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# The roles of gamification, knowledge creation, and entrepreneurial orientation towards firm performance

Elidjen <sup>a,\*</sup>, Desman Hidayat <sup>b</sup>, Edi Abdurachman <sup>a</sup>

<sup>a</sup> Management Department, BINUS Business School Doctor of Research in Management, Bina Nusantara University, Jakarta, 11480, Indonesia

<sup>b</sup> BINUS Entrepreneurship Center, Management Department, Bina Nusantara University, Jakarta, 11480, Indonesia

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## ABSTRACT

In a highly competitive industry, it has been a best practice that dynamic capabilities guide technology firms to cope with challenging situations. Meanwhile, knowledge creation enables the firm to condition the success and continuity of innovations, entrepreneurial orientation to support companies in winning the competition, and gamification to engage employees in a collaborative way towards better firm performance. This study examines how technology companies can improve their performance using gamification, knowledge creation, and entrepreneurial orientation. To test the proposed model, we collected data using a questionnaire survey of 124 technology companies in Indonesia. The theoretical model used structural equation modeling (SEM) with SmartPLS 3. The results show that all constructs have a direct and positive relationship, except for the direct relationship between gamification and firm performance. Thus, entrepreneurial orientation and knowledge creation are essential components of technology companies that mediate the effect of gamification on firm performance. This study provides a theoretical and empirical basis for the antecedents of technological firm performance.

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## 1. Introduction

In the era of Industry 4.0, competition between firms becomes even more intense (Antunes et al., 2018). One of the main challenges for companies is the rapid advancement of technology. In this case, technology firms need to adapt quickly and respond to these changes. Knowledge creation needs to be developed as an essential aspect of technology companies (Arikan and Knoben, 2014). Technology companies should also have a solid entrepreneurial orientation (McKenny et al., 2018). In addition, gamification can improve employees' engagement (Landers et al., 2018), which helps technology companies improve their knowledge creation, entrepreneurial orientation, and even firm performance.

Technology companies need dynamic capabilities to compete in fast-changing environments (Pitelis and Wang, 2019; Teece et al., 1997). Knowledge creation can be a significant advantage in winning a competition. However, although knowledge creation is commonly related to technology companies, more studies are needed to enhance its effectiveness in

\* Corresponding author.

E-mail address: [elidjen@binus.edu](mailto:elidjen@binus.edu) (Elidjen).

affecting firm performance. Thus, exploring gamification and entrepreneurial orientation could provide a new perspective on implementing effective knowledge creation.

With knowledge, entrepreneurial orientation can help companies increase their competitive advantages (Heisig et al., 2016). In the highly competitive environment of technology firms, entrepreneurial orientation can be the key to improving a technology firm's performance (McKenny et al., 2018). These companies are considered entrepreneurial firms when top managers have entrepreneurial top management styles, as shown by the firm's strategic decisions and management philosophy (Covin and Slevin, 1989).

Previous studies on the technology industry have shown the importance of knowledge creation (Freund et al., 2020; Zhang et al., 2021) and entrepreneurial orientation (Liu and Wang, 2022; Ngammoh et al., 2021). However, knowledge creation and entrepreneurial orientation might be ineffective without motivated employees to support them because of the rapidly changing conditions of the technology industry and the challenging innovation situation in developing countries (Hang and Chen, 2021). Thus, gamification in firms can also improve their performance.

Studies on how companies can use gamification have increased over the last decade (Robson et al., 2015). Gamification can help employees contribute more to knowledge creation, entrepreneurial orientation, and firm performance. Some studies examine gamification and its implications for firm performance. However, empirical studies that prove this relationship are insufficient. Although gamification is considered adequate for increasing employee motivation, challenges remain. A previous study by Obaid et al. (2020) showed that there is a possibility of gamification failures in motivating employees, limited studies on gamification, and an unspecific target of gamification. To resolve this inconsistency, we measure how gamification affects firm performance. Furthermore, this study tests the relationship between gamification, knowledge creation, entrepreneurial orientation, and firm performance in technology companies. The remainder of this paper is organized as follows. First, we summarize the literature on each construct, followed by the connection between the constructs and hypothesis development. Next, an explanation of the methods, results, and discussion are provided. Finally, this study concludes by explaining its contributions to theory and practice, limitations, and future research.

## 2. Literature review

### 2.1. Theoretical framework

#### 2.1.1. Gamification

In the last decade, gamification has been a construct that has often been discussed in various fields, such as education (Kalogiannakis et al., 2021), tourism (Xu et al., 2017), and service (Huotari and Hamari, 2012). Based on Deterding et al. (2011), gamification can be defined as “the use of game design elements in non-game contexts.” The most common theory underlining gamification is the self-determination theory (Mitchell et al., 2020; Seaborn and Fels, 2015). This theory argues for three types of motivation: intrinsic, extrinsic, and amotivation (Ryan and Deci, 2000). Gamification focuses mainly on extrinsic motivation while immersing oneself in intrinsic motivation. The controversy surrounding the rewards used for extrinsic motivation is that intrinsic motivation may be reduced (Suh, 2015). Thus, meaningful gamification must consider intrinsic and extrinsic motivations (Xu et al., 2017).

