

# **Application of Game Mechanics to Innovation Management**

Theoretical Foundations and Empirical Studies

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Technischen Universität Carolo-Wilhelmina zu Braunschweig

zur Erlangung des Grades  
Doktor der Wirtschaftswissenschaften (Dr. rer. pol.)

genehmigte Dissertation

von           Dipl.-Kfm. Maximilian Witt

geboren am   07.12.1981

in            München

Eingereicht am:       26. September 2012

Mündliche Prüfung am: 7. Februar 2013

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(2013)



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**List of Abbreviations**

$\alpha$	Cronbach's Alpha
AG	Aktiengesellschaft
AM	Average Mean
Asymp. Sig.	Asymptotic Significance
BDNF	Brain-Derived Neurotropic Factor
CAT	Consensual Assessment Technique
df	Degree of Freedom
EFA	Exploratory Factor Analysis
e.g.	exempli gratia (for example)
e.V.	eingetragener Verein (registered association)
FVA	Forschungsvereinigung Antriebstechnik e.V.
ICC	Interclass-Correlation-Coefficient
i.e.	id est (that is)
IFTF	Institute for the Future
IP	Internet Protocol
KMO	Kaiser-Meyer-Olkin
NPS	Naval Postgraduate School
OEM	Original Equipment Manufacturer
OIG	Online Ideation Game
R&D	Research and Development
SD	Standard Deviation
SDK	Software Development Toolkit
var.	Variance
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V.

# I Introduction

## 1 Problem and Aim

Over the last decade, systems that are used to support the early phases of the innovation process have evolved from simple suggestion boxes to sophisticated social media platforms for the development and refinement of ideas. However, this transition has occurred not only as a result of technological developments, but also because of a paradigm shift from a closed to an open innovation model. Accessing the potential of individuals within and outside organisations has become the threshold for the existence of organisations, and offers opportunities for gaining a competitive advantage (e.g., Chesbrough 2003; Robra-Bissantz & Lattemann 2005; von Hippel 2005, p. 170-171; Gassmann & Enkel 2006; Reichwald & Piller 2009, p. 172-173). With the possibilities currently offered by the World Wide Web, the main challenges are not the accessibility, but rather the design, of social media based open innovation tools such as idea competitions or toolkits. Regarding the design organisations, which want to profit from the use of the tools, face the following two significant and interconnected challenges (Füller 2009; Adamczyk et al. 2010; Füller 2010): First, organisations have to motivate individuals to participate, and they must set them in the state of high involvement and flow<sup>1</sup> (Robra-Bissantz & Lattemann 2005; Füller 2006; Piller & Walcher 2006; Robra-Bissantz 2006, p. 341-342; Toubia 2006; West & Gallagher 2006). Second, organisations must inspire individuals in order to generate creative output, as creativity is the main prerequisite for the ability “to make valuable and innovative contributions to a firm’s new product development process” (Füller 2010, p. 104).

One activity that leads to high motivation, to a feeling of flow and involvement, and to creative output, is play (e.g., Berlyne 1969; Csikszentmihalyi 1990, p. 30-31; Edery & Mollick 2009, p. 4-5). The influence of play on creativity and motivation has been widely recognised. Specifically, neuroscience has demonstrated that play is an important incitement mechanism of human behaviour, and is responsible for the emission

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<sup>1</sup> Flow is a mental state, in which persons are fully immersed in the activity at hand (Csikszentmihalyi 1975, p. 43).

<sup>2</sup> The full reference is listed in the References at Scheiner et al. (2012a).

<sup>3</sup> The starting point of this thesis is the research project *Let’s talk about shopping*, which is supported by a

of neurochemicals that influence development of the social brain and the neural network (e.g., Panksepp & Burgdorf 2003; Gilkey & Kilts 2007). Researchers from social science and psychology (e.g., Dansky 1980a; Dansky 1980b; Howard et al. 2002; Russ 1996) have proposed that play is the child's first creative act, and it stimulates free association, fluidity of thinking and mental transformation. These authors also show that play allows the release of negative affect and results in positive affect (such as enjoyment and relaxation). As early as the eighteenth century, the philosopher Kant (1787, p. 85) defined play as the connection between experience and thinking. And the philosopher Friedrich von Schiller (1794) argued that a person must play in order to do valuable work. More recent organisational literature shows that play can help to improve the product design process (Schrage 2000), engage people in learning (e.g., Statler et al. 2009) and in strategy development processes (Jacobs & Heracleous 2006). In the field of innovation management, however, the concept of play is relatively new (Mainemelis & Ronson 2006).

This dissertation focuses on the question of how to design social media based open innovation tools to harness the potential of play. Accordingly, the dissertation follows the ideas of authors such as Gabe Zichermann and Joseline Linder (2010) and Byron Reeves and Leighton Read (2009) who suggest that the application of game design elements, that is, game mechanics such as points, levels and leaderboards, can help to take advantage of the potential of play.

This work argues that there are two possibilities for applying game mechanics to innovation management — either by enriching open innovation tools with game mechanics (*gamification*) or by adjusting a multiplayer online game to the purpose of ideation (*online ideation game*). Although research has begun to acknowledge the benefits of enriching open innovation tools with game mechanics (Leimeister et al. 2009) and of developing online ideation games (OIGs) (Füller et al. 2010), comparatively little research has been conducted in this context.

In summary, the following can be concluded:

There is a lack of:

1. Research regarding the enrichment of open innovation tools with game mechanics;
2. Theoretical and empirical contributions on the use of OIGs as an open innovation tool;
3. Scientific work regarding the effects of gamification and OIGs on motivation and creativity.

This dissertation addresses this research gap, and sheds new light on gamification in the context of innovation management and OIGs.

## 2 Structure and Method

The work contains four chapters: I Introduction, II Theoretical Foundations, III Empirical Studies and IV Final Conclusion.

In Chapter I the reference framework is presented. Thereby, it comprises the presentation of the problem, and the aim as well as the structure and the method of the overall work.

Chapter II defines the terms and concepts that are essential for an understanding of the empirical studies. In particular, terms and concepts are clarified, which were already mentioned in Chapter I: early phases of the innovation process, open innovation (tools), motivation, creativity, play, game (mechanics), gamification and the online ideation game. The definition of terms is based on intensive *literature analysis*.

In Chapter III, four empirical studies are illustrated. The first, second and fourth studies are outcomes of a research cooperative between the Technische Universität Braunschweig (Institute of Information Systems, Prof. Dr. Susanne Robra-Bissantz) and the University of Erlangen-Nuremberg (Chair of Industrial Management, Prof. Dr. Kai-Ingo Voigt). Table 28 in the Appendix presents the publications that originate from this cooperation.

The first two studies (Chapter III-1 and Chapter III-2) focus on gamification of open innovation tools (namely, idea competitions). Two different methodological approaches are applied in order to develop a stronger understanding of gamification: a qualitative and a quantitative cross-sectional analysis.



The first study (Chapter III-1: “Applying Game Mechanics to Idea Competitions: Motives, Effects and Challenges”) takes into account the views of experts, that is, persons, who decide about the implementation of game mechanics in idea competitions. Therefore, a *qualitative cross-sectional analysis* was conducted, for which experts were interviewed about their experiences with gamification. The aim was to gain insight into motives for application, expected effects, challenges and dangers of gamification. This first study is based on an article published in the *Proceedings of the Multikonferenz der Wirtschaftsinformatik* and presented at the conference *MKWI 2012* in Braunschweig.<sup>2</sup>

The second study (Chapter III-2: “Gamification of Online Idea Competitions”) takes the view of participants into account and illustrates a *quantitative cross-sectional analysis* of a single case in the automotive industry.<sup>3</sup> Participants of an online idea competition were asked about their motives for participation, intrinsic motivation (i.e., enjoyment), involvement and flow and perception of game mechanics with respect to intrinsic motivation (i.e., enjoyment), involvement and flow. This second study is based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings* and presented at the *Informatik 2011* conference in Berlin.<sup>4</sup>

The third study (Chapter III-3) and fourth study (Chapter III-4) focus on the adjustment of games for the purpose of ideation, that is, the use of an OIG. Again, two different methodological approaches are considered: a cross-sectional approach and a longitudinal approach.

The aim of the third study (Chapter III-3: “Sparkling Motivation and Creativity with ‘Online Ideation Games’”) is to determine whether an OIG can motivate a person to generate creative ideas, and if so, why this is so. Based on *qualitative cross-sectional analysis* (semi-structured expert interviews) and the adoption of an *experimental prototyping* method, an OIG was developed. For the prototype, ready-made software was used. This software was provided by the SCVNGR organisation, which generously supported this research project. The OIG was launched as a pilot at a large German univer-

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<sup>2</sup> The full reference is listed in the References at Scheiner et al. (2012a).

<sup>3</sup> The starting point of this thesis is the research project *Let’s talk about shopping*, which is supported by a grant from Volkswagen AG. This research project aims to establish an understanding of how to integrate consumer in the innovation process of e-services in the automotive industry. The industry focus of this project is mirrored in the orientation of specific chapters on the automotive industry (e.g., Chapters II-1.3 and III-2).

<sup>4</sup> The full reference is listed in the References at Witt et al. (2011a).

sity to generate new ideas for improving its services and infrastructure. 77 students took part in the game, although no extrinsic rewards (such as grades or monetary compensation) were promised or given. To explain why individuals played the game, whether players were involved in the game and what the main driver of players' involvement was, a *quantitative cross-sectional analysis* (i.e., an explorative factor analysis and a regression analysis) was conducted. To evaluate the creativity of ideas, a consensual assessment technique was used.<sup>5</sup> This chapter is based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings* and presented at the *Informatik 2012* conference in Braunschweig<sup>6</sup>.

In the fourth study (Chapter III-4: "Creative Process Engagement in a Multiplayer Online Ideation Game"), survey participants played an OIG<sup>7</sup> for more than 1072 hours. The OIG was then evaluated using a twofold approach: First, the change in players' creative process engagement was examined in a *longitudinal panel analysis*. Second, a *qualitative cross-sectional analysis* was conducted to find reasons for this change. To carry out the qualitative cross-sectional analysis, interviews with players were aggregated and evaluated. This chapter is also based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings*, and is also based on two presentations — one at the *Informatik 2012* conference in Braunschweig<sup>8</sup> and the second at the *10<sup>th</sup> International Open and User Innovation Workshop* at Harvard Business School in Boston (Massachusetts).<sup>9</sup>

Chapter IV presents the overall conclusion drawn from the studies, and provides implications for future research and practice.

In sum, this thesis applies core methods of information systems research. A portfolio diagram, which is classified according to the dimensions *degree of formalisation* and *paradigm*, is suitable for presenting an overview of the applied methods (Wilde & Hess

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<sup>5</sup> A detailed description of the consensual assessment technique can be found in Chapter II-1.6.1.

<sup>6</sup> The full reference is listed in the References at Witt & Robra-Bissantz (2012).

<sup>7</sup> The object of the research is the OIG *Evoke* (McGonigal 2011, p. 333). This game was developed by the World Bank Institute and was directed by Jane McGonigal, who provided the permission to utilise the game for this research project.

<sup>8</sup> The full reference is listed in the References at Witt et al. (2012a).

<sup>9</sup> The full reference is listed in the References at Witt et al. (2012b).

2007). Figure 1 depicts this portfolio diagram. Figure 2 summarises the structure of this thesis.

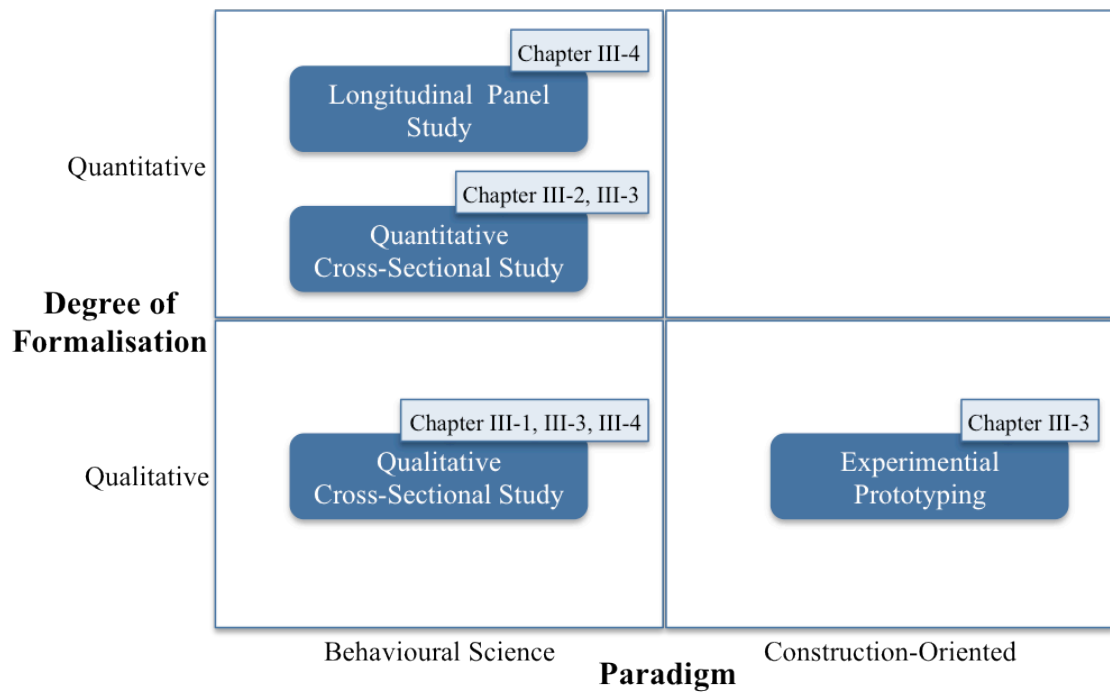


Figure 1: Overview of Applied Methods

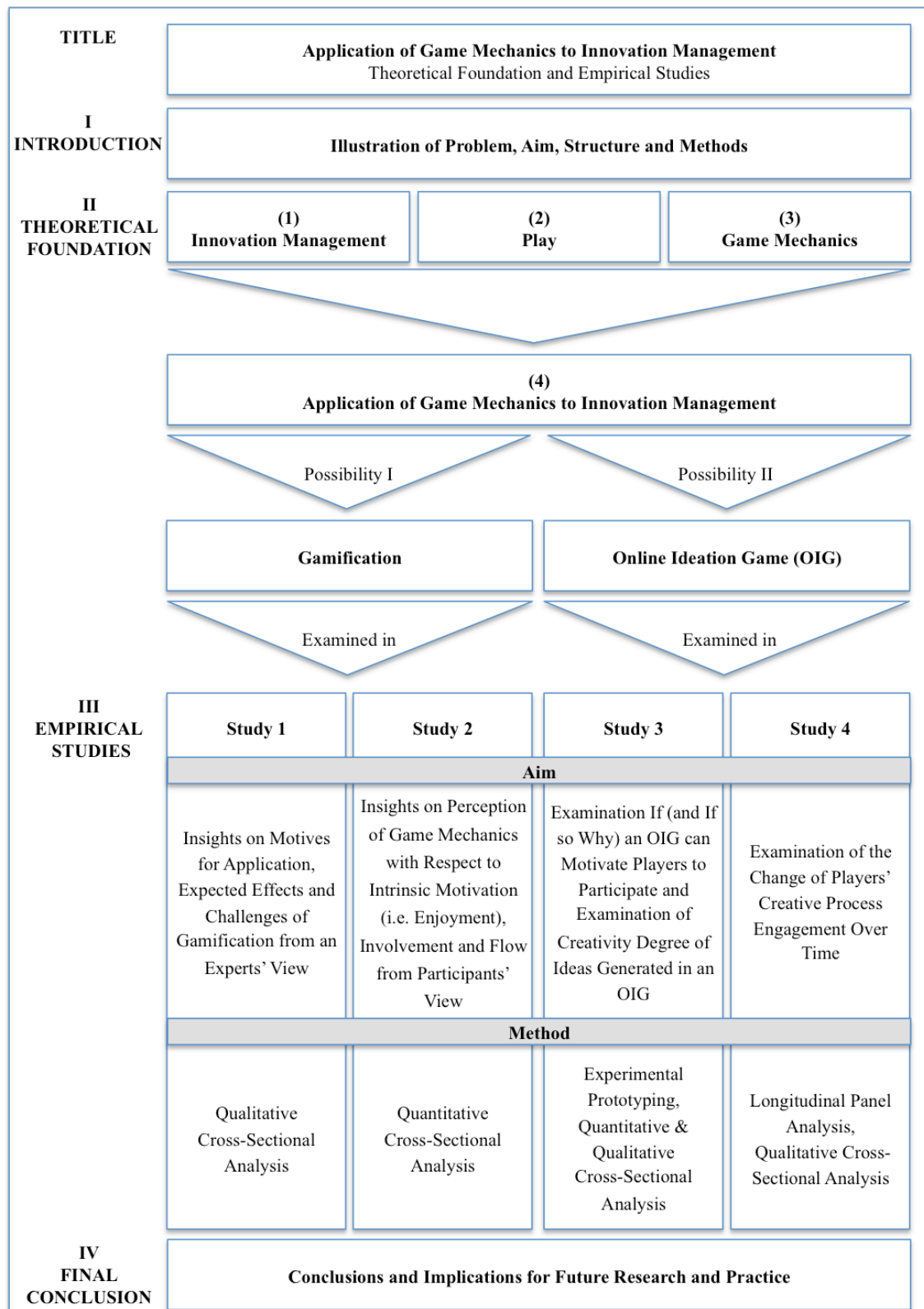


Figure 2: Structure

## II Theoretical Foundations

This chapter aims to illustrate the theoretical framework and to define terms that are essential for a full understanding of the following chapters. As has previously been discussed, the research gap regarding boundaries of innovation management and game mechanics is addressed. In this context, this dissertation provides new and useful insights for the application of game mechanics as a facilitator of motivation and creativity. To that end, Chapter II consists of the following three subchapters: (1) *innovation management*, (2) *play* and (3) *application of game mechanics to innovation management*.

### 1 Innovation Management

*Innovation management* comprises decisions about *ideas* and *innovations*, as well as about the organisation of the *innovation process* (Hauschildt & Salomo 2011, p. 29-30). Therefore, the concepts of idea, innovation, and innovation process are described more closely in the following section.

The generation of *ideas* has been of scientific interest since Plato's detailed discussion of ideas, asserting that material things are imperfect and transient reflections of perfect and unchanging ideas (Ross 1966). In contrast, the modern conception of ideas in the business sciences defines ideas as plans or concepts that are formed by mental effort (Newell et al. 1962). This definition captures the cognitive aspects of ideas. Recent research highlights a view that not only should cognitive aspects be considered when defining the concept of ideas, but social aspects should be taken into account as well (Saatcioglu 2002). In this conceptualisation, ideas are also social products that result from an on-going interaction between thought and action. By incorporating both cognitive and social aspects, the Saatcioglu (2002) study defines an idea as a "cognitive impulse enabled by social experience" (p. 1). Van de Ven (1986) suggests that ideas can originate from "a recombination of old ideas, a schema that challenges the present order, or a formula or unique approach that is perceived as new by the individuals involved" (p. 591). Baron (2006) suggests that three factors have a positive influence on the recognition of opportunities for new product or service ideas, the first of which is engaging in the active search for opportunities. The second factor is alertness, which is

defined as the capacity to recognise opportunities for ideas when they emerge. If people possess this alertness, they can identify existing information asymmetries in the market (Scheiner & Voigt 2012). The third factor that Baron proposes as positively influencing the recognition of opportunities for new product or services ideas is prior knowledge of a market, industry or group of customers. In order to move the recognition of an idea for a product or service to the implementation stage, innovation plays a role. Though the term innovation is a current buzzword, and is not clearly defined<sup>10</sup> (Hauschildt & Salomo 2011, p. 3-5), in this dissertation the term represents the marketable implementation of a (creative) idea (Brockhoff 1992; Vandenbosch et al. 2006). Thus, though an idea is a necessary basic element of every innovation, it remains valueless without exploitation, as is explained by Roberts (1987): “The exploitation process includes all stages of commercial development, application, and transfer, including the focussing of ideas [...] towards specific objectives, evaluating those objectives, downstream transfer of research and/or development results, and the eventual broad-based utilisation, dissemination, and diffusion of the technology-based outcomes” (p. 3). Research shows that an effective structure is needed in order to successfully implement an idea and to bring it into a business (e.g., Simon 1957), particularly because an idea is often altered or re-invented due to changing contingencies and needs (Vandenbosch et al. 2006). The *innovation process* helps organisations to structure the movement from the development of an idea to a market-ready innovation.

### 1.1 Phases of the Innovation Process

The innovation process is often illustrated as a linear phase model in the form of a funnel, and is divided into consecutive stages (Bessant & Tidd 2007, p. 19). The funnel visually portrays the detail that during the process only the best ideas are selected to be developed further and implemented (Möslein 2009). Process models differ significantly in the number of stages, ranging from three (Tranfield et al. 2003) to sixty-seven stages (Walcher 2007, p. 14). However, a number of researchers acknowledge process models with four to six stages (Möslein 2009; Hauschildt & Salomo 2011, p. 21).

This work focuses on the integration of individuals in the *fuzzy front end* of the innovation process. The fuzzy front end is defined as “the period between when an opportunity

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<sup>10</sup> For an overview of definitions for the term *innovation*, see Hauschildt and Salomo (2011, p. 6-10).

is first considered and when an idea is judged ready for development” (Kim & Wilemon 2002, p. 269), and is also called the *early stages*, *initiation stages*, *phase zero*, *pre-project phases*, *predevelopment*, *up-front homework* or *up-front activities* (see, for example, Cooper 1988, p. 237; Dorbandt et al. 1990, p. 157; Gaiser 1991, p. 128; Geschka 1993, p. 160; Zhang & Doll 2001, p. 95). This part of the process begins from the first impulse of an idea, and ends with a *go-no-go-decision* or *money-gate*<sup>11</sup> (Verworn & Herstatt 2007). Consequently, the fuzzy front end of the innovation process includes the activities of idea generation (ideation), idea screening, concept generation and concept testing (Koen 2005). The term *fuzzy* expresses the ambiguous and intangible character of this phase, as there is uncertainty about the needs of customers, activities of competitors, resources required, and strategy alignment (Brun 2008; Jørgensen et al. 2011). Additionally, required information is available, mostly in *tacit* form. Tacit knowledge is defined as knowledge that is at least partially based on experience (Leonard & Sensiper 1998), is not yet explicated (i.e., not yet expressed or declared openly) (Spender 1996) and resides in the unconscious or semiconscious (Leonard & Sensiper 1998; Reichwald & Piller 2009, p. 82). As tacit knowledge is difficult to access and is connected to a specific context, it is also *sticky* (Reichwald & Piller 2009, p. 82). *Stickiness* is defined as “the incremental expenditure required to transfer that unit of information to a specified location in a form usable by specified information seeker. When the expenditure is low, information stickiness is low, when it is high, stickiness is high” (von Hippel 1994, p. 430). Figure 3 shows the fuzzy front end of the innovation process, which is illustrated in the form of a funnel and divided into five stages. The fuzzy front end is of great interest for research, because a successful management of this phase has significant influence on the overall success of projects, project delays and budget escalations (e.g., Bürgel & Zeller 1997; Thomke & Fujimoto 2000; Kim & Wilemon 2002). Although this stage is very important, the literature has given understanding the fuzzy front end only limited attention, especially the phase of ideation (Dahl & Moreau 2002). Also, top-management concentrates attention more on the later phases. Consequently, there is often a lack of support, especially regarding resources (Verworn & Herstatt 2007). Table 1 summarises the characteristics of the fuzzy front end.

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<sup>11</sup> The *go-no-go-decision* or *money-gate* is the point of time when the project is equipped with resources in the organisation (Nobelius & Trygg 2002).

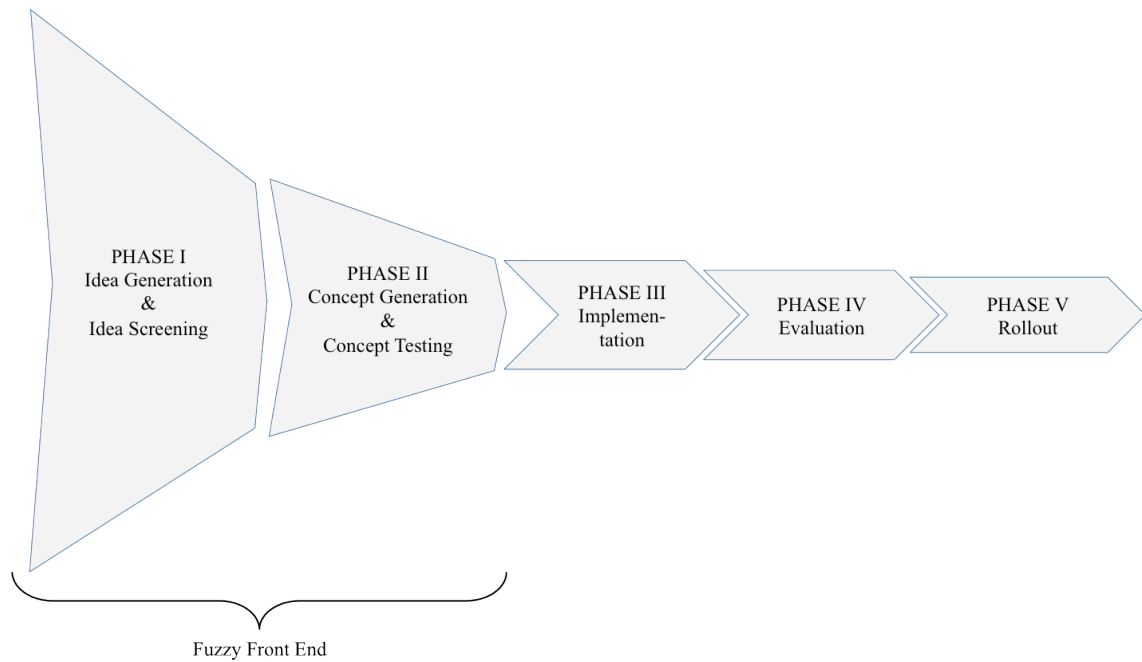


Figure 3: Fuzzy Front End of the Innovation Process

(Following Verworn & Herstatt (2007, p. 9) and Bessant & Tidd (2007, p. 19))

Factor	Characteristics of the fuzzy front end
Uncertainty	High
Required information	Mostly tacit
Influence on overall project success	High
Top-management support	Oftentimes low

Table 1: Characteristics of the Fuzzy Front End

(Following Verworn (2005, p. 32))

## 1.2 Opening the Innovation Process

Traditionally, innovation processes were relatively closed — innovation projects were conducted inside organisational boundaries and important knowledge was developed mainly in-house. In this closed innovation paradigm, the organisation itself is solely responsible for the innovation activities and the success of those activities (Chesbrough 2003). Hence, if an organisation wants to be successful and to gain a competitive advantage, it has to invest in research and development (R&D) activities. The R&D outcomes are applied to the development of products and services, which helps the organisation to generate sales revenue and to make profits. Those profits are once again invested into the company's own R&D. All ideas are generated within, and solely for, the



organisation (Lichtenthaler & Lichtenthaler 2010). Consequently, ideas that are rejected or that do not suit the overall innovation strategy will remain in the organisation, unused, and members of the R&D department run the risk of beginning to think inside the box (Neyer et al. 2009).

Due to changes in the organisational environment, the closed innovation model does not offer companies the possibility of using the full existing innovation potential (Chesbrough 2003). As important innovation stimuli can be found on the fringe of organisational boundaries, organisations have opened their innovation processes in the last two decades (Tsai 2001; Shipton et al. 2006). Valuable insight into needs and problem solutions can be collected in a way that will improve both the innovation process, and the outcome (Chesbrough 2003; Robra-Bissantz & Lattemann 2005; von Hippel 2005, p. 170; Gassmann & Enkel 2006). This new paradigm is called *open innovation*, and was proposed by Henry Chesbrough (2003). Chesbrough (2003) defines open innovation as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” (p. 1). In Figure 4, the contrasting principles of the closed and open innovation model are illustrated.

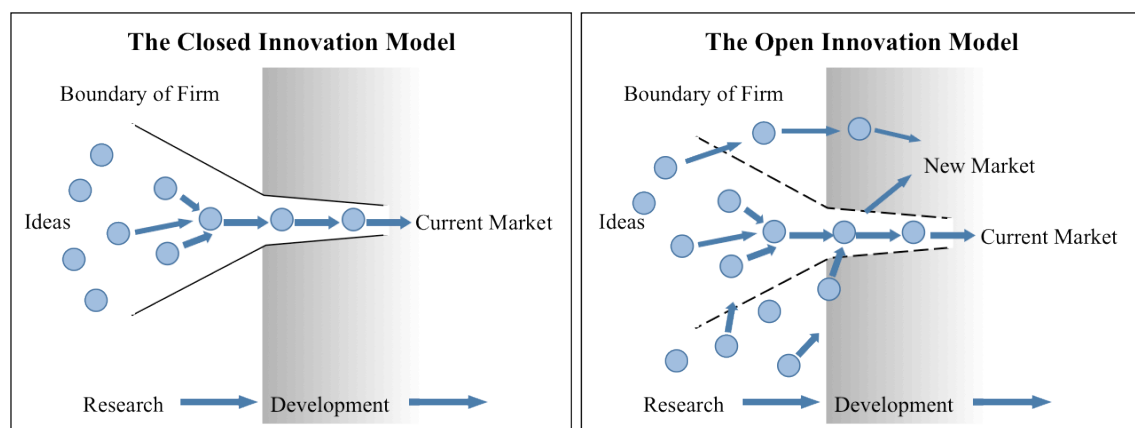


Figure 4: Principles of Closed Innovation Model and Open Innovation Model  
(Following Chesbrough (2003, p. 37))

The emergence of *social media* has accelerated the radical transformation from a closed to an open innovation model (Nambisan 2002). Kaplan and Haenlein (2010) define social media as “a group of Internet-based applications that build on the ideological and

technological foundations of Web 2.0, and that allow the creation and exchange of user-generated content” (p. 61). Social media are the main drivers of this transformation, because they (1) allow access tacit knowledge, (2) can support cognitive processes and (3) enable communication, interaction, collaboration and, thus, social experience (Nambisan 2002; Sawhney et al. 2005; Piller & Walcher 2006).

### 1.3 Open Innovation Tools

When organisations decide to open their R&D processes, they can integrate two types of innovators: the *peripheral inside innovators* and the *outside innovators*. The peripheral inside innovators are employees across business units who are not officially and by job description responsible for innovative activity. They voluntarily contribute their (expert) knowledge, which they have acquired through their daily work. The outside innovators are users, (end) customers, partners, retailers and competitors (Neyer et al. 2009). The outside innovators and peripheral inside innovators can be integrated into the innovation process by a number of tools. This work focuses on tools that use social media and Web 2.0 technologies to integrate a broad range of outside innovators and peripheral inside innovators into the fuzzy front end of the innovation process.<sup>12</sup> As open innovation tools such 3D printers or laser cutters (Möslein & Neyer 2009) do integrate users, but mainly in the later stages (i.e., implementation phase (see Chapter II-1.1)), these tools are not considered. As well, the lead user method is excluded from this work, as it does not aim to integrate a broad range of users but focuses, instead, on the integration of a small number of selected users (Urban & von Hippel 1988; Bilgram et al. 2008).

There are a number of social media based tools that can be used to integrate a broad range of outside and peripheral inside innovators. These tools are characterised by a different emphasis on process orientation, and often provide similar functionalities in varying degrees: Most of the tools allow the users to suggest, evaluate and discuss solutions to problems that were specified by organisations, and to communicate and coordinate with other users. Some tools also allow defining problems and support techniques for inventive problem solving (Hrastinski et al. 2010). Drawing on the literature review,

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<sup>12</sup> Due to the focus on social media and Web 2.0 technologies, in German-speaking countries the topic of this work is situated in the science of information systems (*Wirtschaftsinformatik*): This science is concerned with the design, development and application of information and communication systems in organisations (Lutz et al. 2011, p. 14).

five basic types of social media based tools can be distinguished: idea competitions (e.g., Piller & Walcher 2006), innovation markets (Jeppesen & Lakhani 2010), innovation communities (Möslein & Neyer 2009), innovation toolkits (e.g., Prügl & Schreier 2006) and idea management systems (Brem & Voigt 2007; Bansemir & Neyer 2009). In actual practice, combinations of these basic types are also found (e.g., a combination of idea competitions and innovation communities, or a combination of innovation toolkits and innovation communities). The social media based tools that are implemented to foster the innovation potential of outside innovators are *idea competitions*, *innovation markets*, *innovation communities* and *innovation toolkits*. The one other social media based tool is the *idea management system* (Figure 5), which is used to activate the innovation potential of peripheral inside innovators. These tools will be described in the following sections.<sup>13</sup>

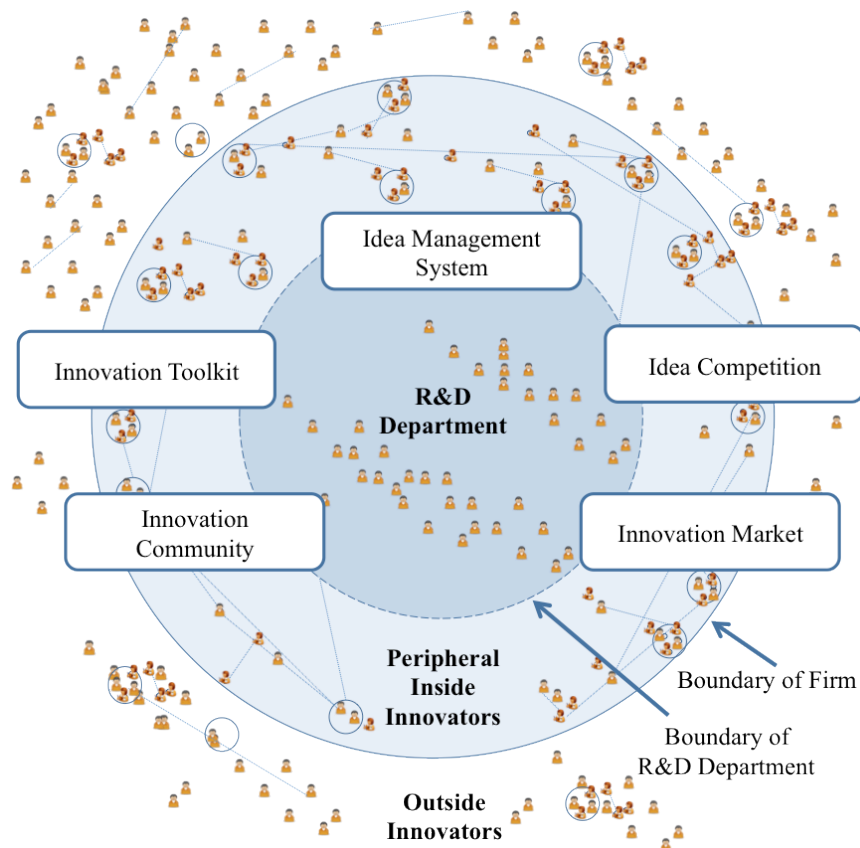


Figure 5: Tools to Activate Peripheral Inside and Outside Innovators

<sup>13</sup> As this work is partly funded by Volkswagen AG, examples from the automotive industry are also provided.

### 1.3.1 Idea Management System

To access the potential of peripheral inside innovators, organisations often use idea management systems.

Idea management systems are seen as a logical development of *employee suggestion systems* (Brem & Voigt 2007, p. 306). Etienne (1997, p. 23) characterises a suggestion system as an organisational feature intended to foster, assess, acknowledge and realise ideas suggested by employees. Bumann (1991, p. 14) defines a suggestion system as a complex and dynamic internal system of the organisation that is designed to foster, evaluate, acknowledge and realise ideas that are submitted by employees. Gaugler (1976) emphasises that a suggestion system contributes to the production, collection, evaluation and exploitation of ideas suggested by employees. Even if these definitions have differences regarding range and scope of participants, common elements of the term suggestion systems can be identified. First, employees shall be motivated to submit novel and valuable ideas. Second, the suggestion systems are driven by a process or workflow paradigm. Despite the potential benefits (Shair 1993) that suggestion systems possess, their outcome is often incremental, because innovators cannot communicate with each other, cannot collaborate, get feedback (if any) only after a long processing time, are excluded from the on-going innovation process and often cannot work on suggestions to bring about realisation of the idea (Carrier 1998; Fairbank & Williams 2001).

Along with the rise of social media, suggestion systems have become sophisticated idea management systems (Brem & Voigt 2007; Bansemir & Neyer 2009). Heidack and Brinkmann (1984, p. 50) define an idea management system as an approach that manages and motivates people in order to solve problems and to enforce decisions and communication in order to realise ideas and innovations through a focused, systematic, organised, fostered and controlled performance. Thom (2003, p. 150) offers a similar definition, and conceives of idea management systems as an approach that combines various creativity-promoting methods into a comprehensive system. In these systems, individuals and groups can communicate (e.g., in a forum or over voice over IP), share information (e.g., in blogs, wikis or repositories), organise and connect information (e.g., via mash-ups or collaborative tagging), deposit information (e.g., via uploading of documents or videos) and assess information (e.g., via star rating) (e.g., Bansemir & Neyer 2009; Koch et al. 2009).

Examples of idea management system providers are Spigit ([www.spigit.com](http://www.spigit.com)), Hype Softwaretechnik GmbH ([www.hypeinnovation.com](http://www.hypeinnovation.com)) and Hyve ([www.hyve.de](http://www.hyve.de)). Figure 6 shows a screenshot of the Daimler idea management system implemented by Hyve.



Figure 6: Screenshot of Daimler’s Idea Management System (Hyve 2011)

According to Hyve (2011), “Daimler intended to implement an internal community for employees to share, discuss and evaluate innovative business ideas. By doing so new business opportunities should be identified and realised” (p. 16). Until 2011, more than 13,000 employees registered, 860 ideas were submitted and 6900 evaluations were performed. One result of an idea submitted by an employee is “Car2Go”. Car2Go is a subsidiary of Daimler AG, which provides car-sharing services in Europe and North America (Hyve 2011).

### 1.3.2 Idea Competition

While idea management systems (see Chapter II-1.3.1) aim to integrate peripheral inside innovators (employees), idea competitions are a way to integrate outside innovators, especially (potential) customers and users, in the fuzzy front end of the innovation process. An idea competition is an invitation for a private or public organiser (such as a company, university, museum or federal ministry) to submit ideas for a specific topic.

The invitation goes to the public or a selective target audience. Contributions can be submitted within a predefined period of time and are evaluated by an expert jury, by peer-review or by self-assessment. After the time has elapsed and the evaluation has closed, winners are announced and performance-oriented rewards are given (e.g., Piller & Walcher 2006; Walcher 2007, p. 39-40; Füller 2009).

