A Framework of using DSS in Business Simulation Games

Study Object: Business Intelligence and Corporate Performance Management

Waranya POONNAVAT\textsuperscript{a,b,1} and Peter LEHMANN\textsuperscript{a}

\textsuperscript{a} Faculty of Information and Communication, Stuttgart Media University,
\textsuperscript{b} School of Computing, University of the West of Scotland,

Abstract. Decision Support Systems (DSS) have been used as a managerial decision supporting information system since the mid-1960s and the evolution of DSSs remains important for academia and industries. A new generation of DSSs technology, Self-Service Business Intelligence (SSBI), gives more powerful for information workers to make better decisions based on facts with less dependency to IT department. However, there are several challenges in teaching and learning how to use SSBI tools, since they are diverse and support broader ways to implement BI ad-hoc solutions. Business Simulation Games (BSGs) is considered as an effective educational platform that mostly be used in business schools and its potential enables students to develop management skills which need for the real life problems. The aim of this research is to propose a framework for teaching and learning decision making by using SSBI with Business Simulation Games (BSGs). Additionally, learning activities will be collected for further learning outcomes evaluation.

Keywords. Self-Service Business Intelligence, Business Simulation Games, Decision Support Systems, Business Intelligence, Management Process, Decision Making.

Introduction

The information systems for supporting management decision making, which are well-known as “Decision Support Systems” (DSS), have been evolving since the mid-1960s [1]. Many DSS applications, tools and technologies are widely revealed on the market after the intensive research and development by Information Technology (IT) companies and universities. Additionally, the evolution of DSS concepts remains an important research topic in both industries and universities.

Over the last two decades, DSS were utilized with some limitations and difficulties, such as heterogeneous data source extraction, multi-dimensional modelling, business analytics, information workers’ collaboration, multi-channel user interfaces and massive data visualisation. Meanwhile, the high demand for managing the corporate information factory [2] brought the modern and powerful DSS concepts and methods

\textsuperscript{1} Corresponding Author: poonnawat@hdm-stuttgart.de
onto the DSS stage, which are compromised under the term “Business Intelligence” (BI).

Today, the emergence of a new generation of decision support technologies – Self-Service Business Intelligence (SSBI) – enables DSS to function for a wider group of end users. DSS applications have moved from the management-focused decision support to the easy-to-use decision support for information workers at all levels of a company – strategic, tactical and operational. The decision making in the companies is necessary for operating and managing the highly optimised business processes.

Nevertheless, the DSS-related subjects are typical in the field of Information System (IS) and have been taught for many years [1,3]. They are still very popular in the academic world. Subjects such as Information Analytics, Management Information System, Business Intelligence and Business Analytics, are based on the DSS concepts.

Moreover, Wixom’s survey about the BI status in academia [4], had a base of 319 professors from 257 universities in 43 countries around the world. There were many BI-related subjects that have been taught in various academic disciplines.

In the survey’s top message, the question about teaching and learning BI was listed as the most challenging issue. Challenges mentioned included: access to data sets, finding a suitable textbook, finding suitable cases and providing realistic experiences [4].

Consequently, this advent of decision support technologies leads to the following questions:

1. “How can students be taught not only the basic concepts about BI and the handling of a BI tool, but also to select the “right” BI tool for making good decisions in the decision making process?”

2. “What kind of educational platform can be used to teach the effective and efficient usage of BI tools?”

1. Literature Review and Literature Search

The review question derived from the questions that mentioned in the introduction section.

- Is there empirical evidence of using DSS/BI associated with business simulation games currently exist in the literature?

In order to answer the review question, the secondary research methodology was used with this search terms:

(“serious games” OR “business games” OR “games-based learning”) AND

(“decision support system” OR “management information system”)

Furthermore, the background theories related to this research including management decision making process, decision-making support technology and business simulation games have been reviewed.
1.1. Management Decision Making Process

DSS and BI technologies are used increasingly to support the management processes, which can be seen as a systematic series of different phases. As an example for management process the following schema will be used to explain the typical management tasks in four phases: Business Analysis, Decision Taking, Organisation & Steering and Success Controlling [5].

![Phase diagram for management process.](adapted from [5])

The business value, which can be gained from management process, depends on the decision making latency or action distance – the distance between the starting point that the business event occurs and the action is taken. The action distance consists of three factors as follows: (1) data latency – the time starting from the point that a business event occurs, relevant data are captured, prepared and stored; (2) analysis latency – the time for data analysis, information generation and delivery to the proper persons, and (3) decision latency – the time to consider and understand all relevant information, make decisions to take the course of action and respond with an intelligent manner [6].

