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READINESS MODEL OF KNOWLEDGE MANAGEMENT SYSTEMS IMPLEMENTATION AT THE HIGHER EDUCATION

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Abstract. *Industry 4.0 is an industry that combines automation technology with cyber technology, and this is a trend of automation and data exchange in manufacturing technology, including the cyber-physical, Internet system for all or the Internet of Things (IoT). The era of the industrial revolution 4.0 has also changed the way people view education. Changes made are not only ways of teaching, but are far more essential, namely changes in perspective on the concept of education itself. Likewise, what happens in the world of higher education, knowledge management systems have become a tool or facility to support the learning process. The next problem that often occurs in optimizing the implementation of knowledge management systems is how to measure the level of community readiness in its implementation. Research related to the readiness of the higher education community in anticipating the industrial revolution in era 4.0 was developed based on the SECI model theory (Socialization, Externalization, Combination, and Internalization) and factor analysis theory, and can be used to analyze community readiness in utilizing knowledge management systems with the substance of the learning process so that results can be achieved. The results of the study were in the form of Knowledge Management System (KMS) readiness model related to the substance of the desired knowledge to support the socialization and internalization of students in higher education influenced by the Lack of Knowledge Utilization, Knowledge Information, Knowledge Sharing Quality, and Network Distribution, which can be simulated and optimized for the development of future implementation strategies.*

Keywords: Industry 4.0, Higher education, Factor analysis, Readiness implementation, Simulation model

1. **Introduction.** Many knowledge management systems have been implemented in several educational institutions, and the use of this knowledge management system can help improve the quality of work and services of the organization [1]. To support the implementation of a knowledge management system in an organization, it is important to consider what factors can influence the success of the knowledge management system in terms of community readiness in the organization.

According to a survey of economists 2007, CEOs have stated that the most important investment in realizing corporate strategy goals is knowledge management. However, majority of knowledge management projects do not deliver what they have promised at the beginning yet [2]. The objectives of this study are:

1) Looking for factors that influence the readiness of the implementation of the knowledge management system at the organization.
2) Looking for indicators that can influence the community in the readiness of the implementation of the knowledge management system at the organization.

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3) Building a readiness model for implementing a knowledge management system at the organization.

It is expected that the output of the built model can be used to develop strategies and policies for implementing knowledge management in higher education organizations until competitive advantage is achieved.

2. **Literature Review.** Knowledge management plays a key role in higher education aimed at [3]:

1) to develop better quality and effectiveness
2) to the development of human resources at all levels, and
3) to develop "knowledge base" of the organizations towards the enhanced knowledge investment of the organization.

Knowledge management is a collaborative and integrated approach to the creation, retrieval, organization, access and use of company intellectual assets [4]. Meanwhile, according to [5] knowledge management is a systematic coordination within an organization or company that manages human resources, technology, organizational structure and processes in order to increase value through reuse and innovation [6]. This coordination can be achieved by creating, sharing, and applying knowledge by using the experience and actions taken by the company for the continuity of organizational learning. SECI model is a knowledge framework created by Ikujiro Nonaka and Irotaka Takeuchi. The SECI framework model was created and used by Japanese companies [7].