The concept behind idea competitions is not new, however. In the eighteenth century transoceanic voyages were very risky for investors and sailors, because there was no possibility for determining the longitude of a ship's position. The British government offered an award of £20,000 to the person who could develop a way of determining longitude. The winner was the British clockmaker John Harrison, who developed the marine chronometer (McKinsey 2009). Napoleon III also used an idea competition in 1867, to search for a cheap substitute for butter that could stay fresh for a longer time. The result was the development of margarine. Today, idea competitions have undergone a renaissance. They are “growing in number and size, are appearing in new forms, and are being applied to a wider range of societal objectives by a wider range of sponsors than ever before“ (McKinsey 2009, p. 7). Also, Füller (2009) points to an *inflationary increase* of idea competitions in the last few years — organisations and brands such as Adidas, LEGO, Henkel, IBM, Bombardier, Cisco, Dell, 3M, Spar, Detecon, Google, Toyota, Melitta, Microsoft, Starbucks, Ideo, Rocher, Samsung and Tchibo have invited users to give their input. And also OEMs in the automotive industry such as BMW, Daimler, Peugeot, Renault, Toyota and Volkswagen have used online idea competitions for integrating customers into innovation activities. Table 2 illustrates the increase in online idea competitions organised by the designated OEMs in the years between 2002 and 2011. One of the first online idea competitions in the automotive industry was BMW's *Connected Drive* (Figure 7). BMW organised this competition in order to receive ideas for the driver assistant system, telematic and electronic services.

Name	OEM	Year	Topic
Connected Drive	BMW	2002, 2007	Ideas for driver assistant system, telematic and electronic services
Interior Idea Contest	BMW	2010	Ideas for the interior of cars

<b>Design Your Smart</b>	Daimler	2010	Ideas for the outward appearance of a Smart car
<b>Design Contest</b>	Peugeot	2002, 2005, 2007, 2008	Ideas for car designs
<b>Renault 4 Ever</b>	Renault	2011	Ideas for the re-design of a Renault 4
<b>We See Beyond Cars</b>	Toyota	2009	Ideas for a “better tomorrow”
<b>Production Award</b>	Volkswagen	2010	Ideas for an electric Audi
<b>App My Ride</b>	Volkswagen	2010	Ideas for applications for a future Volkswagen infotainment system
<b>Think Blue</b>	Volkswagen	2010	Ideas for energy efficiency projects

Table 2: Online Idea Competitions Organised by Automotive OEMs

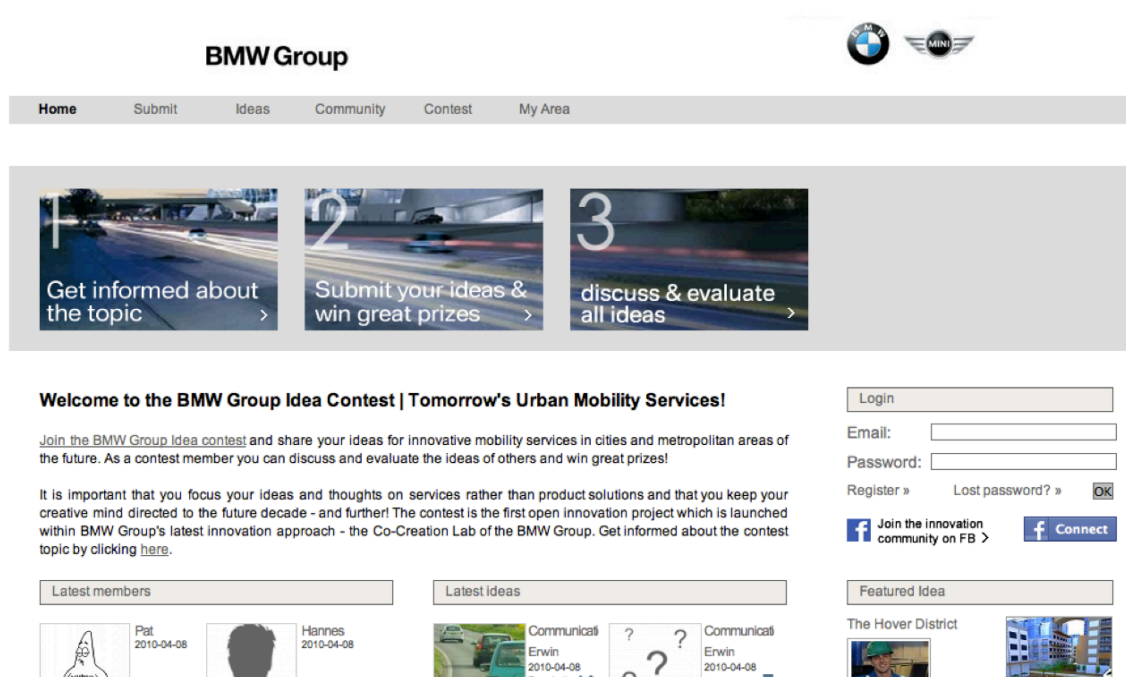


Figure 7: Screenshot of BMW's Idea Competition Connected Drive

### 1.3.3 Innovation Market

In contrast to idea competitions (see Chapter II-1.3.2) that are organised and financed by one single organisation to solve one innovation problem, innovation markets allow a multitude of organisations to use an existing platform<sup>14</sup> to broadcast a number of innovation problems (Jeppesen & Lakhani 2010). An innovation market is a virtual place, where innovation seekers (typically organisations) invite solution providers (typically single innovators or innovator teams) to solve problems (Möslein & Neyer 2009). Regarding the nature of the problems, Nickerson and Zenger (2004) propose that decomposable problems are especially amenable to such a market-based problem solving approach. Problem decomposability thereby “means that a suitable modularity of the problem space has been achieved, i.e., the interactions amongst the sub-problems have been identified and understood” (Jeppesen & Lakhani 2010, p. 1021).

Currently, one of the most well-established innovation markets is InnoCentive ([www.innocentive.com](http://www.innocentive.com)) (Terwiesch & Xu 2008). By the start of 2012 this market had 250,000 registered solvers from nearly 200 countries, and had received over 30,000 solution submissions (Innocentive 2012). Thereby, innovation problems come from a wide range of subjects, such as biology, chemistry, physics, mathematics, engineering, computer science and business management (Boudreou & Lakhani 2009). Lakhani and Jeppesen (2007) found that nonemployees solved 30% of problems posted in InnoCentive between 2001 and 2004 that could not be solved by experienced corporate research staffs. Each problem received attention from more than 200 people and had, on average, ten solution submissions.

Piller (2010) conducted a research project in the German driving system industry to prove the concept of innovation markets. The project was funded by the Forschungsvereinigung Antriebstechnik e.V. (FVA), which is a research consortium specialised in the area of motor vehicles and embedded in the VDMA (German Engineering Federation). In this project, Piller posted in an innovation market five gear-related problems that FVA would typically give to a research institute to solve. For the five problems, 95 solutions were provided from very heterogeneous suppliers (e.g., for-profit organisations, universities, research centres). Piller (2010) summarises the results of this project when

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<sup>14</sup> Providers of innovation markets earn money by asking for a membership fee, a posting fee or/and a success fee (Jeppesen & Lakhani 2010).



stating: “The solutions in general were both from sources new to the companies and did contain a new technological solution“ (p. 25).

#### 1.3.4 Innovation Community

Whereas some innovation markets (see Chapter II-1.3.3) such as InnoCentive use mainly monetary prizes (see Chapter II-1.5.2) to attract and motivate innovators, some innovation markets (such as fellowforce.com and brainfloor.com) motivate their innovators through the community — and thus the social — experience (Möslein & Neyer 2009). Innovation markets with a strong community spirit use another open innovation tool to integrate outside innovators, namely an innovation community.

The rise of social media enables innovation communities. These communities are virtual organised groups of individuals of varying sizes that meet and interact online in order to achieve personal as well as shared goals of their members (Dholakia et. al 2004). Users in these communities can communicate with each other about a specific topic, can interact in multidirectional ways and can collaborate (Franke & Shah 2003). Innovation communities are not homogenous — they differ concerning domain, purpose and benefits (Lakhani & Wolf 2005; Füller et al. 2006), and are meeting places for discussing ideas for new products and product improvements (Kozintes 2002). As a mark of their functional variance, innovation communities can be initiated by a community itself, or by an organisation (Möslein & Neyer 2009). Research shows that both types of communities rely on informal leadership to work effectively and to resist splintering (e.g., von Hippel & von Krogh 2003; Porter et al. 2011).

An example of an innovation community in the automotive area, which is initiated by the community itself, is the OScar Project ([www.theoscarproject.org](http://www.theoscarproject.org)) (Möslein & Neyer 2009). The idea behind this project is that a virtual community plans and develops a new car, maintaining open source principles. Thus, ideas, designs and development plans are shared within the community. The performance specification is summed up in a concept plan: The car should have specific features (e.g., a length of 4m, a width of 1.75m, a weight of about 1000kg, an information and communications system and a driving speed capability of about 145km/h). An example of an innovation community in the automotive industry, which is not initiated and managed by the community itself, but by an organisation, is Local Motors ([www.local-motors.com](http://www.local-motors.com)). The integration of a virtual community in the development of the car is an essential part of the business model of this organisation, which was founded in 2009. The virtual community gener-

ates, develops and evaluates ideas, concepts and prototypes for the cars of Local Motors. An individual, who has decided to buy one of the cars, can also help to build the car locally in real world “micro-factories”. Similar to the OScar Project, construction plans are visible to the community members. In contrast to the OScar Project, community members receive monetary compensation for their work in some cases. In 2011 the community had 25,000 members from 122 countries (Buhse et al. 2011). Figure 8 shows a screenshot of Local Motors’ design portal.

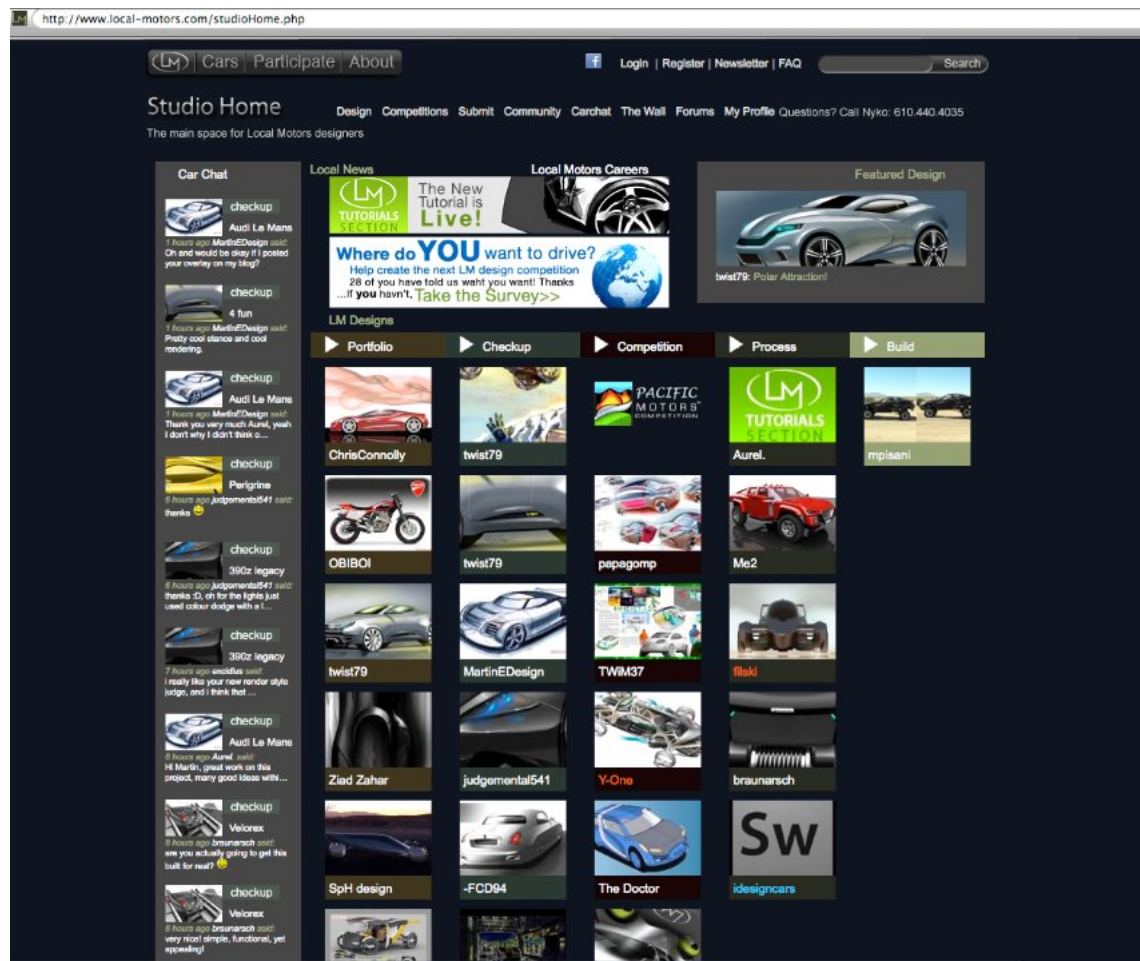


Figure 8: Screenshot of Local Motors’ Design Portal  
(Hillenbrand 2010)

### 1.3.5 Innovation Toolkit

In pure form, idea competitions (Chapter II-1.3.2), innovation markets (Chapter II-1.3.3) and innovation communities (Chapter II-1.3.4) allow outside innovators to contribute ideas, but do not provide a virtual development environment that would give users immediate feedback based on a trial-and-error approach. Innovation toolkits allow organisations to make such a virtual development environment available (e.g., von Hippel 2001; Dahan & Hauser 2002; Thomke & von Hippel 2002; Prügl & Schreier 2006).

Because innovation toolkits give users immediate feedback, they are often embedded in idea competitions, innovation markets and innovation communities (such as Local Motors). Von Hippel and Katz (2002) propose that an effective toolkit will enable five objectives. First, it supports trial-error-learning. Second, it allows users to develop ideas or create solutions within a *solution space*, which may vary from very small to very large. Third, it gives users the possibility of using skills they already have, and allows them to use the design language preferred by the users. As a consequence, they have to be user-friendly. Fourth, the effective toolkit contains libraries of standard modules. According to von Hippel and Katz (2002) provision “of such standard modules enables users to focus their creative work on those aspects of their design that are truly novel” (p. 253). Fifth, an effective toolkit will ensure that products and services designed by users will be producible on the intended production system without requiring revisions by the manufacturers.

In an action-research approach, Füller et al. (2006) prove the effectiveness of innovation toolkits in the automotive industry. They developed the interactive innovation toolkit Audi Virtual Lab for this research project (see Figure 9).



Figure 9: Audi Virtual Lab  
(Bartl 2009)

The toolkit provided users the possibility to express their ideas and visions about the infotainment system of Audi’s new A3 and A4. With 1622 consumers using the innovation toolkit, Audi considered the project to be a success: “For Audi, the gained consum-

er insights were very helpful for the further development of infotainment components. The positive results motivated the company to integrate online consumer groups in other development projects as well” (Füller et al. 2006, p. 69).

#### 1.4 Strategic Risks and Operative Barriers

A business approach based on opening the innovation process and using the tools explained in Chapter II-1.3 has economic and social consequences that involve a number of opportunities for organisations, but it also presents the possibility of strategic risks and operative barriers. Management has to identify, assess and initiate countermeasures to minimise both risks and barriers (Robra-Bissantz & Lattemann 2005). Strategic risks and operative barriers are, thereby, organisation-specific, and they depend on established processes, gained experiences, innovation strategy and organisational culture (Enkel 2009; Van de Vrande et al. 2009).

A strategic risk is defined in this context as the probability of an adverse event occurrence. If after evaluation organisations conclude that the probability occurrence is too high, they will not implement the tools. Core strategic risks are, for example, loss of knowledge, uncompensated costs and cooperation risks (Enkel 2009) (see Figure 10).

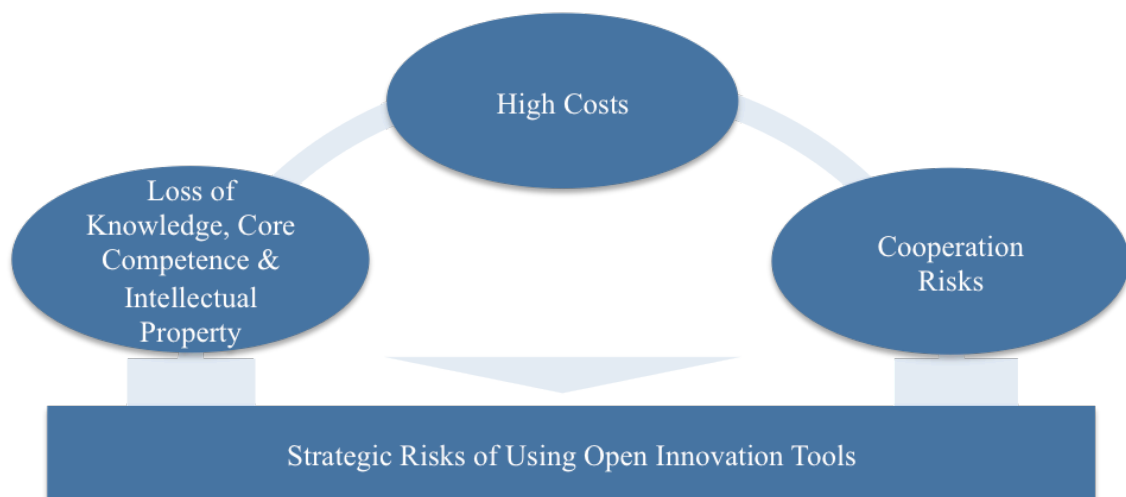


Figure 10: Strategic Risks of Using Open Innovation Tools

- First, opening the innovation process can pose a risk of losing knowledge, core competence and intellectual property (Bughin 2012).
- Second, organisations face the risk that costs (e.g. coordination costs) in terms of money and resources are not adequately compensated by the advantages (Reichwald & Piller 2009, p. 73).

- Third, open innovation activities pose cooperation risks, such as conflict of interest and lock-in effects (Enkel 2009).

An operative barrier is defined as a circumstance that leads, with a certain probability, to unsuccessful use of the tools. Core operative risks, which occur in the fuzzy front end, are identified as bureaucratic and administrative obstructions, insufficient problem definition, lack of innovators' motivation and insufficient quality of generated ideas, and damage to reputation (see Figure 11).

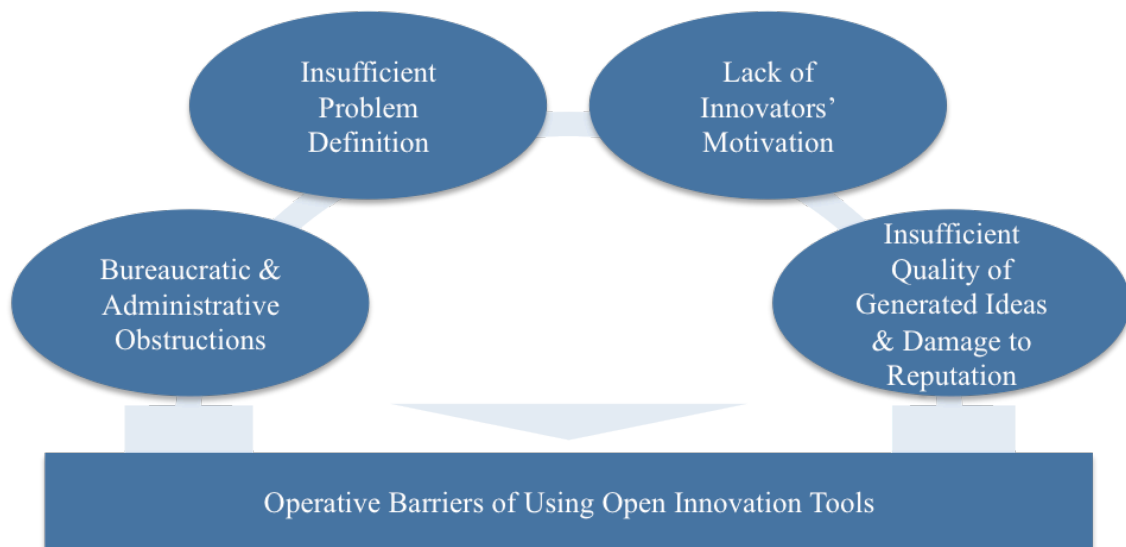


Figure 11: Operative Barriers of Using Open Innovation Tools

- Bureaucratic and administrative obstructions can occur, because new and additional work processes are necessary when open innovation tools are used (Enkel 2009).
- Often, the problems that are the basis for idea generation are either *over-defined* or *under-defined*. If a problem is over-defined, essential sub-problems are excluded and creativity is constricted. If a problem is under-defined, crude, isolated ideas are generated, and the work is unspecific and unnecessary. Profit cuts, additional costs, and loss of time are the consequences of insufficient problem definition (Hauschildt & Salomo 2011, p. 207) (see Figure 12).
- Due to the inflationary use of open innovation tools organisers face an increased competition among each other to attract and to bound participants (Füller 2009; Antikainen & Väättäjä 2010). Therefore, one central challenge is to explore the ways in which peripheral inside and outside innovators can be motivated to voluntary participate in open innovation (e.g., Nambisan 2002; Piller & Walcher

2006; Reichwald & Piller 2009, p. 73). Motivation is essential in the context of open innovation, because it influences quantity and quality of generated ideas (Cheng & Vassileva 2006). Therefore, managers and researchers value the enhancement of motivation as a central challenge for idea management systems (Fairbank & Williams 2001), idea competitions (Füller 2006; Leimeister et al. 2009; Füller 2010), marketplaces (Antikainen & Väättäjä 2010), innovation communities (Antikainen & Väättäjä 2010; Porter et al. 2011) and toolkits (Füller et al. 2006). Despite the clear importance of developing means for motivating participation in innovation toolkits, the body of knowledge remains at a rudimentary level (Leimeister et al. 2009).

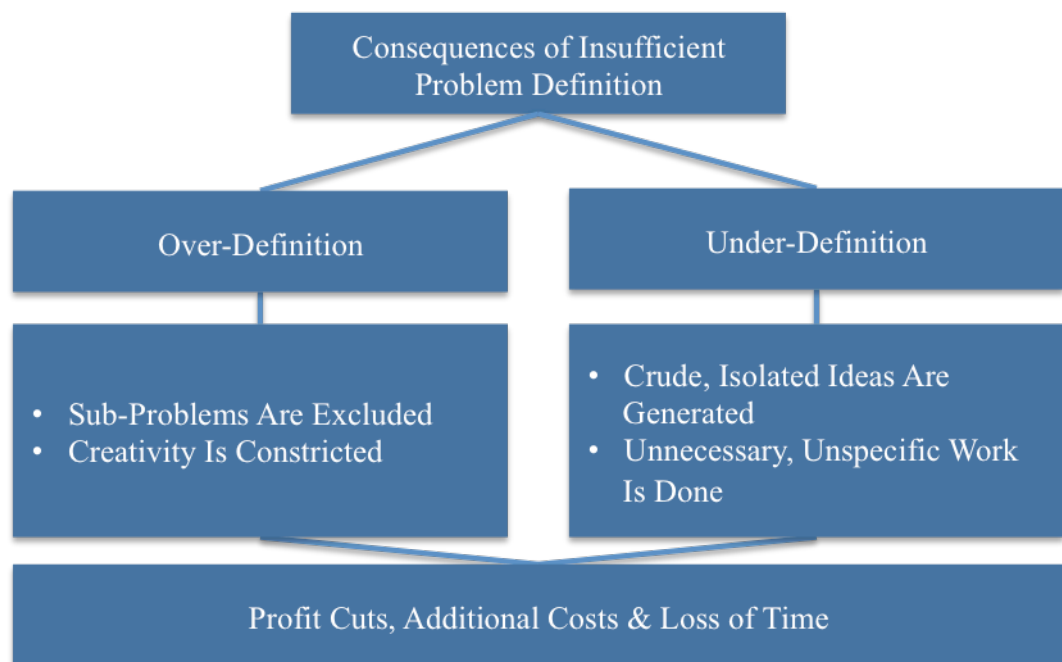


Figure 12: Consequences of Insufficient Problem Definition  
(Following Hauschildt & Salomo (2011, p. 209))

- Insufficient quality can result for three reasons. First, as stated above, organisations themselves are not able to inspire creativity. Second, competitors (in idea competitions, for instance) can use a false name and incorrect e-mail-address to present themselves as customers. By generating ideas that are impractical and unfeasible, these unethical competitors hope to put the organisers to great expense with no return (Brockhoff 2005; Flowers 2008). Third, users try to disrupt the relationship between organisations and innovators by actively posting unsuitable contributions (spam) (Reichwald & Piller 2009, p. 178). One example of an organisation, which was forced to contend with users posting unsuitable

contributions, is Kraft Foods Australia. Kraft Foods Australia initiated an idea competition aiming to search for a name for a new version of the classic Vegemite spread. The competition ended with the selection of the name iSnack 2.0, which obviously makes fun of the competition itself. Over 110,000 users watched YouTube videos ridiculing the competition and T-shirts with the logo iSuck 2.0 Epic Fail went on sale immediately at an online clothing retailer (Hutter et al. 2010). The German-based international conglomerate Henkel had similar experiences. It instituted an idea competition for a new label for a liquid detergent bottle. Within a few weeks consumers had contributed over 50.000 designs, and had discussed them and voted on the selections. Henkel promised the community members that a jury would choose two of the ten designs with the highest number of positive votes, and would sell bottles using the chosen designs. Due to a number of joke-designs that were positively evaluated by the community, Henkel decided to change the rules and to publish designs only after prior approval. They also eliminated positive votes on the grounds that users had influenced the competition by technical means. In both cases, organisations lost control and credibility, and damaged their reputations (Füller 2012).

Such strategic risks, administrative and bureaucratic obstructions, and insufficient problem definition can occur in any open innovation activity. A lack of innovators' motivation and the resulting lack of creativity occur mainly in social media based tools that aim to integrate a broad range of individuals into the innovation process (Füller 2012). Consequently, this dissertation concentrates on motivation (Chapter II-1.5) and creativity (Chapter II-1.6).

## 1.5 Motivation

A deeper understanding of how to motivate innovators to participate in open innovation activities presupposes knowledge about terms such as *motive*, *motivation* and *involvement*, as well as about underlying motivational theories (self-determination theory and flow theory) (Chapter II-1.5.1), about how to measure *enjoyment*, *involvement* and *flow*, and about the literature status-quo regarding motivation in open innovation (Chapter II-1.5.2).



### 1.5.1 Terms and Underlying Theories

According to Heckhausen (1989, p. 17-18), *motivation* comprises a group of phenomena that includes a variety of processes and effects and describes the alignment of human behaviour and energy to expected consequences. According to Amabile (2011), “motivation is a combination of a person's choice to do some task, the desire to expend effort at doing it, and drive to persist with that effort” (p. 33). In contrast, *motives* illustrate the reasons why people initiate and perform voluntary behaviours and, consequently indicate the meaning of human behaviour (Reiss 2004). Motives are relatively constant over time and can be inherent in or developed by social norms (Heckhausen 1989, p. 21-22). The perception of incentives triggers motives, which then leads to the *actual motivation*. The actual motivation results in the *behaviour* (von Rosenstiel 2000, p. 50-51). Figure 13 illustrates the relationships among motives, incentives, motivation and behaviour.

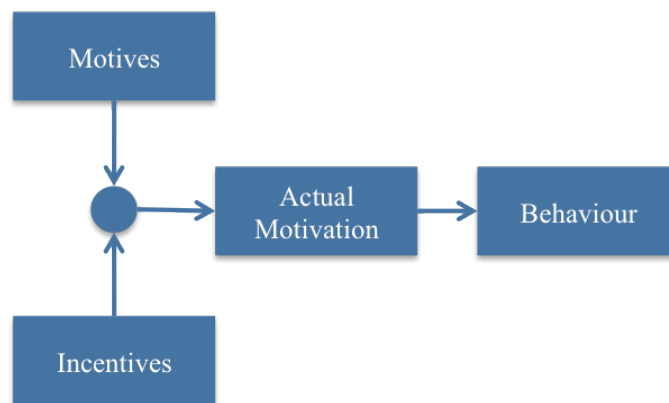


Figure 13: Relationships among Motives, Incentives, Motivation and Behaviour  
(Following Schattke & Kehr (2009, p. 122))

To explain human behaviour, a number of motivation theories exist. They can be classified into two different categories: content and process theories. In the *content theories* form, content and effect of motivation are considered. Content theories try to explain which and how many motives lead to certain human behaviours. Thereby, they classify human needs and capture the driving force structure of individuals with the help of variables (Franken 2010, p. 87). Examples of content theories are Maslow's hierarchy of needs (Maslow 1943), Alderfer's ERG theory (Alderfer 1972), Herzberg's two-factor theory (Herzberg et al. 1957; Herzberg 1976), Emerson's social-exchange theory (Emerson 1990) and Deci and Ryan's self-determination theory (Deci & Ryan 1985). In contrast, *process theories* focus on the cognitive process during decision making. They



try to explain how individuals make decisions about certain behaviours, and how those individuals select an alternative in line with aims, expectations and values (Franken 2010, p. 97). Examples of process theories are Vroom's VIE-theory (Vroom 1995) and Homan's exchange theory (Homans 1958).

Content theories have a higher practicability, because they are easier to understand and they explain behaviour with the help of motives (Berthel & Becker 2003, p. 20; Janzik 2012, p. 63). The explanation of participation in open innovation builds on content theories — more specifically, on the self-determination theory: according to this theory a combination of reasons drive persons to engage in voluntary activities (such as engaging in open innovation activities), ranging from purely extrinsic motives (such as payment), through internalised extrinsic motives (skill development and making friends, for example), to purely intrinsic reasons (such as fun and curiosity) (Ryan & Deci 2000; Gagne & Deci 2005). Individuals are purely extrinsically motivated if they desire to expend effort to obtain outcomes (Brief & Aldag 1977; Amabile 1993). They are internalised extrinsically motivated if they develop a self-regulation towards activities that are useful for effective functioning, but that are not inherently interesting (Deci et al. 1994). Persons are purely intrinsically motivated if they value an activity because they enjoy it and are interested in it. To measure perceived *enjoyment*, Füller (et al. 2009) has developed a scale that is based on Ghani and Desphande (1994). The items of the scale take into consideration how much fun, how exciting and how enjoyable an individual thinks an activity is.

Intrinsic motivation is strongly connected to the experience of *flow* and *involvement*. Figure 14 illustrates the relationship.

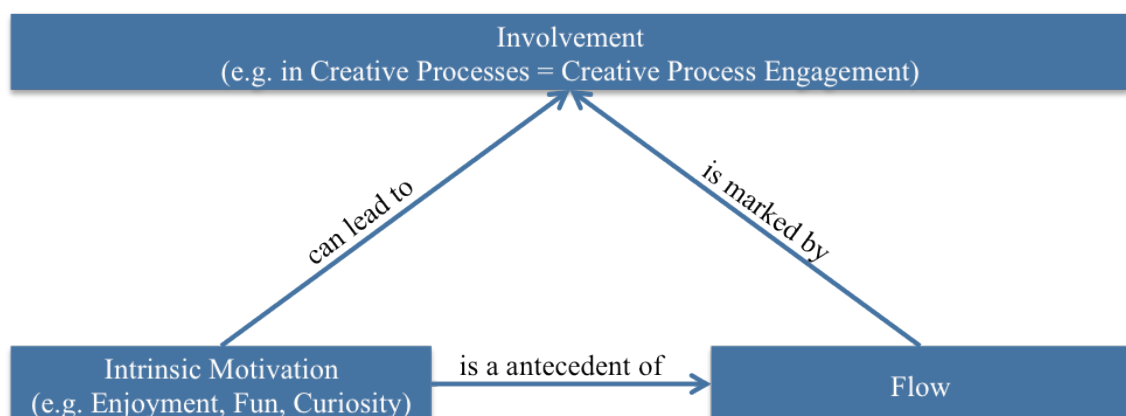


Figure 14: Relationships among Intrinsic Motivation, Flow and Involvement

Intrinsic (and extrinsic) motivation can lead to (task) *involvement* (Zhang & Bartol 2010). Involvement had held great importance for consumer research in the last twenty years (Michaelidou & Dibb 2008). The concept was linked to marketing since Krugman (1967), and was measured and conceptualised in a number of different contexts. These contexts include products (e.g., Kapferer & Laurent 1993) and services (e.g., Keaveney & Parthasarathy 2001), purchase decisions (e.g., Smith & Bristor 1994), advertising (Andrews et al. 1990) and tasks and activities (e.g., Füller et al. 2009). Although there is no universal definition of involvement in any of these contexts, it can be stated that involvement results when an object or a task holds significance, importance or relevance for an individual. Thus, involvement is conceptualised as a need-based cognitive state of psychological identification with some task or object (Kappelman 1995). Involvement depends on motives and on how an object or a task triggers these motives. It is, therefore, “a result of the perceived (and/or actually experienced) motivational potentialities” (Kappelman 1995, p. 66) of an object or a task. Because on-going involved individuals attach significance, importance or relevance to the object or task, they also engage in on-going object-related (i.e., product-related) or task-related information search, processing and transmission (Higie & Feick 1989). For example, Richins and Bloch (1986) demonstrate that involved customers consult and provide others with information about automobiles. To measure involvement, several researchers have developed (context-depending) scales, for example, personal involvement inventory (PII) (Zaichkowsky 1985), revised personal involvement inventory (RPPI) (McQuarrie & Munson 1987), enduring involvement scale (EIS) (Higie & Feick 1989) or creative process engagement (CPE) (Zhang & Bartol 2010). Because PII and RPPI aim to measure involvement regarding a product or a purchase decision that is not the subject of this dissertation, it is only EIS and CPE that hold importance (e.g., in Chapter III-2 and in Chapter III-4). EIS measures enduring involvement by considering underlying motivating factors, self-expression and hedonic components (Higie & Feick 1989). In contrast to CPE, it explicitly does not cover behavioural outcome. CPE measures involvement with regard to the behavioural outcome of creative processes, for example, time spent in problem identification, and effort spent in searching and encoding, or idea and alternative generation (Zhang & Bartol 2010).

The *flow* experience, which is perceived to be a merging with the activity, is marked by strong involvement, and by a perfect match of task difficulty with skills level. Csikszentmihalyi (1975) states:

“‘Flow’ denotes the holistic sensation present when we act with total involvement. It is the kind of feeling after which one nostalgically says: ‘that was fun,’ or ‘that was enjoyable’. It is the state in which action follows upon action according to an internal logic, which seems to need no conscious intervention on our part. We experience it as a unified flowing from one moment to the next, in which we feel in control of our actions, and in which there is little distinction between self and environment; between stimulus and response: and between past, present, and future“ (p. 43).

A person who experiences flow (1) engages in a task that has clear goals and can be completed, (2) concentrates intensively, (3) feels a loss of self-consciousness and a sense of control over a situation, (4) loses sense of time, (5) experiences direct and immediate feedback, and (5) loses awareness of daily worry and frustration (Csikszentmihalyi 1997, p. 110-113; Rheinberg 2010, p. 380).

Outlining the characteristics of flow creates a better understanding of the meaning of flow itself, but does not help to explain how flow occurs (Kowal & Portier 1999). Therefore, researchers such as Massimini, Csikszentmihalyi and Delle Fave (1988) have interviewed subjects to name the precursors of flow and have identified a number of variables that are responsible for the flow state, such as positive mood and nature of the activity. Another antecedent of flow is motivation (Jackson 1992): Results suggest that persons who are highly and intrinsically motivated will experience flow. For example, Haworth and Hill (1992) show, in their study of young adult white-collar workers, that 71% of flow-activities had an optimal skills-challenge level, and were intrinsically motivated.

### 1.5.2 State of Research: Motivation for Participation in Open Innovation

In this chapter, eleven studies focusing on what motivates people to participate in open innovation are analysed. The objective of such a review is to identify and systematise possible motive categories that might explain why innovators engage in social media based open innovation tools. Additionally, this analysis is undertaken to provide insight into whether intrinsic, internalised extrinsic or extrinsic motives have a stronger effect on motivation to participate. A method suggested by Creswell (2009) was the frame for the literature analysis, which developed as follows. Searches of management journals published between 2003 and 2012, were performed in two major databases, EBSCO-database and Scopus-database. The primary keyword search terms used were: motiva-

tion as well as open innovation, idea management system, idea competition (or innovation contest), innovation market, (innovation) community and innovation toolkit. Furthermore, a search on Amazon.com, an extremely thorough resource for book publications, was made to identify significant books in this field. The literature search revealed 25 publications. Skimming this initial group of articles and chapters allowed for identification and exclusion of publications that focus on motivation in open source software projects (e.g., Hars & Ou 2002; Lakhani & von Hippel 2003; Hertel et al. 2003; Lakhani & Wolf 2005), because focusing merely on software can distort the picture of what motivates people to participate in open innovation (Schattke & Kehr 2009).<sup>15</sup> The resulting 11 publications (9 journal publications and two books) were then read closely, analysed for identification of motive categories and then grouped. Table 3 shows the 11 analysed publications and the identified motive categories. While it was possible to identify a number of publications that investigate motives for participation in innovation communities and idea competitions, there is a notable lack of research regarding motivation for participation in social media based idea management systems, innovation markets and innovation toolkits. Table 4 shows a description of the motive categories named in Table 3.

In conclusion, the following can be asserted: (1) This analysis identifies ten motive categories that might explain why peripheral inside and outside innovators engage in open innovation. These are enjoyment and fun, curiosity, self-efficacy, altruism and community support, making friends, information seeking, skill development, recognition and visibility, personal need and dissatisfaction, compensation and monetary reward. Though, relevant studies primarily mention the same motive categories, but often label them differently. (2) The analysis demonstrates that a number of studies (e.g., Füller 2006; Füller et al. 2007) come to the result that intrinsic and internalised extrinsic motives have a stronger effect on motivation for participation than extrinsic motives (Robra-Bissantz & Lattemann 2005; Robra-Bissantz 2006, p. 341-342).

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<sup>15</sup> Authors such as Janzik (2012, p. 76) and Antikainen et al. (2010) also analyse motives for participating in open innovation projects, but do not focus on social media based tools. As well, they include publications that focus on motivation in open source projects.

