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The effects of a web-based business strategy game for understanding of strategic management

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Abstract

Business strategy games are defined as sequential decision-making exercises structured around a model of an enterprise. In these games, participants have to make management decisions from time to time. Their choices of different strategies, such as cost leadership, differentiation or focus, at one time generally affect the environmental conditions under which the subsequent decisions must be made. These games have a long history and with the change of technology also the fields of application changed. Current reasons for using such games are to evaluate personnel, to study individual and group behavior but also to support teaching because of their incredible opportunities for learning. Thus, the aim of this thesis is to develop an own web-based business strategy game, to integrate it in a strategic management course at the university and to analyze if the usage of this game can improve the students' understanding of strategic management. This evaluation was done with a pre- and post-survey to prove if the knowledge level of understanding strategic management has changed significantly. Furthermore, it was also tested how the game participants perceived the game. The results of the first statistical tests identified no significant improvements in understanding. Nevertheless, the second part of the evaluation showed that the participants perceived the game as useful for understanding strategic management and were also satisfied with the learning experience. Moreover, they enjoyed playing the game and perceived it as interesting and challenging. These findings motivate to further improve the business strategy game itself and the course integration to achieve significant results of performance improvements the next time.

Keywords: Business strategy game, simulation games, learning theories, game based learning, teaching strategic management

Kurzfassung

Strategische Unternehmensplanspiele werden als sequentielle Entscheidungsübungen definiert, welche um ein Modell eines Geschäftsbetriebes strukturiert werden. In diesen Spielen müssen Teilnehmer von Zeit zu Zeit Managemententscheidungen treffen. Ihre Wahl der verschiedenen Strategien, wie Kostenführerschaft, Differenzierung oder Fokussierung, beeinflussen in der Regel die Umweltbedingungen, unter denen die nachfolgenden Entscheidungen getroffen werden müssen. Diese Spiele haben eine lange Geschichte und mit den Veränderungen der Technologie haben sich auch die Anwendungsbereiche geändert. Aktuelle Gründe für den Einsatz solcher Spiele sind um Personal zu bewerten, um Einzel- und Gruppenverhalten zu studieren, aber auch als Unterstützung für den Unterricht aufgrund ihrer zahlreichen Möglichkeiten zum Lernen. Daher ist das Ziel dieser Arbeit die Entwicklung eines eigenen Web-basierten strategischen Unternehmensplanspiels, um es in einem strategischen Management-Kurs an der Universität zu integrieren und später zu analysieren, ob die Verwendung dieses Spiels das strategische Management-Verständnis der Studenten verbessert. Diese Auswertung wurde mit einer Vorher- und Nachher-Befragung durchgeführt, um zu beweisen, ob sich der Wissensstand bezüglich strategischem Managements geändert hat. Des Weiteren wurde untersucht, wie die Teilnehmer das Spiel empfunden haben. Die Ergebnisse der ersten statistischen Tests identifizierten keine signifikanten Verbesserungen im Verständnis. Dennoch ergab der zweite Teil der Auswertung, dass die Teilnehmer das Spiel als nützlich für das Verständnis von strategischem Management wahrgenommen haben und dass sie darüber hinaus mit der Lernerfahrung zufrieden waren. Darüber hinaus genossen sie die Spielteilnahme und fanden das Spiel interessant und herausfordernd. Diese Ergebnisse motivieren zur weiteren Verbesserung des strategischen Unternehmensplanspiels an sich und zur Verbesserung der Integration in die Vorlesung, damit bei weiteren Spieldurchführungen signifikante Ergebnisse von Leistungsverbesserungen erzielt werden können.

Schlagwörter: Strategische Unternehmensplanspiele, Simulationen, Spiele, Lerntheorien, Spiel-basiertes Lernen, Unterricht von strategischem Management

Contents

CHAPTER 1

Introduction

The introduction chapter gives a brief overview of the fundamental topics and disciplines of the present work and outlines the objectives of this thesis. Furthermore, it points out the chosen approach as well as the structure of subsequent chapters in order to fulfill the declared goals.

1.1 Problem statement

Nowadays numerous methodologies exist to deepen the understanding of business strategies that are taught in different lectures at universities. Actually these ways are lectures and case studies. In these lectures slides are presented and afterwards the students work on different case studies to get in touch with different strategies [1]. Another way to address this issue are business strategy games. With these games it is possible to simulate the interaction between different markets, force the players to develop strategies and make appropriate operative decisions. The history of strategy games can be traced back nearly 5000 years, when the development of board games and war games, such as chess and 'Go' started. With the change of the technology also the business games changed. Examples for such games are board games, games on mainframe computers, on the PC and nowadays also web-based and online accessible business games exist [2]. First, these business games were not designed for using them in university education, but now they are also integrated in different lectures [1]. One example for such an integration at the Vienna University of Technology is the lecture 'PROST - Produktionssteuerung', which uses a business game (simulation model) to teach production and logistic problems and to present the various interdependencies in a company and on the market. However, there is a big variety of different games especially in the field of accounting [3, 4]. Nevertheless, the main goal of this thesis is to develop a web-based business strategy game for the lecture 'Strategic Management' focusing on the implementation of different business strategies and to analyze if there is an advantage of using such a game in a strategic

management course by a survey among the participants. Furthermore, this game will be played with persons who have never attended a strategic management course. This will be done to analyze if they also have an advantage in using the game to deepen their understanding of strategic management.

1.2 Motivation

The history shows that the variety and number of business games increased over time and that the usage as well as the underlying technology changed [5]. There are several reasons why business games are played. Panosch [6] points out that most games are played for teaching effects because of their great opportunities for learning. She also mentions that another purpose of such games is to evaluate personnel and to study individual and group behavior. Panosch [6] moreover discussed the relevance of management games as a tool in management education for teaching competence and knowledge. As mentioned before, also at the Vienna University of Technology games are used in education, like in the lecture 'PROST – Produktionssteuerung', but there the focus is on production and logistic problems. Wolfe [7] furthermore discusses the effectiveness of business games in strategic management, but his focus is on PC based games and not on web-based games. He ascertained that computer-based business games produce significant knowledge increases. Moreover, Wolfe mentioned that only the case method would be a comparative teaching alternative to the gaming approach. The distinction to already existing business simulation games like [3, 8, 9, 10, 11, 12] is the specific focus on strategic management and the strategy implementation. Another important distinction is that the evaluation of the value and learning experience of the students are the focus of the research question. This evaluation will further be implemented with a pre- and post-questionnaire, instead of just a post-questionnaire [13], to analyze the changes of understanding. Moreover, there will be no comparison to the effects of case studies as a a learning tool like Wolfe [7] has done it.

1.3 Aim and expected results

Taking the problem statement into account, the expected outcome of this work is to show the effects of the usage of a business strategy game in the course, which I expect to have advantages for the students in understanding of different strategies. For this purpose a web-based business strategy game will be developed and integrated in the course. Furthermore, this game will then also be used to analyze if there is an improvement of understanding strategic management for persons who have never attended a strategic management course. In the resulting game the consumers are software agents. These agents make their purchasing decisions depending on previously specified preferences. Another important point is that the participants play against each other and not against an artificial intelligence (AI). However, the thesis concentrates on business strategy games, in particular on the strategy implementation for which such games are

very appropriate but not available with these specific characteristics at the moment. The focus of this thesis is not on general business games. Hence, the research question is:

> 'Can the use of a business strategy game improve the understanding of strategic management?'

A main point of this thesis is the integration of the game in the course and the interactions of the participants with the game. The game will consist of two different roles. One of these roles is the administrator or game leader, who will be able to setup and customize a new business simulation and who can also set several parameters in the beginning (e.g. growth of the market). On the other hand are the players, who will represent different companies. These represented companies compete against each other and not against an AI. At the beginning of the game all the participants have the same initial conditions (e.g. starting capital). The players then have to decide which strategies they want to apply, e.g. generic strategies [14, 15] according to cost leadership, differentiation or focus. Furthermore, they have to implement strategic decisions by choosing appropriate values for decision attributes in various domains, like procurement, sales, marketing, quality management and market research. After predefined deadlines the simulation is executed based on this input resulting in purchasing choices by the software agents. Depending on these choices the companies will get different results. After every simulation round, the players will further receive information about their performance. According to this information they can adapt their strategies and implementations for the next turn. The whole procedure works with feedback loops so that the students can learn from the outcome of their decisions and also from the actions taken of the competing companies. The business game will cover several topics of the lecture including price setting, quality of products, investments in market research and investments in advertisement. Thereby, the participants should get familiar with the different strategies and how those can be applied.

1.4 Methodological approach

For this thesis the 'Design Science' research methodology is used. According to Hevner et al. [16] it is defined as a problem solving process and as an outcome based IT research methodology that offers seven specific guidelines. These guidelines will be described in more detail in Section 3.1. The proactive 'Design Science' paradigm is especially in the information systems discipline one of the leading research methods. Moreover, this paradigm tries to extend the boundaries of human and organizational capabilities through the creation of new and innovative artifacts [16]. This paradigm provides the basis for this thesis. The artifact in this research paradigm will be represented by the developed web-based business strategy game. This game will be integrated in the lecture and evaluated with a questionnaire based pre- and post-survey.

1.5 Structure of the work

According to the methodological approach described above, the structure of this work (see also Figure 1.1) is such, that after this introduction part, it starts with a comprehensive literature review in Chapter 2. In this chapter the topics of simulation games, learning theory, games as a learning tool and strategic management are explored. In Chapter 3 the methodology of how the game was developed and how the questionnaire was prepared and evaluated will be described. A detailed look on the implemented game and integration in the course is taken in Chapter 4. Chapter 5 deals with the outcome of the implemented approach defined in Chapter 3. As such, results of game simulations and results of the questionnaires are outlined. The work concludes with a discussion of results and gives indications about possible limitations and potential future work in Chapter 6.

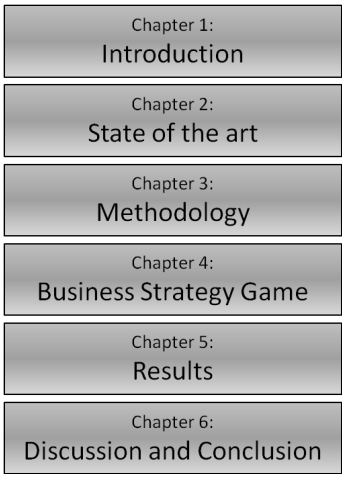


Figure 1.1: Structure of the thesis

CHAPTER 2

State of the art

This chapter aims at building the literature framework for the analysis and consists of four big blocks – simulation games, learning theory, games as a learning tool and strategic management. It starts by discussing concepts of games and simulations and moves towards simulation games by focusing on business simulation games. Moreover, it summarizes the various terms in case of business strategy games and shows how those can be distinguished. This chapter points also out in which fields these games can be used. One application could be in strategic management lectures. Therefore, reasons are identified why to use business strategy games as supporting tools for lectures at universities. As a next step, advantages and disadvantages of simulation games are presented. After illustrating for what reasons a game can be used, it is essential to describe what happens behind the scenes. Thus, different learning theories are introduced and it is shown how participants can learn through playing games. Finally, simulation games are examined as a learning tool and the important parts of strategic management will be illustrated. However, the web-based business strategy game of this thesis will build up on already existing games with the focus on strategy implementation for strategic management understanding and will consider the findings of the literature review.

2.1 Simulation games

Before defining the term 'simulation game' it is important to distinguish between the terms 'games' and 'simulations' as separated parts [17]. Therefore, this section will start with the introduction of games and continues presenting the relations to simulations and other fields of simulations. Furthermore, the term 'business simulation game' will be described as these games build the fundamental of this thesis. These games are already in use and thus, it will be pointed out when and why they are used and by whom.

2.1.1 Games

There are various definitions of what games actually are. Michael and Chen [18, p. 19], for example, define games as a

> *'... voluntary activity, obviously separate from real life, creating an imaginary world that may or may not have any relation to real life and that absorbs the player's full attention. Games are played out within a specific time and place, are played according to established rules, and create social groups out of their players.'*

As such, games have a long history. Usually people see them as entertainment tools. Nevertheless, they may also have an educational purpose. Michael and Chen [18] also explain that games are aiming for educational purposes first and secondly introduce an entertainment factor. They call such games 'serious games', because they educate, inform and train. Furthermore, they state that teaching does not consist just of facts and practice. Instead these serious games can be used to inform players about some issues, for example, environment, business, political views, health, etc. Moreover, there is a continuous support in the literature towards games as an enjoyable and valuable tool which can be used for educational purposes. Another example for the definition of a game would be from Dempsey, Haynes, Lucassen and Casey [19, p. 159]. They describe it, as

> *'... a set of activities involving one or more players. It has goals, constraints, payoffs, and consequences. A game is rule-guided and artificial in some respects. Finally, a game involves some aspect of competition, even if that competition is with oneself.'*

Competition plays a very important role for them and this issue could be realized through competing with other players or against an AI.

2.1.2 Simulations and simulation games

According to Hainey [20], the term 'simulation' commonly refers to a representation of a real system or an abstract system. It can also be seen as an environment or a process that is electronically generated. Crookall and Saunders [21] have a similar view of a simulation and explain it as a representation of a real world system focusing on a specific aspect of reality. In many other cases authors use the term 'simulation' when they see it from a scientific or mathematical perspective, whereas the term 'simulation game' is more common when it comes down to business [22]. Thus, there is both a distinction and an overlap associated with the terms 'simulation' and 'game'. This gives rise to the terms 'simulation game' and 'computer simulation game.' Heinich [23] describes the distinction between a game and a simulation as follows. He states that a game is an activity where participants follow prescribed rules. These rules differ from those of real

life as they try to reach a challenging goal. The distinction between reality and play is the point why games are entertaining. This definition of a game is similar to the ones in Section 2.1.1. Additionally, he [23] describes that on the other hand a simulation is a simplification or abstraction of a real-life situation or process. The participants usually play a role in such simulations involving them in interactions with other people or with elements of the simulated environment. Furthermore, simulation games are also defined as a representation of dynamic models of real situations. In other words they can be seen as a reconstruction of a reality or situation that is itself a social construction. Thus, such games can help to mimic processes, networks, and structures of specific existing systems. Simulation games also incorporate players who take over specific roles in addition to mirroring real-life systems [20]. As stated by Jackson [24], historically, simulation games have been used in specific scientific disciplines, like bio science and engineering, and for high-risk occupational training (military, aviation and training). However, these are not the only applications of simulation games. Bruhn and Mozgira [22], for example, mention several situations where computer simulations are applied, for example market fluctuations predicted by economists and analyzed demographic changes with respect to geographic factors. To go a step further, there is also the combined term 'computer simulation'. Hainey [20] mentioned an existing inventory with twenty-one different definitions of this term. One definition is from McLeod [25] who defines a 'computer simulation' in the largest possible sense as the use of computers to model things whereas Laurillard [26] defines it as an artifact that embodies some model of an aspect of the real world. Moreover, a computer simulation allows the user to make input to the model, as a next step it runs the model and subsequently displays the results.

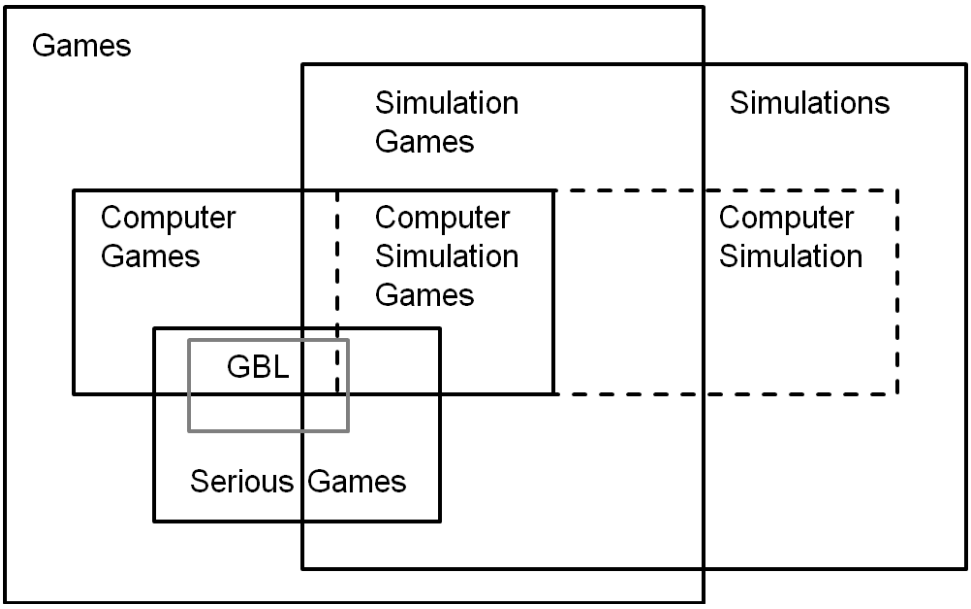


Figure 2.1: Classification of GBL (adapted from [20])

Hainey [20] took these different terms and created a classification, which is visualized on Figure 2.1. This helps to have a better view on the whole topic. As it can be seen, for Hainey games exist on the one side and simulations on the other. In the intersection of these two are simulation games. Additionally, he also differentiates the terms computer games, computer simulations and again in the intersection computer simulation games. Furthermore, Hainey also discussed the two terms serious games and Game Based Learning (GBL). Serious games have more purposes than just entertainment. The main aim of these serious games is to train or educate users. As it is illustrated on Figure 2.1, GBL is a sub-category of serious games. However, Hainey pointed out that the terms are sometimes used synonymously. GBL refers more to the innovative learning approach that is derived from the use of computer games. These computer games have various educational purposes. One of these purposes is to support learning. Moreover, they are used for teaching enhancement, assessment and evaluation of learners [20]. Nevertheless, the focus of this thesis is to consider the computer-based business simulation games and refer to these as simulations and simulation games interchangeably.

2.1.3 Business simulation games

Baptista [27] pointed out that the development of business games has taken place in numerous distinct research areas such as business administration theory, mathematics and game design. The problem of this development was that these areas have been far apart from one another and so they had just little contact resulting in the development of their own terminologies, according to its needs, over the years. Furthermore, this led to the existence of a large collection of overlapping, sometimes distinct, jargon terms as also mentioned before. Many marketing campaigns of business games contributed to the confusion of different terms with the same meaning. They used terms, such as, management simulator, business simulation game, micro-world and flight management simulator. Baptista [27] took this confusion problem into account and presented a stacked Venn diagram (Figure 2.2) that illustrates the relationship between simulations, games and business games. Baptista tried to show with this diagram how he would classify the different terms. This diagram has a slightly different view on these terms than the classification of Hainey [20] as can be seen in Figure 2.1.

To take a step back, the term simulation has also been used by some authors in the designation of business games – as in the term business simulation game. Baptista [27] then summed up the terms again and mentioned that a simulation could be defined as a replication of the essential features of a real world or fictitious situation. Thus, a business game would be then a simulation as it attempts to simulate a real world situation. Such situation could be the environment of a competitive industry. Thus, for Baptista [27] the use of the double word, simulation game, can be considered redundant. Furthermore, according to Narayanasamy et al. [28] game is in fact a narrower concept than a simulation because games include features as competition and rules whereas in simulations these features are not obligatory present. Additionally, Fripp [29] also discusses business simulation games. He states that most of them actually have the same

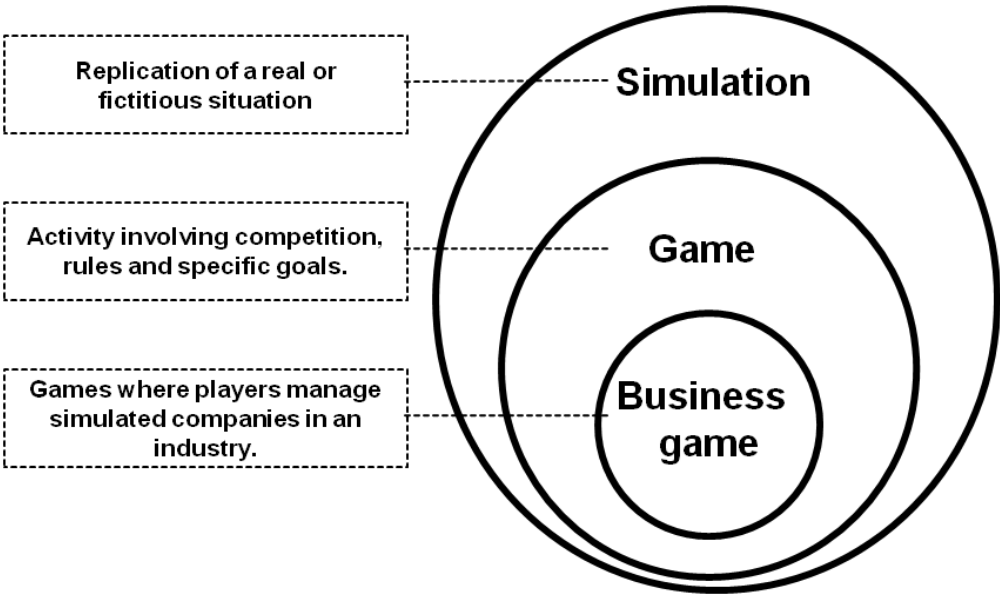


Figure 2.2: Stacked Venn diagram (adapted from [27])

basic structure and are designed to represent real or hypothetical business environments where players can compete. Players of these games are usually developing products or services and have to make different decisions and actions concerning these products [22]. Nevertheless, Keys [11] mentioned that some authors prefer to use the terms strategy and management instead of business when referring to business games but according to Baptista [27] the terms management and strategy can be considered too general to accurately define business games. He mentions that also war games develop management skills and strategic reasoning. Therefore, the use of the term business was considered most suitable alternative in the context of business games. However, in this thesis the term **business strategy game** is used to point out the focus on the strategic management process.

2.1.4 Simulation Game Usage

Bruhn and Mozgira [22] mentioned that Gilgeous and D'Cruz [30] identified numerous business divisions across many industries that use games. Examples for companies which use simulation games would be British Gas, E&Y, Bank of England, The Body Shop, etc. Additionally, they describe that most educational institutions that are teaching management, business or economics are also users of such games. Apart from this, Bruhn and Mozgira state that Naish [22] discusses how the recruitment sector is using the games. For example, companies mainly use games on their websites in order to recruit people to be ahead of other companies with respect to recruiting the best graduates. Furthermore, this is a chance for the companies to build a social network among the students who talk about the game. Additionally, especially for applicants, this kind of game can give

a rather realistic preview of the possible job. The important point is that, nevertheless, the game does not select the applicant it allows the company to get another perspective of the applicants' skills like motivation, strategy, analytical thinking, team-working, etc. This is resulting in better fitting people who are recruited for specific positions in a company. These findings of Naish [22] can be supported by looking at the work of Funke [31]. He assesses computer-based simulations for job selection and training with respect to complex problem solving (CPS). Funke [31] argues that computer-based scenarios are very attractive for evaluation purposes because they permit to design complex scenarios that may be very dynamic. Furthermore, these scenarios also respond to the decisions taken by the player. Another example of the usage of business simulation games can be found by Solomon [32]. He refers to IT executives that use simulation tools stating that they enable employees to better align their work with business strategies. They want to help the employees to change the way they are thinking about cost-effective work. Furthermore, they want to encourage them and to come up with new revenue-generating ideas. Solomon [32] mentioned the problem that IT workers are very good in their field but are sometimes limited to the ability to see the whole picture. Taking these problems into account, the simulation tools can help the workers to see the company from a macro perspective. Moreover, simulations have shown possibilities for some companies to balance risks and rewards resulting in the identification of investment possibilities for particular projects. In another company, a simulation helped to determine key success factors in some business areas [22].

The users of business simulation games

Michael and Chen [18] identified students as the target audience for serious game projects in the research about serious games. Nevertheless, as already mentioned, business simulation games are used also within companies. Gilgeous and D'Cruz [30], for example, identified applications such as management, training, student training, and general employee training. They discovered that the last one is the most rarely used and that many of the users actually are not aware of the full scope of the games.