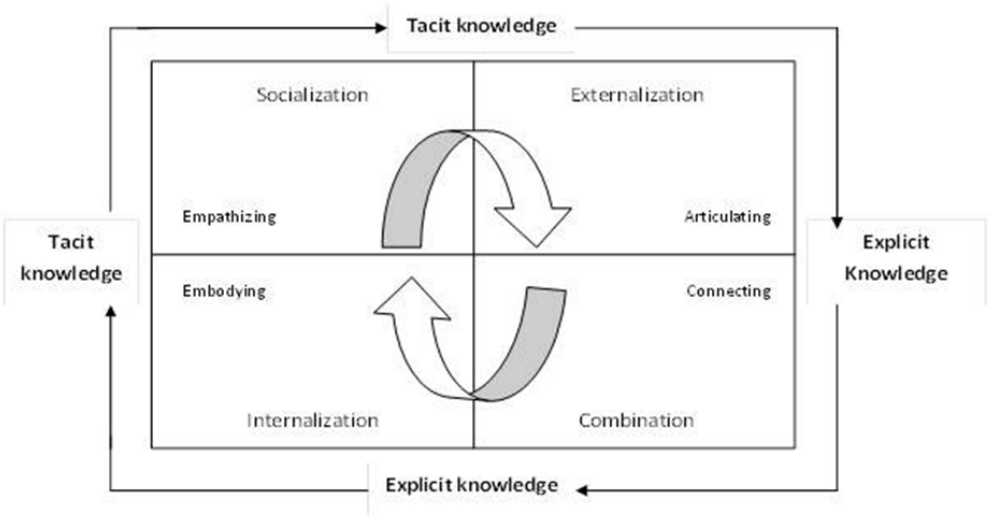

FIGURE 1. SECI framework model [7]

3. **Methodology.** In this study descriptive method was used using convenience sampling techniques and survey approaches. Data collection techniques for conducting this research include the following.

1) Observation

This observation method is carried out to find out information related to learning methods that are currently running at the organization and the use of systems related to the teaching and learning process on campus by observing the situation and conditions at the organization.

2) Interview

Interviews are conducted when observing the campus by meeting directly with the parties concerned to obtain information related to research at the organization.

3) Questionnaire

Some samples that have been determined as respondents will be asked to answer a number of questions and statements regarding the preparation of the implementation of the knowledge management system at the organization. This questionnaire is closed. Respondents simply choose one answer from the answers provided. Questions in the questionnaire are built based on the research instruments that have been made that come from six factors from the knowledge management life cycle. The scale technique used in this study is integrated rating scales using the 5 Likert Scale Indicator.

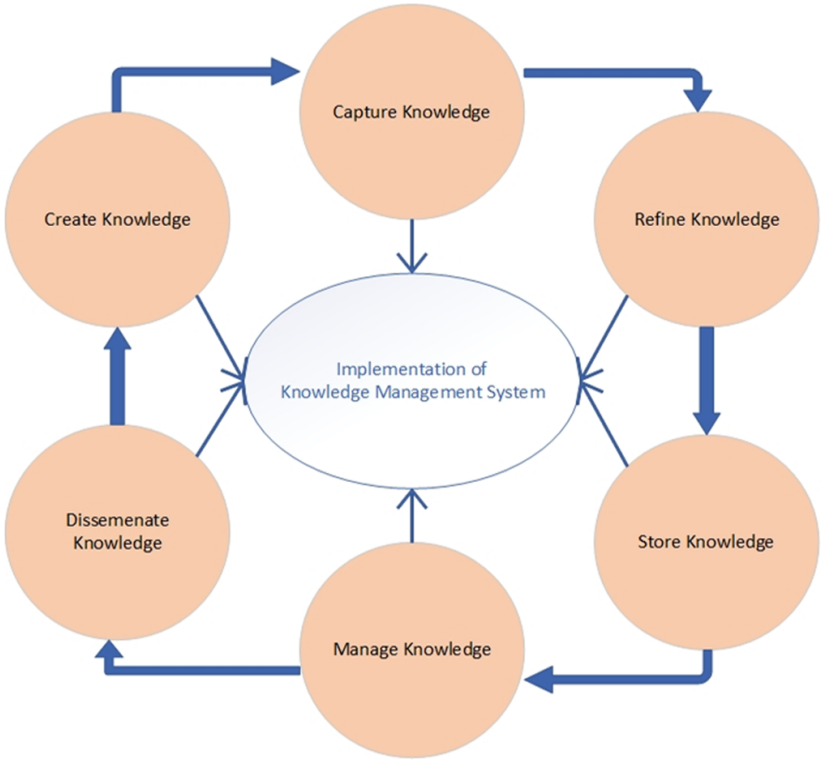

FIGURE 2. KMS life cycle

4) Literature study

Literature studies are carried out using several sources from articles and books and general journals related to research. This literature study is useful to find out the theoretical basis and knowledge of external environment information and the internal environment within the company.

This research is quantitative research conducted to assess the readiness of the implementation of the knowledge management system at the organization based on knowledge management life cycle theory.

This study uses the factor analysis method with several stages as follows.