Year	Authors	Tool	Motive Categories										
			Intrinsic		Internalised Extrinsic							Extrinsic	
					Enjoyment & Fun	Curiosity	Self-Efficacy	Altruism & Community Support	Make Friends	Information Seeking	Skill Development		
2003	Wang & Fesenmeier	CO	+		+	+	+	+		+			
2005	Wasko & Faraj	CO	+			+	0				+		
2006	Jeppesen & Frederiksen	CO									+		
2006	Füller	IC	+	+	+	+	+	+	+		0		0
2007	Füller et al.	CO	+	0	+	+	0	+	+	+	+		0
2007	Walcher	IC	+	+		+	+	+			0		+
2009	Leimeister et al.	IC						+			+		+
2010	Nov et al.	CO	+			+	0		+	+			
2010	Füller	NS	+	+		0	0			0	+		
2011	Porter et al.	CO	+			+	+	+			+		
2012	Janzik	CO	+		+	+	+	+	+	+	0	+	0
with 0 = no positive effect; + = positive effect; CO = innovation community; IC = idea competition; NS = not specified													

Table 3: Analysis of Studies Regarding Motivation for Participation

Motive Category	Description
<b>Enjoyment &amp; Fun</b>	Individuals may participate in open innovation initiatives because they consider it to be a fun and enjoyable activity, valued for its own sake, and therefore perceived as more intrinsically rewarding than an effort.
<b>Curiosity</b>	Individuals may engage in open innovation initiatives because they are curious. The reasons prompting this desire for knowledge are intrinsic.
<b>Altruism</b>	Altruism may motivate individuals to engage in virtual open innovation activities and to support producers in new product development.
<b>Make Friends</b>	Getting in touch with like-minded people may be a reason for individuals to participate in virtual new product development.
<b>Self-Efficacy</b>	Individuals working virtually on new product development tasks may derive a sense of accomplishment due to their contributions. They may perceive the activity as a challenge to be mastered.
<b>Information Seeking</b>	Individuals may engage in open innovation projects because they are seeking innovation or product-related information pertinent to their hobbies, toward upcoming product purchases, or just through novelty-seeking behaviour.
<b>Skill Development</b>	Engaging in open innovation initiatives enables individuals to improve their skill and gain additional knowledge. They may be interested to learn more about new technologies and products, and to find solutions to unanswered questions.
<b>Recognition &amp; Visibility</b>	Individuals may participate in virtual new product development to become visible and to gain recognition from other participants, producers, project managers, chief executives, etc.

<b>Personal Need &amp; Dissatisfaction</b>	Personal need may motivate participants to engage virtually in new product development.
<b>Compensation &amp; Monetary Reward</b>	Both immediate and delayed payoffs may be the reason why participants engage in virtual open innovation activities.

Table 4: Description of Motive Categories for Participation  
Füller (2010, p. 105)

## 1.6 Creativity

Apart from the question about how innovators can be motivated to participate, it is relevant for research and practice to determine how quality (i.e., creativity) of ideas can be enhanced (Kristensson et al. 2004) (see Chapter II-1.4).

An understanding of the ways in which creativity of ideas can be increased presupposes knowledge of the terms *creativity*, knowledge about how to measure creativity (Chapter II-1.6.1) and of the literature status-quo regarding creativity in open innovation (Chapter II-1.6.2).

### 1.6.1 Terms and Underlying Theories

Rhode (1987) uses a literature review to explore four different categories of definitions regarding creativity that refer to (1) persons, (2) processes, (3) context, or (4) products. Within this thesis creativity regarding products plays a pivotal role. According to the product-related view, creativity is centred on the outcome of creative behaviour; it is defined through the impressions a creative product creates in outsiders. Therefore, product-related definitions of creativity contain elements that describe impressions. Most definitions contain the elements *original* (e.g., Barron 1955; Martindale 1989; Sternberg & Lubart 1999), *useful* (e.g., Martindale 1989; Sternberg & Lubart 1999), *far-reaching* (e.g., Barron & Harrington 1981) and *feasible* (e.g., Guilford 1950). This thesis pays attention to Theresa Amabile (1982a), who also defines creativity through the impressions a creative product creates in outsiders (Amabile 1982a). For her, creativity is the quality of products assessed to be creative by appropriate observers who are evaluating independently from each other. Amabile's (1982a) definition also helps to build understanding of the Consensual Assessment Technique (CAT), which is the most high-

ly regarded method for evaluating creativity because of its relative simplicity (e.g., Baer et al. 2004; Kaufman et al. 2007; Hennessey & Amabile 2010): To assess creativity with the CAT, experts are asked to assess the creativity of artefacts independently of each other on the basis of the same dimensions. The technique has been applied to many different artefacts (e.g., poems, writings, stories, pictures, puzzles, ideas) with both adults and children (e.g., Amabile 1982a; Amabile 1982b; Baer 1997; Baer 1998; Piller & Walcher 2006; Walcher 2007, p. 58-61). While experts within an assessment receive the same dimensions for evaluation, the dimensions between different assessments and for different artefacts can vary. For example, in one study by Amabile (1982a), 22 girls aged 7 to 11 years were asked to design something silly with materials such as paper, colours and glue. Creativity of the designs was measured on the basis of 22 dimensions such as novel use of materials, novel ideas effort, variation in shapes, detail and complexity. In another study by Amabile (1982a), poems of 48 female students were evaluated — for example, with the help of 14 dimensions such as novelty of word choice, originality of idea and sophisticated rhythm.

Although the method is relatively simple, there are several requirements that need to be fulfilled for an appropriate application of the CAT (Amabile 1982a; Walcher 2007, p. 51-62): Requirements for the task, for the jury, for the assessment and for the utilisation. Figure 15 illustrates an overview of the requirements.

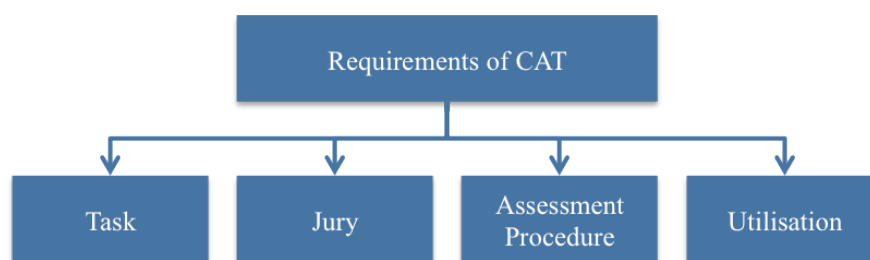


Figure 15: Requirements of CAT

### Requirements for the task

- 1) Accomplishment of a task that leads to creative outcome should not depend significantly on certain specialised skills (e.g., drawing ability).
- 2) The task should be open-ended, so that flexibility in the responses is possible.
- 3) The task allows a novel outcome that is clearly observable and assessable for the jury.



### **Requirements for the jury**

- 1) Jury members should have experience in, and should be familiar with, the domain in question. In this regard, they should be *experts*. However, experts are not required to have identical experience, nor must they have ever developed artefacts (such as ideas) that are rated to be creative.
- 2) The number of jury members should be between three and ten.

### **Requirements for the assessment procedure**

- 1) Experts should assess, independently from each other, in order to assure that judgments are subjective.
- 2) Judges should be given dimensions that make assessment possible. In this thesis, the dimensions used are originality, usefulness, far-reachingness and feasibility.<sup>16</sup>
- 3) Experts should rate the artefacts relative to one another rather than against an absolute standard.
- 4) Judges should view the artefacts in a random order.
- 5) Test supervisors should not give any influencing instructions (Amabile 1982a; Walcher 2007, p. 51-62).

### **Requirements for the utilisation**

To utilise the results of the CAT, each dimension has to be analysed for interjudge reliability. According to Amabile's (1982a) definition, this is essential, as the quality of evaluation depends on the consensus of evaluations. Thus, if the consensus is high, the evaluation has high quality (i.e., is valid and reliable)<sup>17</sup> (Amabile 1982a). Researchers (Shrout & Fleiss 1979; McGraw & Wong 1996; Piller & Walcher 2006; Walcher 2007, p. 55) suggest using the interclass correlation coefficient (ICC) to measure the consensus. ICC builds on Pearson's correlation coefficient. ICC values above 0.7 indicate a high quality of evaluations.

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<sup>16</sup> This work follows Walcher (2007, p. 51-62).

<sup>17</sup> Amabile (1996, p. 45-46) emphasises the view that interjudge reliability and interjudge consensus is equivalent in this method of constructing validity.

### 1.6.2 State of Research: Creativity in Open Innovation

There is much anecdotal evidence that outside innovators ought to be considered as valuable source of creative ideas (e.g., von Hippel 2007; Magnusson 2009). Examples include the development of office equipment such as Tip-Ex, equipment for sports such as kayaking, snowboarding, mountain biking and kiting (e.g., Lüthje et al. 2005; von Hippel 2007). However, only limited research exists, which measures the creative outcome in the context of open innovation. Chapter II-1.6.2 presents an analysis of eight identified studies that focus on creativity measurement in open innovation. Table 5 shows the analysed publications that appeared between 2004 and 2012.

In the study by **Kristensson, Gustafsson and Archer** (2004) professional product developers, ordinary users, and advanced users were given the task of generating ideas for mobile phone services. An experimental three-group design allowed the comparison of these groups, and a consensual assessment technique (CAT) was used to evaluate the creativity of the ideas. Results of this study are twofold: One result was that professional developers and advanced users generated more easy realizable ideas than ordinary users, yet the second result showed that ordinary users had significantly more original and valuable ideas than professional product developers and advanced users.

In cooperation with the sports manufacturer Adidas, **Piller and Walcher** (2006) and **Walcher** (2007) developed an idea competition based on social media. Creativity of ideas was assessed with the CAT: 10% of the generated ideas were evaluated as only marginally creative, 80% of the generated ideas were assessed as improvements to Adidas's offerings and 10% of the ideas were assessed as radical new ideas that could expand Adidas's business spectrum. Although the management at Adidas was very content with this result, Piller and Walcher (2006) stress that quality of submissions could be improved by optimizing the design and enhancing the usability of the idea competition. Additionally, Walcher (2007, p. 119) emphasises that Adidas management aims to increase participation and heighten the creativity level of ideas in future social media based idea competitions.

Year	Authors	Title
2004	Kristensson, P., Gustafsson, P. & Archer, T.	Harnessing the creative potential among users
2006	Piller, F. T. & Walcher, D.	Toolkits for idea competitions: A novel method to integrate users in new product development
2007	Walcher, D.	Der Ideenwettbewerb als Methode der Kundenintegration. Theorien, empirische Analyse und Implikationen für den Innovationsprozess
2009	Füller, J., Mühlbacher, H., Matzler, K. & Jawecki, G.	Consumer empowerment through internet-based co-creation
2009	Magnusson, P.R.	Exploring the contributions of involving ordinary users in ideation of technology-based services
2010	Kristensson, P. & Magnusson, P.R.	Tuning users' innovativeness during ideation
2011	Blohm, I., Leimeister, J.M., Bretschneider, U. & Krcmar, H.	Does collaboration among participants lead to better ideas in IT-based idea competitions? An empirical investigation
2012	Poetz, M.K. & Schreier, M.	The value of crowdsourcing: Can users really compete with professionals in generating new product ideas?

Table 5: Analysed Creativity-Studies

**Füller, Mühlbacher, Matzler and Jawecki** (2009) present a large-scale empirical study in which they investigate how social media based open innovation tools can empower consumers. Participants were asked about their experienced tool support, perceived enjoyment, perceived empowerment and readiness for future participation. To calculate the level of creativity, participating consumers were asked questions about their domain-specific skills, their innovation task motivation, and their creative cognitive style. Results show that the effect of task involvement on perceived tool support is stronger when customers are creative. Additionally, customers who are more creative perceive the virtual environment to be more supportive for completing their tasks than less creative ones. Füller et al. (2009) explain this result through the fact that creative consumers have a higher need to transfer their knowledge, as well as to develop their

innovation skills and feel a sense of mastery. The team of scholars also comes to the conclusion that these results have to be taken into consideration in order to optimise the virtual environment regarding open innovation.

**Magnusson** (2009), as well as **Kristenson and Magnusson** (2010), show that for an organisation, involving ordinary users has strategic importance for innovation, as the users have a propensity to generate ideas that challenge the dominant logic of the organisation. The study reveals that the creative potential of users is dependent on their not knowing too much about the technical restrictions, but also not knowing too little. Again, the CAT was used here to measure the creativity of ideas.

The study by **Blohm, Leimeister, Bretschneider and Krcmar** (2011) reveals that user collaboration in a social media based idea competition positively influences creativity of ideas. For their analysis, they assessed the ideas with the CAT. Their results reveal that a successful design and implementation of an idea competition can lead to better outcomes.

**Poetz and Schreier** (2012) present a comparison of ideas generated by firm's professionals and ideas generated by users in an idea competition. Both groups had to provide ideas to solve problems in the consumer goods market. Executives from the company evaluated the ideas through a procedure similar to the CAT. Study results show that user ideas scored higher for customer benefit and novelty, but lower for feasibility. However, in contrast to the other two evaluation dimensions, feasibility scored relatively high in both groups, and thus was not a bottleneck.

In sum, the analysis of the eight studies reveals that

- open innovation allows creative outcomes;
- the use of online tools can enable users to generate creative ideas; and
- the user interface of online tools must be optimised to tap participants' full creative potential.

Table 6 summarises these findings.

Year	Authors	Open innovation allows creative outcomes	Tools can enable users to generate creative ideas	Tools must be optimised to tap participants' creative potential
2004	Kristensson, P., Gustafsson, P. & Archer, T.	✓		
2006	Piller, F.T. & Walcher, D.	✓	✓	✓
2007	Walcher, D.	✓	✓	✓
2009	Füller, J., Mühlbacher, H., Matzler, K. & Jawecki, G.		✓	✓
2009	Magnusson, P.	✓		
2010	Kristensson, P. & Magnusson, P.R.	✓		
2011	Blohm, I., Leimeister, J.M., Bretschneider, U. & Krcmar, H.	✓	✓	✓
2012	Poetz, M.K. & Schreier, M.	✓	✓	

Table 6: Analysis of Studies Regarding Creativity

To optimise the user interface of online open innovation tools in order to tap the full creative potential of participants, Shneiderman (1999, 2000) shows that a *genex framework* can be used. The *genex*<sup>18</sup> framework is designed to suggest improvements for user interfaces in web-based, creativity-supporting software-tools (Shneiderman 1999; Shneiderman 2000; Leimeister et. al 2009). According to the *genex* approach, efficient creativity-supporting software tools must encourage four generic behaviours — accumulating, relating, creating and disseminating (see Figure 16). The generic behaviour *accumulating* refers to such behaviours as learning from previous work, as well as searching, browsing, validating and indexing information. The generic behaviour *relating* implies behaviours such as consulting with peers and mentors. The generic behaviour *creating* relates to behaviours such as exploring and composing possible solutions. The generic behaviour *disseminating* describes the behaviour of spreading, and thereby contributing, information and elaborated solutions over, for example, digital libraries (Shneiderman 1999; Shneiderman 2000).

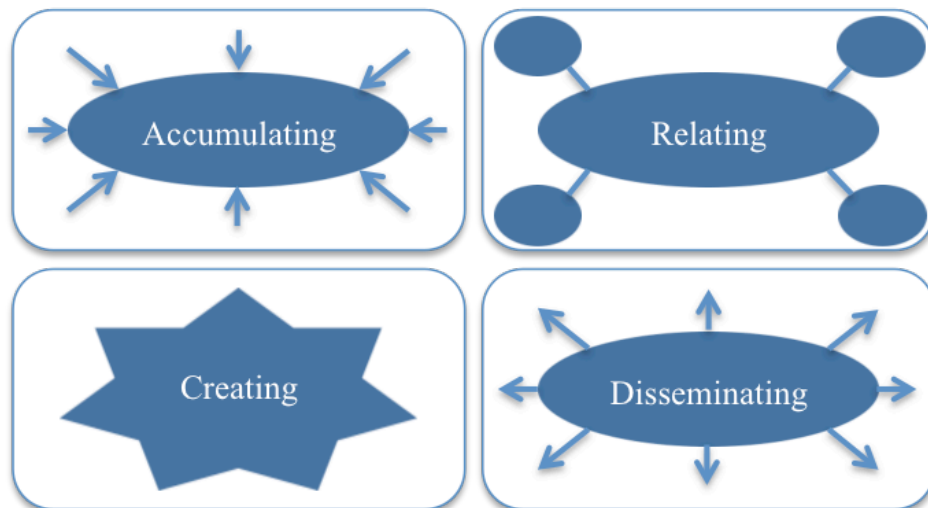


Figure 16: Activities for Creativity-Supporting Software Tools According to Genex

<sup>18</sup> The term *Genex* stands for “generator of excellence” (Shneiderman 1998; Shneiderman 1999; Shneiderman 2000).

## 2 Play

The previous chapter revealed a need to optimise open innovation tools in order to motivate innovators and to tap their full creative potential. As stated in Chapter I-1, play is an activity that leads to high-level of intrinsic motivation (i.e., enjoyment), involvement and a feeling of flow, as well as creative output (e.g., Berlyne 1969; Edery & Mollick 2009, p. 4-5; Rheinberg 2010, p. 380). Therefore, this work focuses on the question of how social media based open innovation tools can be designed to harness the potential of play. Thus, it is useful to provide a review of definitions for the term *play* (Chapter II-2.1), and to explain how play affects motivation and creativity (Chapter II-2.2).

### 2.1 Definition

There is no common understanding about how the term *play* is defined (Sutton-Smith 2001, p. 1-6; Garris et al. 2002). Sutton-Smith (2001) expresses the difficulty of defining the term when states: “We all play occasionally, and we all know what playing feels like. But when it comes to making [...] statements about what play is, we fall into silliness. There is little agreement among us, and much ambiguity” (p. 1). Ambiguity arises because a large number of seemingly unrelated activities are referred to as play, because the same activity can be seen as play from some persons, but not from others, and because an activity might sometimes be called play, and at other times not (Linder et al. 2001). For example, cooking or designing is an activity that can be seen as play for some persons or at certain times, but for others and at other times cooking or designing is profession — a job, or an imposed obligation or responsibility (Mainemelis & Ronson 2006).

However, by drawing on insights from different scientific disciplines (psychology, neuroscience, sociology, philosophy, business sciences and information systems), a deeper understanding of the term play can be derived:

Psychological and educational sciences view play, primarily, as an activity that leads people to become emotionally and cognitively mature (Statler et al. 2009). From this perspective, play is viewed as the first creative activity of a person, and helps to develop imagination as it stimulates flexibility, improvisation, curiosity, problem solving behaviour and learning (e.g., Dansky 1980a; Dansky 1980b; Russ 1996).

Neuroscience affirms results from psychology and demonstrates that play is an activity vital to the development of mammals’ brain and, therefore, to the development of hu-

mans' brain: Play stimulates the release of the molecule brain-derived neurotropic factor (BDNF), which accelerates the growth of nerves (Pankseep & Burgdorf 2003). Furthermore, play activates the amygdala, which is part of the limbic system and shown to perform an essential role in the processing and memory of emotional reactions (Amunts et al. 2005). Also, Gilkey and Kilts (2007) state that while playing the prefrontal cortex is engaged. The prefrontal cortex is located in the centre of highly cognitive processes (e.g., reward, reasoning and memory).

In the field of sociology, extensive research has been developed to support an understanding of play as a process through which social relationships are adapted and developed (Statler et al. 2009). According to Mead (2001), play helps build a familiarity with societal symbols provides guidance in how to act in a society. Following this logic, Smith (1982) also argues that play helps societies to survive.

Philosophers such as Immanuel Kant (1724-1804) or Friedrich von Schiller (1759-1805) have emphasised the importance of play for humans (Kant 1787, p. 85). For example, Kant (1787, p. 85) argues that play helps to develop human rationality, which is based on human imagination. In a direct statement about play, von Schiller (1794) stated: "Man only plays when in the full meaning of the word he is a man, and he is only completely a man when he plays."

While the body of research regarding play is quite large in scientific disciplines such as psychology, it is still quite small in the business sciences. This can be explained by the general societal view of play, since the Industrial Revolution, as activity without productivity value — as useless actions (Spariosu 1989, p. 35-37). Work and play appear to be mutually exclusive (Statler et al. 2009). This assumption, however, does not fully reflect the given situation between work and play: play itself is also considered valuable already in many aspects of work (Starbuck & Webster 1991; Cooper et al. 2010). Play can enhance the productivity in the workplace (Starbuck & Webster 1991), can improve decision making processes (Statler et al. 2009), can facilitate learning (Dickey 2007), can help to solve scientific problems (Cooper et al. 2010) and can positively influence strategy processes and scenario development (Buergi & Roos 2003; Roos et al. 2004; Jacobs & Heracleous 2006; Jacobs & Statler 2006; Statler et al. 2008; Statler et al. 2009). For some companies, exemplified by Google and IDEO, play is even a central part of the workplace culture (Sutton & Hargadon 1997).

In information systems literature, the term *playfulness* has held importance. Starbuck



and Webster (1991) thereby argue that something (like behaviour or software) is playful if it adds to pleasure and enjoyment. Thereby, playful behaviour can, for example, enhance productivity in the workplace, while playful software can elicit more concentration, more effort, and more attention and induce users to spend more time handling the software. Webster and Martochio (1992) called for longitudinal research focussing on how characteristics of information technology influence the playfulness of users, which they define as cognitive spontaneity.

By drawing on these insights about play from different scientific fields, it is possible to shape a more precise vision about the theoretical concept of play. On the basis of a range of statements and definitions<sup>19</sup> (Huizinga 1955; Caillois 1961; Avedon & Sutton-Smith 1971; Singer & Singer 1990; Russ & Grossman-McKee 1990; Costikyan 2002; Salen & Zimmerman 2004; Suits 2005; Russ & Schafer 2006), play is defined for this work as follows:

**Play is a voluntary, goal-oriented activity governed by rules. It is separate from the ordinary life, is characterised by conflict, involves decision making and permits the expression of feelings by equal players.**

Elements of the definition of play are described in Table 7.

Elements of Play Definition	Description	Source
Voluntary	Players are not forced into the activity of play.	Huizinga (1955, p. 13); Caillois (1961, p. 9-10); Avedon & Sutton-Smith (1971, p. 405)
Goal-Oriented	Play has a (clear) goal. This mirrors e.g., in winning, losing or a numerical score. By winning, losing and scoring, players get feedback.	Avedon-Sutton-Smith (1971, p. 405); Costikyan (2002)

<sup>19</sup> For an overview see, for example, Juul (2003) or Salen & Zimmerman (2004, p. 73-80).

Governed by Rules	Rules are explicit, fixed, and repeatable and limit players in their activities.	Huizinga (1955, p. 13); Caillois (1961, p. 9-10); Salen & Zimmerman 2004 (p. 80; p. 120-124; Suits (2005, p. 54-55)
Separate from Ordinary Life	Play is separate from the outside world. This means that the conflict is induced artificially <sup>20</sup> , but it does not mean that real-world problems are not solvable by playing. Furthermore, it means that play “promotes the formation of social groupings, which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means” (Huizinga 1955, p. 13).	Huizinga (1955, p. 13); Salen & Zimmerman (2004, p. 80)
Conflict-Characterised	Play is characterised by a conflict — for example, conflict with other players in the form of competition.	Avedon & Sutton-Smith (1971, p. 405); Salen & Zimmerman (2004, p. 80)
Involves Decision-Making	Players are confronted with (new) situations and have to make choices.	Costikyan (2002)
Permits Expression of Feelings	Play permits the expression of affects, such as enjoyment, passion, sadness, fear, frustration and disappointment.	Singer & Singer (1990); Russ & Grossman-McKee (1990); Russ & Schafer (2006)
Equal Players	One or more participants in the activity, players, engage in the activity. Thereby, there is no hierarchy between the players other than one that is earned.	Salen & Zimmerman (2004, p. 80); Costikyan (2002)

Table 7: Elements of Play Definition

<sup>20</sup> Abt (1970, p. 7) and Salen and Zimmerman (2004, p. 75) point to the importance of this definition element when they state that fighting in a war or arguing are also goal-oriented, conflict-characterised activities that permit the expression of feelings and involve decision-making. However, these activities are not separate from ordinary life.

However, it must be stated that this definition is narrow and not universally valid, as it excludes a number of activities that also belong to play and are referred to as play:

First, this definition describes play as voluntary. Thus, this definition excludes activities, which are not voluntary and thus are forced. However, there are a number of situations, in which play can be forced for example by friends (Salen & Zimmerman 2004, p. 76).

Second, as this definition describes play as goal-oriented and governed by rules, it is, then, understood to exclude informal play, which is “merely undirected play or ‘playing around’ as when children play at rough and tumble” (Parlett 1999, p. 3). Therefore, this definition is centered on adult play and not children’s play (Linder, Roos & Victor 2001).

## **2.2 Facilitator of Motivation and Creativity**

The proposed framework shown in Figure 17 suggests that certain factors (*person factor*, *social factor*, *escaping boundaries* and *task factor*) increase the likelihood that players are more motivated (and thus more involved and in flow (e.g., Rheinberg 2010, p. 380)) and are more creative than non-players. The underlying constructs of the factors are derived from the definition of play (Chapter II-2.1); Figure 18 illustrates this derivation. The following chapters<sup>21</sup> (Chapter II-2.2.1 through Chapter II-2.2.4) explain the integral parts of these factors and the link to play.

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<sup>21</sup> Chapters II-2.2 and II-3.2 are based on an article published in *Lecture Notes in Informatics (LNI) Proceedings*, presented at the conference *Informatik 2012* in Braunschweig (Scheiner et al. (2012c)).

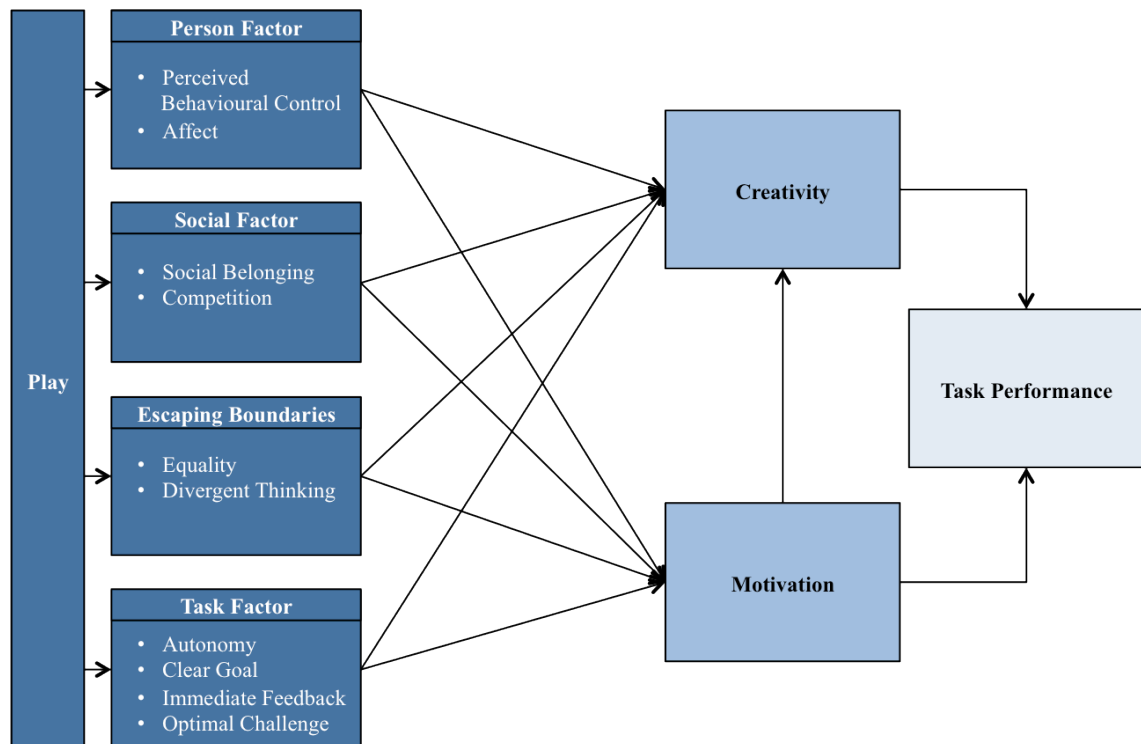


Figure 17: A Framework for Play as Facilitator of Creativity and Motivation

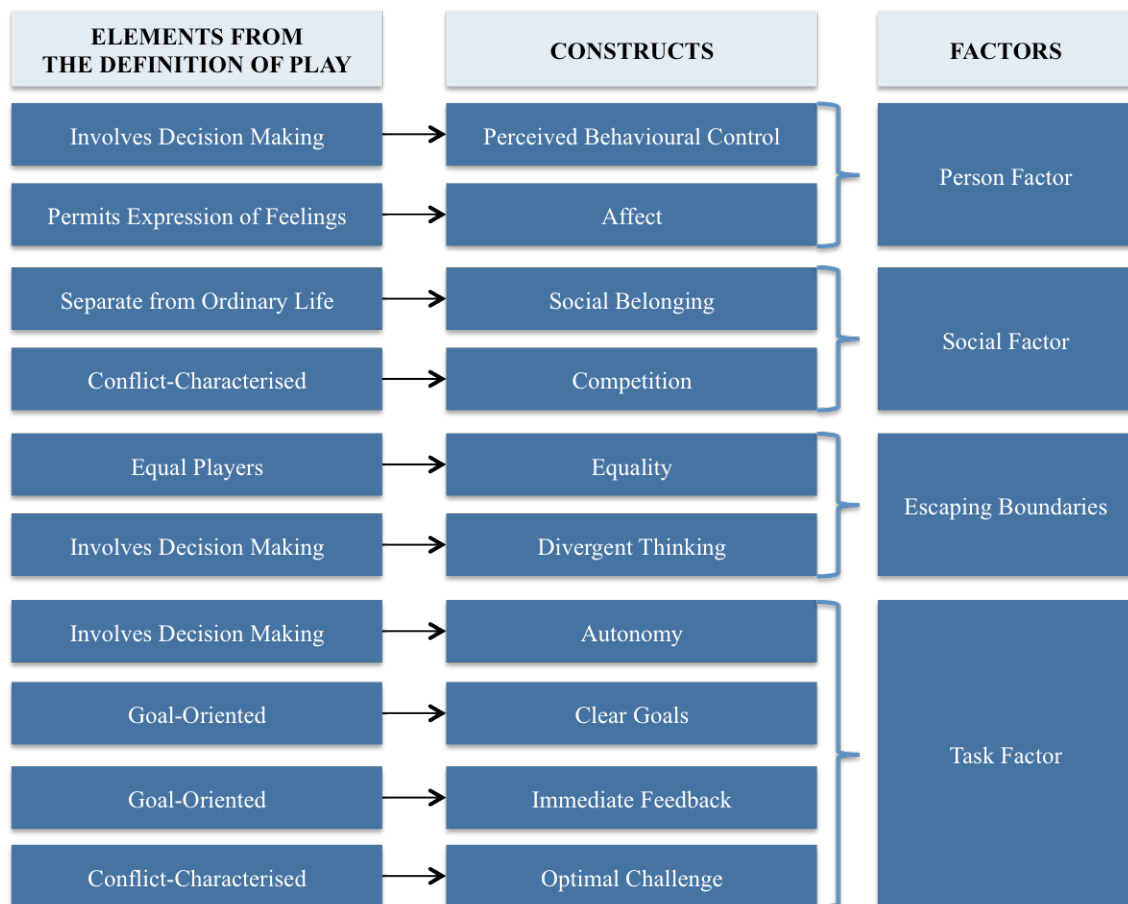


Figure 18: Derivation of Constructs from Elements of Play Definition

### 2.2.1 Person Factor

The *person factor* consists of perceived behavioural control and affect.

**Perceived behavioural control** resembles the concept of self-efficacy proposed by Bandura (1977), and refers to a person's belief about performing a given task with respect to her or his capabilities. It determines the activities in which people participate, how much effort they invest to overcome obstacles and how long they stay in the activity (Tipton & Worthington 1984). According to Bandura (1982), people develop and strengthen their self-efficacy through mastery experiences and by modelling observational learning, verbal persuasion and judgments of their own physiological states (Bandura 1982; Wood & Bandura 1989; Gist & Mitchell 1992). The development of self-efficacy is additionally influenced by assessing, from both individual and situational perspectives, the availability of resources and impediments that may affect future performance (Ajzen 1991; Gist & Mitchell 1992). Gist (1989) shows in problem-solving tasks that an increase in self-efficacy is linked to a larger number of generated ideas that were, moreover, characterised by a higher divergence. Furthermore, research by Dewett (2007) demonstrates that self-efficacy is linked to intrinsic motivation in the field of research and development. There are different ways in which play facilitates self-efficacy. For instance, players often master easy challenges by making decisions at the beginning. During the activity of play, the level of difficulty rises with the self-perceived level of competence. Mastery experience and observational learning by other players continuously intensifies self-efficacy during playing.

**Affect**, a second component of person factor, supports motivation and fosters cognitive processes, which are important for creative problem-solving process (Isen & Baron 1991; Kahn & Isen 1993; Staw & Barsade 1993; Hirt et al. 1996; Aspinwall & Taylor 1997; Mano 1997). Positive affect enhances verbal fluency (Greene & Noice 1988), broadens cognitive categories (Isen & Daubman 1984) and increases the likelihood of individuals pursuing a problem-solving approach (Carnevale & Isen 1986). While Isen et al. (1987) show that positive affect enhances the performance in creative tasks, studies by Vosburg (1998) and Clapham (2001) prove that positive affect does not necessarily have an influence on idea generation. George and Zhou (2007) explain these opposing viewpoints by the ambivalent effect of moods towards creativity. Negative mood signals individuals to try harder in order to improve, which leads to the development of creative ideas. Play is "a vehicle for the expression of feeling states and affect-laden

thoughts” (Russ & Schafer 2006, p. 248) or moods, respectively. Play permits expression of the moods enjoyment, passion, sadness, fear, excitement, anxiety, frustration and disappointment (Russ & Grossman-McKee 1990; Singer & Singer 1990, p. 68-71). As indicated in Chapter II-2.1, play also stimulates nerve growth in the amygdala, which is part of the limbic system, and assumes a primary role in the formation and storage of emotional reactions, thereby helping to develop emotional maturity (Panksepp & Burgdorf 2003; Amunts et al. 2005).

### 2.2.2 Social Factor

The *social factor* comprises the elements of social belonging and competition.

**Social belonging**, which is defined as the need to belong and the need to interact with others, is a fundamental human need and is universal, regardless of culture and individual differences (Baumeister & Leary 1995). In Maslow’s (1968) hierarchy of needs, the social needs become prominent as soon as the essential needs for survival and safety are satisfied. Moreover, they are given higher importance than esteem and self-actualization needs. As play is separate from ordinary life (Chapter II-2.1), it “promotes the formation of social groupings, which tend to surround themselves with secrecy and to stress their difference from the common world by disguise or other means” (Huizinga 1955, p. 13). Therefore, playing is a possible way to satisfy social needs. For adults, one essential motive for play is, accordingly, the desire to become an active part of a social community and to feel a sense of belonging (Sutton-Smith 2001, p. 91). In addition to its motivational influence, social belonging that is induced through play stimulates the willingness to engage in a creative process and generates innovative outcomes (Mainemelis and Ronson 2006).

**Competition**, on the other hand, allows individuals to compare their own skills and competencies with others. The desire to be better than others can motivate individuals to tap the full potential of their skills and abilities (Toubia 2006) and can drive them to participate in generating and developing ideas (Piller & Walcher 2006). Competition, however, can also trigger negative side-effects that impact creative processes such as information searching and encoding. More precisely, an increased level of competition can lead to a decrease in the willingness to share necessary information between innovators (Franke & Shah 2003). Nevertheless, competition is an important element of play (Chapter II-2.1) and is considered to be the most essential reason why people play (Vorderer et al. 2003; Yee 2007).

### 2.2.3 Escaping Boundaries

The third factor — *escaping boundaries* — consists of the elements equality and divergent thinking.

A low level of **equality** between individuals and a strong hierarchical structure within an organisation can reduce intrinsic motivation. Inequality can hinder or even prevent people from participating in innovation activities (Wildemann 1995). Play can help to overcome organisational hierarchies that hinder equality, as playing is generally characterised by the principle of equality (Chapter II-2.1) and the application of anti-authoritarian principles (Linder et al. 2001). All players begin at the same hierarchical level and follow the same rules. Players, who perform well, have the chance to advance. Thus, leadership is bestowed while playing and is not predetermined. In this way, play can cause satisfaction in the sense of Herzberg's (Herzberg et al. 1957; Herzberg 1976) motivation theory: According to Herzberg (Herzberg et al. 1957; Herzberg 1976), the possibility to advance is one of the most important factors that leads to satisfaction at the workplace. According to Bolles (1972), however, equality only becomes comprehensible if the assignment of rewards and reinforcements is characterised by transparency for all participants. If transparency is missing, not only will the perception of equality be hindered, but superstitious beliefs could also be developed. These beliefs would then determine the perception of what is rewarded and reinforced. The result thereof could be unwanted and unintended behaviours, as well as a decrease in or loss of motivation.

The second element — **divergent thinking** — is considered to be the major cognitive process in creativity, and is used to generate a variety of ideas and associations related to problems. Divergent thinking involves fluidity of thinking, free association and broad scanning ability, and is interrelated with mental transformation that enables the conversion of existing knowledge into new patterns of configuration (Guilford 1968). A significant and positive relationship between divergent thinking and play has been acknowledged in prior studies (e.g., Peppler & Ross 1981; Russ & Grossman-McKee 1990; Fisher 1992; Wyver & Spence 1999; Seja & Russ 1999). Dansky and Silverman (1973; 1975) explain the positive effect of play on divergent thinking with an increase of associative fluency. Associative fluency is thereby defined as the ability to form associations among actions, objects, and ideas that are typically unrelated. Furthermore, Dansky (1980a; 1980b) delineates the view that play influences divergent thinking, because it

helps people to abandon old associations — an outcome that is due to three reasons: First, players assign to objects subjective characteristics determined by their personal interests (*distorting assimilation*). Second, players combine unrelated symbols to make play possible (*free assimilation*). Third, players are often confronted with new situations while playing, and have to make choices (Chapter II-2.1). Thereby, they have to overcome routines, experiment and explore the limits of their knowledge (Levitt & March 1988; March 1991; Barrett 1998).

#### 2.2.4 Task Factor

The *task factor* focuses on a given task. It combines the elements of autonomy, clear goals, immediate feedback, and optimal challenge.

The first element — **autonomy** — is acknowledged in the scientific literature as an important facilitator of creativity (e.g., Abbey & Dickson 1983; Amabile 1988; Deci et al. 1989; Shalley 1991; Scott & Bruce 1994; Zhou 1998; Shalley et al. 2000; Amabile 2011, p. 55). It comprises the feeling of ownership and control over activities, and leads to a higher intrinsic motivation (Alge et al. 2006; Hackman & Oldham 1980). A voluntary activity, which provides a feeling of ownership and control over activities, and a high degree of freedom and independence confined by rules, is play (Chapter II-2.1). Therefore, play gives participants a feeling of autonomy. For example, in role-playing online environments players often can choose between different options; they can take on new identities for characters they have created or they may even assume unrealistic roles (Mainemelis & Ronson 2006).

Setting **clear goals** might be viewed as detrimental for creativity (Hennessey & Amabile 2010). However, studies have shown that clear goals can facilitate creativity and motivation (Hennessey & Amabile 2010): goals that concern creative activity enable cohesion, task focus and concentration, and help to prevent distractions from the task (Shalley 1991; Shalley 1995; Csikszentmihalyi 1997, p. 111; Shalley 2008). Play channels activities through setting clear goals that are predefined by the rules (Crookall et al. 1987; De Felix & Johnston 1994; Garris et al. 2002) (Chapter II-2.1).