Mollick and Werbach (2015) explained that gamification could reduce boredom, increase satisfaction, increase performance, encourage work, and make human resources more effective. On the other hand, gamification can also demotivate people and reduce their performance (Liu and Wang, 2020). To achieve an effective gamification outcome, companies need to have their employees consented to the game, represented by a clear understanding of the game rules, a perceived sense of justice and fairness, and active engagement (Mollick and Rothbard, 2014). Companies also need to manage the utilitarian, hedonic, and social aspects of gamification to make it effective (Hamari and Koivisto, 2015). There is no universal way to develop gamification within a company (Mollick and Werbach, 2015). Accordingly, this study explores technology companies' gamification.

Gamification is a way to make a company's activities interesting for employees. Employees enjoy their work activities just as they enjoy playing games (Aziz et al., 2017; Kamasheva et al., 2015; Robson et al., 2016). When employees are more motivated in their job, the company benefits, such as higher performance (Mollick and Werbach, 2015) and more engaged employees (Kamasheva et al., 2015).

#### 2.1.2. Knowledge creation

Knowledge is a vital part of the knowledge-based view of the firm, which requires the individual to create and the organization to apply (Grant, 1996). Knowledge assets are complex and difficult to imitate, making them good assets for producing long-term sustainable competitive advantages (Alavi and Leidner, 2001; Lee and Choi, 2003). Knowledge creation is making individual knowledge available and connecting it to an organization's knowledge system (Weerakoon et al., 2020). Four significant aspects of knowledge creation explain how tacit and explicit knowledge interact: (1) socialization, (2) externalization, (3) combination, and (4) internalization (Alavi and Leidner, 2001; Lee and Choi, 2003; Nonaka and Takeuchi, 1995). Socialization converts tacit knowledge into tacit knowledge, which explains how someone can obtain tacit knowledge from others without using language. Externalization converts tacit knowledge into explicit knowledge by triggering dialogue

or collective reflection. This combination converts explicit knowledge to other explicit knowledge by systemizing concepts into a knowledge system. Internalization can be explained as 'learning by doing', representing the conversion from explicit knowledge to tacit knowledge (Nonaka and Takeuchi, 1995).

### 2.1.3. Entrepreneurial orientation

Entrepreneurship theory discusses discovering opportunities and exploiting them into values (Shane and Venkataraman, 2000). Entrepreneurial orientation is one of the most promising research areas in entrepreneurship (Montiel-Campos, 2018). Entrepreneurial orientation can be defined as an attribute of an organization that helps the organization sustain entrepreneurial behavior patterns of new entries, where new entries can be related to new products, services, technology, markets, or business models (Covin and Wales, 2019; Lumpkin and Dess, 1996).

Two common approaches related to entrepreneurial orientation are unidimensional and multidimensional (Montiel-Campos, 2018). The unidimensional approach uses three dimensions: innovativeness, risk-taking, and proactiveness. Meanwhile, multidimensional entrepreneurial orientation adds two more dimensions: competitive aggressiveness and autonomy. Thus, this study focused on five dimensions as it is a more comprehensive approach to represent entrepreneurial orientation.

### 2.1.4. Firm performance

Firm performance is the realization of a firm's objectives (Abubakar et al., 2019). It is often measured as part of organizational effectiveness theory (Venkatraman and Ramanujam, 1986). To understand organizational effectiveness, it is not sufficient to measure firm performance only from the financial aspect. However, measuring it in terms of its operational and non-financial aspects is also essential.

## 2.2. Hypotheses formulation

### 2.2.1. Gamification and knowledge creation

Gamification can increase employee motivation (Friedrich et al., 2019), an integral part of the firm, as knowledge creation relies greatly on individuals (Grant, 1996). The gamification components, such as points, badges, and leaderboards, can help strengthen knowledge creation in companies. Gamification is thought to affect knowledge (Singhsomrangsukh and Heo, 2017). Another study showed that gamification could effectively escalate knowledge creation (Hidayat et al., 2021). Nevertheless, there is still a lack of studies confirming this relationship. Therefore, considering the relationship between these constructs, this study proposes the following hypothesis:

**H1.** *Gamification has a positive effect on knowledge creation.*

### 2.2.2. Gamification and entrepreneurial orientation

There is limited evidence on the effect of gamification on motivation and behavior, especially in terms of entrepreneurship (Ruiz-Alba et al., 2018). Previous studies have discussed how gamification can be related to entrepreneurship education (Isabelle, 2020) or entrepreneurial intentions (Ruiz-Alba et al., 2018). In entrepreneurship education, a gamified approach can help increase students' experience, engagement, and self-efficacy related to entrepreneurship (Isabelle, 2020). The same outcome can be observed in how gamification enhances entrepreneurial intentions within the group of users of an online platform (Ruiz-Alba et al., 2018). Nevertheless, there are few empirical studies on gamification and entrepreneurial orientation. This study analyzes how these constructs are related. Based on this discussion, this study proposes the following hypothesis:

**H2.** *Gamification has a positive effect on entrepreneurial orientation.*

### 2.2.3. Knowledge creation and firm performance

Although often considered necessary, knowledge creation does not always directly and positively affect firm performance (Akhavan et al., 2014). Nevertheless, with the implementation of the knowledge-based view of the firm, knowledge creation is known to have positive effects on firm performance (Al Ahbabi et al., 2019; Li et al., 2009). This result has been tested in developing countries, developed countries, and public and private sectors (Al Ahbabi et al., 2019). Therefore, this study proposes the following hypotheses to confirm the relationship between knowledge creation and firm performance.

**H3.** *Knowledge creation has a positive effect on firm performance.*

### 2.2.4. Entrepreneurial orientation and firm performance

Entrepreneurial orientation is essential for companies to compete, especially in highly competitive industries (Gupta et al., 2016). Entrepreneurial orientation can positively and significantly affect firm performance (Mcgee and Peterson, 2017; Palmer et al., 2019). The improvement in firm performance by entrepreneurial orientation is argued to be even higher in long-

established firms (Mcgee and Peterson, 2017). A highly competitive environment might require a higher entrepreneurial orientation to survive competition (Basco et al., 2020). Since there is high competition in the technology industry, entrepreneurial orientation might become vital for the firm to survive. Therefore, this study proposes the following hypotheses:

**H4.** *Entrepreneurial orientation has a positive effect on firm performance.*

#### 2.2.5. Gamification and firm performance

Previous studies on the relationship between gamification and firm performance have revealed exciting controversies. Gamification can positively affect performance (Mollick and Rothbard, 2014). When a company consents to games, it can positively affect work. Otherwise, the positive effect would decrease. Another study showed that gamification could backfire and lower performance if not carefully diagnosed before implementation (Liu and Wang, 2020). This inconsistency in the results will be explored further in this study. Therefore, this study proposes the following hypotheses:

**H5.** *Gamification has a positive effect on firm performance.*

#### 2.2.6. Knowledge creation as the mediator of gamification and firm performance

Knowledge creation has been discussed as an important aspect of improving firm performance. Nevertheless, managers still have problems making their employees share knowledge (Jalili, 2020). Gamification may be a solution to this problem. Moreover, gamification is a novel approach to improving firm performance (Rocha et al., 2020). Furthermore, past studies have suggested that these three variables are intertwined. Therefore, this study proposes the following hypothesis:

**H6.** *Knowledge creation mediates the relationship between gamification and firm performance.*

#### 2.2.7. Entrepreneurial orientation as the mediator of gamification and firm performance

Gamification has been investigated as a viable method for assisting people in their understanding of entrepreneurship (Isabelle, 2020). It also has to do with how companies are managed (Liu and Wang, 2020). Even so, empirical studies on how entrepreneurial orientation can be the mediating variable that relates gamification to firm performance are still lacking. Therefore, the following hypothesis was proposed in this study:

**H7.** *Entrepreneurial orientation mediates the relationship between gamification and firm performance.*

### 3. Methods

#### 3.1. Samples

This study used 124 technology companies in Indonesia as the unit of analysis. Because the technology industry in Indonesia is highly competitive, organizations emphasize knowledge creation and entrepreneurial orientation. Gamification has become one of the industry's innovations to survive competition as the industry is continually innovating. Therefore, technology companies in Indonesia should serve as appropriate samples for this study.

From the company age, participating companies can be divided into five groups: those that have just been established for <5 years (12.90%), 5–9 years (25.81%), 10–14 years (22.58%), 15–19 years (12.90%), and >20 years (25.81%). Another characteristic of the respondent companies was the number of employees, which can be divided into ≤10 employees (8.87%), 11–50 employees (40.32%), 51–200 employees (38.65%), 201–500 employees (8.87%), and >500 employees (11.29%). Respondents' characteristics are listed in Table 1.

The survey was conducted over four months, from August to November 2020. The survey was conducted through an online questionnaire. The respondents for this survey were managerial-level employees who could represent the company's point of view. Eight of 132 responses were removed because the respondents did not represent the technology industry, resulting in 124 valid responses (93.94%).