When and why the games are used

According to Jones [33], simulation games can be used to develop communication skills, for behavioral and organizational issues, for linguistic practices or as an icebreaker. Additionally, he mentioned that the reasons for using simulations are to a large extent case dependent. Referring to Gilgeous and D'Cruz [30] the most popular times when to use a game was breaking up the training session, to start a conference or sometimes finish a conference. Sometimes they are used in workshops and lectures but mostly they are used in training sessions. Additionally, Gilgeous and D'Cruz [30] mentioned that to keep the participants interested is the most popular reason for using a simulation game. Moreover, some games help to encourage the interaction among participants [30].

An interesting point that Gilgeous and D'Cruz investigated was the fact that the majority of companies had relied on 'in-house' developed games instead of games provided by

suppliers. They argue that users might be more oriented towards custom-made games. Suppliers, who take care of this can have many opportunities in the market. Mostly companies tend to use games of an appropriate business environment or particular management skill. Less popular are games on business or practical skills. This results in games which are often custom-made to be relevant to the business environment of the company [30]. Furthermore, most of the users think that a good game should contain several elements: fun, education, and competition.

Jones [33] reveals that not all simulations are appropriate in every situation and for everyone. This means that teachers have to be careful when choosing various simulation games for their classes. They definitely should try out the simulation before introducing the games to their classes. An important point is that the students should accept their roles in the simulation games and do not just perceive the simulation games as just having fun. Otherwise it may not bring the expected results [33].

2.1.5 Benefits of games

Bruhn and Mozgira [22] describe that many studies concentrate on the benefits of computer-based simulation games and that in many cases the findings are similar. Only the way the benefits are prioritized differs sometimes. Furthermore, they [22] identified some advantages of computer-based business simulation games in the literature. The first one and also the one with the most important effects is that games allow active participation. Players can practice how things should be done instead of just hearing and getting instructions. Secondly, Gilgeous and D'Cruz [30] propose that the game can be used as an addition to already existing teaching tools to develop completely new skills. They describe different benefits. Games, for example, allow the users to illustrate some particular point and encourage the participants to learn from their experience. Furthermore, games are seen to be cheaper than 'on-the-job' training and games also have higher personal involvement. With them it is possible to practice decision-making and analytical techniques. Another important point is the aspect, that games are able to offer feeling of reality and real-life issues to the player. Further, they also give feedback on decisions made by the players [30].

Fripp [29], on the other side, has a different view and states that one of the main advantages for using simulation games is that they are more realistic than alternative methods. Furthermore, he describes, that some authors have also been trying to determine the extent to which simulations are able to capture the essential features of real-world and points out that simulation games are one of the most realistic 'off-the-job' training opportunities. According to Fripp [29] there is also an UK survey identifying five advantages for simulations. The first one is the motivation because simulation games stimulate students more than other learning possibilities and also make the learning process more enjoyable. Secondly, with simulation games it is possible to develop team-working skills. Thirdly, simulations offer risk-free environments resulting in opportunities for participants to make decisions and try out actions that they could not make in the real world because of the high costs. If the participants would act in the wrong way, it would

not be as expensive as in the real life. Fourthly, these games differ from traditional learning methods, like reading books, and can supplement the traditional ones with another variety. Finally, these simulation games provide feedback on taken actions and thus allow experiential learning. This enables the players to see the consequences of the made decisions [22]. Moreover, Jones [33] found the following advantages of simulation games: motivation and high degree of involvement, realism, use of authentic materials, encouraging reading between lines and mechanism of correction and guidance.

Additionally, Funke [31] also identifies several benefits for the use of computer-based simulations. He also thinks that these simulations are more attractive for the players and increase motivation. Providing an opportunity for practice and augmented feedback are other advantages. Further, Funke sees them as a possibility to present complex scenarios in a more regular way and allow fast calculations of results. Frauenheim [34] also goes in the same direction and describes that people have a higher willingness to participate in simulation games because they are having fun. Furthermore, Frauenheim confirms, that the possibility to have safe simulations of situations that would be dangerous in real life and the opportunity to increase retention are other benefits.

2.1.6 Disadvantages of games

Although various benefits of computer-based simulation games exist, there are also some critiques. Funke [31], for example, has discovered some disadvantages regarding computer-based scenarios. Often such scenarios are rather complex that even developers have a hard time finding the best suitable solution for it. He additionally states, that many computer-based simulations produce a lot of behavioral data and for most of them the psychological interpretation may be unclear. Another point is the difficult evaluation of these simulations with regard to the validity of the simulated domain. Moreover, there is also a disadvantage on the social level because most simulations need decisions made by a single subject. Real life is characterized by way more interaction instead. Finally, Funke [31] states that there is a higher requirement of useful data in order to be able to show their benefits in the practice of management. Additionally, Bruhn and Mozgira [22] describe computer-based simulation games as just another feature in the digital world. Further, there might exist threats as for any application which is technology intensive. Frauenheim [34], for example, notes that there still exists a lack of confidence in the success of games. Thus, e-learning was also not as successful as expected for educational purposes and the perception of game as being just a fun tool has negative effects on the emergence of games in the business.

2.2 Learning theory

In this section a short introduction to learning theory will be given. Different approaches describing how various people learn new topics or theories exist. Building up on this, it will be pointed out how games can support such learning approaches and how they can be distinguished compared to other teaching tools. This should help to get an overview

of what happens behind the scenes when a participant plays a game. Furthermore, it should be shown that business simulation games are already used in lectures and what effects they have. The last part is to describe how strategic management can be taught through such games.

2.2.1 What is learning?

Learning is a widely used term but sometimes hard to define. The Oxford Dictionary, for example, describes learning as to gain knowledge or acquire skills by study, experience or teaching. Furthermore, different perspectives on knowledge exist. Newell, Robertsson, Scarbrough & Swan [35] discuss the structuralist perspective where knowledge is perceived as an objective, discrete, largely cognitive entity. Additionally, knowledge can be divided in two types in this perspective. These types are the tacit and explicit knowledge. On the one hand is tacit knowledge which is extremely hard to articulate because it is known to lie within the person and is often referred to as 'know-how'. It lies in our heads and in our practical skills and actions. Bruhn and Mozgira [22] further describe one example of tacit knowledge and this is how we ride a bike. When we are learning and trying to ride a bike, we know how to do it, but it could be very difficult for us to describe it exactly how to do it. On the other hand is explicit knowledge. This is known as knowledge that can be easier described and explained to others. Bruhn and Mozgira [22] again take the example of the bike and explain it as the instructions a person needs to be able to ride it, such as to put the feet on the pedals and start pedaling. Further, they [22] discuss a completely different form of learning of Ivan Pavlov [36]. Pavlov studied how different stimulus of people and animals are triggered at different situations. John Watson, who is well known for the behaviorism, used the same principle. He taught a child to develop a fear for fur-animals by creating a loud sound when a bunny was presented. The sight of the bunny became a conditional stimulus that triggered a conditional response of fear. This learning process is known as classical conditioning [36]. Furthermore, there also exists operational conditioning and this occurs when an individual is reinforced or punished to affect its surrounding. Bruhn and Mozgira [22] additionally described that Burrhus F. Skinner was studying this learning process and tried to find out to what extent a certain behavior appears as the function of what earlier has become the consequence of just that behavior. They [22] mentioned that Skinner discovered that it is more likely that a specific behavior comes up if it is followed by a reinforcement, meaning a consequence that is desirable from the object's point of view. Regarding to Bruhn and Mozgira [22], Skinner, Watson, and Pavlov all saw learning as a change in behavior. This change is studied as a function of practice that all probable consequences are of conditional and unconditional stimulus.

Another point of view on learning comes from Read and Kleiner [37]. They ascertained that learning occurs when persons get rewarded for their results implying that two important factors have to be taken into account when someone is training. The first important point is an active participation from the player. No learning will occur, if the learners do not take in the information that is presented to them. It may differ how it

could be able to understand the information. This could be done from reflecting over the information to repeating it. Secondly, according to Read and Kleiner [37], people are more willing to learn if there is reinforcement involved but this reinforcement does not have to be monetary. Often praise and acknowledgment can be enough. Yet, the learner can also feel internal satisfaction from learning and that could be another reinforcement option. Further, people often feel a need to seek for increased satisfaction when feeling internal satisfaction leading to a spiral of continuous learning [37].

2.2.2 Different approaches to learning

Though, referring to Bruhn and Mozgira [22], there are many suggestions on what learning is and how it occurs. Several approaches of learning can be identified and Lainema and Makkonen [38] present four different ways of learning: the behaviorist, objectivist, cognitivist, and constructivist. Firstly, behaviorists are interested in student's behavior in relation to teaching. Secondly, constructivists are interested in the mental processes which affect the behavior of the student. A traditional lecture is based on the behaviorist approach whereas project and coursework is typical constructivist learning. Another example is computer-supported learning which is often linked to behaviorism and constructivism. However, programmed instructions are more associated with objectivism and behaviorism because they emphasize learning by manipulating learners behavioral patterns. Regarding to Lainema & Makkonen [38], cognitivists on the other side emphasize learning as the construction of knowledge and the development of the personal knowledge presentations of the learner. A cognitivist way of solving a problem is having the need to use a model that someone has used before to be able to solve the problem. Therefore, by using the right model the problem can be understood, dealt with and finally be solved [22]. Furthermore, regarding to Bruhn and Mozgira [22], cognitivists believe that the existing knowledge structures and enables or hinders new learning. It is assumed that people do not develop their expertise by just gathering information. Instead it is how they represent problems based on their principled and coherent way of thinking.

Duffy and Jonassen [39] present moreover the 'constructivist cognitive science' view. There the learning is seen as a constructive process. In this process the learner is building an internal representation of knowledge. This representation consists of different structures and linkages resulting in a foundation. On this foundation, other knowledge structures are added. Moreover, constructivists see learning as an active process where the meaning is developed on the basis of experience. Based on this the main point that needs to be attained is that learning must be situated in a rich context. Regarding to Bruhn and Mozgira [22], learning needs to reflect a real-world context for constructive processes and occurs in environments beyond school or training classroom. Furthermore, solving real-world problems with available tools can support this process.

The explained constructivism approach of learning is well suited for business simulation games as this approach emphasizes realistic settings and a student's own contribution to learning [38]. Additionally, Perkins [40] describes that a central vision of constructivism

is the perception of the organism as active and not just responding to stimuli. In this view the learners do not just take in and store information. Instead they try to interpret, elaborate, and test their interpretations. Furthermore, the basic goals of education are set to be rather simple by Perkins [40]. The educational aims are the retention, the understanding and the active use of knowledge and skills. However, these three objectives are difficult to achieve. Especially the retention is very difficult to accomplish. Thus, Perkins [40] acknowledges that understanding and active use of knowledge and skills confronts educators today on massive scale. Furthermore, the underfunding of education and tutors with lower technological skills exacerbate this situation.

2.3 Games as a learning tool

Simulation games are in some degree new learning tools because they introduce features traditional learning tools would not be able to. Tompson and Tompson [41], moreover, use ten criteria to evaluate the distinctions between the usage of computer-based simulations for group projects and traditional group projects among university students. These criteria are: interest, novelty, motivation, effort, business relevance, major relevance, course relevance, course improvement, learning, and difficulty. They discovered various points that show the advantages of the use of computer-based simulation for group projects instead of traditional methods. Computer-based business simulations, for example, encourage experiential learning and motivation. Additionally, they allow students to experience zero-sum competition during the simulation game and received on average higher scores than the traditional way of doing group projects. Students further mentioned that they were more motivated and interested and put more effort into the simulation. Another advantage noted by the students is that the simulations are more novel and improve the course on average. Hence, Tompson and Tompson [41] conclude with the findings that the usage of computer-based simulations in student courses lead to an increase in motivation, interest, effort and moreover learning.

Even though it is clear that simulation games are different from other learning tools but the question is if they also improve learning. Walters, Coalter, and Rashed [42], for example, believe that simulation games allow students to have some degree of realism in their actions. They further describe that business simulation games are effective tools for exploring strategic alternatives and their consequences. Another point of view is that the satisfaction with the game does not only depend on the game or how the game is administered. Instead, also psychological and team factors can influence the student satisfaction level to a high degree. Group consensus for example, can lead to higher satisfaction within the group whereas a bad fit between team members and their strategy is resulting in a declining satisfaction level. Moreover, Tonks and Armitage [43] discuss theories and discovered that data on learning from simulations is limited both in quantity and quality but this applies also to the other traditional learning methods. Thus, they state that from a simulation point of view a model of experience-based learning is especially useful in two ways. The first point is that it enables students to gain competence, knowledge and skills. Secondly, students learn to craft their own

mental model, try it out, and evaluate their results. Furthermore, Tonks and Armitage [43] discuss reflection and criticism as desirable features when learning. Regarding to that, general literature on management learning often talks about three learning domains. These domains are called cognitive, affective and skills. Bruhn and Mozgira [22] mention that there are authors who believe that simulations cover all three areas of learning and this view is further supported by others that identify the learning outcomes, which are commonly desired in the simulations. However, Tonks and Armitage [43] state that it is still unclear if learning through simulation is more effective in some domains than alternative learning methods. They mention that the cultural setting, the institution and the subject will have a big influence to the specified learning outcomes. Furthermore, the outcome depends on how the learning theory is adopted by the tutor in the curriculum design and course assistance.

According to Romme [44], one benefit with simulation games is that they allow building synergies between thinking in the theoretical framework and dealing with the actual situation. Nevertheless, Bruhn and Mozgira [22] cite Funke [31] who argues that the ability to achieve the expected goals does to a large extent depend on the activities taken by the teacher and not only depend on the learner. Furthermore, Martin and McEvoy [45] ascertained that applying several concepts and principles with a simulation game is very effective. Moreover, these two authors evaluated a simulation game as more effective than lectures and case studies and they found out that such a game encouraged testing for ability of critical and analytical thinking. They also state that computer-based simulations are designed to provide a real-world edge that is not available in traditional training forms like lectures and case studies. Gilgeous and D'Cruz [30] on the other hand argue that the purposes of the usage of games are to maintain interest of the audience, their effectiveness, to teach some particular concept and because they are enjoyable. Furthermore, they state that sometimes games are used to have fun, teach some skill or to present a difficult concept in a more understandable way. Thus, Gilgeous and D'Cruz [30] additionally describe that games have some benefits of traditional teaching methods like case studies, role-plays and lectures. Nevertheless, these games should not be used as the only teaching tool in the course. Regarding to the authors, the best approach would be to combine it with traditional teaching methods to use the advantages of both methods.

Romme [44] proposes motivation and assistance for deeper and more integrated understanding of students. To encourage active and long-term engagement with learning tasks it is important to focus on the right teaching and assessment methods. Moreover, frequent and tailor-made feedback on progress plays another important role in learning. Thus, Romme [44] concludes too that through the combination of lectures, case studies and readings, students can be stimulated towards deeper learning. Bruhn and Mozgira [22] further mention two other reasons for the application of computers within the education field. Firstly, the world is becoming more complex and specialized. Sometimes this phenomenon is referred as information or knowledge society and it requires continuous development. Secondly, computer systems are flexible and cost effective. Further,

computer-based teaching is accessible at any time, (nearly) any place and enables individual, self-responsible and anonymous studying. Additionally, they [22] state that computer-based training is a way for learners to practice and deepen their knowledge. Teaching software also aims at transferring knowledge, check on the achievements of teaching goals and allow for individual repetition and explanation.

2.4 Teaching strategic management with a business game

Knotts and Keys summarize [46] the experiences of two professors who have taught a strategic management course collectively for over 50 years, using a game as the centerpiece. Firstly, they describe a set of learning objectives of a strategic management course which includes various major objectives. These objectives could be taught either by a case, a game or a combination of both:

1. One objective is to gain a working knowledge of strategic planning and to understand the strategic management process.
2. Further, it is important to develop an understanding of teamwork which is necessary to conduct strategic planning for an organization.
3. The third aim is to realize how functional areas of business are integrated to facilitate strategic planning.
4. Fourthly, how to analyze one or more important industries in the world should be provided.
5. Another objective is to illustrate the difficulties of going global and to provide an orientation to international management and business trends.
6. Moreover, the development and improvement of skills in analyzing marketing, operations, and financial areas are relevant.

The authors discovered that the first and third learning objective seem to be the two most important objectives of a strategic management course. Further, Knotts and Keys [46] present game pedagogy and the different phases of the strategic management process. This process consists of the subsequent five steps: the mission, objectives and strategy; the external analysis; the internal analysis; the selection of the strategies and as a last step the implementation of the selected strategies. Many of these steps can be taught with either games or cases but it should be supported with a strategic management literature. The authors, however, prefer to use a combination of both teaching methods and list several reasons why. Firstly, they assume that some intuitive skills can be developed with a game experience which cannot be taught with cases or text. Secondly, they discovered that game-based courses have produced superior learning compared to case-based courses. This kind of learning is very important to strategic management and is also implicit included in the already mentioned learning objectives. However, an advantage

of game-based courses is that skills obtained from such courses appear to have a greater validity. This is a result of the possibility that game experience allows various iterations of decisions within similar data-sets while providing concurrent concrete feedback. The replication of a practice set and concrete feedback are important factors in skill-building sessions for many areas but they are absent in case and lecture classes [46].

CHAPTER 3

Methodology

The following chapter will focus on the research method. The purpose is to describe and illustrate the chosen methodology with respect to the objectives of this work. As such, the specific game concept, the development method for the game implementation as well as the analysis methods are covered in this part of the thesis. The methodology follows an iterative user-centered design process that finally leads to a web application and is later evaluated and discussed. The methods in Figure 3.1 were chosen to assess the research questions and are introduced in the following section.

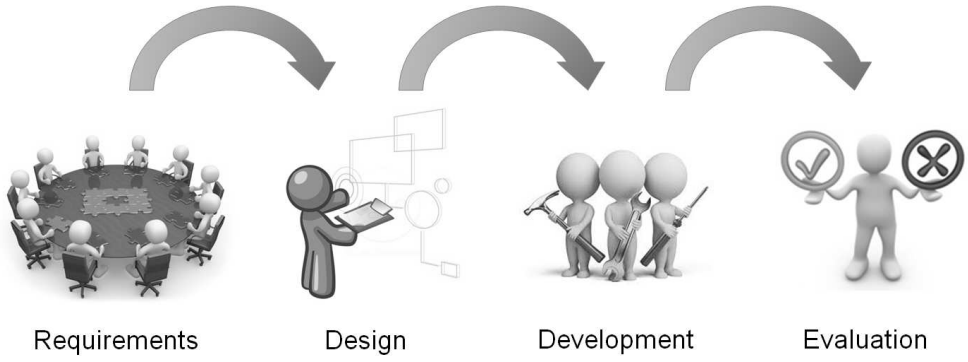


Figure 3.1: Methodology

3.1 Methodological approach – Design Science

The whole work bases on the 'Design-Science' Paradigm [16]. In this paradigm, knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artifact. 'Design Science' is a problem solving process where IT artifacts are created and evaluated to solve identified organizational problems.

It is a proactive paradigm with respect to technology and consists of seven guidelines [16]:

1. **Design as an artifact**: The aim of this research is to create a purposeful IT artifact. This IT artifact can be a construct or a model. Furthermore, also a method or an instantiation can represent such an artifact.

2. **Problem relevance**: The aim of the design-science research is to develop technology-based solutions for relevant and important business problems.

3. **Design evaluation**: Well-executed evaluation methods have to be used demonstrating the quality, efficacy and utility of the design artifact.

4. **Research contributions**: The essential point for any research is to emphasize what are the new contributions and why are they interesting. Thus, the design-science research has to provide verifiable and clear contributions to three types of areas. These areas are the design artifact, the design foundation and/or the design methodologies.

5. **Research rigor**: At the construction and evaluation of a design artifact, rigorous methods have to be applied.

6. **Design as a search process**: Design science can be seen as a search process where an effective solution to a problem is discovered with iterative process steps.

7. **Communication of research**: The design-science research has to be effectively presented to technology- and furthermore to management-oriented audiences.

To follow these guidelines different actions are necessary. To follow guideline 1 (GL1) a web-based business strategy game is implemented. As mentioned before, the problem is that there is a need for a business strategy game in the area of strategic management to teach the different strategies through 'learning-by-doing'. (GL2) To evaluate the whole work there will be surveys before and after the game to prove if there is an advantage of using this game. (GL3) The contribution of the design-science research is the artifact itself, so the business strategy game. (GL4) The rigor is derived from the effective use of the knowledge base so there will be different methodologies like iterative procedure models with feedback cycles that are applied in the construction/implementation phase of the artifact. (GL5) As also mentioned in [16] the design science is inherently iterative and there are often Generate/Test Cycles. In the implementation phase there will also be such cycles to find the best features for the artifact. (GL6) These results are then document in an understandable way for technology- and management-oriented audiences. (GL7)

Furthermore, the methodological approach to reach the expected results comprises the following parts. These parts are also illustrated in Figure 3.1.

1. **Literature research:** At the beginning it is necessary to examine and review the existing literature regarding the history of business games in general and the integration in different lectures [46, 47].
2. **Evaluation of the standards in the development of business strategy games and requirements analysis for the lecture:** It is important to focus on web-based strategy games. Especially if there are existing standards of how such games can be developed and which elements are important for the 'Strategic Management' lecture [48]. A main point is the requirements analysis to identify how different strategies can be represented in the game. This is done with the integration of different stakeholders and a review of existing business strategy games [3, 8, 9, 10, 11, 12, 49].
3. **Implementation of the business strategy game:** After the first main requirements for the game are identified, the design and implementation of the game starts. That is done in iterative steps with feedback loops of a predefined testing group.
4. **Integration in the lecture, execution of the game and evaluation if there is an advantage:** The last step is to integrate the business strategy game in the lecture and let the participants play it. A survey is conducted before and after the game to determine how good the participants understand different business strategies. The two outcomes of the surveys are then compared with a parametric t-test for two paired samples to ascertain if the understanding of strategic management concepts improved significantly. Furthermore, a Sign test and a Wilcoxon signed-rank test are used to prove if the participants perceived the game in a positive way.

3.2 Game concepts

At the beginning it was important to specify the context criteria. As already mentioned, many games exist on the market and so it was crucial to define the specific elements which characterize the game. To ensure this approach, different requirements engineering sessions were done with the advisor of this thesis who was further the product owner of the game. The aim of this game is to develop a web-based business strategy game with the focus on doing strategic decisions. This game should be used in the strategic management course to support the students in understanding of strategic management by 'learning-by-doing'. It should be possible for the students to apply their learned knowledge about strategic management in a risk free simulation game. The participants are simulating a company and are competing against other participants and not an AI.

3.2.1 Game aspects

Before developing and designing the game, different key aspects were identified which have to be considered when developing the game:

- **Flexibility**: The game should be designed in such a specific way that it is flexible on the administrator and moreover the participant side. First it has to be possible for the administrator to create different consumers resulting in different consumer markets. On the other side also the participant should have the opportunity to create different product portfolios. To enable this, various products have to be provided. Further, the players should be able to do different investments resulting in the possibility for the players to differentiate themselves from their competitors.
- **Accessibility**: To provide a game which can be easily played from everywhere at any time it should be possible to access the game with a standard browser without any additional software that has to be installed. The users just have to log-in with their username and password and then get an overview of their different decision possibilities and summaries of their performance. Furthermore, the administrator of the game should have easy access to update data sets when problems with the games occur or to change the consumer market if wanted.
- **Expandability**: The business strategy game should be developed as such that it is possible to expand it in a way of more participant decision possibilities or to change the customer decision utility function.
- **Transparency**: The consumer buying decisions should be transparent for the administrator and in some situations also for the participants. These users should be able to see why the consumer decided to buy which product. This information has to be provided in the game and historically saved for subsequent evaluations of the game.
- **Comprehensibility**: To make the consumer buying decisions comprehensible, the preferences of the consumers have to be provided for the participants in a clear way. With these given preferences the participants should be able to understand why the consumers bought which products and also make some future forecasts.

These requirements are the backbone of the whole game implementation and will be further explained in the following chapters and subsections.

3.2.2 Participant perspective

As can be seen in Figure 3.2, the game is about companies who provide different products and consumers (software agents) who buy the products. The participants play the role of the companies who are retailers. They have the possibility to buy products from different suppliers with specific product costs and quality. Afterwards they can resell them to the customers with a self-defined selling price. It is a time-to-market principle. That means that the companies do not have to say how many products they want to buy from a specific supplier. They just decide which products from which supplier for which price they want to sell. The products have different costs and different quality levels. So the companies have to think of different generic strategies at the beginning.

