

BUSINESS SIMULATION FOR EDUCATION AND TRAINING ON SUSTAINABILITY MANAGEMENT

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0043/316/380-3237

Abstract

To enable education and training in the field of sustainability management an interdisciplinary team of researchers, consultants and practitioners developed a management game called “sustainability manager” (www.sustainabilitymanager.at). This paper presents the key features of this business simulation and reflects the experiences of the application of this management game in trainings in master courses at several universities. This management game is based on a business simulation, i.e. a company is modelled using web technology and soft computing approaches. The sustainability manager can be used as web-based training instrument for sustainability management and can in principle be adapted to specific training situations.

Keywords: sustainability management, CSR, business simulation, training, management game

POSLOVNA SIMULACIJA ZA IZOBRAŽEVANJE IN USPOSABLJANJE O SONARAVNEM MENEDŽMENTU

Povzetek: Da bi omogočili izobraževanje in usposabljanje na področju sonaravnega upravljanja, je med-strokovna ekipa raziskovalcev, svetovalcev in praktikov razvila menedžmentsko igro z imenom 'vodja sonaravnosti' (www.sustainabilitymanager.at). Prispevek prikazuje ključne lastnosti te poslovne simulacije in odseva izkušnje iz uporabe te menedžmentske igre v magistrskih predmetih na več univerzah. Igra temelji na poslovni simulaciji: podjetje simuliramo u uporabo mrežne tehnologije in pristopa z mehkim računalništvom. Igra se da uporabiti kot pripomoček s temeljem na omrežju za usposabljanje za sonaravno vodenje. Načelno se da prilagoditi svojim posebnim položajem usposabljanja.

Ključne besede: sonaravno upravljanje, DOP, poslovna simulacija, usposabljanje, menedžmentska igra

1. Introduction

If a sustainable society should be realized, we have to rely on capabilities and actions from the business sector, too. Corporations have cognitive resources, technologies and skills which can be used to contribute positively to a sustainable transition. Some corporations engage directly in sustainability related activities, many others will need regulations and incentives (Laudal (2010)). Regardless of its motivation a corporation has to organize, to structure and to embed sustainability related actions into its activities, strategies and routines, i.e. into its management systems. To enable education and training in the field of sustainability management a management game called “sustainability manager” was developed in an interdisciplinary team of researchers, consultants and practitioners. This paper presents the key features of this business simulation and reflects the experiences of the application of this management game in several business seminars as well as trainings in master courses at Universities.

2. Sustainability Management

The United Nations Brundtland commission defined Sustainable development as ethical standard (World Commission on Environment and Development (1987)). To realize sustainable development a more tangible definition is necessary. The Framework for Strategic Development (FSSD) - developed by ten pioneering sustainability scientists - offers such a definition in using four general principles for sustainability (Robert, Schmidt-Bleck et al. (2002)):

1. In a sustainable society, nature is not subject to systematically increasing concentrations of substances extracted from the Earth's crust,
2. concentrations of substances produced by society,
3. degradation by physical means
4. and in that society people are not subject to conditions that systematically undermine the efforts to meet their needs.

The role of business regarding sustainable development has usually been discussed as “responsibility” to society; here responsibility is seen as any effort to eliminate or reduce negative effects of business (Carpenter and White (2004), p. 52). As this is understandable based on the many problems we face through our unsustainable development, one should also think about how business can contribute to the goals of sustainable development actively, i.e. to link responsibility with opportunity. In this case sustainable development can be a source of value creation for the company, society and nature. Responsibility has to be the basis for opportunity. But approaches focusing on responsibility alone are only successful over a certain period of time: for instance eco-efficiency as aspect of environmental sustainability gains usually big saves in the starting phase; in the following years it becomes harder and harder to find further improvements (Carpenter and White (2004), p. 54).