Another integral part of play is **immediate feedback** (e.g., by other players, by winning or losing or scoring) that gives players information about the quality of their decisions and about their progress towards the goals (Chapter II-2.1). In this way, play allows and stimulates learning by trial-and-error experiences (Linder et al. 2001). Mainemelis and Ronson (2006) state that errors “are used in play as triggers of exploration and practice,



allowing one to perfect his or her skill and to discover unnoticed variables or opportunities” (p. 100). Depending on the rules, learning can occur in consequence a wide range of trial-and-error learning (true trial-and-error learning, trial-and-error learning with solely positive reinforcement and trial-and-error learning with positive and negative reinforcement). These different types of learning differ in their use of rewards and punishment for a particular behaviour (Hull 1930). Trial-and-error learning that is provided through immediate feedback facilitates the development and acquisition of tacit knowledge (von Hippel 2001), which is crucial for idea generation and creative performance (Arrow 1962; von Hippel & Tyre 1995; Füller & Matzler 2007). Yet feedback, per se, is not inherently positive (Pittman et al. 1980). If it is unhelpful, controlling, or solely negative, if it focuses on the person (and not on the task) or is addressed without a specific context, it can lead to a decrease in intrinsic motivation and creativity (Pittman et al. 1980; Ryan 1982; Kluger & Denisi 1996; Hattie & Timperley 2007; Zhou 2008). If, however, immediate feedback is given for a task or a competence in an informational and balanced manner, helping an individual to develop and improve, it can enable the generation and transfer of tacit knowledge (Nambisan 2002), it can foster motivation and creative behaviour (Arnold 1976; Martocchio 1992; Zhou 2008) and it can help to develop and stabilise intended behaviour (Hull 1930).

The element of **optimal challenge** is another integral part of play, and is conducive for both motivation and creativity (O’Brien & Dowling 1980; O’Brien 1983; Csikszentmihalyi 1997, p. 111). If the personal level of skills is in balance with the challenge (Csikszentmihalyi & Rathunde 1993; Csikszentmihalyi 1997, p. 111), the challenge is optimal. Should the challenge exceed the skills, the consequences could be anxiety, boredom, frustration and lack of motivation (Shalley & Oldham 1985). According to Csikszentmihalyi (1997), participants enjoy playing when they “are balanced on the fine line between boredom and anxiety” (p. 111). In other words, the conflict that the players are struggling (Chapter II-2.1) with is not too easy, nor is it too difficult. Over time, the skills of players improve and the level of challenge increases (Mainemelis & Ronson 2006). At the same time, players also gain perceived behavioural control.

### 3 Game Mechanics

Insights gained from the previous chapter suggest that play has the potential to positively influence motivation and creativity. Recently, authors such as Gabe Zichermann and Joseline Linder (2010) and Byron Reeves and Leighton Read (2009) have suggested that the application of game design elements or game mechanics (such as points, levels and leaderboards) can help to take advantage of the potential of play. To understand how *games* and *game mechanics* can be used for the redesign of open innovation tools, these terms are defined in Chapter II-3.1. In Chapter II-3.2, types of game mechanics considered in this work will be specified.

#### 3.1 Definition

The term *game mechanics* consists of the two terms *game* and *mechanic*.

While the term *mechanic* originates from the Greek word *mechanikos* (μηχανικός), and describes the art of building and constructing a machine, the meaning of *game* is strongly interconnected with the term play. This is reflected by the fact that, in some languages the words game and play have the same word stem: “Play a game” in German is “ein Spiel spielen” and in French the phrase is “on joue á un jeu” (Parlett 1999, p. 1; Salen and Zimmerman 2004, p. 72). In this work games are considered to be “a subset of ‘play’”, because there are forms of play that are “looser and less organised than games” (Salen and Zimmerman 2004, p. 72). Figure 19 illustrates the relationship between games and play.

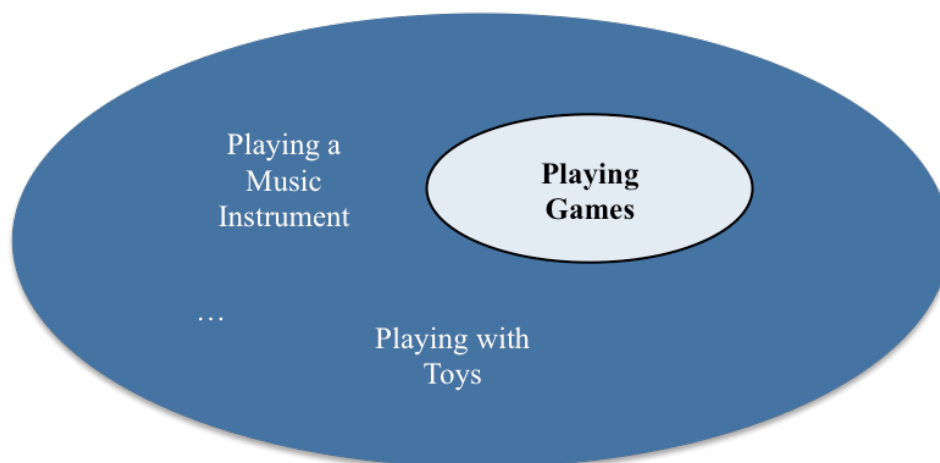


Figure 19: Relationship between Games and Play  
(Following Salen and Zimmerman (2004, p. 72 and p. 303))

There are a number of definitions for the term *game*<sup>22</sup>. For example, Salen and Zimmerman (2004) define a game as “a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome” (p. 80) and Costikyan (2002) defines a game as “an interactive structure that requires players to struggle toward goals” (p. 21). From Salen and Zimmerman’s (2004, p. 80) viewpoint, engaging “in an artificial conflict, defined by rules, that results in a quantifiable outcome” is also defined as play; from Costikyan’s (2002, p. 21) viewpoint, “struggling of players toward goals” is also defined as the activity of play.

In this work, the term *game* is defined as follows:

**A game is an interactive system in which play happens.**

A full understanding requires explanation of the specific aspects of this definition:

First, games are distinguished from other entertainment offerings (e.g., movies) because the behaviour of players participating in the game determines future events within the same game. Thus, games can be labelled as *interactive* (e.g., Salen & Zimmerman 2004, p. 58-59). Second, a game can be called a system because it consists of a set of parts<sup>23</sup> that interrelate, and thus build a formal structure (Costikyan 2002; Salen & Zimmerman 2004, p. 50-53; Sicart 2008). Third, in games the activity of play happens. Play can be defined as a voluntary, goal-oriented, conflict-characterised activity that is separate from ordinary life and is governed by rules (see Chapter II-2.1).

There is no consensus on how game mechanics can be defined (Sicart 2008). Table 8 summarises the range of identified definitions.

Author(s) (year, page)	Definitions of Game Mechanics Retrieved from Literature: Game Mechanics are ...
Lundgren & Björk (2003, p. 4)	“ ... any part of the rule system of a game that covers one, and only one, possible kind of interaction that takes place during the game, be it general or specific [...] mechanics are regarded as a way to summarise game rules.”

<sup>22</sup> For an overview see, for example, Juul (2003) or Salen & Zimmerman (2004, p. 73-80).

<sup>23</sup> For example, in soccer, the players, the goal nets and the playing field are parts. When the soccer game begins, these parts interrelate (Salen & Zimmerman, p. 50).

<b>Rouse &amp; Ogden (2005, p. 310)</b>	“ ... what the players are able to do in the game-world, how they do it, and how that leads to a compelling game experience.”
<b>Fullerton et al. (2004, p. 34)</b>	“ ... the actions or methods of play allowed by the rules [...] they guide player behaviour, creating interactions.”
<b>Hunicke et al. (2004, p. 2)</b>	“ ... particular components of the game, at the level of data representations and algorithms [...] mechanics are the various actions, behaviours, and control mechanisms afforded to the player within a game context.”
<b>Järvinen (2008, p. 254)</b>	“ ... the means to guide the player into particular behaviour by constraining the space of possible plans to attain goals”
<b>Sicart (2008)</b>	“ ... methods invoked by agents, designed for interaction with the game state.”
<b>Kim (2009)</b>	“ ... the systems and the features that make games compelling, fun and addictive.”

Table 8: Definitions of Game Mechanics  
(Following Sicart (2008))

In this work, game mechanics are defined as follows:

**Game mechanics are triggers for eliciting, controlling and sustaining certain behaviours of players. Thus, game mechanics can have a motivational effect on behaviours that are allowed by the rules and game mechanics are a necessary instrument for guiding players towards the game’s goal.**

The elements of the game mechanic definition are described in Table 9.

<b>Elements of Game Mechanic Definition</b>	<b>Description</b>
<b>Triggers to Elicit, Control and Sustain Certain</b>	Game mechanics guide players towards behaviours (e.g., creative behaviours. If players have not yet shown a specific behaviour, game mechanics can motivate them to the evocation of it. If players have

<b>Behaviours</b>	<p>shown the behaviour, game mechanics can motivate them to repeat and proceed with that behaviour. In this regard the definition of game mechanics is similar to that of Kim (2009), who also emphasises the motivational effect of game mechanics. This motivational effect that propels players towards certain behaviours can be explained through the game mechanic's impact on constructs, which are influenced by play. These constructs are perceived behavioural control, affect, social belonging, competition, equality, divergent thinking, autonomy, clear goals, immediate feedback and optimal challenge (Chapter II-2.2).</p> <p>Developers, who are responsible for the application of game mechanics do not ask themselves how individuals will play the game, but rather how a game has to be designed so that individuals will exhibit certain behaviours. Consequently, developers spark motivation by implementing game mechanics.</p>
<b>Allowed by the Rules</b>	<p>As part of the game system, game mechanics and game rules are interrelated. The implementation of game mechanics has the objective of motivating behaviours that are allowed by the rules. In some instances, game mechanics even facilitate the implementation of the rules. For example, the game mechanic <i>game points</i> (see Chapter II-3.2) simply state, that during the game there is a possibility for players to receive points automatically from the system. The behaviours for which players receive game points, and how many game points they receive, can be specified in the rules.</p>
<b>Instrument to Guide Players towards the Game's Goal</b>	<p>Game mechanics help players to judge how their behaviour is bringing them closer to or farther away from the game's goal. Thus, they help players to understand the importance of their behaviour in attaining the game's goal. In many games this goal is defined as a victorious end point; in others "the goal is to play as long as possible to achieve the highest score" (Salen &amp; Zimmerman 2004, p. 258).</p>

Table 9: Elements of Game Mechanic Definition

### 3.2 Types

Although, there is no common set of mechanics inherent in every game, a number of mechanics occur more often. Depending on the underlying definition, a number of different game mechanics can be distinguished. According to Järvinen (2008, p. 385-394), accelerating, shooting, attacking, defending, bidding, building, catching, choosing, conquering, controlling, jumping, moving, performing, sprinting, submitting, taking, transforming or voting are examples of game mechanics. Moreover, according to Hunicke et al. (2004), examples of game mechanics depend on different genres of a game. For example, in shooter games, examples include weapons, ammunition and spawn points; in the game of golf, the balls, clubs and sand traps are examples of game mechanics. For Rouse & Ogden (2005, p. 362), more general examples of game mechanics categories are weapons, items, levels and enemies. According to Kim (2009), frequently occurring game mechanics are game points, social points, redeemable points, collecting, leaderboards, levels, exchange, stories and virtual identity (see Figure 20).

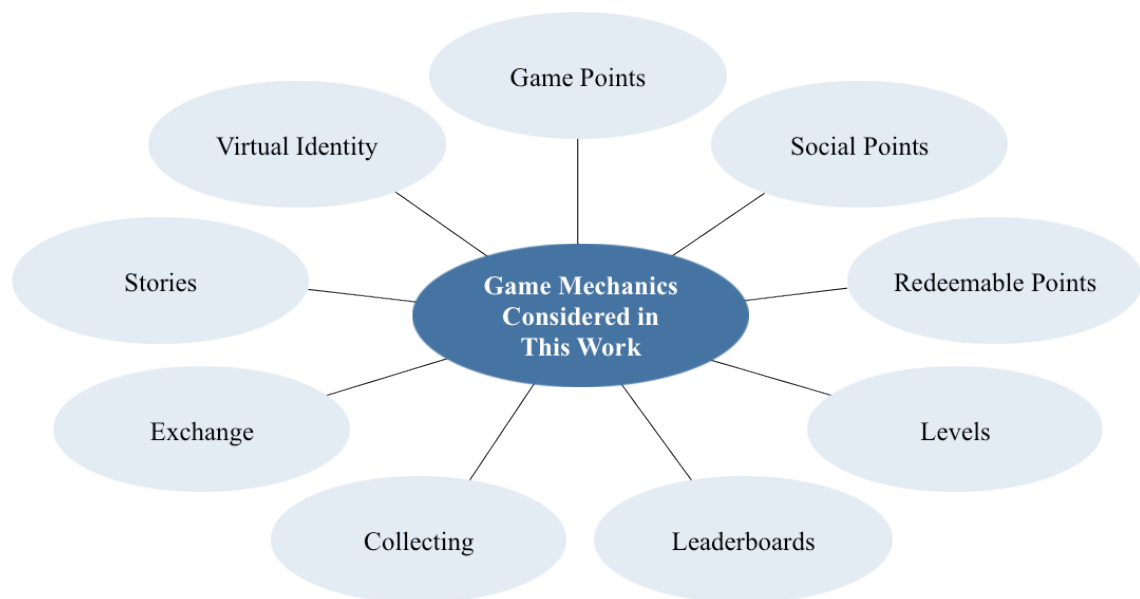


Figure 20: Frequently Occurring Game Mechanics Considered in This Work  
(Following Kim (2009))

This group of game mechanics was selected for this work because Kim (2009) not only takes into account the motivational effect of game mechanics, but also articulates abstract examples of game mechanics that are independent of different game-genres. These game mechanics and their potential impact on specific constructs are discussed in the following section. The specific specific constructs are perceived behavioural control,

affect, social belonging, competition, equality, divergent thinking, autonomy, clear goals, immediate feedback and optimal challenge (see Chapter II-2.2).

*Game points* are awarded automatically by the system when participants show a specific behaviour (Hacker & von Ahn 2009). By gaining game points, individuals are provided with immediate feedback and a clear goal. In addition to helping participants channel their activities towards a clear goal and enhancing perceived behavioural control, the use of game points can be a formal expression of equality in games. All players receive the same number of points for a same activity. Thus, points also serve as a basis for competition. In a transparent system, where players see each other's scores, it is possible to compare. By causing excitement and enjoyment, therefore, gaining points can affect a person on an emotional level. In the overall view, game points can have an impact on immediate feedback, clear goal, perceived behavioural control, equality, competition, and affect.

*Social points* contrast game points, as they are awarded not by the system, but by other players: Players receive social points when their fellow-players judge them positively. Accordingly, an absolute judgment can be distinguished from a relative judgment (Füller et al. 2010). A relative judgment allows players a pair-wise comparison and assignment of social points. An absolute judgment only allows players to give an absolute score. This score can be generated on the base of meta-data such as clicking and viewing (first type) or by explicitly awarding social points (second type). The second type of social points relies on scales (e.g., a five-point Likert-type scale) and is visually presented, for example, in a five-star rating form or in the form of a thumbs-up, thumbs-down response. As well, this second type of social points often builds on multidimensional ratings, which are presented in an overall score (Malone et al. 2009; Möslin et al. 2010). In this context, if social points provide the opportunity to demonstrate interest in players, the act of earning and assigning points may provoke a feeling of social belonging: the more social points a person has awarded and received within a group, the stronger is that person's connection to the group. As well as inducing a feeling of social belonging, social points may also stimulate competition due to the possibility of comparison. They are, moreover, an expression of social expectations towards the behaviour of an individual within a group, and they set a clear goal for that individual behaviour. As a final factor, social points may intensify the feeling of equality, when all persons within a community can assign only the same number of social points as the other players. Social points, therefore, may support immediate feedback, social belonging, compe-

tition, clear goals and equality.

*Redeemable points* function as a virtual currency. Users who have earned redeemable points can exchange them for items (Hamari & Lehdonvirta 2010). According to Hamari and Lehdonvirta (2010) these “items can range from weapons and armour in online games to clothes in virtual worlds and simple two-dimensional graphical badges” (p. 15). By giving the option to convert points into new items, redeemable points provide the individual with greater freedom of expression. Subsequently, redeemable points may positively influence the perception of autonomy.

The accumulation of points enables the design of levels and leaderboards. *Levels* can occur as sections or stages. If levels are conceptualised as sections, they do not differ in difficulty. Levels in the form of sections allow players to choose between different parts of the game world, and to break down the gameload (Byrne 2005, p. 223). If levels are designed as stages, a “discrete change in difficulty” (McGuire & Jenkins 2009, p. 104) arises from one level to the next. Thus, stages indicate major encounters for the next game period: players often unlock features and abilities and thus become more powerful when reaching a higher level. Therefore, levels can be a form of a steadily growing optimal challenge. Along with the gradual increase of challenges, the belief intensifies that individuals can accomplish new tasks successfully. Levels may, accordingly, give rise to perceived behavioural control. If the achieved level can also be shared with others, this would allow a comparison and might foster competition among participants. Levels, then, may support optimal challenge, competition and perceived behavioural control.

*Leaderboards* show players their ranking position in comparison to others. Thus, they give players feedback about their chances for success (Reeves & Read 2009, p. 75). Leaderboards can foster competition, as they offer a possibility for direct comparison among participants and enable visibility in the game. Thus, leaderboards function as an anchor point for both assessing and appreciating individual achievements, as well as for increasing in perceived behavioural control. In the overview, then, leaderboards may support competition and perceived behavioural control.

*Collecting* (e.g., of badges) is a further game mechanic. The term collecting has been defined as the “process of actively, selectively and passionately acquiring and possessing things removed from ordinary use and perceived as part of a set of non-identical objects or experiences” (Belk 1995, p. 67). The function of the objects is, thereby, of secondary (or no) concern, because collectors do not use the items they collect (Long &



Schiffman 1997; McIntosh & Schmeichel 2004). Instead, collectors seek to complete a set of different items and display their collection to persons who understand and admire them (e.g., Danet & Katriel 1989; Godbole 2009). Collecting is, thus, viewed as an activity that drives competition and triggers fear of scarcity (Formanek 1991; Long & Schiffman 1997). It offers the possibility of strengthening social bonds, and may contribute to satisfying the need for social belonging. Games, especially board games (e.g., Carcassonne or Ra) and online games (e.g., Farmville), build on the human urge to complete a set of badges (Thompson et al. 2007). Badges, which are sometimes called achievements or awards, are visualised in form of virtual graphic objects. Oftentimes one single badge is illustrated as a part of a set that players strive to complete. Collecting, then, may support competition and social belonging.

*Exchange* relations in games occur two ways — competitively and cooperatively (Blau 1964). Competitive exchanges are reflected in taking turns or trading, and are also called explicit exchanges. Taking turns and trading are necessary to keep the game running and/or to win the game. Examples for games that use explicit exchange in the form of taking turns are board games such as chess, and examples in the form of trading are board games such as Settlers of Catan (Habgood & Overmars 2006). Cooperative exchanges are called implicit exchanges. Examples of implicit exchanges are sharing, helping and gifting (Kim 2009). Players who are involved in the process of sharing, helping and gifting are motivated by the obligation to give, receive and repay (reciprocity), and by earning social reputation. They want to become an active part of a social community and to feel a sense of belonging (Sun et al. 2006). Exchanges offer a possibility for strengthening personal bonds between participants, and help to satisfy the need for social belonging. Divergent thinking and collaboration may be induced and supported if information is shared between the participants.

*Story* is another category of game mechanic. Two types of stories can be distinguished in a game environment — stories that are static, predefined and passive (Mallon & Webb 2000) and stories that are dynamic, unplanned and interactive (Crawford 2004, p. 46-50). The static, predefined and passive type often appear in games in the form of background stories, and comprise the elements of setting, theme, plot and resolution. The background story provides a narrative and imaginary frame in which players can act. Background stories further facilitate the process of connecting pieces of information, even if not all of these pieces can be communicated or even if the story itself possesses minor inconsistencies and logical gaps (Fletcher 2007). The dynamic, un-

planned and interactive type are found in games where players have the opportunity to write a story on their own, and thus to influence the game itself. Both types of stories offer possibilities for socializing, for generating commitment and for imposing social pressure and control (McWhinney 1984; Boyce 1996). Schank and Abelson (1995) even argue that all meaningful social knowledge is acquired and memorised in the form of stories. Thus, stories help to meet the social need of belonging and can impact readers on an emotional level. They can increase suspense, curiosity and surprise (Alwitt 2002), and can attract the attention of players. In extreme cases, absorption in a story can cause a reader to lose connection to the real world (Brookes 2010). Stories, therefore, may support clear goals, divergent thinking, social belonging and affect.

*Virtual identity* is the final game mechanic described for this work. Virtual identity can be described as a “vehicle of the self” (Castranova 2005, p. 5) in a game environment that other players can see or interact with. Identities thus often become a representation of social status within games (Jakobsson 2002). This applies especially to online games. In online games, players often can create a virtual identity in the form of an avatar, which can be customised in a variety of features such as skin colour, hair colour, age, sex or body shape (Jin 2009). Players often choose avatars that are similar to themselves in appearance and sex (Hsu et al. 2005; Rymaszewski et al. 2007; Trepte et al. 2009; Trepte & Reinecke 2010), but not in character traits (e.g., extraversion, conscientiousness and neuroticism) (Bessière et al. 2007). Such designations of traits of appearance and character help players to create, within the game, a personal identity that is free from the deficits of real life, and that is characterised by a high degree of anonymity (Jakobsson 2002; Kang & Yang 2006; Bessière et al. 2007; Asimina & Joinson 2009; Trepte & Reinecke 2010). Based on Kohler, Matzler and Füller (2009), anonymity of virtual identities can help overcome hierarchical restrictions and boundaries. Virtual identity may also reduce perceived obstacles and strengthen a player’s belief in her or his ability to achieve a desired outcome. Hence, virtual identities may improve perceived behavioural control. In summary, virtual identities may support affect, equality and perceived behavioural control.

Potential effects of the named game mechanics are summarised in Table 10.

Constructs	Game Mechanics								
	Game Points	Social Points	Redeemable Points	Levels	Leaderboards	Collecting	Exchange	Stories	Virtual Identity
Perceived Behavioural Control	✓			✓	✓				✓
Affect	✓							✓	✓
Social Belonging		✓				✓	✓	✓	
Competition	✓	✓		✓	✓	✓			
Equality	✓								✓
Divergent Thinking							✓	✓	
Autonomy		✓	✓						
Clear Goal	✓	✓						✓	
Immediate Feedback	✓	✓							
Optimal Challenge				✓					

Table 10: Potential Effects of Game Mechanics

## 4 Application of Game Mechanics to Innovation Management

This work will argue that there are two possibilities for applying game mechanics to innovation management. The first possibility is to enrich open innovation tools<sup>24</sup> with game mechanics (*gamification*). The second possibility is to adjust a multiplayer online game to the purpose of ideation (*online ideation game* (OIG)).

These two possible applications of game mechanics to innovation management further the objective of creating open innovation tools that are both *hedonic* and *utilitarian*.<sup>25</sup> The term *hedonic* derives from the Greek *ἡδονή*, and means “joy, pleasure, enjoyment”. Hedonic systems are designed to be an end in themselves, to provide a self-fulfilling value to the user and to trigger intrinsic or internalised extrinsic motives<sup>26</sup> (van der Heijden 2004). When designing a hedonic system, the overall aim is to drive engagement and to encourage prolonged use (van der Heijden 2004). Games are examples of hedonic systems. In contrast, utilitarian information systems aim to increase the task performance of users. The term *utilitarian* derives from the Latin word *utilis* and means

<sup>24</sup> For an overview of open innovation tools, see Chapter II-1.3.

<sup>25</sup> Drawing on consumer psychology (Batra & Ahtola 1990; Haim & Oliver 1993; Dhar & Wertenbroch 2000), information systems researchers distinguish “hedonic” from “utilitarian” systems.

<sup>26</sup> For a definition of the terms *intrinsic* or *internalised extrinsic*, see Chapter II-1.5.1.

“useful”. Van der Heijden (2004) argues that these systems must provide as “little distraction as possible to help the user perform his or her task” (p. 696). When designing an utilitarian system, the overall aim is to encourage productive use. Currently, however, productive and active innovators voluntarily use open innovation tools, and often do so out of intrinsic and internalised extrinsic motives (Firat & Venkatesh 1995; Moon & Kim 2001) (Chapter II-1.5.2). Designers who face the challenge to develop open innovation tools that are simultaneously hedonic and utilitarian can either convert purely utilitarian open innovation tools into more hedonic ones by gamifying them, or they can convert a hedonic system in a more utilitarian one by adjusting a game to the purpose of ideation (see Figure 21).

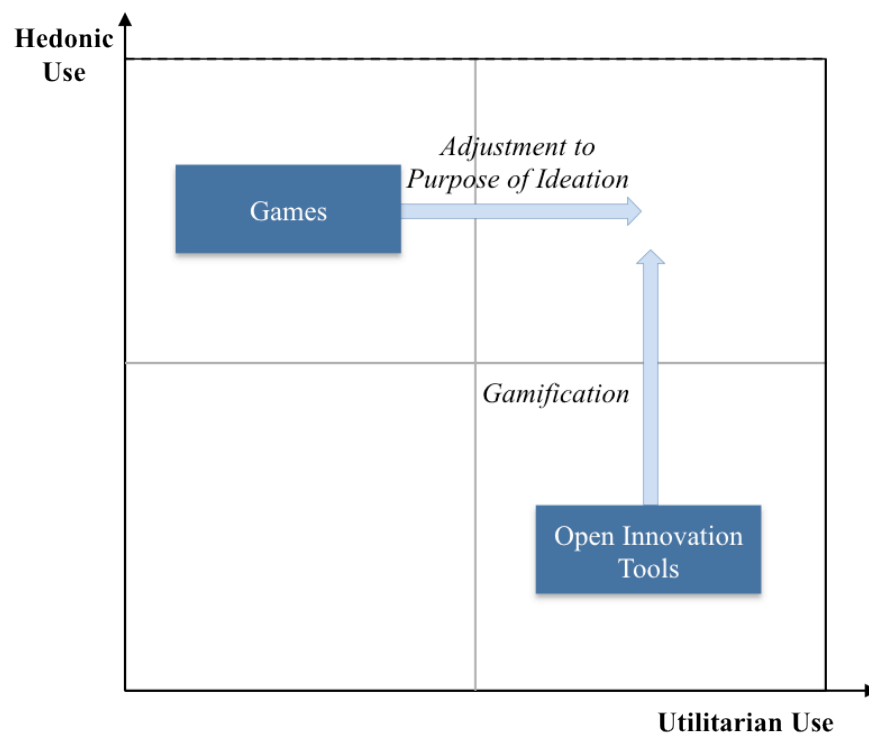


Figure 21: Possibilities for Applying Game Mechanics to Innovation Management

In Chapter II-4, both possibilities for applying game mechanics to innovation management are described. Thereby, gamification is addressed first (Chapter II-4.1) and OIGs second (Chapter II-4.2) because of two interrelated reasons: First, game mechanics have already been applied to open innovation tools for a number of years, while OIGs have been realised for only a short time. Second, while gamified open innovation tools ap-

pear *gameful*<sup>27</sup>, OIGs are games. The order of the application possibilities, therefore, reflects the evolution of open innovation tools from *non-gameful* tools, to *gameful* tools, to games. Figure 22 illustrates this evolution.

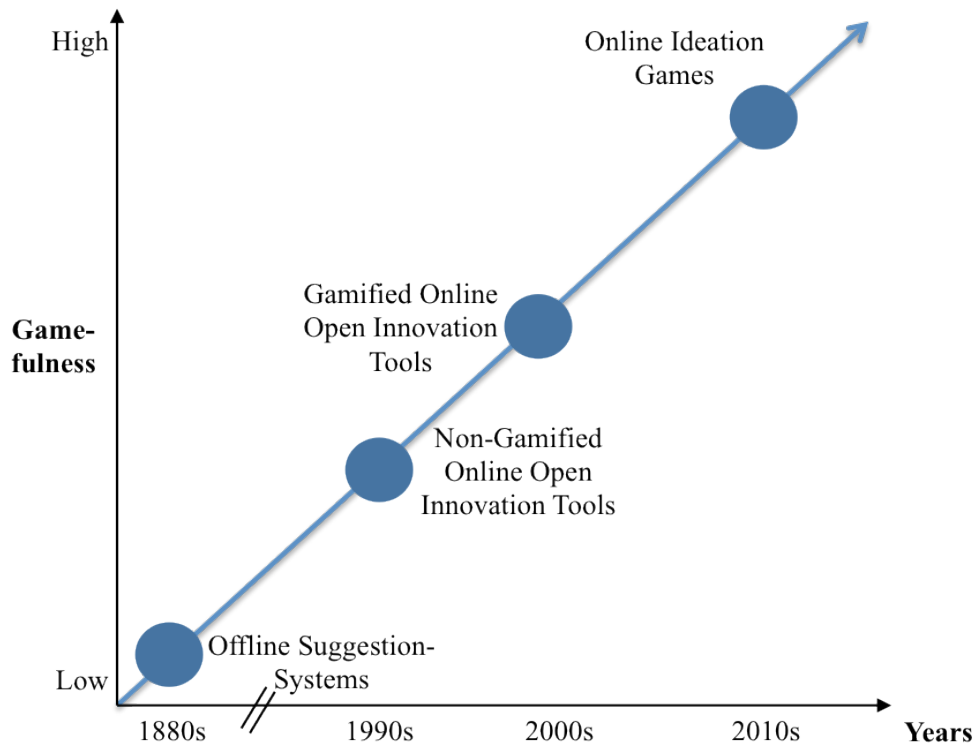


Figure 22: Evolution of Open Innovation Tools

#### 4.1 Gamification

*Gamification* is defined as the application of game design<sup>28</sup> elements to a non-game context (Deterding et al. 2011b). *Game design elements* are characteristic of games and comprise terms such as game mechanics (see Chapter II-3) and so-called “game design heuristics” (such as challenge, fantasy and curiosity) (Malone 1982). *Application in a non-game context* means that these game design elements are used “for other purposes than their normal expected use for entertainment” (Deterding et al. 2011b, p. 3). The idea behind gamification is that developers of utilitarian systems can spark (intrinsic) motivation (e.g., enjoyment), as well as other related states such as flow and involve-

<sup>27</sup> *Gamefulness* here describes the extent to which the design of a system appears to be a game. The term was introduced by McGonigal (2011, p. 54 and p. 80). Accordingly, Deterding et al. (2011a) add: “Where ‘playfulness’ broadly denotes the experiential and behavioural qualities of playing (*paidia*), ‘gamefulness’ denotes the qualities of gaming (*ludus*)” (p. 3).

<sup>28</sup> *Game design* is thereby defined as “the process by which a game designer creates a game, to be encountered by a player, from which meaningful play emerges” (Salen & Zimmerman 2004, p. 80).

ment, by implementing game design elements. In 2011, consulting companies such as Gartner, Deloitte or M2 popularised the term gamification through statements of the type illustrated in Table 11, and by adding the term to the “Hype Cycle of Emerging Technologies 2011” (Figure 23). The Hype Cycle shows in a graphic maturity, adoption and application of certain technologies (Gartner 2012).

The non-game context in this work refers to innovation management — that is, the open innovation tools named in Chapter II-1.3. With regard to game design elements, this work focuses on the above-described game mechanics. The following section describes how game mechanics can be implemented in social media based open innovation tools. Thereby, specific examples<sup>29</sup> of idea competitions and idea management systems that are used in the automotive industry serve as a helpful explanation.

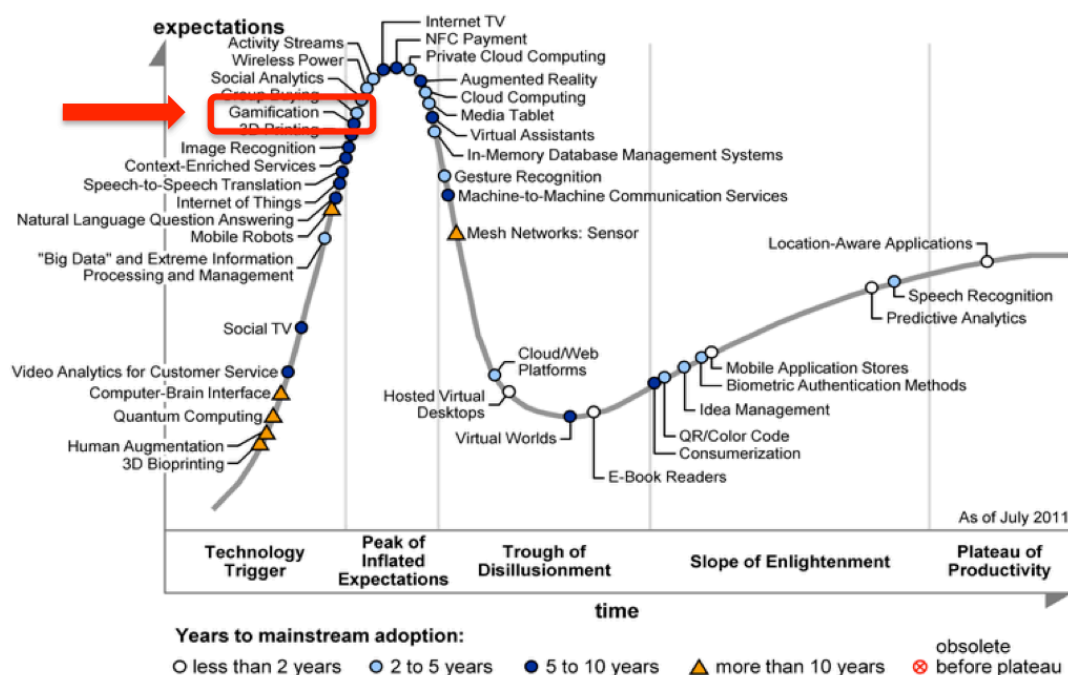


Figure 23: Hype Cycle of Emerging Technologies 2011  
(Gartner 2011c)

<sup>29</sup> These examples are already described in Chapters II-1.3.1 and II-1.3.2.

Companies	Statements
<b>Gartner</b>	“Over 70% of global 2000 organisations will have at least one gamified application by 2014.” (Gartner 2011a)
	“By 2015, more than 50% of organisations that manage innovation processes will gamify those processes.” (Gartner 2011b)
<b>Deloitte</b>	“The potential of gamification for the enterprise is likely to grow with time. Organisations that embrace the trend have the opportunity to gain loyal customers and find a competitive edge in recruiting, retention, talent development and business performance.” (Deloitte 2011)
<b>M2</b>	“The gamification market is expected to climb beyond \$2.8 billion in direct spending in the United States by 2016.” (Flory 2012)

Table 11: Exemplary Statements about Gamification from Consulting Companies

One possibility for structuring the described game mechanics in the context of innovation management is the *genex framework* (see Chapter II-1.6.2) (Shneiderman 1999; Shneiderman 2000; Leimeister et. al 2009). The framework identifies four generic behaviours (accumulating<sup>30</sup>, relating<sup>31</sup>, creating<sup>32</sup>, disseminating<sup>33</sup>) that need to be triggered by game mechanics.

**Game points** can serve as triggers for all four behaviours. They can be assigned for activities such as tagging information (*accumulating*); commenting, leaving a message to someone, rating an idea or connecting to peers (*relating*); developing an idea by adding further information or creating videos or pictures of prototypes (*creating*); or posting (i.e., publishing) the idea (*disseminating*). For example, in VW’s idea competition

<sup>30</sup> *Accumulating* refers to such behaviours as learning from previous work, as well as searching, browsing, validating and indexing information (see Chapter II-1.6.2).

<sup>31</sup> *Relating* implies behaviours such as consulting with peers and mentors (see Chapter II-1.6.2).

<sup>32</sup> *Creating* relates to behaviours such as exploring and composing possible solutions (see Chapter II-1.6.2).

<sup>33</sup> *Disseminating* describes the behaviour of spreading, and thereby contributing, information and elaborated solutions over (see Chapter II-1.6.2).

*App My Ride* (Chapter II-1.3.2), participants could earn game points for commenting on an idea, leaving a message to another member, rating an idea and submitting an idea.

**Social points** can serve as triggers for the *relating* behaviours, as they are a way to gather feedback from, and thus consult with, others. An idea competition in the automotive industry for which social points were assigned was BMW's *Interior Idea Contest* (Chapter II-1.3.2). Participants could evaluate ideas from other participants by clicking "thumbs-up" or "thumbs-down" on two dimensions ("I like this idea" and "I would use this service"). Diverse evaluation dimensions are applied, including dimensions such as originality, degree of innovation, marketing potentials or customer value (Leimeister et al. 2009; Möslin et al. 2010). In open innovation tools, assessment through social points is labelled as *open evaluation* (Möslin et al. 2010), *community rating* (Leimeister et al. 2009) or *group decision* (Malone et al. 2009).

**Redeemable points** can serve as triggers for *creating* and *relating*. For example, in the idea management systems of Hype and Spigit<sup>34</sup>, users can spend their earned points in a *virtual store*. In these virtual stores, innovators can redeem their points for money or monetary compensation (such as a holiday trip). Monetary compensation does not necessarily mean a reward that can be converted outside the company or the innovation tool. In some systems the innovators can instruct professional designers to sketch or to build a prototype of their idea by paying them with redeemable points. The designers take pictures of sketches and prototypes to upload into the system. Therefore, redeemable points can be assigned to the behaviour of *creating*, because they help participants to compose their ideas. The Spigit idea management system also gives participants the option to invest their points in the ideas that they find most promising. Participants who buy shares of the ideas that are selected for further development or implementation are rewarded with additional redeemable points, which indicates that this approach also allows for evaluating ideas.<sup>35</sup> Therefore, redeemable points can also serve as triggers for *relating* behaviours, as they are a way to gather feedback from, and thus consult with, others.

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<sup>34</sup> Hype Softwaretechnik GmbH ([www.hypeinnovation.com](http://www.hypeinnovation.com)) and Spigit ([www.spigit.com](http://www.spigit.com)) are among the largest idea management system providers worldwide (Chapter II-1.3.1).

<sup>35</sup> The efficiency of this approach has been already proven in a number of studies (e.g., LaComb et al. 2007; Dahan et al. 2007; Soukhoroukova et al. 2007).



**Levels** that can be implemented in the form of sections or stages (Chapter II-3.2), can serve as triggers for the behaviours *accumulating* or *creating*. When levels are implemented in the form of sections, they imply the possibility of browsing through information (and thus support *accumulating*). For example, in the idea management system of Hype, users can choose to take part in different campaigns. A campaign is a single challenge that focuses on one topic. Different campaigns do not have to be approached gradually by users, and can be interpreted as a level in the form of a section. When levels are implemented in the form of stages, they, for example, gradually give innovators the opportunity to work on ideas in the later stages of the innovation process and provide ever-increasing challenges. Therefore, levels in form of stages relate to *creating*, because users have to explore and compose new solutions in order to move up a level. Levels in the form of stages, however, are either not applied, or are applied only in a limited way in open innovation tools that are available on the market.