#### 3.2. Study instrument

The first part of the questionnaire captured descriptive data from respondents representing the companies. The second part of the questionnaire used a 5-point Likert scale for the items, ranging from "1" for strongly disagree to "5" for strongly agree. Gamification is measured using utilitarian, hedonic, and social indicators (Hamari and Koivisto, 2015). Meanwhile, the knowledge creation variable was measured using socialization, externalization, combination, and internalization adapted from Yu et al. (2017). Entrepreneurial orientation was measured using innovation, risk-taking, proactiveness, competitive aggressiveness, and autonomy adapted from Vidic (2013). Lastly, the firm performance variable was derived from financial and non-financial performance (Tseng and Lee, 2014).

**Table 1**  
Respondents' characteristics.

Company Age Since Established		
Company Age Since Established	Frequency	Percentage
<5 years	16	12.90%
5–9 years	32	25.81%
10–14 years	28	22.58%
15–19 years	16	12.90%
≥20 years	32	25.81%
TOTAL	124	100%
Number of Employees		
Number of Employees	Frequency	Percentage
>500 employees	14	11.29%
201–500 employees	11	8.87%
51–200 employees	38	30.65%
11–50 employees	50	40.32%
≤10 employees	11	8.87%
TOTAL	124	100%

### 3.3. Data analysis

Before the data analysis, the indicators underwent validity and reliability tests. The validity test kept items with outer loadings >0.70 and average variance extracted (AVE) > 0.50 (Hair et al., 2017). Constructs need to have Cronbach's Alpha between 0.60 and 0.90 and composite reliability (CR) 0.60–0.90 (Hair et al., 2017) to be reliable. Thus, all constructs were reliable. The results of the validity and reliability tests are presented in Table 2.

Furthermore, the discriminant validity results show how a construct is empirically different from the other constructs. Fornell and Larcker (1981) assessed these results. Table 3 shows the results of discriminant validity.

## 4. Results and discussion

### 4.1. Results

This study tested the hypotheses using structural equation modeling (SEM) with SmartPLS 3. With a 95% confidence level,  $p$ -values <0.05, indicating a significant relationship. The results can be divided into direct and indirect relationships with the mediating constructs.

The results show that four direct hypotheses have a significant effect. Gamification positively and strongly affects knowledge creation (path coefficient = 0.714;  $p$  = 0.000) and entrepreneurial orientation (path coefficient = 0.699;  $p$  = 0.000). Entrepreneurial orientation also positively and strongly affects firm performance (path coefficient = 0.501;  $p$  = 0.000). Thus, knowledge creation is related to firm performance (path coefficient = 0.220;  $p$  = 0.037). Nevertheless,

**Table 2**  
Validity and reliability test results.

Constructs	Items	Loadings	Alpha	CR	AVE
Gamification	GAM1	0.812	0.834	0.889	0.668
	GAM2	0.839			
	GAM3	0.830			
	GAM4	0.786			
Knowledge Creation	KNC1	0.775	0.851	0.889	0.573
	KNC2	0.782			
	KNC3	0.788			
	KNC4	0.711			
	KNC5	0.752			
	KNC6	0.730			
Entrepreneurial Orientation	ENO1	0.743	0.847	0.886	0.566
	ENO2	0.785			
	ENO3	0.739			
	ENO4	0.726			
	ENO5	0.781			
	ENO6	0.736			
Firm Performance	FP1	0.736	0.800	0.870	0.627
	FP2	0.739			
	FP3	0.840			
	FP4	0.846			

**Table 3**

Discriminant validity.

Constructs	Mean	Entrepreneurial Orientation	Firm Performance	Gamification	Knowledge Creation
Entrepreneurial Orientation	3.712	<b>0.752</b>			
Firm Performance	3.542	0.604	<b>0.792</b>		
Gamification	3.823	0.699	0.460	<b>0.817</b>	
Knowledge Creation	3.886	0.618	0.496	0.714	<b>0.757</b>

**Table 4**

Summary of direct relationship results.

Relationship	Path Coef.	SD	T Stat	p-values
H1: GA -> KC	0.714	0.048	14.845	0.000***
H2: GA -> EO	0.699	0.062	11.267	0.000***
H3: KC -> FP	0.220	0.105	2.093	0.037*
H4: EO -> FP	0.501	0.127	3.931	0.000***
H5: GA -> FP	-0.047	0.144	0.329	0.742

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ; SD = Standard Deviation; EO = Entrepreneurial Orientation; FP = Firm Performance; GA = Gamification; KC = Knowledge Creation.

gamification in this study did not have a direct effect on firm performance ( $p = 0.742$ ). This result indicates that Hypotheses 1, 2, 3, and 4 are supported, while Hypothesis 5 is not supported. Therefore, knowledge creation and entrepreneurial orientation have significant direct effects on firm performance. Table 4 summarizes the results of the direct relationship.