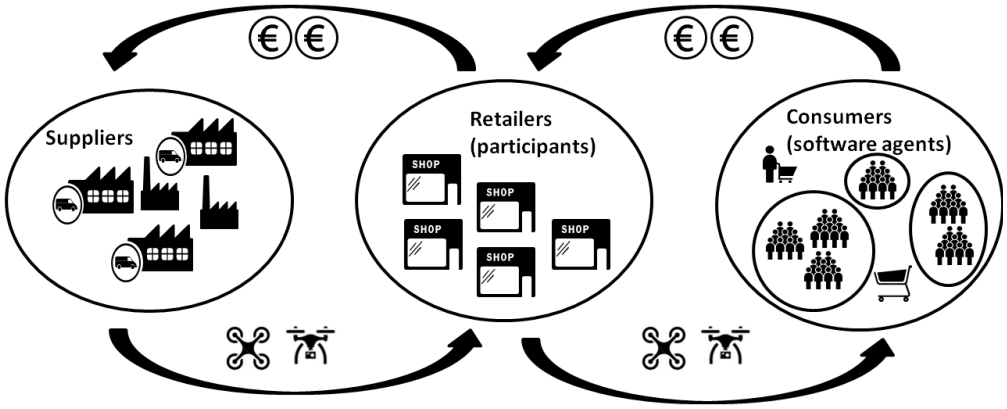


Figure 3.2: Involved parties

One strategy could be to just sell cheap and low level quality products. Another option would be to sell expensive high level products and a third possibility could be to discover if there is a niche. One important thing is that it is not possible to provide all products for different prices, so to try all different strategies. If the company provides more than for example three products then the company has to pay additional logistic costs.

Thus, the first essential point is to decide which products the companies want to sell for which prices. The second point is that it is also possible to do marketing, personal and R&D investments. These investments help the companies to improve their image. The third point is to decide if the company wants to spend on some money in market analysis. These analyzes would help to better understand the consumers and the competitors. Furthermore, with market reports it is possible to discover which preferences the consumers (software agents) have and which decisions the competitors have done in the previous rounds. It is important that the companies always have their current budget in mind. If the budget is negative, the companies have to pay overdraft costs.

These described decisions have always to be done until predefined deadlines. After these deadlines it is not possible anymore to do decisions. Then the market simulation starts. At the simulation the consumers (software agents) are searching the market for different products. Depending on their predefined preferences (price, quality, image) every agent buys one product with the highest utility value. If the utility value of all products is too low (price and quality is not in a good relation) the customer buys no product. After the executed simulation, the next round starts where the companies can do their new decisions depending on their previous performance.

Summarized, the following points are important:

- The company has to provide different products (costs, quality) for specific selling prices.

- If too much products are provided, the company has to pay additional logistic costs.
- The company can do investments (marketing, personal, R&D) to improve the company image.
- The companies can also invest in market analysis reports to see the customer preferences and how their competitors have performed.
- The company image is calculated out of the round investments (marketing, personal, R&D) and the company product sales of the last round. Furthermore, the previous image plays an important role.
- If the company investments are too high and the budget is negative, the company has to pay overdraft costs.
- The consumers (software agents) have different preferences (product price, product quality, company image). Depending on their preferences the agents buy one or no product. They buy no product if the utility value of the product is too low (e.g. too high prices for low quality products).
- There are no fix costs in the game for simplification. So, the participants can focus on tasks such as strategic analysis and formulation.

3.2.3 Administrator perspective

The administrator, also called operator, is the head of the game and is able to log-in to the application with a specified username and password. The operator administrates different games, gets overviews of these games and can configure overall game settings. Thus, the main functionality is to create, adapt and simulate the games. First of all, the administrator can set the surrounding conditions of a specific game like start and end-time of different rounds and which companies can participate in the game. Furthermore, it is possible to configure the consumer market for every round. So, different customer groups can be specified in amount and buying decision preferences.

Within the predefined time-slots the participants can make their decisions. After the round deadline exceeds, the administrator has to simulate the round with the configured consumer market. The results of the simulation are visible directly after the simulation.

The consumer market can be configured for each round in order to ensure the flexibility of the market composition. The administrator can define different consumer types. A consumer type can be modeled through a specific amount and the mean preferences for product price, product quality and company image. According to the defined consumer types, the configured amount of agents is generated with normal distributed preferences where the mean preferences from the configured consumer type is used. During the decision process each consumer software agent is using a weighted utility function to

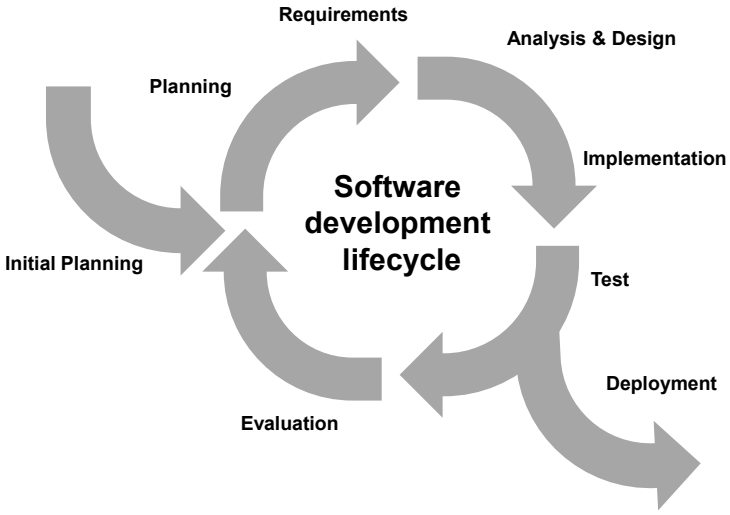


Figure 3.3: Iterative software development lifecycle

determine which product on the market satisfies the predefined preferences most. Depending on the utility value the consumer will decide to buy a product or not. If the consumer decided to buy a product that is available on the market it will be bought without any restrictions or barriers. The administrator is able to configure a minimum utility which has to be fulfilled to buy a product. This represents a minimum requirement for a product that has to be fulfilled for a customer, such as relating product price to product quality.

As mentioned before, for each game the round decisions and outcomes have to be visible in tables and graphs. With this functionality, the administrator is able to analyze the performances of the companies and the done decisions of the software agents.

Furthermore, the administrator has the possibility to get an overview of the game values like predefined suppliers, products, costs, image calculation values etc. and can also adapt these values.

3.3 Development method

The development of the whole game is based on an iterative and incremental software development process. This development approach is a combination of an iterative design and an incremental build model for the software development. This approach is widely suggested and used for larger software projects. Furthermore, it is used in different models like the Rational Unified Process (RUP), Extreme Programming, Scrum and several other agile software development frameworks [50, 51]. This development process is similar to the plan-do-check-act cycle of business process improvement [52]. The

cycles of the incremental and iterative techniques consist of parts evolved from the known waterfall model. The process of the waterfall model [53] is repeated in smaller parts of the total project scope throughout the whole development lifecycle. This smaller parts are handled like with its own waterfall process beginning with analysis, followed by design, implementation, and finally testing. These iterations are repeated until the whole project scope is implemented and the result can be delivered [54]. This whole approach can be seen in Figure 3.3 where the iterative and incremental development process with the different activities according to Cohen et al. [54] is shown. The agile approach was chosen to be more flexible in the implementation and for receiving faster feedback of the developed parts. Referring to Cohen et al. [54] the iterative development deals better with changes because not all requirements have to be specified very detailed at the beginning of the development. Detailed requirements are just important in the current iterations. Even though there have to exist provisional requirements at the beginning of the implementation to get an overview of the whole software project. The advantage of this method is that these provisional requirements can be changed until the analysis phase of the next iteration [54]. The uncertainty of the extent of development was therefore the main reason why the iterative and incremental development process was chosen to implement this business strategy game. Further, one of the decisive factors for this model was the flexibility to change the scope and the requirements and get early feedback after a finished iteration.

3.4 Game execution

The game was executed with participants that attended the course 'Strategic Management' and also additional participants who have never taken such a lecture. These participants competed in different games were each game consisted of four to six competing companies on the market. The specific games consisted of ten rounds and every round lasted for about one day. Within this time slot the participants had the possibility to make their decisions. A predefined rule was to not inform the participants about the starting consumer composition of the market and if and when changes on the market occurred. There was neither the information how the preferences of the consumers are distributed on the markets nor how many potential consumers were on the market. Even though, this knowledge could have been acquired through the acquisition and following analyzes of market reports. All players had the same starting conditions, like starting budget to be able to make investments in personal, R&D and marketing or to buy the mentioned market reports. The market composition changed two times and simulated a shift of the consumer preferences during a defined time horizon. These three phases with the different market compositions of the agent types throughout the simulation are listed in Table 3.1.

Agent preferences	Round 1-3	Round 4-7	Round 8-10
Share of agents on the market that prefer lower priced products	20%	35%	50%
Share of agents on the market that prefer products with relatively high quality	50%	40%	25%
Share of agents that prefer products from companies with a relatively high image	30%	25%	25%

Table 3.1: Market composition

3.5 Empirical study

For the empirical part of the thesis a quantitative method was used. The reason for that was because there is a general tendency that quantitative methods are more suitable for testing hypothesis than qualitative ones [55]. As a next step it was decided to use a pre- and post-survey for data collection. So, the participants had to fill in a questionnaire before and after the simulation to provide the basis for the strategic business game evaluation. These two surveys were implemented by a written questionnaire via the Internet. Using this method saved time and costs. Additionally, this is seen as quite objective because the interviewer has no direct contact with the participants and thus cannot influence the answers. A big disadvantage is that the data collection cannot be controlled. Thus, it is not possible to verify if the target persons have filled in the questionnaires on their own [56, 57]. Following this, concrete questions for all relevant topics were developed. The survey had five constructs consisting of different statements/items. These constructs cover the topics of the strategic management process [58] as can be seen in Figure 3.4.

For the realization of the surveys as online questionnaires, the Google Forms web application was used. This decision was based on diverse and numerous advantages compared to other possibilities. First, the application has an easy user interface and thus the first survey was created really fast without any complications. Further, it offers a high flexibility in questionnaire design without any limitations concerning length of the questionnaire, the number of respondents or also other person who can configure the questionnaire. The application also provides supporting statistics and exports the answers as Microsoft Excel-file. Moreover, it can be used for free for scientific purposes without commercial background and the creator of the questionnaire just has to have a Google account.

To be precise, for the implementation of the questionnaire all questions and response options must be included in the Google Forms survey. Then also the order of the questions was fixed. In the first initial part of the questionnaire a welcoming text was included. This text was followed by the constructs of the strategic management process that were mentioned before (Figure 3.4). After the implementation of the complete questionnaire

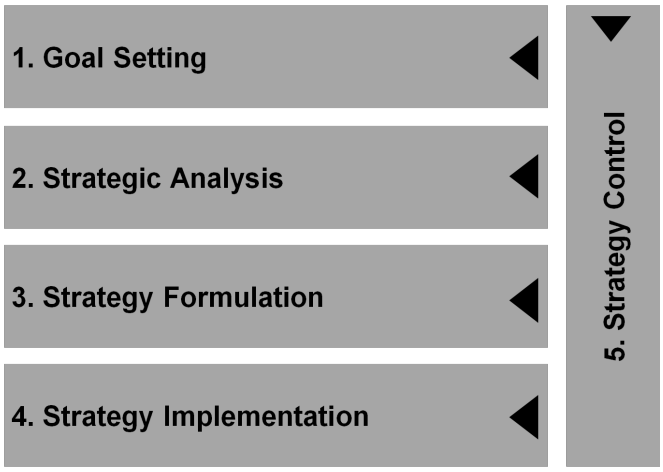


Figure 3.4: Strategic management process steps

with Google Forms, detailed pretests were carried out with four different people. These were online-pretests where the tester was enabled to fill out the questionnaire and give written feedback through e-Mail communication. Afterwards, the whole questionnaire and the notes taken were discussed. Based on the feedback of all pretests the questionnaire was then optimized. At the end, a final revise and a technical test were done.

3.6 Questionnaire

As mentioned before, a pre- and post-questionnaire were developed for the empirical study. The pre-survey consisted of three general questions and five question constructs for assessing the knowledge level of the strategic management process. These five constructs where split up to 15 single questions/items. The complete questionnaire can be found in the Appendix in Section A.2. The post-survey consisted out of the pre-questionnaire and twelve additional statements/questions which can also be found in Appendix A. The statements which are allocated to these constructs are evaluated based on a Likert scale. The Likert scale is named after the psychologist Rensis Likert [59] and is a psychometric scale that is often applied in research using questionnaires. Moreover, this scale is the most widely used approach for scaling responses in survey research. The answer to a statement on a Likert questionnaire specifies the level of agreement or disagreement. This level is represented on a symmetric agree-disagree scale for a set of statements [59]. Though, it is challenging to find the optimal number of responses but it can be assumed that the higher the number of response options the more sensitive the scale. In contrast, it is more difficult for the respondent to make a choice the more options the scale has. Thus, it may take longer for the respondent to make a choice [60]. For this thesis, it was decided to choose the five-point Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement). The odd number of response options avoids forced choice. Furthermore, a 'No answer' (NA) possibility was provided to avoid

that participants choose ‘Neither/nor’ when they do not know exactly what they want to choose or if they just do not want to give an answer. To prove if the students really read the statements or just choose specific answers, three statements were reversed, e.g. from positive to negative formulation. Based on these surveys for evaluation, the changes of understanding strategic management are analyzed for the participants’ perspective.

CHAPTER 4

Business Strategy Game

This chapter presents the developed web-based business strategy game and the used technological components. It starts with the technological architecture and the chosen frameworks. Subsequently, the deployment architecture is described to get a better understanding of the whole web application. Second, also used design patterns are explained to show how the application is separated in different parts for better maintainability. As a next step the entity relationship model in the background to store the data and the user interfaces (UI) in the front to present the data will be described in detail. The UI is an important part of the whole application because it is the first touch point of the participants with the game. Through this component the players do their decisions and also get the feedback about their performance. Thus, the different web masks are described in more detail. To also get an understanding how the market simulation functions, it is also pointed out as a next step how the software agents choose a specific product. In the last section of this chapter the whole integration in the lecture and the execution of the game are explained.

4.1 Technological architecture

This section focuses on the technological architecture and is separated into two parts. First the web application architecture and the corresponding frameworks will be discussed to give an overview of the taken decisions for the deployment architecture. Afterwards the focus will be on the chosen software architectural pattern which was used for implementing the user interfaces and the according business layers. A first overview of the different components and chosen technologies is illustrated in Figure 4.1. For the persistence layer the object relational mapping (ORM) framework Hibernate was chosen and for the graphical user interface the JavaServer Faces (JSF) framework. Additionally, the Spring framework is also used because it provides a comprehensive programming and configuration model for modern Java-based enterprise applications. This Spring

framework can be further used on any kind of deployment platform. More details about the whole architecture and about the chosen technologies are provided in the following sections.

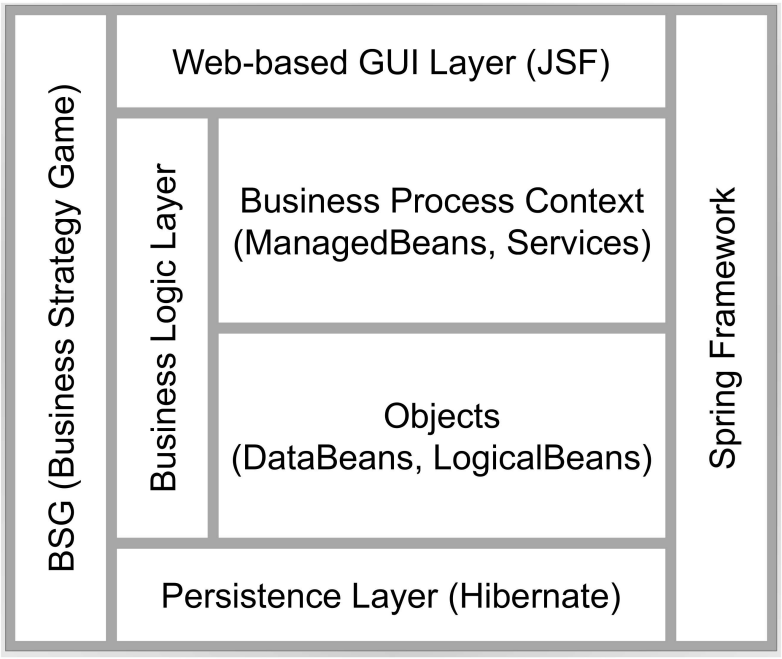


Figure 4.1: Technology stack

4.1.1 Deployment architecture

A deployment diagram(Figure 4.2) is used to visualize the run-time architecture of the application including the installed software. Moreover, the used components of the system and middleware that is used to connect different components can be seen. These components will be described in more detail to make the overview more comprehensible [61].

The web-based business strategy game was developed with Java running on a web server. MySQL Server 5 is used as the database which interacts with the application for loading and persisting data. The whole application is deployed on an Apache Tomcat that serves as a web server and servlet container for the Java based web application. This configuration was chosen in order to have a lightweight and easy architecture for the application. Further, this enables to run the application on different environments without having any license costs. To implement the application, as mentioned before the programming language Java was chosen as a result of different arguments [62]:

1. **Popularity and spreading:** In 2016 Java is reported as one of the most popular programming languages [63]. This popularity should guarantee that no specific

knowledge is needed for further developments. Further, it ensures that the application is written in a well-defined and documented language [64].

2. **Licensing:** The Java Development Kit (JDK) is under the GNU General Public License (GPL). This is the most used free software license that guarantees end users the freedom to run, study, share and modify the software [62].

3. **Portability:** Applications that are written for a Java platform run also on any combination of hardware and operating system with the necessary runtime support. Java achieves this portability by compiling the language code to an intermediate representation, which is called Java byte-code, instead of directly to architecture-specific machine code. This results in fewer problems for participants with different operating systems and various technical devices [62].

4. **Agent representation:** The objective of the game is to represent the consumers as individual software agents. These agents are objects with individual characteristics. Java has such class-based and object-oriented characteristics that support the agent-based modeling approach.

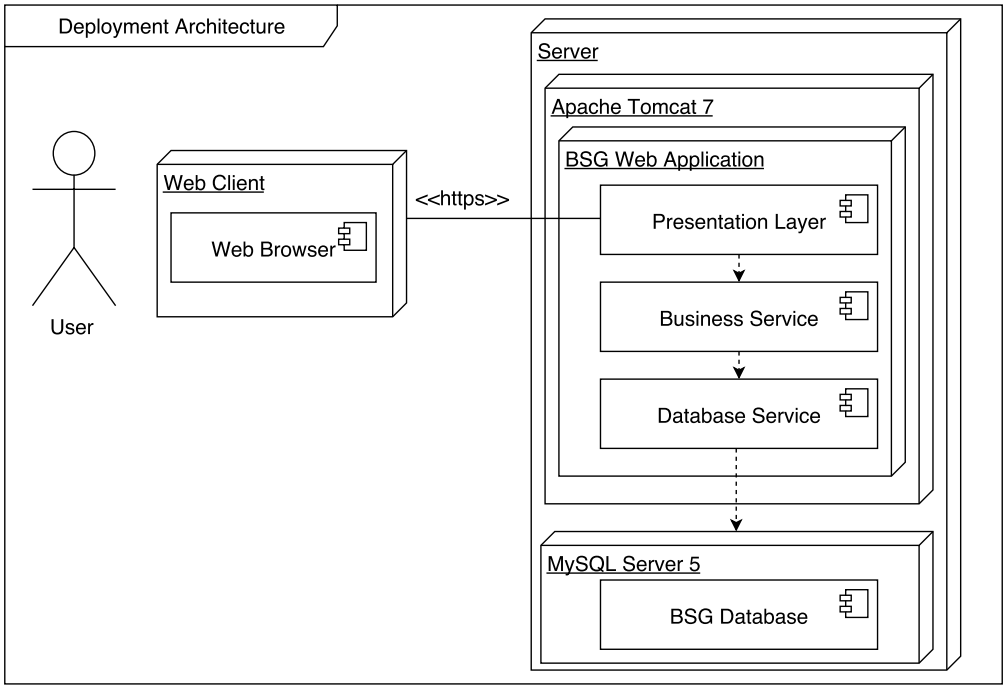


Figure 4.2: Deployment diagram of the web-based business strategy game

A MySQL database was chosen as a relational database management system (DBMS) to create, update, delete and read the data for the application. MySQL is an open-source relational database management system (DBMS). The database is only used as a back-end database that is accessed indirectly through the web-based business strategy game.

Therefore, it is not possible for the users to connect directly to the database itself and manipulate data. Further details about the data access can be found in Sub-section 4.2.2. The architectural reasons for the usage of the MySQL database are listed subsequently:

1. **Popularity and spreading:** MySQL is currently the most popular Open Source SQL database management system (DBMS). Furthermore, it meets the compliance with the well known SQL standard. Due to the fact that it is also well documented and uses the common SQL standard, the possible extendability is also ensured for the DBMS component of the application [65].

2. **Performance:** The MySQL database server is appropriate for fast processing and heavy-load production systems as well as for embedding into mass-deployed software. It was originally designed to work with medium-sized databases on small computer systems but can nowadays handle terabyte-sized databases and is therefore adequately for the web application to meet the given requirements [65].

3. **Licensing:** As Java also MySQL can be used as an Open Source product under the terms of the GNU GPL.

In Figure 4.2 the overall deployment architecture with its interfaces and components can be seen. As mentioned before, the web-based business strategy game (BSG) runs on an Apache Tomcat web server. This web server is located on the same server where also the MySQL relational database management system is installed. These two components communicate through the Java database connectivity technology (JDBC) interface to receive and write data to the database. This technology is an API provided for the Java programming language that defines how a client can access an existing relational database and further enables to create, read, update and delete data. On the other side the user communicates through a web client with the web server via a web interface that is secured with the Transport Layer Security (TLS) protocol that guarantees the secure communication between the user and the web server over the network. The HTTPS protocol is used in order to protect the integrity and privacy of the exchanged data between the user and the application. Moreover, it is important that the ports are free so that everyone can access the web application.

4.1.2 Model-View-Controller pattern

During the implementation also software design patterns [66] were taken into account to speed up the development process because they provide tested and proven development paradigms. One of the chosen patterns is the model-view-controller (MVC) pattern. MVC is a software architectural pattern and is applied to separate the software application into three interconnected components. The application of this pattern allows splitting the internal representation of the information from the way how it is represented to the user. Modeling the user interface of an application should be separated

from the behavior of the application in terms of its problem domain. The model representing the behavior of the application manages therefore the data, logic and rules of it. This MVC pattern has applied as a de facto standard for the design of many complex software systems and consists of the following three components:

1. **Model:** A model represents knowledge and can be a single object like a simple integer variable or some structure of objects. Thus, the model stores all the data, has the information about the current state and further holds the application logic. The view and controller have no direct access to this data but the model provides an interface for manipulating and retrieving its state. Moreover, it can send notifications of various state changes to its observers.

2. **View:** The visual representation of a model is the view component. This component normally gets the state and needed data for displaying directly from the model. Further, it ordinarily highlights specific attributes of the model and suppresses others.

3. **Controller:** A controller is the link between the system and a user. It further contains the interfaces between associated models, views and also input devices. The controller receives the input from the user and investigates what it means for the model.

