Incentive design and gamification for knowledge management

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ABSTRACT

Knowledge is one of the most important resources for businesses. Knowledge management systems (KMS) are implemented to guarantee an adequate handling of this resource. While innovations in Knowledge Management often focus on technical approaches or structural aspects of knowledge storing, less attention is paid to the different aspects of human motivation and the individual willingness to knowledge sharing. The employee as sharer and receiver of knowledge, however, has to be motivated properly in order to ensure a high content quality within the KMS and appropriate handling of knowledge. Gamification has proven to be a feasible approach to increase employee motivation. This paper, therefore, analyses the effects of game mechanics on motivation and knowledge sharing behavior. In addition, advantages and risks of implementing game components in KMS are illustrated.

1. Introduction

The sustainable use of business resources is a key to corporate success. In addition to human, physical or financial resources, knowledge is a rather abstract but no less crucial key resource of a company (Helm, Meckl, & Sodeik, 2007). It gives companies a decisive advantage over their competitors and secures the flow of business processes. The notion of "knowledge is power" represents the struggle for success and competitive advantages in the world of business. While on the one hand, the adequate protection of the company's own knowledge is of great importance for companies, on the other hand, a free and open handling of knowledge is required in the internal process. Withholding of knowledge has a negative impact on knowledge sharing (KS) behavior of the knowledge community as a whole like intra-organizational knowledge-hiding (Serenko & Bontis, 2016) and may additionally lead to knowledge gaps. These can have far-reaching consequences for the company's operating capability in the event of an employee's absence like loss of the organizations' ability for task performance (Levy, 2011; Massingham, 2008). Furthermore, knowledge loss can cause high time and cost efforts for training and acquisition of knowledge which is or has already been possessed by co-workers (Serenko & Bontis, 2016). This makes knowledge management capability a competitive factor for organizations (Chuang, 2004).

Knowledge management (KM) comprises the processes of creating, storing, transferring and applying knowledge within a company (Alavi & Leidner, 2001). Knowledge Management Systems (KMS) are IT-systems that provide technical support to employees in the processes of KM (Desouza & Awazu, 2005). Examples of KMS are Content management systems (CMS), Wikis, Blogs, Enterprise social networks (ESN), Groupware systems or Bugtracker. They allow employees to create documents or other forms of knowledge artifacts (videos, instructions, tickets), to store and structure them. Creating and maintaining a shared and searchable knowledge base supports the re-usage of knowledge and, hereby, value-creation of the company. But a KMS alone cannot guarantee successful KM. The relevance of different contextual factors for KS and KM such as relational models (Boer, Berends, & van Baalen, 2011), subjective norms (Chennamaneni, Teng, & Raja, 2012), corporate culture (Girdauskienė & Savanevičienė, 2007; Huerta, Salter, Lewis, & Yeow, 2012; Javernick-Will, 2012) but also barriers have been examined comprehensively (Hong, Suh, & Koo, 2011; Richter & Derballa, 2009; Riege, 2005; Singh & Kant, 2007).

Irrespective of the company's requirements with regard to KM, employees ultimately decide for themselves to what extent they provide their knowledge by transforming tacit into explicit knowledge or hide their knowledge instead (Serenko & Bontis, 2016). For example, employees might hesitate to use a KMS due to technical, organizational or individual barriers (Ardichvili, Page, & Wentling, 2003; Richter & Derballa, 2009). Instead of using the KMS as a platform for KS, they
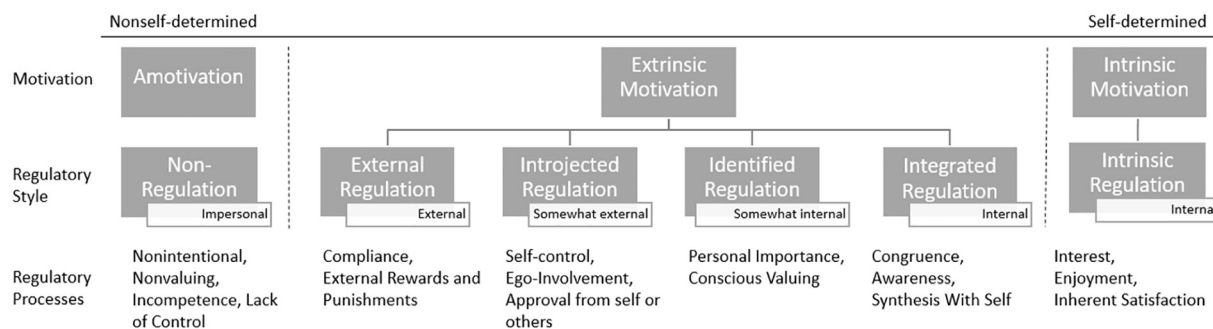

Fig. 1. Self-determination theory (Ryan & Deci, 2000a).

communicate directly or refuse to share knowledge (Ardichvili et al., 2003; Wasko & Faraj, 2005). This can be due to a lack of understanding of the relevance of KS for the community or to underestimating the value of one's own knowledge (Ardichvili et al., 2003). But also perceived loss of power due to giving up the ownership to knowledge negatively effects the attitude towards KS (Chennamaneni et al., 2012). It is the task of corporate management to establish a corporate culture that is characterized by openness and fairness (Bock, Zmud, Kim, & Lee, 2005; Chennamaneni et al., 2012; Wasko & Faraj, 2005) and values KM. By underlining the overall entrepreneurial value of KS the "knowledge is power"-attitude within the company can be overcome (Hong et al., 2011; Singh & Kant, 2007; Webster et al., 2008; Wong & Aspinwall, 2005). Another individual barrier that keeps employees from KM is motivation (Hong et al., 2011; Richter & Derballa, 2009; Singh & Kant, 2007). Actually, motivation has been identified as one of the most crucial points for KS (Chen, Chang, & Liu, 2012; Gagné, 2009; Šajeva, 2014; Singh & Kant, 2007).

According to Rosenstiel (2011), human behavior is affected by the four conditions individual skills, situational enabling, empowerment and obligation, and individual desire. Together with personal values, the motivation forms the individual desire. There is a positive correlation between motivation and KS willingness and behavior (Lin, 2007; Liu & Fang, 2010). Furthermore, motivation is decisive with regard to the quality of KS (Gagné, 2009). Studies identified a diverse spectrum of KS motivating that ranges from intrinsic motivation such as altruism (Lin, 2007; Liu & Fang, 2010) to aspects of social relevance like reputation or peer-recognition (Chennamaneni et al., 2012; Javernick-Will, 2012; Lin, 2007) and external factors such as rewards (Bock et al., 2005). Also the illustration of the reciprocal benefit of KS, both for oneself and the company highlights the individual value of KM, addresses feelings such as gratitude, obligation and trust (Javernick-Will, 2012) and thus has a positive impact on KS behavior (Bock et al., 2005; Cho, Li, & Su, 2007; Lin, 2007). Such an illustration of reciprocal benefit can be achieved by the provision of feedback which can furthermore provide recognition and appreciation (Gagné & Deci, 2005). The aim of this paper is to outline opportunities to address and strengthen the necessary motivation for KM in a targeted manner.

For the general context of work, Lindenberg (2001) argues that "obligation-based intrinsic motivation is more important than enjoyment-based intrinsic motivation" and that such an obligation-based motivation can be sustained by allowing enjoyment as a compatible background goal. Gamification seems to be a feasible approach here. Deterding, Khaled, Nacke, and Dixon (2011) define gamification as "the use of game elements in non-game contexts". It is an approach to change or influence the behavior of someone by increasing motivation through persuasive design (Spagnolli, Chittaro, Gamberini, & Werbach, 2014; Vassileva, 2012). Game mechanics such as competition, status, immediate or long-term feedback or challenges target on an enhancement of the recipients' motivation (Hamari, 2017; Hamari & Koivisto, 2015). Through game components like rankings, ratings or badges, incentives can be created. With the aim of enhancing the motivation of

recipients, gamification has been applied to various contexts such as education and learning or business (Hamari, Koivisto, & Sarsa, 2014; Koch, Ott, & Oertelt, 2013; Reiners & Wood, 2015). Also for the context of KM, benefits of gamification have been addressed but predominantly not in a holistic way (Shpakova, Dörfler, & MacBryde, 2017) but limited to selective measures such as points for content creation (Swacha, 2015; Trees, 2015).