1) Make a Reliability Test based on the results of the questionnaire using SPSS software to find out whether the questionnaire is worthy of being used as research data or not.
2) Arrange the correlation matrix between each variable by determining the value of the Barlett Test of Sphericity used to determine whether there is a significant correlation between variables, and the Measure of Sampling Adequancy Test using Keizer Meyers Oklin.
3) Perform factor extraction against a set of variables that are formed so that one or more factors are formed.
4) Rotate factors to change factor matrices into simpler matrices so that it is easier to interpret using the varimaxrotation method.
5) Name new factors that have been formed based on predetermined variables.

6) Make factor scores for the needs of further analysis needed in this study.

The results of this factor analysis will be used as an evaluation of the readiness of the implementation of the knowledge management system as shown in Table 1.

Table 1. Research instrument development

	Factor	Indicator	Reference
Knowledge Management System Life Cycle	Create Knowledge (CK)	Acquisition (CK1)	[9]
		Tacit Knowledge and Explicit Knowledge (CK2)	[10]
		Organizational Culture (CK3)	[11]
		Internal Communication (CK4)	[12]
		Knowledge Reuse (CK5)	[13]
	Capture Knowledge (CA)	Suitability (CA1)	[14]
		Knowledge Fusion (CA2)	[15]
		Analyzing (CA3)	[16]
		Knowledge Source (CA4)	[17]
		Knowledge Transfer (CA5)	[18]
	Refine Knowledge (RK)	Identification and Codification Knowledge (RK1)	[19]
		Indexing (RK2)	[20]
		Evaluating (RK3)	[21]
		Optimizing (RK4)	[22]
		Knowledge Development (RK5)	[24]
	Store Knowledge (SK)	Classifying (SK1)	[25]
		Knowledge Repository (SK2)	[26]
		Knowledge Accessibility (SK3)	[27]
		Knowledge Storage (SK4)	[28]
		Security (SK5)	[29]
KMS Life Cycle	Manage Knowledge (MK)	Knowledge Update (MK1)	[30]
		Usefulness (MK2)	[31]
		Knowledge Base System (MK3)	[32]
		Knowledge Quality (MK4)	[33]
		Frequency of Use of the Knowledge Base (MK5)	[34]
	Dissemenate Knowledge (DK)	IT Infrastructure (DK1)	[35]
		Shared Vision and Common Understanding (DK2)	[36]
		Organizational Learning (DK3)	[37]
		Sharing Knowledge (DK4)	[38]
		Co-operative Culture (DK5)	[39]

4. **Result and Discussion.**

4.1. **Gathering data.**

4.1.1. *List of respondent.* Based on the total population of 755 employees consisting of lecturers and students who are included in the study population, a minimum number of samples is needed in this study using the Slovin formula. The estimated sample error is 5%, the result of the calculation for the minimum number of respondents used is 260 respondents.

4.1.2. *Demographic data of respondents.* The following is a descriptive description of the research respondents.

Based on Table 2, there were 31 respondents who were new employees because they were still under 1 year old. Then there are 87 respondents who have worked for around 1-2 years. There were also 60 respondents who had worked for around 2-4 years, and there were also 82 respondents who had worked for more than 4 years. The results obtained show that the majority of respondents have worked for 1-2 years and more than 4 years.

Table 2. Respondent's data based on the duration of work

Length of work	Respondent	Percentage
$<$ 1 years	31	12%
1-2 years	87	33%
2-4 years	60	23%
$>$ 4 years	82	32%
Total	260	100%

Based on Table 3, obtained data show as many as 164 male respondents and 96 female respondents. This respondent's data is only information on the number of population for each gender.

Table 3. Respondent's data based on gender

Gender	Respondent	Percentage
Male	164	63%
Female	96	37%
Total	260	100%

As shown in Table 4, the respondents' data obtained were 13 respondents aged less than 20 years, 126 respondents aged 21 to 30 years, 59 respondents aged 31 to 40 years, and 62 respondents aged 40 years and above. The results obtained show that the majority of respondents in this study were 21 to 30 years old. This can facilitate the introduction and training of knowledge management systems in organizations.

Table 4. Respondent's data based on age

Age	Respondent	Percentage
$<$ 20	13	5%
21-30	126	48%
31-40	59	23%
$>$ 40	62	24%
Total	260	100%

It can be seen in Table 5, respondents who entered into this study amounted to 11 respondents for high school, vocational education 40 respondents, 116 respondents for undergraduate education, 49 respondents for graduate education, and 44 people for post graduate education. The results obtained showed that the majority of respondents had S1 education, where the knowledge and abilities of respondents were considered to be good enough.