In addition to the direct relationship between constructs, there are also two indirect relationships between constructs through the mediating construct. Both mediating constructs relate to the relationship between gamification and firm performance. Table 4 shows that gamification has no significant direct effect on firm performance ( $p = 0.742$ ). Regarding the indirect relationship, knowledge creation and entrepreneurial orientation were both tested for their mediating effects on the relationship between gamification and firm performance. Knowledge creation mediates the relationship between gamification and firm performance based on the result, as shown by the  $p$ -value of 0.038, which is  $< 0.05$ . This relationship was also positive, with a path coefficient of 0.157. Thus, Hypothesis 6 is supported. The mediating effect of entrepreneurial orientation also showed a positive and significant effect on the relationship between gamification and firm performance (path coefficient = 0.350;  $p = 0.000$ ), supporting Hypothesis 7. Between the two indirect effects, the path coefficient of entrepreneurial orientation as the mediating variable was 0.350, whereas the path coefficient of knowledge creation as the mediating variable was 0.157. Thus, entrepreneurial orientation has a better effect on mediating the relationship between gamification and firm performance. The mediation results are summarized in Table 5.

$R^2$  measures the proportion of the variance predicted from the dependent variables. This study explains 37.4% of firm performance by knowledge creation, entrepreneurial orientation, and gamification. Entrepreneurial orientation can be explained by gamification with a value of 48.4%. Meanwhile, 50.6% of knowledge creation can be explained by gamification. The research model with path coefficients,  $p$ -values, and  $R^2$  measurements is shown in Fig. 1.

#### 4.2. Discussions

This study examines the relationship between gamification, knowledge creation, and entrepreneurial orientation as antecedents of firm performance. Gamification had a significant positive effect on knowledge creation (H1). Previous studies have examined the relationship between gamification and knowledge creation (Friedrich et al., 2019; Hidayat et al., 2021; Tsourma et al., 2019). This study provides empirical results on how these constructs are related.

Previous studies have discussed how gamification and entrepreneurship are related but still lack empirical research (Ruiz-Alba et al., 2018). In this study, gamification significantly affected entrepreneurial orientation (H2). This result magnifies the relationship between the constructs and opens new opportunities for further research in this area. Therefore, technology companies can focus more effectively on gamification to increase entrepreneurial orientation.

Previous studies have also discussed how knowledge creation affects firm performance (Abubakar et al., 2019; Al Ahbabi et al., 2019; Li et al., 2009). Despite previous studies showing that knowledge creation does not directly affect firm performance (Akhavan et al., 2014), this study proved that technology firm performance is directly affected by knowledge creation (H3). Therefore, knowledge creation is a reliable and vital aspect for technology companies to improve their performance.

There is a positive and significant relationship between entrepreneurial orientation and firm performance (H4). This result confirms previous studies that have discussed the positive relationship between both constructs (Lomberg et al., 2017; Mcgee and Peterson, 2017; Palmer et al., 2019). A technology industry with high-tech characteristics needs entrepreneurial

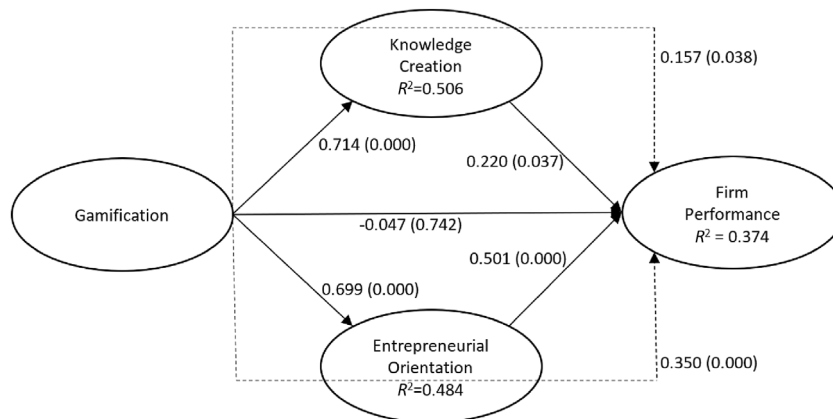


**Table 5**

Summary of mediation results.

Direct Effects			Indirect Effects				
Relationship	Path Coef.	p-value	Relationship	Path Coef.	SD	T Stat	p-values
GA -> FP	-0.047	0.742	H6: GA -> KC -> FP	0.157	0.076	2.081	0.038*
			H7: GA -> EO -> FP	0.350	0.089	3.929	0.000***

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ; SD = Standard Deviation; EO = Entrepreneurial Orientation; FP = Firm Performance; GA = Gamification; KC = Knowledge Creation.

**Fig. 1.** Research model.

orientation, especially proactiveness and innovativeness (Lomberg et al., 2017). Thus, based on this study, entrepreneurial orientation is essential for technology companies.

