the simulation plan, the system automatically calculates the total salary of the average manpower in the market; According to the simulation plan to hire manpower, the system automatically runs out of recommendations and manpower structure diagrams.

### 8. Financial plans

Calculate the monthly simulated turnover on a trial basis, calculate the profit and loss turnover on a trial basis according to the turnover, and automatically draw the profit and loss statement graph.

## Description of script examples

Take the script as an example: in the environment of competition between multiple groups of companies in the oligopolistic market, the management team uses the operation mode of division of rights and responsibilities, through the discussion of team members, gives full play to the different site conditions of the three chain stores, and adopts different marketing strategies, management tactics, analysis methods and other operational techniques for five commodity groups with different attributes, so as to exert the overall synergy. In order to obtain competitive advantages in the market, grasp the foundation of operating profits, and make use of this successful business model as the basis for the subsequent development of chain operation, so as to expand the scale of operation and market territory. The market size of each company in the zero period is about 20 million, and the benchmark value is set based on the number of participating groups, and the working capital available to each company is 15 million yuan in the initial stage, and the fixed cost of the head office is 450,000 yuan. The fixed costs of each quarter of the three stores are 1.2 million yuan, 1.05 million yuan, and 900,000 yuan, and the other variable expense rate of each store is 5%, and the advertising and promotion fee and service training fee are the decision-making values, which are entered into the system at the discretion of the participants. The income tax rate of a profit-making business is 25%, and the bank interest rate is 5%, due

to the different environments and customer layers of the three stores, the sales structure and profit situation of the goods are naturally different, and the strong and weak transformation of the competitive situation is gradually formed. This paragraph describes a part of the scenario, considering the simulation close to the real world and the individual needs of teaching, most of the aforementioned numbers can be changed to a limited extent through the teacher's settings.

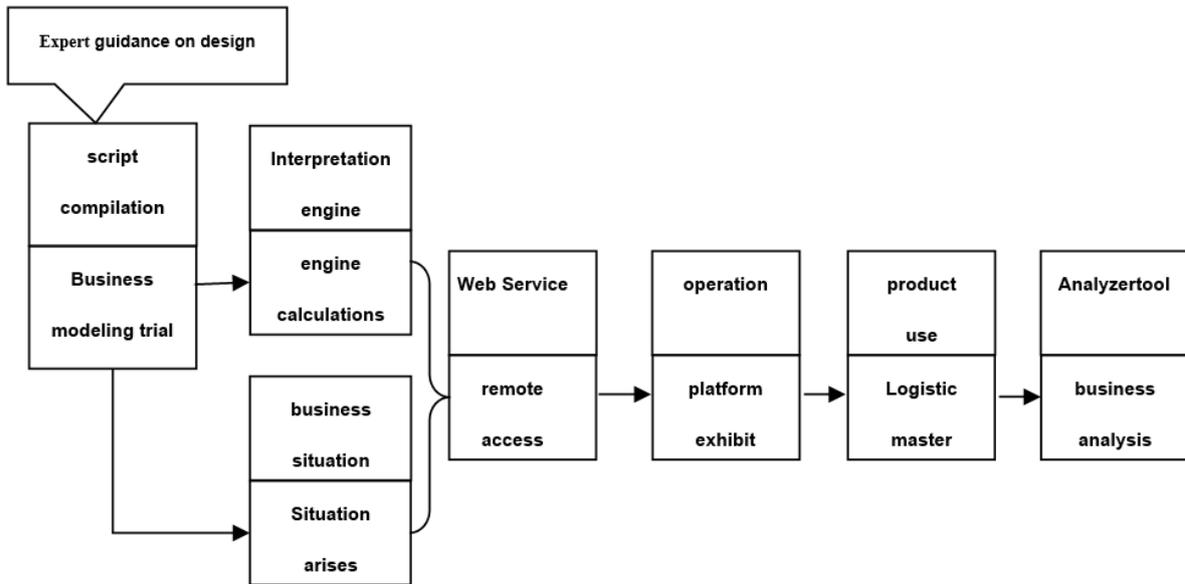


Figure 3 Example script

### Hold Supply Chain Operation and Management Simulation Competitions

After completing the research and development of supply chain operation and management simulation software, hold supply chain management simulation competitions to stimulate students' willingness to learn and depth of learning, learn the practical experience of shopping malls through competing competition theories, experience the pressure of operating a supply chain, racing against time, how to make correct decisions in a limited time, learn cost and profit estimation and sustainable operation methods, personally experience the fun and hardships of entrepreneurship, so that students can be more practical in realizing entrepreneurial dreams. Have a deeper understanding and understanding of future career planning, and then evaluate whether you have the characteristics and abilities to start a business.

Scoring issues should be paid special attention to in this game to avoid unfair associations among participants. When using simulation scoring, methods vary widely. There are three alternatives that can provide some ideas on how to score to best meet your own goals. Most professors will use a combination of these alternatives to weigh in a way that supports your goals. Few academics will measure only bottom-line performance without some subjective material. Similarly, the purpose of mock scoring is to encourage integrated long-term thinking in a team environment.