**Leaderboards** can serve as triggers for the genex framework behaviours *accumulating* and *relating*, as they support behaviours such as searching, browsing, and consulting with others. *App My Ride* can again serve as an example for an open innovation tool with a leaderboard. In *App My Ride*, a ranking list shows participants how they perform in comparison to others in the categories of idea generation, evaluation and development. The leaderboards can be sorted and browsed according to the following criteria: 1) activity-counter<sup>36</sup>, 2) number of comments, 3) number of evaluations, 4) number of messages and 5) number of ideas.

**Collecting**, which is also only marginally applied to open innovation tools, can be assigned to the behaviour of *accumulating*, as it is a way to gather information about the submitted ideas of others: In some idea competitions (e.g. in BMW's *Interior Idea Contest*) participants have an opportunity to show others their collections of generated ideas.

**Exchange** can be assigned to the behaviours *relating* and *disseminating*, because it relates to gathering information from peers and mentors (*relating*) and to publishing information (e.g., in a forum) (*disseminating*). For example, in VW's *People's Car Project* (Chapter II-1.3.2), participants could help each other with ideas by commenting and share thoughts.

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<sup>36</sup> The calculation of rank in the activity counter is based on a combination of the number of submitted ideas, written messages and comments, and ratings.

**Stories** can be assigned to the generic behaviour of *creating* and *disseminating*: Ideas can be composed and published in the form of a dynamic, unplanned and interactive story. For example, in BMW's *Interior Idea Contest* or in VW's *People's Car Project*, participants had an opportunity to write and share their ideas in the form of stories (e.g., in a blog or in a wiki).

**Virtual identity** can be assigned to the behaviour of *relating*: In all named idea competitions, participants could generate a visual representation of themselves within the system, and could contact and consult with other community members through their virtual identities.

Figure 24 shows an overview of the game mechanics implemented in the investigated idea competitions and idea management systems structured according to genex.

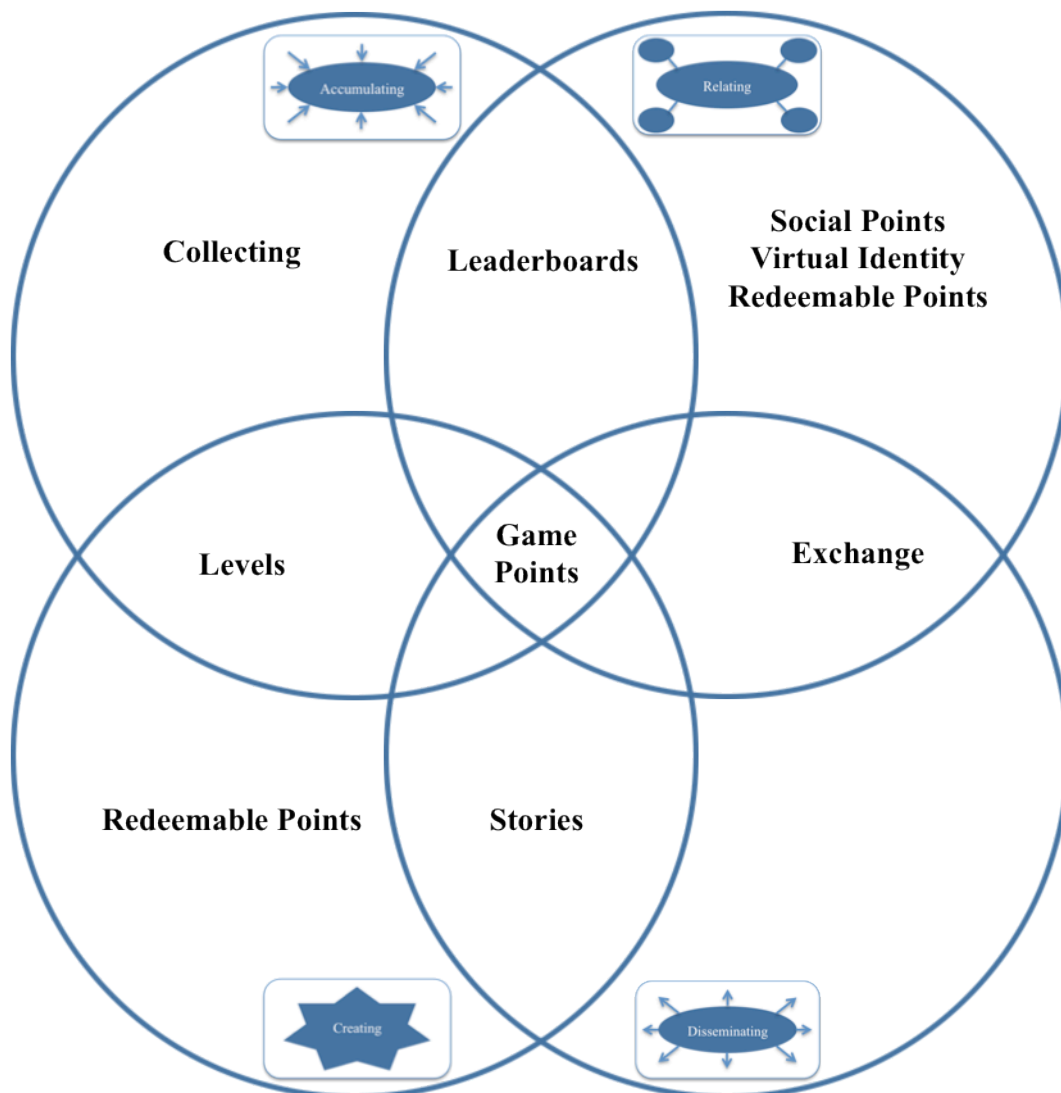


Figure 24: Game Mechanics Structured According to Genex

## 4.2 Online Ideation Game

The second possibility for applying game mechanics to innovation management is the use of a multiplayer online game for the purpose of ideation. A multiplayer online ideation game (OIG) gives players the opportunity to solve real-world problems within a game environment. Thus, an OIG follows the idea of “games with a purpose, i.e., games that are fun to play and at the same time collect useful data for tasks that computers cannot yet perform” (Hacker & von Ahn 2009, p. 2). Researchers such as Hacker and von Ahn (2009), Füller et al. (2010) and Cooper et al. (2010) have recently demonstrated that online games have the potential to motivate people to deliver useful data. However, the utilisation of online games for integrating individuals into ideation has been, to date, almost completely ignored in scientific research. One plausible explanation for this research deficit is that, since the dawn of the Industrial Revolution, playing games has been viewed as superfluous or even hazardous for adults (Spariosu 1989, p. 35-37) (Chapter II-2.1). Play was and is often described as the opposite of work (Mainemelis & Ronson 2006). From this perspective, an *ideation game* is an oxymoron: according to the French social thinker Roger Caillois, (1961, p. 9-10) playing a game is separate from the real world and is non-productive. In the opposite to playing a game, ideation relates to the solution of real-world problems and is undertaken to achieve a specific outcome (i.e., the generation of creative ideas). The concept an OIG, then, appears to encounter the same critiques as did game-based learning its early days (Garris et al. 2002): Critics pointed out that harnessing the potential of games for instructional purposes squeezes out what is enjoyable about games in the first place. However, a number of OIGs have recently been applied to solve real-world problems. Examples of OIGs include *MMOWGLI* ([www.mmowgli.nps.edu](http://www.mmowgli.nps.edu)), *Foldit* (<http://fold.it>), *Breakthroughs to Cures* (<http://breakthroughstocures.org>) or *Catalysts for Change* (<http://catalyze4change.org>):

### MMOWGLI

*MMOWGLI* is an acronym for “Massive Multiplayer Online War Game Leveraging the Internet”. Using the game *MMOWGLI*, the United States Navy aims to explore whether players of a multiplayer online game can solve complex geopolitical problems, i.e., how to deal with piracy in the Gulf of Aden. The game, which was launched in June 2011 and ran for three weeks, was sponsored by the Office of Naval Research, and was developed cooperatively by the Institute for the Future (ITF) and the Naval Postgraduate

School (NPS). In this game, which runs in any web-browser, ideas are labelled as *cards*. Players can play cards and can build *card chains* by collaborating with other players' and thus form larger sets of ideas. By building on these card chains, an *action plan* is jointly developed among the players. Masters moderate the game progress (MMOWGLI 2011a).

### **Foldit**

*Foldit* is a game that was developed at the University of Washington from computer science and engineering departments in collaboration with the department of biochemistry. It was launched in the year 2008 and has been playable since that time. In *Foldit* players help to develop ideas for the folding of proteins<sup>37</sup>. These ideas can help lead to a cure for diseases such as HIV, cancer and Alzheimer's (Cooper et al. 2010). In the game, players focus on creating accurate protein structure models (Khatib et al. 2011). Players change protein structures with a variety of tools and manipulations, and share their strategies as *recipes* in a social media based environment. Other players can advance developed recipes.

### **Breakthroughs to Cures**

In *Breakthroughs to Cures*, players generated ideas about the enhancement of the medical research system and about drug development. The game was hosted by the Myelin Repair Foundation (MRF). It was funded through a grant from the Robert Wood Johnson Foundation's Pioneer Portfolio and developed by the Institute for the Future (ITF). Uniquely, this game was available for play only twice, and only for 48 hours each time, (from October 7 to 8, 2010, and from November 9 to 10, 2010). The game is similar to *MMOWGLI*: After watching a video, participants can play "positive imagination" and "critical imagination" cards. One card is limited to 140 characters. Cards can be seen in a stream (similar to the micro-blog Twitter). Players can build card chains, which means to debate, extend and pose questions about the generated ideas (Breakthroughstocures 2010).

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<sup>37</sup> Proteins are building blocks of cells. Researchers have long sought to understand how the long chains of amino acids (protein elements) fold into their specific configurations.

## Catalysts for Change

The goal of *Catalysts for Change* is to “identify new paths out of poverty in just 48 hours of gameplay with hundreds of players from all walks of life” (CatalystsforChange 2012). With this basis, the “game invites players to share their own ideas for helping the destitute or to build upon more than 600 ideas that have been already created by 11 non-profit groups from all around the world“ (Takahashi 2012). It was also developed by the IFTF and supported by the Rockefeller Foundation, and could be played for 48 hours only: From April 3 to April 5, 2012 (Catalystsforchange 2012).

The specific examples of OIGs, and OIGs in general, can be classified with respect to the following two design elements:

- **Mission specificity.** OIGs provide players with missions’ goals to solve. Mission topics can be either very specific or very broad. An example of a game with very specific missions is *Foldit*. *MMOWGLI*, *Breakthroughs to Cures* and *Catalysts for Change* are examples of OIGs with broader missions (Cooper et al. 2010; MMOWGLI 2011a; Breakthroughstocures 2011; Catalystsforchange 2012)
- **Duration.** While some OIGs do not have a time limit, others have a predefined duration. *Foldit* is one example of a game without a time limit (Cooper et al. 2010). The OIGs *Breakthroughs to Cures* and *Catalysts for Change*, on the other hand, has a duration of only 48 hours, and must be completed within that time limit (Catalystsforchange 2012).

*MMOWGLI*, *Foldit*, *Breakthroughs to Cures* and *Catalysts for Change* also allow exemplifying how game points, social points, levels, leaderboards, collecting, exchange and stories can serve as building blocks for the OIGs, thereby covering behaviours of the genex framework (Chapter II-1.6).

**Game points** serve as triggers in the investigated online ideation games for *relating* (commenting, leaving a message to someone or rating an idea), *creating* and *disseminating* (generating and publishing an idea). For example, in *MMOWGLI* players can earn game points for becoming author of an action plan, for adding a comment or rating an action plan. Game points are also multiplied if the game masters rate a player’s action plan as one of the top five plans, or if a player has added five comments to a plan that are positively evaluated.

**Social points** serve as triggers in the investigated online ideation games for *relating*: For example, MMOWGLI players also get a social point if they consult with other players — that is, other players build on their cards (MMOWGLI 2011b). In *Catalysts for Change* players also received explicit social points when someone marked the idea as interesting (Catalystsforchange 2012).

**Levels** serve as triggers in the investigated online ideation games for *accumulating* and *creating*. An example for an OIG with levels in the form of two stages is *Foldit*. In the *Intro Levels* players learn the rules of the game, as well as learning how to fold and how to create an accurate protein structure model (*accumulating*). In the *Science Levels*, players are able to fold a variety of different proteins with a scientifically unknown structure (Cooper et al. 2010). In contrast to *Foldit*, *Catalysts for Change* has a level system that is connected to the points system: The more points *Catalysts for Change*-players earn, the faster they level up<sup>38</sup>. Therefore, they relate to *creating*, because players have to explore and compose new solutions to level up.

**Leaderboards** serve as triggers in the investigated online ideation games for *accumulating* and *relating*, because they evoke behaviours such as searching and browsing, as well as consulting with others. *Foldit* is also an example of an OIG with a leaderboard: A ranking list shows players how they perform in relation to others (Witt et al. 2011b).

**Collecting** (e.g., badges, awards or achievements) is a further game mechanic that can be found in OIGs. Collecting serves as a trigger in the investigated online ideation games for *accumulating*, *creating* and *relating*. For example, in MMOWGLI four badges can be earned for such actions as starting the longest card chain in a move or earning the most points in a move (MMOWGLI 2011b). Therefore, collecting badges relates to *creating*, because players have to explore and compose new solutions in order to receive badges. In *Catalysts for Change* three types of awards can be earned: Automatic awards, game guide awards and celebrity awards. (These awards are described in Table 12.) The awards can be shown to others and thus evoke behaviours such as searching and browsing (*accumulating*). Additionally, collecting can be assigned to the behaviour *relating* of the genex framework, because the game guide awards and celebrity awards (Table 12) support consulting with peers and experts.

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<sup>38</sup> In total, there are nine levels in Catalysts for Change, which are: Novice (0 points), Keen (1-4 points), Inspired (5-19 points), Brilliant (20-42 points), Luminous (43-79 points), Genius (80-179 points), Extreme Genius (180-299 points), Beyond Extreme Genius (300-424 points), Legend (> 425 points).

Type	Description
<b>Automatic Award</b>	“When you reach a goal, such as most cards played or most points won, these awards are automatically added to your player profile. As your points grow, you also ‘level up’ to gain a global reputation as a winning player.”
<b>Game Guide Award</b>	“Game guides will be watching the gameplay. They will give out awards to highlight players who are stepping up to win a mission by solving particular problems — such as paths out of poverty for seniors or green paths out of poverty.”
<b>Celebrity Award</b>	“A few secret celebrities will choose their favourite cards or card chains to grant their own celebrity awards.”

Table 12: Types of Awards *Catalysts for Change*  
(Catalystsforchange 2012)

**Exchange** serves as triggers in the investigated online ideation games for *creating*, *disseminating* and *relating*. In *MMOWGLI*, *Breakthroughs to Cures* or *Catalysts for Change*, for example, players can comment on ideas or contribute to an action plan (*creating* and *disseminating*) (MMOWGLI 2011a; Breakthroughstocures 2011; Catalystsforchange 2012). In *Foldit*, players can chat with each other and discuss how *recipes* should be elaborated (*relating*) (Cooper et al. 2010).

**Stories** can serve as triggers in the investigated online ideation games for *accumulating*, *creating* and *disseminating*. In *Breakthroughs to Cures* both types of stories are implemented: (1) dynamic, unplanned and interactive stories and (2) static, predefined and passive stories. The first type appears as players have the possibility to write a story on their own and thus influence the game itself. For example, players of *Breakthroughs to Cures* have the opportunity to write a story on their own, and thereby influence the game itself through dynamic, unplanned and interactive stories. These stories allow exploring/composing and publishing ideas, and in this way relate to the generic behaviour of *creating* and *disseminating*. In the background story of *Breakthrough to Cures*, a futuristic scenario that takes place in 2020 is presented: A widespread contamination has triggered a neurological disease that is expected to infect hundreds of millions of

people (Breakthroughstocures 2011). The background story supports the collection of information and thus can be assigned to *accumulating*.



### III Empirical Studies

In the following section, four empirical studies are presented. The first two studies offer insights on the first major research focus of this work (gamification of open innovation tools). The latter two studies offer insights on the second major research focus of this work (OIGs).

To achieve insights about gamification and OIGs, it is useful to consider, first, the experts, and then the user's point of view. The consideration of the expert's point of view offers the possibility for obtaining a broader perspective on the topic, and for highlighting organisational issues that would have remained hidden had only users been surveyed (Khilji 2006). The consideration of the expert's point of view also allows researchers to gather knowledge, which helps to generate hypothesis for a survey of users.

Therefore, experts are interviewed in the **first empirical study** (Chapter III-1). In the scope of this study experts are defined as persons who make decisions about the implementation of game mechanics in idea competitions. Experts are asked to name game mechanics that they have applied, and to explain their motives for — and effects of — application on an organisational level. To achieve an understanding of effects at the individual level, users of an online idea competition are asked in the **second empirical study** (Chapter III-2) about their motives for participation, flow, enjoyment, task involvement and perception of game mechanics with respect to intrinsic motivation (i.e., enjoyment), involvement and flow.

To achieve insights about OIGs, the **third empirical study** (Chapter III-3) considers the points of view of both experts and users (i.e., players). Experts contribute to the conceptual design of an OIG and evaluate ideas generated in the developed OIG-prototype. Users are surveyed in order to develop a better understanding of the motives to play the game, to determine whether the players are involved in the game and to ascertain the main driver of that involvement. The **fourth empirical study** (Chapter III-4) concentrates again on the users' view: To gain understanding about the persistence that OIG players show for engaging in creativity-relevant cognitive processes (such as problem identification, information searching and information encoding, idea generation and alternative generation), a **longitudinal study** is conducted. Figure 25 gives an overview of the empirical studies' order in Chapter III.

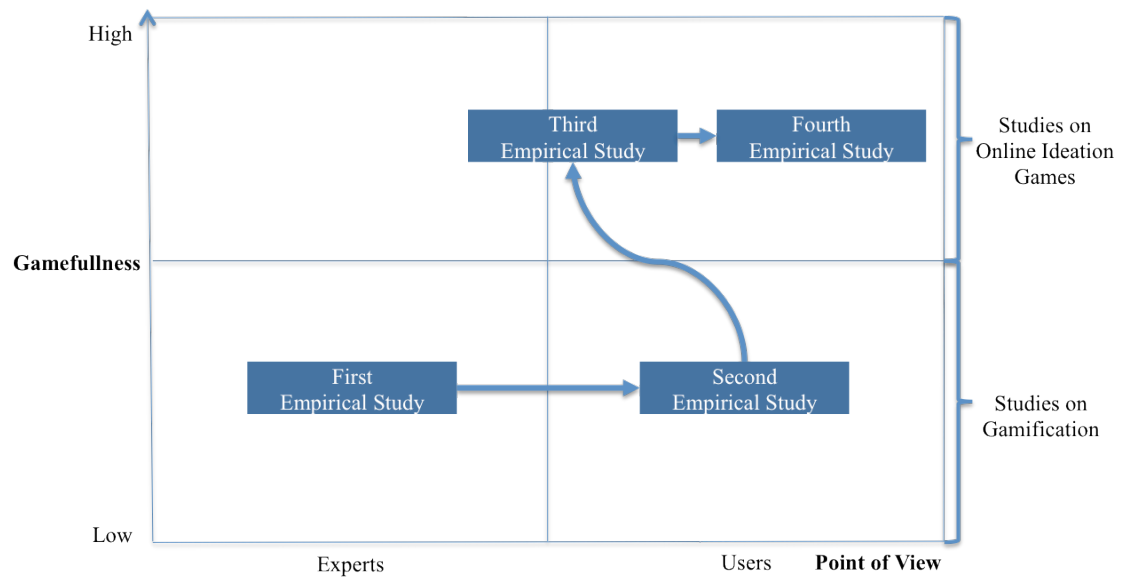


Figure 25: Overview of Empirical Studies

# 1 Applying Game Mechanics to Idea Competitions: Motives, Effects and Challenges

To further understand the potential of gamification and to gain insights into how game mechanics can be implemented in an adequate and sophisticated way, the following chapter<sup>39</sup> takes the **view of experts** into account, that is, the views of persons who make decisions about the implementation of game mechanics in idea competitions. Questions, depicted in Figure 26, serve as the basis of the survey and analysis:

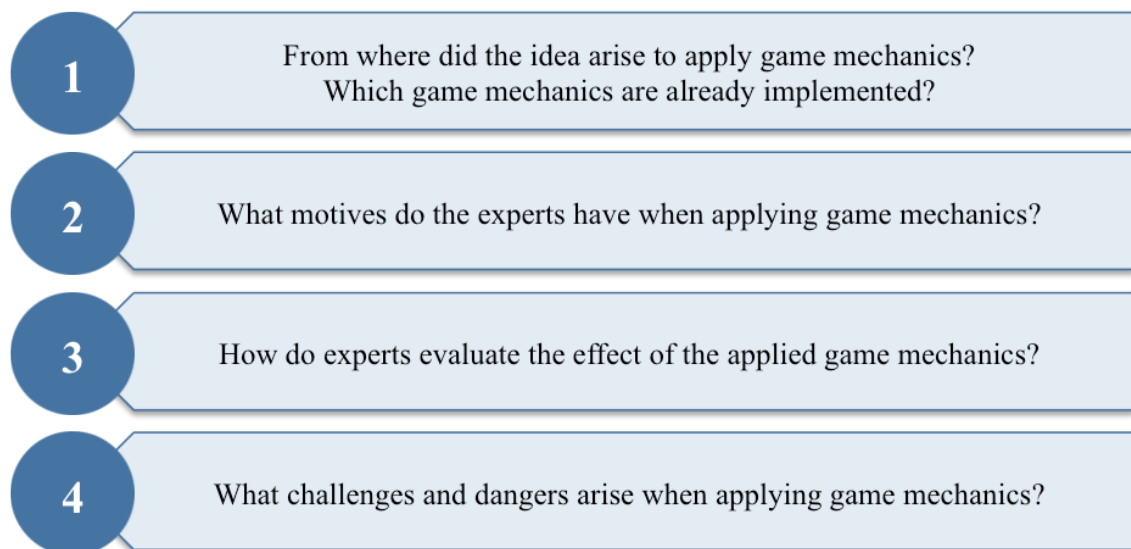


Figure 26: Underlying Questions for Survey and Analysis for First Study

## 1.1 Background Information

The study is based on the collection of primary data in the form of expert interviews. Expert interviews are particularly suitable for interpretive research, if expert knowledge for the design, implementation and/or control of problem solving is from interest (Pfadenhauer 2005). This first study is based on an article published in the *Proceedings of the Multikonferenz der Wirtschaftsinformatik* and presented at the conference *MKWI 2012* in Braunschweig.

Persons in this study are termed experts under the following conditions:

1) They have to have influence on the design of idea competitions and thus on the application of game mechanics. Hence, an expert could work for two types of organisa-

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<sup>39</sup> Chapter III-1 is based on an article published in the *Proceedings of the Multikonferenz der Wirtschaftsinformatik* and presented at the conference *MKWI 2012* in Braunschweig. The full reference is listed in the References at Scheiner et al. (2012a).

tions: Either he works for an agency, which designs and programmes idea competitions for a third party, or for an organisation, which has organised an idea competition in the previous year.

2) They have to have exclusive knowledge about the use of game mechanics in idea competitions.

3) They have to have access to relevant information. This included both insight into the motives for the choice of game mechanics and their effect on the participants.

The identification of the experts was made through the Internet and through literature research (e.g., Bullinger & Möslin 2010; Birke et al. 2011;). By using a field manual, a semi-structured interview was conducted. The field manual consists of open formulated questions. These questions shall help to push the conversation towards specific topics, shall allow giving the conversation a better focus and shall ensure a later comparability of the results on the other (Hopf 1978; Schober & Conrad 1997). The formulation of the questions took into account if the experts worked for an organisation, which designs idea competitions for a third party or for an organisation, which has organised an idea competition in the previous year. The study identified thirty organisations that design and programme idea competitions for a third party or that have organised an idea competition in the previous year. Persons from 12 of these organisations declared themselves willing to participate in the survey. During the interview, it turned out that people of two of the companies did not meet the second and third condition for experts. Thus, the answers of only ten experts are used for the evaluation. Eight of the experts are employed in agencies, and the other two in companies that have organised idea competitions. The companies are headquartered mostly in Europe. Some companies have their headquarters in the United States of America and Asia. The interviews were conducted between March 2011 and April 2011. The average duration was about 40 minutes. All interviews were recorded and transcribed. The method of analysis was based on qualitative content analysis carried out in three steps (Mayring 2008). In a first step the transcribed version of the interviews are summarised into a short version by paraphrasing, generalisation and reduction. In a second step, the unclear content is explicated with additional information (e.g., retrieved from the website of the organisation that the experts work for). In a third step, the summarised and explicated content is structured. Thereby, similar topics that are often mentioned are identified, as are interesting state-

ments, and a ranked order of statements according to their significance is built (Figure 27).

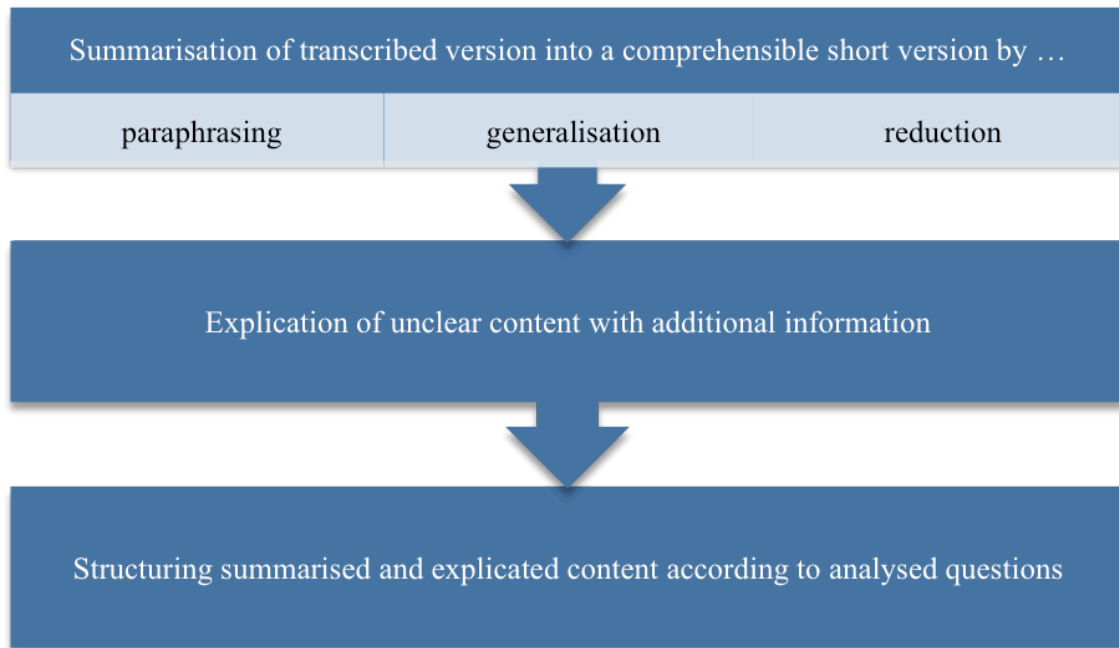


Figure 27: Steps of Qualitative Content Analysis  
(Mayring 2008)

## 1.2 Results

Results are ordered according to the above named questions (see Figure 28).

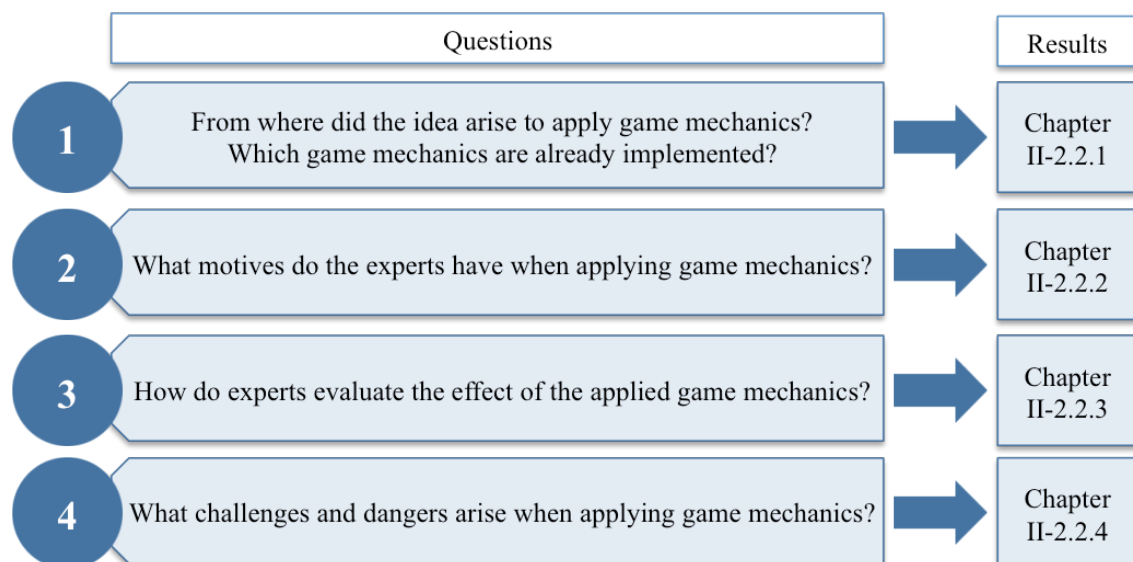


Figure 28: Order of Results of First Study

### 1.2.1 Use of Game Mechanics

The idea of the interviewed experts for using game mechanics in idea competitions comes mainly from the orientation towards existing organisations. Facebook, specifical-

ly, has the function of a role model. Three of the experts explicitly point out in the interviews the importance of Facebook for organising their own competitions. In addition, social networks like Foursquare, and Gowalla or Internet companies like Amazon are called *orientation points*: In Facebook users can rate and comment contributions, in Foursquare and Gowalla they can collect badges and in Amazon products can be rated via social points. In this context expert 1 pointed out “that many decisions are taken this way, [...] [that] it has been seen that this works well elsewhere. [...] And then we thought that we'd make it that way too.” In addition to the orientation towards other companies, knowledge from previous organised competitions or own research play a role for the decision of applying game mechanics. So, an expert states that his own scientific work is essential for the use of game mechanics. Expert 4 states that the decision to implement game mechanics is based on a combination of gained experience and orientation towards other companies: “We have simply learned by watching others. We have examined awards that we have conducted in our company and [...] we considered successful social media applications, especially Facebook. We have [...] watched how something works there and [...] have [then] tried to adapt as much as we can to our competition.” However, partially the application of game mechanics was carried out poorly conceived. Expert 3 gives an example for this: “I think that we haven't really considered this [the application of game mechanics].” Expert 1 expresses this by stating: “We considered the application of game mechanics rather coincidental.”

To increase understanding of how far the application of game mechanics has progressed, experts were asked which game mechanics they have already implemented, which they are about to be implemented, and which they plan to implement in the future. Competitions that were developed or organised by the surveyed organisations are applied mostly game points. Nine experts said that game points were applied in one of their designed or organised competitions. Eight experts stated that social points were used. Seven experts asserted that game points and total points are transferred into leaderboards. The exchange mechanic between the participants also plays an important role. Seven experts indicated that exchange is used in their idea competition. Half of the experts stated that redeemable points have been integrated in the competitions. In addition, an expert is currently working on the implementation of redeemable points. Two experts point out that they use levels in their competitions. Badges have not been used so far; five experts pointed out, however, that they are about to implement them in competi-

tions or can imagine their use in the future. Table 13 summarises the status-quo of applied game mechanics in idea competitions.

Expert	Game Mechanics						
	Game Points	Social Points	Redeemable Points	Badges	Leaderboards	Exchange	Levels
Expert 1	✓	✓	✓	p	✓		
Expert 2				p	✓		
Expert 3	✓	✓	✓	p	✓	✓	
Expert 4	✓	✓					
Expert 5	✓	✓	u	p	✓	✓	✓
Expert 6	✓	✓	✓	p	✓	✓	✓
Expert 7	✓	✓				✓	
Expert 8	✓	✓			✓	✓	
Expert 9	✓		✓			✓	
Expert 10	✓	✓	✓		✓	✓	

Table 13: Status Quo Analysis of Applied Game Mechanics in Idea Competitions

(✓=realised; u=undergoing implementation; p=planned/being considered)

### 1.2.2 Motives for Gamification

According to the interview analysis the overarching reason for application of game mechanics in idea competitions is increasing the motivation of participants. Six of ten experts, altogether, said that this was essential for their decision. Expert 10 explains this with the existing scientific knowledge. For expert 5 “[...] the playfulness [which arises with help of gamification] has the advantage of motivating people, because that's just inherent in the people.” In particular, experts aimed to trigger the intrinsic and internalised extrinsic motives through playful elements. Expert 6 pointed this out: “[...] we wanted to try and keep people engaged beyond [...] making money. Because not everybody makes money on every project. So, we wanted to give people a reason to stick around and sort of incentive participation from another standpoint, from a non-monetary standpoint.” Also expert 1 emphasises that game mechanics were applied, “because we [...] believe that in our case [...] the intrinsic motivation is essential”. Expert 2 also applied a leaderboard, because he considers that it can trigger intrinsic motives. According to expert 4 game mechanics such as points, leaderboards and exchange are implemented, because it is “important to develop some kind of conversation. So that someone does

not just throw an idea into a black hole and hears nothing more about it. But there should be a possibility for immediate reaction according this idea.”

Five experts explicitly state that the increase of participants perceived fun is an important motive for applying game mechanics. The aim of expert 9 is to make the competition generally as entertaining as possible. Participants should not consider the participation “as work or something like that, but really make joy out of it” said expert 10. Also for expert 1, it was always clear that “it must be fun for people. Otherwise they don’t do it and the result is not so good.” For expert 4, game mechanics are elements that make the competition funnier.

In addition to motivation and especially fun, recognition is also an important motive for the application of game mechanics for four of the experts. Expert 4 points out: “[...] it is - I think - a human phenomenon that one readily receives some kind of feedback for what one does. And we believe that someone who is very hardworking and who makes a lot and involves herself or himself in the working process could show this in their profile.” Expert 5 inserts points and levels, because “[...] we want to give the users the opportunity to make themselves visible in this community and to present themselves.” Expert 6 has the same point of view: “[...] we think that people enjoy it, you know, kind of like being able to say, ‘Oh hey, I’m in the top 5 here’, ‘I’m in the top 10 this year.’”

Furthermore, a few experts (2, 8 and 9) think that by applying game mechanics they can get more ideas. For example expert 2 states: “A company pays us money for the ideas that they receive. [...] So we want to increase the number of submissions. We think that we can increase that amount if we make it more fun.”

Five experts (expert 1, 3, 4, 5, 10) hope to increase by using gamification not only the quantity, but also the quality (i.e., the creativity degree) of submitted ideas. This really brings the statement of expert 5 to the point. To the question, what he expects from the use of game mechanics, he answered as follows: “Humour and game enrich creativity because the people are more relaxed, let go and then begins lateral thinking.” From the experts’ point of view, there are several reasons why game mechanics affect the quality and creativity of the submitted ideas: One reason is that game mechanics give users clues to what is valued in the system and what goal they should follow. Expert 5 explains: “When someone makes mischief, he will never achieve anything. This is basically just like in a game: If you are not abiding by the rules of the game, then you’re not the winner.” Hence, game mechanics give signals to the user about how a task can be



solved successfully within the system. Expert 8 illustrates this effect with the example of a leaderboard: “I think that is where the leaderboard is very interesting, because it gives you some direction. It signals to everyone: ‘Here is a successful example of what you should be trying to do.’” Experts 4, 5 and 8 also believe that game mechanics help for improving the ideas, because they allow quick feedback. This is shown, for example, through the statement of expert 4: “We hope that the submitted ideas will be improved. The interacting inspiration of ideas was important to us.” Expert 5 also points out that the feedback that is induced by game mechanics “[...] is important for generally improving the idea or for its further development.”

Expert 3, 5, 8, 10 hope that gamification strengthens the feeling of belonging to a community: “I believe that by using such mechanisms a stronger innovation community can be established” (expert 5). Expert 3 adds: “Social points in the community are used to support the community’s spirit.”

With the help of game points, social points or leaderboards, the experts also hope to simplify the selection process for ideas (expert 8) and to identify particularly active or creative innovators (expert 2, 5, 6): “Users, that have meaningful ideas, [...] may be more visible” says expert 5. Expert 8 sees as the motive for using points or leaderboards, “that the highest scoring people on that platform get invited to do additional work.”

Figure 29 summarises experts’ motives of gamification.

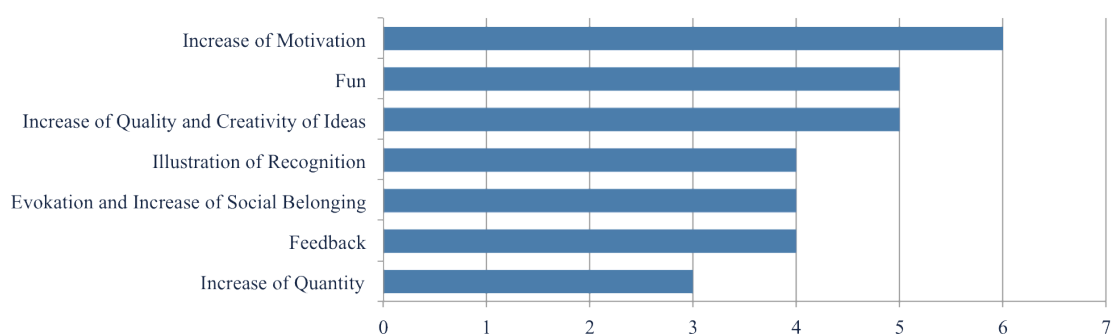


Figure 29: Experts’ Motives for Gamification

### 1.2.3 Effect of Game Mechanics

Altogether, the experts judge the effect of game mechanics positively. The expectations of expert 4 were, “met or almost over-met” and expert 7 even confirms a “very serious impact.” Expert 1 was also satisfied with the use, so that “we want to expand it [gamification] even more.” Specifically the experience with the use of leaderboards was so far

positive, because they give excellent grounds for writing many comments. Expert 3 reported that the allocation of social points together with leaderboards strengthens social belonging of the participants and causes increased activity. It led “to nice self-reinforcing tendencies, so that there were formed groups that feel really committed to the community. [They go to the page with the leaderboards] and look: ‘Ah, I’ve gained more points, very cool and this person now has more than me. I want more than him!’” Expert 5 has a similar point of view. He thinks that the exchange among the participants especially has a positive effect on the activity and on the quality of ideas. For expert 8 the use of points and leaderboards has the advantage that the participants were given an orientation for their own behaviour, which was highly valued. Expert 9 considers that the double number of comments and other activities is due to the use of game mechanics. Expert 6 emphasised the positive experiences with leaderboards. It has gone so far with him that the participants write to him: “‘Hey, how come my points have not updated yet as I moved up three places on the leaderboard?’ And I would have to say ‘well, it takes a hundred minutes.’” However, this behaviour began only after promising rewards for the best participants. Expert 10 considers the use of game points as negative. Therefore, according to expert 10 this mechanic will no longer be used in the future. The exchange among the participants could meet the expectations of expert 10 and will be used in the future. Expert 2 was not able to give an opinion at the time of the survey, because game mechanics had been applied only recently.