Finally, gamification has been discussed as a factor that affects firm performance (Liu and Wang, 2020; Mollick and Rothbard, 2014; Mollick and Werbach, 2015). However, the effect of gamification on firm performance remains controversial. It might increase performance (Mollick and Rothbard, 2014; Mollick and Werbach, 2015) or decrease performance (Liu and Wang, 2020). This study showed an interesting result: gamification does not directly affect firm performance (H5). The results also show that knowledge creation (H6) has a significant mediating effect on firm performance. The same result is also shown in the relationship between gamification and firm performance, mediated by entrepreneurial orientation (H7). This result shows the importance of knowledge creation and entrepreneurial orientation in helping gamification affect firm performance.

## 5. Conclusions

Gamification has recently emerged in management studies. This study provides an empirical result on how gamification can directly affect knowledge creation and entrepreneurial orientation and how it can indirectly affect firm performance through entrepreneurial orientation and knowledge creation. As an essential component of technology companies, knowledge creation directly affects firm performance. This study also highlights the critical role, as it directly affects firm performance and acts as a mediating construct for gamification to increase firm performance. In conclusion, gamification, knowledge creation, and entrepreneurial orientation are essential for technology companies to improve their performance.

### 5.1. Contribution to theory

This study advances firm performance as a dependent construct by providing empirical evidence on how gamification, knowledge creation, and entrepreneurial orientation are related. From a theoretical perspective, one of the most important contributions of this study is that it extends the understanding of the relationship between gamification and firm performance by highlighting the important mediating roles of knowledge creation and entrepreneurial orientation. This study also provides empirical results that complement those of previous conceptual studies. Although the direct relationship between gamification and firm performance was found to be insignificant in this study, the results provide insights for future research related to the effectiveness of gamification in companies. This study also contributes to self-determination theory, the knowledge-based view of the firm, and entrepreneurship theories. Furthermore, this study broadens the gamification literature as part of self-determination theory by relating it to management theories.

## 5.2. Contribution to practice

This study highlights how technological companies should pay attention to entrepreneurial orientation. In a competitive industry, entrepreneurial orientation can help technology companies compete and improve their performance. They will be more proactive, innovative, and able to act toward the competition they face. Technology companies must also consider knowledge creation. For companies with a fast-changing environment, knowledge creation can help them survive and adapt to the changes. Gamification can also help motivate employees in technology companies to improve their performance. A gamification system can be developed and implemented in a company's knowledge system to make it more effective in creating knowledge.

## 5.3. Limitations and future research

This study has several limitations. First, we gathered data from Indonesian technology companies. The results may be different for other industries or locations. Therefore, future research should consider obtaining respondents from other industries, broader locations, or even other industries. Second, this study was conducted during the pandemic. Future research should be conducted in the post-pandemic era to compare these results. Third, testing other aspects related to technology companies, such as organizational learning, task-technology fit, and the UTAUT or TAM model, can enrich the results of this study.

## Declaration of competing interest

The authors declare that there is no conflict of interest.

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**Update 1 of 2**

**International Journal of Innovation Studies**

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## Erratum regarding missing Ethic Statements in previously published articles

Ethic Statements were not included in the published version of the following articles that appeared in previous issues of International Journal of Innovation Studies.

The appropriate Ethic Statements, provided by the Authors, are included below.

1. "Knowledge and learning in the horticultural innovation system: A case of Kashmir valley of India" [International Journal of Innovation Studies, Volume 4, Issue 4, December 2020, Pages 116-133] <https://doi.org/10.1016/j.ijis.2020.06.002>  
Ethics statement: The participants provided their informed consent to participate in this study.
2. "Sustainable career development for R&D professionals: Applying a career development system in Basque country" [International Journal of Innovation Studies, Volume 4, Issue 2, June 2020, Pages 40-50] <https://doi.org/10.1016/j.ijis.2020.03.002>  
Ethics statement: The participants provided their informed consent to participate in this study.
3. "Third-party relational governance and collaborative innovation performance: The role of IPR protection" [International Journal of Innovation Studies, Volume 4, Issue 1, March 2020, Pages 1-15] <https://doi.org/10.1016/j.ijis.2020.02.002>  
Ethics statement: The participants provided their informed consent to participate in this study. We have taken their permission and consent for the Study from the companies.
4. "Influence of organization learning on innovation output in manufacturing firms in Kenya" [International Journal of Innovation Studies, Volume 4, Issue 1, March 2020, Pages 16-26] <https://doi.org/10.1016/j.ijis.2020.02.001>  
Ethics statement: The participants provided their informed consent to participate in this study. We have taken their permission and consent for the Study from the companies.
5. "Using Delphi and fuzzy DEMATEL for analyzing the intertwined relationships of the barriers of university technology transfer: Evidence from a developing economy" [International Journal of Innovation Studies, Volume 4, Issue 3, September 2020, Pages 85-104] <https://doi.org/10.1016/j.ijis.2020.07.002>  
Ethics statement: The participants provided their informed consent to participate in this study.
6. "Technological trajectory based on micro level technological capability: Evidence from the Brazilian rice industry" [International Journal of Innovation Studies, Volume 6, Issue 3, September 2022, Pages 196-215] <https://doi.org/10.1016/j.ijis.2022.07.001>  
Ethics statement: The participants provided their informed consent to participate in this study.
7. "The nexus between innovativeness and knowledge management: A focus on firm performance in the hospitality sector" [International Journal of Innovation Studies, Volume 6, Issue 1, March 2022, Pages 26-34] <https://doi.org/10.1016/j.ijis.2021.12.002>  
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**International Journal of Innovation Studies**

