



Using serious games to manage knowledge: The SECI model perspective☆



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ABSTRACT

This research studies the contribution of serious games to improving knowledge management and benchmarking in a human resource management context. This exploratory research uses Nonaka's (1991) conceptual framework of SECI models and analyzes three serious games developed in three different financial companies in France, the United States, and India. These three case studies result in a seven-step development process of knowledge management serious games. The banking sector provides interesting characteristics for this study because some of the associated knowledge is very standardized yet highly heterogeneous. The study shows that serious games significantly contribute to improving the socialization, externalization, combination, and internalization of knowledge as well as promoting benchmarking throughout a company.

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1. Introduction

Since the mid-2000s, the world's leading companies have been using serious games to select, integrate, and train their employees. In France, all CAC40 companies—40 multinational firms that constitute the main French stock market index—have gradually adopted serious games (Allal-Chérif & Makhoulouf, 2015). Professionals who invest heavily and regularly in these games and researchers who emphasize their advantages and their rapid user adoption prove the utility of serious games in terms of training compared to other methods (Wortley, 2014).

Training is one of the most common uses of serious games (Alvarez & Djaouti, 2010) and to remain competitive in an increasingly unstable and unpredictable environment, banks and other companies encourage their employees to share their knowledge and practices.

This article analyzes the serious games of three financial companies to determine how these contribute to the collection, formalization, and dissemination of knowledge and good practices by exploring their impact on the four knowledge management processes identified by Nonaka (1991) in the SECI model.

Following this introduction, Section 2 reviews the literature linking serious games to knowledge management and benchmarking. Section 3 presents the exploratory case study methodology. Section 4 analyzes the serious games of three financial companies in France, the United States, and India. Section 5 formalizes the seven development

phases of this type of serious game. Section 6 provides discussion and recommendations.

2. Managing knowledge and optimizing benchmarking through serious games

Banks need knowledge management and dissemination of best practices because their activities inherently involve calculated risk-taking based on past experience.

2.1. Disseminating good practices through serious games

Serious games are video games used in a professional context to make training more exciting and immersive (Zyda, 2005). These games differ from simulations and microworlds because they are mostly used in firms, not schools, and they take players into virtual worlds, often fantastic, where they learn in a funny and entertaining way (Romme, 2003). Serious games allow businesses to remember past events and permit employees who did not actually experience them to confront such events in an interactive and fun way and to learn to adopt the best knowledge, practices and behaviors (Alvarez & Djaouti, 2010).

Companies interview older employees to collect the needed cultural knowledge to create these games, which lead to new relationships between younger and older employees (Alklind Taylor, Backlund, & Niklasson, 2012). Serious games enable businesses to recall past events and facilitate new employees in learning how to adopt existing best knowledge, practices, and behaviors (Alvarez & Djaouti, 2010). Simulation-based pedagogy increases motivation and engagement in the learning process and professional performance (Littlejohn & Margaryan, 2014). The brain activity stimulated is professionally

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valuable because the brain does not distinguish between real and artificial stimuli (Kosslyn & Moulton, 2012).

2.2. Benefits and limitations of serious games as benchmarking tools

Knowledge management comprises identifying, formalizing, organizing, storing, and disseminating knowledge in an organization (Nonaka & Takeuchi, 1995). According to Nonaka's (1991) SECI model, knowledge management entails the four simultaneous and complementary processes of socialization, externalization, combination, and internalization. Socialization brings together novices and experts so that the former can benefit from the latter's experiences. Externalization transforms tacit knowledge into explicit knowledge, providing a representation that can be stored and memorized. Combination is the evolution of explicit knowledge into new and more complex knowledge. Internalization transforms explicit knowledge into tacit knowledge (Donate & de Pablo, 2015). The SECI model has been criticized by numerous scholars but Nonaka and von Krogh (2009) respond by confirming the distinction and interaction between tacit and explicit knowledge in the creation of organizational knowledge.

Information systems play a key role in knowledge management at each stage of the SECI model (Alavi & Leidner, 2001; Alklind Taylor et al., 2012). Human resource management has used information systems to train through simulations, e-learning, and business games (Derouin, Fritzsche, & Salas, 2005). The databases and scenarios required to develop serious games are the fruit of benchmarking by business experts.