The aim of this paper is to close this gap by adding a holistic approach for the incentive creation through gamification in KM. Based on an extensive literature study on the identification of KM-relevant motivational factors, we examine gamification as a method for applying incentives within KMS and the creation of an incentive system KM. Advantages and risks of specific game mechanics, especially in regard to their long-term-effect on KS behavior, are theoretically analyzed in order to identify benefits as well as possible side effects. In this way, the paper provides practical implications that support a far-sighted development and implementation of KMS.

2. Theoretical background

In order to correctly assess the opportunities and challenges of designing incentives in KM, a fundamental understanding of motivation is mandatory. Motivation is the intention to perform an action. We base our analysis on the self-determination theory (SDT), which is a theory of motivation and personality that was developed by Deci and Ryan (1985). A model of the SDT is given in Fig. 1. Within their theory, the authors differentiate between intrinsic and extrinsic motivation. The basis of the SDT is the assumption of the existence of three basic psychological needs each human has and pursuits to satisfy. These needs that form the basis for intrinsically motivated behavior are *autonomy*, *competence* and *belonging* (Ryan & Deci, 2000a).

Ryan and Deci (Deci & Ryan, 1985; Ryan & Deci, 2000a) describe intrinsic motivation as the self-propelled drive to perform an activity. The actor's focus is on the activity itself which is performed for its own sake. Acting out of an intrinsic motivation brings a feeling of doing something valuable or doing it out of enjoyment. Other than the autonomous type of intrinsic motivation, extrinsic motivation is controlled and makes people act out of obligation, pressure or coercion (Deci & Ryan, 2015). In terms of extrinsic motivation, the focus of an activity is directed towards the anticipation of a compensation or achievement that is subject to direct or indirect external influence.

In the context of business, extrinsic motivation is often associated with financial rewarding, e.g. performance-based bonuses or an extra day off. But the expectation of a financial reward is just a small part of the extrinsic motivation, namely *externally regulated* extrinsic motivation. Altogether four levels of self-determination and self-regulation are differentiated. The extrinsic motivation by external regulation has the lowest degree of autonomy.

In the case of *introjected regulation*, the trigger of an activity is the internal pressure, which, however, is experienced as caused by the outside. This means an activity is carried out "because that's how it

should be" or because it is expected. This differs from the *identified regulation*, where the personal objective is attributed to the objective of the action. The degree of the perceived external influence is low.

Acting based on an extrinsic motivation with *integrated regulation* differs only marginally from intrinsic motivation in the degree of perceived self-determination. The difference is the objective. While intrinsic motivation derives from the performance of an activity for its own sake, in the case of integrated regulation the activity is performed out of an identification with the associated goals. The action itself corresponds to the actors' own system of values and norms and is not perceived as externally determined.

In the following, we want to show how gamification based incentives can address different forms of motivation and which implications they might have in terms of KM.

3. Approach

In order to identify relevant gamification elements and evaluate their applicability as incentives for KM, a systematic literature review was conducted. This research was guided by research questions, which we defined, based on the theoretical foundations of motivation theory and the assumption that incentives can enhance the motivation for KM and influence KS behavior. Therefore, the relation between motivation and knowledge management was examined at first. Accordingly, the first research questions were defined:

RQ1: What types of motivations support KS and KM activities?

RQ2: Which potential barriers can affect the motivation for KM?

The findings from the first part of the SLR supported a deeper understanding of the motivation for KS in a business context in general and employee's motivation for KM activities in particular. This understanding built the basis for further research on the applicability of gamification in order to create incentives for KM. In a second step, therefore, another three research questions were formulated:

RQ3: To what extent can incentives and gamification be utilized to provide meaningful support for KM?

RQ4: How can gamification be used to create incentives within a KMS?

RQ5: Which gamification components can be used to support KM activities?

The approach of the literature review is illustrated in Fig. 2. Based on the research questions, keywords were extracted and used for a combined search. The literature survey was performed on two platforms covering the time period from 1980 to 2017. In the first place, the keywords given in Fig. 2 were used for a combined search on EBSCO-host for abstracts of publications with full-text access from peer-reviewed journals. In the second step of the literature survey, we searched Google Scholar for publications with the defined keyword combinations. Subsequently, the findings were filtered by applying the defined quality criteria and criteria leading to the exclusion of publications.

Fig. 2. Literature review approach.

Finally, cross-references were taken into consideration, too. Altogether, after filtering and the removing of duplicates, a number of 54 relevant publications, analytical as well as empirical research papers, have been included in the analysis. An overview is given in Table 1.

The analysis of the identified literature allowed to draw theoretical conclusions about the effectiveness of game mechanics as incentives for KM. These results form the basis for further empirical research. Additionally, the insights can also be used by practitioners implementing an incentive system for KM.

4. Literature review

In the following, the findings of the literature review on the relation of motivation and KM are presented. Due to the fact, that KS is a crucial part in KM, we also included empirical studies that have a strong focus on KS behavior without explicitly discussing KM implications. Addressing RQ1, the first part of our review gives a summary of motivation for KM with a strong focus on KS (Section 4.1). Following this, barriers (Section 4.2) and incentives (Section 4.3) for KS but also for additional KM activities, e.g. in the context of KMS usage, are described in order to address RQ2 and RQ3.

4.1. Intrinsic and extrinsic motivation for KS

In the context of incentive system integration and motivation, it is important to note the relation between self-determination and engagement. Studies have shown a negative impact of external regulation or control on interest, engagement, and effort (Ryan & Deci, 2000b). On the contrary, intrinsic motivation and more autonomous forms of extrinsic motivation are related to job satisfaction and engagement and hence, qualitative outcomes of a performance (Gagné & Deci, 2005; Ryan & Deci, 2000b).

Knowledge sharing comprises the externalization process of transforming tacit into explicit knowledge (Nonaka & Toyama, 2003). The conversion from implicit to organizational knowledge, i.e. concretely into qualitative contributions in the KMS, is associated with a not inconsiderable effort (Cho et al., 2007). It is closely tied to motivational factors that affect the willingness of knowledge owners to articulate their knowledge and actively communicate with their colleagues (Hendriks, 1999; Lin, 2007). Thus, the lack of motivation has been identified as a relevant barrier for KS behavior and is a challenge for successful KM (Hong et al., 2011; Riege, 2005; Singh & Kant, 2007). Research on the motivation for KS identified certain motivational factors that contribute to the attitude towards KS. As a first result of the literature review, a summary of motivational aspects that had been identified as relevant for KS is given in Table 2.

Intrinsic motivation is of high relevance in the exchange process of tacit knowledge (Finke & Will, 2003). In regard to KS, intrinsic motivation or altruism can arise from enjoyment in helping others (Hung et al., 2011; Javernick-Will, 2012; Lin, 2007; Webster et al., 2008) by sharing knowledge and, thus, support the work of colleagues (Lin, 2007). Also, the wish to support the organization and thus, contribute to the success of the company, is an intrinsic factor that motivates employees to share their knowledge (Šajeva, 2014; Vuori & Okkonen, 2012). Herein, the aspect of relatedness, which describes the interaction of the individual within a social structure and a feeling of affiliation with the social group, strengthens the community and therefore is another promoting factor for KS (Javernick-Will, 2012; Šajeva, 2014). In this context, an organizational climate and corporate culture that is characterized by open exchange and fairness has a positive influence on the attitude of the employees towards KS (Bock et al., 2005; Foss et al., 2009; Gagné & Deci, 2005; Lin, 2007; Wu, 2013). A noncontrolling job-design and support for self-determined or autonomously motivated behavior are favorable in the context of KS (Foss et al., 2015).

