Using Self-service Business Intelligence for Learning Decision Making with Business Simulation Games

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Abstract: This position paper presents, firstly, the evolution of decision support systems (DSS) and the challenges in teaching in the field of DSS. Secondly, the concepts of management process, decision support technology, self-service business intelligence (SSBI), business simulation games and literature search results on business games associated with DSS are presented. Lastly, we suggest a conceptual framework of using DSS/SSBI on top of business simulation games to support better decision making.

1 INTRODUCTION

Information systems for supporting management decision making, known as *Decision Support Systems*, or DSS, have been evolving since the mid-1960s (Power, 2007). The evolution of DSS concepts remains an important research topic in both industries and universities (e.g., DSS 2.0 Conference, 2014).

Over the last 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's information factory (Inmon, Imhoff and Sousa, 2001) brought the modern and powerful DSS concepts and methods onto the DSS stage, which are compromised under the term "*Business Intelligence",* or BI. Starting in the late 90s, Gartner coined the term BI to describe "a set of concepts and methods to improve business decision making by using fact-based support systems" (Power, 2007, p. 11-12). This enables BI applications to function for a wider group of end users and move from the management-focused decision support to the easy-to-use decision support to users at all levels of a company – strategic, tactical and operational. Decision making in companies is necessary for operating and managing highly optimised business processes. Using BI applications with less support from the information technology (IT) departments is called *"Self-Service Business Intelligence"*, or SSBI (Imhoff and White, 2011, p. 5). SSBI is a new BI generation beyond traditional BI technology which needs more IT contribution. Using SSBI tools, users have a variety of personal decision support features and functions, for instance creating, searching, exploring, modelling, analysing, visualising, sharing and collaborating to develop their own ad-hoc BI solutions. The complexity of BI functionalities, therefore, is far more powerful than ever and users are able to use SSBI technology within their desktops or spreadsheet applications with a higher degree of independency from the IT departments.

Nevertheless, the BI-related subjects are typical in the field of Information System (IS) and have been taught for many years (Power, 2007). 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 DSS/BI concepts. Moreover, Wixom's survey about the BI status in academia (Wixom, Ariyachandra and Mooney, 2013), 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, for instance Information System, Decision Science, Statistics, Computer Science, Management Information System, Business Analytics, Operations Research,

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Supply Chain Management, Economics, Marketing and Accounting.

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 (Wixom et al., 2013).

Consequently, the questions about how to teach and learn BI have arised as follows:

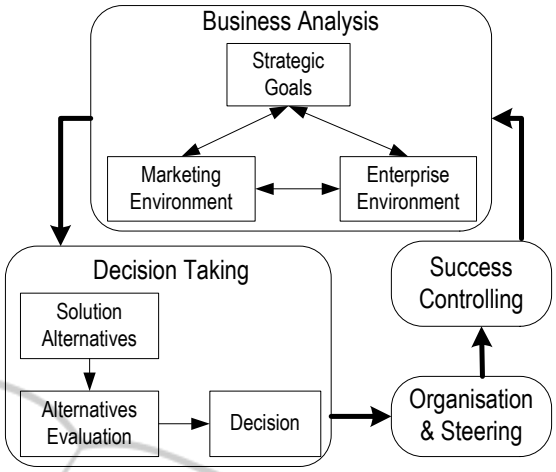
(1) "How can students be taught not only the basic concepts about BI and the handling of a BI tool, but also to select the "right" BI tool for making good decisions in the decision making process?" Since BI/SSBI tools are diverse and often overlap each other, as a consequence they are difficult to use for some users or with a high risk to be overused by other users (Eckerson, 2012).

(2) "What kind of educational platform can be used to teach the effective and efficient usage of BI tools?" Business simulation games are popular and known as one of the most effective education methods, which are widely used for teaching and learning managerial skills, such as making decisions, using management techniques, integrating ideas, applying theory to practice and giving the experiential learning to students (e.g., Ben-Zvi, 2010; Faria, Hutchison, Wellington and Gold, 2009; Lin and Tu, 2012; Wawer, Miloz, Muryjas and Rzemieniak, 2013; Williams, 2011).

In this position paper we suggest a framework to teach and learn BI concepts as a decision supporting method on top of business simulation games. The framework focuses on using SSBI which is a new and powerful BI technology generation for a wide range of decision making by users or information workers. We will focus on SSBI because it gives the opportunities to all kind of users to design DSS/BI models with less IT-technical background needed.

