

# Applications of a Roleplaying Game for Qualitative Simulation and Cooperative Situations Related to Supply Chain Management

Thiago Schaedler Uhlmann and André Luiz Battaiola

UFPR – Universidade Federal do Paraná, Curitiba, PR, Brazil  
{tsumkt,ufpr.design.profe.albattaiola}@gmail.com

**Abstract.** This article presents the current stage in the development of a serious game. The main goal of this game is to provide an environment where students and professionals can train Supply Chain Management (SCM) accordingly to a qualitative point-of-view. The Serious Game consists of a Roleplaying Game system for SCM training and simulation, where players simulate, as characters, organizations placed into a Supply Chain with mutual interdependence relationships. During the play session, players respond to situations faced in a simulated organizational setting (a market, a producer or consumer of goods and services) and experience the challenges of an organizational environment. The research method consisted of four consecutive phases: research, development, application and evaluation of this game. The article concludes pointing future possibilities to use the game system in purposes related to SCM area, such as Quality and Environmental Management, Health and Safety, development of new products and services, among other.

**Keywords:** Gamification in business, Supply chain management, Serious Games.

## 1 Introduction

One of the possible tools for building knowledge in organizations is the use of games and simulations, particularly the use of Serious Games (games developed for purposes beyond simple entertainment, such as games that simulate behavioral situations, processes, among other themes in the management of organizations).

This paper describes a survey done as part of T. S. Uhlmann Master's thesis at the Post-Graduate Program in Design in UFPR – Universidade Federal do Paraná (Federal University of Paraná), in Brazil. The main objective of this research is to develop and apply a Roleplaying Game that simulates Supply Chain Management (SCM), in order to verify the usefulness of this game system as training and simulation tool. The name of the game is SCMDesign (Supply Chain Management Design). The target public are business courses students and business and management professionals.

During a game session, players respond to possible situations occurring in a simulated organizational setting (a market, a producer or consumer of goods and services) and experience the challenges of an organizational environment, under the mediation

of another player, called Game Moderator. The Game Moderator presents a narrative that contains situations and proposed challenges to be solved by the players using the resources provided by the game.

The research described in this paper is mainly justified based on three arguments. First, the need for further research on possible applications of Design concepts and tools in areas related to SCM, in particular 3PL activities (Third-Party Logistics Service Providers) [11]. Second, the authors noticed the lack of games, in particular, Roleplaying Games, addressing qualitative issues related to Strategic Management, Quality Management or SCM [10]. The SCMDesign game intends to fill this gap. Finally, the authors detected the existence of board games for entertainment available in the market that discuss various issues related to SCM, as well as academic papers that address the development of games with these themes. But these board games, as well as the games developed in these academic papers, use a quantitative approach in SCM (players essentially manages quantities such as, for example, numeric demands, currency values, among others). SCMDesign, however, simulates behavioral, social and relationship elements between people involved in organizations, which are part of a supply chain structure.

## 2 Methodology

This research was divided in 4 phases described below.

**Phase 1.** The first phase was a literature review. At this phase, academic and commercial games related to SCM and Collaboration/Professional Training (especially Management Training) were evaluated. [12]

**Phase 2.** The second phase was about the development process. Based on the information collected in phase 1, the first prototype of the game was developed. The development process considered three main parts: Roleplaying Game system, game elements and game narratives (stories to be played using the developed game system). The game elements were created considering Järvinen's approach [6] (figure 1). The narratives were developed based on literature evaluated in phase 1, and based on information collected in interviews conducted with two SCM professionals. However, only one of the narratives has been used so far.

**Phase 3.** The third phase comprehended the tests. Game play sessions were conducted, with several groups of students and professionals whose interests include SCM. In all, five game sessions were conducted, three of them in an academic environment (under-graduate and graduate business courses) and two of them in a business environment (SCM professionals, both in a multinational electrical appliances industry, and in a national logistic provider company). The play sessions were moderated by one of the authors and thoroughly monitored in order to ascertain the effectiveness of the game.