#### 1.2.4 Challenges and Dangers of Gamification

The experts see a number of challenges that must be solved, if game mechanics are applied to idea competitions:

First, there is a risk of causing undesirable behaviour when incentives are set incorrectly. Challenge is here identifying and rewarding valuable behaviour. Expert 8 explains: “And I think that this is one of the biggest challenges, right? We want to award points, but we want to award points for ‘ham’ and we want to penalise ‘spam’.” If unwanted behaviour, such as spam-like comments or thoughtless opinions, is rewarded, the incentive system does not work anymore and the quality of the contributions decreases. Expert 2 says: “We would be decreasing the value of our leaderboards if we give away points for stupid stuff.” Expert 10 summarises this relationship as follows: “We gave up using [game points] because one or another feels inspired [...] to post ‘spam-like’, for example. And this led to reduced quality of the average contributions. And we said that

such a purely quantitative calculation, which can also be further intensified, is not effective. What should be rewarded is a total contribution, a total quality.”

Another challenge is that game mechanics do not trigger behaviour, because users do not value them. Expert 6 states: “I think the real danger with game mechanics is that they can come off as kind of cheesy. If you are not careful, people might think: 'What is this silly badge? This does not mean anything.'”

Furthermore, the experts also see that gamification bears the risk to evoke fraud. Social points, in particular, provide this opportunity. Expert 8 refers to a case where users had created more than one account in order to evaluate each other. Expert 3, 7 and 8 had the experience that there are ‘rating gangs’ (expert 3). Expert 8 says: “We have already seen this, that people try and use different rating strategies to support their friends and vote against their competitors.”

The experts are at odds with each other how transparent an incentive system should be which uses game mechanics. Expert 3 speaks for complete transparency: “When we haven’t explained how the points were composed there was a major uprising and all people wanted to know details. Now they know it exactly and it is good. But this is actually the most important thing: If the platform works very transparently, then you can include almost all of the elements.” On the other hand, expert 8 does not recommend full transparency: “So, I think that probably the hardest thing for me is trying to strike a balance between something that people understand enough that they realise there is some recognition. But once people understand it too well there are always people who try to manipulate and to reverse engineer the system.”

### **1.3 Discussion and Future Research**

Game mechanics are widespread in practice and are considered possible solutions to existing challenges in idea competitions. There are a number of use purposes, such as increasing the motivation of the participants, the quantity and the quality of ideas. However, the findings in this study have indicated that further research is needed to put the previous experience on a solid scientific basis. Thus, it is possible to prove these explorative insights on one hand, and to avoid the dangers by the use of game mechanics on the other. Because the answers of the experts show that, along with all positive experiences, the use of game mechanics is not trivial, requires well-thought design concepts and is related to considerable effort in its implementation. For example, game mechan-

ics can also cause undesirable behaviour and even misbehaviour such as fraud. The present study can represent only the first step in this scientific process, since the work has limitations and cannot answer some questions because of the research approach. The number of respondents is limited to 10 participants. The size of the companies also varies significantly. Thus, some of the experts come from small companies, others from large multinational companies. In evaluating the statements, according to the evaluation of game mechanics, it must also be noted that none of them is based on direct measurement or research, but on the experts' own observations or on indications of the participants. An exception here is expert 9, who stated that in his case a statistical analysis that had to make the effects traceable was made. This means that the information about the effect of game mechanics is not objectively verified. Therefore, the general conclusions remain for future research. In addition, not all of the game mechanics described in chapter II-3.2 were used by the experts, and the composition of the used game mechanics also differs greatly between the used idea competitions and the implemented ones. Although the majority of experts come from Europe, the participants come from different countries and cultures. This includes the possibility that cultural influences have affected the findings. Whether cultural influences exist and what kind of significance they have should therefore be examined as well.

## 2 Gamification of Online Idea Competitions

To gain first insights on gamification in the context of innovation management, this study<sup>40</sup> analyses an online idea competition<sup>41</sup> that was organised by an OEM of the automotive industry. For years the European automotive industry has been trapped by innovation pressure — a development for which there are several important drivers. The most important ones are saturation of consumption in core markets such as Central Europe, the United States and Japan, increasing international competition, rapidly changing environmental objectives, regulations and growing customer demands (for performance, design, comfort, entertainment, safety and fuel economy) (e.g., Kalmbach 2003, p. 34-40; Diez 2006, p. 161 and p. 406). As a consequence, OEMs have started to open their innovation process and use a number of open innovation tools (for an overview see Chapter II-1.3). For example, BMW, Daimler, Peugeot, Renault, Toyota and Volkswagen used online idea competitions to obtain ideas from external sources, namely customers. Table 2 in Chapter II-1.3.2 illustrates the rapid increase of online idea competitions organised by the mentioned OEMs in the last two years.

### 2.1 Background Information

The OEM that organised the analysed idea competition is one of the largest multinational companies in the automotive industry. Headquartered in Germany, the company produces cars as well as automotive services. Its core markets are Europe and China, and in 2010 it sold over 7 million vehicles. The company is innovation-driven: According to the *2010 EU Industrial R&D-Investment Scoreboard* report (Hernandez 2010), it is one of the top research and development investors in Europe. Customers are, however, mainly integrated into the innovation process only in the late stages. So far, the company had only a few attempts to open the fuzzy front end<sup>42</sup> of the innovation process with social media based open innovation tools. However, the most often used tool in the last two years had been an idea competition. The analysed idea competition was organised by a single brand of the OEM, and it took place in an eight-week period during the

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<sup>40</sup> This Chapter is based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings* and presented at the *Informatik 2011* conference in Berlin. The full reference is listed in the References at Witt et al. (2011a).

<sup>41</sup> For a definition for the term *idea competition* see Chapter II-1.3.2.

<sup>42</sup> For a definition for the term *fuzzy front end* see Chapter II-1.1.

summer of 2010. Participants (customers, coders and developers) were asked to submit application-ideas for a future navigation system. Ideas had to be submitted online either in text or implemented form. Ideas in an implemented form could be developed with a software development toolkit (SDK). Six weeks after the end of submission ideas, nine experts evaluated the ideas according to different criteria. The best ideas were awarded cash and monetary compensation worth around 10 000 euro.

### 2.1.1 Game Mechanics in the Analysed Idea Competition

In the analysed idea competition, three game mechanics were integrated — game points, social points and leaderboards (Figure 30).

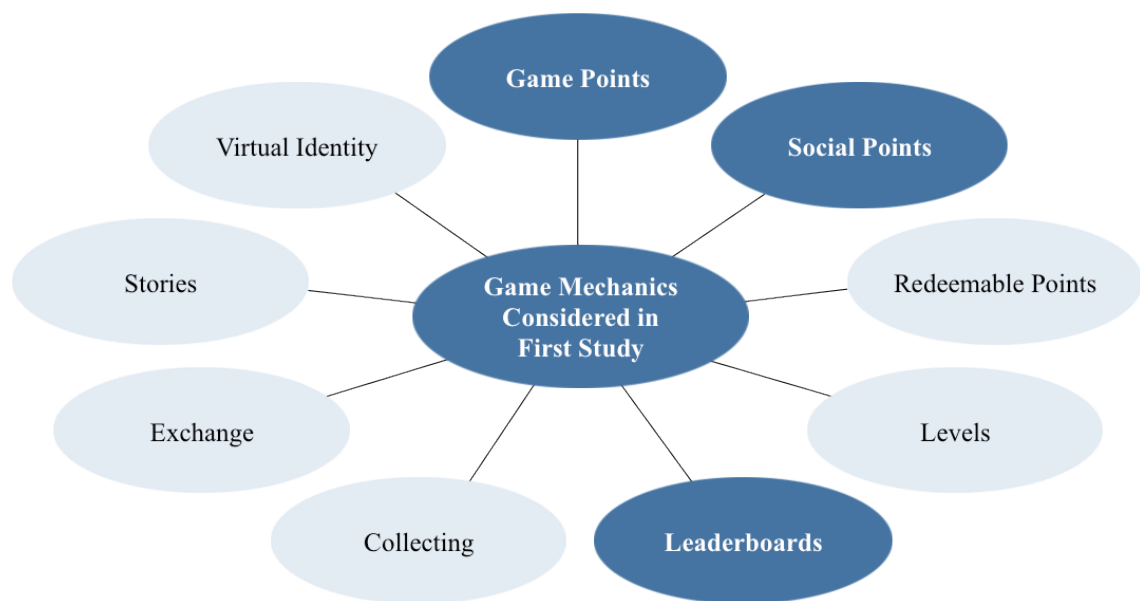


Figure 30: Game Mechanics Considered in Second Study

In the idea competitions, game points were given for different activities. Users received **game points** for contributing ideas, writing a comment, leaving a message to another member or evaluating an idea, as well as for a once-only upload of a profile picture.

Other participants could also award **social points**. Idea contributors in the underlying idea competition could get social points when participants evaluated the ideas positively in the form of a “thumbs-up” button.

In the analysed idea competition, participants also could see, in six different **leaderboards**, their own ranking position in relation to others. In a drop-down menu, participants could choose one criterion (number of social points, number of comments, number of evaluations, number of messages, number of ideas, number of aggregated points).

### 2.1.2 Research Questions

The overall aim of this study is to shed further light on the effect of game mechanics within online idea competitions. Therefore, a threefold procedure was chosen. The following research questions reflect the procedure.

In a *first step*, both the motives individuals had for engaging in the referred competition, and the ways in which these motives for participation are similar to the ones of previous studies (Chapter II-1.5.2), are analysed. Therefore, the following research question is proposed:

Research question 1: What are the main drivers of motivation within this idea competition?

In a *second step*, the level of intrinsic motivation (i.e., enjoyment), involvement and flow (Chapter II-1.5.1) is examined, in order to gain an overall impression of participants' motivational states. This step is necessary for understanding of the effects of game mechanics regarding these constructs in later stages of the described procedure.

Chapter II-1.5.2 demonstrates that intrinsic motivation has a strong effect on participation in open innovation. To see how intrinsically rewarding individuals perceived participation to be and, in a narrower sense, how they considered the activity to be enjoyable, the second research question is proposed:

Research question 2: Do participants within this online idea competition experience enjoyment during the competition?

Perceiving an activity as enjoyable can lead individuals to attach significance, importance or relevance to it. In this case, individuals are involved in a task (Chapter II-1.5.1). Individuals who engage in a highly involving idea competition are more focused, feel more competent to make contributions and feel more supported (Füller 2009 et al.; Füller 2010 et al.). Hence, the level of involvement in the analysed idea competition is also from interest. The following research question is thereby proposed:

Research question 3: Does participation within this idea competition lead to task involvement?

Sometimes individuals who are intrinsically motivated and “act with total engagement” (Csikszentmihalyi 1975, p. 3) experience a feeling of flow (Chapter II-1.5.1). Flow experience can attract persons and can give them a feeling of reward. Therefore, Füller (2010) argues that flow-theory “may give further guidance in the actual specification of a rewarding co-creation experience” (p. 119). For this reason, the following research question is proposed:

Research question 4: Is flow fostered within the analysed idea competition?

A *third step* examines how participants generally perceive the game mechanics that were integrated into the analysed idea competition (Chapter III-2.1.1). Furthermore, the idea behind gamification is to positively influence specific constructs such as enjoyment, flow and involvement (Chapter II-4.1), so the analysis addresses whether interdependencies exist between the specific constructs and the integrated game mechanics, and if so, in which capacity the interdependencies exist. As a consequence, the following research questions are proposed.

Research question 5a: How do participants perceive game mechanics?

Research question 5b: Are there interdependencies between game mechanics and any of the constructs noted as flow, enjoyment and task involvement?

### 2.1.3 Methodology

For the purpose of this study, a quantitative analysis on the basis of an online survey was conducted.

The questionnaire consisted of three parts. The first part addressed personal information such as gender, age, country and level of education. In the second part, general questions regarding previous experience with idea competitions were asked, as were questions regarding design and programming skills. The third part comprised aspects related to the competition itself, and the perception and evaluation of the competition. Thus, this section contains questions regarding motives for participation (research question 1), enjoyment (research question 2), involvement (research question 3), flow (research question 4) and the perception of game mechanics (research question 5).



Regarding the motives for participation, an open question was used. The answers to these open questions were aggregated to groups. The variables of enjoyment were oriented on Füller (et al. 2009)<sup>43</sup>, who have developed a scale based on Ghani and Deshpande (1994) (Chapter II-1.5.1). To measure task involvement, the enduring involvement scale (EIS) from Higie & Feick (1989) was used (Chapter II-1.5.1). The items of flow were oriented on Walcher (2007, p. 164). Items regarding the perception of game mechanics directly refer to the integrated game mechanics (points and leaderboards). To measure the perception of game mechanics, two general aspects are considered — first, comprehension of the game mechanics, and second, perceived positive effect. The perceived positive effect was measured with items that asked participants to evaluate the influence of integrated game mechanics on their perceived happiness and motivation. To measure the variables enjoyment, involvement, flow and perception of game mechanics, a five-point Likert-type scale was used, ranging from “strongly agree” (1) to “strongly disagree” (5). Table 14 gives a summary of applied measures for task involvement, enjoyment, flow and game mechanics.

Variables	Items
Enjoyment	The participation in the contest was fun.
	The participation in the competition was enjoyable.
	The participation in the competition was exciting.
Task involvement	It is enjoyable to generate, develop and evaluate new ideas on online idea competitions.
	It is interesting to generate, develop and evaluate new ideas on online idea competitions.
	It is stimulating to generate, develop and evaluate new ideas on online idea competitions.
	It is exciting to generate, develop and evaluate new ideas on online idea competitions.

<sup>43</sup> The study of Füller et al. (2009) is illustrated and summarised in Chapter II-1.6.2.

<b>Flow</b>	Time passed quickly for me during the task performance.
	I thought about other things than the task during the participation.
	I was distracted from the activity during the participation.
	The development of ideas made me feel content.
<b>Game mechanics</b>	Gaining points made me happy.
	The allocation of points was comprehensible.
	Gaining points increased my motivation to introduce further ideas.
	During the contest I started to check my points more often.
	The decrease in my ranking on the leaderboard made me feel less happy.
	Improving my ranking on the leaderboard made me feel happy.
	Improving my ranking on the leaderboard increased my motivation to introduce further ideas.
	The calculation of the leaderboard was comprehensible.
	The decrease of my ranking on the leaderboard lowered my motivation to introduce further ideas.

Table 14: Summary of Applied Measures

The data were mainly analysed with frequencies and cross-tabulation with respect to the small sample. Partial correlation analysis is conducted. The prerequisite of interval scaling was ensured in the formulation of questions, while the prerequisite of normal distribution was tested with the Kolmogorov-Smirnov-test. All items, with the exception of enjoyment, were normally distributed. Thus, either the Pearson correlation coefficient or the Spearman rank correlation coefficient was applied according to the (non-)existence of normal distribution.

## **2.2 Results**

The survey was carried out from July 6, 2010, to August 6, 2010. Almost 530 participants of the idea competition were contacted via mail. From these, 55 followed the link to the questionnaire, and 30 of those questionnaires could be used for the analysis. This represents approximately 6% of all participants in the online idea competition. The sample comprised 28 male and 2 female respondents. Of these respondents, two had earned a PhD, twelve had completed a bachelor or a master's degree, two had graduated from high school and two did not specify their achieved educational level. Furthermore, a somewhat mixed picture regarding age characterised the sample. The youngest respondent was 19 years of age, while the oldest was 57 years old at the time of the survey. The median age was 26 years. Regarding country of origin, Germany had the most respondents, with ten participants. Five respondents were from India, and two each were from Russia, Egypt and Italy. One respondent each came from Spain, China, Romania, Portugal, Mexico, Brazil, Turkey, Canada and Israel. The majority of respondents were taking part in an online idea competition for the first time. Seven stated that they had already participated in one idea competition, and three had participated in more than one idea competition.

### **Motives for participation**

The most important motives for participation, as determined from the analysis, were use of existing knowledge and curiosity. Reward-driven and therefore (internalised) extrinsic in nature was the third-most important motive, with four responses, and subsumed elements such as monetary or self-promotional aspects. Overall, it could be concluded that the participation was mainly driven by intrinsic or internalised extrinsic motives (see Figure 31).

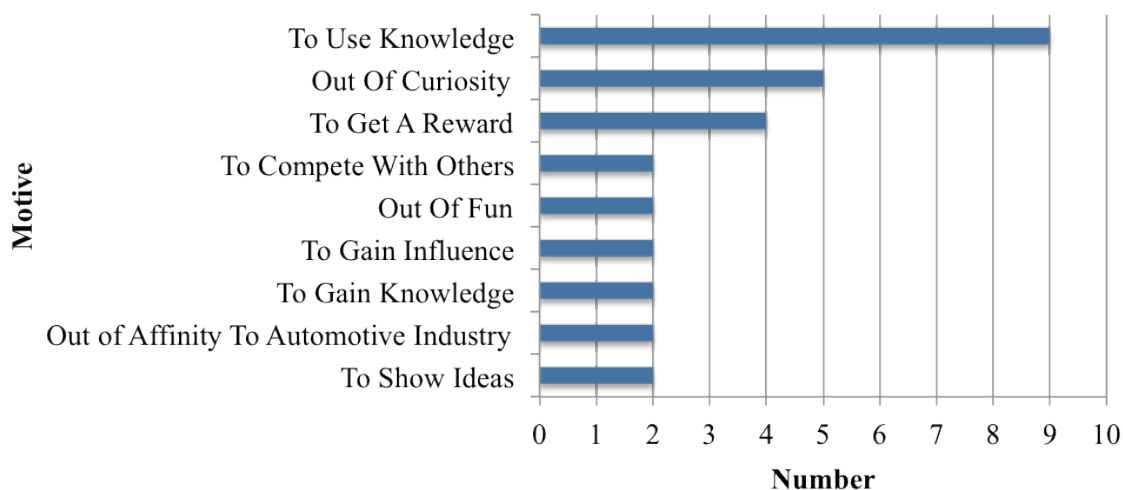


Figure 31: Motives for Participation  
(n=29)

## Enjoyment

The majority of participants evaluated the participation in the competition positively. All three enjoyment-items surpassed an approval rating of more than 50%. In the items “enjoyable” and “exciting”, the mode was the highest degree of agreement (see Figure 32).

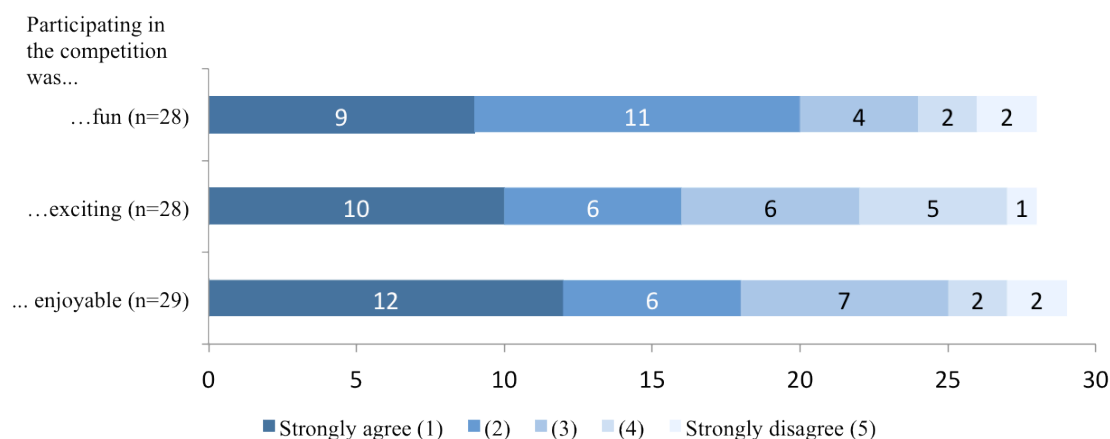


Figure 32: Results: Enjoyment

(Five-point Likert-type scale with answers from “strongly agree” (1) to “strongly disagree” (5))

## Task involvement

The results of enjoyment were also reflected with respect to task involvement. The values of all four items showed a medium to full agreement with the statement that the

generation, development and evaluation of novel ideas was enjoyable, interesting, stimulating and exciting (see Table 15). The mode for all four variables was the tendency to agree, and not more than three people tended to disagree or completely disagree with the statements. In addition, the items were significantly correlated with the enjoyment items “enjoyable” and “exciting” (Pearson correlation coefficient: 0.379-0.724;  $p < 0.05$  (2-tailed)). The items “exciting” (Spearman  $Rho = 0.440$ ) and “interesting” (Spearman  $Rho = 0.412$ ) were significantly ( $p < 0.05$  (2-tailed)) correlated with “enjoyment”.

Task involvement	AM	SD
It is enjoyable to generate, develop and evaluate new ideas on online idea competitions. (ENI) (n=29)	1.90	0.860
It is interesting to generate, develop and evaluate new ideas on online idea competitions. (INI) (n=29)	1.97	0.981
It is stimulating to generate, develop and evaluate new ideas on online idea competitions. (SNI) (N=30)	2.17	1.085
It is exciting to generate, develop and evaluate new ideas on online idea competitions. (EXNI) (N=30)	2.17	1.085

Table 15: Results: Task Involvement

(Five-point Likert-type scale with answers from “strongly agree” (1) to “strongly disagree” (5))

## Flow

The items regarding flow support prior findings (Füller et al. 2006), as they indicate as well that the participants started to be immersed in the competition. They tended to feel that time passed quickly, they were not easily distracted, and they felt content when developing ideas (see Table 16). Simultaneously, they tended to think about other things than the task given.

Flow	AM	SD
Time passed quickly for me during the task performance. (TPQ) (N=30)	2.30	1.119
The development of ideas made me feel content. (DIC) (N=30)	2.13	1.008
I thought about other things than the task during the participation. (TAO) (n=29)	2.79	0.978
I was distracted from the activity during the participation. (DA) (n=29)	3.48	1.022

Table 16: Results: Flow

(Five-point Likert-type scale with answers from “strongly agree” (1) to “strongly disagree” (5))

### Game mechanics

The perception of game mechanics within the idea competition was mainly characterised by the tendency to evaluate its effect less strongly, which is mainly due to the effect of predominantly evaluating the statements with the value 3 (“neither agree...nor disagree”). Respondents tended to state that the influence of an increase or a decrease on the leaderboard had only a minor effect on the motivation to introduce further ideas about their level of happiness (see Table 17). Only a small minority of respondents, however, did not pay attention to the leaderboard itself (n=6) or seldom looked at it (n=2). Ten respondents checked the leaderboard at least once per week, and eight did so daily. Ten respondents agreed with the statement of having started to check their points more often during the competition.

Game mechanics	AM	SD
Gaining points made me happy. (GPH) (n=27)	2.74	1.259
The allocation of points was comprehensible. (AP) (n=28)	2.96	1.138
Gaining points increased my motivation to introduce further ideas. (GPM) (n=28)	2.96	1.201
During the competitions I have started to check my points	3.04	1.427

more often. (CP) (n=27)		
The decrease of my ranking in the leaderboard made me feel less happy. (DRH) (n=28)	3.21	1.315
Improving my ranking in the leaderboard made me feel happy. (IRH) (n=28)	3.21	1.287
Improving my ranking in the leaderboard increased my motivation to introduce further ideas. (IRM) (n=28)	3.29	1.329
The calculation of the leaderboard was comprehensible. (CA) (n=28)	3.32	0.945
The decrease of my ranking in the leaderboard lowered my motivation to introduce further ideas. (DRM) (n=28)	AM=3.32	SD=1.389

Table 17: Results: Game Mechanics

(Five-point Likert-type scale with answers from “strongly agree” (1) to “strongly disagree” (5))

### Enjoyment and game mechanics

If respondents agreed that the participation was fun, exciting and enjoyable, they also agreed, in the majority, with the statement that gaining points made them happy (GPH). However, it also appears in the examination of GPM (“Gaining points increased my motivation to introduce further ideas”) and enjoyment, that if participants assented to the items of enjoyment, they disagreed in the majority with GPM. It was also found that people who agreed with the two enjoyment-items “fun” and “exciting” also agreed in the majority with the statement about having started to check their points more often (CP). In matters of the item about participation being enjoyable, no tendency could be found, as the same number of people agreed and disagreed with the statement to CP. Results also show that participants evaluated the allocation of points comprehensibly (AP) in the majority if they perceived the participation as fun, exciting and enjoyable. The calculation of the leaderboard, however, shows the tendency of the majority of respondents to disagree with its comprehensibility, if there was an agreement with the items of enjoyment. The evaluations of IRM (“Improving my ranking in the leaderboard

increased my motivation to introduce further ideas”), DRM (“The decrease of my ranking in the leaderboard lowered my motivation to introduce further ideas”), IRH (“Improving my ranking in the leaderboard made me feel happy”), and DRH (“The decrease of my ranking in the leaderboard made me feel less happy”) were characterised by a majoritarian disagreement if the enjoyment items are agreed with.

### **Task involvement and game mechanics**

Gained impressions in enjoyment were confirmed in the comparison of task involvement and game mechanics. Isolating the positive statements about SNI (“It is stimulating to generate, develop and evaluate new ideas on online idea competitions”), ENI (“It is enjoyable to generate, develop and evaluate new ideas on online idea competitions”) and INI (“It is interesting to generate, develop and evaluate new ideas on online idea competitions”), participants agreed, in the majority, with the statement that gaining points made them happy. In the task involvement item EXNI (“It is exciting to generate, develop and evaluate new ideas on online idea competitions”), it was found that most respondents disagreed with GPH. If INI and SNI were positively rated, those results were mirrored by a positive evaluation of GPM by the majority, whereas mainly opposing evaluations to GPM in ENI and EXNI described the response behaviour. Where the generation, development and evaluation of ideas was rated as stimulating, enjoyable and interesting, participants agreed in the majority that they had started to check their points more often during the competition. In the comparison of task involvement items and the allocation of points, the majority of responses agreed with the comprehensibility if those answers to task involvement that agreed with the statements were considered. The calculation of the leaderboard, however, was seen as not comprehensible if the positive evaluations of task involvement items were taken. The same applies to DRH, IRH, DRM and IRM.

### **Flow and game mechanics**

The comparison of flow (TPQ, DA, TAO, DIC) and the item “Gaining points made me happy” (GPH) shows that those participants who agreed with the statement about being content while developing new ideas (DIC) agreed also, in the majority, with the statement that gaining points made them happy. In addition, the majority of participants who stated that gaining points made them happy felt that time passed quickly during the task performance (TPQ). If respondents indicated not having thought about other things during participation (TAO), they disagreed with GPH in the majority. The just described



tendency in the responsiveness could also be found in a similar way in the comparisons of DIC, TAO, DA and the item “Gaining points increased my motivation to introduce further ideas” (GPM). The majority of participants agreed with with GPM if participants also agreed on the flow-items. The evaluation of statements between AP (“The allocation of points was comprehensible”) and all flow-items shows that participants assented with AP in the majority if they agree to the statements regarding flow. The statements about the calculation of the leaderboard differed from the former finding only in the item TAO. In this case, the evaluation of both items indicated opposing results. The response behaviour with respect to flow and IRH (“Improving my ranking in the leaderboard made me feel happy”) was mainly characterised by contradicting evaluations. If participants agreed with the flow items they disagreed predominantly with IRH. For TPQ and IRH, no tendency could be found. With DRH (“The decrease of my ranking in the leaderboard made me feel less happy”), IRM (“Improving my ranking in the leaderboard increased my motivation to introduce further ideas”) and DRM (“The decrease of my ranking in the leaderboard lowered my motivation to introduce further ideas”), the picture was even clearer, as participants who affirmed the flow items disagreed in a majority with the statements regarding the game mechanics.

### **2.3 Discussion and Future Research**

The findings of this study offer firsthand insight into the effect of game mechanics within an online idea competition. However, it must be borne in mind that this study faces several limitations. With 30 questionnaires, the sample is very small and does not fulfil the requirements of representativeness. In addition, only one specific competition was analysed. Within the competition, only a few game mechanics (points, leaderboard) were applied. The application was not regarded as an essential component in the definition and architecture of the idea competition, and was thus not in the main focus during the development of the online competition. It is, as such, a first try for gaining experience with game mechanics. The game mechanics were subsequently not implemented in a sophisticated way. As a consequence of these limitations, the study is explorative in nature and all findings are in the area of tendency statements.

The participation was in accordance with prior studies (e.g., Füller et al. 2006) that are mainly driven by intrinsic or internalised extrinsic motives. Participants tended to agree that flow is fostered by the idea competition, that they enjoyed the tasks and that they were immersed in the tasks. Regarding the evaluation of the game mechanics in general,

it has to be stated that perception of them is not as strong as expected, and the degree of agreement is lower than expected. An explanation for these findings is probably the way game mechanics were used in the competition. Leaderboards were difficult to find, they were confusingly presented, the calculation was unclearly described and the presentation was not adjusted to the individual participants on the website. This is supported by the statements regarding the calculation of the leaderboard and the effect of increase or decrease of the ranking in the leaderboard itself if mirrored with statements in agreement regarding flow, enjoyment and task involvement. Almost all participants who stated having experienced flow and enjoyment, and who were immersed, disagreed with a statement that an increase or decrease of their own position in the leaderboard had any effect on the motivation or the degree of happiness. There are, however, a number of hints that game mechanics can be a promising and fruitful solution to motivate participants in online idea competitions. In all three constructs (namely flow, enjoyment and task involvement) the item “gaining points made me happy” received majority agreement if compared with positive statements towards the single items of flow, enjoyment and task involvement. There was a simultaneous tendency for those participants who agreed with the statements regarding flow, enjoyment and task involvement to start to check their points more often during the competition. Regarding the statements about flow, there is, furthermore, an indication that gaining points motivated the introduction of further ideas.

In conclusion, the analysed idea competition offers hints on what positive effects the implementation of game mechanics may have, and what may happen if game mechanics are implemented in an inadequate and unsophisticated way. Their potential is simply not accessible, and thus cannot offer an important contribution to the success of an online idea competition. To further understand their potential and to gain insights into how game mechanics can be implemented in an adequate and sophisticated way, further studies are needed.

### 3 Sparking Motivation and Creativity with ‘Online Ideation Games’

This study<sup>44</sup> aims to examine if and why an OIG can motivate to generate creative ideas. Using ready-made software (SCVNGR) and adopting the method of experimental prototyping, an OIG named *Campus Game* was developed and evaluated. *Campus Game* was launched as a pilot at a large German university in the winter term of 2011/2012 in order to generate new ideas for improving its services and infrastructure. The number of students taking part in the game was 77, although no extrinsic rewards (such as marks or monetary compensation) were promised or given. The evaluation of the game is threefold. First, the motives responsible for playing are examined. Second, the degree of players’ involvement is analysed and its main driver is identified. Third, the creativity degree of ideas generated by the players is investigated. To examine the motives, the degree of players’ involvement and its main driver, 34 players were surveyed after the end of the game using an online questionnaire. To evaluate the creativity of ideas experts were interviewed using consensual assessment technique (Chapter II-1.6.1).

#### 3.1 Background Information

In the following section the research process (Chapter III-3.1.1), the *Campus Game* (Chapter III-3.1.2), operationalization and data collection (Chapter III-3.1.3) are described in detail.

##### 3.1.1 Research Process

Initially four *experts* were identified by a pyramiding-approach (Bijker 1995). Persons were classified as *experts* if they worked for the university and had exclusive knowledge about its complaint and innovation management. Experts also needed to have access to information about areas in which new ideas were needed in the university environment. The interview with the experts was threefold: First, experts are asked about the existing university’s innovation process and students’ motivation to contribute ideas for the improvement of the university’s offer. Second, experts are asked to name conditions, that the OIG *Campus Game* was required to meet. Third, they are asked to formulate possible mission topics. The face-to-face interviews were transcribed and

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<sup>44</sup> This chapter is based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings* and presented at the *Informatik 2012* conference in Braunschweig. The full reference is listed in the References at Witt & Robra-Bissantz (2012).

evaluated following the procedure suggested by Creswell (2009, p. 173-202). Following the interview process, the *Campus Game* was developed using the concept of experimental prototyping (Manninen 2002; Holopainen 2011). Experimental prototyping is a typical method in the preproduction phase of a game development process; it facilitates testing the game to receive input about its design idea. In addition, experimental prototyping permits the observation of the behaviour of potential players (Holopainen 2011). According to Manninen (2002), the use of ready-made software for game prototyping is a promising approach. For this purpose, the ready-made software SCVNGR was used for the *Campus Game*-pilot. SCVNGR ([www.scvngr.com](http://www.scvngr.com)) is a platform, that facilitates the creation of a multi-player game. During a short pre-test phase of two weeks the functionality of the software was tested and the practicality of missions was improved, after which the pilot was launched. The game had a predefined duration of 59 days between the 3<sup>rd</sup> of December 2010 and the 30<sup>th</sup> of January 2011. During this period, 104 students of the university registered for the game. Of those registered students, 77 actually played the game, which represents 74%. Subsequently, players were asked regarding their motives and involvement via an online questionnaire. Finally, an expert jury evaluated the 73 ideas generated while playing, which related to new services and infrastructure improvements at the university. For evaluation, Amabile's Consensual Assessment Technique (CAT) was used (Amabile 1982a; 1996) (see Chapter II-1.6.1).

### 3.1.2 Research Background: The *Campus Game*

Due to increasing mobility of students, the Europeanization of higher education and growing number of colleges and universities, students in Germany have a much higher awareness of their right to receive a good product (Gudlaugsson 2010). Thus, it is essential to integrate students in ideation to improve the products which universities offer (Williams 2002). The product of universities not only consists of academic teaching, but also of social and physical elements, such as infrastructure (Sevier 1996). To integrate students in the innovation process, the university under investigation launched a blog in February 2009. The blog gives students the opportunity to submit complaints and contribute ideas to improve university's product. However, interviews with experts (complaint managers and developers of the corporate blog) revealed that users lacked the motivation to contribute, and consequently the decision was made to pilot an OIG. Experts also identified the following four conditions, that the game was required to meet. All conditions are connected with the aim to evoke motivation and creativity:

- **Allow location-based solution of mission.** Research shows that the motivation and creativity of ideas can be increased when one is confronted with a problem in reality (Plattner et al. 2009, p. 118-120). Thus, a game playable on smartphones was developed. The game was intended to give players missions to solve. These missions were intended to be tied to particular locations on the university campus and solvable at those places.
- **Assign clear missions.** Specific missions enable focus and concentration and thus can have a positive influence on motivation and creativity (Shalley 2008; Hennessey & Amabile 2010). Thus, missions should be clear and be supported by the rules of the game. In these missions, specific areas are addressed where product innovation is needed. The research team and the experts were required to jointly formulate missions.
- **Provoke competition.** Research shows that competition is a main reason why people play (Crookall et al. 1987; Yee 2007). All named examples for OIGs also aim to encourage playing and to inspire creativity with help of competition between players. Thus, the developed game was required to provoke competition.
- **Induce social belonging.** Social belonging can have a positive influence on motivation and creativity (Amabile 1988; Perry-Smith & Shalley 2003). Thus, the developed game was required to give players the possibility to virtually connect with each other like on a social networking website, to comment on and to evaluate ideas.

For the development of *Campus Game*, the conditions, that were identified by the experts, were taken into consideration: *Campus Game* is a *pervasive game*. Pervasiveness “means that the game can be played in different places and the location can affect the game-play” (Holopainen 2011, p. 104). Designers of a pervasive game aim to give players the feeling that the real world merges with the virtual game world (Jegers & Wiberg 2006). *Campus Game* players may (inter-)act in this world through smartphones or tablet PCs (Holopainen 2011). Using satellite-positioning players are required to reach five geographically defined locations on campus that are visible on an integrated Google maps API. Upon arrival at one of those locations, students can solve three clear defined missions, that refer solely to the specific location: one *incremental*, one *insight*, and one *university-related* problem.

Both the incremental and the insight problems are fictitious, in contrast to the university-related problems, which are real-world. The solution of incremental problems require

some time to solve, while the solution of insight problems “pop into mind” (Schooler & Melcher 1995). The fictitious problems were derived from Wieth and Burns (2006). An example for a fictitious problem is: “A woman did not have her driver’s license with her. She failed to stop at a railroad crossing, then ignored a one-way traffic sign and travelled three blocks in the wrong direction down the one way street. All this was observed by a policeman, yet he made no effort to arrest the woman even though there was nothing stopping him. Why?” (Wieth & Burns 2006, p. 1393). The real-world problems were jointly formulated by the research team and the experts and related to new services and infrastructure improvements at the university. An example of a real-world problem is: “Students often cannot find a space to park their cars on campus. Get creative and generate ideas for a smartphone-application that might solve this problem!”

Inspired by the games named in Chapter II-4.2, several game mechanics are used as building blocks for *Campus Game*. More specifically, game points, social points, leaderboards, collecting (badges), virtual identity and exchange are implemented to provoke competition and to induce social belonging (see Figure 33).

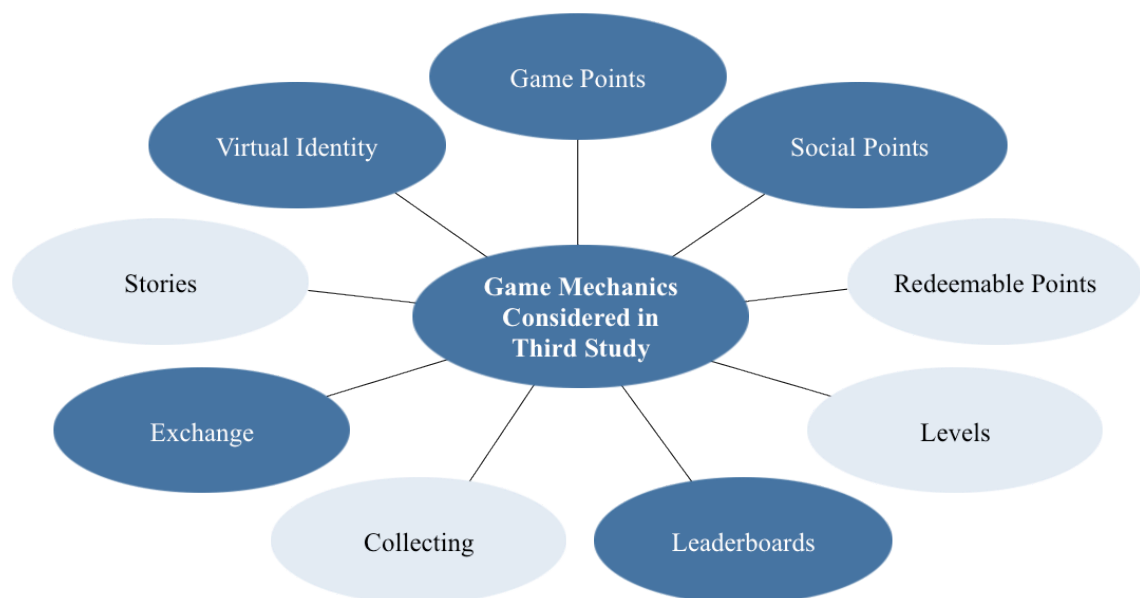


Figure 33: Game Mechanics Considered in Third Study

Players receive game points for solving each mission. In addition, players receive social points when peers positively evaluate their solution. The winner of the game is the player who has earned the most points. Leaderboards show players how they perform in relation to others in form of a ranking list. Badges are either given for the solution of a certain number of missions or for playing the game on particular days unknown to the

players. To induce social belonging players have a virtual identity (i.e., a profile), can virtually connect with each other (explicit exchange) like on any social network (e.g., Facebook) and comment on others ideas (implicit exchange). Figure 34 shows exemplary screenshots of the game.