Based on Table 6 it can be obtained information that respondents who gave 4 scores as many as 4 people, respondents who gave a value of 5 as many as 28 people, respondents who gave a score of 6 as many as 37 people, respondents who gave a score of 7 as many as 55 people, respondents who gave 8 scores 72 people, respondents who gave 9 scores as many as 50 people, and respondents who gave a score of 10 as many as 14 people. The results showed that the majority of respondents gave a score of 8 where according to respondents the readiness to implement KMS was good and could be applied in the organization.

TABLE 5. Respondent's data based on latest education

Latest education	Respondent	Percentage
High school	11	4%
Vocational	40	15%
Undergraduate	116	45%
Graduate	49	19%
Post graduate	44	17%
Total	260	100%

TABLE 6. Respondent's data based on understanding levels

Level of understanding	Respondent	Percentage
1	0	0%
2	0	0%
3	0	0%
4	4	2%
5	28	11%
6	37	14%
7	55	21%
8	72	28%
9	50	19%
10	14	5%
Total	260	100%

4.2. **Reliability and factor analysis.**

4.2.1. *Reliability test.* Reliability test can be done using reliability analysis through Cronbach's Alpha with the help of SPSS 20. In this study reliability test was conducted on 260 respondents. Decision making based on Cronbach's Alpha value > 0.70 is said to be acceptable, Cronbach's Alpha value > 0.80 is said to be good, and Cronbach's Alpha > 0.90 is said to be very good. After testing reliability, as shown in reliability statistics, the value of Cronbach's Alpha obtained from 30 indicators is 0.954. This shows that the instrument variables used in this study are reliable.

4.2.2. *Factor analysis.* In carrying out factor analysis, the variables analyzed are said to be feasible to be factored if the KMO-MSA value is > 0.5 and significant value (sig) or opportunity (p) < 0.05.

Based on the results of data processing in this study the KMO-MSA value was 0.953. It is also known that the Bartlett's Test value is 0.000. This shows that the data collected has the right to be factored.

Anti Image Correlation, variables can be used as a joint component or cannot be determined based on the value of the anti image correlation with the following conditions.

1) MSA $= 1$, variables can be predicted without errors from other variables.
2) MSA ≥ 0.5, variables can still be predicted and need to be analyzed further.
3) MSA < 0.5, variable cannot be edited and cannot be analyzed further.

Total Variance Explained, to measure the variance of all variables for these factors is assessed from the eigen values. The eigen value ratio illustrates the importance of factors to variables. After processing the data using the eigen value greater than one, four new factors are formed from the total components ranging from 1 to 6 which represent the number of independent variables. The cumulative results of the overall variant extraction of components are 56.41%.

Component Matrix, after carrying out the factor extraction process, the next step is to determine the indicators of each new factor that is formed according to the results of data processing with component matrix processes.

The first new factor is Lack of Knowledge Utilization, which is a representation of a number of variables consisting of variables:

1) Knowledge Base System (MK3) = KM can help find solutions to problems.
2) Frequency of Use of the Knowledge Base (MK5) = The large number of users accessing KMS is one indicator of KMS success.
3) Knowledge Transfer (CA5) = KM distributes knowledge to users.
4) Identification and Codification Knowledge (RK1) = Codification of knowledge helps search knowledge.
5) Knowledge Storage (SK4) = KMS can be accessed anywhere.
6) Classifying (SK1) = Knowledge is classified into broader scope and detailed coverage.
7) Knowledge Development (RK5) = KM perfects knowledge based on the latest research on that knowledge.
8) Co-operative Culture (DK5) = Dissemination of knowledge becomes easier with co-operation from employees.
9) Knowledge Update (MK1) = KM can update old knowledge into new knowledge.
10) IT Infrastructure (DK1) = Information technology is a means of supporting KMS.
11) Suitability (CA1) = Knowledge is obtained based on organizational needs.