In contrast to that, extrinsic motivation arises from the expectation of a tangible or intangible return (Ryan & Deci, 2000a). Referring
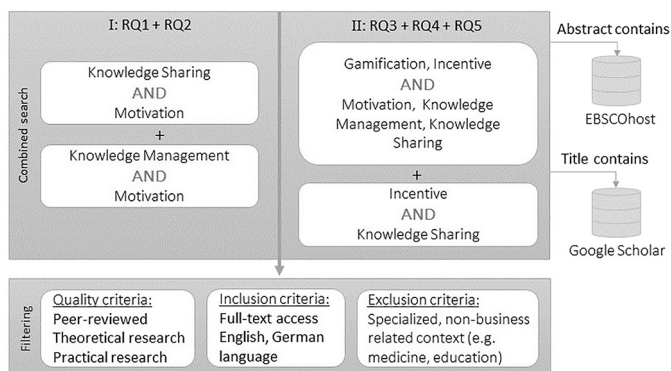
Table 1
Literature review overview.

Key-words	Results EBSCO host	Results Google scholar	Identified literature
"Motivation" & "knowledge management"	51	54	(Ardichvili et al., 2003), (Ahlert, Blaich, & Spelsiek, 2006), (Chan & Chao, 2008), (Cho et al., 2007), (Huerta et al., 2012), (Hung, Durcikova, Lai, & Lin, 2011), (Javernick-Will, 2012), (Cho et al., 2007), (Richter & Derballa, 2009), (Riege, 2005), (Semar, 2004), (Singh & Kant, 2007), (Wasko & Faraj, 2005)
"Motivation" & "knowledge sharing"	62	192	(Ardichvili et al., 2003), (Bock et al., 2005), (Foss, Minbaeva, Pedersen, & Reinholt, 2009) (Foss, Pedersen, Reinholt Fosgaard, & Stea, 2015), (Gagné, 2009), (Hendriks, 1999), (Huerta et al., 2012), (Hung et al., 2011), (Javernick-Will, 2012), (Lin, 2007), (Cho et al., 2007), (Riege, 2005), (Šajeva, 2014), (Yuan, Zhao, Liao, & Chi, 2013), (Spelsiek, 2005), (Vuori & Okkonen, 2012), (Wu, 2013), (Yu, Lu, & Liu, 2010)
"Incentive" & "knowledge sharing"	44	91	(Chennamaneni et al., 2012), (Chen et al., 2012), (Javernick-Will, 2012), (Semar, 2004), (Zaunmüller, 2005)
"Gamification" & "motivation"	51	181	(Bakhuys Roozeboom, Visschedijk, & Oprins, 2017), (Blohm & Leimeister, 2013), (Darejeh & Salim, 2016), (Dicheva, Dichev, Agre, & Angelova, 2015), (Hamari et al., 2014), (Hamari & Koivisto, 2015), (Hamari, 2017), (Hanus & Fox, 2015), (Koivisto & Hamari, 2014), (Kwon, Halavais, & Havener, 2015), (Mekler, Brühlmann, Tuch, & Opwis, 2017), (Meske, Brockmann, Wilms, & Stieglitz, 2017), (Sailer, Hense, Mayr, & Mandl, 2017), (Seaborn & Fels, 2015), (Pe-Than, Goh, & Lee, 2014), (Richter, Raban, & Rafaeli, 2015), (Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016), (Sailer et al., 2017), (Seaborn & Fels, 2015)
"Gamification" & "knowledge management"	4	13	(Ahmed & Sutton, 2017), (Ďuriník, 2015), (Reiners & Wood, 2015), (Suh & Wagner, 2017), (Swacha, 2015), (Shpakova et al., 2017; Shpakova, Dörfler, & Macbryde, 2016)
"Gamification" & "knowledge sharing"	2	6	(Kwon et al., 2015), (Silic & Back, 2017), (Swacha, 2015)

motives that address extrinsic motivation are, for example, the wish for feedback, rewards or other forms of external incentives, such as participation or solidarity with the team. According to Chennamaneni et al. (2012) and Lin (2007), the employees' willingness for KS is not significantly affected by expected organizational rewards like bonuses or other economic incentives. While economic rewards can have a positive influence on the satisfaction of a subject, they do not promote knowledge sharing behavior (Hung et al., 2011). Foss et al. (2009) showed that a focus on external incentives causes a strategic handling of knowledge. Other than intrinsically motivated people, external reasons make people weigh how much KS effort is necessary (amount of knowledge) to obtain the expected reward. In contrast to this, the relevance of social context factors like reciprocity (Cho et al., 2007; Javernick-Will, 2012) and the strive for recognition (Javernick-Will, 2012) or reputation (Hung et al., 2011; Wasko & Faraj, 2005) have been proven. Peoples willingness to externalize and share their knowledge with the community (Hendriks, 1999) is supported by these factors of *social motivation* (Javernick-Will, 2012). In this context, an organizational climate that is characterized by fairness, innovativeness, and affiliation (Bock et al., 2005) and that promotes KM activities by providing mechanisms for social motivation has a strong positive influence on KS (Hung et al., 2011). The provision of feedback on KS activities is one possibility that supports the understanding of KS relevance for the organization (Bock et al., 2005). Feedback mechanisms allow employees to gain mutual recognition and thereby build a reputation which has a positive impact on KS attitude, as long as formal recognition, performance evaluation, and feedback are not associated with external pressure (Foss et al., 2009). As already stated above, this indicates that autonomy and self-determination are not only related to job satisfaction in general but do also have an influence on KS in particular.

In summary, it can be stated that intrinsic motivation and motivation based on the three basic needs for competence, autonomy, and relatedness are more desirable in the context of KS than extrinsic motivation resulting from the expectancy of a return. The reason is its positive and lasting influence on KS attitude (Bock et al., 2005; Foss et al., 2009; Wasko & Faraj, 2005; Wong & Aspinwall, 2005; Wu, 2013; Yu et al., 2010). In its empirical study, Wu (2013) showed a negative correlation between the increasing satisfaction of extrinsic motivation and the willingness to engage in KS behavior. Due to the fact, that KM activities are commonly performed within KMS, additional motivational aspects that emerge from the context of software usage should be considered. Joy, e.g. through using an attractive tool, or the admission of autonomy in regard to the self-determined and self-responsible creation of content in the KMS are two intrinsically motivating factors (Gagné & Deci, 2005).

4.2. Barriers

Not every knowledge management initiative is a success. In the past, KM repeatedly failed, due to various failure factors (Braganza & Möllenkramer, 2002; Chua & Lam, 2005). Therefore, barriers that impede successful KM need to be identified and strategies for their avoidance or removal have to be developed.

In the literature, barriers are typically differentiated into technical, organizational and human/individual ones. On a technical dimension,

Table 2
Motivation for KS.