2.3. Knowledge and the specific practices of the banking sector

The main difficulty in designing serious games is integrating educational content and learning techniques into scenarios and rules to transfer the required business knowledge and skills. Players must be able to clearly identify the virtual situations as well as the knowledge, practices, methods, processes, and tools to use them in the most appropriate way in similar real situations.

Particularly in the banking sector, inappropriate decisions can degenerate into serious risks. The impact of a bad decision on bank performance is immediate and significant losses can occur (Tektaş, Ozkan-Gunay, & Gunay, 2005). Since the 2008 economic crisis, speculations, trader scandals, and prohibited transactions with countries under

embargo have had deep and long-lasting effects on the performance and image of many banks, who are trying to learn from these occurrences and develop action plans to minimize future risk (Dermine, 2013; Wallace, de Chernatony, & Buil, 2013).

In 2009, BNP Paribas launched two of the best known and most often referenced serious games: "Ace Manager," which in 2014 grouped together about 20,000 finance students across 136 countries, and "Starbank," which has been used to train tens of thousands of new employees about their company's culture, values, and 300 other topics. In 2006, Société Générale launched the serious game "Citizen Act" with the objective of making young employees aware of socially and environmentally responsible banking practices. A year earlier, Crédit Agricole began launching serious games and today has more than ten designed to improve interpersonal skills, ethics, safety, and hospitality (Allal-Chérif & Makhlouf, 2015). In 2013, the CIC Group launched a serious game for wealth management in partnership with KTM Advance to help clients understand the issues associated with heritage and encourage making better investments.

These serious games examples illustrate the variety of games in use and associated learning objectives. (Fig. 1)

3. A methodology adapted to a new and polymorphic object of study

This research uses a case study methodology of the banking sector to observe emerging knowledge management and benchmarking practices gathered by serious games to analyze the methods of collecting, structuring, and disseminating knowledge and best practices.

3.1. An exploratory study

Serious games are recently adopted tools with diverse uses and aim not only to provide an accurate representation of an emerging reality but also identify the properties, processes, and performance of complex events (Hancock & Algozzine, 2011). The case study seeks to develop hypotheses for an analytic vocation by identifying some variables that can be extended with more explanatory and quantitative approaches. Specifically, this research can be defined as a hybrid exploration based on initial knowledge to give meaning to its empirical materials by frequently going back and forth between the collected empirical material and theory.

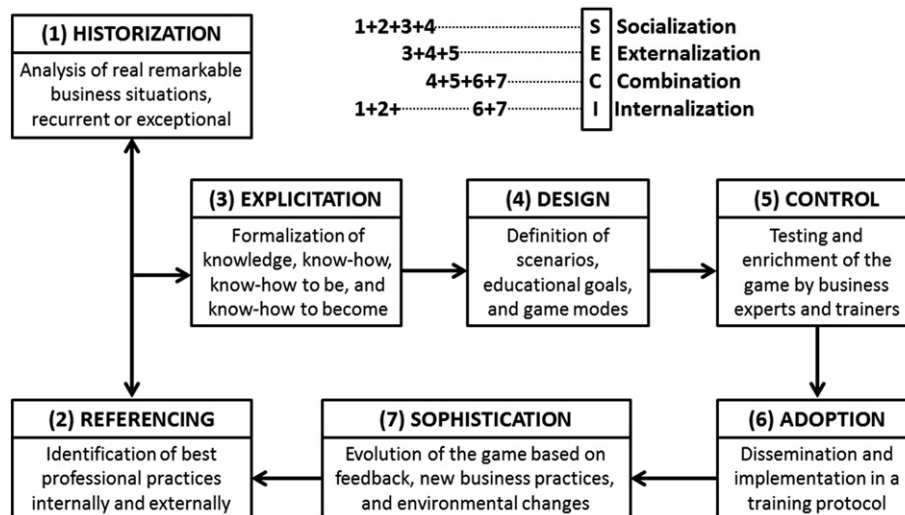


Fig. 1. Serious game development process.

Given the essentially exploratory nature of this study, two limitations arise. The study is essentially described from an inner perspective whereas the exploratory perspective seeks to establish the serious games phenomenon through the grid validity conditions used in banking industry training environments to transfer knowledge and best practices. This research has no ambition to establish a causal framework but rather to identify and characterize the key variables that can then be deductively tested (Yin, 1981).