**Phase 4.** The fourth phase was the evaluation of the results. At the end of each game section, the group was invited to evaluate the game and suggest improvements. After that, both the group's and the authors' findings about the game were reevaluated, and the resulting recommendations were incorporated in the game. Now, after the fifth playtest session, the game is substantially evolved, but it is not finished yet. The authors consider that more tests will be necessary to further improve the game in order to reach a final version.

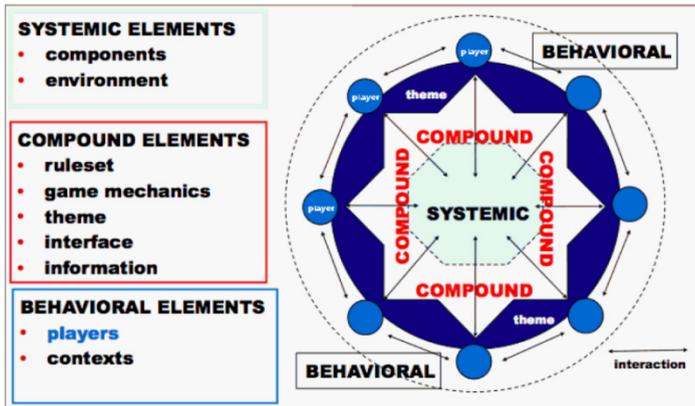


Fig. 1. Game elements overview [6]

### 3 Theoretical Elements Used in the Game Development

SCM, Design Thinking and Game Design concepts support the SCMDesign development. The main aspects of these concepts are described below.

#### 3.1 Supply Chain Management and Design Thinking

This research considered many definitions of SCM in order to develop the game system, and especially the narrative applied in the game tests [12].

However, the principal definition of SCM used in the game development is a systemic approach. According to Slack and Johnson [9], SCM is the "management of the interconnection of organizations that relate to each other through upstream and downstream linkages between the different processes that produce value in the form of products and services for the end consumer." This definition is important because the game, as a qualitative solution for SCM simulation, emphasizes the relationship between companies and people through collaborative and interconnected actions.

Mehrjerdi [7] defends interconnected and collaborative actions between organizations in a Collaborative Supply Chain due to the fact that "the basic idea behind the collaboration is that it is not possible for a company to compete in this competitive market successfully by itself." So, in a Collaborative Supply Chain, "to ensure optimum performance, companies must work to reduce costs, accelerate operation, and improve quality both in their own processes and in their partner organizations.

By gaining cross-company visibility and control, companies can identify and pursue opportunities for SC improvements. Both buyers and suppliers can benefit by collaborating on critical SC issues.” [7]

Collaboration and interconnection are principles used also in Design Thinking processes. Thus the developed game system intends to stimulate, among other factors, creative thinking in solving organizational problems according to the mentioned Design Thinking principles.

Design Thinking, as mentioned by Brown [3], “is a discipline that uses the designer’s sensibility and methods to match people’s needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity.” According to this definition, the game system developed was based also in Design and Business Modeling frameworks, such as MSD – Multilevel Service Design. “The MSD method unites the contributions of different fields and designs the service offering through the different levels of customer experience. This method recognizes that organizations cannot design customer experiences, but service systems can be designed for the customer experience.” [8]. According to Patricio [8], this method is based on four steps: design of the service concept, design of the service system, design of the service encounter and design of the service offering. A similar method is used by SCMDesign to design the simulated Supply Chains. First, the concept of a Supply Chain is defined. Second, the Supply Chain system is created by designing the narrative to be applied using the game. Third, situations between the narrative components (such as the narrative characters, represented by players) are created.

### 3.2 Game Design

Also, this research considered Game Design concepts, such as Roleplaying Games and Serious Games, as described below.

A Roleplaying Game “is one in which the player controls one or more characters, typically designed by the player, and guides them through a series of quests.” [1] By completing these quests, players become winners. There is a narrative presented by a Game Moderator, and, according to the situations presented, the players make decisions using their characters, which are present in the applied narrative.

