The Preliminary Results of the KMS Model with Additional Elements of Gamification to Optimize Research Output in a Higher Education Institution

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Abstract: *In this paper, we propose a new approach to optimize research output in the higher education institution environment. This new approach is in the form of a knowledge management system (KMS) model with the addition of elements derived from games or better known as gamification. The study began with a review of related research and studying papers that have been published by other researchers. Based on the results of learning, we found a gap in the absence of a KMS model that can be used by research managers in higher education institutions to increase the research output. First, we study the existing KMS models and related previous researches. Furthermore we added several elements that came from games into the proposed KMS model. Adding elements that came from games expected can increase the motivation of researchers to be more productive, which in turn can increase the research output in HEI. We compare elements that came from games and elements came from the previous KMS model. The result of the brief comparison shows the elements came from games more dynamic then elements came from previous KMS model. The elements that came from games much better in some ways, such as has the ability to display differences in performance between one researcher to others and can be implemented in many fields. In further research, we will conduct testing and evaluation of the proposed KMS model, involving researchers from higher education institutions.*

Index Terms: *Research Output, Knowledge Management System, Gamification, Higher Education Institution.*

I. INTRODUCTION

The use of Knowledge Management Systems (KMS) in Higher Education Institutions (HEI) is a hot issue. Implementation of KMS in Higher Education level is a necessity [1][2], because the HEI is a gathering place and disseminated knowledge. There must be a mechanism that regulates knowledge at HEI level so that it can be more useful and efficient. Based on the KMS in HEI topic search results that we did on the ScienceDirect database [3], it was found that the total search results reached 198,398 spread from 1996-2020 (Fig. 1), with details as follows:

Table 1: The number of articles that discusses KMS in HEI [3]

Type of article	Search result
Review Articles	16.544
Research Articles	140.126
Encyclopedia	2.418
Book chapters	18.220
Conference abstracts	4.630
Book reviews	1.302
Case reports	135
Others	15.023

Table 1 shows the topic of KMS in HEI is still very much needed and continues to develop. Figure 1 shows the trend of the discussion on the topic of KMS in HEI continues to increase every year, data calculations began in 1996.
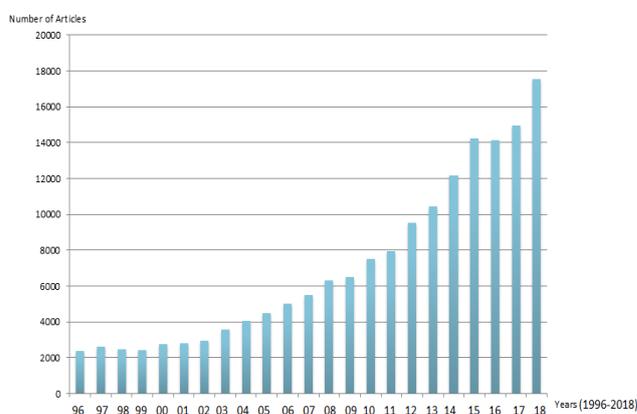

Fig. 1: The trend of discussions about KMS in HEI in recent years [3]

Therefore it can be concluded that the topic of KMS in HEI still has an interest at least until 2020. Publications relating to KMS in HEI will continue to grow along with the awareness of researchers in utilizing KMS in HEI or college environment. According to the results of the KMS in HEI topic that has been conducted, there are several KMS uses spread over several sectors including the following in Figure 2 (data obtained randomly from multi-year search):

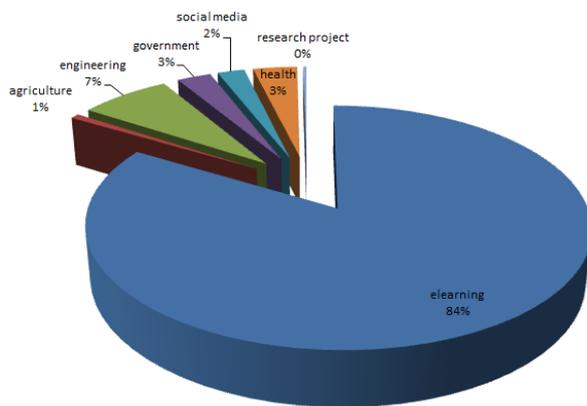| purposes	numbers
e-learning	936
agriculture	8
engineering	80
government	30
social media	24
health	39
research project	3

Fig. 2: Utilization of KMS in various fields [3]