3.2. A complicated emerging phenomenon

Serious games are still an emerging phenomenon and are characterized by particularly unstable, innovative, and complex modes of evaluation, training, knowledge management, and benchmarking. In general, case studies are the preferred strategy when how or why questions arise, when the researcher has little control over events, and when the focus is on a contemporary phenomenon in a real-life context (Yin, 1993). An inductive approach leads to a broader view of the serious training games used in banks.

The main reason to explore complex situations through immersion in several cases is to clarify the interactions between the different actors and to understand the specific phenomena. The possibility of formulating causal laws is doubtful because the uncertainty margin is too high between the antecedent and the consequent and even more so because frameworks and circumstances vary and change.

3.3. Field of study: the banking sector

Serious games initiatives are manifold, polymorphic, and spontaneous. Limiting the study to the banking sector enables maintaining the variety of observed objects. Numerous parameters influence the behaviors of actors in serious games and their strategies and interactions are extremely diverse. Observing these mechanisms in their context and acquiring a global view of stakeholder motivations leads to better understanding and obtaining stronger performance measures.

To provide the most relevant answers, the case method must be validated by triangulation of the collected information; validation of data, testimonies, and theories; and use multiple sources (Eisenhardt, 1991; Yin, 1981). This study analyzes three different cases to meet the requirement of having a sample that is small enough for a thorough qualitative analysis yet is large enough for a consistent comparative study. The number of cases depends on research objectives: if the aim is to explore new practices or discuss an original question, one or a few cases are enough (Wacheux, 1996). Some serious games in the banking sector are backed by widespread communication campaigns that increase the availability of secondary data.

3.4. Data collection and case construction methodology

A literature review yields the first part of the study; the second step involves systematically exploring the websites of the targeted banks. Thereafter, the analysis focuses on the websites of serious games creators. The studied cases are relatively well-known and serve as references. The IT service companies that design serious games list their achievements on their websites, posting functional as well as technical sheets. The third step entails a content analysis of several specialized websites. The fourth step involves reviewing press articles on serious training games in the banking sector. The simultaneous use of multiple data collection methods improves the reliability of information obtained from the Internet (Dochartaigh, 2002). Cross-checks are carried out among several sources, particularly comparing institutional websites with specialized websites. Triangulation obtains a greater level of accuracy concerning the different uses of serious games; indeed, the declared intentions of the game editors and their customers

are sometimes contradictory, ambiguous, or incomplete (Jonsen & Jehn, 2009).

4. Case studies

The following three case studies present the serious games used in three financial companies in three different countries: BNP Paribas in France, Omega Performance in the United States, and ICICI in India. In each case, the four knowledge management processes of the SECI model (Nonaka, 1991) are highlighted as essential elements of the operation and performance of the serious games.

4.1. “Starbank”: the BNP Paribas new employee integration serious game

The objective of the BNP Paribas “Starbank” game for new employees is to train them to become proficient in banking activities. The game immerses participants in a futuristic world—the 31st century—and helps them understand primary banking principles. The players try to establish the most effective winning strategy in the presented challenges and must satisfy customers, shareholders, and colleagues by creating agencies, managing real estate project investments, and optimizing assets. The tests can be very difficult and technical and require good knowledge of the economic environment and financial techniques. Losing is also a form of education and encourages players to retry and progress through the levels.

“Starbank” constantly challenges its players. Employees can connect anywhere through the Internet to take control of their avatar, perform tasks, and progress through the levels. This tool facilitates the dissemination of the corporate culture, the integration of new employees and their individual development through a better understanding of the bank’s functioning. The learning situations mirror reality based on the bank’s history and past phenomena (externalization) in fictional worlds that foster the immersion of players driven to use their knowledge (internalization) but also to adopt knowledge-creation behaviors (combination) to solve increasingly complex challenges. Indicators summarized on dashboards measure employee performance. The investment choices generate immediate positive or negative feedback as videos or playful activities conveying lessons explaining the consequences of each decision.

The rules foster collaborative work between players from different nationalities and generations (socialization). The combination of a specific social network and dedicated community managers stimulates a competitive spirit. The editors of “Starbank” state that 170 teams have formed and the game has 4000 players from 52 countries after only two months of competition.