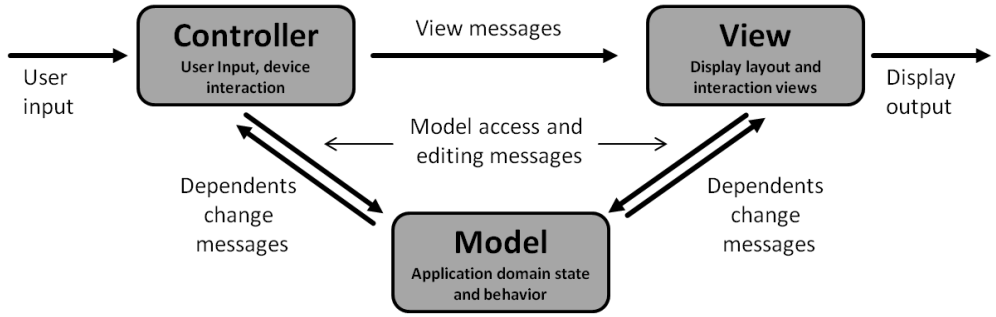


Figure 4.3: Model view controller (MVC) interaction cycle (adapted from [67])

The separation of these three components should provide a more detailed overview of the different tasks the web application has to handle during the execution. If further developments have to be done in one of these three components this does not lead to problems because they are not directly influencing each other. Furthermore, this enables to really focus just on the affected component. Therefore, the internal business-logic of the web application and the representation of the processed data are strictly separated from each other. The interaction between the three components is visualized in Figure 4.3. There the user provides some input and afterwards the active controller notifies the model to change itself accordingly. The model is then responsible to take the according actions such as changing its state and broadcasting that changes occurred

to the other two components (view and controller) which are also called dependents. If necessary, the view can request the new state of the model and update the display. Further, the controller may change the method of interaction depending on the new model state.

To apply this Model-View-Controller architectural pattern in the business strategy game, the JavaServer Faces (JSF) technology was used. JSF is a Java framework for building component-based user interfaces (UI) for web applications. It combines a MVC design approach with the component-based UI development framework that simplifies Java EE web development while using existing markup and servlet technologies. Furthermore, JSF ensures that the maintainability of the web application increases by integrating the established MVC architectural design pattern into the overall architecture. How the use of the JavaServer Faces framework separates the components according to the Model-View-Controller pattern can be seen in Figure 4.4.

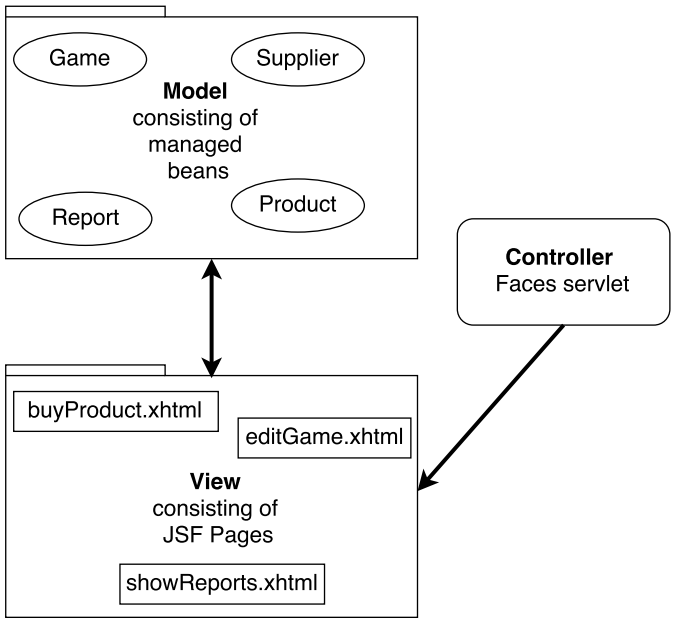


Figure 4.4: Model-View-Controller design paradigm with JSF (adapted from [68])

The 'View' component is represented by the UI-code and is clearly separated from the 'Model' component that is represented by the business logic and the application data. The 'Controller' component handles the user interactions, provides the application data access for the web pages and restricts unauthorized access of the web pages. This usage of the JSF framework guarantees the compliance with the guidelines for the MVC pattern. Additionally, choosing the JSF framework enables the use of different available components for the implementation of a state of the art web interface.

4.2 Data model and access

This section focuses on the Entity Relationship Diagram which represents the important data entities of the application. Furthermore, the implementation of the data access to provide the data in an efficient way in the application will be discussed.

4.2.1 Entity relationship model

To describe the data and information aspects of the business domain an entity-relationship-model (ERM) was used. This model is used to visualize the needed business data and provides the basis for the implementation of the relational database used in the application. The ERM was developed based on the initial requirements and further expanded incrementally within the development cycles of the implementation process. As a result, twelve artifacts where identified in the requirements engineering phases. These artifacts are modeled as entities in the ERM with necessary relationships. In the following the twelve artifacts are described shortly to get a better overview of the whole model:

- **Game:** The game entity is one of the central parts of the application. It contains all relevant information for a game such as available rounds, suppliers, products, agents and corresponding participants.
- **User:** Without users a game would not be possible. Thus, the user is the second main entity of the business strategy game. On the one hand it represents the data of the participants which are simulating the companies but there are also administrators who are special kinds of users. The administrator is able to create and manage the different games.
- **Supplier:** This entity represents a simple supplier who provides different products to the participants in the role as retailers. Specific supplier entities can be part of different games.
- **Product:** A product is an important entity because the participants can define their assortment with different products. Every product is provided by a specific supplier and has a quality factor and defined costs.
- **Round:** A game consists of different rounds. Every round has a predefined start and end date and defines the time period when the participants are able to do their decisions.
- **AgentType:** Each round consists of different agent types which are defining the consumer market. The type includes the mean preferences and the amount of agents that will be created according to these definitions. Mean preferences are defined for the price, the quality and the company image.
- **Agent:** An agent is an instance of the agent type. This agent consists of the predefined preferences and represents an individual consumer on the market. Every

agent is part of the decision process where the defined preferences are used to decide for a purchase option.

- **CompanyRoundDecisionAndResult:** Every round a company can make different decisions such as investments in marketing or R&D which are stored in this entity. Moreover, this entity includes the results of the simulated round like revenues and expenses. Thus, this entity has relations to the actual round, the specific user (company), the provided products of a company in this specific round, the bought market analysis reports, the different investment decisions and according revenues and costs of the simulated round.

- **CompanyProduct:** The company product is a product which is related to the chosen product of a company. This entity additionally stores the defined purchase price which was set by the participant and is related to different agents who bought this product. Furthermore, it includes how often it was bought by the agents.

- **Report:** A report is a special entity of a market analysis and contains the report price. Various types of reports can be defined which are differentiated through their details. With a report it is possible to get information about the competitors and the consumer market.

- **News:** The news entity is used to inform the participants about game changes, to notify them about important events or to just deliver further information about the game.

- **Setting:** This entity stores application wide parameters for the game initialization, simulation and agent creation. These settings can only be changed by administrators. Moreover, this entity has no relations to the other entities.

The above described relations are shown in Figure 4.5 which also contains all entities. Detailed information about the attributes of the model and their corresponding data types can be found in the Appendix A.1.

4.2.2 Data access

The data access to store, change and view the data in the entity-relational MySQL database is realized with the Hibernate object-relational mapping (ORM) framework. This framework is used in the Java environment to provide a mapping of a traditional relational database scheme to an object-oriented domain model in the application. Thus, Hibernate maps database tables with Java classes. Trough this mapping process it is possible to persist the data which is stored in the object-oriented domain model to the database and also to provide a loading mechanism from the database to the object-oriented domain model. These two mechanisms are used in the model component of the Model-View-Controller architectural pattern. Furthermore, Hibernate also provides native SQL statements which are used for statistical analysis in this application. The

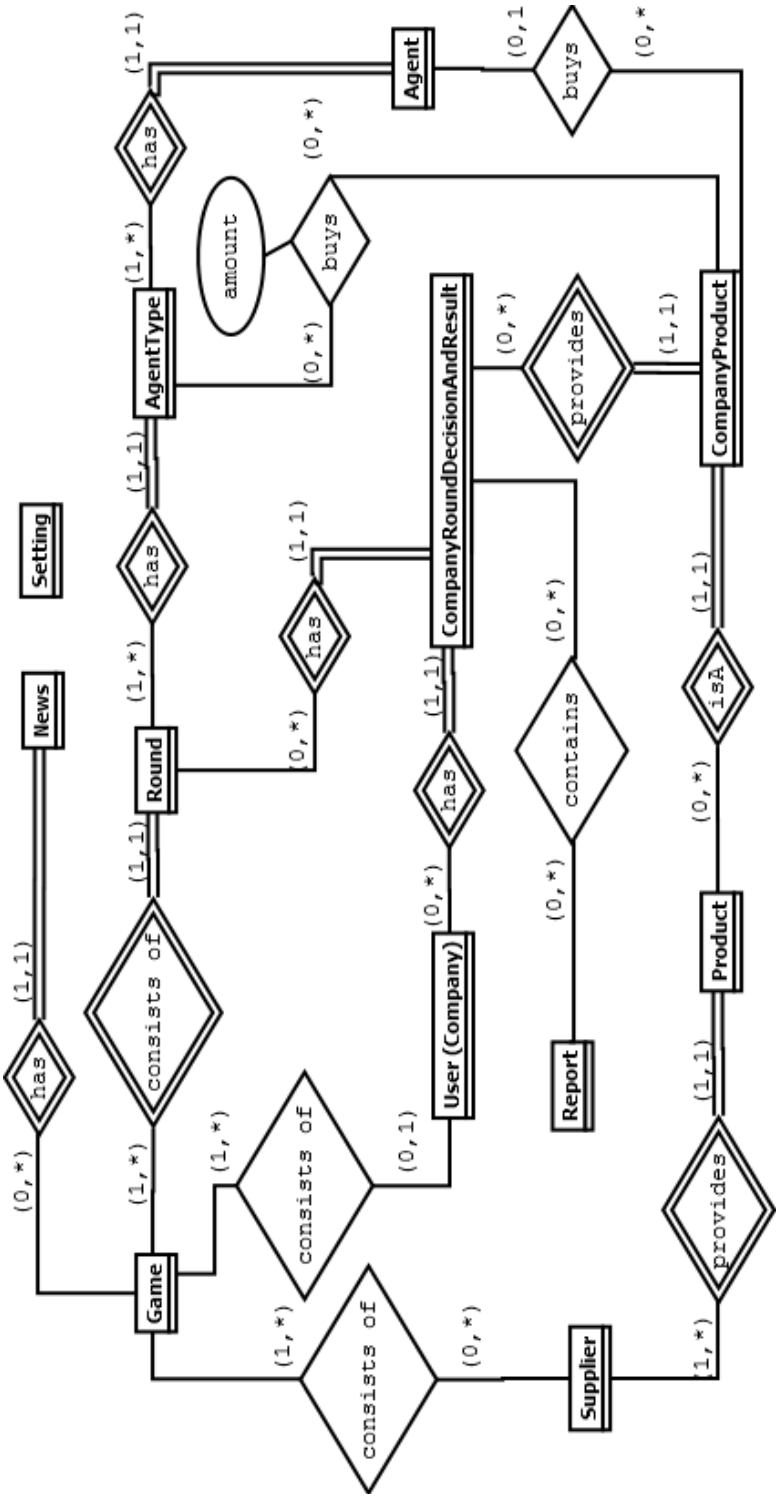


Figure 4.5: Simplified entity relationship diagram of the business strategy game

reasons for using the Hibernate framework in the business strategy game application will be listed in the following [69]:

- **Efficiency:** Hibernate reduces the development effort that would be increased with additional manual data handling in SQL and JDBC.
- **Object support:** The generation of object-oriented domain models will be supported. These models can be directly used for the business logic in the application.
- **Abstraction:** The framework encapsulates the vendor-specific SQL code and automatically translates the result sets from a tabular representation of the database to an object-based in the Java environment.
- **Flexibility:** Besides working with Java objects also native SQL statements are provided. This makes it possible to write more complex queries for statistical evaluations of the game.
- **Readability:** Through the usage of Hibernate the source code has less overhead code and is therefore easier to read for current developers and also future ones. The use of the object-oriented domain model increases the comprehensibility of the code compared to native SQL methods.
- **Expandability:** The abstraction of the relational-database to the object oriented domain model leads to less effort when extending the domain model. New dependencies to new objects in the domain model can be added with less overhead.

According to these arguments the Hibernate framework was chosen for implementing the data access layer in the application.

4.3 User Interface Implementation

This section provides an overview of the most important graphical user interfaces (UI). As the UI is the interaction point between the participants and the game it plays an essential role resulting in a more detailed description of the different web masks. The following figures illustrate how the different sites are structured and how to navigate through the whole application. Especially the possibility to make different decisions is important for the participants as this is the major functionality. This decision making should be done in an easy comprehensible way. The participants should intuitively know how they can transform their strategies from theory to practice. Furthermore, they are supported by market reports to control if their outcomes match their predefined goals. If not, they have to revise their taken decisions. To make own calculations, every result-table in the application provides an export functionality to get an Excel-file for further analyzes. Hence, the decision making possibility and the market reports for analyzing actions are the two most important functionalities and are further described in more detail. As there are two different users who are able to interact with the game, the user

interface description is split up in two parts. First the user interfaces of the companies are described and afterwards the user interfaces of the administrator.

4.3.1 Company UI: Login, Welcome, Menu and Financial Overview

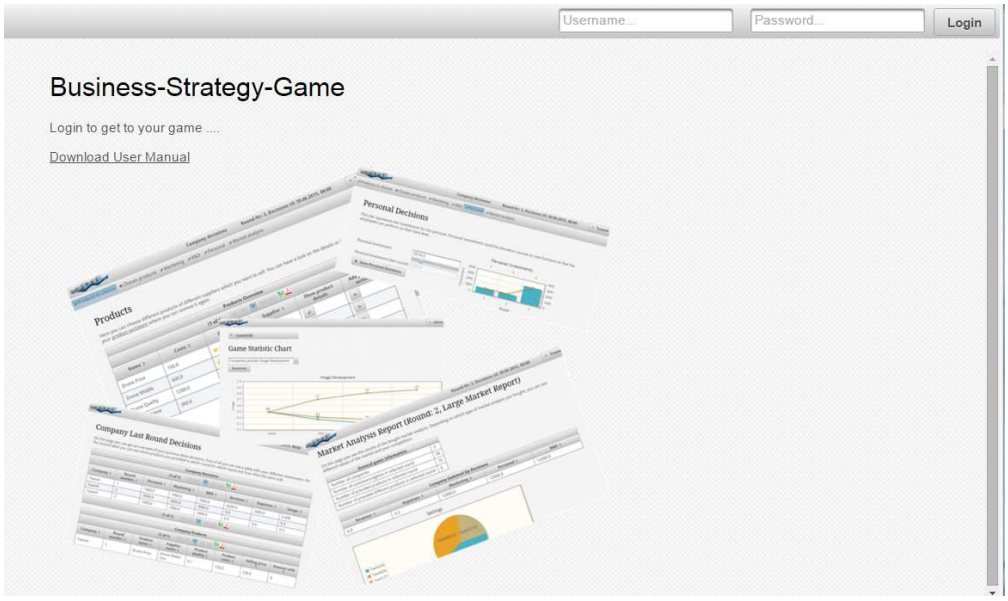


Figure 4.6: Login page

As a first contact point the user has to **log-in** into the game (Figure 4.6) with a predefined username and password. Depending on the predefined user rights, the users have then different possibilities to interact with the game. In this section it is important to present the rights of the game participants as they are the focus group of this thesis. The user further has then the possibility to change the username and the password after the log-in occurred as it is illustrated on Figure 4.7. Moreover, on the 'Own Settings'-site in Figure 4.7 it is possible to change the nickname and the contact addresses if a company is simulated by more than one participant.

After the successful log-in process, the first page (**'Company Welcome Site'**, Figure 4.8) is presented to the user with a description of the different menu items and an overview of current news. These news messages are provided by the administrator (game head) of the game to inform the participants about different game changes or essential deadlines.

The **user menu** is located in the right top corner as it is also visualized at Figure 4.8. This design decision was done to make the menu similar to Facebook and thus more intuitive. So, the users do not have to think much where the menu could be located. With this menu it is possible to navigate through the different websites like:

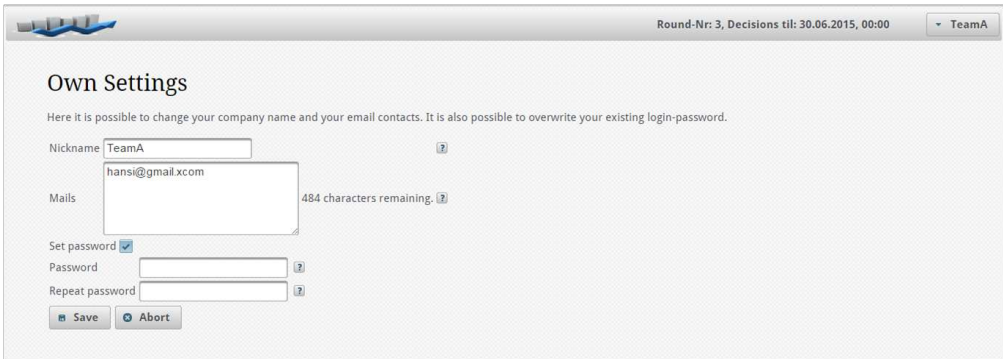


Figure 4.7: Own settings

- Company Main Site: It is the welcome site with some information about the application.
- Company Overview: An overview of the actual financial situation is presented.
- Decisions: Here the actual decisions of every round have to be done.
- Previous Decisions: Decisions of the previous rounds can be found here.
- Reports: Bought reports of the last rounds can be inspected.
- Own settings: General user settings can be changed.
- Logout: This is the simple logout functionality of the application.

These various web pages will be described in more detail in the following sub-sections.

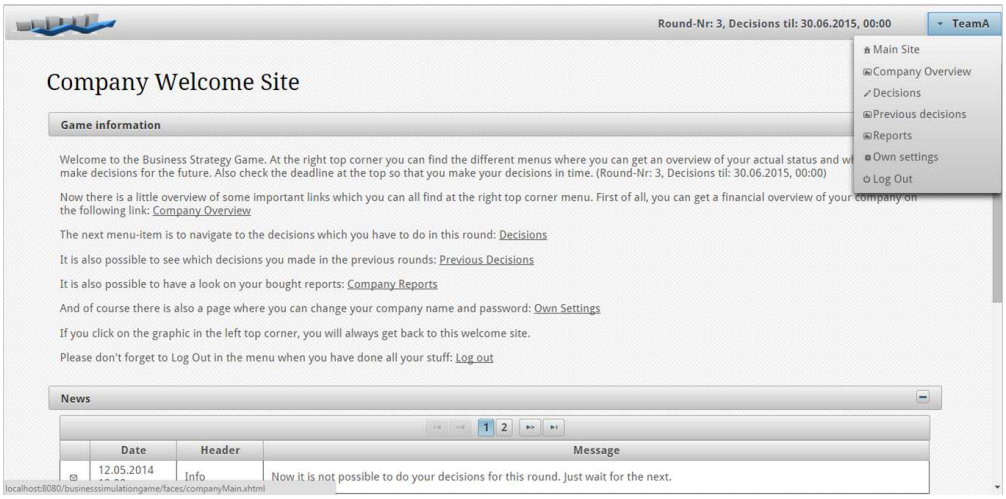


Figure 4.8: Company Welcome Site and Menu

The **company's financial overview** page (Figure 4.9) helps the user to get a quick summary of the financial data, like the current budget, the expenses, the revenues and the accumulated investments that have been done in the last rounds. It is also possible to see the current image of the company and how many products have been sold. This should help the students to be informed about their current status at all times. These numbers are just summed up results of the different rounds. Thus, for more information the participants can have a look on the 'Previous Decision' page (Figure 4.18) where they get a detailed overview of the historical development of their decisions and resulting outcomes of the different rounds.

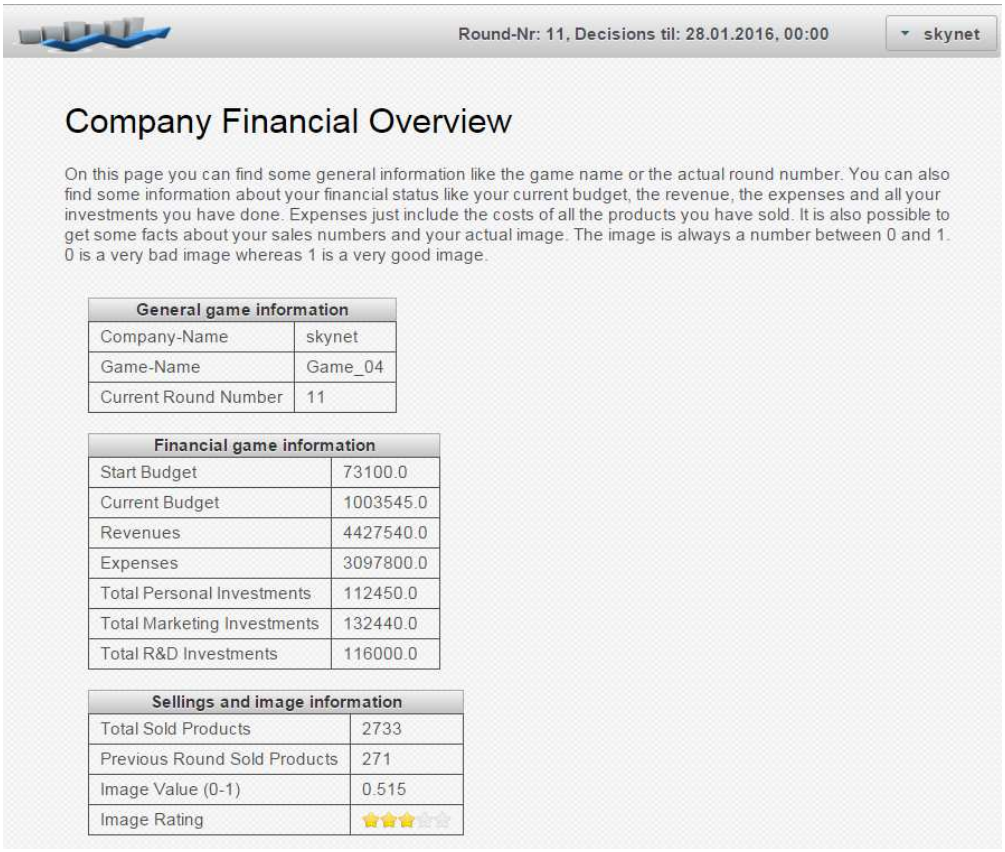


Figure 4.9: Company Financial Overview

4.3.2 Company UI: Product assortment decisions

As already mentioned several times before, the main aim is to try out different strategies through the game in a simulation environment. Thus, the important part of the business strategy game is to take decisions and to analyze them. These decisions can be made on the following described web pages like it is illustrated on the 'Decisions'-site (Figure 4.10). This site is split up into different tab menus. On the first one the user is able to choose

from different products which the user wants to provide for the consumers. So, these products would represent the product assortment. The different product characteristics are shown in the table such as product name, costs, quality and supplier. If more details about the product are required, the user has to push the 'product details' button and a new web mask with additional characteristics appears which can be seen in Figure 4.11 exemplary. This web-page has currently not much additional information but it would be possible to add a product picture and more additional information if the product for example has a good image all in all.