Sustainability management has special challenges: integrate externalities, avoid/reduce negative social and environmental impacts and identify opportunities caused by a (more) sustainable behaviour are central aspects for sustainability management. These aspects have to be regarded in any sustainability oriented business training.

An important step in the development of this management game was to concretize sustainability management. Starting point were experiences of the development team in numerous consulting projects regarding sustainability and an extensive literature review regarding corporate sustainability management and CSR, especially using the principles for sustainability from the framework for strategic sustainable development (Robèrt et al. (2002)). The team incorporated economic, environmental and social sustainability aspects into the management game; examples for the economic dimensions are innovation and technology management, collaboration with stakeholder and partners, knowledge management, processes, purchase or sustainability reporting. Examples for the environmental aspects are the use of resources (materials, energy) including use of recycled resources, emissions into the air, water or ground, waste and hazardous waste, biodiversity and environmental issues of the product. Social aspects are divided into internal social aspects like corporate governance, motivation and incentives, health and safety, and human capital development; external social aspects are ethical behaviour and human rights, avoidance of controversial activities, avoidance of corruption and cartel and corporate citizenship (Baumgartner and Ebner (2010); GRI (2006); Labuschagne et al. (2005); Labuschagne and Brent (2006)).

3. Knowledge Based Management Games Using Business Simulation

An important aspect of any management initiative is to train and to educate employees. One possible way to do this is to use management games and business simulation as they allow the learning and training of new competencies (Hoffmann (2009)). An advantage compared to classical leaning approaches is the possibility to repeat the learning content easily and the possibility to learn and test new competences virtually; this virtual learning and testing allows also failing without facing real consequences. To fully benefit from the advantages of management games they should be designed as knowledge based games, i.e. real world facts and situations should be implemented in the game in a realistic way. As reality is truly non-linear and non-deterministic, but highly complex a knowledge based management game has to be designed in a similar way (for a detailed description of this section see Baumgartner et al. (2009)).

3.1 Requirements for Knowledge Based Management Games

Usually the requirements will differ for individual roles in a management game. These roles are usually the player, the game administrator, the game engineer and the system administrator (see table 1): the player is the “user” of the game, whereas the game administrator is in charge to supervise the game in the training situation. The game engineer is responsible for the design and the content of the game, the system administrator is the expert for the technical solution.

Table 1: Different roles in knowledge based management games

Role	Task
Player	Playing the game, communicate
Game Administrator	Development of scenarios Game administration Configuration of new game sessions Auditing
Game Engineer	Development and declaration of facts, rules and flows Development of test scenarios
System Administrator	Import flows from system components Structuring

3.2 Business Simulation

Basis for a knowledge based management game is the simulation of the reality, in case of management games the simulation of business situations. To realize this, real world facts have to be translated into a virtual “simulated” world. These facts are generated based on data in the game engine and the rule engine. These data contain the relevant information about stakeholder, companies, competitors, markets, authorities, resources, environment or other necessary aspects relevant for the management game. The level of details of individual data is described with data granularity. The granularity can be adjusted according to the required game sequence. For instance employees can be described very detailed with data about their education, motivation, productivity or just with the factor labour costs. Another important point for realistic business simulations is the feature of emergence: a specific situation in the business simulation is not fully explainable by single aspects of the system; instead it is also dependent from non-linear relations between these aspects.