4.2. “SimuStar”: the credit risks management serious game

In 2013, Omega Performance and Capsian Learning launched “SimuStar.” This serious game educates lending bankers to master professional best practices and accept or refuse loans based on the information provided or collected on their potential customers. They must adopt a critical attitude to render a customer portfolio that is as healthy as possible. The objective is to enable lenders to compare the broadest possible scenarios they may experience during their professional life. Omega Performance relies on its 30 years of financial consulting expertise to infuse “SimuStar” with educational content (externalization).

This game is designed to enable users to adopt the correct attitude, mobilize the right knowledge and skills, and acquire specific business competencies to limit risks. Learners immediately apply the taught theories in practical cases in which the results, positive or negative, are consistent with what would happen with real loans. Novice lenders must take into account all the variables and capture all the nuances of the situations they may face (internalization).

Players interact not only with prospects but also with colleagues, managers, and virtual tutors who help and advise them (socialization).

According to its designers, this realistic game immerses players in an authentic environment that guarantees learning and memorizing best practices that later can be reproduced naturally. The serious game acts on judgment and financial-decision capabilities, behaviors that are very difficult to improve, and leads to innovation by facing extreme or unlikely situations requiring creativity (combination). This simulation, considered by professionals to be the most successful in the credit universe, is integrated into the training programs of banks and financial companies.

4.3. “Cash detectives”: benchmarking to combat counterfeit banknotes

ICICI is the second largest Indian bank with 35,000 employees and a turnover of \$13 billion in 2009. With 30 million customers in more than 20 countries, the bank is growing and recruiting many new counter clerks. ICICI managers' key concern is training these clerks to detect counterfeit banknotes, which is very common in India. Great difficulties are encountered in this area with the growing volume of cash passing through the bank.

ICICI managers have established a training plan incorporating a serious game to make employees aware of the need to detect all counterfeit banknotes and provide them with the right techniques to accomplish this. The company approached TIS (Tata Interactive Systems) to use an interactive methodology for innovative knowledge transfer called GamBLsTM (game-based learning objects). This application capitalizes on the knowledge of counter clerks who are experienced in counterfeit banknote detection and disseminates this knowledge to novices (externalization). This game involves simulations, images, videos, graphics, tests, and generates a learner involvement rate that is four times higher than that of a lecture on the same subject.

The player becomes a secret agent fighting against a terrorist organization that uses counterfeit banknotes to finance its operations. The game is based on employee patriotism and suspense generated by the consequences of each decision. Employees are aware of the socioeconomic implications of counterfeit money and the impact of its circulation. In addition to improving awareness and motivation, the game leads players to develop the necessary skills to detect counterfeits through challenges that will enable them to progress in the different levels (internalization). As the game progresses, agents must conduct deeper investigations based on knowledge that is increasingly diverse and sophisticated (combination). In case of difficulty, supers agents assist players requesting help by providing memorization enhancement hints (socialization).

5. Results and observations

Banks that use serious games as tools for benchmarking observe similar development processes. The first is the historization (1) of events that have occurred in the bank and aims to identify situations and relationships within and across the organization, describe internal and external changes, and explain strategic and tactical decisions. Historization accompanies referencing (2) the best practices the company or its competitors use to carry out the activities according to the main events in the company's history. These best practices relate to people, services, partners, tools, technologies, processes, and behaviors.

Editors use these elements in the next phase, explicitation (3), consisting of formalizing knowledge that is then mobilized by each of the best practices identified in the first phase. Explicitation is even more difficult when the practices are natural and spontaneous and the knowledge and methods to use them are undocumented. The design (4) phase aims to re-create a playful and immersive world where players can recognize situations from historization and implement the knowledge and best practices from the explicitation and referencing phases. This virtual universe obeys the rules of an accurate and consistent set of practices associated with educational objectives, enabling the measurement of the players' progress, supporting their learning,

and encouraging collaboration between players and nonplayers. Professional referent avatars or artificial intelligence can help players overcome the most complex situations.