A Serious Game, according to Iuppa and Borst [5], consists of a game that, in addition to providing entertainment to the players, enables learning, persuasion and behavior transformations. The SCMDesign game intends to be a Serious Game because its main goal is to simulate situations in a Supply Chain, emphasizing learning, persuasion, and relationships between the participants, among other elements. In order to achieve this goal, the game development was also based on other educational and commercial board games, as described below.

## 4 Board Games and Academic Games

The game system development was also based on existing games.

One of the academic games considered is the classical Beer Game, developed in the 1960s by Jay Forrester at MIT - Massachusetts Institute of Technology, and also commercially available in different versions.

The Beer Game “is a replica of a system for producing and distributing a single brand of beer. There are four positions at each game board: Factory, Distributor, Wholesaler and Retailer. Two people are typically assigned to each position, one to actually play the game and another to keep score. The number of participants at each position is flexible and can vary depending on the number of people in the class.” [4] Different from SCMDesign, the Beer Game adopts a quantitative view of SCM (players manages time, demand, monetary values, among other quantitative values). SCMDesign adopts a qualitative view, emphasizing behaviors and relationships in the management of the simulated supply chain.

Another game considered was Brass [14]. The game scenario is England in the Industrial Revolution era. The board is composed of places like Liverpool, Ellesmere Port, Southport, among others. Each place has its own vocation (some have ports, other are iron or coal producers, among other characteristics). The objective of the game is to manage a Supply Chain and evolve in terms of score. Figure 2 illustrates this game.



Fig. 2. Brass game (Source: photo taken by the researcher)

## 5 Game Development (First Version)

The first version of SCMDesign game was developed using the theoretical elements described previously and concepts found in available academic and commercial board games.

The game board, a major component of the game, represents the Supply Chain where organizations, stakeholders and characters controlled by players are role-played. Figure 3 illustrates the first version game board. The square black chips represent units (production, storage or contact) controlled by the players. The colored chips represent the different stakeholders of the organization controlled by players. The characters role-played by the players were described in cards.



**Fig. 3.** The first version of SCMDesign game system (Source: [12])

In order to test the game, two narratives were developed. One narrative's theme was activities performed by 3PL Logistics Service Providers [13]. The other narrative was based on the case discussed in Integrated Logistics for DEP/GARD [2].

## 6 Test Applications of the Game

The following subsections describe the game tests, three in academic environments and two in commercial organizations.

### 6.1 Tests in Academic Environment

The first, second and third tests of the SCMDesign game system occurred as part of under-graduated classes taught in private colleges located in Curitiba, Parana State, Brazil.

**First Test.** Local: classroom of a Business Under-Graduate course. Audience: 5 under-graduate students. Period: September 2013. Narrative: Integrated Logistics for DEP/GARD [2]. Game session time: around 1 hour.

An agreement between the game authors and the professor responsible for the discipline established the narrative case. The game session emphasized dialogues between players-to-players and players-to-Game\_Moderator. Each player (a student) represents a specific game character. The Game Moderator drives the story actions and represents other auxiliary characters. Players were allocated around a table (figure 4), but they had freedom to move to other places to talk in private with other players.



**Fig. 4.** Players around a table in the first game test (Source: authors' video file)

In general, during the debriefing, the participants recommended a better introductory presentation of the game and narrative characteristics. The players' recommendations resulted in several improvements in the game system.

The textual introductory presentation of the narrative was remodeled in a comic story style with the use of photographs, drawings and text. The narrative was also modified, in order to describe, in more detail, each character involved in the narrative. Modifications were also made in Organizational Worksheet; its content and layout were restructured by use of a new spreadsheet format. The game board, which represented a Supply Chain, was also enlarged. The rules of the game were modified to incorporate more dynamism in the game play.

**Second Test.** Local: classroom of a Business Under-Graduate course. Audience: 6 under-graduate students. Period: November 2013. Narrative: Integrated Logistics for DEP/GARD [2]. Game session time: around 1 hour.