Identified motives for KS	Source
Altruism/enjoyment of helping others	(Ardichvili et al., 2003; Chennamaneni et al., 2012; Javernick-Will, 2012; Lin, 2007; Vuori & Okkonen, 2012)
Contribute to the company success	(Ardichvili et al., 2003; Bock et al., 2005;Cho et al., 2007 ; Lin, 2007 ; Vuori & Okkonen, 2012)
Self-efficacy	(Cho et al., 2007; Lin, 2007; Vuori & Okkonen, 2012)
Reciprocity	(Bock et al., 2005; Chennamaneni et al., 2012; Cho et al., 2007; Javernick-Will, 2012; Lin, 2007; Vuori & Okkonen, 2012)
Fellowship/participation	(Gagné & Deci, 2005; Vuori & Okkonen, 2012)
Reputation	(Ardichvili et al., 2003; Chennamaneni et al., 2012; Cho et al., 2007; Hendriks, 1999; Hung et al., 2011; Vuori & Okkonen, 2012; Wasko & Faraj, 2005)
Signaling competence	(Ardichvili et al., 2003; Gagné & Deci, 2005; Hendriks, 1999; Javernick-Will, 2012)
Recognition	(Ardichvili et al., 2003; Hendriks, 1999; Javernick-Will, 2012; Vuori & Okkonen, 2012)
Conformity/following norms/responsibility	(Ardichvili et al., 2003; Bock et al., 2005; Hendriks, 1999; Javernick-Will, 2012; Vuori & Okkonen, 2012)

an insufficient integration of KMS or mismatches between technical support and user requirements can impede successful KM (Riege, 2005). The handling of KMS may furthermore be complicated due to poorly designed user interfaces (Chan & Chao, 2008), a lack of structure (Reiners & Wood, 2015) or information overload and redundancies (Richter & Derballa, 2009). Considering the organizational dimension, inadequate management strategies or general insufficient processes of work organization, like lack of time for KM activities (Richter & Derballa, 2009; Singh & Kant, 2007) or an unfavorable knowledge culture within the company (Richter & Derballa, 2009), are exemplary barriers. On the human dimension, inadequate or missing motivation (Hong et al., 2011; Richter & Derballa, 2009; Singh & Kant, 2007; Swacha, 2015), uncertainty and anxiety on side of the knowledge owner (Ardichvili et al., 2003; Richter & Derballa, 2009) or an under-valuing of the KM due to low awareness for KS benefits (Ardichvili et al., 2003; Hong et al., 2011; Riege, 2005) had been identified. Individual barriers can be found on both sides, the knowledge owners' as well as the recipients' side. As an example, a lack of trust in regard to KS can cause withholding of knowledge on side of the knowledge owner but can also have the effect that potential recipients hesitate to use the knowledge (Hong et al., 2011).

While technical barriers can be avoided by comprehensive implementation and an alignment of requirements and functions, an appropriate and supportive corporate culture that supports KM and highlights the benefits of KM can help to avoid organizational ones. All kinds of barriers can impede effective KM processes. Due to the fact that KM is a process that takes place within a socio-technical environment (KMS in organizations), it is important to keep in mind, that there are interdependencies between barriers. Thus, in the conception of an incentive system, these barriers must not be underestimated by solely focusing the aim of increasing motivation.

4.3. Incentive systems

The purpose of the use of incentives in a business context is to motivate employees for showing a certain behavior or performing an action. Incentives work as an intensifier of the underlying motivation but cannot create motivation which is not at least subliminally present (Brandenberg, 2001; North & Varlese, 2001). Nevertheless, from an ethical point of view, researchers as Grant (2002) describe incentives as a way "in which people can get other people to do what they want them to do". Since autonomously motivated behavior is supportive for KS (Foss et al., 2009), employees must not perceive incentives as forms of behavioral manipulation or control which would undermine intrinsic motivation (Gagné, 2009).

In accordance to Zaunmüller (2005), we define an incentive system as the sum of all consciously offered (external) or consciously designed (internal) incentives that reinforce desired behaviors (achievement of corporate goals) and reduce undesired behaviors (counteracting corporate goals). In order to assure its success, several requirements to an incentive system have to be defined in advance. In an overview based on an extensive literature review, Zaunmüller (2005) lists transparency, flexibility, economic efficiency, justice, individuality, performance orientation, motivational effect and simplicity as the general requirements for incentive systems. With a focus on incentive systems for KM, Zaunmüller (2005) adds orientation along target agreements and consideration of corporate culture whereas Semar (2004) names sustainability and qualification. With the aim of providing a holistic approach for the engineering of gamified software, Morschheuser, Hassan, Werder, and Hamari (2018) identified and collected design principles and assembled a method for gamification engineering which contains seven main phases. These are (1) Project preparation, (2) Analysis of context and users, (3) Ideation, (4) Design, (5) Implementation, (6) Evaluation and (7) Monitoring.

In the beginning of the design and engineering process, it is necessary to articulate clear objectives of the gamification project

(Morschheuser et al., 2018). The later selection of incentives should be based on these pre-defined objectives, which are ideally the result of an agreement between employees and management (Zaunmüller, 2005). Exemplary objectives in KM are an increase of contribution quality and quantity or the intensification of KMS usage. Overcoming barriers that hinder KM activities can be another incentive objective (Spelsiek, 2005). Herein both, the company objectives and the needs and ideas of the employees must be taken into account and incentives need to be adjusted to the corporate culture (Hamari et al., 2014; Javernick-Will, 2012). In the selection process of incentives, it is also important to note that the individuality of the recipient but also the context influences the effectiveness of an incentive (Hamari et al., 2014). Depending on individual motivation, incentives can have different, sometimes even contrary effects (Restivo & van de Rijt, 2014; Suh & Wagner, 2017). Therefore, Morschheuser et al. (2018) suggest a context as well as a user analysis that precedes the implementation process. Furthermore, an evaluation of the efficiency and effectivity of incentives (Zaunmüller, 2005) should be performed regularly in order to assure that the system meets the predefined objectives (Morschheuser et al., 2018). Evaluation and monitoring could also reveal unintended side effects of incentives, e.g. a rapid increase of contribution quantity that might be an indication of cheating. On basis of a regular evaluation, incentive system can be modified and re-aligned to the framework conditions of the company (Zaunmüller, 2005).

A well-designed incentive system is able to strengthen KS motivation and has a positive effect on individual KS engagement (Chen et al., 2012). In order to support awareness for the differing effects of incentive types, we will describe them in the following section.

4.3.1. Internal and external incentives

In the following, we make a general distinction between internal and external incentives, the latter being subdivided into further subtypes. Fig. 3 gives an overview of the terminology, including the different types of incentives and their characteristics. Internal incentives are an integral part of an activity (Zaunmüller, 2005). The process of work itself can be understood as an internal incentive (e.g. interacting with children as an internal incentive for educators), but also elements of work design (teamwork, free space to create on solutions) that can add value to an activity (enjoyment, fun). External incentives are tied to the precondition of completing an activity (Fishbach & Choi, 2012). They can thus be understood as compensation, both tangible and intangible, for a performance. Compensation is received in accordance with defined target agreements. Their achievement is measured by key indicators which, in turn, build the basis for the rewarding. Recipients of external incentives have a focus on the reward, not the action.

External incentives are subdivided into two categories, tangible (monetary and non-monetary) and intangible rewards (badges, rankings, rating systems). Tangible rewards, which may be given in form of direct monetary incentive (e.g. bonus payment) or indirect remuneration (e.g. in form of free-time-bonuses), should be chosen with care. They may cause behavior adaptions of employees in order to provide the required key figures and receive the promised incentive. Further, other unrewarded work areas might become neglected which, in sum,
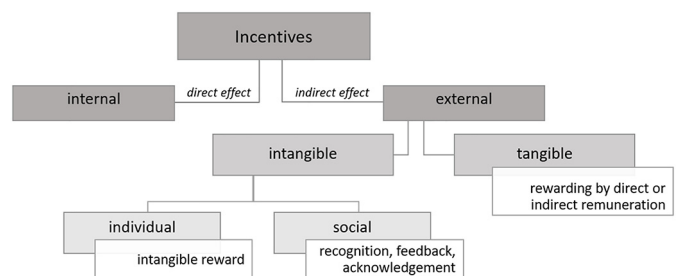

Fig. 3. Incentive types overview.

leads to a declining work quality (Foss et al., 2009; Ryan & Deci, 2000a; Scekic, Truong, & Dustdar, 2013). Especially monetary incentives entail the risk of a so-called *motivation crowding effect* (Bock et al., 2005; Frey & Jegen, 2001), which means the suppression of intrinsic motivation and thus, a worsening of the basic attitude towards KS. The exchange of knowledge is not (anymore) a matter of course but transforms to an action that is performed in order to receive a bonus for it (Bock et al., 2005; Hars & Ou, 2002). As Javernick-Will (2012) stated, tangible rewards initially encourage people in performing KS behavior due to extrinsic motivation, but begin to question their behavioral effort and the activity as a whole as soon as the reward is taken away. Thus, tangible rewards can induce a change of behavior and result in changing key figures, e.g. contribution quantity, but they do not have a positive effect on the attitude towards KS (Hung et al., 2011) or intrinsic motivation (Mekler et al., 2017). Additionally, monetary incentives lead to great pressure for the employees which entail the risk of suppression of intrinsic motivation (Foss et al., 2009).