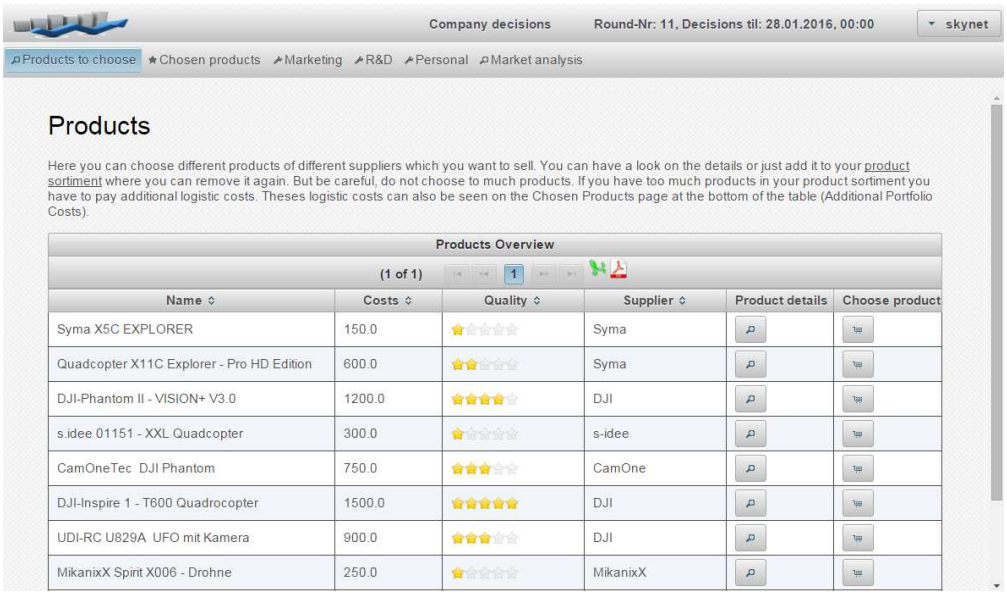


Figure 4.10: Product overview

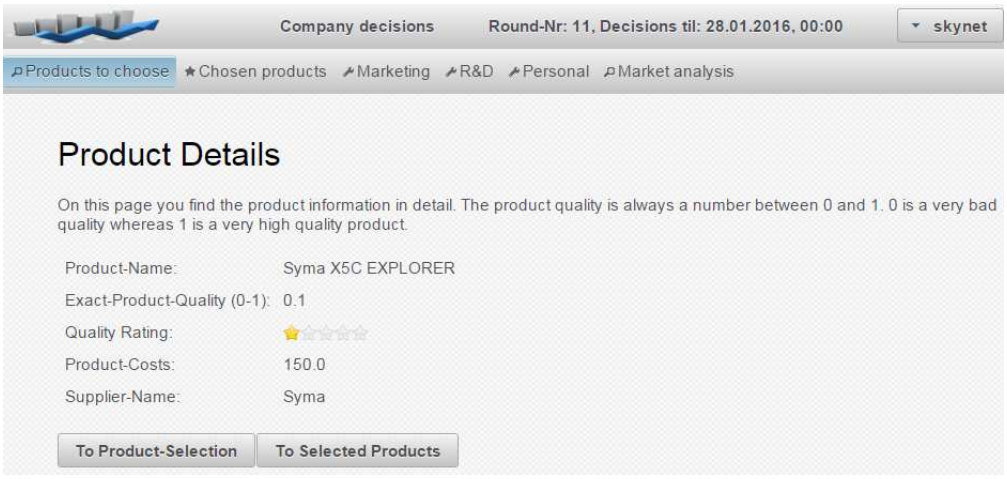


Figure 4.11: Product details

To a have look again on the product overview page (Figure 4.10), it is possible to add a product to the current shopping basket with the button on the right side. That means that the user wants to provide this product for the consumers. As a first design idea, the opportunity to set the selling price was just possible at an own web site that is described later (Figure 4.13). However, after the first simulation round with the students, problems occurred because a student forgot to set this selling price on the separated web site. To avoid such cases, the workflow of setting the selling price was adapted. Now, when choosing a product for the assortment, an additional pop-up (Figure 4.12) occurs and asks for setting the selling price. By default, the actual product costs are set as the selling price, but it is still possible to set prices lower or higher than the product costs. This could be done for trying out different other strategies. Furthermore, it is possible to export this data-table as PDF- or Excel-file for more detailed individual analyzes.

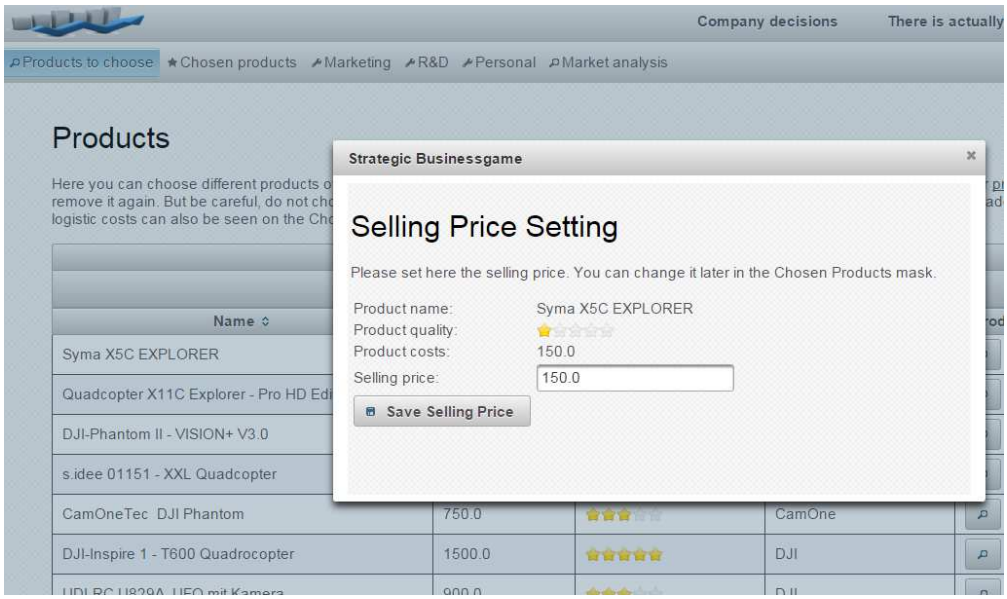


Figure 4.12: Product selling price setting

On the next tab, the 'Chosen Products' page (Figure 4.13), the user is able to see which products have been selected for sale. It is very important to set the selling price and then push the save-button to store the decisions. It is also possible to get some detailed product information again like on the product overview page and also to delete/remove a product from the provided product list. The price-setting decision is a very essential part of the game, as the price is one of the three factors why a consumer would buy a product or not. If the other companies are also providing the same product for lower prices, then maybe they have more sales depending on the other buying decision factors. Thus, much effort should be put in deciding the right selling price.

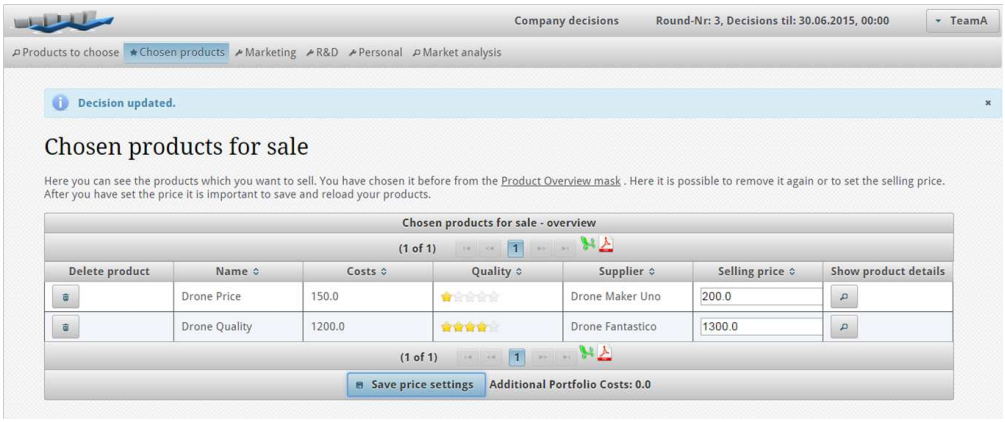


Figure 4.13: Chosen product

4.3.3 Company UI: Investment decisions and market analysis possibility

Moreover, it is also possible and important to do various investment decisions. These investments help the participant/company to achieve a better company image compared to the competitors. If there are a huge amount of predefined consumers who just want to buy products from companies with a high image on the market then it would be advantageous if the participant has done some investments. Thus, on the **marketing page** (Figure 4.14) it is possible to do some marketing investments for advertisement in different channels (marketing mix). The amount of the investment should be set through a slider. This slider was implemented to support the participants a little bit because the slider had a maximum limit of possible investments. So, the players know more about how much money they should invest in different areas.

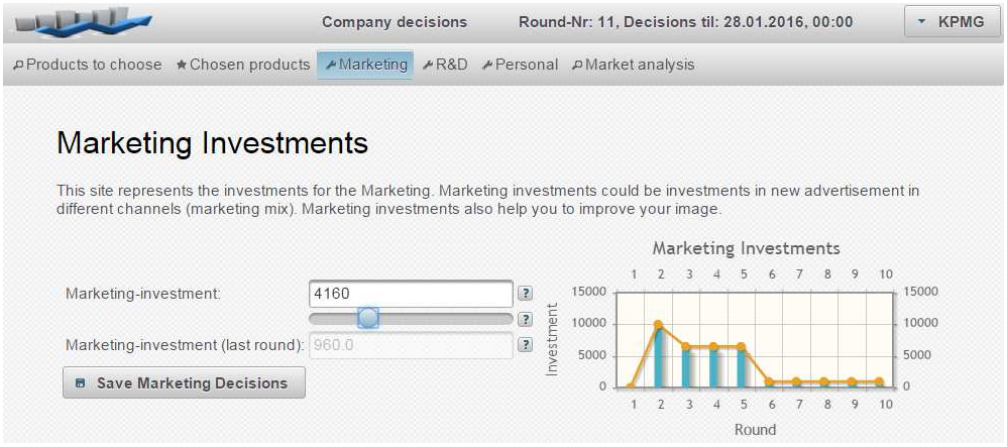


Figure 4.14: Marketing investments

As it is possible for marketing, also investments in R&D can be done. The **research and development page** (Figure 4.15) is structured like the other investment websites. Investments in R&D also can improve the total company image because it would be (theoretically) possible that the companies improve their services and so consumers would be more satisfied.

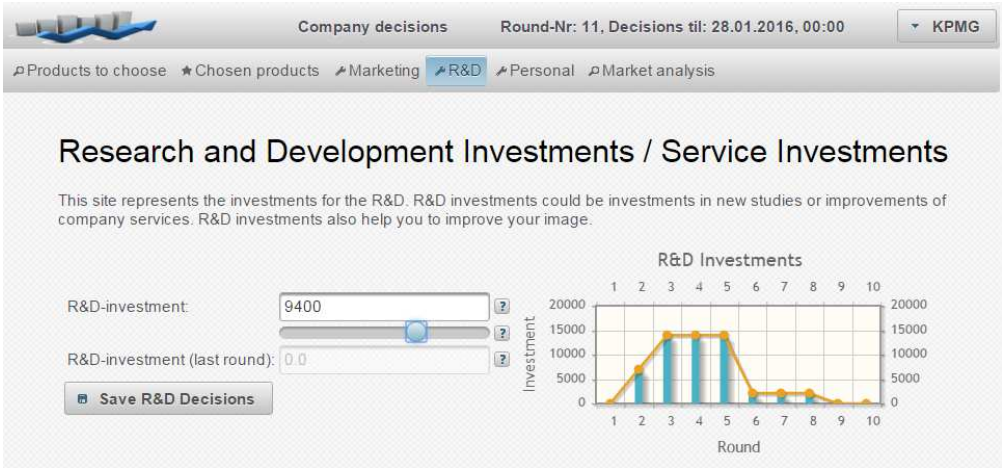


Figure 4.15: R&D investments

The third investment decision can be done on the **personal decision** page (Figure 4.16). There the participants have the opportunity to do some investments in personnel to provide good working conditions resulting in more satisfied employees. These satisfied employees can lead to better rankings in 'good place to work'-surveys and thus can improve the image in the daily newspapers. If the consumer knows, that the company treats its employees well and that they are satisfied, they consumers might decide to buy the product from that specific company.

A fourth option to do an investment is to decide to buy market reports. On the market analysis page (Figure 4.17) it is possible to buy such market analysis reports. The participant can choose from three different general market reports. These reports are available after the round has been simulated and should help the participants to figure out the preferences of the agents/consumers, to see which decisions the competitors have done and if they were successful with their chosen strategies. So, these reports play an important role to control the previously taken decisions and to analyze the competitors, so called external analyzes. Participants who put much effort in analyzing these reports can maybe identify trends and change their strategies or decisions regarding these findings.

4.3.4 Company UI: Last Round Decisions and Results

For doing internal analyzes the page 'Last Round Decisions and Results' Figure 4.18 can be used. There it is possible to get an overview which decisions the participant

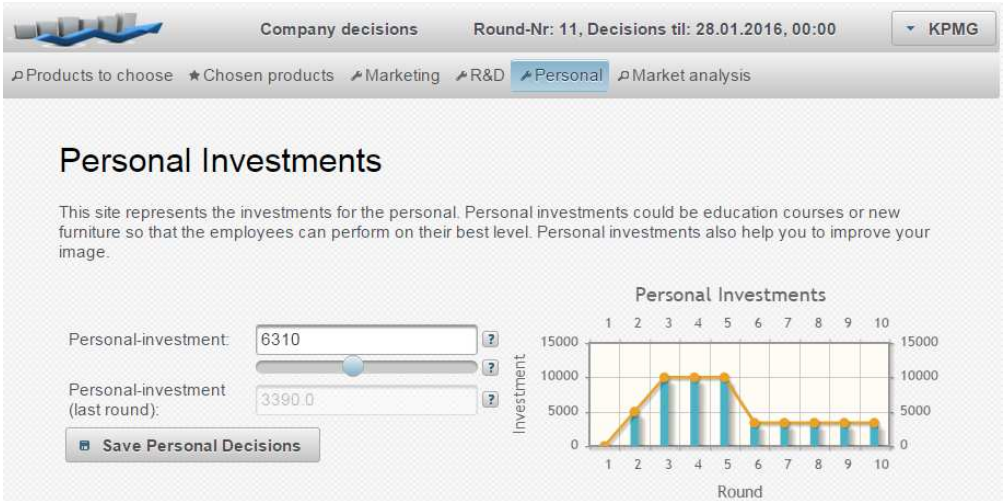


Figure 4.16: Personal investments

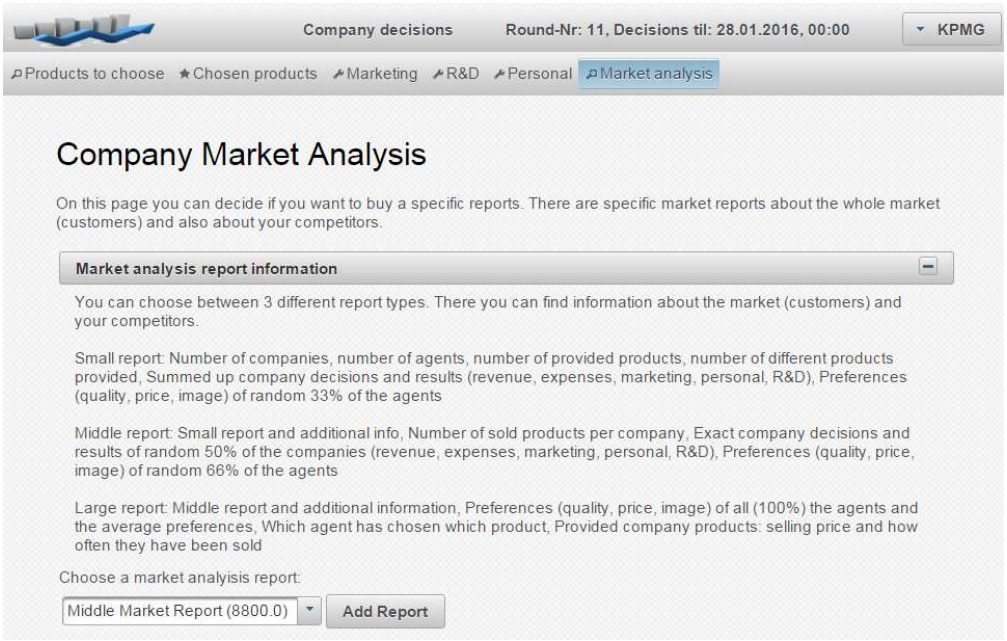


Figure 4.17: Company market analysis

made per round and if the decisions were successfully, resulting in for example a huge amount of sold products. Thus, the first part presents the done round investments in personnel/staff, marketing and R&D but also the how the revenues and expenses developed. Further, it is visualized how the company image changed in the different rounds. The second part of the web-page illustrates the product assortment decisions. It is possible to see which products were provided in different rounds and for which prices. Moreover, the amount of sold products is visualized. As already mentioned, with this web-page it is only possible to see which influences the own decisions had on the market. However, it cannot be seen how the consumer market is composed or which decisions the competitors have done and how they have performed. Sometimes participants do not change their investments or product decisions in one round but their performance decreases. Then it would be difficult for them to analyze why the performance changed without external analysis possibilities.

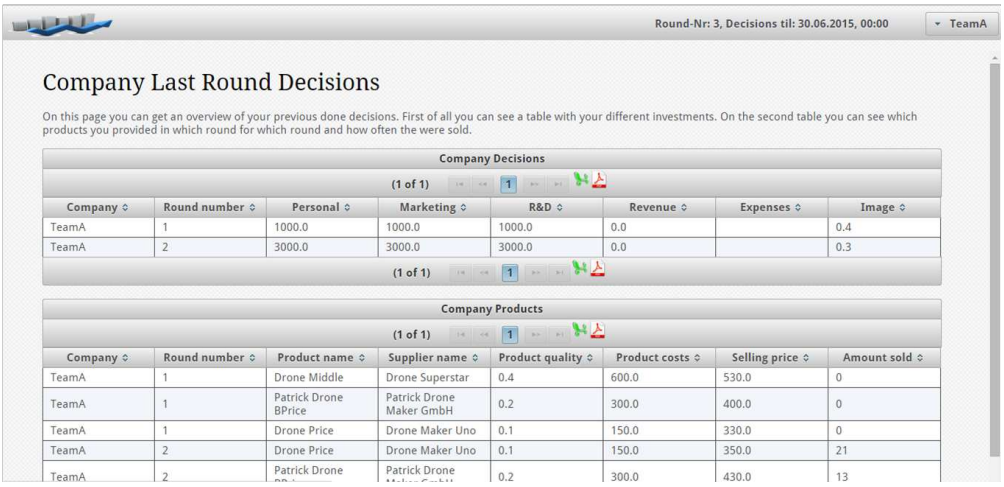


Figure 4.18: Company last round decisions

4.3.5 Company UI: Market analysis reports

On the company reports page (Figure 4.19) the participant is able to see a list of different reports which have been bought in the previous rounds. These reports are just available after the specific round has been simulated. It is possible to use them and study them carefully to see how the market is composed and what decisions the other companies have taken. Thus, these reports are the main artifacts to do external analyzes. A detailed description of the content of the different reports will be presented in the following section.

Company - Report Description: As described before, it is possible in the game to buy three different types of reports for market analysis: 'Small Market Report', 'Medium Market Report' and 'Large Market Report'. The small market report consists of some

Figure 4.19: Company reports (market analysis about competitors and customers)

general information. The medium report builds up on the small report and adds additional information of more agents/consumers and information about the competing companies. The large market report consists of the medium report and again some general more specific information about the agents/consumers and the competitors. The detailed structure of the reports will be described in Table 4.1.

Content/Information	**Small**	**Medium**	**Large**
Number of companies	✓	✓	✓
Number of agents	✓	✓	✓
Number of provided products	✓	✓	✓
Number of different products provided	✓	✓	✓
Summed up company decisions and results (revenue, expenses, marketing, personal, R&D)	✓	✓	✓
Preferences (quality, price, image) of random 33% percent of the agents	✓		
Number of sold products per company		✓	✓
50% of company decisions and results (revenue, expenses, marketing, personal, R&D)		✓	
Preferences (quality, price, image) of random 66% percent of the agents		✓	
100% of company decisions and results (revenue, expenses, marketing, personal, R&D)			✓
Preferences (quality, price, image) of all (100% and not just 50%) the agents and the average preferences			✓
Chosen product per agent			✓
Provided and sold products of companies: selling price and how often they have been sold			✓

Table 4.1: Market analysis reports - content/information

As it can be seen in Table 4.1, the large market report contains the most information and thus, the visual representation will be described subsequently. The first section

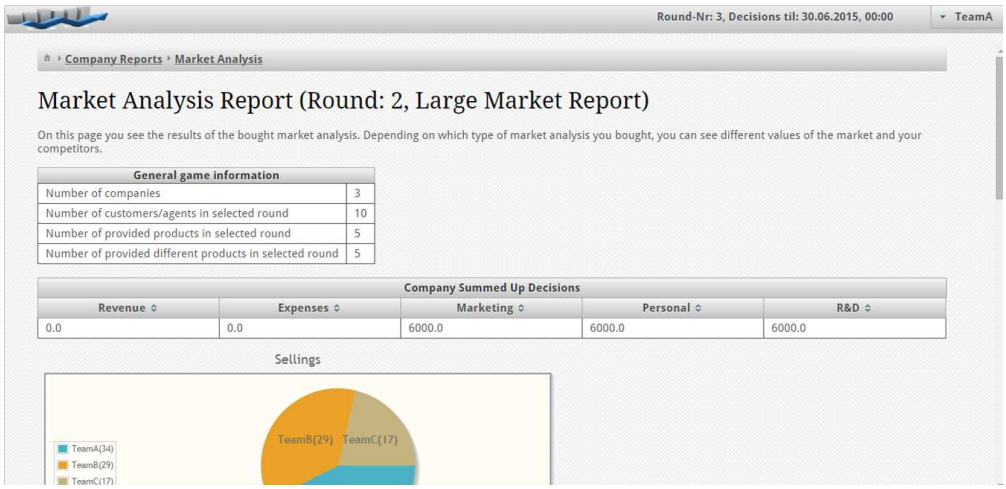


Figure 4.20: Report - general game information and company summed up decisions

of the large report (Figure 4.20) is the main part of the small market report where it is possible to get general information about the game, such as number of companies and agents, and summed up decisions of the companies. Although this is not much information but it is still possible to do further calculations. These numbers can be used for example to calculate possible revenues and market sizes. Moreover, the average company investments can be figured out. At the bottom it is possible to see a chart that shows how the different companies contribute to the overall sales. This chart is already a part of the medium and large market report. At the top section of the next Figure 4.21

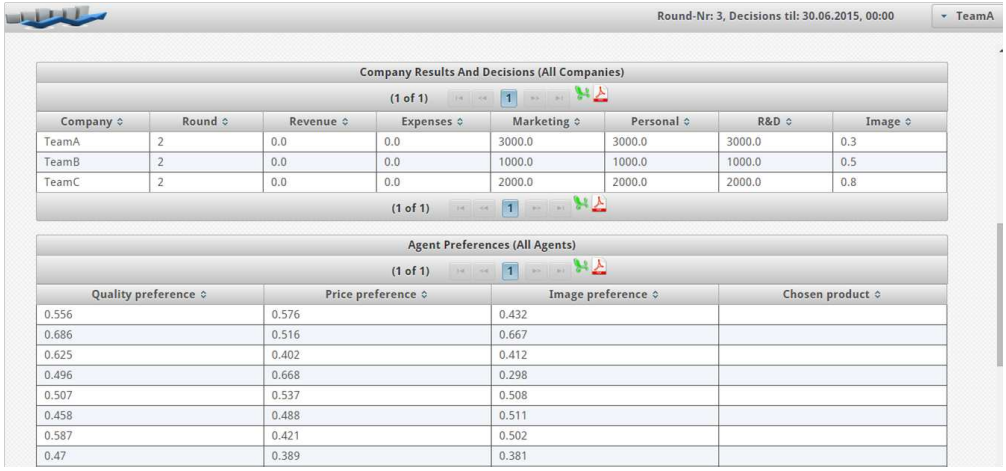
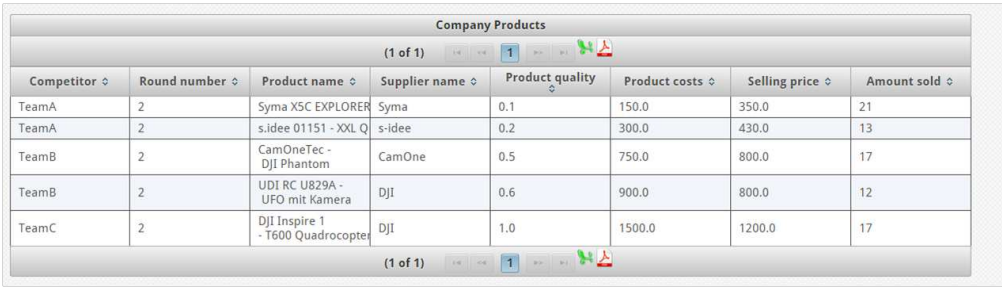


Figure 4.21: Report - company results and decisions in detail and agent preferences

it is possible to see the different decisions of the companies like marketing, personal

and R&D investments but also the revenues and expenses. At the bottom a table with agent/consumer information is located. The participants have the opportunity to analyze the preferences of the different agents and which product an agent has chosen. A preference is a number between zero and one, where zero is representing a low preference and one as a high preference. As already mentioned, the agent has three preferences that are used for the decision if a consumer buys a product or not:

- **Price preference:** A high price preference means that an agent is anxious to buy products with low prices compared to other products, because the consumer wants to save money.
- **Quality preference:** A high quality preference describes that an agent prefers the products with higher quality.
- **Image preference:** A high image preference means that an agent prefers products from companies that have a high image compared to other ones.