2 MANAGEMENT PROCESS AND DECISION MAKING

DSS/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 (Gluchowski, Gabriel and Dittmar, 2008) (see Figure 1).



(Adapted from Gluchowski et al., 2008, p. 21)

Figure 1: Phase diagram for management process.

Phase 1 Business Analysis: the managerial decisions always occur along the business processes, which depend on the context of business objectives, internal and external environment. This initial phase focuses on the (permanent) analysis of situations based on three pillars: *(1) Strategic Goals* – all objectives from all levels of company should be harmonised, not be in conflict and used as a strategic framework to influence and balance with the other two pillars; *(2) Marketing Environment* – such as competition, economic growth and stability and technological advancements, and *(3) Enterprise Environment* – such as availability of resources, organisational culture and structure. All activities, that have an impact or influence on the stability of this system have to be observed, analysed and validated.

Phase 2 Decision Taking: this phase emphasizes the planning for taking decisions and consists of three steps: *(1) Solution Alternatives* – any possible, realistic and relevant alternatives are formulated and collected under a given assumption for any expected future actions; *(2) Alternatives Evaluation* – all collected alternatives have to be evaluated and compared based on the possible risks, feasibility and implications of each alternative, and *(3) Decision* – an alternative is selected out from others which has an acceptable risk and is suitable for a specific business situation for further implementations.

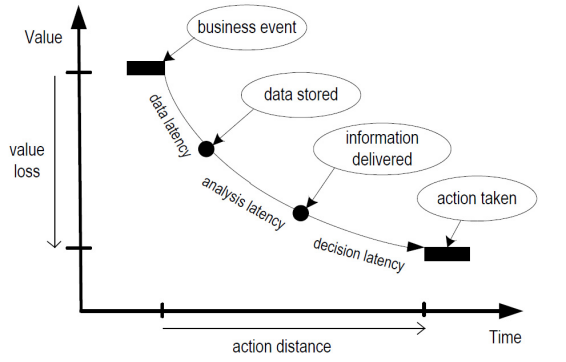
Phase 3 Organisation & Steering: the selected alternative has to be implemented and a course of actions has to be undertaken. Therefore, the organisational structure and project management have to be designed and developed in order to transfer any accountabilities, responsibilities and communication through all hierarchical management

levels during the implementation period.

Phase 4 Success Controlling: the selected alternative is used as the baseline and the actual results are used to measure and compare with the baseline. The variances have to be analysed, which leads to any new actions and restarts the next cycle of the management process.

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 (Hackathorn, 2003).

Figure 2 shows the value-time curve – 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.



(Adapted from Hackathorn, 2003)

Figure 2: The value-time curve.

3 DECISION SUPPORT TECHNOLOGY

Shim, Warkentin, Courtney, Power, Sharda and Carlsson (2002) 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. Classical DSS tools have been designed with three main components: (1) the capabilities to access internal and external data, information and knowledge; (2) the functions for modelling and analysing, and (3) the simplified user interfaces to enable interactive queries, reporting and graphing functions. In addition, 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) (Wixom and Watson, 2010). In addition, data warehouse technology has emerged to handle massive data, operate OLAP and implement dashboard or scorecard applications for DSS (Power, 2007). 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) (Shim et al., 2002).

Since the early 1990s, Gartner coined the term BI and the term BI also has been used to describe the analytical and decision support applications. Wixom et al. (2010, p. 14) also 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, or SSBI, offers an environment to support and empower users to create their own ad-hoc 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 (Evelson, 2012; Howson, 2013).

4 SELF-SERVICE BUSINESS INTELLIGENCE

The concept of personal decision support systems is the oldest form of DSS (Arnott, 2008), and the concept of SSBI has been attempted to integrate in BI systems for many years (Mundy, 2013). Originally, the objective of both concepts is supporting personal decision making. In recent years, however, the development of SSBI emerged as a new advanced BI technology in the marketplace in order to fulfil this objective. Some significant drivers for SSBI requirement are as follows: the business needs 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., Eckerson, 2012; Imhoff and White, 2011; Kulkarni, 2012).

SSBI 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" (Imhoff and White, 2011, p. 5). These facilities focus on four main objectives: (1) to make BI results easy to consume and enhance; (2) to make BI tools easy to use; (3) to make data warehouse solutions fast to deploy and easy to manage, and (4) to make data sources easy to access (Imhoff and White, 2011).

Since SSBI tools are diverse, 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 or fuctions of SSBI they need (Imhoff and White, 2011). Moreover, Imhoff and White (2011) found that business users' skills and the lack of business users' training are two of the top five inhibitors for SSBI.