Intangible incentives are another form of extrinsic incentives. They provide the opportunity to reward a performance without giving it a material value, e.g. by giving points for a performed action or honoring an employee by displaying him as the employee of the month. Intangible incentives might also have negative side effects. An ambitious employee, for example, might overestimate the value of an intangible reward and thereby create an undesired dynamic of competition and rivalry within the team.

4.3.2. Social incentives

Social incentives are a form of extrinsic incentives, that are awarded directly by the community or at least base on community feedback and thereby strengthen relatedness. The concept of social incentives is used by Kwon et al. (2015) in order to describe the effect of the (online) community within gamified systems on the individual, who is not isolated but acts within this group of interests. By acknowledging performance and using, criticizing or simply recognizing the outcome of an action, the community is able to create a value and addressing needs for relatedness. A strong feeling of relatedness, in turn, has a positive impact on the willingness to share one's own internal knowledge with others (Javernick-Will, 2012; Wong & Aspinwall, 2005; Wu, 2013). Accordingly, community dynamics can be supported by implementing game mechanics such as rewards or feedback. Relatedness and an understanding of knowledge as a public good that belongs to the whole organization have a positive influence on knowledge exchange (Ardichvili et al., 2003). But highlighting ambition and egoistic motives such as prestige and status, social incentives may also implicate negative effects (Pascual-Ezama, Dunfield, Gil-Gomez de Liano, & Prelec, 2015). If this rivalry is directed to the exclusiveness of knowledge, KM activities are undermined (Ardichvili et al., 2003). In the awareness of that, the peer effects of social incentives provide, in our view, a great opportunity for the overcoming of the "knowledge is power" thinking if their application is designed with care.

4.4. Gamification for knowledge management

Gamification is the implementation of game design elements in order to increase the motivation of the addressee. Theoretically, three aspects of gamification can be distinguished: game dynamics, mechanics, and components. The most direct and concrete forms of gamification are game components such as points, rankings, levels or quests that are implemented in a system. These components realize game mechanics which are equivalent to incentives, e.g. challenge, competition, feedback, rewards or cooperation and hereby create various motivational dynamics, which are the most abstract form of gamification. Dynamics cannot be implemented or managed directly (Shpakova et al., 2016) but have a decisive impact on motivation. An overview of the concepts of gamification is given in Fig. 4. The listing makes no claim to completeness but gives a summary of game design

elements from literature on gamification that have been analyzed within this paper (Blohm & Leimeister, 2013; Darejeh & Salim, 2016; Dicheva et al., 2015; Hamari et al., 2014; Sailer et al., 2017). Gamification offers a number of components that address a KMS users' need for feedback like points, progress bars, badges, ratings or leaderboards (Blohm & Leimeister, 2013; Hamari et al., 2014). For the context of KM, Swacha (2015) suggest four categories of points: Socialization (interact with KMS users), Externalization (create new contributions), Combination (link or supplement contributions), and Internalization (make use of contributions). Points can have a positive impact on quantitative key figures such as tag or contribution quantity but do not have an impact on the intrinsic motivation of an employee (Mekler et al., 2017). Nevertheless, they support KMS user engagement by providing direct and almost immediate feedback for activities (Ďuriník, 2015). Within their research on the effects of gamification on KS practice, Silic and Back (2017) found that job motivation, and thus the motivation for KS, is strongly linked to performance expectancy. By providing performance-based feedback and offering different component to make achievements visible, KM activities can be rewarded. Thus, gamification is a method for companies to meet the requirements of employees for performance expectancy and strengthen KM (Ahmed & Sutton, 2017; Shpakova et al., 2016; Silic & Back, 2017; Suh & Wagner, 2017). Recognition of work outlines and strengthening of self-esteem are further positive effects a gamified KMS could bring if it is accompanied by the proper corporate culture that emphasizes collaboration instead of competition (Ďuriník, 2015).

Unlike points and leaderboards, badges are a more complex form of feedback mechanisms. In the context of KS, badges can be given for the achievement of a defined goal, displaying a certain knowledge status or performing KS activities. The positive effects of badges for usage quantity have been shown by Hamari (2017) and Mekler et al. (2017). They may be used as social markers and status representations (Hamari, 2017; Kwon et al., 2015; Robson et al., 2016; Silic & Back, 2017; Suh & Wagner, 2017) which makes them extrinsic incentives. Since badges are limited to the system, they tie a user to the system and thus become exit barriers. By triggering emotions like fun or ambition, badge collections work as intrinsic incentives (Silic & Back, 2017). This shows that in the context of gamification, the contextual type of rewarding can make a difference. Chou (Chou, 2013) describes six contextual types of rewards, namely fixed action reward, random reward, sudden reward, rolling reward, social treasure, and price packing. For example, a badge can be awarded as a fixed action reward for achieving a defined goal (e.g. a specific number of created KMS contributions). In this case, the employee can consciously work towards the set target and satisfy his or her ambition. Thus, badge collections create a competing and challenging user experience (Suh & Wagner, 2017). On the other hand, it is also possible to receive a badge based on a hidden key figure, such as user access to a KMS contribution (sudden reward). This type of reward creates a joyful experience or surprise, making the system more attractive to the user. A badge could also be given as a social treasure, with which a colleague can reward a particularly valuable contribution and thereby underline the collaborative aspect of knowledge work. The employee notices that his or her KS activities are relevant for others too and hereby experiences reciprocity (Swacha, 2015). The usage of different contextual types of rewards ensures variety and keeps the engagement of the system users high (Darejeh & Salim, 2016). This way, the novelty effects of gamification that lead to a diminishment of enjoyment and playfulness over time (Koivisto & Hamari, 2014) could also be avoided.

A joyful user experience affects intrinsic motivation and hereby has a positive impact on KM-related processes like learning (Shpakova et al., 2016). Emotions such as happiness, or satisfaction by achieving success are driving user activity (Darejeh & Salim, 2016). In general, it is important to keep in mind that an incentive system does not work as an isolated motivation tool but has to be an integrated part of an organizational strategy. Gamification of systems often fails because the
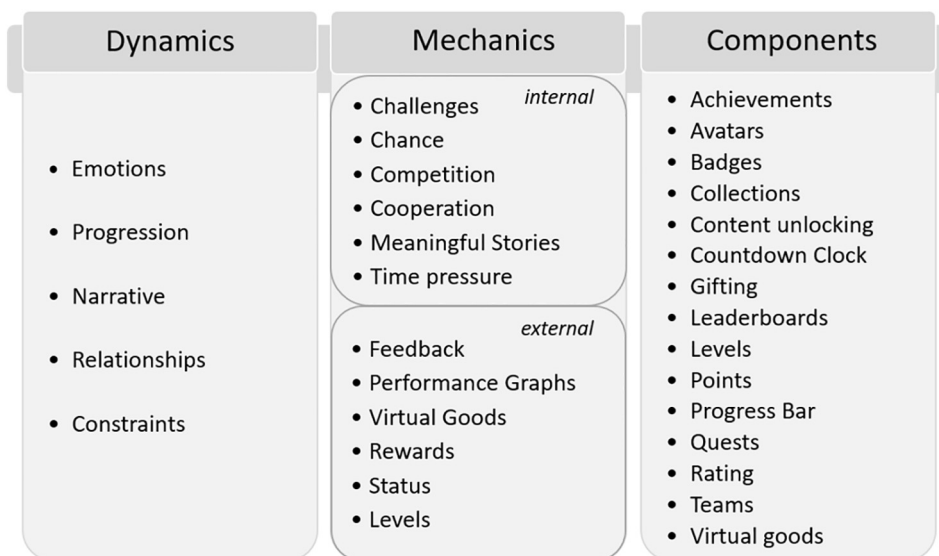
Fig. 4. Aspects of gamification.