The test began with a slide show, in a comic book style, describing the main research objective, the game system, the narrative, and the characters. After this presentation, the cards of the characters controlled by players were distributed. Also, the researcher presented the representation of the simulated supply chain on the board, involving the transformation of raw materials into finished products, and the distribution of the products to the client organization represented in the narrative.

The narrative was organized in turns, each player representing his character in their respective turn, making individual decisions from the situations presented by the Game Moderator. After each character/player made their decision, the supply chain was simulated: raw material was transformed in products that were distributed to clients of the company represented on the board). The various challenges in the presented narrative (conflicts between sectors, a quality audit, variations in the amount of goods in the warehouses of the organization, conflicts between the organization and its customers, differences of opinion regarding outsourcing processes, among others) were played in this game session. Figure 5 illustrates the second test event.



**Fig. 5.** Players around a table in the second game test. The man at the extreme left side of this picture is the Game Moderator (Source: authors' video file).

The players noticed some positive points in the game: its general purpose, the experience provided by the game, allowing for the training of negotiation skills. On the other hand, players related difficulties to understand some elements in the characters' cards. They considered the time of the test (about one hour) insufficient to fully

experience the game. More time for the game session, in their opinion, would be more appropriate. Finally, players suggested emphasizing some specific topics in the narrative, especially the topics related to Production and Logistics in a SCM.

The third test was applied just a few days after the second one, and thus the improvements resulting from the second test were made after the third test.

**Third Test.** Local: classroom of a Business Under-Graduate course. Audience: 7 under-graduate students. Period: November 2013. Narrative: Integrated Logistics for DEP/GARD [2]. Game session time: around 1 hour.

This test was conducted like the previous one. Figure 6 illustrates the third test event. As occurred in the previous test, the players complained about the duration of the game session. They argued that the introductory presentation of the narrative and game system was too complex and would require more time to be fully understood. They also observed that the game board and other game components were little used.

Based on the comments from the players in the second and third tests, the board was simplified. Other game components were also modified.



**Fig. 6.** Players around a table in the third game test (Source: authors' video file)

## 6.2 Tests in a Commercial Environment

The audience of the fourth and fifth game tests included personnel from two private companies located in Curitiba, Parana state, Brazil. The players were planning analysts and team coordinators, among others.

**Fourth Test.** Local: training room of a Third-Party Logistics service providing company located in São José dos Pinhais, a city of Paraná State. Audience: 7 workers. Period: December 2013. Narrative: Integrated Logistics for DEP/GARD [2]. Game session time: around 1 hour.

The participants of this test were selected by the company among planning analysts, area coordinators, and Personnel Management professionals. The game system presentation process followed the schema of the previous tests. Figure 7 illustrates the fourth test event.



**Fig. 7.** Players around a table in the fourth game test (Source: authors' video file)

After an unfinished game session, the players analyzed the game ability to produce immersion (the game allows high involvement of players with the game elements and narrative). Also, this version of the game, according to some players, allowed systemic view regarding aspects of SCM but, again, the time available for the test prejudiced the performance of the players (it is to be noted that office personnel, just like students, do not have much available time). The participants suggested that the game could encourage players to adopt faster responses in a specific pre-defined time.

Regarding the theme, one participant suggested possibilities for practical application of that game, for example, in Personnel Management applications, such as selection processes, coaching and professional development.

After the test, another improvement was made to the game system. To control the time of each participant during the play session, as well as limiting the response time of each character (in order to make the game a more dynamic system in terms of performance), one more component was adopted: an hourglass, which limits the time allowed to each player in each game turn.

**Fifth Test.** Local: meeting room of a multinational company located in Curitiba, a city of Paraná State. Audience: 6 players. Period: December 2013. Narrative: Integrated Logistics for DEP/GARD [2]. Game session time: around 1 hour.

The audience of the fifth test was composed of SCM analysts, an assistant and a SCM area coordinator. Figure 8 shows the fifth test event.