A more subjective approach requires students to prepare essays and/or presentations, including an analysis of admission decisions, a market plan at the beginning and after, and a final presentation focusing on lessons learned. Here are some examples. (1) Your initial regional marketing strategy. Ensure that this includes the countries entered, the target markets served, and the positioning and portfolio strategies for those countries; (2) Any significant changes to your initial strategy and the rationale for those changes. (3) Your company's performance targets and actual performance; (4) key strategic initiatives that led to your success (or demise); (5) how you can leave the company and prepare for the future; (6) Important lessons learned from the simulation experience

## Results and Discussion

### New supply chain markets

The competition is based on countries representing major trading countries in Asia, such as Japan, China, Indonesia, South Korea, Thailand, Vietnam, Singapore, Malaysia, India and Taiwan. There are some factors in this game. With regard to geographical regions, we select the main members of ASEAN+3 (Association of Southeast Asian Nations, see Figure 2), but do not include countries that are less international or technology-oriented. Therefore, we have selected Japan, China, Indonesia, South Korea, Thailand, Vietnam, Singapore, and Malaysia from the ASEAN+3 list. Moreover, since the IT industry is the focus of this game, we must focus on India and Taiwan. India is an important outsourcing destination for multinationals and a major exporter of software and financial, research, and technology services. The same applies to Taiwan. Some of these countries are developed countries, such as Japan, while others are developing countries. Regardless of education level and GDP, in this era of globalization, all countries need foreign trade to transfer toilets, food, products, etc.



**Figure 4** Logistic supply chain area, Site selection under the global consideration in the online simulation system

(Source: Top Boss MBS, <https://www.top-boss.com.tw/singapore/products/mbs/>)

## Monetary considerations

The reason we consider different currencies is that the real world is not so fixed in Asia. Many countries in Asia are developing countries, and the economic situation is facing dramatic changes in both depression and prosperity. Some cause serious inflationary problems, while others are more stable. For these reasons, we consider currency and monetary interest, and Asian marketing can be a game focused on international financial strategy. We distinguish between importing and exporting countries. There are three importing countries, namely Japan, China, and Indonesia. So, there are four currencies such as USD, JPY, Chinese CND, and Indonesian Rupiah.

## Consumer Market

Let's take the industrial and consumer markets as examples, with chips (microprocessors) and mini laptops as their respective products. Chips are traded between countries, with Japan (higher cost and product quality) and China (lower cost and product quality) being the only countries of origin. After that, the company chooses the location where to produce the laptop. Players must choose at least one of the eight countries (China, Indonesia, South Korea, Thailand, Vietnam, Singapore, Malaysia, and India). Therefore, players must choose between air freight (higher cost and product quality) or sea freight (lower cost and product quality). Finally, the company sells mini laptops from the countries of production to at least one country of purchase (Indonesia, Japan, and China). Purchased items will be listed in the customer's inventory for the next time period. The same applies to the choice of air or sea freight (Thavikulwat, 1989 ; 1990).

Of course, for example, the management of the cold chain is another matter, and in the future, we will also consider the details of this type of supply chain.

## Features of the Game Learning

1. Flexible business environment. The game administrator can decide the number of products to be manufactured and sold, and control the economic parameters of the relevant economy, as well as the country and registration country of the relevant industry.

2. Common and business-level strategies. Players can design and implement the most complete strategy any game has to offer.

3. International dynamics. Students can experience currency fluctuations, VAT, dividend taxes, technology transfer, joint ventures, product patent cross-licensing, different labor wage rates, culturally relevant productivity and absenteeism, and offshore manufacturing opportunities.

4. Network-based. The surface of the coil is simple

5. Major events. Game moderators can invoke up to ten critical events during gameplay. These events come in the form of small cases that highlight the "soft" side of the strategic manager's decision-making situation.

6. Based on reality. Real-world data is available for each country in which it operates and the various financial markets in which it operates.

## Features of the Game

1. Improve teachers' ability to teach supply chain operation and management practices In advanced countries in Europe and the United States, simulation and gaming teaching It is widely used in all walks of life as a new generation of management teaching methods. However, in supply chain operation and management, although practical teaching is emphasized, the classroom teachers may not have practical experience in supply chain operation and management and are also proficient in production, marketing, personnel, finance, research and development, and other management functions. Therefore, through the organization of business simulation teaching teacher study, teachers are taught how to use the "Supply Chain Management Simulation Lab" to operate various enterprise operations and management simulation software, so as to enhance the practical teaching ability of supply chain operation and management (Keys, 1987).

2. Enhance students' willingness to actively learn supply chain operation and management Modern young people like games, willing to use the computer or the Internet, for entertainment, dating, or business (online shooting), in line with this trend, the use of simulation business laboratories, hold business simulation competitions, so that students enjoy learning, enhance students' willingness to actively learn the operation and management of the catering supply chain. Therefore, with a background in supply chain operation and management, marketing strategies, manpower planning, price setting, inventory management, promotional activities, and other business management concepts are presented using network software, and case simulation lesson plans are carried out with learning plans, so as to make classroom learning livelier through games, so as to improve the lack of traditional static teaching.