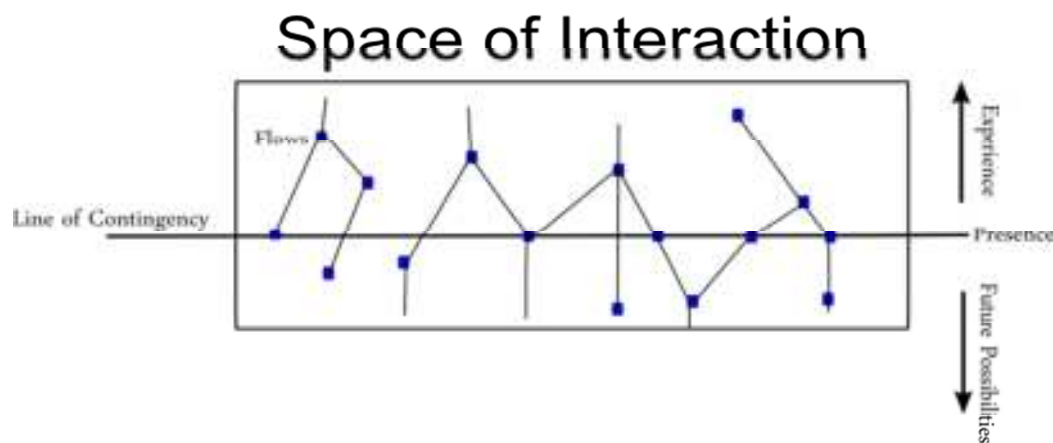


Figure 1: Space of Interaction (Baumgartner et al. (2009))

To determine the actual status in the simulation, the real world data are combined with meta-world-facts. These facts describe the basic features and relations in the simulation. It is important to acknowledge that this simulated system is path-dependent: each situation and (possible) decision is based on previous situations and decision. Every new decision will lead to new situations which are described by changed or new data and facts generated by the system (game and rule engine). Figure 1 explains this so called “space of interaction”: all previous decisions induced certain actions which had specific impacts. For a given point in time, these previous decisions, actions and impacts allow new specific decisions (line of contingency) which will lead to new situations. This means previous decisions will have an influence on future situations, but in a non-linear way due to the feature of emergence.

3.3 Technical Solution

The technical solution is realised with JBoss Rules (also named as Drools), version 5. This software contains an expert system, a human-computer-interface, rule flows to display processes and a business rules management system (BRMS). One advantage of this system compared to other process management systems is that the actual flow of processes is dependent on previous activated rules (The activation of rules is based on decisions of the player).

The technical system developed and used for the sustainability manager consists of a game engine, a rule engine and a process/flow engine. The game engine controls the game. It was programmed by attractive software (www.attractivesoftware.com), it is technically connected to the drools BRMS Guvnor 5. A high usability was reached by using AJAX technologies (IBM/JBoss Richfaces). The game engine is used for the game cycle management (i.e. initialization (settings, scenarios), periodicity (time-driven evolution), save/restore), goals management, game history, rule/flow execution, human task interaction, story-telling, fact visualisation (tables, graphs), logging and auditing and finally interpretation). Additionally the game engine is used for the game administration (game setup, player management, world setup (facts, real world, meta world), scenario setup, goal setup and editing of the story board).

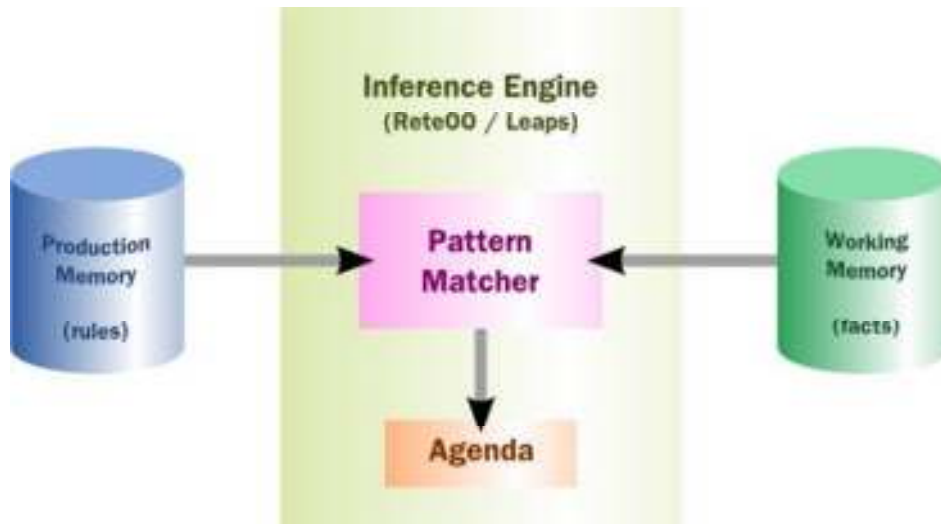


Figure 2: JBoss Drools Rule Engine (<http://downloads.jboss.com/drools/docs/5.0.1.26597.FINAL/drools-expert/html/ch01.html#d0e103>, 15.02.2011)