**Fig. 8.** Players around a table in the fifth test of the game (Source: authors' video file)

The game session started as the previous one, with the game system presentation. After the game session, participants recommended a production of an instruction

manual to be distributed to the players before the game session. In this case, players could read and understand the game system before they started to play.

Once again, according to one participant, the time available for the game session was insufficient to fully understand the game system and play.

Participants also recommended a more balanced distribution of players around the table; for example, participants that represent characters that will have conflicts could sit in a face to face position.

In addition, there were suggestions regarding the introduction of badges identifying the characters, as well as the department to which they belong in the simulated organization.

Based on this feedback, the authors decided to stimulate the use of the game board. They incorporated to the game ten-sided dice to represent materials and product quantities in the supply chain simulated in the game (quantities of raw material, finished products, and stored products, among others). Also, houses were included in the game board, which are in turn covered by pieces representing the characters; in every house covered, the player must make a decision related to that house. The movement of pieces on the board is the players' responsibility. Besides, nameplates were developed, to be positioned on the table in front of each player. This new component can help the identification and positioning of each character.

The improvements made after these two tests resulted in the current game version, described in Figure 9. Further tests will result in new improvements to the game.



**Fig. 9.** The final version of SCMDesign game system (Source: author photo)

## 7 Final Considerations

The game evolved with respect to its board shape (from the format described in Figure 3 to the current hexagonal format presented in Figure 9), to the characters used in the narrative (who acquired personality traits, as suggested by some players), to the counters used (the format of the counters was also modified according to the suggestions collected in the tests), and to the rules (they were more adapted to SCM concepts in accord to each test results).

The research, as described above, faced several limitations, especially in the time available for play sessions in colleges and organizations. However, it was possible to reach the current version, which will be used in a future work – an electronic version of the game.

## References

1. Adams, E.: *Fundamentals of Game Design*, 2nd edn. (2008)
2. Bowersox, D.J., Closs, D.J., Cooper, M.B.: *Gestão Logística de Cadeias de Suprimentos*. Bookman, Brazil (2007)
3. Brown, T.: *Design thinking*. Harvard Business Review (June 2008)
4. Goodwin, J.S., Franklin, S.G.: *The Beer Distribution Game: Using Simulation to Teach Systems Thinking*. Journal of Management Development 13(8), 7–15 (1994)
5. Iuppa, N., Borst, T.: *End-to-end game development: creating independent serious games and simulations from start to finish*. Kindle Version. Elsevier (2010)
6. Järvinen, A.: *Games without Frontiers. Theories and Methods for Game Studies and Design*. Doctoral dissertation study for Media Culture. University of Tampere, Finland (2008)
7. Mehjerdi, Y.Z.: *The collaborative supply chain*. Assembly Automation 29, 127–136 (2009)
8. Patricio, L., Fisk, R.P., Cunha, J.F., Constantine, L.: *Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting*. Journal of Service Research 14, 180 (2011)
9. Slack, N., Chambers, S., Johnston, R.: *Administração da produção*, Atlas, Brazil (2009)
10. Uhlmann, T., Battaiola, A.L.: *Aplicações possíveis dos RPGs na tomada de decisões em Administração Estratégica*. In: *Anais do 4º Congresso Internacional de Design de Interação*. São Paulo - SP, Brazil. Blücher (2012)
11. Uhlmann, T., Heemann, A., Battaiola, A.L.: *Serviços logísticos e design de serviços: relações colaborativas*. In: *II International Conference on Design, Engineering, Management for Innovation* (2012)
12. Uhlmann, T., Battaiola, A.L.: *Desenvolvimento de um Serious Game para a simulação de atividades de Gestão da Cadeia de Suprimentos*. In: *Brazilian Symposium on Computer Games and Digital Entertainment*, pp. 152–161 (2013)
13. Uhlmann, T., Battaiola, A.L.: *Desenvolvimento de Narrativa para Serious Game com o uso da notação BPMN – Business process Model Notation*. In: *Interaction South America 2013*, Recife, Brazil (2013)
14. Wallace, M.: *Brass*. Board game. Warfrog games (2007)