incentive design is unstructured or not sufficiently thought through in its basic conception (Blohm & Leimeister, 2013; Sailer et al., 2017). Additionally, inter-relational effects of incentives need to be considered. As an example, points awarded for content creation within the KMS may not provide information on the quality of the contribution but may indicate quantitative improvements in performance. Combined with a ranking and maybe an additional rewarding system for high-ranked employees, there is a risk that rivalry shifts the focus from the performance-based reputation to standing which provokes dishonest behavior and cheating (Pascual-Ezama et al., 2015). The basic objective, increasing the number of KMS contributions, could be suppressed when people decide to focus on their ranking position and earn point by making useless or low-qualitative contributions. Additionally, employees might feel controlled or observed so that using the system would mean stress and pressure instead of fun. This means, that a poorly designed gamified system can in the worst case lead to the destruction of intrinsic motivation through frustration or motivation-crowding effects. Therefore, the gamification of a system by an implementation of incentives has to be designed well and accompanied by organizational efforts (Blohm & Leimeister, 2013; Sailer et al., 2017).

5. Game mechanics and incentive design for knowledge management

Based on the findings from the literature review on the motivation for KS and KM, in the following benefits and risks of gamification mechanics as incentives for KM are evaluated (addressing RQ 4 and 5). For this purpose, game mechanics have been identified in the literature analysis and assigned to the KS-relevant aspects of motivation. The hypothesized interaction between game mechanics and motivation is shown in Table 3 and forms the basis of the following theoretical-conceptual consideration of gamification and KM. As can be seen from the overview, no gamification mechanic is assigned to the motivational aspect of conformity/following norms and orders. This is due to the fact that this aspect is addressed by general working instructions and we did not find evidence, that conformity, in particular, could be promoted by gamification. In accordance with our assumption of interactions between game mechanics and motivation, we focus on *challenge*, *competition*, *feedback*, *performance graphs*, *rewards*, and *status*. In doing so, we show benefits of an incentive-creating gamification of KMS. Hereby, the effects of game mechanics on the motivation for KM are examined, paying special attention to their functionality as social incentives. An overview of the incentives matching gamification components can be

Table 3
Gamification mechanics addressing KS motivation.

Motivation for KS	Gamification mechanism
Altruism/helping others	Feedback
Contribute to the company success	Feedback, performance graphs
Fun/enjoyment of KS	Challenge, feedback, competition
Self-efficacy/visibility of achievements	Feedback, performance graphs
Reciprocity	Feedback, rewards
Fellowship/participation	Feedback, status
Reputation	Feedback, status, rewards
Signaling competence	Performance graphs, status
Recognition	Feedback, rewards, status
Conformity/following norms and orders	/
External rewards	Rewards

found in Table 4.

5.1. Challenge

Gamification provides certain possibilities for implementing challenges into software. For example, team quests provide the opportunity to master challenges by working collaboratively on a solution for a given task (Swacha, 2015). Quests within KMS could be the identification of relevant content for a given keyword, the linking of articles or artifacts that deal with the same issue. The integration of the team component highlights the collaborative aspect of the task (Robson et al., 2016). The integration of time constraints might increase the challenging effect (Ďuriník, 2015) and thereby increase the willingness to perform KM activities. But time pressure within challenges may cause a disregard of contribution quality. Therefore, they should be limited to repetitive tasks (Ďuriník, 2015) such as sharing contributions with a number of colleagues. Another way to create a challenging incentive is the representation of achievable badges. The challenge of a badge collection addresses the ambition of the user. With regard to the crowding out effect, the focus of the incentive system should not be on the ambition of the user and should only have a low priority within KMS.

5.2. Competition

Competitive activities can make a process more interesting and attractive for a player. Suh and Wagner (2017) showed that competition in general and the creation of a competitive environment, in particular,

Table 4
Game components realizing gamification mechanics.

Game mechanics	Incentive implementation in KMS
Challenge	Badge collection, team quests
Competition	Contributor ranking, knowledge quiz, team quests
Feedback	Content rating, contributor ranking, qualitative badges, peer-to-peer rewards, team chat
Performance graphs	Badge collection, contributor ranking, points for contribution, quantitative badges
Rewards	Qualitative badges, quantitative badges, peer-to-peer rewards, points for contribution
Status	Contributor ranking, content responsibilities, content unlocking, knowledge status

can have a positive impact on the quality and quantity of knowledge contributions. The integration of knowledge quizzes is one possibility for competition within the KMS (Zinke & Friedrich, 2017). A quiz can be used for training or as a means to evaluate the actual knowledge status of the employees. The integration of rankings and leaderboards is another way to implement the challenge aspect within the system. Based on points or badges, employees can compare their individual performance with the group (Sailer et al., 2017; Swacha, 2015). In both ways, competition makes tasks more enjoyable, especially for ambitious people, and thus encourage them to engage in KS (Suh & Wagner, 2017). Nevertheless, it is important to keep in mind, that unlike gamers, users of gamified business software cannot decide whether to use the tool or not. Employees might also feel pressured by rankings (Hung et al., 2011). Accordingly, a strong focus on ambition and competitiveness impairs open knowledge exchange (Hanus & Fox, 2015; Pascual-Ezama et al., 2015). If competition is perceived as controlling mechanism, it may also set pressure on employees (Gagné & Deci, 2005) which is not supportive for KS.

5.3. Feedback

Gamification provides different forms of feedback for users. On the one hand, displaying points or results right after the performance of an action provides a form of feedback through rewards (Bock et al., 2005; Lin, 2007). In the same way, achieving badges or ranking positions based on reviews by the colleagues, e.g. through rating systems, state a form of feedback (Hamari et al., 2014). Additionally, feedback is an option to use the peer effects of social incentives by creating opportunities for mutual recognition. As an example, by providing a comment column, employees are empowered to give feedback and become part of the knowledge community even as a predominantly passive member (Hamari et al., 2014). Authors benefit from performance-based feedback which supports the understanding of their work's relevance for the community. The degree of task significance has a positive impact on the engagement of employees and their KS activities (Spelsiek, 2005).

Positive feedback from the community can be perceived as a form of recognition that strengthens self-confidence and provides relatedness (Foss et al., 2009; Hamari et al., 2014). When feedback is given in a public environment or rewards are given based on community feedback, e.g. in form of peer-to-peer, the reciprocal benefits of KS and the collaboration aspect of KM are emphasized (Hamari & Koivisto, 2015; Hung et al., 2011; Silic & Back, 2017). The reputation which can be seen as an outcome of public feedback has a significant positive effect on the quality as well as quantity within the context of KS (Hung et al., 2011). By fostering relatedness and self-confidence, peer-to-peer feedback has a positive impact on the organizational climate and affects the perceived working satisfaction (Bock et al., 2005; Gagné & Deci, 2005).

But unintended side effects have to be considered also. Negative feedback may cause a feeling of pressure and fear that will keep employees from participating and sharing their knowledge with the community (Hung et al., 2011; Zhu, Zhang, He, Kraut, & Kittur, 2013). But in virtual communities such as KMS employees might also fear criticism or ridicule of their contributions (Ardichvili et al., 2003). In this way, a lack of trust or unclear communication rules and standards can keep people from participating (Ardichvili et al., 2003) and may even foster

withholding of knowledge (Webster et al., 2008). Here again, the necessity of fairness and supportive corporate culture that encourages employees and tolerates mistakes becomes clear (Bock et al., 2005; Girdauskienė & Savanevičienė, 2007).