Figure 2 it can be seen that the research related to KMS in HEI mostly aims to improve the effectiveness of the teaching and learning process [4][5][6]. The use of multimedia channels in e-learning with various facilities such as audio, interactive video, image and graphics interfaces [7] involves a lot of data and knowledge exchange. If it is not regulated properly, the complexity of data and knowledge will be higher and have a negative impact on the performance of the eLearning system used. The application of KMS in HEI is based on the use of information technology and is strongly influenced by a leader's managerial ability to regulate the processes that occur in the KMS model. Therefore, the application of KMS in HEI must prepare various elements forming the KMS model, namely:

Table 2: Elements in the KMS Model

Elements	Desc	References
Leadership	The ability to lead and regulate KMS activities within the organization	[8][9][10][11][12][13]
Information Technology	IT-based infrastructure support and use	[10][14][15][16]
People and Community	The involvement of individuals and groups in the success of the KMS process in the organization	[11][12][16]
Process	Data and Knowledge Flow	[9][14][17]
Organization	The environment that uses and runs the KMS system	[8][9][12][13]
Intellectual Skill	The ability to acquire, process and convey knowledge	[10]

Most KMS utilization in HEI focuses on increasing the effectiveness of teaching and learning [5] [6], so it is very rare to find the use of KMS for research management in HEI environments. In this study, we find spaces and gaps that can be raised as the topic of research. The research topic that can be raised here is the development of a KMS model for research management in HEI. However, the use of the KMS model with the classic approach is still considered inadequate, because the needs and research results in HEI continue to develop. Therefore, a mechanism is needed that can balance the development of the research world so that the proposed KMS model can be the main axis in meeting the needs of researchers in HEI, which in turn can motivate and increase the research output results in HEI. Before going further with the planned mechanism to be added to the proposed KMS model, we will show an overview of the use of KMS in the current modern era.
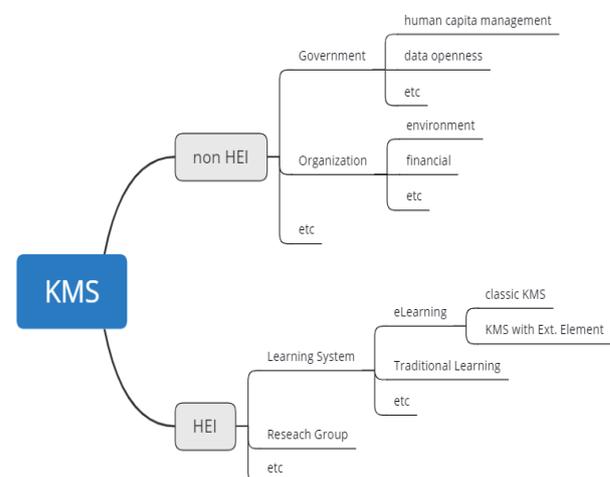

Fig. 3: The Used of KMS in the Modern Era

The dominant use of KMS is in the government field, including those related to human capital management [18][19][20][21], or data openness [22][23][24], and other fields related to the environment [25][26][27][28]. Henceforth we focus on the utilization of KMS in HEI, because it is relevant to the research domain to be studied.

As shown in Figure 3 the use of KMS to improve the effectiveness of the learning process has been carried out by several researchers [4][5] but the use of KMS for research groups, especially management of research output is still very little. This can be seen from the absence of references or publication of articles that discuss the use of KMS to increase research output in HEI. The use of KMS to raise research output in HEI is strongly influenced by the culture and habits of researchers in HEI. Research culture in a country can be different from other countries. The cultures of research in Indonesia or Asian countries are different from those in Europe. Therefore, the use of KMS is not needed if a country has a good research culture. In a sense, the massive research output has become commonplace in the country's research culture. The research culture in Indonesia is very different than others countries, a mechanism is needed that research can produce massive research output. A model is needed that can motivate and move all existing potential that it can produce research results to the fullest. We try to find the right mechanism that can be used to increase the results of research output in the HEI environment by studying related publications. The use of KMS to increase the research output is the right choice. But, based on the learning that has been done, the utilization of the classic KMS model [29] [30] [31] still has many limitations, therefore new elements are needed. Then we continued the literature study as a reference to get the right elements, to be added to the KMS model. This new element must be accepted by other KMS elements and can fulfill the hypothesis question. In other words, this new element must be able to motivate researchers in HEI to be more active in spawning the output of their research. Based on the results of the literature study we found new elements that could be used to meet expectations while answering the initial hypotheses expected. This new element comes from the new approach which began to be used a lot in recent years. A new approach is a game approach, better known as gamification. Gamification itself means the use of game designs or elements in games for needs outside of games or non-context games [32][33]. The use of gamification in the HEI environment became a quite hot topic in recent years. This is evidenced by the increasing number of studies related to the use of elements derived from games for various needs [34][35][36][37]. The use of gamification in the HEI environment is currently focused on increasing student motivation in attending lectures [38][39][40]. A games player is usually very motivated to win every level of the game. Unlock the new level and get many skills and medals from the levels that have been passed. We want to transfer the motivation possessed by a game player to the researchers in HEI. Motivation to produce research results in the form of publications or recognition in the form of patents. Therefore it is necessary to know the dominant elements contained in the games that make a person become very eager to improve their abilities, consistent in completing level after level in games. Other researchers [33][41] also divided the motivation of a game player into 4 indicators, namely capability, connection, goal, and independence. The game approach to arouse motivation that belongs to a game player is as follows [32][41][42][43]:

Table 3: Player Motivation and Game Elements

Player Motivation Elements	Appropriate Game Elements
Capability	Leaderboards, points, grades, level, and dashboards
Connection	Competition, social status, storyline, avatar, teammates, quest and badges
Goal	Virtual map, navigation
Independence	Unlock level, progress bar, upgrade skill, leaderboard, quests, and lives bar

The first motivation possessed by a games player is the satisfaction of having the ability to solve challenges for challenges in the level of games. To arouse the motivation of a games player, the games kit provides several elements arranged in stages such as leaderboards, points, grades, level, and dashboards. Another motivation that a game player can have is the desire to establish friendships or connections with other players. To fulfill this desire, the game equipment provides elements such as competition, social status, storylines, avatars, teammates, quests and badges. The same thing applies to the other two motivations, namely goal, and independence. The games device provides game features such as virtual maps, navigation, unlock levels, progress bars, upgrade skills, leaderboard, quests and lives bar. Thus several studies have been conducted that related to our research.

II. PROPOSED METHODOLOGY

Next, we will convey step by step used to achieve the research objectives that already described.
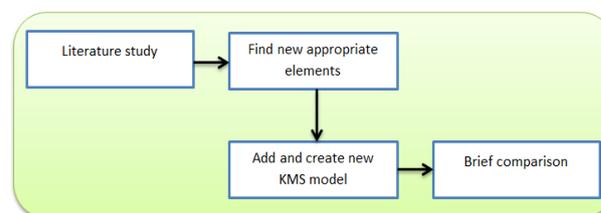

Fig. 4: Research steps

The focus that we did at the initial stage was the literature study, studying various studies and publications related to the domain to be studied. The literature study is the initial step of research commonly used by researchers [44].

Literature study starts from a broader domain then converges into research on the use of KMS models with the research group as subdomain and its researcher in HEI. The next step is to look for elements that can be added to the KMS model based on the problems that we found in the field. Elements that must be added can be a solution to the problems faced by higher education institutions in improving research output. Elements added can be derived from the HEI environment or external elements, provided that it can increase the motivation of researchers to produce research output optimally. Next, we tried to make a KMS model prototype with additional new elements.

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The final step, we did a brief comparison between the new elements that was added with the original elements from the previous KMS model [45][46]. Based on the explained gamification element, we try to add it to the previous KMS model in the hope that it can increase the motivation of the researchers in HEI. The existence of the KMS model with the addition of gamification elements is expected to make the research atmosphere in HEI more productive. The process of adding gamification elements is done in stages, not all at once so that the evaluation results for each addition of elements are more accurate, unbiased. So that based on the addition of gamification elements gave birth to several research questions (RQ), such as: Is the addition of gamification elements into the KMS model able to increase the productivity of research output? Or, can the addition of gamification elements increase the motivation of researchers to produce maximum research output? Based on these questions we tried to make an initial model or prototype of the KMS model with the addition of gamification elements. This initial model is a development of the KMS model that already exists or has been developed by other researchers (Figure 5).
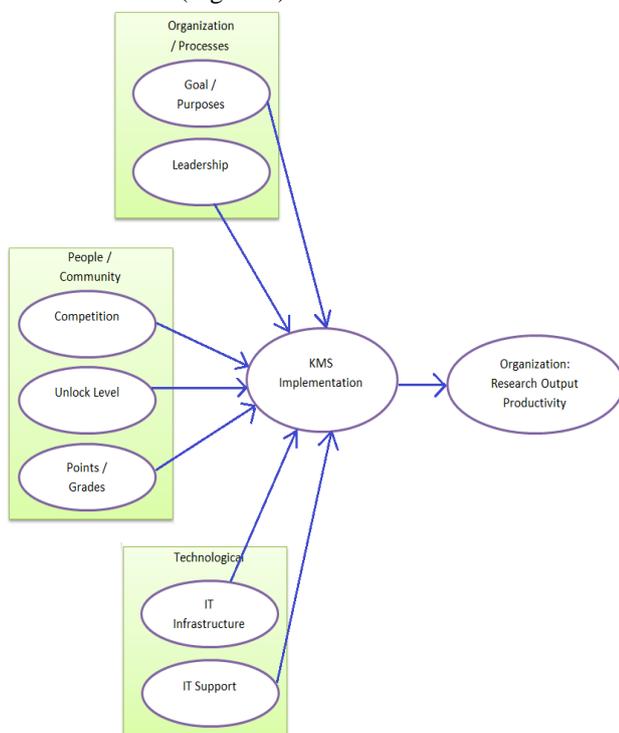