5 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" (Hainey, 2010, p. 44). The term *"game"*, is defined by Hay as "an artificially constructed, competitive activity with a specific goal, a set of rules and constraints that is located in a specific context" (as cited in Wilson, Bedwell, Lazzara, Salas, Burke, Estock, Orvis and Conkey, 2009, p. 2). Cruickshank stated that the term simulation game is used as "one in which participants are provided with simulated environment in which to play" (as cited in Connolly and Stansfield, 2006, p. 466).

Faria et al. (2009) 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., Ben-Zvi, 2010; Lin and Tu, 2012; Wawer, 2013; Williams, 2011). 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 (Wawer, 2013).

6 LITERATURE SEARCH

The literature search has been performed to find the empirical studies about business games associated with DSS. The literature search has been done using several online databases – Google Scholar, ScienceDirect, EBSCO, IEEE, Springer, Wiley Online, ACM and Emerald. The terms used for searching from abstracts, titles and keywords, as follows:

("serious games" OR "business games" OR "games-based learning") AND ("decision support system" OR "management information system")

The initial search returned 1,362 results, of which ten articles met the criteria - business games associated with using DSS for making decision – and two added articles were found in the references.

The 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. However, the strength was on teaching business scenario.

7 PROPOSED SOLUTION

This position paper suggests a conceptual framework of using DSS on top of business simulation games to teach and learn decision making (see Figure 3).

In the research project, business simulation games will be used as an educational platform to simulate the business scenario. During the business processes, the DSS tools – SSBI – will be applied for each business activity to support the decision making process.

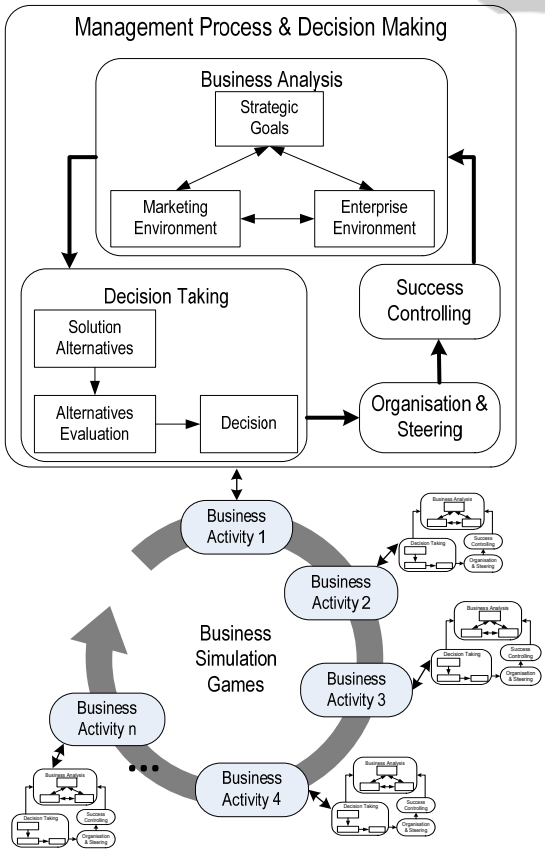


Figure 3: A conceptual framework of using DSS on top of business simulation games.

We will select business simulation games which support the representative business processes, evaluate a software platform for DSS provided SSBI functionalities and then attach with the business simulation games, lastly, create criteria for measuring the learning outcomes.

The framework will be used for experiments to prove that whether it is able to support learning and teaching BI, provide a better understanding of using SSBI tools and applications and SSBI technology will help end users to make better (valuable/actionable) decisions.

Furthermore, this framework will integrate an instrument for students and teachers to measure the learning outcomes based on the concept of "learning analytics" (Siemens, Gasevic, Haythornthwaite, Dawson, Shum, Ferguson, Duval, Verbert and Baker, 2011).

8 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- or BI-related subjects are still difficult, complex and challenging. Moreover, the demand for well-educated students in the field of DSS is still growing.

We are working on a framework using business simulation games to overcome the restrictions and limitations of the existing DSS teaching solutions. We will embed a SSBI solution into business simulation games in order to learn and teach DSS/BI in a modern, integrated and fun-to-use environment.

We also believe that the integration of SSBI into business simulation games will increase the learning outcomes. We will provide a platform to measure and manage students' learning in the field of DSS/BI. Our 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 (Redecker, Leis, Leendertse, Punie, Gijsbers, Kirschner, Stoyanov and Hoogveld, 2011).

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