3. Strengthen students' entrepreneurial investment and supply chain operation and management capabilities Supply chain operation and management requires enterprise-oriented management ability, so the theory and practice are combined into one, and the supply chain operation and management simulation laboratory is used to put students in a close to real environment, through role play for teaching, discussion and competition, using written and oral methods, repeatedly practicing the understanding, analysis and decision-making of supply chain operation and management, so that students can repeatedly practice supply chain operation and management skills under the honing of learning, and strengthen students' ability to venture capital and supply chain operation and management.

4. Strengthen industry-university cooperation and promote exchanges between academia and industry Cooperate with manufacturers to convert the implicit experience of supply chain operation and management into explicit system knowledge, and jointly develop supply chain operation and management simulation software, in addition to providing schools at all levels with practical teaching, and can collect technology transfer funds from manufacturers through technology transfer to increase the income of the school fund.

5. Improve the quality of practical teaching of supply chain operation and management education Through the research and development of supply chain management simulation software and the holding of supply chain operation and management simulation competitions, the R&D results will be promoted to promote

observation and exchange, and the quality of practical teaching of supply chain operation and management technical and vocational education will be improved.

## Conclusions and Recommendations

1. In this study, a set of methodologies and a series of platforms/tools are developed to combine academic theory, technology, and professionals in various fields of business, management, mathematics, and information technology to develop a diversified simulation competition teaching system, which can meet the needs of future management teaching.

### 2. Study Limitations

First, the difficulty of cross-field professional integration

At present, there is a lack of cross-field product development experience in China, and when staff in different fields work together, there will inevitably be communication problems caused by unclear goals or different positions and backgrounds. The research and development of a supply chain operation and management simulation teaching system involve supply chain operation and management professional knowledge, information technology application, teaching, and administrative homework, who does not understand the computer who understands supply chain operation and management, coupled with the cumbersome administrative operation specifications of public institutions, cross-field professional integration is not easy.

Second, the gap between the real world, models, and software technology

This project attempts to transform the subjective experience implicit in the supply chain operation and management industry into explicit objective knowledge from the academic community, which should not only conform to the practical operation of the industry but also meet the teaching needs of the academic community. Therefore, how to refine and simplify the huge and complex real world into an abstract conceptual model, and then transform it into a software program performance, there is an insurmountable gap between the real world, theoretical models and software technology, and researchers at all stages need further efforts to smoothly transfer the results to the next stage.

## References

- Cohen, K. J., & Rhenman, E. (1961). The role of management games in education and research. *Management Science*, 7, 131-166.
- Crookall, D., Martin, A., Saunders, D., & Coote, A. (1986). Human and computer involvement in simulation. *Simulation & Gaming*, 17, 345-375.
- Thavikulwat, P. (1990, March). Consumption as the objective in computer-scored total enterprise simulations. In *Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference (Vol. 17)*.
- Graham, R. C., & Gray, C. F. (1969). *Business games handbook*. New York: American Management Association.

- Hu, Y., Chen, M., & Saad, W. (2020). Joint access and backhaul resource management in satellite-drone networks: A competitive market approach. *IEEE Transactions on Wireless Communications*, 19(6), 3908-3923.
- Keys, J. B. (1987). Total enterprise business games. *Simulation & Games*, 18, 225-241.
- Porter, M. E. (2011). *Competitive advantage of nations: creating and sustaining superior performance*. Simon and Schuster.
- Osterwalder, A., Pigneur, Y., Oliveira, M. A. Y., & Ferreira, J. J. P. (2011). Business Model Generation: A handbook for visionaries, game changers and challengers. *African journal of business management*, 5(7), 22-30.
- Raia, A. P. (1966). A study of the educational value of management games. *Journal of Business*, 39, 339-352.
- Rebstein, P. J., Weeks, G., & Spiegelman, G. B. (1993). Altered morphology of vegetative amoebae induced by increased expression of the Dictyostelium discoideum ras-related gene rap1. *Developmental genetics*, 14(5), 347-355.
- Thavikulwat, P. (1989). Modeling market demand in a demand-independent business simulation. *Simulation & Games*, 20, 439-458. (1990, March). Consumption as the objective in computer-scored total enterprise simulations. In *Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference* (Vol. 17).
- Van, D. N. (2003). *The E-Learning Fieldbook: Implementation Lessons and Case Studies from Companies that are Making E-Learning Work*. McGraw-Hill.
- Ward, D. (2005). An overview of strategy development models and the Ward-Rivani model. *Economics Working Papers*, 6, 1-24.
- Wolfe, J. (1978). The effects of game complexity on the acquisition of business policy knowledge. *Decision Sciences*, 9, 143-155.