Company Products

(1 of 1) 1

Competitor	Round number	Product name	Supplier name	Product quality	Product costs	Selling price	Amount sold
TeamA	2	Syma X5C EXPLORER	Syma	0.1	150.0	350.0	21
TeamA	2	s.idee 01151 - XXL Q	s-idee	0.2	300.0	430.0	13
TeamB	2	CamOneTec - DJI Phantom	CamOne	0.5	750.0	800.0	17
TeamB	2	UDI RC U829A - UFO mit Kamera	DJI	0.6	900.0	800.0	12
TeamC	2	DJI Inspire 1 - T600 Quadrocopter	DJI	1.0	1500.0	1200.0	17

(1 of 1) 1

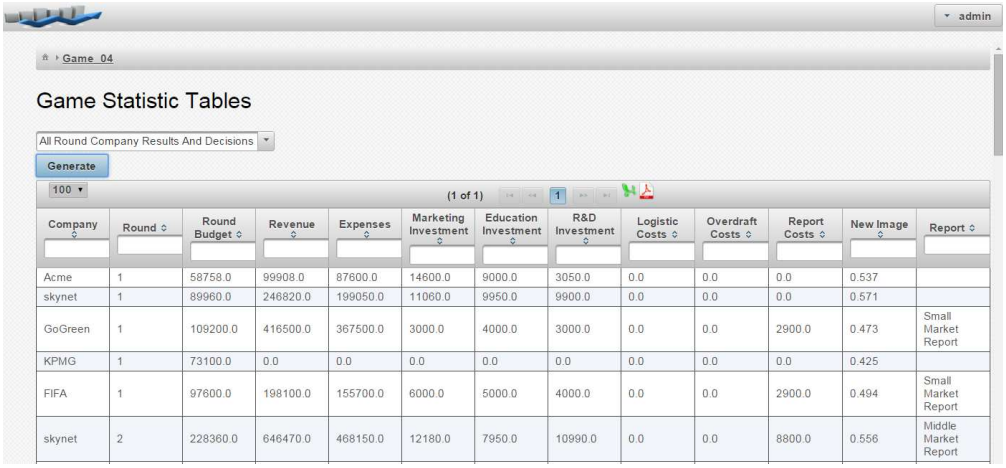
Figure 4.22: Report - provided and sold products with price, costs and quality

At the last section of the large market report it is also possible to see a table which contains different provided products including their characteristics and how often they have been sold in the specific rounds (Figure 4.22). This helps the participants to discover how the competitors set the prices for specific products. Furthermore, they have the opportunity to realize why the own performances have changed even though the own decisions have not changed. Thus, participants who are buying market reports and analyze them carefully can have huge advantages against their competitors.

4.3.6 Administrator UI

As already described, the administrator is the game head and responsible for the creation of the different games. The game head defines how many companies can participate in a specific game and how long such a game lasts. Further, the administrator has to define the consumer market. Thus, specific agent types with different preferences can be generated and also the amount of these simulated consumers have to be defined. After a round has reached the deadline, the game head has to start the simulation. Afterwards there

exists the possibility to evaluate the performance of the participants with different tabular and graphical statistics. The focus of this thesis are the participants and how they interact with the game whereas the administrator is not in the focus group. So, these different web-pages will not be described in detail. Even tough the administrator has also the role of the professor of the strategic management course. Thus, it is important to show how it is possible to evaluate the performance of the different simulated companies. As mentioned before, the administrator has the opportunity to get the results of each round in tabular form as illustrated on Figure 4.23. There it is possible to figure out which investments the companies have done in the various rounds and what their performances were in case of revenues. Furthermore, the administrator can identify who bought a market report in one round and if this report resulted in a better performance in the following rounds. If wanted, the game head can also have a look on the provided products with their set selling prices.



Company	Round	Round Budget	Revenue	Expenses	Marketing Investment	Education Investment	R&D Investment	Logistic Costs	Overdraft Costs	Report Costs	New Image	Report
Acme	1	58758.0	99908.0	87600.0	14600.0	9000.0	3050.0	0.0	0.0	0.0	0.537	
skynet	1	89960.0	246820.0	199050.0	11060.0	9950.0	9900.0	0.0	0.0	0.0	0.571	
GoGreen	1	109200.0	416500.0	367500.0	3000.0	4000.0	3000.0	0.0	0.0	2900.0	0.473	Small Market Report
KPMG	1	73100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.425	
FIFA	1	97600.0	198100.0	155700.0	6000.0	5000.0	4000.0	0.0	0.0	2900.0	0.494	Small Market Report
skynet	2	228360.0	646470.0	468150.0	12180.0	7950.0	10990.0	0.0	0.0	8800.0	0.556	Middle Market Report

Figure 4.23: Administrator game statistics table

On the other side, the administrator is able to generate graphical statistics. This feature could be helpful to see specific information at first glance such as the company with the highest budget (Figure 4.23). Moreover, it is possible to see historical trends like the image development of the different companies that is visualized on Figure 4.25. So, the administrator has various possibilities to get a good overview of how the companies performed and if there are relations to specific done decisions.

4.4 Consumer simulation implementation

Before the market simulation starts, the administrator has to define the consumer market as already mentioned before. A consumer is represented through a software agent. This agent has three different preferences: product price, product quality and company image. The administrator can weight these preferences and can thus define if for one agent the

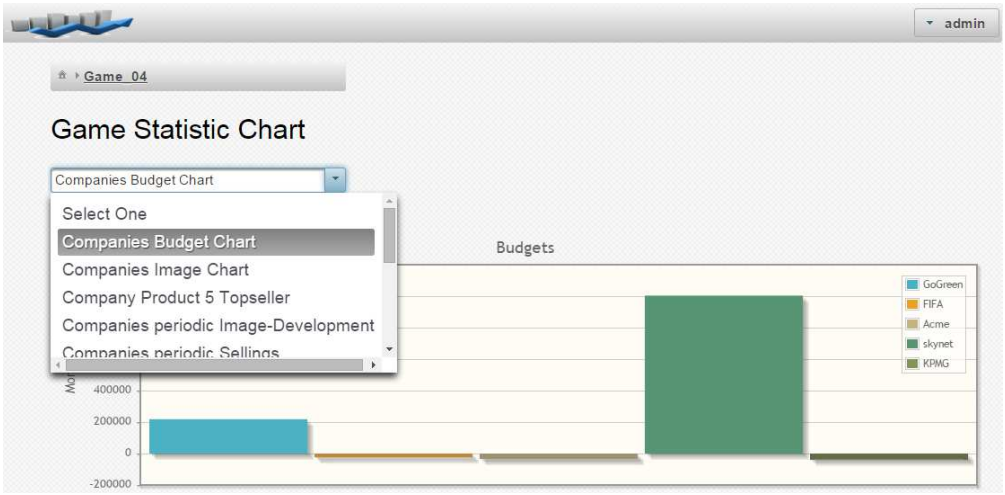


Figure 4.24: Administrator game statistics chart - budgets

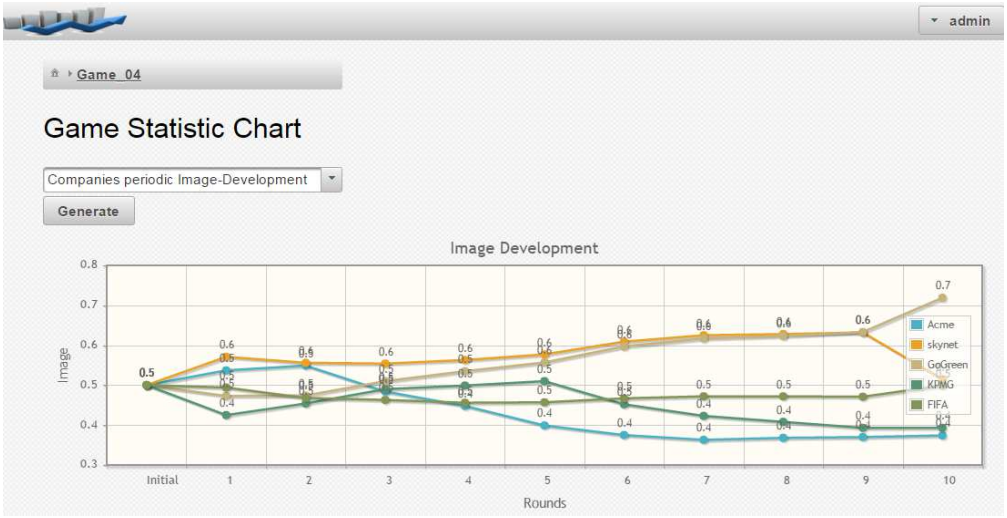


Figure 4.25: Administrator game statistics chart - image development

product quality is more important than the product price. At the beginning of the simulation, every agent has to run through a buying decision process. First each agent collects the different products on the market and compares them against each other. Depending of their defined preferences and the provided products the agents calculate the utility for each single product. If the utility of a product is lower than a predefined level, then the product will be dismissed. The remaining products are sorted based on their utility value. The agent chooses the product with the highest utility value. If two products have the same utility value, the agent randomly chooses one of these two products. At the end of the simulation it is stored which company has sold which products. This buying decision process is visualized on Figure 4.26.

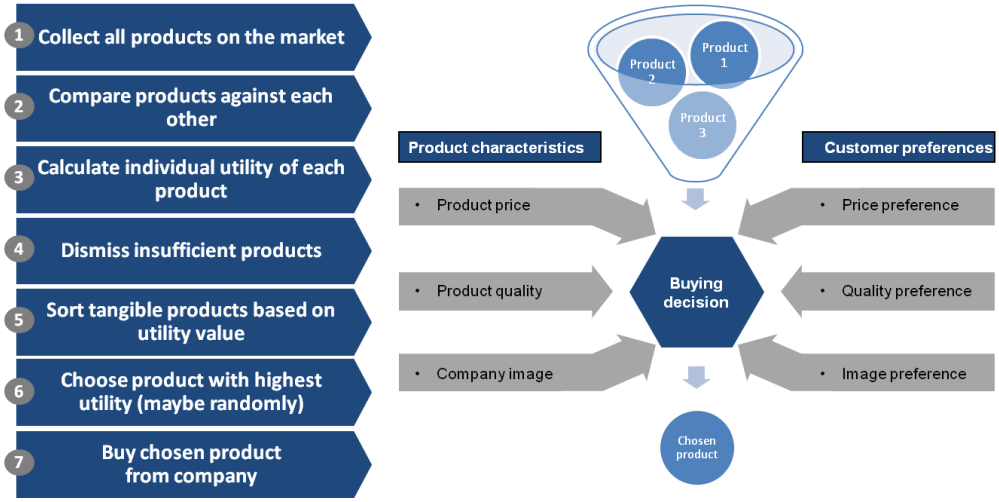


Figure 4.26: Buying decision process for an agent with its actions

4.5 Game integration and execution

After the implementation of the game it was important to find a favorable way how to integrate and execute the game in the lecture and how to play it with other participants that are not attending the strategic management course. Thus, the rules and deadlines of the business strategy game have to be specified. As also in other games, first the participants get an introduction about the game content. Further, they receive a user manual which can be compared with a usual game instruction so that participants know how the game is played, which decisions they can take and how the results can be interpreted. However, this manual does not have specific information about the market composition in the first round. This missing information can result in that already the first round may be challenging for the players because they cannot assess the market conditions for the first round. This situation can be compared with a new product launch in a new market. This procedure was determined by the advisor of this thesis who is the product owner of the game. The first deadline for the participants is then to do the pre-

survey to assess their current knowledge in strategic management. After the surveys are done the game starts for all participants on a specified date. From this 'Game start' day on, the participants have to make their decisions every day such as choosing products they want to provide for specific prices, doing investments in marketing or R&D and thinking of buying market analysis reports to have a basis for the next round decisions. So, the participants have about one day until a specified deadline to make their decisions. This day represents a business year. After this deadline the administrator of the game starts the game simulation where the software agents, who represent the consumers, decide if and which products they want to buy. When the simulation finishes, the participants are able to see their performance and the outcome of the simulated round. Depending on the fact if they have bought market reports, they can see more details about the simulated round such as which consumer has bought which product for what price. Then the players are able to change their decisions again until the next deadline. This procedure will be repeated for ten rounds as it is presented at Figure 4.27 and is moreover similar to the Deming cycle. There it is important to plan strategies, do decisions, check the outcome and act to get the predefined outcome [70].

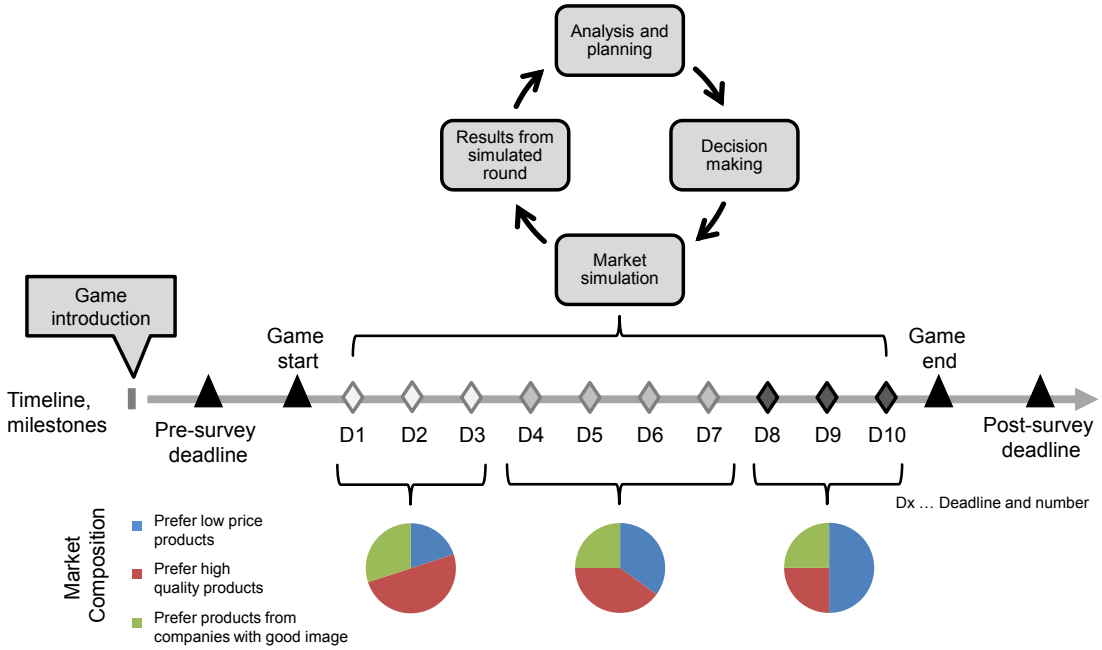


Figure 4.27: Timeline of game introduction and execution

Furthermore, it is important to analyze the market composition every round because this composition can change as it is visualized on Figure 4.27. During the decision cycles the participants are able to ask the administrator or other game heads questions via a web forum and email communication. After the last game round the users have to do the post-survey to assess their strategic management knowledge after they have played the

game. Furthermore, it can be specified ('Game end' deadline) how long the participants are able to log-in to the game to see their final results.

4.5.1 Game supervision and feedback possibilities

As the aim of the game is to improve the strategic management knowledge of the participants, it is important that the players can focus on their strategies and do not have to spend much time in solving problems that occur with the game. Thus, the players get a user manual as already mentioned where they can find hints on how to use the different game elements. Furthermore, this manual also provides information about the market reports including which data they can get from the different report types and how they have to read specific information like the agent preferences. If the user manual does not answer their questions, the participants have the possibility to request help from the administrator or game leaders via email communication or a web forum. Therefore, the responsible game leaders have to be prepared for questions and also have to plan available time for fast replies. Furthermore, the game administrator has to proactively monitor the game to detect problems or irregularities within the game.

One important aspect for learning through game participation is to get feedback of the self taken decisions [46]. Thus, the game provides standard performance feedback on web masks where it is possible to see how many and which products the company has sold in the previous rounds. This can help to reconsider the chosen strategy. If the results were acceptable, then maybe nothing has to be changed but if the results are declining, the participants should think of adapting their decisions. However, this is not the only possibility to get knowledge of the market. The participants are also able to buy market reports for further analyzes. With these reports the preferences of agents can be studied and also the decision of the competitors can be better interpreted. Additionally, trends can be eventually identified with this supplementary data resulting in better decisions.

4.5.2 Incentives and bonus points for good performance

To motivate the students to participate in the game, bonus points are awarded. Therefore, an acceptable bonus point system was developed with the advisor of the game who is also the professor of the strategic management course. It is possible to gain in total five bonus points. As the lecture consists of 100 points, these would be five percent that can be gained additionally. The participants already get two points if they do the pre- and post-survey and if they participate in the game. Participation in this context means that they do decisions such as providing products for specific prices or do investments in marketing or R&D. The additional three points can be achieved with a good performance. This performance will be measured depending on the resulting budget of the company. The best third of the game participants gets the whole amount of three points, the second third two points and the rest still gets one additional bonus point. These bonus points should be a little motivation for the students to perform well in the game and think of fitting strategies that will lead to perfect outcomes.

CHAPTER 5

Results

The following results chapter deals with the findings revealed as a result of the approach described in Chapter 3. The results of the empirical investigation are presented and analyzed. Furthermore, the different quantitative researches undertaken aimed at investigating the effectiveness of business strategy games as learning tools, by uncovering the main factors and processes that influence learning through business strategy games, as well as the nature and extent of potential learning outcomes. In this regard, the thesis attempted to link playing business strategy games to learning, to show the effectiveness of game simulations as academic learning tools. For the evaluation of the gathered data the software R and Microsoft Excel were chosen. Therefore, the data of all completed questionnaires was exported from the Google Forms application, imported to R and prepared for the analyzes. As a next step, descriptive statistics were calculated to explore the data. Thereafter, a paired t-test was done to show if the use of business strategy games can improve the understanding of strategic management. Finally, it was also evaluated how the participants perceived the game. To prove this, specific additional questions of the post-questionnaire were evaluated. In this case a Sign test and a Wilcoxon signed-rank test were chosen.

5.1 Experimental game execution and description of participants

As already described in Section 3.4 and as can be seen in Section 4.5 a survey was done with the participants before and after the game execution. The simulation game lasted for ten rounds. In these ten rounds the participants had to work on finding the right game strategies and further had to think of how to implement and control them. This section describes how the participants were composed and how they were assigned to the specific games. Moreover, it presents the final amount of persons who really participated in the game and filled out the corresponding questionnaires.

Games with actual course students: Firstly, 28 students declared that they want to participate but then just 25 students really participated in the game and did the pre- and post-survey. So, in total there were 25 active students who each simulated a company in the business strategy game. These resulting 25 companies were assigned to five different games ('Game_xx') as illustrated in Table 5.1.

Games with other persons: To have a larger population also other persons like study colleagues and friends were asked to participate. In total additional 22 players were found and assigned to four different games ('FG_xx'). This assignment can also be seen in Table 5.1.

Game name	Students with course	Colleagues without course	Total
Game_01	6		6
Game_02	6		6
Game_03	4		4
Game_04	5		5
Game_05	4		4
FG_01		5	5
FG_02		6	6
FG_03		6	6
FG_04	5		5
Total	**30**	**17**	**47**

Table 5.1: Game participants - course students and other colleagues

All five participants of game FG_04 completed the strategic management course some years before the actual semester course. The other three games consisted of 17 friends and study colleagues who never attended this course.

These total amount of 47 participants was then split up in two groups for the later evaluation. One group represented students who have attended a strategic management course and the other group represented participants without a course attendance. As already described, 17 participants never attended a strategic management course whereas the remaining 30 students have done such a course. These different sample sizes (with course, without course and all together) were then used for all of the following mentioned evaluations.

5.2 Data preparation and Cronbach's α test

Before the analysis started, the data was prepared whereas this process is described chronologically in this section. First, it was important to filter out wrong data sets, like test entries that were done before the official game or duplicate entries from a single participant who submitted the questionnaire twice. Moreover, three data sets from students who registered for the game but never participated had to be deleted. The

next step was to reverse the negatively formulated statements, such as 'I8', 'I11' and 'I14' (The whole list of questions can be found in Section A.2). As a third step numeric values had to be assigned to the written answer possibilities for later calculations:

- Strongly agree: 5
- Agree: 4
- Neither/Nor: 3
- Disagree: 2
- Strongly disagree: 1
- No answer: NA

After these first preparation activities, the reliability (consistence) of the pre-questionnaire constructs was tested, including all 47 participants. The Cronbach's α test was chosen for this task. In general the Cronbach's α test is used to test the expected correlation of two or more questions that are assigned to the same construct. If the internal consistency is at least acceptable, the average correlation of a set of items can be used as an accurate estimate of the average correlation of all items that belong to a certain construct. The reliability for a construct is given if the resulting reliability for the Cronbach's alpha test provides a value that is at least 0.7 for this construct of questions. The application of this this test results in that nearly all constructs where reliable (Cronbach's $\alpha \geq 0.7$) as it is pointed out on Table 5.2. There was just one construct ('C3') where it was necessary to remove one question/item ('I11'). After the removal of this item the Cronbach's α test for this construct was reliable. Afterwards, the means for each construct were calculated. These means were also needed for later paired t-test calculations. The results of the descriptive statistics and the paired t-test are presented in the next sections.

Construct	**Question items**	**α-value**
C1 (Goal Setting)	I4, I5	0.88
C2 (Strategic Analysis)	I6, I7, I8, I9	0.71
C3 (Strategy Formulation)	I10, ~~I11~~, I12, I13	0.71, ~~0.63~~
C4 (Strategy Implementation)	I14, I15, I16	0.7
C5 (Strategy Control)	I17, I18	0.73

Table 5.2: Cronbach's α reliability test

5.3 Results of survey analyzes

The following tables illustrate if and how the knowledge level of the participants changed on average (column **'Mean'**). For better readability just the item or construct number

No.	Min	1^{st} Q.	Median	3^{rd} Q.	Max	Mean	SD
I2 (pre)	2.000	4.000	4.000	5.000	5.000	4.067	0.640
I2 (post)	2.000	4.000	4.000	5.000	5.000	4.033	0.850
I3 (pre)	3.000	4.000	4.000	4.000	5.000	3.967	0.556
I3 (post)	3.000	4.000	4.000	4.000	5.000	3.900	0.548
C1 (pre)	3.500	4.000	4.500	5.000	5.000	4.467	0.472
C1 (post)	3.000	4.000	4.500	4.875	5.000	4.383	0.503
C2 (pre)	3.000	3.750	4.000	4.565	5.000	4.128	0.489
C2 (post)	2.750	3.750	4.000	4.500	5.000	4.033	0.560
C3 (pre)	3.000	3.752	4.330	4.670	5.000	4.201	0.515
C3 (post)	3.000	4.000	4.165	4.670	5.000	4.212	0.451
C4 (pre)	2.670	3.415	4.000	4.330	5.000	3.972	0.619
C4 (post)	2.670	3.330	4.000	4.330	5.000	3.999	0.613
C5 (pre)	3.000	4.000	4.250	5.000	5.000	4.350	0.575
C5 (post)	3.000	4.000	4.250	5.000	5.000	4.350	0.589

Table 5.3: Descriptive statistics: participants with course

of the different questions are displayed. The list of all these questions can be found in the Appendix in Section A.2.

Table 5.3 illustrates that the average knowledge level of the 30 students who attended a strategic management course before the game decreased in two constructs ('C1','C2'), slightly increased in two constructs ('C3','C4') and staid equal in one construct ('C5'). The means of the two single items also decreased ('I2', 'I3). So, it cannot be really identified a trend that the students who attended a course before improved their knowledge level on average.