Control (5) is the testing phase, checking the overall coherence of the game by key users who then become referents and trainers. These business experts also categorize the main levels into variations that take into account the particularities of their professions and the specificities of subsidiaries or countries. Adoption (6) consists of deploying the serious game in a comprehensive training protocol facilitated by internal marketing campaigns and a community manager to federate targeted populations. Sophistication (7) consists of the evolution and continuous improvement of the game based on user feedback, new standards, tools, professional practices, and environmental changes. The design phase takes the sophistication phase into consideration in and guarantees that the game does not become obsolete. These development phases match the four processes of Nonaka's (1991) SECI model and are particularly useful for knowledge management and benchmarking in financial companies.

6. Discussion, recommendations, and perspectives

The realism of serious games using the most modern audiovisual technologies enables the high transfer of best practices close to reality (De Gloria, Bellotti, & Berta, 2014; Oksanen & Hämmäläinen, 2014). The situations faced in the game easily can be associated with previous or subsequent experiences. The games used in the banking sector intend to integrate new employees and help them learn to manage different situations. The playful aspect of serious games may compensate for the dull side of some subjects and make training that often can be boring seem fun (Littlejohn & Margaryan, 2014).

These games allow error because players face virtual clients with no risk and can learn at their own pace. No supervisor will criticize their work yet a trainer keeps a watchful eye to provide help and advice. The learners are the actual actors of their own training: they set their own goals, learn from their mistakes, measure their progress, analyze their results, and also learn by watching others play. Players are also generally encouraged to seek advice via forums or dedicated social networks (Wortley, 2014). Serious games are used primarily to test the ability of players to analyze situations, making the right decisions in a limited amount of time, improvising when facing unexpected events, optimizing resources, coordinating skills, and proposing outside-the-box solutions.

Players face situations such as high market fluctuations, economic crises, bankruptcies, and other events that require quick and rigorous reactions. Developing experience in dealing with these types of situations is difficult given that they rarely occur. New employees may face such events only after several years of experience, whereas older employees may have already experienced such phenomena and are therefore more capable of dealing with them. Capturing the specific knowledge and practices developed by these professionals and transferring them through playful and immersive simulations is an ideal way to ensure novices are prepared (Oksanen & Hämmäläinen, 2014).

Expert players who coach novice players foster the transfer of knowledge and practices through intergenerational exchange that can continue outside the game (Alklind Taylor et al., 2012). The learning delivered by the game can be refined and made operational through discussion, perspective, and anecdotes.

Games are just one method and should be considered as part of a holistic training approach through which practices and knowledge can be conveyed and transferred (Allal-Chérif & Makhlouf, 2015). The cases under study show that serious games are always part of a more elaborate training program including traditional courses, role-playing, individual or group interviews, competitions, coaching, benchmarking, debriefings, and evaluations. Tests have shown that players who follow all these forms of training and discuss their

game experiences significantly outperform those who exclusively use serious games without such conversations (Allal-Chérif & Makhlouf, 2015).

The knowledge and practices gained from serious games should be easily transmissible and replicable in the daily practices of learners, albeit some are difficult to achieve in relatively rare banking situations. The game cannot be considered effective if it is too distant from the work environment and players do not make the connection between virtual and actual practices. Dedicating a serious game to exceptional situations that occur only once or twice in an entire career in the banking sector may thus seem inappropriate, yet the rarity and severity of the events entail the need to simulate the situation to train tomorrow's professionals as a precaution. Assessing whether the educational goals of the game have been achieved is essential; however, such assessments are sometimes difficult and often neglected. Frequently, only player involvement and their performance are controlled without identifying if they really mastered the tools, processes, or situations to improve their work.

7. Conclusion

This research shows the contribution of serious games to each of Nonaka's (1991) SECI model phases. Each step in the development of serious games contributes at least once to each of these phases. The three games analyzed show that knowledge is selected, historized, contextualized, explicated, integrated into scenarios and game modes, controlled and enhanced by experts, disseminated and incorporated into training, and associated, refined, and adapted by learners.

Other sectors with greater heterogeneity and complexity of knowledge and practices could be studied to test the serious game development processes and evaluate its utility in extreme conditions. Telecommunications or industrial sectors could be considered in future research. Furthermore, a specific study of the performance of serious games in each of the four phases of the SECI model would also enable professionals to adjust approaches and projects to their specific needs.

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