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## Erratum

## Erratum regarding missing Ethic Statements in previously published articles

Ethic Statements were not included in the published version of the following articles that appeared in previous issues of International Journal of Innovation Studies.

The appropriate Ethic Statements, provided by the Authors, are included below.

1. “Gamification in innovation teams” [International Journal of Innovation Studies, Volume 6, Issue 3, September 2022, Pages 156–168] <https://doi.org/10.1016/j.ijis.2022.05.003> Ethics statement: Ethics approval was obtained from the Ethics Committee of Unidade de Investigação em Design e Comunicação. The participants provided their informed consent to participate in this study.
2. “The Roles of Gamification, Knowledge Creation, and Entrepreneurial Orientation towards Firm Performance” [International Journal of Innovation Studies, Volume 6, Issue 4, December 2022, Pages 229–237] <https://doi.org/10.1016/j.ijis.2022.07.002> Ethics statement: The participants provided their informed consent to participate in this study. We have taken their permission and consent for the Study from the companies.
3. “Deciphering the black box of HPWSeinnovation link: Modeling the mediatory role of internal social capital” [International Journal of Innovation Studies, Volume 6, Issue 2, June 2022, Pages 78–91] <https://doi.org/10.1016/j.ijis.2022.04.004> Ethics statement: The authors declare that it is not mandatory at Abdul Wali Khan University to seek written approval for survey data where respondents’ details are kept anonymous. We did obtain written consent from all participants in our study where respondents were asked to read and sign the consent form. The consent form also has personal and identification information that can be traced back to the respondents. All data have been anonymized to protect the privacy and confidentiality of the participants.
4. “Modeling the Dynamics of Innovation Ecosystems” [International Journal of Innovation Studies, Year; Volume 7, Issue 2, June 2023, Pages 142–158] <https://doi.org/10.1016/j.ijis.2022.12.002> Ethics statement: The authors declare that ethical review and approval were waived for this study, as it follows GDPR rules (EU)
5. “Influence of Technology Transfer From Universities On Manufacturing Firms’ Innovative Performance” [International Journal of Innovation Studies, Volume 7, Issue 2, June 2023, Pages 115–126] <https://doi.org/10.1016/j.ijis.2022.12.003> Ethics statement: Ethics approval was obtained from the Ethics Committee of Mount Kenya University. The participants provided their informed consent to participate in this study. We have taken their permission and consent for the Study from the companies.
6. “Technology trajectory in aviation: Innovations leading to value creation (2000–2019)” [International Journal of Innovation Studies, Volume 6, Issue 3, September 2022, Pages 128–141] <https://doi.org/10.1016/j.ijis.2022.05.001> Ethics statement: Ethics approval was obtained from the Ethics Committee of Griffith University. The participants provided their informed consent to participate in this study.
7. “Green managerial practices and green performance: A serial mediation model” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Pages 196–207] <https://doi.org/10.1016/j.ijis.2022.12.004> Ethics statement: Ethics approval was obtained from the Ethics Committee of Abu Dhabi School of Management. In addition, we have taken the participants’ permission and consent to participate in this study.
8. “An Exploratory Examination of the Barriers to Innovation and Change as Perceived by Senior Management” [International Journal of Innovation Studies, Volume 7, Issue 2, June 2023, Pages 159–170] <https://doi.org/10.1016/j.ijis.2022.12.005> Ethics

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statement: Ethics approval was obtained from the Ethics Committee of Abu Dhabi School of Management. The participants provided their informed consent to participate in this study.