On the other side, the average knowledge level of the 17 students who never attended a strategic management course (Table 5.4) before the game increased slightly in all five constructs ('C1','C2','C3','C4','C5'). Also the means of the two single items increased ('I2', 'I3) a little bit. Thus, the students who never attended a course before showed a trend that they improved their knowledge level on average but just also slightly.

The average knowledge level of all the 47 participants (Table 5.5) of the game slightly decreased in two constructs ('C1','C2') as it was the same case at the evaluation of students with course attendance and slightly increased in the other three constructs ('C3','C4','C5') which can eventually be traced back to participants without course attendance. Also the means of the two single items increased ('I2', 'I3) a little bit. Summarized, it looks like that there was a little improvement in the average knowledge level but it could be the case that most of these positive effects are just influenced by the students without a course.

Now it was the time to test if the participants significantly improved their understanding in the strategic management process. To prove this significance, the parametric t-test

No.	Min	1^{st} Q.	Median	3^{rd} Q.	Max	Mean	SD
I2 (pre)	2.000	3.000	4.000	4.000	4.000	3.471	0.717
I2 (post)	2.000	4.000	4.000	4.000	4.000	3.588	0.795
I3 (pre)	1.000	1.000	3.000	4.000	4.000	2.567	1.263
I3 (post)	1.000	2.000	3.000	4.000	4.000	2.941	1.144
C1 (pre)	2.000	3.000	4.000	4.000	4.500	3.529	0.910
C1 (post)	2.500	3.000	4.000	4.000	5.000	3.647	0.656
C2 (pre)	2.250	3.000	3.500	4.000	4.500	3.471	0.605
C2 (post)	2.250	3.000	3.750	4.000	4.250	3.529	0.624
C3 (pre)	2.000	3.000	3.670	4.000	5.000	3.529	0.707
C3 (post)	2.330	3.330	3.670	4.000	4.330	3.549	0.600
C4 (pre)	2.000	2.670	3.000	4.000	4.330	3.246	0.735
C4 (post)	1.330	3.000	3.670	3.670	4.330	3.422	0.713
C5 (pre)	2.500	3.500	4.000	4.000	5.000	3.676	0.660
C5 (post)	2.500	3.500	4.000	4.000	5.000	3.824	0.557

Table 5.4: Descriptive statistics: participants without course

No.	Min	1^{st} Q.	Median	3^{rd} Q.	Max	Mean	SD
I2 (pre)	2.000	4.000	4.000	4.000	5.000	3.851	0.722
I2 (post)	2.000	4.000	4.000	4.000	5.000	3.872	0.850
I3 (pre)	1.000	3.000	4.000	4.000	5.000	3.478	1.090
I3 (post)	1.000	3.000	4.000	4.000	5.000	3.533	0.928
C1 (pre)	2.000	4.000	4.000	4.500	5.000	4.128	0.797
C1 (post)	2.500	4.000	4.000	4.500	5.000	4.117	0.661
C2 (pre)	2.250	3.500	4.000	4.250	5.000	3.890	0.617
C2 (post)	2.250	3.500	3.750	4.250	5.000	3.851	0.627
C3 (pre)	2.000	3.670	4.000	4.330	5.000	3.958	0.669
C3 (post)	2.330	3.670	4.000	4.330	5.000	3.972	0.598
C4 (pre)	2.000	3.165	4.000	4.330	5.000	3.709	0.744
C4 (post)	1.330	3.330	4.000	4.330	5.000	3.790	0.702
C5 (pre)	2.500	4.000	4.000	4.500	5.000	4.106	0.683
C5 (post)	2.500	3.750	4.000	4.750	5.000	4.160	0.626

Table 5.5: Descriptive statistics: all participants (with and without course)

for two paired samples was chosen. This test needs two dependent paired samples, e.g. one before playing the game and one after. For calculating the corresponding statistical values, the software R was taken into account. As already mentioned, the aim of the master thesis is to show that there is a statistically significant improvement of strategic management knowledge after the game participation. Therefore, the H0 hypothesis stated that the knowledge level after the game simulation was lower or equal than before. According to this, the H1 hypothesis means that the knowledge level increased after playing the business strategy game. However, as it is illustrated in Table 5.6, the H0 hypothesis could not be rejected in any of the cases. This outcome means, that there was no significant result verifying the improvement of the strategic management knowledge of the participants after playing the game.

	With course		**Without course**		**All**	
No.	**T**	**p**	**T**	**p**	**T**	**p**
I2	0.1893	0.5744	-0.5230	0.3041	-0.1545	0.4389
I3	0.7011	0.7556	-1.5759	0.0680	-0.6843	0.2487
C1	0.8174	0.7898	-0.7199	0.2410	0.1209	0.5478
C2	1.0585	0.8507	-0.3939	0.3494	0.4995	0.6901
C3	-0.1336	0.4473	-0.1466	0.4426	-0.1999	0.4212
C4	-0.2481	0.4029	-0.7808	0.2232	-0.7599	0.2256
C5	0.0000	0.5000	-0.9245	0.1845	-0.6067	0.2735

Table 5.6: Paired t-test for testing significant improvements

	Pre		**Post**	
No.	**T**	**p**	**T**	**p**
I2	-2.9378	0.0026	-1.7641	0.0423
I3	-5.2452	0.0000	-3.8916	0.0002
C1	-4.6660	0.0000	-4.3139	0.0000
C2	-4.0602	0.0001	-2.8443	0.0034
C3	-3.7442	0.0003	-4.2886	0.0000
C4	-3.6071	0.0004	-2.9236	0.0027
C5	-3.6590	0.0003	-2.9992	0.0022

Table 5.7: Knowledge level differences of participants depending on course attendance

An additional paired t-test was used to prove the assumption that the self-assessed competence level of course students is higher than at students without a strategic management course participation. Therefore, the H0 hypothesis was that course students have an equal or lower self-assessed strategic management knowledge level than students who never attended a strategic management course before. The according H1 represents the statement that course students have a higher knowledge level than the other participants. When executing this t-test, all cases were rejecting the H0 hypothesis as it is illustrated in Table 5.7. This means that it is statistically significant proven that course

students self-assessed them with a higher strategic management knowledge level than the other participants. Moreover, this was the case before ('Pre') and also after ('Post') the game simulation.

5.4 Additional evaluation of participants' game perceptions

Besides the main aim of the thesis, that was to test if there are significant improvements in understanding of strategic management by using such a business strategy game, it was moreover essential to discover how the participants perceived the game. Thus, the objective of this part of the thesis was to explore if the players liked to participate in the game, if it was interesting for them and if they think that the game was useful for the understanding of strategic management. In case that the participants liked to play the game but not really improved their understanding, the game can be adapted and integrated in the course again. To ascertain this hypothesis, additional twelve questions/statements (Appendix A.2) were added to the post-questionnaire and evaluated afterwards with the R software package. Each of these questions was therefore analyzed individually and not grouped to constructs. Diagrams were created for each question to show the distribution of the Likert-scale values. These diagrams are added to the Appendix in Section A.3 and can help to get an overview of these questions including the mean values for all valid answers. As a next step, the game perception was investigated with statistical tests to discover if the results are significant. Therefore, three different groups of participants were discovered. Firstly, it was tested how all the participants together perceived the game. Secondly, the group of players who attended a strategic management course before were analyzed. And as a last part, the participants who never attended a strategic management course were evaluated. Before investigating if the results are significant, a Shapiro-Wilk test was executed to prove if the population is normally distributed. Therefore, the H0 hypothesis stated that the values are normally distributed. As it can be seen in Table 5.8 all items rejected the H0 resulting in that the answers were not normally distributed. According to this finding, two specific tests were chosen to test these values on significance where the data does not have to be normally distributed.

Thus, as a first step a Sign test was used to prove if the median is higher than a specific value. In this case it was tested if the median is higher than 3, as 3 is representing the answer 'Neither/Nor' and all answers above would be 4 for 'Agree' and 5 for 'Strongly agree'. This two answers would for example mean that the participants 'agree' that the game was useful for understanding strategic management and further would for example 'strongly agree' represent the meaning that the game was interesting. Thus, the H0 hypothesis represents that the median is ≤ 3 and the H1 hypothesis formerly states that the median is > 3. The results in Table 5.8, which is presenting all participants, illustrate that the H0 can be rejected in eight out of ten cases, implicating that the H1 hypothesis will be accepted. Only 'I21' and 'I28' were not rejected, meaning that

				Shapiro-W.	Sign	Wilc.
No.	**Question/Statement**	**Med.**	**Mean**	**W** **p**	**S** **p**	**V** **p**
I19	The business simulation game was useful for understanding strategic management.	4	3.47	0.821 0.005	29 <0.001	564.5 0.001
I21	The game provided me with knowledge that I can apply in making strategic management decisions in real life.	3	3.07	0.882 <0.001	17 0.292	253 0.326
I22	The game increased my understanding of strategic decisions and its impacts.	3	3.43	0.883 <0.001	23 0.001	345.5 0.002
I23	Overall I was satisfied with the learning experience.	4	3.55	0.838 <0.001	30 <0.001	534.5 0.002
I24	In my opinion the business simulation game was interesting.	4	4.11	0.784 0.001	37 <0.001	764 <0.001
I25	I perceived playing the game as challenging.	4	3.95	0.847 0.044	31 <0.001	517 <0.001
I26	I enjoyed playing the business simulation game.	4	3.96	0.822 0.009	33 <0.001	624 0.011
I27	Playing the game was exciting for me.	4	3.96	0.777 <0.001	35 0.002	730.5 0.031
I28	In my opinion the game provided enough feedback to perform well in the game.	3	3.10	0.839 0.033	20 0.108	286 0.333
I29	I think that the time schedule of the game was appropriate.	4	3.90	0.790 <0.001	33 0.002	652 0.009

Table 5.8: Game perception of all 47 participants: overview of the statistical results

				Shapiro-W.	Sign	Wilc.
No.	**Question/Statement**	**Med.**	**Mean**	**W** **p**	**S** **p**	**V** **p**
I19	The business simulation game was useful for understanding strategic management.	4	3.5	0.864 0.001	18 0.005	214.5 0.007
I20	The game enabled me to apply relevant theories and models from the course to a practical scenario.	3.5	3.367	0.883 0.003	15 0.021	155 0.023
I21	The game provided me with knowledge that I can apply in making strategic management decisions in real life.	3	2.933	0.860 0.001	9 0.593	76.5 0.674
I22	The game increased my understanding of strategic decisions and its impacts.	4	3.5	0.896 0.007	16 0.006	168 0.007
I23	Overall I was satisfied with the learning experience.	4	3.5	0.848 <0.001	18 0.005	195 0.038
I24	In my opinion the business simulation game was interesting.	4	4.179	0.754 <0.001	24 <0.001	324 <0.001
I25	I perceived playing the game as challenging.	4	3.964	0.851 <0.001	19 <0.001	204 <0.001
I26	I enjoyed playing the business simulation game.	4	3.964	0.792 <0.001	21 <0.001	276 <0.001
I27	Playing the game was not exciting for me.	4	3.929	0.751 <0.001	22 <0.001	305 0.002
I28	In my opinion the game provided enough feedback to perform well in the game.	3	3	0.879 0.004	12 0.416	125 0.528
I29	I think that the time schedule of the game was appropriate.	4	3.926	0.784 <0.001	22 <0.001	285.5 <0.001
I30	In my opinion the effort of playing the game justifies the maximum achievable bonus points.	4	3.28	0.885 0.009	13 >0.084	>119.5 0.157

Table 5.9: Game perception of 30 course participants: overview of the statistical results

there is no statistically significant evidence that the game provided knowledge that can be applied in making strategic management decisions in real life. Furthermore, as represented through 'I28', it could not be significantly proven that the game provided enough feedback to perform well in the game.

To go a step further and to support these results, a Wilcoxon signed-rank test was performed to test again if all the participants liked the game and think that this game helped in understanding strategic management. This test is a non-parametric statistical hypothesis test and is used as an alternative to the paired t-test when it cannot be assumed that the population is normally distributed. The H0 and H1 hypothesis were the same as at the Sign test. The results for all participants together of this Wilcoxon signed-rank test are also illustrated in Table 5.8. It can be seen that just 'I21' and 'I28' again were not rejected. All other cases yielded statistically significant results that the participants for example where satisfied with the learning experience ('I23'). So, overall these test results could lead to the assumption that the participants all together liked playing the game and moreover saw also the learning potentials.

As mentioned before, these three tests (Shapiro-Wilk, Sign, Wilcoxon signed-rank) were also applied to the group of just students who attended the strategic management course and to persons who never attended such a course. These two other considerations led to similar results. As first, results of the students who attended a course are presented subsequently. There, two additional questions were evaluated. The first question/statement was 'I20' which states that the game enabled the student to apply relevant theories and models from the course to a practical scenario. Additionally, 'I30' tried to find out if the effort of playing the game justifies the maximum achievable bonus points. As can be seen in Table 5.9, again 'I21' and 'I28' were not rejected. Moreover, also the new statement 'I30' was not rejected. Neither with the Sign test nor with the Wilcoxon signed-rank test meaning that the students were not satisfied with the achievable bonus points. However, it can be seen that the students were able to apply relevant theories and models from the course to a practical scenario ('I20').

Afterwards, also the game perception of the students without course attendance were separately analyzed. The results of this evaluation can be seen in Table 5.10. Additionally to the first evaluation (Table 5.8), the participants did not think that their understanding of strategic decisions and their impacts increased ('I22'). Furthermore, the results of the Sign test showed that these participants had not the feeling that this game was useful for the understanding of strategic management ('I19').

				Shapiro-W.	**Sign**	**Wilc.**
No.	**Question/Statement**	**Med.**	**Mean**	**W** **p**	**S** **p**	**V** **p**
I19	The business simulation game was useful for understanding strategic management.	4	3.412	0.655 <0.001	11 0.059	88 0.038
I21	The game provided me with knowledge that I can apply in making strategic management decisions in real life.	3.5	3.312	0.856 0.017	8 0.194	54 0.106
I22	The game increased my understanding of strategic decisions and its impacts.	3	3.294	0.789 0.001	7 0.090	35 0.055
I23	Overall I was satisfied with the learning experience.	4	3.647	0.765 <0.001	12 0.006	91 0.004
I24	In my opinion the business simulation game was interesting.	4	4.25	0.825 0.006	13 <0.001	99.5 0.001
I25	I perceived playing the game as challenging.	4	3.933	0.764 0.001	12 <0.001	78 <0.001
I26	I enjoyed playing the business simulation game.	4	3.938	0.808 0.003	12 <0.001	78 <0.001
I27	Playing the game was not exciting for me.	4	4	0.825 0.006	13 <0.001	99.5 0.001
I28	In my opinion the game provided enough feedback to perform well in the game.	4	3.286	0.687 <0.001	8 0.055	36 0.194
I29	I think that the time schedule of the game was appropriate.	4	3.875	0.801 0.005	11 0.011	80 0.006

Table 5.10: Game perception of 17 persons without course: overview of the statistical results

CHAPTER 6

Discussion and Conclusion

This concluding chapter summarizes the major outcomes and findings of the present work, especially with respect to the research question outlined in Chapter 1. Additionally, the subsequent Section 6.2 describes limitations of this work and according future work for further research in the field of business strategy games.

6.1 Summary and main findings

The aim of this thesis was to prove if the use of a business strategy game can improve the understanding of strategic management. The results of this thesis should lead to reconsidering the usage and integration of a business strategy game in a strategic management course.

In the first part of this work, a comprehensive overview of the state-of-the-art in research is given. It is useful to know how games and simulations can be classified and why such games are used. Therefore, it is important to know how people learn new topics and to understand the different learning theories. Moreover, it is shown where such games are already used and for which purposes. Depending on the purpose, the participants, the various games and other surrounding conditions, the usage of games is beneficial or not. In addition, it is also presented how strategic management could be taught with a business strategy game. Therefore, this chapter builds the basis for understanding the different usage possibilities of games.

In the second part of this thesis, the methodology was presented. The whole work is based on the 'Design-Science' Paradigm, which is a problem solving process where IT artifacts are created and evaluated to solve identified organizational problems. Moreover, the software development method was illustrated. The development approach was a combination of an iterative design and incremental build model. As a first step of the development it is important to know the requirements of the game. For this, the game

aspects were presented, meaning describing the game rules and participating roles. The next step was to explain how the developed game should be integrated in the lecture and then simulated with the participants. As the important part of this thesis is to prove an improvement in understanding strategic management it was essential to show how this should be tested. Therefore, the different statistical tests and surveys were described. This methodology chapter describes how the whole thesis was created, how the game was developed and integrated in the lecture. Subsequently, it shows how the business strategy game was evaluated.

The 'Business Strategy Game'-Chapter 4 is the third part of the thesis, presenting the resulting business strategy game. The different technologies and frameworks which were used for the creation of the game, like Java, MySQL, JSF or Hibernate, are described. In addition, it is possible to see the data model including all entities behind the whole application and how the deployment architecture is designed. As the participants play the important part in the game, also the graphical UI with the different web-masks is presented to show how the players can apply their predefined strategies. Moreover, it is important to present how the participants get feedback about how they performed in the previous rounds. Therefore, the different market analysis reports were described in detail. As a last part of this chapter, also the whole integration of the business strategy game in the course was presented. Figure 4.27 therefore shows that before and after the game a survey was conducted. Furthermore, it was mentioned how the bonus point system was designed for the students to motivate them. As can be seen, this chapter presents the whole application, shows how the participants interacted with the game and which functionalities were provided. Moreover, this presentation of the whole game can help to understand why the participants evaluated the simulation in their ways.

The aim of this thesis is to analyze if participating in a business strategy game helps to improve the understanding strategic management. To evaluate this issue, a survey was executed before and after the game. Thus, the fourth part of this thesis presented the results of the evaluation (Chapter 5). First, it mentions some information about the participants. As there were just 25 course students who participated, 22 additional persons were found for also playing and assessing the game. Moreover, it is described how exactly the participants were split up in different groups and how they were evaluated. Next, it was important to prepare the received data from the surveys and remove not needed or wrong data sets. The evaluation of the game was then separated in two parts. The first part was to analyze the main objective of this thesis, namely to test if there are statistically significant improvements in understanding of strategic management when using a business strategy game. The second part was to identify the perception of the participants after playing the game. This procedure was done in that way to first prove if the business strategy game really helps to improve the understanding of the students and next to show if they also liked playing the game and if it was interesting for them. If the game does not lead to high improvements in understanding but the participants' perceptions were positive, then an adaption of the game could lead to better results. Although if there would not be neither an improvement in understanding

nor a good game perception then the usage of such a game should be reconsidered. To test, if there was an improvement in understanding, first descriptive statistics were presented which illustrated that on average the strategic management knowledge level improved slightly at some constructs. However, the aim was to test if these results are significant. To prove this significance, a parametric t-test for paired samples was performed. With this t-test it was not possible to verify that there is a statistically significant improvement in understanding strategic management with participating in this specific business strategy game. This was not the case neither for course students nor for participants who never attended a strategic management course before. After knowing that there is no significant improvement, it was tested how the participants perceived the game. To show this, the additional twelve questions/statements of the post-questionnaire were evaluated. These questions/statements were not grouped to constructs, instead every single question was evaluated itself. Firstly, a Shapiro-Wilk test was performed proving if the population was normally distributed. This was not the case. According to this outcome, a Sign test and a Wilcoxon signed-rank test were chosen to prove if the participants perceived the game in a good way. The results of the Sign test show that all in all the game is perceived in a positive way, meaning that the participants enjoyed playing the interesting and challenging game and that they also were satisfied with the learning experience. Only two questions could not be significantly tested for all participants together. The first one was that it could not be significantly verified that the game provided the participants with knowledge that they can apply in making strategic management decisions in real life. The second one was that in their opinion the game provided enough feedback to perform well in the game. So, when analyzing the first statement, it seems that they do not really have the connection of the game to the real life and secondly that they had not received enough feedback to really perform well. These two findings should be taken into account for adapting the game for better feedback and for changing the integration and execution of the game so that the users have a better relation of the game to the real world. To go a step further, also a Wilcoxon signed-rank test was executed for testing the participants' game perception again. This test led to similar results as the Sign test. Afterwards, students who attended a strategic management course before and participants without course attendance were separately evaluated with the three before mentioned tests (Shapiro-Wilk, Sign, Wilcoxon signed-rank). The outcome of these additionally analyzes was that participants, who never attended a strategic management course before, do not think that the game helped to increase the understanding of strategic decisions and its impacts. On the other side, the course students were not satisfied with the maximum achievable bonus points compared to the effort of playing the game. So, this statement is an indication that the integration of the game should be adapted. However, this chapter presented the results of the surveys.

Summarized can be said that no significant improvement in understanding of strategic management was found but the players perceived the game as useful for understanding strategic management. Further, they thought it was interesting and exciting. They also mentioned that they were satisfied with the learning experience, enjoyed playing

the game and perceived the game as challenging. Nevertheless, they were not really convinced that the game provided them with knowledge that they can apply in making strategic management decisions in real life. Thus, on the one hand they were satisfied with the learning experience but on the other hand they did not think that this helps for later making strategic decisions. This shows that such games are accepted in the lecture. Nevertheless, the integration of the game in the course has to be improved. As a conclusion, it can be mentioned that the results of this thesis lead to the assumption that business strategy games can be used in lectures for support and consolidation but should not be used as a stand-alone learning tool.

6.2 Limitations and future work

It should be noted that this thesis has primarily focused on the development of an easy to use business strategy game. The aim was to create a game with a good balance between a quite easy to play but also challenging game with a convenient amount of possible decisions to take. Further, as it was the first execution of the game in a strategic management course, the students had the option to choose if they wanted to participate because they just got additional bonus points. Thus, the participation was not mandatory. Another result of this situation was that the introduction to the game was really short and not many surrounding conditions about the game were provided. Out of these setting and of the analyzed results some important limitations will be listed and discussed in the following. Moreover, recommendations for future work will be given.

Results have shown that the participants have not really known how the game provided them with knowledge that they can apply in making strategic management decisions in real life. It seems that the participants had no relation to the practice with this game. This could be the case because the strategic management course was not tighten linked to the game where it would have been possible to point out this relation to the real life. The game was just introduced in the last lecture of the course with not much surrounding information. Therefore, the students were sometimes not able to see how the application of their learned theories in this game can be linked with real life scenarios. Thus, for the next courses it would be advantageous if the game would be introduced at the beginning of the course and to connect the game and its functionalities every lecture with the presented theories and also with practical situations. For example, if the lecture presents internal and external analysis, then the professor can show the students how such market analyzes can be done with the game or what it means in the real life to do such analyzes. Moreover, these actions would support the students in discovering the game functionalities.

It also seems that the game provided not enough feedback to perform well. For some students it was not clear what exactly the market reports indicate. Sometimes they were also not sure why an agent chose a specific product. Thus, the game was a black box for them. These two problems can also be handled by providing more and better background information about the game. Even though, it is important to provide not

too much details about the agent purchasing process. This should avoid that it will not get too easy for the participants finding the right decisions.

The next question is also, why no significant results were found verifying that the usage of the business strategy game improved the understanding of strategic management. This could be the result of the first two problems but also maybe the whole evaluation process could be adapted. Firstly, the number of the participants was relatively small (47) and there were also participants who have never attended a strategic management course before. Secondly, the game lasted just for ten days. Maybe this time period was too short. If the players have more time to think over their strategies and to get more involved in the game then their knowledge level would probably increase. Another reason could be the five-point Likert scale. This scale could be changed to a seven-point Likert scale resulting in more possibilities for the participants to choose how they think their knowledge level is. However, for future work it would be advantageous if more students would participate, have more time for their decisions and can assess themselves with more answer possibilities.

As an additional evaluation, it could be discovered if there is a relation between the game performance of a participant and the improvement of understanding strategic management. In future work it could be analyzed if better performing students also improve their knowledge level or if the students who fail in the game improve their knowledge level more. A third option could be that students who engage most in the game and try different decisions get the most out of the game and improve their understanding of strategic management. Although this is an interesting question, it could be also difficult to verify that. Some participants do not change their first done decisions because after reviewing the market reports they think that they are on the right way. On the other side, there are students who do not change their decisions because they had forgotten to do this. Thus, it is hard to discover which participants have changed their decisions for which reason.