The rule engine is used to edit and use the rules for the simulation; it is managed by the game engine. The rule engine (see figure 2) consists of a production memory (containing all possible rules) and a working memory (containing the real-world facts). Similar facts are grouped to several types, e.g. all relevant facts about employees are grouped into one type. Rules are described as if-then-relations which allow logical reasoning (inference). Rules are activated based on specific criteria at defined points in time. An activated rule can also activate other rules. The rules are activated based on an expert system using the ReteOO/Leaps algorithm. This expert system allows in contrast to a deterministic and linear activation of rules feedback loops, i.e. rules can be reactivated in case of changed facts.

The interaction between the player and the business simulation is based on actions which are induced by decisions a player has to make. As described above the availability of these decisions and actions is determined by previous actions. Processes and process flows describe in the process engine the relation between different actions over time. The game is realized as browser game which enables the use of the management game with web-browsers like Internet Explorer 7 or 8, Firefox 2 or 3, Safari or Chrome. As it is not necessary to install specific software to use the management game the barriers to use the game are very low and practicability and usability are maximized.

4. The Sustainability Manager

The sustainability manager is realized based on the technology described in section 3. The goal of the sustainability manager is to provide a know-how based management game to educate and train competences in sustainability management. The business simulation includes strategic aspects, organizational structure of the company, and material, energy and cost data. As training object a medium-sized company is used. The main characteristics (=initial settings of the game) of the company are following:

- Production characteristic: assembling of 50ccm light weight cars
- 1200 cars are sold per month
- Price per car: 7600 €
- 150 employees
- High share of unused production capacity
- Innovativeness is low

The player is asked to make all relevant and necessary management decisions (like to decide upon the price of cars, number of cars produced, purchasing of raw materials, hiring of employees, ...) and to choose other management actions (like implementing a management system, training of employees,...). The consequences of these decisions and actions are made visible with indicators. The indicators are grouped according to the dimensions of sustainable development in economic, environmental and social indicators. Decisions and actions are structured according to the main elements of Porters value chain framework (Porter (1995)): infrastructure, human resources, technology, procurement, inbound logistics, production, outbound logistics, marketing & sales and services (see figure 3).

The player's goal is to run the virtual company in the best sustainable way. The effects of the decisions in one game period (e. g. one month) are simulated and sustainability indicators are calculated; these indicators show the

development of the company in respect to economic, environmental and social aspects. After reviewing this feedback the player has to make decisions for the next period. So in fast motion the long term effects of decisions and their impact on sustainability performance are demonstrated. The player can learn period after period to understand the essential aspects of sustainable management and is enabled to develop strategies for his or her practical work in the field of sustainability management.



Figure 3: Screenshot of Sustainability Manager

5. Experiences and Future Application

The sustainability manager has been used in different seminars for practitioners and in university courses. Usually teams of 2-3 people are playing with the sustainability manager. One advantage of using this web-based training instrument is a high usability as no specific software is required to play the management game and game logic is easy and intuitively understandable. In order to playing this management game, key qualifications like responsibility, team work, communication, creativity and flexibility are necessary and these qualifications are therefore trained and improved. The participants' feedback was very positive and confirmed the idea of this management game as well its applicability. The technical solution enables the adaption of the sustainability to new training situations and target groups. Therefore the sustainability manager could be adjusted to the requirements for the use in schools and in youth education.

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