5.4. Performance graphs

Performance graphs and additional forms of graphs like progress bars that illustrate the performance and individual achievements of an employee allow for reflection of work and self-affirmation. Based on the different points that employees can earn within the system, performance graphs could visualize progress on different levels such as contribution quantity (externalization points), experience (combination of badges and points) or intensity of KMS usage (all forms of points). In this way, performance graphs satisfy the psychological needs for competence (Sailer et al., 2017). The KMS user is given an opportunity to display the individual progress which has a positive impact on the perceived enjoyment (Dicheva et al., 2015; Hamari et al., 2014). The use of performance graphs additionally allows to integrate another game mechanic which is called shadowing. According to Thiebes, Lins, and Basten (2014), shadowing as a method where users can compete against their own records. By saving or filtering performance progressions for specific time frames, e.g. badges achieved last year, externalization points earned last month, employees can constantly try to challenge themselves and take advantage of the competition aspect without creating an extrinsic incentive.

5.5. Rewards

Rewards are a means to award an employee for a performance and provide an opportunity to easily represent achievements. Therefore, they address extrinsic motivation of different form. Generally, rewards are allocated based on key indicators which must be achieved.

A typical gamification reward form is a badge. In KM, badges may, for example, be given for a certain number of contributions or positive evaluations. These badges allow a comparison with the group and in that way, function as social markers (Hamari, 2017). This targets the ambition of the incentive addressee and, hereby, enhances the activity (Dicheva et al., 2015; Foss et al., 2009; Hamari et al., 2014). This positive effect of badges was also demonstrated by the example of Stack Exchange, where badges were successfully used to motivate users to perform the desired activities (Bornfeld & Rafaeli, 2017). Badges can also convey a sense of competence and recognition for the underlying performance which makes them a form of social incentives (Hamari, 2017; Kwon et al., 2015). As Swacha (2015) showed, badges can rewards various aspects of KM such as reciprocity (helping others), promptitude (be the first one to answer) or regularity (keep the system running by avoiding periods of inactivity). Mechanics such as unlocking or collecting of badges base on the user's curiosity or enjoyment of ambitions goal achievements (collect all) (Hamari, 2017). When all achievable badges are visible, they become desirable, especially for extrinsically motivated employees with strong ambition. In this way, badges can support intrinsic motivation (Silic & Back, 2017). In this case, it is enough to present badges in the private part of the user profile. Another option is to publish badges on the public profile or at

another point of the KMS, e.g. a forum. The effect of visibility of achievements was proven by Suh and Wagner (2017). On the one hand, employees might use badges to show their expertise. On the other hand, colleagues might feel encouraged to work harder in order to achieve the same.

Another form of reward is given by leaderboards, e.g. for the most-read contributions in the KMS, the most active authors or best assessments. Leaderboards are another way to incorporate gamification mechanics and thereby, increase user motivation for KM by addressing needs for competence and autonomy (Blohm & Leimeister, 2013; Sailer et al., 2017). The use of leaderboards instead of completely visible rankings protects employees which do not belong to the group of high performer from demotivation through competition which might be a side effect of extrinsic incentives (Hanus & Fox, 2015). Mekler et al. (2017) showed that points, levels, and leaderboards have a positive influence on individuals contribution quantity. At the same time, they found a negative correlation between contribution quantity and quality what they attribute to a neglect of accuracy in content creation in favor of the metric necessary to preserve the rewards. Therefore, in order to avoid the effect of motivation crowding (Frey & Jegen, 2001) and, along with that, avoid the risk of neglecting quality, the use of rewards should be considered well in context of KM.

Within a business context, it seems plausible to convert acquired (virtual) rewards into tangible incentives like bonus payments or an extra day off (Trees, 2015). Badges, points or leaderboard positions could serve as valid indicators. But as we have outlined before, the creation of such tangible incentives on a meta-level is not supportive of KM. Even though they may provoke a change of behavior that leads to increasing key indicators, the effect of monetary rewards is not sustainable and undermines the intrinsic motivation for KM activities (Frey & Jegen, 2001; Lin, 2007; Šajeva, 2014).

5.6. Status

The collection of points, badges and ranking positions provides an opportunity to signal competence and gain reputation within the social group due to an honorable knowledge status (Blohm & Leimeister, 2013; Robson et al., 2016; Shpakova et al., 2017). Reputation has a great influence in KS communities because it creates trust on the knowledge recipient's side with regard to the knowledge transferor (Girdauskienė & Savanevičienė, 2007). Also, rankings or leaderboards fulfill a status function by representing positions including the aspect of comparison (Swacha, 2015). When transferring status to the context of KMS, it seems also possible to link authorizations and responsibilities within the KMS to it. For example, it would be conceivable to assign the authorization for opening new topic complexes in the KMS only to users with a certain experience resp. status. Like in competitions, an emphasis on status is an external motivation. Accordingly, in the context of KM, the implementation of mechanics that support status thinking should be thought out well.

Besides the effect of recognition, the aspect of status may also be implemented by user roles that have, in accordance with their competencies, different authorization rights within the KMS, e.g. reviewing or rejecting of contributions. This way, it is also possible to define responsibilities for thematic areas within the KMS according to the status of a user.

6. Practical implication

It can be stated that gamification has the potential to support KM activities in multiple ways. Based on the work in Section 5, we have listed examples of how incentives can be implemented using gamification components in Table 5. This overview may serve as advice for practitioners who are planning to implement gamification mechanics into an existing KMS or develop a new one. Three crucial points have to be considered in the designing process of an incentive system for KM.

First, when selecting incentives, the focus should always be on long-term effects. This means that intrinsic and social incentives that strengthen and highlight the value of KM are preferable to those to extrinsic incentives. Secondly, the effectiveness of incentives must always be monitored in order to be able to adjust them if necessary and to avoid that the effect of incentives fades away over time (novelty effect) which may result in a decrease of the level of changed behavior (Hamari, 2017; Koivisto & Hamari, 2014). Monitoring in form of direct supervision by the management or the peer group which in our case is the KM community (KMS user) can moreover limit the risk of cheating and unethical behavior (Pascual-Ezama et al., 2015). Thirdly, a holistic approach is required in the overall design of a gamified KMS in the prevention of failure (Morschheuser et al., 2018). This is a complex tasks "that exceeds applying simple point systems and badges" (Blohm & Leimeister, 2013). The risk that gamified systems do not attain the favored results, due to disregarded interrelations of elements or inappropriate design, is high and many gamification projects fail due to an unawareness for that (Morschheuser et al., 2018). As an example, Hanus and Fox (2015) showed that in the context of learning, a combination of leaderboards, badges, and competition mechanics can harm motivation and have negative effects on the recipients. Further research could analyze, for example, if leaderboards or anonymity in context with social comparison can mitigate the negative effect (manipulation of key figures, cheating) that come with reputation and standing.

In the phase of ideation and design of the gamified KMS, it should be kept in mind that some game mechanics are more preferable with regard to KM than other. Mechanics that allow for community-based feedback or rely on quality key figures ensure a high quality of content in the KMS (Hung et al., 2011; Suh & Wagner, 2017) which supports companies in retaining knowledge in the company in the long term. In order to avoid a neglect of quality due to a focus on quantitative measures (Mekler et al., 2017), points and leaderboards should only be used in the context of non-content producing work like structuring of contents, reading or rating activities. Otherwise, there is a risk that the focus of the employee might shift from intrinsic or autonomous extrinsic motivation with its positive correlation with contribution quality (Ryan & Deci, 2000a) to the rewards as such along with the necessary achievement of the required key figures (Ďuriník, 2015; Frey & Jegen, 2001).