Although it was not possible, as a consequence of the mentioned limitations, to get statistically significant results that the understanding of strategic management improved, a positive trend was identified. This trend illustrates that the game integration in the course had positive learning effects on the students. Still, work has to be done to strengthen this effects but the first step has been taken with this thesis.

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Glossary

AI	Artificial Intelligence.
BSG	Business Strategy/Simulation Game.
DBMS	Database Management System.
ERM	Entity Relationship Model.
GBL	Game Based Learning.
GPL	General Public License.
JDBC	Java database connectivity technology.
JSF	Java Server Faces.
MVC	Model View Controller.
ORM	Object relational mapping.
UI	User Interface.

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APPENDIX A

Appendix

A.1 Entity Relationship Model - Entities

This section provides additional information of the entity-relationship-model(Figure 4.5) which was introduced in Section 4.2. Therefore, the attributes of the model and their corresponding data types will be presented subsequently.

Game	
Attribute	**Data type**
name	String
initDate	Timestamp
startDate	Timestamp
roundTime	Integer

User	
Attribute	**Data type**
nickName	String
password	String
email	String
admin	Boolean
budget	Double
imageValue	Double
marketingBudget	Double
employerEducationBudget	Double
rdBudget	Double
salt	String

Supplier	
Attribute	**Data type**
supplierName	String
active	Boolean

Product	
Attribute	**Data type**
productName	String
qualityFactor	Double
productCosts	Double
active	Boolean

Round	
Attribute	**Data type**
roundNumber	Integer
startDate	Timestamp
endDate	Timestamp
played	Boolean

AgentType	
Attribute	**Data type**
agentName	String
amount	Integer
meanQuality	Double
meanPrice	Double
meanImage	Double

Agent	
Attribute	**Data type**
preferenceQuality	Double
preferencePrice	Double
preferenceImage	Double

CompanyRoundDecisionAndResult	
Attribute	**Data type**
revenue	Double
expenses	Double
marketingInvestment	Double
employerEducationInvestmetn	Double
rdInvestment	Double
overdraftCosts	Double
logisticCosts	Double
newImage	Double

CompanyProduct	
Attribute	**Data type**
sellingPrice	Double
amountSold	Integer

Setting	
Attribute	**Data type**
portfolioExtraCostsPerProduct	Double
startImageForCompanies	Double
interestRate	Double
minimumConsumerUtility	Double
maxFreePortfolioProducts	Double
startBudgetForCompanies	Double
factorMarketing	Double
factorPersonal	Double
factorRD	Double
factorMarketShare	Double
factorMarketShare	Double
newsDate	Timestamp
newsDate	Timestamp
newsDate	Timestamp
newsDate	Timestamp
preferenceVariance	Double
portfolioFactor	Double
exponentialSmoothingFactor	Double
agentAmountCompanyFactor	Double
tradeMargin	Double
factorCostMarketing	Double
factorCostRD	Double
factorCostPersonal	Double
factorReportSmall	Double
factorReportMiddle	Double
factorReportBig	Double
factorReportSpy	Double
factorLogisticCosts	Double
factorStartBudget	Double
maxCostsMarketing	Double
maxCostsRD	Double
maxCostsPersonal	Double
utilityPrecision	Double

Report	
Attribute	**Data type**
reportTypeName	String
reportType	Integer
reportLongText	String
reportPrice	Double

News	
Attribute	**Data type**
text	String
header	String
newsDate	Timestamp

A.2 Questionnaire

General questions/statements:

- I1 - How many business simulation/strategy games have you played before?
- I2 - In my opinion a business strategy game can increase strategic management knowledge.
- I3 - My knowledge level in strategic management in general is good.

Goal Setting C1

- I4 - I understand the concept of company's vision and mission.
- I5 - I am familiar with requirements for well defined goals.

Strategic Analysis C2

- I6 - I am knowledgeable in the different possibilities to analyze competitors and competitive forces.
- I7 - I know why it is important to analyze the customers' preferences.
- I8 - I do not know how company activities shape their outputs.
- I9 - I know how resources influence competitive potential.

Strategy Formulation C3

- I10 - I am knowledgeable in the different generic competitive strategies.

- I11 - I have a lack in understanding the importance of how the fit of product characteristics and customer requirements can influence the product sales.
- I12 - It is clear for me why finding the right strategic position can be helpful.
- I13 - I understand the necessity to balance internal and external aspects to achieve the predefined goals.

Strategy Implementation C4

- I14 - I do not know how to translate a defined strategy into operative decisions.
- I15 - I am aware of the processes that primarily support competitive strategies (cost leadership, differentiation, niche focus)
- I16 - I am aware of opportunities to differentiate products and reduce costs.

Strategy Control C5

- I17 - I understand the importance to adapt my decisions if they do not lead to the aspired outcomes.
- I18 - I am aware of the necessity to adapt strategies to observed internal and external changes.

Additional questions/items of post-questionnaire

- I19 - The business simulation game was useful for understanding strategic management.
- I20 - The game enabled me to apply relevant theories and models from the course to a practical scenario.
- I21 - The game provided me with knowledge that I can apply in making strategic management decisions in real life.
- I22 - The game increased my understanding of strategic decisions and its impacts.
- I23 - Overall I was satisfied with the learning experience.
- I24 - In my opinion the business simulation game was interesting.
- I25 - I perceived playing the game as challenging.
- I26 - I enjoyed playing the business simulation game.
- I27 - Playing the game was exciting for me.

- I28 - In my opinion the game provided enough feedback to perform well in the game.
- I29 - I think that the time schedule of the game was appropriate.
- I30 - In my opinion the effort of playing the game justifies the maximum achievable bonus points.

A.3 Additional diagrams illustrating participants' game perceptions

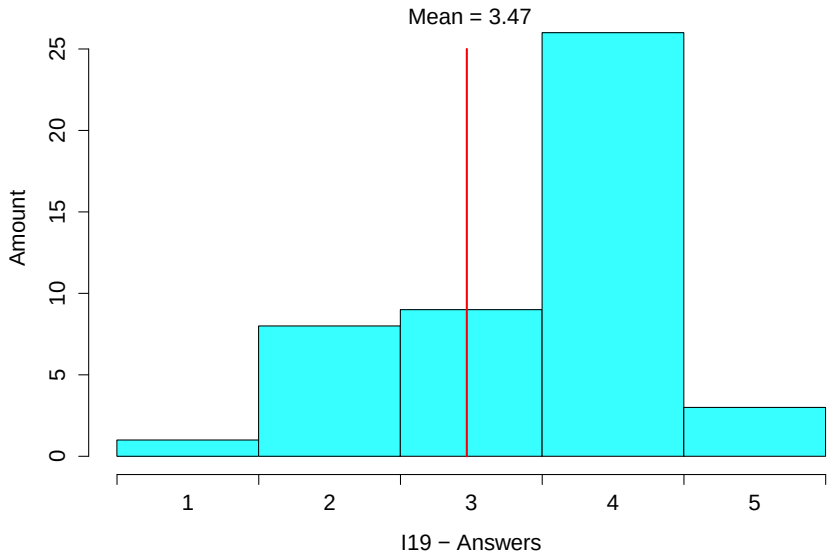

Figure A.1: I19 - The business simulation game was useful for understanding strategic management.

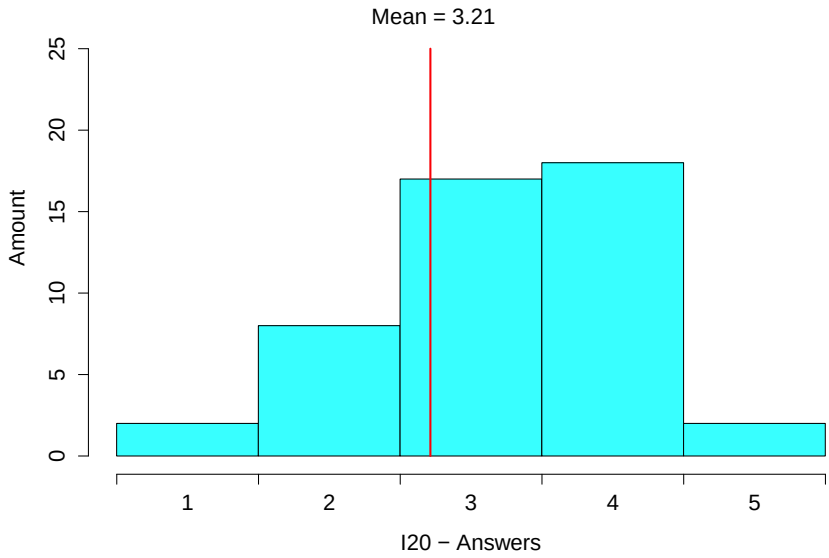

Figure A.2: I20 - The game enabled me to apply relevant theories and models from the course to a practical scenario.

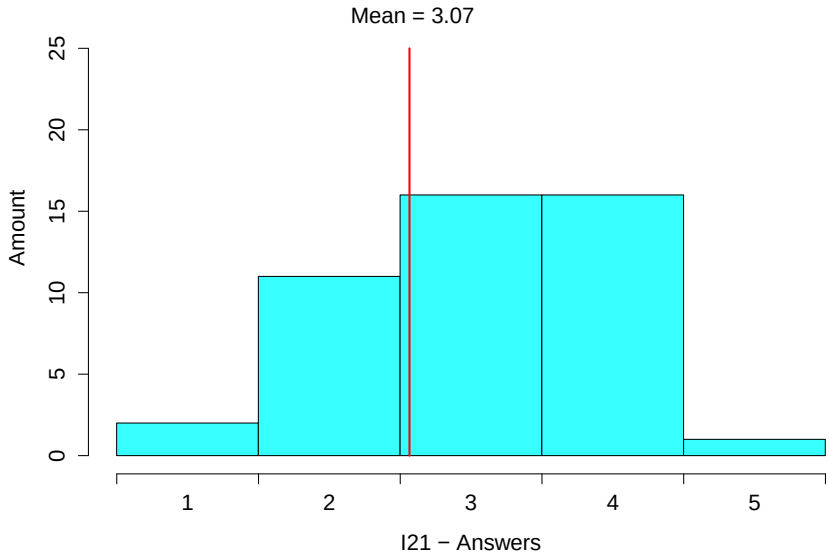

Figure A.3: I21 - The game provided me with knowledge that I can apply in making strategic management decisions in real life.

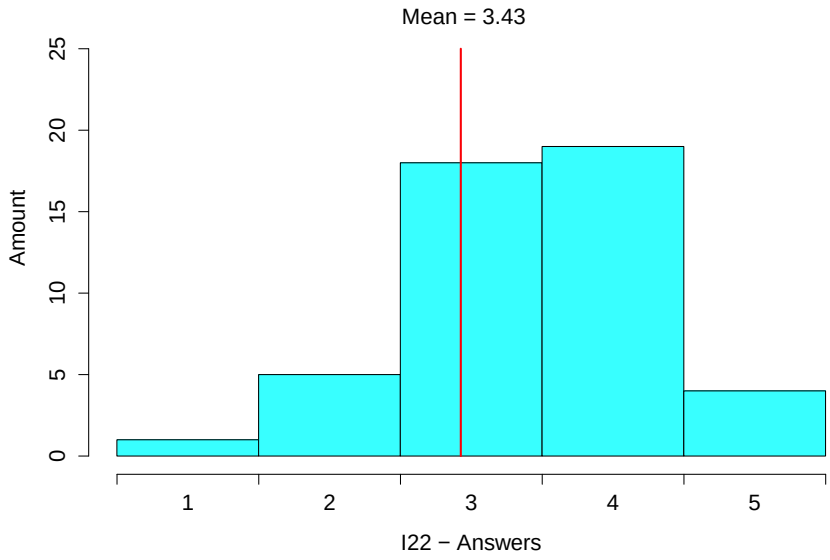

Figure A.4: I22 - The game increased my understanding of strategic decisions and its impacts.

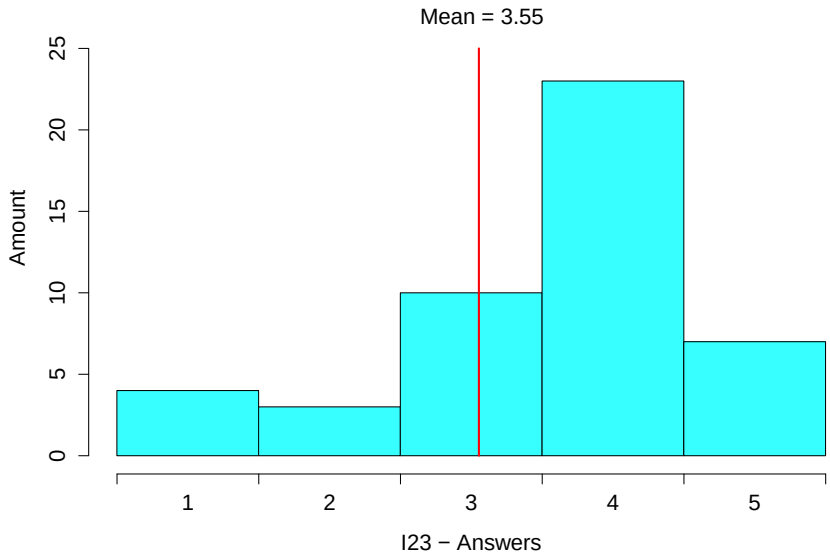

Figure A.5: I23 - Overall I was satisfied with the learning experience.

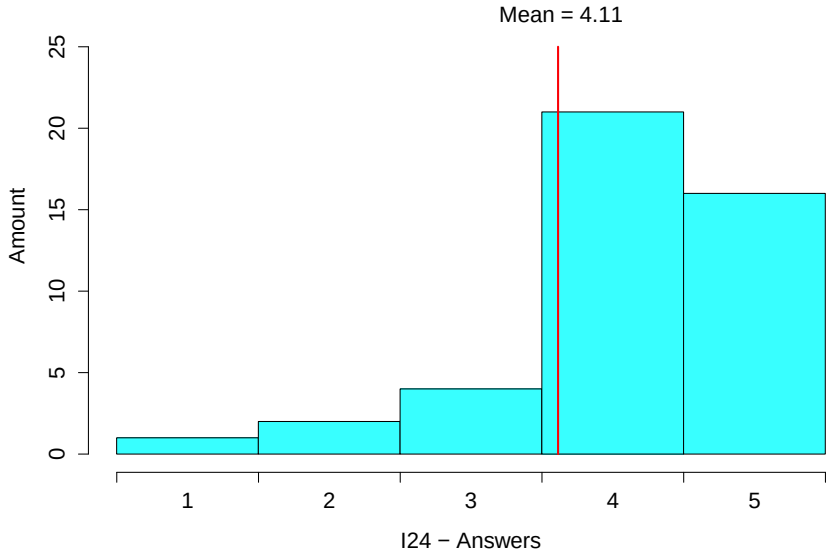

Figure A.6: I24 - In my opinion the business simulation game was interesting.

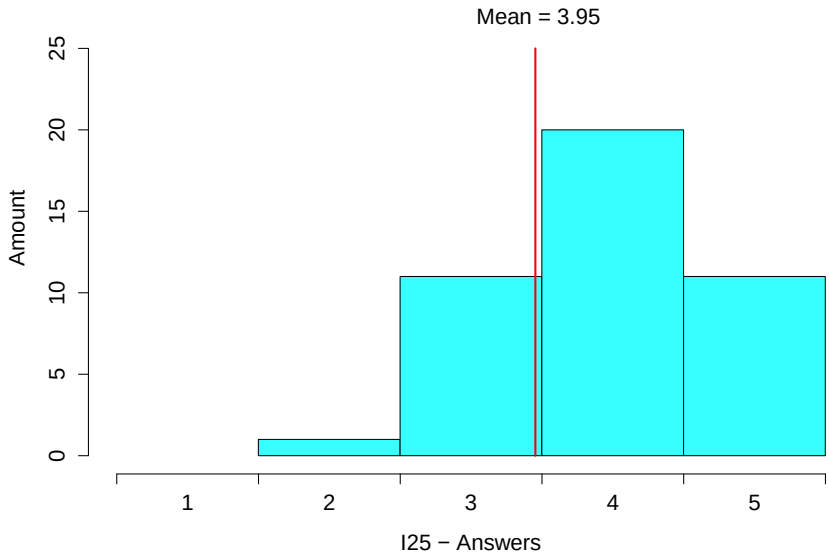

Figure A.7: I25 - I perceived playing the game as challenging.

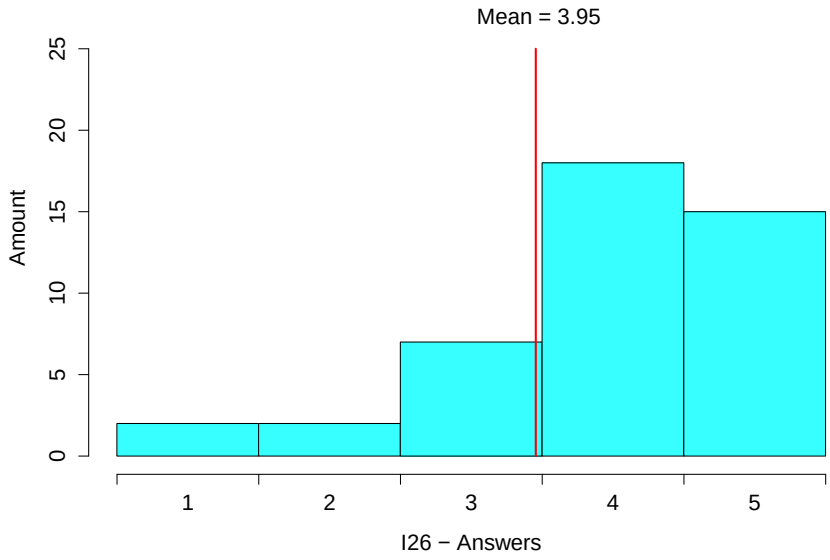

Figure A.8: I26 - I enjoyed playing the business simulation game.

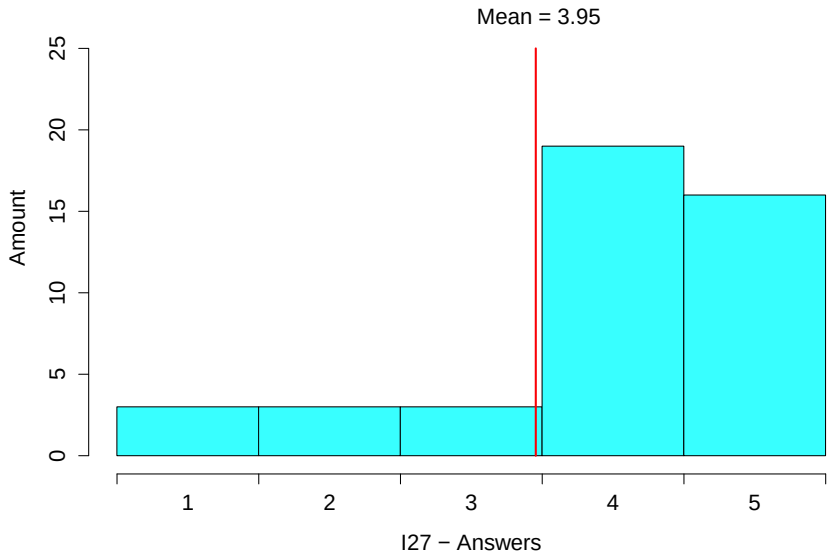

Figure A.9: I27 - Playing the game was exciting for me.

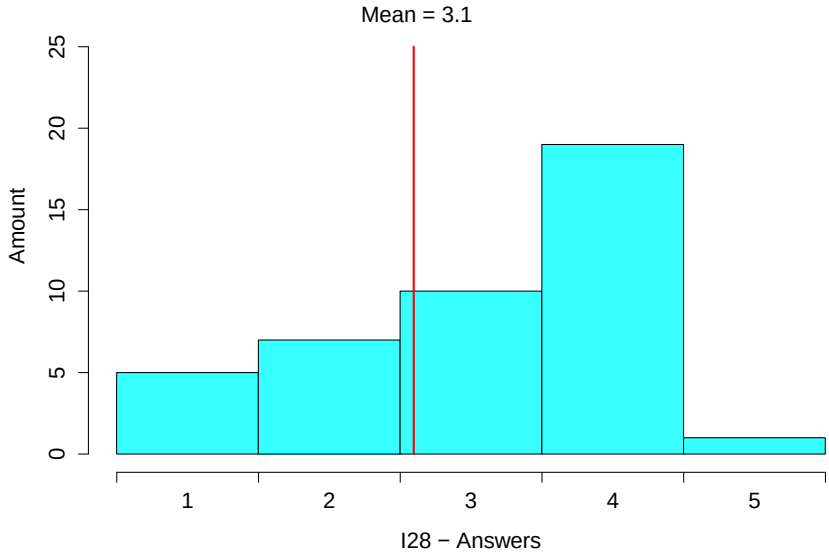

Figure A.10: I28 - In my opinion the game provided enough feedback to perform well in the game.

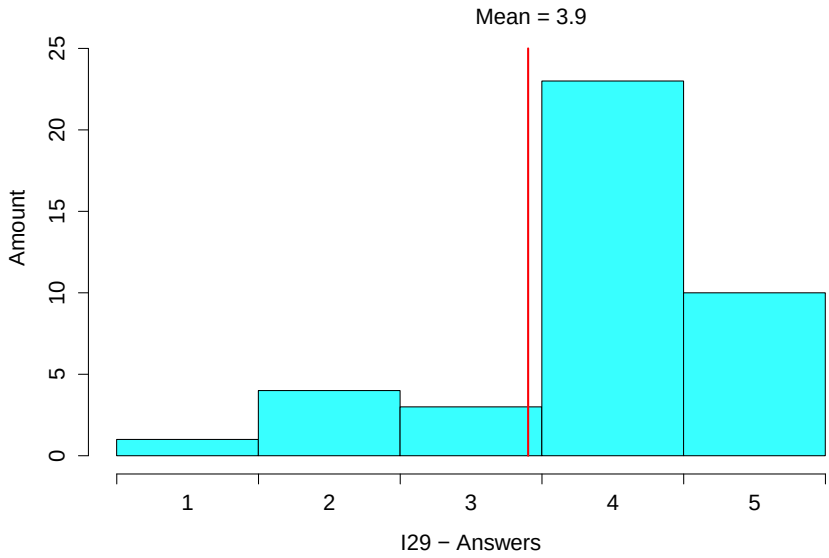

Figure A.11: I29 - I think that the time schedule of the game was appropriate.

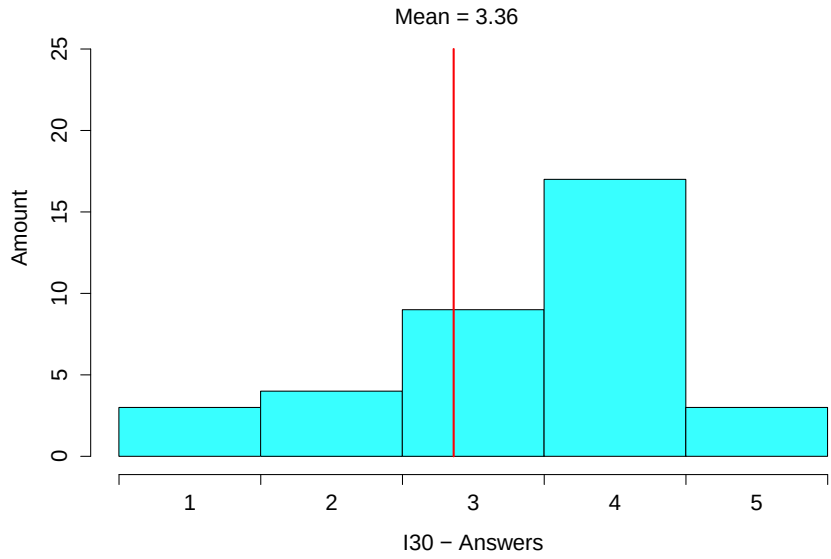

Figure A.12: I30 - In my opinion the effort of playing the game justifies the maximum achievable bonus points.