Fig. 5: Proposed KMS Model

III. RESULT ANALYSIS

As explained in Table 2, the KMS model consists of several elements, namely organization, leadership, people/community, process, and information technology. Gamification elements can be added to elements of people or community. Gamification elements added in the KMS model in Figure 5 are competition, unlock level and points/grades. The addition of element competition is expected to be a trigger for researchers in HEI to compete with each other or compete to complete the stages by stages of research until they reach the finish line. Leveling is a feature that research providers can provide in HEI, starting from the lowest level to the highest level. Researchers can start from the lowest level, if you want to go up to a higher level or unlock a level, the

researcher must meet several criteria set by the research manager at HEI. Each level has different rewards and points. The higher the level achieved the higher the reward, points or grade that can be obtained.

Following are the brief comparison of elements from previous KMS model [45][46] and elements from gamification (see Table 4):

Table 4: A brief comparison of elements from classic KMS and elements from gamification

Point of comparison	Elements	
	Previous KMS Model (such as Training/Education, Resources Organization, etc)	Gamification (such as Competition, Unlock Level, Points/Grades)
Requires individual skills	✓	✓
Requires teamwork	✓	✓
Dominant in individual skills		✓
Involve many parties		✓
Learning from the teacher and experience	✓	✓
Intermediate level and expert		✓
Beginner and intermediate level	✓	
Advanced Level		✓
Fundamental Level	✓	
Oriented to achieve organizational goal	✓	✓
Can be implemented in many fields		✓
The development tends to be static	✓	
The development is very dynamic		✓
Can be replaced easily		✓
The results can be seen in a short time		✓

The role of infrastructure is very dominant	✓	
The ability to display differences in performance		✓
Assessment results are not biased		✓
Involves many interests	✓	✓

According to the brief comparison, you can see some points that only have or can be achieved using gamification elements. Individual skills are very dominant in gamification elements, but sometimes teamwork is also needed, this also applies to elements from previous KMS model. It is best if you just start as a researcher must go through training or learning to senior researchers who have a lot of experience. This learning process can be fulfilled by elements from KMS classic, but it is also possible to obtain from the gamification element for researchers who are adaptable. Elements from KMS classic are very dependent on the availability of infrastructures, such as IT devices, classrooms, and time schedules. As much as the gamification element is very flexible and dynamic, the results of the assessment of the researcher in HEI are not biased and very clear. Another advantage of using gamification element is that the replacement process can be done quickly because it is only based on application. Finally, the KMS model with a gamification element is believed to be used in many fields, not only in one field, and easy to implement. The addition of gamification elements, it is expected to increase the motivation of researchers in HEI, such as the motivation of the game players to complete level after level in games. We did not make changes to other KMS model elements such as goals/purposes within the organization, IT infrastructure and support in technological elements. It is a preliminary result to assess whether this KMS model can meet our expectation because it has not gone through a comprehensive testing phase. However, it is expected that this model is the first step in making a more mature model, which can answer the research questions that have been explained previously.

IV. CONCLUSION

The research output at higher education institutions is expected to be improved using the KMS model is proposed. The addition of gamification elements in the form of competition, unlock levels and points (grades) are expected to increase the motivation of researchers to compete with each other to complete level after level of research and obtain higher grades. Furthermore we compare elements that came from games and elements came from the previous KMS model. The result of the brief comparison shows the elements came from games more dynamic then elements came from previous KMS model. The elements that came from games much better in some ways, such as has the ability to display differences in performance between one researcher to others

and can be implemented in many fields. This study is the first step to develop the proposed model before it is implemented in the real research environment.

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