Second, the motivation of users is essential to ensure a high quality of knowledge contributions over a long period of time, where otherwise there is a risk that a high-quality collection of company-relevant knowledge will be created once and will neither be used nor consistently expanded afterward. In order to ensure that the KMS is maintained and its contents are regularly updated, rewards and recognition must not be limited to processes of knowledge creation. Instead, they must comprise all steps of KM, from creation and storing of knowledge up to transferring and applying (Alavi & Leidner, 2001). Due to its positive effect on KS behavior, incentives that strengthen the intrinsic motivation of users, like a knowledge quiz that increases fun and enjoyment of a task (Zinke & Friedrich, 2017), should be preferred. Knowledge quizzes can be implemented as part of the KMS. This way, learning not only becomes an integrated part of KM activities but is also embedded in a playful and challenging working task. Furthermore, components which enhance collaboration and cooperation like team quests, peer-rewards or contribution ratings serve as useful social incentives. On the contrary, incentives that are based on competition should be designed with care in order to avoid a strong focus on rivalry, which could foster egoistic motives and unfair behavior and thus, harm motivation (Hanus & Fox, 2015).

The effectivity of incentives, however, depends on the character and individual values of the recipient as well as the working atmosphere. As an example, Restivo and van de Rijt (2014) showed the differing effect of rewards for Wikipedia contributors. While rewards had a significant positive effect on the productivity of highly-active contributors (with a high intrinsic motivation), the productivity output on less-active

Table 5
Gamification components as incentives for KM.

KM incentives	Advantages	Risks
Badges	• Social markers (Hamari, 2017) • Marker for experiences (competence needs), reputation (Kwon et al., 2015) • Enhances the activity (Dicheva et al., 2015;Foss et al., 2009 ; Hamari et al., 2014)	• New badges have to be added over time in order to keep the badge system interesting and make use of novelty effects (otherwise effects wear off) (Hamari, 2017)
Badge collection	• Fast overview on achievements • Can improve intrinsic motivation (Hamari, 2017; Silic & Back, 2017) • Positive impact on behavior by addressing motivational driver of collecting (Suh & Wagner, 2017)	• Risk of motivation crowding (focus on badge achievements rather than KM activity) (Blohm & Leimeister, 2013)
Content rating	• Recognition in form of positive rating outcomes - strengthen self-confidence (Foss et al., 2009; Hamari et al., 2014)	• Negative rating might increase uncertainty (Ardichvili et al., 2003) that can keep employees from contributing • Employees might feel pressured (Hung et al., 2011)
Leaderboards (contributor, socializer, KMS user)	• Supports comparison between coworkers (Swacha, 2015) • Address needs for competence and autonomy through recognition and acknowledgment (Blohm & Leimeister, 2013; Sailer et al., 2017)	• May be perceived as external control • Strong focus on ambition and competitiveness impairs open knowledge exchange (Hanus & Fox, 2015; Pascual-Ezama et al., 2015)
Knowledge quiz	• Challenging when played against one's own results • Immediate feedback on the individual state of knowledge (Zinke & Friedrich, 2017)	• Competitive character (rivalry)
Knowledge status	• Comparison with the community (Swacha, 2015) • Reputation and acknowledgment • Signaling of competence created trust on side of the recipients (Girdauskienė & Savanevičienė, 2007)	• Stresses "knowledge is power" thinking • Alleged comparability of employees can put pressure on KMS users • Negative effect in terms of upward comparison (Hanus & Fox, 2015)
Peer-to-peer rewards	• Recognition by the team • Reciprocity (Swacha, 2015)	• Risk of an advancement of certain team members (unobjective feedback)
Private performance graphs	• Employees can try to improve their own performance (shadowing) (Thiebes et al., 2014) • Satisfy the psychological needs for competence (Sailer et al., 2017)	
Points for contributions	• Immediate reward for a performance (Ďuriník, 2015)	• Risk of crowding-out of intrinsic motivation due to strong focus on rewarding (Ďuriník, 2015)
Team quest	• Collaboration emphasizes corporate value of knowledge • Offers challenges and social status (Robson et al., 2016)	• Weak employees can hide behind powerful team performances

contributors had not been affected. On the contrary, recognition through rewards could even harm intrinsic motivation of less-active contributors and thus have a de-motivating effect on the long-term which resulted in a shortening of the voluntary commitment. Although the results of this study cannot be transferred one-to-one to the operational KM context, they show that gamification alone cannot be a panacea that automatically causes all employees to increase productivity. Therefore, we cannot give a universal model for a KM incentive system.

Basically, the effectiveness of an incentive system should be measured through key indicators like contribution quality and quantity and the satisfaction of the employees, according to previously defined objectives on the other hand. In this respect, both negative effects of incentives and a reduction in their effectiveness (due to the novelty effect) can be detected and system components can be adjusted as required.

7. Conclusion and future research

The analysis showed, that gamification indeed provides various possibilities to increase the motivation of employees for KM activities. But to unfold its potential a gamified KMS requires for a fitting environment. In other words, gamification will be successful in the long term only in combination with an appropriate corporate culture and an organizational climate that promote an open exchange of knowledge and rewards KM activities. A corporate culture, which is characterized by open exchange and fair feedback has a positive influence on the attitude of the employees towards the division of knowledge exchange (Bock et al., 2005; Foss et al., 2009; Gagné & Deci, 2005; Lin, 2007). The effect of incentives like feedback varies in dependency to the perceived control and external regulation which is crucial in that context (Foss et al., 2009). Thus, the creation of an incentive system and the

engineering of a gamified KMS can only be part of a holistic KM approach (Morschheuser et al., 2018). Herein, individual, technical as well as organizational aspects have to be taken into account (Baptista Nunes, Annansingh, Eaglestone, & Wakefield, 2006; Wong & Aspinwall, 2005). Moreover, it must not be forgotten that incentives do not have a uniform effect on all employees. The individual perception of external incentives, whether they are perceived as controlling or not, has impact on the effect (Ryan & Deci, 2000a). As Hamari et al. (2014) showed, next to the individual motivation, the design of the gamified system is a factor that have an influence on the engagement by gamification. In order to give a comprehensive overview of the results of this paper, we briefly revisit our initial research questions below:

RQ1: What types of motivations support KS and KM activities?

Intrinsic motivation has proven to be the most supportive motivational type for KM because of its lasting effect and its positive impact on KS quality (see Section 4.1). As Foss et al. (2015) showed, the degree of autonomy and self-regulation positively correlates with KS behavior.

RQ2: Which potential barriers can affect the motivation for KM?

Next to a lack of motivation of the employees, technical and organizational barriers such as missing KMS usability or a corporate culture that puts competition over collaboration may hamper KM.

RQ3: To what extent can incentives and gamification be utilized to provide meaningful support for KM?

Incentives need to be adjusted to the individual demands of its recipients. Accordingly, it is not possible to make a general statement about the benefits and required extent of incentives. Rather it depends on the given framework conditions of the social-technical environment (corporate culture, organizational and technical conditions). However, it has been shown that generally intrinsic and social incentives are more preferable in terms of quality aspects.

RQ4: How can gamification be used to create incentives within a KMS?

Gamification mechanics like challenges, competition, feedback, performance graphs, rewards, and status create incentives within the KMS that address intrinsic motivation through KMS design as well as extrinsic motivation (Table 4).

RQ5: Which gamification components can be used to support KM activities?

Gamification elements like points, badges, and leaderboards can be used to address motivational aspects like reciprocity, reputation, and visibility of achievements. A list of exemplary implementations is given in Table 5.

The potential of gamification for KM has been recognized by an increasing number of researchers and practitioners in recent years. The scientific literature contains theoretical papers, descriptions of implementations as well as analyses of existing gamified systems to support KS. But measurements of actual (long-term) effects of gamification in the context of corporate KM are still rare. Furthermore, future research must go beyond measuring the effectiveness of specific mechanisms. Relevant framework conditions such as corporate culture and group dynamics have to be taken into account in order to develop holistic approaches for motivation. Also, the duration of efficacy has to be monitored in order to show the long-lasting effects of incentive systems.

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