The Value-Time Curve shows the relationship between the (business) value and time to take the action – which represents as a decay function. The business value decreases rapidly after the business event happens, therefore, the faster to take action, the higher to save business value.
Shim et al. [7] stated that computer technology solutions have been used to support complex decision making and problem solving since the late 1950s in terms of DSS and become more significant since the early 1970s. The research areas of DSS technology typically focus on how to improve the “efficiency” of users’ decision making and the “effectiveness” of decisions.

DSS applications can be used to describe any analytical applications that help managers in planning and optimising business goals and objectives, such as production planning, investment portfolio optimisation, Executive Information System, expert system and Online Analytical Processing (OLAP) [8]. DSS remain popular in corporate and academic research publications due to the contribution of the four powerful DSS technologies: data warehouse, OLAP, data mining and World Wide Web (WWW) [7].

Since the early 1990s, Gartner coined the term BI to describe “a set of concepts and methods to improve business decision making by using fact-based support systems” [1], and the term BI also has been used to describe the analytical and decision support applications. Wixom et al. [8] defined BI as “a broad category of technology, applications and processes for gathering, storing, accessing and analysing data to help its users make better decisions”. The authors also stated that BI plays a critical role, impacts to organisational success, is required to compete in the marketplace and changes from being used by a few specialists to many workers.

In today’s economic environment, BI solutions become more important and essential for managing the company intelligently. However, many decisions still are not based on BI because of the limitations to access information and to use suitable BI tools for business analytics. A new development of BI technology called Self-Service BI (SSBI) offers an environment to support and empower end users to create their own BI solutions and making decision faster. The development of SSBI technology is highly growing and the new SSBI functionalities will be launched more into the marketplace [9,10].

Today, the development of SSBI emerged as a new advanced BI technology in the marketplace in order to fulfil this objective. The paradigm shift of SSBI is about the changing in semantic modelling concept which is beyond the traditional BI concept. Some significant drivers for SSBI requirement are as follows: the businesses need to
change constantly and rapidly, the IT departments are unable to satisfy the business users’ requirements in timely manner, the slow access to information provided by the IT departments, the business users need to do more analytics and the limitation of IT budget (e.g., [11-13]).

SSBI has evolved from BI technology and is defined as “the facilities within the BI environment that enable BI users to become more self-reliant and less dependent on the IT organisation” [12].

Since SSBI tools are diverse, this makes SSBI tools difficult to use for some information workers or with a high risk to be overused by others [11]. An appropriate self-service environment can be provided by knowing the types of information workers, the skill levels of different information workers and the tools of SSBI they need [12], moreover, business users’ skills and the lack of business users’ training are two of the top five inhibitors for SSBI.

1.3. Business Simulation Games

Business simulation game is a subset of simulation games which focuses on business content, whereas, the broader definition of simulation game underlying of two concepts: simulation and game. The term “simulation” generally refers to “a representation of a real system, an abstract system, an environment or a process that is electronically generated” [14]. The term “game” is defined as “an artificially constructed, competitive activity with a specific goal, a set of rules and constraints that is located in a specific context” [15]. Cruickshank stated that the term simulation game is used as “one in which participants are provided with simulated environment in which to play” [16].

Faria et al. [17] stated that business simulation games have been developed and used as the vehicles for teaching the business concepts for more than 40 years in universities and companies. The major reasons of using business simulation games were as follows: gained experience, strategy aspects, decision-making, learning outcomes and teamwork experience. The advancement of IT provided more opportunities to improve the learning experience and the way to use business simulation games and also to develop a more complex environment. In addition, business simulation games have moved from being a supplemental tool to a central tool and have become a major form of pedagogy for business education.

Several studies stated that business simulation games enable students to learn how to make decisions, manage the business process in a modern enterprise, link between abstract concepts and real world problems and improve quantitative skills (e.g., [3,18,19]). Furthermore, the new concept of business simulation games, which combines with case-based approaches and experience-based learning theories, results in business simulation games being one of the popular and effective way of education methods [18]. Moreover, games will be one of ICT trends for the future of learning [20].