9. “Empowerment sustainability perspectives for Bahraini women as entrepreneurs” [International Journal of Innovation Studies, Volume 7, Issue 4, December 2023, Pages 245–262] <https://doi.org/10.1016/j.ijis.2023.04.003> Ethics statement: Ethics approval was obtained from the Ethics Committee of Ahlia University. In addition, we have taken the participants’ permission and consent to participate in this study.
10. “When the sum adds up: Using public procurement to avoid intersectoral cooperation barriers in lagging regions” [International Journal of Innovation Studies, Volume 7, Issue 4, December 2023, Pages 273–282] <https://doi.org/10.1016/j.ijis.2023.05.003> Ethics statement: The authors declare that ethical review and approval were not required for this study, as this study adhered to the International Ethical Guidelines and the Declaration of Helsinki. When it came to data collection and handling, we followed the recommendations outlined in the European Commission’s Ethics for Researchers (2013 version). We placed special emphasis on securing informed consent from key informants. Additionally, we adhered to the interview protocol developed by the College of Arts at the University of Glasgow, which outlines best practices for interview procedures, interview locations, and ensuring the security, confidentiality, and consent of informants. Throughout this study, we ensured the voluntary, free, and well-informed participation of interviewees. We also prioritized the anonymity and confidentiality of their information, both during the interview process and when handling and publishing the data.
11. “Cognitive style and fostering of technological adaptation drive E-entrepreneurial of new mature business” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Pages 230–243] <https://doi.org/10.1016/j.ijis.2023.04.001> Ethics statement: Ethics approval was obtained from the Ethics Committee of A’Sharqiyah University. In addition, we have taken the participants’ permission and consent to participate in this study.
12. “Enabling affordances of blockchain in agri-food supply chains: A value-driver framework using Q-methodology” [International Journal of Innovation Studies, Volume 7, Issue 4, December 2023, Pages 307–325] <https://doi.org/10.1016/j.ijis.2023.08.001> Ethics statements: Ethics approval was obtained from the Ethics Committee of University of Canterbury. In addition, we have taken the participants’ permission and consent to participate in this study.
13. “A configurational approach to innovation performance: The role of creativity” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Pages 171–186] <https://doi.org/10.1016/j.ijis.2023.03.001> Ethics statements: The authors declare that there was no requirement for ethics approval at the time the survey was conducted. Participants received a document were they asked to participate voluntarily, and they were explained the use of the data collected.
14. How beneficial are relational capital and technology orientation for innovation? Evidence from Mexican SMEs [International Journal of Innovation Studies, Volume 6, Issue 1, March 2022, Pages 1–10] <https://doi.org/10.1016/j.ijis.2022.02.001> Ethics statements: The authors declare that ethical review and approval were not required for this study, as it adheres to the guidelines and policies set forth by the Mexican Government (Instituto Nacional de Transparencia, Acceso a la Información y Protección de Datos Personales). This study complies with all ethical norms and research integrity standards, including data confidentiality and informed consent. In addition, all participants were fully informed about the research’s objectives, methodology, and potential use, including publication of the results. Furthermore, all data have been anonymized to protect the privacy and confidentiality of the participants.
15. Organizational learning antecedents and open innovation: Differences in internationalization level [International Journal of Innovation Studies, Volume 5, Issue 4, December 2021, Pages 161–174] <https://doi.org/10.1016/j.ijis.2021.12.001> Ethics statements: The author declares that ethical review and approval was not required for this study. The study follows the Faculty’s academic integrity policy. In addition, the participants voluntarily participated in this study, and participation is anonymous.
16. Applicability of public sector reform initiatives of the Yemeni government from the integrated TOE-DOI framework [International Journal of Innovation Studies, Volume 6, Issue 4, December 2022, Pages 286–302] <https://doi.org/10.1016/j.ijis.2022.08.005> Ethics statements: The authors declare that ethical review and approval were not required for this study, as it follows International Islamic University Research and Innovation Policy. In addition, we have taken the participants’ permission and consent to participate in this study.
17. Erratum for “Sustainable career development for R&D professionals: Applying a career development system in Basque country” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Page 244] <https://doi.org/10.1016/j.ijis.2023.08.004> Ethics statements: Ethics approval was obtained from the Compliance Committee of Vicomtech. The participants provided their informed consent to participate in this study.
18. Erratum for “Technological trajectory based on micro level technological capability: Evidence from the Brazilian rice industry” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Page 244] <https://doi.org/10.1016/j.ijis.2023.08.004> Ethics statements: The authors followed the protocol of the Ethics Committee of the Federal University of Rio Grande of 2022, which makes optional the ethics approval in the area of social sciences. In addition, the participants provided their informed consent to participate in this study.
19. Erratum for “Third-party relational governance and collaborative innovation performance: The role of IPR protection” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Page 244] <https://doi.org/10.1016/j.ijis.2023.08.004> Ethics statements: Ethics approval was obtained from the Ethics Committee of Zhejiang A&F University. The participants provided their informed consent to participate in this study.
20. Erratum for “The nexus between innovativeness and knowledge management: A focus on firm performance in the hospitality sector” [International Journal of Innovation Studies, Volume 7, Issue 3, September 2023, Page 244] <https://doi.org/10.1016/j.ijis.2023.08.004> Ethics statements: The authors declare that ethical review and approval was in line with University academic policy. In addition, the participants voluntarily participated in this study, and participation is anonymous.