Figure 34: Exemplary Smartphone Screenshots of the *Campus Game*  
(from left to right: start screen, profile, leaderboard)

### 3.1.3 Operationalization and Data Collection

The subsections below summarise measure development and data collection of players' motives, of their degree of involvement and requirements evaluation for the CAT.

Drawing on literature of motivation research found in fields of open innovation (Chapter II-1.5.2) and games (e.g., Yee 2007), various motives can be identified explaining why students participated in the *Campus Game*. Prior studies find that users generate ideas for organisations, because they want to get recognition (GR) from peers and organisers (e.g., Franke & Shah 2003; Jeppesen & Frederiksen 2006; Walcher 2007, p. 168-169). Participants may be motivated because of the desire to support (SU) the university or other students (Füller 2006). They may also take part to learn something new and develop their skills (DS) (Füller 2006; Antikainen et al. 2010; Ståhlbröst & Bergvall-Kareborn 2011). Antikainen et al. (2010) proposed that users innovate to obtain a sense of efficacy (SE). Other motives include pursuing the opportunity to get to know people (KP) and having the feeling of social belonging (SB) (Kozinets 2002; Ridings & Gefen 2004; Yee 2007; Antikainen et al. 2010). One other reason why players

may engage in this game is because they want to keep up (KU) with new ideas (Füller 2006). Curiosity (CU) may lead to motivation for participation (Füller 2010). Personal need (PN) may be also a motive to participate in this game (Hars & Ou 2002; Franke & Shah 2003; Ridings & Gefen 2004; Lakhani & Wolf 2005; Jeppesen & Frederiksen 2006). Although no compensation (like marks or money) was promised or given, players may have participated because they hoped for a reward (RE) (Wasko & Faraj 2000; Lakhani & Wolf 2005). Yee (2007) shows that people play online games, because they want to escape from the world, stress and boredom (ESB), to compete (CO) with each other and to understand the game and its mechanics (UGM). Naturally, players (Yee 2007) and user innovators (von Hippel & von Krogh 2003) may engage, because they are intrinsically motivated, enjoy solving puzzles and try to gain the feeling of fun (FU) during the activity. Based on this literature review, 32 motive items were identified. GR, PN, CU, KP were measured with items adapted from Walcher (2007, p. 152-168). The CO, DS, KP, SU, SE and FU motives were captured with items adapted from Füller (2006). For SB, CO, ESB and UGM, Yee's (2007) measures were used. Described motives with underlying measurement items are illustrated in Table 20. To measure task involvement four items were used developed from Higie and Feick (1989).

To evaluate why 77 persons played the *OIG Campus Game* and how they were involved in the task, an online survey was used for data collection. A five-point Likert-type scale was applied, anchored by "strongly disagree" (1) and "strongly agree" (5). Based on the approach of Raab-Steiner and Benesch (2010, p. 58), a pre-test with 10 participants was performed and followed with an adjusted questionnaire. Data collection with the final questionnaire was conducted within three weeks in February 2011. E-mails with a link to the questionnaire were sent to all 77 players. After two reminder-e-mails, 34 complete questionnaires were returned in total. This corresponds to a response rate of 44.16%. 67.6% of the participants were male, and 32.4% were female. On average, participants were 26.5 years old. 79.41% held a certificate of qualification for university matriculation and 20.59% held a college degree.

The 77 players submitted 73 ideas for the real-world problems in multiple game sessions. Thus, 0.95 ideas were on average handed in per player relating to type two problems.

To assess the creativity of these ideas, Amabile's (Amabile 1982a; 1996) highly regarded CAT (e.g., Kristensson et al. 2004; Matthing et al. 2006; Piller & Walcher 2006) was



used. According to this method an idea is creative when a jury of “appropriate experts” independently agree it is (Amabile 1996, p. 33; Piller & Walcher 2006) (Chapter II-1.6.1).

To apply this method requirements for the task, for the jury, for the assessment and for the utilisation have to be met. A detailed description of these requirements can be found in Chapter II-1.6.1. Table 18 shows that all CAT-requirements are met.

Category	No.	Description	Evaluation
Task	1	No need of specialised skills for accomplishment.	✓
	2	Open solution space.	✓
	3	Outcome observable and assessable for the jury.	✓
Jury	4	Jury should have experience in and should be familiar with the domain in question.	✓
	5	Number of jury members should be between 3 and 10.	✓
Assessment	6	Independent assessment.	✓
	7	Judges should be given dimensions (originality, usefulness, far-reachingness and feasibility).	✓
	8	Assessment of ideas relatively to one another.	✓
	9	Assessment of ideas in a random order.	✓
	10	No influencing instructions.	✓
Utilisation	11	ICC values above 0.7.	✓

Table 18: Overview of Evaluated CAT-Requirements

(✓= requirements are met)

The evaluation is based on the following analysis:

### **Requirements for the task**

*Campus Game* builds on SCVNGR, which is “an online platform that's easy to understand, even easier to use” (Anderson 2010). Thus, no certain specialised skills (like drawing or programming abilities) are necessary to play this game. Players submit their ideas in form of a short text. The text had to be written into a free text field. This free text field provides an open solution space. Submitted ideas are observable and assessable by the jury. In sum, requirements 1 to 3 are met.

### **Requirements for the jury**

For the evaluation a jury of five persons was recruited. The persons all work for the university (dean, complaint manager, referee for tuition fees, head of students union, study coordinator). Every jury member has experience in students' affairs and is familiar with the problems that students face in the university. They also have knowledge about the *Campus Game* and about its missions. Thus, jury members can be labelled experts. Requirements 4 and 5 are also met.

### **Requirement for the assessment procedure**

Guidelines for the execution of the evaluation were taken from Baer and Mckool (2009): Jury members evaluated all ideas individually and were asked not to speak with other members until the process of evaluation had finished. Experts evaluated ideas relatively to one another in a two-step procedure. Initially, they sorted the randomly presented ideas in three classes of creativity (low, middle, high). Subsequently, they rated creativity of ideas with help of dimensions (Amabile 1982a). The following four valid and reliable measurement dimensions (Chapter II-1.6.1) were used for this assessment: *degree of originality*, *usefulness for students*, *number of expected beneficiaries*, *feasibility*. Following Baer et al. (2004) experts rated ideas on a five-point Likert-type scale anchored by “strongly disagree” (0) and “strongly agree” (4). Thereby they were asked to use the full scale (Baer & Mckool 2009). Dimensions are presented, but not explained to jury members. Jury members do not have to justify their decisions. To avoid manipulation, experts were also not allowed to ask any questions. Thus, requirements 4 to 5 are also met.

### **Requirements for the utilisation**

As mentioned in Chapter II-1.6.1, the quality of evaluation with CAT is high and accordingly reliable when there is high consensus between experts. To measure the con-

sensus, the interclass correlation coefficient (ICC) can be used (Wirtz & Casper 2002, p. 35). The ICC builds on Pearson's correlation coefficient and indicates a high degree of consensus, when values are over 0.7 (Amabile 1996, p. 68). As every expert evaluated all 73 ideas, a two-way model of reliability was chosen (Wirtz & Casper 2002, p. 169). In this study, all ICC values were above 0.7 (see Table 19). Therefore, the quality of evaluation is high and accordingly reliable.

Degree of originality	Usefulness for students	Number of expected beneficiaries	Feasibility
0.764	0.824	0.765	0.825

Table 19: ICC Values

### 3.2 Results

The 32 motive items ordered according to strength of agreement are illustrated in Table 20.

Con-struct	Why did you play <i>Campus Game</i> ?	Mean	SD
CU	1. Because I enjoy novel things.	4,09	0,933
CU	2. Because I like to test different things.	4,03	0,937
FU	3. Because I'm generally interested in the solution of tasks/problems.	3,91	0,965
FU	4. Because I enjoyed finding ideas and solutions for the given tasks.	3,82	0,999
CU	5. Because I like diversion.	3,82	0,983
UGM	6. I wanted to understand how the game works and which rules exist to advance within the game.	3,61	0,998
ESB	7. I played out of boredom.	3,55	1,092
DS	8. To gain new knowledge/expertise.	3,50	1,187
ESB	9. I enjoyed exploring the game world and discovering secrets.	3,48	1,029

<b>SU</b>	10. Because I think that other students will benefit from my solutions and ideas.	3,36	0,962
<b>KU</b>	11. To keep up with new ideas and innovations.	3,35	1,152
<b>SU</b>	12. Because I think that the university can make students a better offer when realizing my ideas and solutions.	3,24	0,955
<b>SB</b>	13. I enjoyed seeing me as a member of a player's community.	3,18	1,334
<b>PN</b>	14. Because I have needs that are not met by the existing university's goods and services.	3,13	1,264
<b>CO</b>	15. I have tried to be the best or better than other players.	2,84	1,273
<b>GR</b>	16. Because I have ideas that I want to introduce to the project managers.	2,76	1,200
<b>PN</b>	17. Because I would greatly benefit from the realization of my ideas.	2,73	1,172
<b>SB</b>	18. I rather played in a group than alone.	2,66	0,865
<b>DS</b>	19. To improve my skills.	2,59	1,048
<b>SE</b>	20. To test my capabilities.	2,47	1,261
<b>GR</b>	21. Because I hope the project managers acknowledge my ideas.	2,41	0,979
<b>KP</b>	22. Because I want to meet new people.	2,29	1,115
<b>GR</b>	23. Because I hope to get positive feedback from the project managers.	2,29	1,115
<b>FU</b>	24. For me, playing is rewarding.	2,26	0,864
<b>RE</b>	25. Because I expect a compensation in return.	2,18	1,103
<b>SE</b>	26. To gain a sense of accomplishment.	2,15	0,821
<b>CO</b>	27. I wanted to provoke other players and compare with them.	2,09	1,146
<b>RE</b>	28. Because I hope to win a prize.	2,06	0,982
<b>GR</b>	29. Because I hope other players acknowledge my solutions and ideas.	2,06	1,029

<b>GR</b>	30. Because I hope to get positive feedback from other players.	2,00	0,853
<b>ESB</b>	31. I have played to relax from stress.	1,97	1,237
<b>ESB</b>	32. I have played to forget about some of my real-life problems or worries.	1,79	1,083

Table 20: Motive Items Ordered According to Strength of Agreement  
(Five-point Likert-type scale anchored by “strongly disagree” (1) and “strongly agree” (5)).

To detect a structure behind this large set of motive items an exploratory factor analysis (EFA) was performed (Backhaus et al. 2011, p. 330).

Variables with low Measure of Sampling Adequacy (MSA) ( $<0.50$ ), low factor loadings ( $<0.50$ ) and high cross loadings ( $>0.35$ ) were removed iteratively (Füller 2006; Weiber and Mühlhaus 2010, p. 107). The remaining 12 items were used to conduct EFA with principal component extraction and varimax rotation. Varimax was chosen to facilitate easier interpretation (Bühl 2010, p. 591). The correlation matrix is with a Kaiser-Mayer-Olkin (KMO) of 0.700 suitable for a factor analysis (Kaiser & Rice 1974). Bartlett’s test of sphericity<sup>45</sup> ( $\chi^2=170.717$ ;  $df=66$ ;  $sig.=0.000$ ) indicates adequate application of factor analysis. Also, the criterion of Dziuban und Shirkey (1974) is met, as the proportion of non-diagonal elements in the anti-image covariance matrix that are different from zero ( $>0.09$ ) accounts less than 25%.<sup>46</sup> The scree test<sup>47</sup> was used to define factors (Backhaus et al. 2011, p. 359-360). Four factors emerged, that explain altogether 76.955% of the variance. Each of the four factors demonstrated good scale reliability with coefficient

<sup>45</sup> Bartlett’s test is used to examine the hypothesis that the variables are uncorrelated (Backhaus et al. 2011, p. 341)

<sup>46</sup> Guttman states that the variance of a variable can be broken down in two parts: The image and the anti-image. The image describes the proportion of the variance, which can be explained with the remaining variables by a multiple regression analysis. In contrast, anti-image illustrates the proportion, which is independent of the rest of the variables. As the factor analysis implies that the variables have factors in common, it is understandable, that the variables are only appropriate for a factor analysis, when the anti-image of the variables is very low (Backhaus et al. 2011, p. 341-342)

<sup>47</sup> Scree test criterion is derived by plotting the eigenvalues against the number of factors in their order of extraction, and the shape of the curve is used to evaluate the cut-off point. Background of this procedure is that factors with the smallest eigenvalues are unfeasible for explanatory purposes and thus do not have to be extracted (Backhaus et al. 2011, p. 359)

$\alpha$ 's over 0.7 (Nunnally & Bernstein 1994, p. 252). To test convergent validity, separate EFAs were conducted with all items of one factor. These factor analyses resulted in one-factor solutions and explained variances over 50% (Homburg & Giering 1996). Thus, criteria of convergent validity are met. Table 21 summarises the results of the EFA and contains name of factors, items, factor loadings, explained variances,  $\alpha$ 's and explained variances of one-factor solutions.

Name of factors and items	Factor loading	Expl. var. (%)	Reliability ( $\alpha$ )	Validity expl. var. (%)
<b>Receiving feedback and sense of accomplishment</b>		22.028	0.813	73.736
Because I hope other players acknowledge my solutions and ideas.	0.892			
Because I hope to get positive feedback from other players.	0.844			
To gain a sense of accomplishment.	0.831			
<b>Dissatisfaction with existing solutions</b>		19.019	0.810	74.142
Because I think that the university can make students a better offer when realizing my ideas and solutions.	0.893			
Because I think that other students will benefit from my solutions and ideas.	0.895			
Because I have needs, that are not met by the existing university's goods and services.	0.630			
<b>Learning</b>		18.243	0.723	55.498
To keep up with new ideas and innovations.	0.900			
To gain new knowledge/expertise.	0.789			
I wanted to understand how the game works and which rules exist to advance within the game.	0.545			
<b>Achievement</b>		17.665	0.745	75.466

I have tried to be the best or better than other players.	0.758
To improve my skills.	0.651
To test my capabilities.	0.667
<i>Total N=34</i>	<i>76.955</i>

Table 21: Summary of EFA, Reliability and Convergent Validity

After assessing why the game was played, involvement of the players in the game was measured. Table 22 illustrates the items assessing players' involvement ordered according to strength of agreement.

Measures	Mean	SD	$\alpha$
Playing <i>Campus Game</i> is ...			0.669
...interesting.	3.97	0.647	
...enjoyable.	3.81	0.693	
...stimulating.	3.34	0.865	
...exciting/fun.	3.28	0.924	
<i>N=32</i>			

Table 22: Summary of Applied Measures of Players' Involvement  
(Five-point Likert-type scale anchored by "strongly disagree" (1) and "strongly agree" (5))

To determine, which motive factor was responsible for involvement a multiple regression analysis was conducted. Therefore, the four involvement items were averaged. As the significant result (Table 23) shows, learning is the main driver for players' involvement.

By adding the scores of each of the five experts for each single idea, a *creativity score* was built (Piller & Walcher 2006; Blohm et al. 2011). The creativity score ranges from 0 to 80 (4 (scale points) x 4 (measurement dimensions) x 5 (number of experts)). The creativity score allows ranking ideas. The idea with the highest ranking has a creativity score of 75; the idea with the lowest ranking has a creativity score of 13 (mean=44.41;

SD=16.149). Figure 2 shows the distribution of the ideas according to their creativity score within five-point intervals.

Independent variables	Dependent variable
	Involvement (Std. Beta)
Factor 1: receiving feedback and sense of accomplishment	0.041
Factor 2: dissatisfaction with existing solution	0.214
Factor 3: learning	0.587*
Factor 4: achievement	-0.06
R <sup>2</sup>	0.477
F	5.482*
* p<0.05	

Table 23: Summary of Regression Analysis

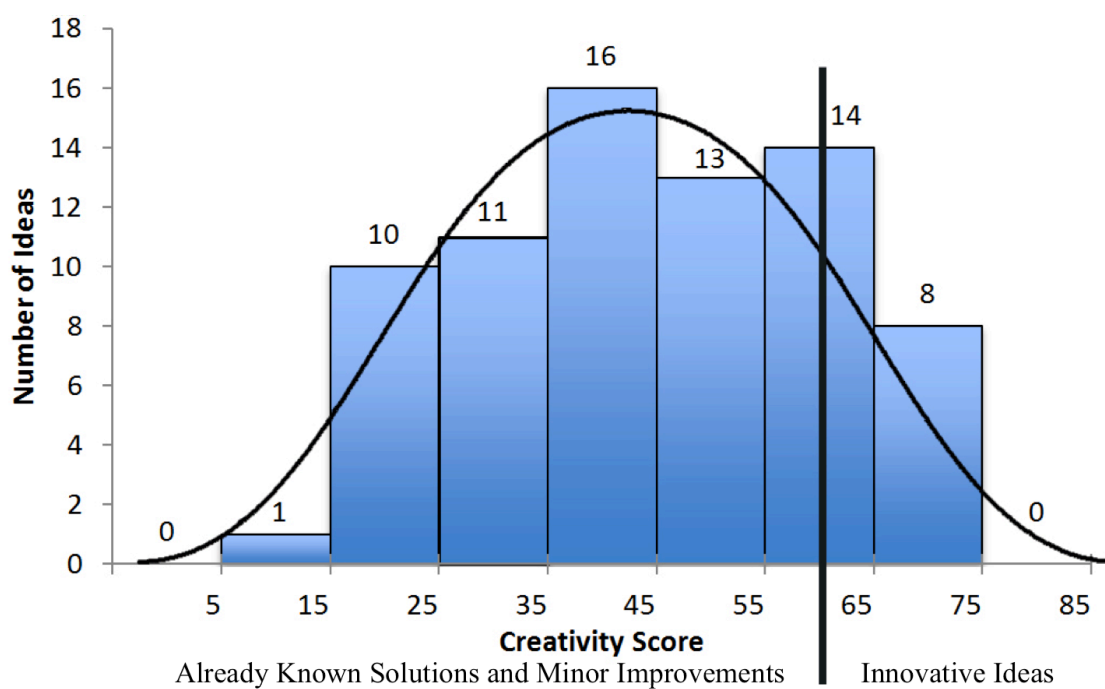


Figure 35: Distribution of Ideas according to Their Creativity Score (within five-point intervals)

The Kolmogorov-Smirnov-Test showed that the distribution of the ideas is Gaussian and normality of the data can be assumed ( $p=0.688$ ). 15 ideas (21%) were evaluated as innovative ideas and 58 ideas (79%) were assessed as already known solutions and minor improvements. Thus, the percentage of new and valuable ideas in this study lies



above the percentages named in other user innovation projects: Piller and Walcher (2006) labelled 10% and Blohm et al. (2011) 12% of generated ideas valuable.

### 3.3 Discussion and Future Research

In this study an OIG was presented as an online tool to empower users. Thereby it was outlined why users might engage in such a game. In contrast to other online open innovation tools, where monetary rewards may determine involvement, users of *Campus Game* principally participated in order to receive positive feedback from other players and a sense of accomplishment. Another driving factor elucidated was dissatisfaction with existing solutions. Furthermore, they wanted to achieve something — absolutely and in relation to other players. Finally, they played because they wanted to learn. Learning was also a major impetus of player involvement. This result accompanies a statement of game designer Raph Koster (2005): “That's what games are, in the end. Teachers. Fun is just another word for learning” (p. 45). Overall, the involvement of players and the quality of ideas generated in this OIG was high.

Certainly, this study has several limitations. First, it is exploratory: a new method for user empowerment is introduced and tested on a small scale for a non-profit organisation, specifically a German university. As a result the number of complete returned questionnaires was very small (34). Thus, the empirical analysis should be more regarded as an illustration of a theoretical idea than as an ample proof for the effectiveness of OIGs. Second, the data of the CAT stems from interviews with persons, who work for the university. As such, their experiences and their knowledge backgrounds may bias their evaluation. However, despite these limitations, this study allows to infer practical and theoretical implications.

From a theoretical perspective, the above-mentioned limitations can be a starting point for future research. Further research should strive for generalizations and test OIGs in a variety of contexts. Although such data is difficult to obtain, future studies may gather more comprehensive information by collecting longitudinal information for example. From a design perspective, it may be interesting to investigate how single game features or mechanics effect constructs like *competition*, *social belonging*, *autonomy* or *affect* and thus motivation and creativity. The issue of how OIGs should be designed is only one out of many interesting research questions. Further examples are: when can an OIG be used? Which users play OIGs? Can OIGs compensate for the additional effort that their realization causes? Thus, further research ought to compare the outcome and effort

that the realization of OIGs causes, to other online Open Innovation Tools. Another interesting question raised is: can an OIG be used to identify lead users?

Organisations, which want to profit from OIGs, can draw inspiration from this case. Such organisations face the challenge to design games, which achieve the generation of creative ideas, without eliminating what makes them fun and involving. Along the way to a sophisticated ideation-inside-an-online-game, companies need to experiment, perhaps sometimes with disappointing results. However, this study demonstrates that it might be valuable for companies to use such unpaved road, as OIGs may provide the answer to an urgent, practical question: how can users be motivated to deliver creative ideas?

## 4 Creative Process Engagement in a Multiplayer Online Ideation Game

For this study,<sup>48</sup> students of two large German universities played an OIG in the summer 2011 term, for a total of more than 1072 hours. The OIG was evaluated in a twofold approach: First, the degree of players' creative process engagement (CPE) (Chapter II-1.5.1) was examined in a longitudinal perspective. Second, in-depth, full-structured interviews were conducted when the game had ended to discern reasons for the degree of creative process engagement. For this purpose players were asked to describe and explain their feelings regarding game mechanics, because they may provide possible explanations for the degree of creative process engagement.

### 4.1 Background Information

#### 4.1.1 Research Questions

Amabile (1983) proposed that intrinsic motivation (Chapter II-1.5.1) is highly relevant in determining behaviours that may lead to creative outcomes. She points out, that intrinsic motivation “makes the difference between what an individual can do and what an individual will do” (Amabile 1988). This also explains why a number of studies come to the result that intrinsic motives have a stronger effect on motivation for participation in open innovation than extrinsic motives (Chapter II-1.5.2). Shalley's research (Shalley 1995; Shalley et al. 2000) indicates in this regard that when individuals are intrinsically engaged in creative work, all of their attention and effort will be more likely focused on their jobs, making them more persistent and leading them to higher levels of creativity. Thus, using a hedonic system, which triggers intrinsic motives (van der Heijden 2004), would positively effect the involvement in creativity-relevant process over a long period of time. Thereby, involvement in problem identification, information searching and encoding, and idea and alternative generation is labelled creative process engagement (Zhang & Bartol 2010) (Chapter II-1.5.1). The first research question, therefore, is:

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<sup>48</sup> This study is based on an article published in the *Lecture Notes in Informatics (LNI) Proceedings* (Witt et al. 2012a) and is also based on a presentation at the 10<sup>th</sup> *International Open and User Innovation Workshop* at Harvard Business School in Boston (Massachusetts) (Witt et al. 2012b).

Research question 1: Can a system, which aims to be hedonic and utilitarian simultaneously, lead to a permanent creative process engagement?

Operating from an instrumental perspective, one could argue that changes in creative process engagement over time can be explained with a changing perception of the game itself and especially the constituting game mechanics, which actually trigger the behaviour of players. The explanation for this change lies in the individuals' desire to maintain equality between contributions and rewards (Adams 1965). The following research question guided the evaluation:

Research question 2: What are the game-immanent reasons for changes in creative process engagement over time?

#### 4.1.2 Methodology

To answer the proposed research questions a twofold approach is chosen with both primary data of a longitudinal panel study and qualitative interviews.

The longitudinal study is based upon an online survey. Before the OIG started participants had to answer questions to the socio-demographic background (e.g., sex, age, family background). During the game another questionnaire was used to measure CPE. Therefore the items of Zhang and Bartol (2010) were taken. These items are based on Amabile (1983), Perry-Smith (2006) and Reiter-Palmon and Illies (2004). Zhang and Bartol (2010) distinguish three components of creative process engagement: problem identification, information searching and encoding, and idea and alternative generation. The construct comprises in total 11 items. Respondents were asked to answer the following question: “To what extent did you engage in the following actions when seeking to accomplish the mission [task] of the last week.” (1=“never”, 2=“rarely”, 3=“occasionally”, 4=“frequently”, 5=“very frequently”). Table 24 illustrates the items of CPE.

<b>No. 1: Problem identification</b>	
<b>1</b>	I spend considerable time trying to understand the nature of the problem.
<b>2</b>	I think about the problem from multiple perspectives.
<b>3</b>	I decompose a difficult problem/assignment into parts to obtain greater understanding.
<b>No. 2: Information searching and encoding</b>	
<b>4</b>	I consult a wide variety of information.
<b>5</b>	I search for information from multiple sources (e.g., personal memories, Internet etc.).
<b>6</b>	I retain large amounts of detailed information in my area of expertise for future use.
<b>No. 3: Idea and alternative generation</b>	
<b>7</b>	I consider diverse sources of information in generating new ideas.
<b>8</b>	I look for connections with solutions used in seeming diverse areas.
<b>9</b>	I generate a significant number of alternatives to the same problem before I choose the final solution.
<b>10</b>	I try to devise potential solutions that move away from established ways of doing things.
<b>11</b>	I spend considerable time shifting through information that helps to generate new ideas.

Table 24: Creative Process Engagement  
(Zhang & Bartol 2010)

This second questionnaire had to be answered within six hours after each interval of the OIG. Each participant logged into the online survey with a unique code. This ensured that the data could be allocated to a specific participant under the premise of anonymity and could be used for a longitudinal panel analysis. A Friedman test is conducted to examine effects over time and. It uses data from a repeated-measure design to compare the differences between three or more related samples (Gravetter & Wallnau 2009, p. 666). Because the test does not require normal distribution of the sample data, it is a non-parametric test. The null-hypothesis for this test is that there are no differences between the variables. If the calculated p-value (Asymp. Sig.) low ( $p < 0.05$ ) the null-hypothesis can be rejected and it can be concluded that at least two of the variables are

significantly different from each other. Furthermore, the Friedman-test produces a chi-square statistic, with a large value indicating that there are differences (Hinton et al. 2004, p. 240).

As the Friedman test can only identify longitudinal effects, no statements can be given towards differences between single intervals. As such, paired t-tests are used to overt such changes as the Kolmogorov-Smirnov test shows normal distribution for all items on  $p < 0.05$  of CPE-components 1, 2 and 3.

At the end of the play time 22 participants were asked to answer game-specific and -related questions. Players had access to relevant experience and could gain first hand experience in an OIG. Hence, respondents were able to acquire useful cognitive frameworks, as well as game-specific and game-related knowledge (Meuser & Nagel 1991). The interview was conducted in a standardised written interview. Respondents were sent eight questions that had to be answered within a week (see Table 25). While the quantitative approach offers insights into developments and changes over time, the interviews allow a deeper understanding of the reasons for the changes in CPE.

No.	Question
1	What were the positive experiences that you made while playing the game?
2	What were the negative experiences that you made while playing the game?
3	What should be improved in the game in order to increase the motivation?
4	What should be improved in the game to increase the information brokerage?
5	What should be improved in the game in order to ease the completion of the tasks given?
6	Please describe a moment that has been especially memorable to you while playing the game?
7	Which game mechanics have you perceived as positive and why?
8	Which game mechanics have you perceived as negative and why?

Table 25: Interview Guideline

#### 4.1.3 Sample Subject and Study Sample

The analysed OIG is called *Evoke* ([urgentevoke.com](http://urgentevoke.com)). Figure 36 shows a screenshot of the start screen. Players of this game had to submit ideas to ten different topics within ten weeks. The game took place in two periods of time. The first period began on 3rd of March 2010 and was open to everyone. Within this work persons were questioned, who played the game in the second period. In the second period, which began on 28th of March 2011, only selected and approved people from, in particular, schools and universities could join. *Evoke* was developed by the World Bank Institute and directed by Jane McGonigal (2011, p. 334).



Figure 36: Exemplary Screenshot of *Evoke*'s Start Screen

Each player had one week to complete a task, and background information was available within the online game environment. Players found further information via incorporated links (McGonigal 2011, p. 333-334). Furthermore, players could examine the solutions of other participants to gather supplementary information. Hence, no knowledge

was necessary to be successful and to play the game. Players were, however, encouraged to broaden the base of information by self-research. All tasks had a social innovation background and were selected to address general, major social problems. Exceptions were the first and the last task. In the first, participants were asked to get to know the background theme of *Evoke*. In the last, suggestions are made about how the OIG could be improved in the future.

The organisers of *Evoke* recommended that only individuals from the age of 13 and up should take part to ensure that participants possess at least a basic understanding of the addressed social problems and basic skills to work in the website. In addition, only small restrictions were given as to how ideas had to be presented in the game. Players could submit their ideas for example in blog posts, videos, or photos (McGonigal 2011, p. 337). *Evoke* contains the following game mechanics:

- **Game points** are given automatically for the completion of a topic. **Social points** are given, if other players positively evaluate the contribution.
- **Levels** are designed in sections. Each week a new level in the form of a new task is presented. It is, however, not obligatory to complete the former level to have access to the following. Figure 37 shows a screenshot, which presents an overview of the first three levels.
- **Collecting** is realised in such a way that players can achieve six badges for the completion of intervals (e.g., completion of the first mission or achievement of the first 100 social points) or specific activities (e.g., completion of a secret mission). The degree of difficulty grows with every achieved badge. The six badges are illustrated as part of a set. As soon as a further badge was collected it colorised.
- **Exchange** is included into the game with its very basic functions. Participants can give feedback on the work of others by commenting and writing messages.
- **Story** is used in a multifaceted way. The static, predefined and passive story appears in *Evoke* in the form of a background-story visualised as comic strips (Figure 38) and presented as intro-video before the game starts and drawings before every mission: “The world of *Evoke* is set ten years in the future. The story, told in the form of a graphic novel, follows the adventures of a secret superhero network based in Africa” (McGonigal 2011, p. 334) The dynamic, unplanned and interactive, stories are embedded into the game in the form of short stories and blog entries.



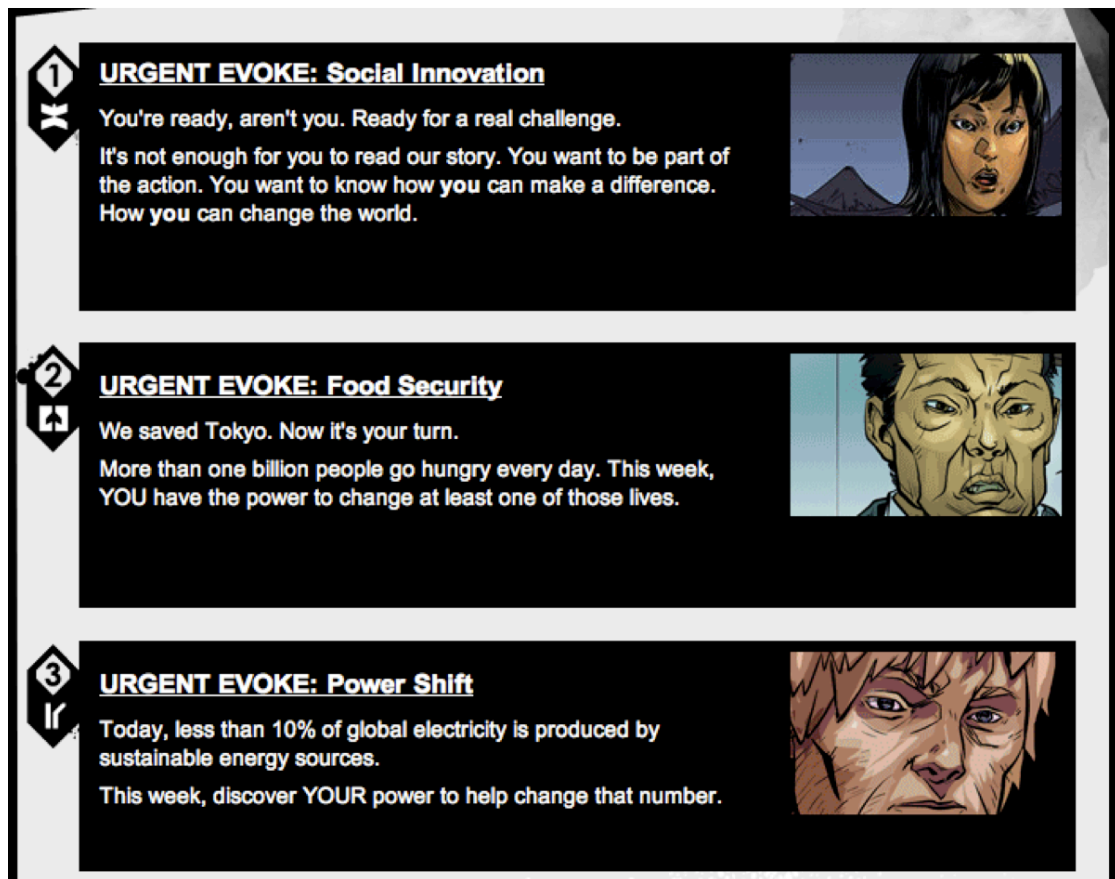


Figure 37: Exemplary *Evoke*-Screenshot of Level-Overview

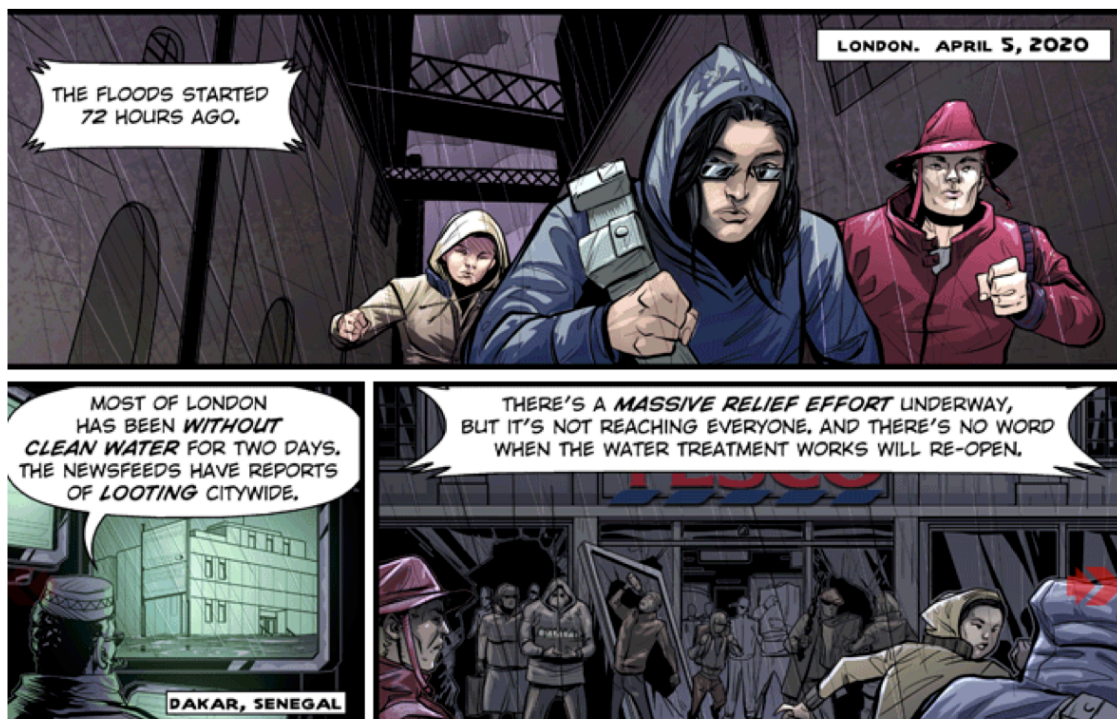


Figure 38: Exemplary *Evoke*-Screenshot of Background-Story

Figure 39 gives an overview of the game mechanics considered in this study.

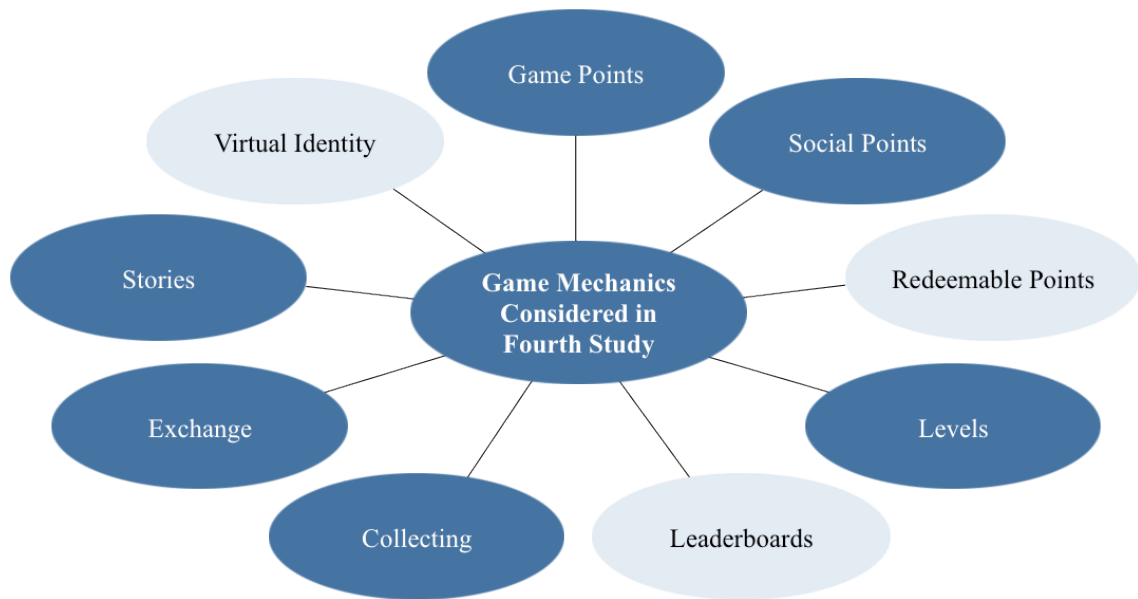


Figure 39: Game Mechanics Considered in Fourth Study

The study sample comprises 27 participants who played *Evoke* from start to finish. The average respondent is 26 years old. Twenty participants are male and seven female. Participants spend in total more than 1072 hours in the OIG. This means that in average every participant played *Evoke* for over four hours and twenty minutes per week.

## 4.2 Results

### 4.2.1 Analysis of Longitudinal Data

Figure 40 depicts the evaluation of creative process engagement split in its components *problem identification*, *information searching and encoding*, as well as *idea and alternative generation* over time.