1.4. Literature Search Result

The literature search has been performed and carried out using several online databases: Google Scholar, ScienceDirect, EBSCO, Wiley Online Library, ACM, Springer, IEEE, and Emerald. The initial literature search returned 1,362 articles. There were ten articles meet the criteria and other two articles were added from the references.
The empirical studies showed that some business simulation games provided decision support tools inside the games and some others used the external decision support tools. The reporting in the business simulation games was often based on pre-defined queries with little flexibilities in using ad-hoc queries. Analytical modules for prediction were restricted to the database of the games. The flexibility for tactical queries and automated decisions were not foreseen. Moreover, business simulation games in the studies were not designed with regard to teaching and learning BI concepts and a new generation of DSS/BI technology. However, the strength was on teaching business scenario.

1.5. Research Gap

There is no framework using business simulation games as a BI learning platform that focused in teaching and learning the BI concept and skills, how to use and apply the right SSBI tools, and concerning the decision making latency in the management process.

2. Research Question and Research Methodology

2.1. Research Question

- Would the proposed BI-learning framework be possible to improve students’ BI knowledge and skills, using and applying the right SSBI tools, and decision making skill?

2.2. Research Methodology

In order to answer this research question, the survey research and the experimental research methodology will be used.

The prototype of BI-learning framework will be developed. Expert interview will be taken. The search of experts will be considered within Germany and will select at least four experts from both academia and companies. The aim of the interview is to collect the experts’ ideas and recommendation to revise the prototype and framework before the experiment.

The true experimental research will be undertaken and utilizing a between-subjects approach with a pre- and posttest control group design. The procedures are as follows:

- Students will be randomly assigned to a control group and an intervention/experimental group.
- The control group and experimental group will include at least 30 students each.
- Students in the control group will participate only in the pre-testing and post-testing phases of the study.
- Students in the control group will play business simulation games and making decision without BI-learning framework or without using DSS/SSBI tools.
- Students in the BI-learning framework experimental group will play business simulation games and making decision with BI-learning framework or with using DSS/SSBI tools.
• Both group will be pretested and post-tested on the BI questions and exercises. The participants will be students from Stuttgart Media University or other universities which have basic knowledge about BI.

3. Plan for Completion

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4. Proposed Solution and Expected Contribution

The main aim of this thesis is to propose the BI-learning framework, which consists of the conceptual framework (Figure 3) and technical framework (Figure 4), of using DSS on top of business simulation games to teach and learn how to make decisions in the management decision making process. The BI-learning framework will be tested empirically and will be generalizable to any business simulation games, SSBI tools, and learning analytic engines.

4.1. Conceptual Framework

For a conceptual framework (Figure 3), business simulation games will be used as an educational platform to simulate the business scenario and business processes. During the cycle of business process, the management decision-making process will be taken in each business activity to support better decision making and decrease the decision making latency.
4.2. Technical Framework

A technical framework (Figure 4) will be used to support the conceptual framework. In this framework, data sources from a business simulation game will be extracted, transformed and loaded into data warehouse. Semantic models will model information requirements based on business processes from business simulation game. Semantic models will compose of unified model and physical model such as dimensional fact model (DFM), tabular model or other modelling tools. Data mart and data cube will be built and able to access, analyse, and visualise with SSBI front-end tools. Moreover, learning data and learning activities will be collected and used to measure the learning outcomes.
4.3. Expected Contribution

This research will make the following contributions to the body of knowledge as follows:

- Providing a generalizable BI-learning framework for any business simulation games, SSBI tools, and learning analytics engines
- Providing a prototype of using DSS based on SSBI on top of business simulation games to teach and learn decision making
- Providing a semantic layer to support information modelling based on model-driven approach

5. Conclusions

For many years, DSS have been used to improve the quality of managerial decisions. DSS applications have changed over the last decades, moving from Enterprise Reporting System to Management Information System and nowadays to Business Intelligence Solutions. The issue of teaching and learning DSS is still a big challenge in the academic world, since the DSS-related subjects are still difficult, complex and challenging. Moreover, the demand for well-educated students in the field of DSS is still growing.

This research is working on the frameworks to overcome the restrictions and limitations of the existing DSS teaching solutions. A SSBI solution will be embedded into a business simulation game in order to learn and teach DSS in a modern, integrated and fun-to-use environment to increase the learning outcomes. A platform will be provided to measure and manage students’ learning skills in the field of DSS/BI. Later, the platform will also be used for experiments to measure learning behaviour, with a strong focus on the 21st century skills defined by the European Community [20].
References