The second new factor is Knowledge Information, which is a representation of a number of variables consisting of variables:

1) Acquisition (CK1) = Knowledge comes from within the human and organizational environment.
2) Organizational Culture (CK3) = Organizational culture is a KMS success factor.
3) Tacit Knowledge and Explicit Knowledge (CK2) = New knowledge is obtained in the form of data and individual experience.
4) Analyzing (CA3) = Not all knowledge can be used.
5) Suitability (CA1) = Knowledge is obtained based on organizational needs.
6) Knowledge Reuse (CK5) = KMS can reuse customized knowledge adapted to technological developments.
7) Internal Communication (CK4) = Good communication produces new knowledge through sharing.

The third factor is Quality of Knowledge Sharing, which is a representation of a number of variables consisting of variables:

1) Sharing Knowledge (DK4) = Knowledge sharing helps employees at work.
2) Usefulness (MK2) = KM ensures useful knowledge and can be used in organizations.
3) Knowledge Quality (MK4) = Knowledge that is accurate and relevant affects the quality of knowledge.
4) Internal Communication (CK4) = Good communication produces new knowledge through sharing.

The fourth factor is Network Distribution, which is a representation of a number of variables consisting of variables:

1) Security (SK5) = KMS needs to pay attention to the security of stored knowledge.
2) Optimizing (RK4) = Optimizing existing knowledge so that knowledge is more easily understood and understood by users.
3) Knowledge Source (CA4) = Valid knowledge comes from a valid source.
4) Knowledge Accessibility (SK3) = KMS can provide user convenience in accessing knowledge.

With the discovery of 4 new factors obtained after going through factor analysis, namely, Lack of Knowledge Utilization, Knowledge Information, Quality of Knowledge Sharing, and Network Distribution, these four factors will be used to analyze KMS implementation readiness at the organization. An overview of new factors can be seen in Figure 3. By using an assessment of the current level of KMS implementation readiness as a dependent variable and factor score as an independent variable, the analysis is continued by making a regression of factors towards the respondents' understanding. From the results of the analysis, an equation is found that can be used as a formula that describes the readiness of KMS implementation at the organization.

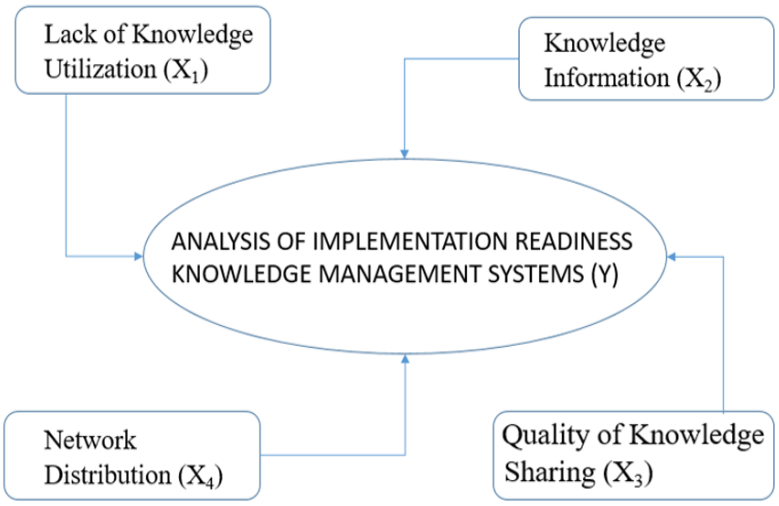

FIGURE 3. New factors affecting KMS implementation readiness

Based on the model above, the knowledge management readiness implementation analysis model can be seen in Figure 4 as follows:

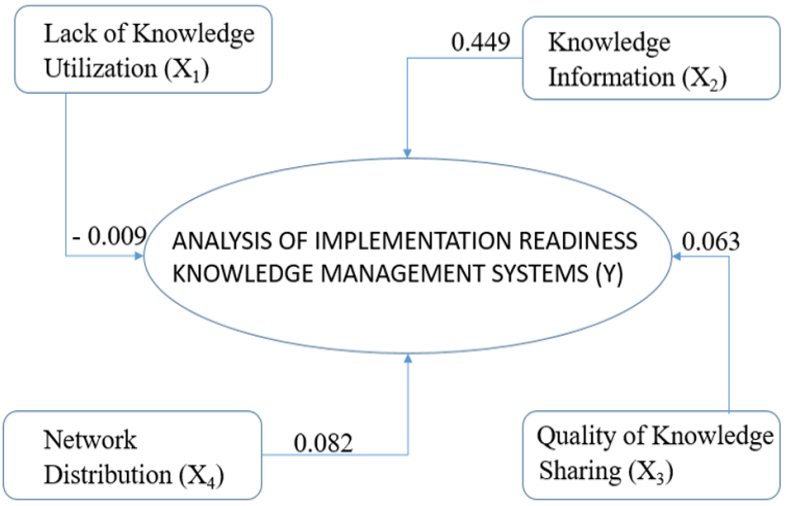

FIGURE 4. Factor value for respondent's level of understanding

From the resulting model it can be seen the first factor, namely the Lack of Knowledge Utilization has a negative value of 0.009 which indicates that there is limited quality in:

1) The first factor which is a representation of a number of variables which can affect −0.009 to the lack of understanding of respondents to knowledge management implementation system in the organization.

2) The second factor, Knowledge Information, has a positive value of 0.449 which indicates that improving quality with the indicators contained in the second factor can increase respondents' understanding of the knowledge management system. This factor has the greatest value compared to the other four factors.
3) The third factor is Quality of Knowledge Sharing with a positive value of 0.063 which indicates that the improvement of the quality of the third factor which is a representation of a number of variables will influence the increase in respondents' understanding of the application knowledge management system.
4) The fourth factor is Network Distribution which is a representation of a number of variables with a positive value of 0.082 which indicates that the improvement in the quality of indicators in the fourth factor will affect 0.082 increase in respondents' understanding of the knowledge management system.

In the form of a mathematical model, the above model can be explained by the following equation:

$$\mathbf{Y = 7.419 - 0.009X_1 + 0.449X_2 + 0.063X_3 + 0.082X_4}$$

with an explanation of the $\mathbf{X}$ value limit:

$$-3.176 \leq \mathbf{X_1} \leq 2.882$$
$$-4.033 \leq \mathbf{X_2} \leq 1.786$$
$$-4.380 \leq \mathbf{X_3} \leq 2.389$$
$$-4.148 \leq \mathbf{X_4} \leq 2.788$$

and after the model is simulated, an illustration is obtained for achieving the optimum value of the readiness for the implementation of knowledge management is 8.628 with a scale between 1.000 and 10.000. However, if this condition is not considered, then the level of readiness will drop to a value of 4.966 as shown in Table 7.

TABLE 7. Simulation model of readiness for implementation of knowledge management system

Variable / Condition	Y	β_0	X_1	X_2	X_3	X_4
Normal	7.419	7.419	0	0	0	0
Un-expected	4.966	7.419	2.882	−4.033	−4.380	−4.148
Optimum	**8.628**	**7.419**	**−3.176**	**1.786**	**2.389**	**2.788**

5. **Conclusion.** From the results of research on the readiness analysis of the implementation of the knowledge management system at the higher education by using factor analysis involving as many as 260 respondents, researchers proved that:

1) Find four new factors that influence the readiness of the implementation of the knowledge management system, namely Lack of Knowledge Utilization, Knowledge Information, Quality of Knowledge Sharing, and Network Distribution.
2) Every new factor found represents several indicators:
   a) The first factor (Lack of Knowledge Utilization) which consists of several indicators namely the Knowledge Base System, Knowledge Base, Knowledge Transfer, Identification and Codification Knowledge, Knowledge Storage, Classifying, Knowledge Development, Co-operative Culture, Knowledge Update, IT Infrastructure, Suitability.
   b) The second factor (Knowledge Information) which consists of several indicators namely Acquisition, Organizational Culture, Tacit Knowledge and Explicit Knowledge, Analyzing, Suitability, Knowledge Reuse, and Internal Communication.

c) The third factor (Quality of Knowledge Sharing) which consists of several indicators, namely Sharing Knowledge, Usefulness, Knowledge Quality, and Internal Communication.
d) The fourth factor (Network Distribution) which consists of several indicators, namely Security, Optimizing, Knowledge Source, and Knowledge Accessibility.

3) Models that illustrate the readiness of the implementation of knowledge management systems in higher education organizations can be used to determine the organization's strategy and policies in the future in order to increase organizational competitive advantage.

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