The evaluation of CPE shows that the means of the component problem identification is mainly located near the value of three. This implies that the average of the participants state that they are occasionally engaged in the activity of problem identification. The means of CPE-components information searching and encoding as well as idea and alternative generation are located between the values three and four. This implies that the average of the participants state that they are occasionally or even frequently engaged in these activities. Thus, problem identification is the activity with the lowest degree of engagement during the whole idea competition, while information searching and encoding possesses the highest.

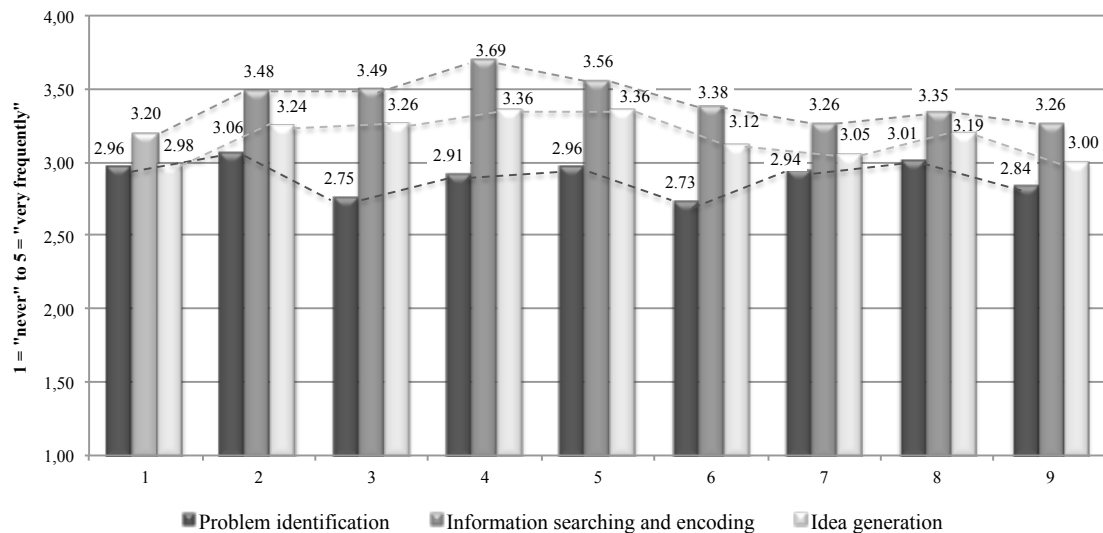


Figure 40: Creative Process Engagement Components over Time (Means)

Regarding the stability of engagement over time the Friedman test shows significant changes for information searching and encoding, as well as idea and alternative generation (see Table 26). Hence, engagement in both components increases substantially while engagement in problem identification stays at the same level.

Creative process engagement		Chi-Square	df	Asymp. Sig. (2-tailed)
No.	Components			
1	Problem identification	11.937	8	0.154
2	Information searching and encoding	23.215	8	0.003
3	Idea and alternative generation	21.580	8	0.006

Table 26: Friedman Test for CPE-Components

Although the Friedman test is able to identify changes over time, no insights can be gained into differences between single intervals. This research gap can be closed by using paired t-tests as items fulfil the premise of normal distribution measured with a Kolmogorov-Smirnov test. The visible decreases in problem identification from interval two to three, from five to six as well as from eight to nine are significant changes on a level of  $p < 0.05$  in the paired t-test. The increase between interval six and seven is significant on  $p < 0.10$ . Regarding information searching and encoding the increase of engagement from interval one to interval two is significant on a level of  $p < 0.05$ . Until interval five the engagement stays stable to decrease then significantly from 3.56 to 3.38

in interval six ( $p < 0.05$ ). In the component idea and alternative generation significant changes ( $p < 0.05$ ) can be observed between the intervals one to two, five to six and eight to nine. In the beginning the engagement rises from 2.98 to 3.24 and remains stable until it falls from 3.36 to 3.12 from interval five to interval six and later from 3.19 to 3.00. Table 27 summarises the significant paired t-test results.

Creative process engagement No.	Interval	Paired Differences					t	df	Sig. 2-tailed
		Median	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
1	2-3	0.309	0.546	0.105	0.093	0.525	2.935	26	0.007
1	5-6	0.235	0.569	0.109	0.010	0.460	2.144	26	0.042
1	6-7	-0.210	0.608	0.117	-0.450	0.030	-1.796	26	0.084
1	8-9	0.173	0.407	0.078	0.012	0.334	2.207	26	0.036
2	1-2	-0.284	0.512	0.099	-0.487	-0.081	-2.88	26	0.008
2	5-6	0.173	0.492	0.095	-0.022	0.368	1.824	26	0.080
3	1-2	-0.267	0.625	0.120	-0.514	-0.019	-2.217	26	0.036
3	5-6	0.237	0.451	0.087	0.059	0.415	2.732	26	0.011
3	8-9	0.193	0.398	0.077	0.035	0.350	2.514	26	0.018

Table 27: Significant Paired T-Tests

#### 4.2.2 Analysis of Interview Data

To illuminate the above-described changes in creative process engagement interviews are analysed.

Missions (problems) were directly introduced and explicated to the players, which can explain the relatively low and stable degree of **problem identification**. The missions were “clearly and understandably formulated” (player 3), “described in detail” (player 6) and “neither too easy nor too difficult” (player 16, player 17). Consequently, it was not difficult for players to identify and understand the problem (player 13).

In fact, the game offered possibilities to engage in **information searching and encoding**. The analysis of the longitudinal quantitative data also shows that players devoted time and effort for these activities. Engagement even increased especially at the beginning of the game (intervals 1 to 4) and then decreased during the following intervals until the end. Half of the interviewed players (2, 3, 4, 5, 6, 12, 15, 17, 20, 21, 22) state that they consulted especially in the first five intervals a variety of information. The sources were provided within the game and illustrate the problems from different cultural and national perspectives. Player 4 expressed the opinion, that he used large amounts of information, when saying: “By playing the game a lot of information was spread. [...] During the game there have been stories told about problems mainly from countries far away from Germany and while playing [...] players became aware of problems, which they considered as non-existent.”

The players name two reasons that might explain, why engagement in information searching and encoding decreased from interval 4 on until the end. First, missions were perceived as more unspecified and open-ended in later intervals. Hence, provided links could not offer large amounts of detailed and sufficient information anymore and players reduced their engagement twofold. They did not consult provided information sources and did not shift through information that supported the idea generation. Player 11 recapitulates: “Towards the end playing the game became a duty. Missions turned out to be less clear. It wasn’t possible to investigate a solution anymore.” Second, the game mechanic exchange could not unfold its potential. From the players point of view exchange plays generally a “pivotal role” (player 6) “[...] to share information and receive feedback” (player 14) and thus might exert an influence on long-term engagement in information searching and encoding. An enduring exchange between players was, however, not possible, because only a small group played in the second period (player 2, 7, 10, 13, 22). Player 10 exemplifies this: “Actually, at the beginning of the game, I received some messages and comments from Spanish, Bolivian, and American players, but after week three the only ones to read my blogs seemed to be people on my friends list. The input, therefore, was rather small [...].”

The game also allowed players to engage in idea and alternative generation. Players considered a variety of information sources (like blogs, videos, comics, websites) to generate new ideas and moved away from established ways of doing things (player 9, 12, 15). The following quotations illustrate why engagement with regard to idea and alternative generation increased in the first intervals: “I learned a lot about the different

social problems and aspects from all over the world and I think I came up with a few creative solutions to a few urgent social problems.” And player 15 adds: “For me, *Evoke* was a success and generally achieved what it should: it made me more aware of social problems in this world and got me thinking about solutions to them.” Aside from these reasons, which also explain a decline in information searching and encoding, the following four explanations might elucidate the decline in engagement regarding idea and alternative generation.

First, at the beginning players engaged in idea and alternative generation to receive game points (player 9, 14, 18), but there was, however, no long-lasting positive perception of game points (players 1, 7, 9, 11, 12, and 22). Player 22 explains: “By and by it became clear to me, that there is no attraction behind it [...]. Somebody, who took the task seriously and spent considerable time in writing contributions got the same amount of points as a person, who wrote just two lines. This cannot be!” Thus, the allocation of game points independent from their quality offers an explanation as to why engagement in idea and alternative generation might have decreased.

Second, though nine players (2, 3, 4, 6, 9, 12, 19, 21, 22) are convinced of a general, positive effect of social points towards engagement in idea and alternative generation, some also name drawbacks that might have undermined their positive effect. Player 2 and 11 believe that game points corrupted gradually the positive effect of social points, because game points were easier to reach than social points. This can probably be traced back to and was intensified by the fact that the second period did not offer players a vibrant community. “Thereby social points lost with time their attraction. And I didn’t feel like giving points anymore, too” (player 17). Furthermore, players started to game the system by cartelization among their friends (player 5, 10, 14). Player 14 asserts: “As I mentioned before, the awarding of points can be seen as unfair. Friends mostly rate their own friends, this often being independent of the quality of their posts.” In sum, some players felt that the method of how social points were implemented lowered engagement in idea and alternative generation over the long-term.

Third, the way in which collecting was implemented might explain the decrease of engagement in idea and alternative generation, because (as described in Chapter III-4.1.3) unlocking badges was linked to the successful completion of missions. Although for example player 8 stated that collecting badges is “[...] really motivating and interesting [...]”, players agree that collecting can encourage prolonged use only if the number of

badges is higher than six (players 2, 5, 18, 20) and if there is a balanced growth in difficulty to achieve them (player 11, 12, 18, 22). While the first three badges in *Evoke* could be gained easily, the following three badges were too difficult to achieve. Hence, it became too difficult to complete the set (player 5). Player 17 summarises: “At the beginning achieving badges was fun, but after I have reached the first three [badges], this feature became quickly boring. One reason might be, that there were too few achievements. Additionally, there was a huge time lag between obtaining the first three and the last three badges.”

Fourthly, stories were highly appreciated of some player as they “motivated to develop new ideas” (player 5), helped “finding solutions” (player 12), and “delivered ideas for solutions” (player 17), but were seen critically by other players. Player 16, 20 and 21 held the opinion that the background stories in the form of comics did not have enough in relation to the mission aims. Player 20 even stopped reading the comics “after the third or fourth mission.” Consequently, stories weren’t used as a source of information in generating new ideas anymore, which could explain why engagement in idea and alternative generation decreased.

### 4.3 Discussion and Future Research

This study examines the use of a hedonic system to integrate users into the process of ideation: An online ideation game aims to engage players to solve real-world problems within an online game. The findings of this study show from an empirical, longitudinal panel basis that an OIG influences CPE, i.e., information searching and encoding, as well as idea and alternative generation. The average of participants state that they are occasionally or even frequently engaged in the creative processes. The Friedman test revealed significant changes for these two components of CPE. Descriptive analyses and paired t-tests display an increase until the fourth and accordingly the fifth interval and a decrease in the following intervals until the end. Results from full-structured interviews provide logical explanations for this development. Engagement in information searching and encoding might be negatively influenced by an altered perception of the missions towards the end of the game and an insufficient vibrant community. Engagement in idea and alternative generation might be negatively affected, because game points, social points, collecting and stories did not attain their full potential.

Certainly, this study has several limitations. First, only a small number of selected people could join the second period of the game. Consequently, the game lost to some ex-

tent its multiplayer-character. Second, only a small number of players were surveyed. As a result this study does not strive for generalizations.

A number of implications follow for both theory development as well as practice. With regard to theoretical advancement, researchers have to investigate how to design and deploy OIGs effectively, so that creative process engagement is steadily fostered. The issue of how game mechanics have to be applied is in this regard of high importance. Examples for further interesting research questions are: How can game points be applied without undermining social points? How should social points be implemented to avoid cartelization? How does collecting influence long-term CPE? How do stories have to be designed to give the adequate amount of information to positively influence CPE?

From the perspective of practice, two essential implications follow. A first key implication for managers relates to the design of OIGs. OIGs must be implemented carefully. Otherwise they cannot unfold their potential and are less likely to trigger creative process engagement. It has to be bore in mind: Along the way to a sophisticated OIG, companies need to be courageous and enduring. Second, results point to the importance of designing and applying hedonic systems (i.e., online ideation games), to spark creative process engagement of users. OIGs are a capable response to the uncertainties and difficulties that are faced by ideation today.



## IV Final Conclusion

In this chapter, results of the empirical studies are summarised (Chapter IV-1), and overall implications for future research (Chapter IV-2) and practice (Chapter IV-3) are given.

### 1 Summary

This work argues that there are two possibilities for applying game mechanics to innovation management. One possibility is enriching open innovation tools with game mechanics (*gamification*), and the second is using, for the purpose of ideation, a game (*online ideation game*) in which game mechanics are used as building blocks. Although research has begun to acknowledge the benefits of enriching open innovation tools with game mechanics (e.g., Leimeister et al. 2009), as well as the benefits that play holds for open innovation (e.g., Füller et al. 2010), comparatively little research has been conducted in this context.

Synthesizing the insights gained from numerous data collection strategies, this dissertation addresses the research gap in four empirical studies. Results of the empirical studies can be summarised as follows (Figure 41):

The first study (Chapter III-1) provides insight on motives for application, expected effects and challenges of gamification from an expert's view. Experts decided for the application of game mechanics for example because they want to enhance motivation of participants, they want to increase perceived fun and social belonging of participants, they want to stimulate open exchange of feedback among participants and want to increase the quality and quantity of ideas. Altogether, the experts judge the effect of game mechanics positively, but also see a number of challenges (e.g., fraud) when applying game mechanics.

The second study (Chapter III-2) indicates that game mechanics had a relatively low positive influence on flow, enjoyment and task involvement in the underlying idea competitions. However, results also suggest that game mechanics can have a positive effect on these constructs if they are implemented in an adequate and sophisticated way.

The third study (Chapter III-3) suggests reasons why the online ideation game *Campus Game* was played. Four motivational factors could be extracted to explain why individuals played the game: a) receiving feedback and sense of accomplishment, b) dissatisfaction with existing services, c) learning and d) achievement. Results also indicate that players were highly involved and that learning is the main driver of players' involvement. To evaluate the creativity of ideas, a consensual assessment technique was used, with the result that, overall, experts rated creativity as high.

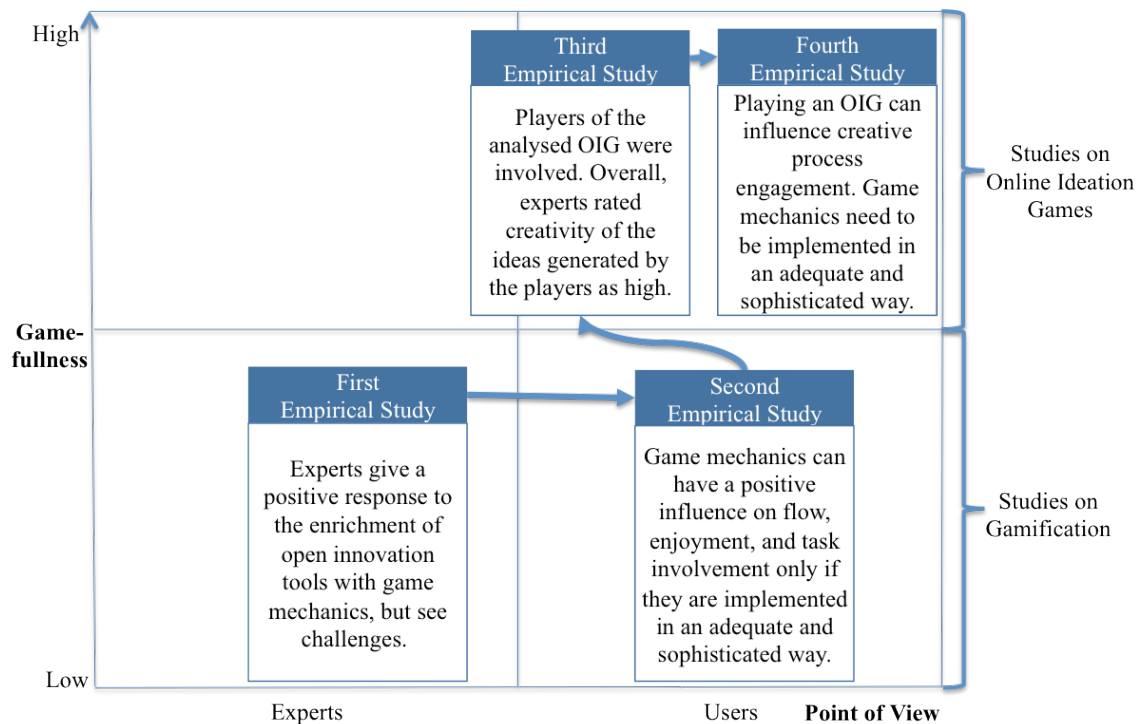


Figure 41: Overview of Summarised Results of Studies

From the basis of an empirical, longitudinal panel, the findings of the fourth study (Chapter III-4) indicate that an OIG (i.e., the game *Evoke*) influences creative process engagement, that is, information searching and encoding, as well as idea and alternative generation. The Friedman test revealed significant changes for these two components of creative process engagement. Descriptive analyses and paired t-tests display an increase until the fourth and accordingly the fifth interval, and a decrease in the following intervals until the end. Results from full-structured interviews provide logical explanations for this development. Engagement in information searching and encoding might be negatively influenced by an altered perception of the missions towards the end of the game and by an insufficient elaborated application of the mechanic exchange. Engagement in

idea and alternative generation might be enhanced by a redesign of game points, social points, collecting and stories.

## 2 Implications for Research

This dissertation has investigated the topic of the application of game mechanics to innovation management, which until now has rarely been the subject of scientific studies. Thereby, the findings from this work make several contributions to the current literature of both game research and open innovation research (Figure 42).

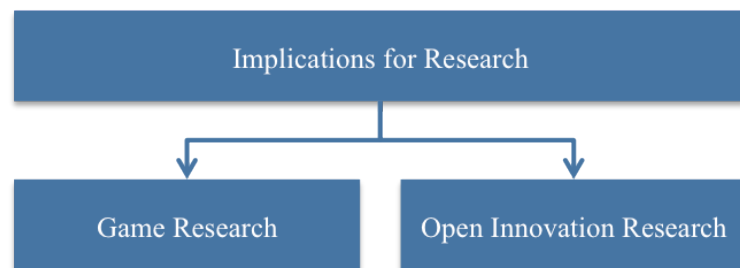


Figure 42: Implications for Research

This work contributes to game research by explaining how play facilitates motivation and creativity. While previous work only highlights single constructs (such as social belonging, affect or competition), a holistic framework is suggested herein. Furthermore, evidence uncovered in this dissertation reveals a new field for game researchers — online ideation games — and confirms the idea that games with a purpose in the context of innovation management are worthwhile to investigate. Additionally, the work provides theoretical suggestions for ways to design online ideation games, and for measuring their effectiveness (e.g., using the consensual assessment technique). Research questions that are put forward in chapter sections III-3.3 and III-4.3 can also serve as starting points for further investigation of OIGs.

In the field of open innovation, the present study provides additional insights with respect to motivation and creativity. First, the current work adds to the understanding whether game mechanics applied to open innovation tools can lead to intrinsic motivation (in a narrower sense, enjoyment), involvement and flow, and if so, how. Second, the present work provides evidence that players of an OIG can be not only involved, but their ideas can be highly creative, as well.

Overall, combining the two academic disciplines of game research and open innovation research carries with it enormous potential. Fully exploiting this potential requires a

continuous process of exchange, and of understanding, between both disciplines. For the purpose of describing and finding joint solutions to research problems, a common language has to be found. Additionally, it is necessary that the two disciplines share such information as criteria and methods for the evaluation of gamification and OIG-projects.

### 3 Implications for Practice

The findings of this work present definitive support for recommendations to apply game mechanics in innovation management. Synthesizing the insights gained from the empirical studies detailed in Chapter III and that of several further studies by the author of this work (see Appendix, Table 28), a set of **key lessons** can be generated. These key lessons not only can help managers who strive to apply game mechanics to innovation management, but they are a necessary condition for the successful application of game mechanics. The key lessons relate to (1) the planning and design phase and (2) the introduction and operation phase of a gamified open innovation tool or an OIG.

#### (1) PLANNING AND DESIGN PHASE

The lessons to be recognised from the design phase are *follow a structured process, provide clearly defined goals, minimise the risk of fraud and create an environment characterised by high usability*.

*Follow a structured process:* Results of the first study (Chapter III-1) show that the application of game mechanics was often carried out poorly conceived and inadequate. A structured process can help to apply game mechanics in an effective way (Kim 2010, p. 165). Before applying game mechanics to innovation management, as a first step the aims of the system must be defined. Thus, innovation managers must answer the following question: What shall be accomplished with the open innovation tool or OIG? Whether using a gamified system or the OIG, innovation managers must gain a clear understanding of how many ideas they want to have generated and commercialised as short-, middle- and long-term objectives. In a second step, innovation managers have to determine all possible activities that are, from their perspective, important for effective ideation within the system. Examples for such activities are *post an idea, log in, finish tutorial, give other participants advice, refer to a similar idea, post a comment, enlarge virtual identity, visit virtual identity, suggest a campaign, suggest an expert, rate an idea*. In a third step, innovation managers must rank the activities determined in the se-

cond step according to their importance. As a fourth step of the process, motives of targeted innovators have to be investigated, and in a fifth step managers must choose and align game mechanics so that motives and, accordingly, behaviours are triggered.

*Provide clearly defined goals:* The fourth study showed that players of an OIG want to have clearly defined and formulated missions and goals. When goals were too fuzzy, participants tended to be overextended and frustrated. One possibility for specifying missions and goals — and thus motivate participants — is using background stories in the form of comics such as are found in the OIG *Evoke*. Stories can provide information in order to clarify the topic. However, it is central to many users that this information is perceived as useful for the solution of missions; otherwise, they will quickly lose interest in reading the stories.

*Minimise the risk of fraud:* Results of surveys among experts (Chapter III-1) and among participants (e.g., Scheiner & Witt 2012; Scheiner et al. 2012b; Chapter III-4) stress the importance of anticipating and minimizing the risk of fraud when designing a gamified open innovation tool or an OIG. Therefore, designers have to think carefully about which kind of undesirable behaviour the application and the configuration of game mechanics can evoke (Dellarocas 2011). For example, before deciding to allocate game points for posting an idea or comments, designers should consider that users might disregard the quality of their contributions and might post just to boost their scores or the numbers of collected badges. The same applies for social points: Participants might act in rating gangs or use unfair rating strategies to enhance their reputation within the system (Chapter III-1). As outlined in Chapter III-4, fraud can make the use for participants less enjoyable and can be detrimental to a game (Salen & Zimmerman 2004). As it is, in general, impossible to create a gamified system or game that is totally fraud-resistant (Salen & Zimmerman 2004), a few strategies (detailed as follows) can help to minimise the risk.

There are three dimensions that can influence the fraud-resistance of a gamified system or an OIG, and that have to be considered in the design phase (e.g., Dellarocas 2011; Chapter III-1; Chapter III-4):

1. The larger the efforts and the more time necessary to cheat, the lower the probability of fraud will be.

The effort and time necessary to cheat can be increased with a number of strategies. For example, users receive game points depending on their trustworthiness-level (Farmer

2011). Trustworthiness of a user can be calculated either by “rating-the-rater” or by using meta-data about a user’s behaviour (Pentland 2009; Lampe 2011; Clippinger 2011). In this way, gaining game points for spam-like postings becomes more difficult. As well, social points (for example) are only allocated if a certain number of persons — persons who have not evaluated the user’s last ideas — rated the idea positively. This increases the effort and time necessary to act in rating gangs, and thus exacerbates efforts to cheat. Both this increase in complexity and the increase in control, however, have a downside, as either can lessen a site’s credibility and usability.

2. The more transparent the rules are, the easier it is for cheaters to find strategies for cheating.

Concealing the details about such aspects as how game points and social points are allocated, or exactly when a new level can be reached, or how a user can reach a higher position in the leaderboard is another possibility for resisting fraud in open innovation tools or OIGs. As an example, concealing details is a strategy used by Amazon and Google for their rankings list. Dellarocas (2011) highlights in this regard that Amazon “does not disclose the precise formula they use to rank-order reviewers” and Google “does not disclose all the details of rank-ordering search results” (p. 9). However, designers have to be aware that lack of transparency has disadvantages as well (Chapter III-1): Concealing (feedback) information provided by game mechanics can hinder users, diminishing their ability to learn and lessening their trust in the system and in a site’s credibility (Dellarocas 2011).

3. The more the true identity of a user is known, the lower is the probability of fraud.

When virtual identities are completely anonymous and are easy to create, users are able to generate fake identities and spam the system with low-quality contributions and fabricated ratings. Mapping virtual and real identities can help to reduce such behaviours. To counter privacy concerns, real identity characteristics do not have to be visible to every community member, but could be available only to administrators of the system. When mapping virtual and real identities, however, designers also have to be aware of the potential disadvantages. The tactics can discourage users from joining the system, can cause users to post only positive feedback and can increase reporting bias (Dellarocas 2011). Thus, identity mapping can have a negative influence on constructs (named in Chapter II-2.2) such as equality and divergent thinking.

When deciding how to balance these dimensions, designers have to take context information (e.g., motives of participants, or business culture) into account.

*Create an environment characterised by high usability:* In the design phase, usability considerations hold great importance. The second study (Chapter III-2), especially, revealed that game mechanics open up their potential only if the system provides intuitive usage, and a clear and individually adjusted navigation structure. For example, leaderboards must be easy to find and clearly presented — participants need to be able to quickly see themselves in the rankings list without clicking through a long list.

## **(2) INTRODUCTION AND OPERATION PHASE**

The lessons contributed by the introduction and operation phase are *care for the community* and *evaluate and improve application of game mechanics*.

*Care for the community:* In many cases a vibrant community is an essential prerequisite of an effective, gamified open innovation tool or OIG (Chapter III-4): Social points are given by other participants, leaderboards show the position of a user in relation to other participants, and exchange takes on characteristics of communication between participants. Because of this emphasis on the relationships among participants, continuous management and support of the community is necessary. This task is time-consuming and cost-intensive, and must have support from top management (Hutter et al. 2010). Care, therefore, is essential to creating success through a gamified open innovation tool or an OIG community.

*Evaluate and improve application of game mechanics:* Testing the effect of game mechanics iteratively is not only important for the design phase, but also for the introduction and operation phase. Opinions about, and behavioural patterns in response to, game mechanics are often difficult to foresee. While testing and evaluating, designers can encounter problems such as a need to improve the design of leaderboards (Chapter III-2), game points that have to be more difficult to reach, in relation to social points (Chapter III-4) and badges that need a more balanced increase in level of difficulty (Chapter III-4).

Figure 43 provides an overview of the key lessons from the empirical studies.

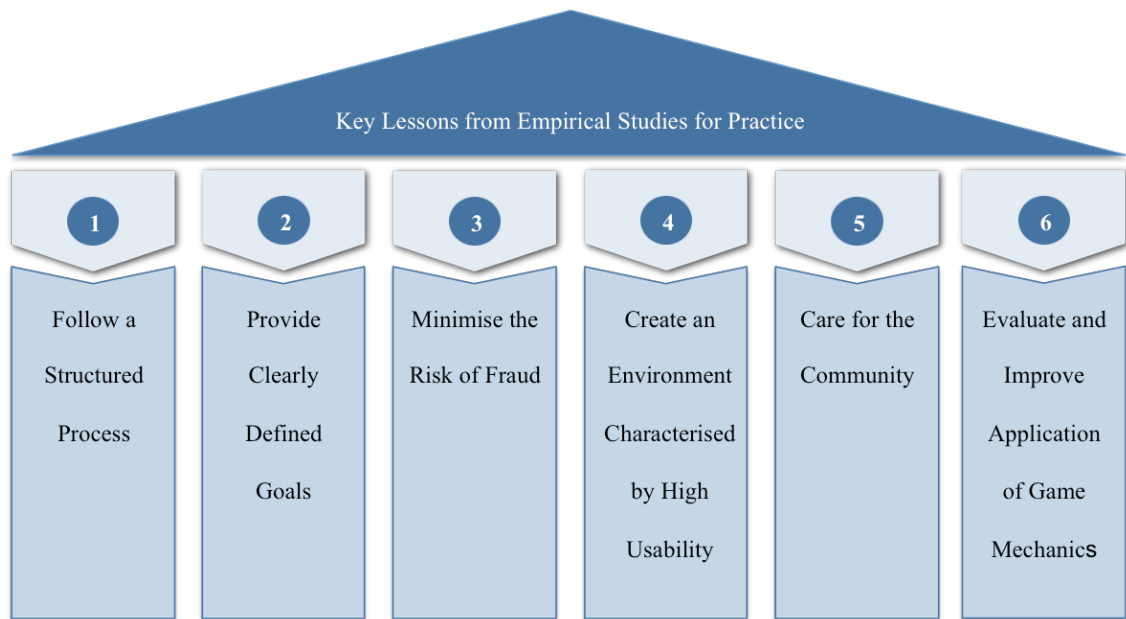


Figure 43: Key Lessons from Empirical Studies for Practice



## Appendix

Year	VHB WKWI <sup>49</sup>	VHB JQ2.1 <sup>50</sup>	Authors	Title	Publication	
2012	B	C	Witt, M., Robra-Bissantz, S.	Sparkling motivation and creativity with 'online ideation games'.	Lecture Notes in Informatics (LNI) Proceedings, Vol. P-208.	
2012	B	C	Scheiner, C., Witt, M., Robra-Bissantz, S. Voigt, K.-I.	The backbone of gamification. A theoretical consideration of play and game mechanics.	Lecture Notes in Informatics (LNI) Proceedings, Vol. P-208.	✓
2012	B	C	Witt, M., Scheiner, C. W., Robra-Bissantz, S. Voigt, K.-I.	Creative process engagement in a multiplayer online ideation game.	Lecture Notes in Informatics (LNI) Proceedings, Vol. P-208.	✓
2012	-	-	Witt, M., Scheiner, C. W., Robra-Bissantz, S. Voigt, K.-I.	From idea competitions to online games — a longitudinal analysis of creative process engagement.	10th International Open and User Innovation Workshop at Harvard Business School. Boston 2012.	✓
2012	-	-	Scheiner, C., Witt, M., Voigt, K.-I., Robra-Bissantz, S.	Is gamification the new solution for idea competitions? Longitudinal insights into the perception of game mechanics towards motivation.	10th International Open and User Innovation Workshop at Harvard Business School. Boston 2012.	✓
2012	-	-	Scheiner, C., Witt, M.	The longitudinal impact of game mechanics on motivation in the fuzzy front end.	Proceedings of the European Academy of Management EURAM 2012 Proceedings. Rotterdam 2012.	✓
2012	-	-	Scheiner, C., Witt, M., Robra-Bissantz, S., Voigt, K.-I.	The evolution of idea competitions. Enhancing motivation by gamification.	International Association for Management of Technology IAMOT 2012 Proceedings. 21th International Conference on Management of Technology, Taiwan.	✓

<sup>49</sup> Ranking of "Verband der Hochschullehrer für Betriebswirtschaft Wissenschaftliche Kommission Wirtschaftsinformatik/Gesellschaft für Informatik (GI E.V.) Fachbereich Wirtschaftsinformatik 2008 (VHB E.V.)" (available at: <http://www.kaifischbach.net/wkwi/orientierungslisten.pdf>, accessed 9 June 2012).

<sup>50</sup> Ranking of "Verband der Hochschullehrer für Betriebswirtschaft Jourqual 2.1 Ranking 2011 (VHB E.V.)" (available at: [http://vhbonline.org/uploads/media/Ranking\\_Gesamt\\_2.1.pdf](http://vhbonline.org/uploads/media/Ranking_Gesamt_2.1.pdf), accessed 9 June 2012).

2012	C	D	Scheiner, C., Witt, M., Robra-Bissantz, S., Voigt, K.-I.	Einsatz von Spielmechaniken in Ideenwettbewerben: Einsatzmotive, Wirkungen und Herausforderungen.	Proceedings of the Multikonferenz der Wirtschaftsinformatik - MKWI 2012, Braunschweig.	✓
2011	B	C	Witt, M., Scheiner, C., Robra-Bissantz, S.	Gamification of online idea competitions: Insights from an explorative case.	Lecture Notes in Informatics (LNI) Proceedings, Vol. P-192.	✓
2011	-	-	Witt, M., Scheiner, C., Skornia, R., Robra-Bissantz, S., Voigt, K.-I.	Wie Spielen komplexe Innovationsvorhaben unterstützt - Eine Fallstudienanalyse.	Beiträge zur wissenschaftlichen Konferenz "Innovation und Wettbewerb", Sofia.	✓
2011	-	-	Birke, F., Witt, M., Robra-Bissantz, S.	Applying game mechanism to idea competitions.	Malik, K.; Cloudhary, P. (eds.): Business Organizations and Collaborative Web: Practices, Strategies and Patterns.	
2010	-	-	Witt, M., Robra-Bissantz, S., Weinmann, M.	Using game mechanisms to change the way companies innovate.	Palma dos Reis, A.; Abraham, A. P. (eds.): IADIS Multi Conference On Computer Science and Information Systems MCCSIS 2010, Freiburg.	

Table 28: Publications in the Context of the Research Topic

(✓=in Cooperation with University of Erlangen-Nuremberg (Chair of Industrial Management, Prof. Dr. Kai-Ingo Voigt))

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**Eidesstaatliche Erklärung**

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Hiermit versichere ich an Eides statt, dass ich die vorliegende Arbeit mit dem Titel „Application of Game Mechanics to Innovation Management. Theoretical Foundations and Empirical Studies“ selbstständig und ohne Benutzung anderer als der angegebenen als der angegebenen Quellen und Hilfsmittel angefertigt habe. Diese Arbeit ist oder war nicht Gegenstand eines anderen Prüfungs- oder Promotionsverfahrens. Ich habe noch keinen Doktorgrad erlangt oder zu erlangen versucht.

## Zusammenfassung

In den vergangenen Jahren werden Kunden, Partner, Lieferanten und Mitarbeiter verstärkt in den betrieblichen Innovationsprozess eingebunden. Im Rahmen der *Open Innovation*, also der Öffnung der betrieblichen Innovationsprozesse, haben Unternehmen zwei (zusammenhängende) Herausforderungen zu lösen. Erstens, Kunden, Partner, Lieferanten und Mitarbeiter sind zur Teilnahme zu motivieren. Zweitens, es ist sicherzustellen, dass die eingebrachten Ideen von hoher Qualität beziehungsweise kreativ sind.

Eine Möglichkeit, diesen Herausforderungen zu begegnen, stellt der *Einsatz von Spielmechaniken im Innovationsmanagement* dar. Spielmechaniken (wie zum Beispiel Punkte, Levels oder Leaderboards) lassen sich entweder mittels *Gamification* oder *Online Ideation Games* (OIGs) im Innovationsmanagement einsetzen. Im Rahmen der Gamification werden die Spielmechaniken in einen nicht-spielbezogenen Kontext eingebunden, nämlich in die auf Social-Media-basierenden Open-Innovation-Instrumente. Im Rahmen der OIGs werden die Spielmechaniken in einen spielbezogenen Kontext integriert, nämlich in Online-Spiele, die mit dem Ziel eingesetzt werden, Ideen zu generieren. Tatsächlich werden Spielmechaniken schon vielfach in Social-Media-basierten Open-Innovation-Instrumenten eingesetzt. Zudem finden sich in der Praxis bereits erfolgreich durchgeführte OIGs. Trotz der Beliebtheit dieses Themas in der Praxis finden sich jedoch nur wenige systematische, wissenschaftliche Untersuchungen zum Einsatz von Spielmechaniken im Innovationsmanagement. Übergeordnetes Ziel dieser Arbeit besteht darin, einen Beitrag zum Schließen dieser Forschungslücke zu leisten.

Daher werden in einem ersten Schritt die Designer von Open-Innovation-Instrumenten zu ihren Erfahrungen und Einsatzmotiven bei dem Einsatz von Spielmechaniken interviewt. Die Auswertung der Interviews zeigt, dass die Experten eine Reihe an Herausforderungen bei dem Einsatz sehen und dass die Experten hoffen, unter anderem die Motivation und den Spaß der Teilnehmer beeinflussen zu können. In einem zweiten Schritt werden Teilnehmer eines Ideenwettbewerbs zu dem von ihnen empfundenen Spaß, Flow und Involvement sowie ihrer Wahrnehmung auf die in dem Wettbewerb eingesetzten Spielmechaniken befragt. Die Ergebnisse deuten daraufhin, dass Spielmechaniken — wenn sie durchdacht und adäquat eingesetzt werden — positiven Einfluss auf Spaß, Flow und Involvement haben können. Um festzustellen, ob sich Spieler auch in einem OIG in dem Zustand des Involvements befinden, warum sie sich bei einem OIG betätigen und ob die in dem Spiel entstanden Ideen kreativ sind, wurde in einem dritten Schritt ein OIG pilotiert: Spieler des analysierten OIGs sind involviert, und der motiva-

tionale Faktor "Lernen" ist der wesentliche Treiber des Involvement. Die im OIG entstandenen Ideen sind dabei von Experten als insgesamt kreativ eingeschätzt worden. Während in dem dritten Schritt die Befragung der Teilnehmer zu ihrem Involvement im Rahmen einer Querschnittsanalyse erfolgte, wird in einem vierten Schritt in einem weiteren OIG das Involvement im Rahmen einer Längsschnittanalyse untersucht. Konkret werden die Teilnehmer zu dem Involvement in die im Rahmen der Ideengenerierung notwendigen Kernprozesse und -aktivitäten (Creative Process Engagement) befragt. Die Ergebnisse zeigen, dass zwei Komponenten des Creative Process Engagement in dem untersuchten OIG zu Beginn ansteigen, dann jedoch wieder abfallen. Die Auswertung von Interviews mit Spielern identifiziert die Ausgestaltung der Missionen und der Spielmechaniken als Ursachen für die Entwicklung. In einem letzten Schritt werden konkrete Empfehlungen zur Implementierung von Spielmechaniken im Innovationsmanagement gegeben.

## Curriculum Vitae

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### Wissenschaftlicher Mitarbeiter und Doktorand

an Technischer Universität Carolo-Wilhelmina zu Braunschweig (Institut für Wirtschaftsinformatik, Abteilung Informationsmanagement), Mitarbeit in einem Kooperationsprojekt der Volkswagen AG, Dozent der TU Sophia und der VWA Braunschweig

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### Wissenschaftlicher Mitarbeiter

an Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

Mitarbeiter am Verbundprojekt (HHL Leipzig, TU München, FAL Nürnberg) „Open Innovation im Unternehmen“ (gefördert vom Bundesministerium für Bildung und Forschung und Europäischer Sozialfonds)

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### Studentische Hilfskraft am Lehrstuhl Wirtschaftsinformatik II

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### Praktikant bei Werbeagentur Neuland Communication

Mitarbeit bei Projektorganisation, Marktanalysen, Veranstaltungsvermarktung, PR-Arbeit

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### Praktikant bei MAN/Nutzfahrzeuge

Mitarbeit bei Monatsabschluss, Materialwertführung, Hauptbuch- und Kreditorenbuchhaltung

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10/2002 – 05/2008

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