Selection Of Creative Industry Sector ICT Suitable Developed In Pesantren Using Fuzzy - AHP

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Submission date: 25-Dec-2021 01:11PM (UTC+0700)
Submission ID: 1735576258
File name: A01._JATIT_Vol_82_No_1.pdf (2.81M)
Word count: 2431
Character count: 12495

Journal of Theoretical and Applied Information Technology
10th December 2015. Vol.82. No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

SELECTION OF CREATIVE INDUSTRY SECTOR ICT SUITABLE DEVELOPED IN PESANTREN USING FUZZY - AHP

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ABSTRACT

Selection of the type of creative industries field of Information and Communication Technology (ICT) suitable to be developed in Pesantren is a complex problem, this is caused by some kind of creative industries fields ICT one of which must be chosen, whereas every kind of creative industries contain several criteria that must be assessed in conformity with the priority location will be developed. because with a situation that is complex and uncertain, so that decision makers difficulty in determining the decision, usually makers typically use intuition and subjectivity alone. approach *Fuzzy -Analytic Hierarchy Process* (Fuzzy-AHP) is one method that can answer this question. Because this method can lead decision makers to assess each criterion and alternative determined. Fuzzy numbers are used to present the assessment, with this approach, the decisions that are selected will be more accurate and reliable.This study has four (4) criteria, Twelve (12) sub-criteria and four (4) decision alternatives.The criteria used in this study were (E) = Economy, (T) = Technology, (S) = Human Resources (HR) and (Markets. Alternative decisions to be selected is (A) = Advertising, (F) = Fashion, (M) = Music and Photography. Results of the simulation method of the F-AHP weighting the results obtained alternative creative industries on each criteria and sub-criteria as follows: [1] Advertising = 0.299, [2] Fashion = 0.284, [3] Photography = 0.252 and [4] Musik = 0.207 so that the creative industries field ICT suitable to be developed in Pesantren is a kind of advertising.

Keywords: *Creative Industry, Pesantren, F-AHP*

1. INTRODUCTION

The presence of the longest bridge in addition to speeding up the transport of Surabaya to Madura is also expected to provide some positive impact on economic activity increased PDRB each district and well-being of the community in Madura.

Pesantren in Madura until now still has a considerable influence on the living conditions of society, it is no wonder if until now the existence of Pesantren remains believed to create the Muslim intellectual character. But what happens is pesantren alumni in Madura still be one source of poverty because they lack the skills acquired while studying in pesantren..

Based on Figure 1 on the survey results 70% of graduate students of pesantren 70% unemployed, 13% of students worked odd jobs, 12% continue their studies to a higher level, 5% undetectable (Hozairi, 2013).

This shows that the greatest challenge for the Government is how to accelerate towards improving the competitiveness of pesantren and students to enter the working world, so that the Madura community will host in its own territory.

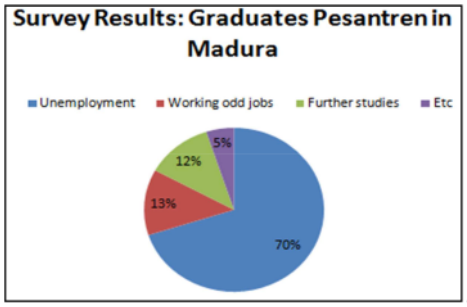

Figure 1. Results Of The Survey Of Graduates Pesantren In Madura

On the other hand the pesantren still do not glance at the market opportunities of work for the students, although the potential of creative industries in Madura very large but have not optimized properly to drive economic growth adjusted to the potential of pesantren as one of the containers that are able to develop human resources who are active, creative and innovative.

Based on Figure 2 on the creative industry sector of the ICT field, permasalahanya how to choose the type of creative ICT industry are suitable for

Journal of Theoretical and Applied Information Technology
10th December 2015. Vol.82. No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

pesantren and the students, for that is what needs to be analyzed qualitatively and quantitatively about the choice of the creative industry.

Figure 2. The Field Of Creative Industries Creative Industries Sector ICT (Source: Ministry Of Industry And Trade: 2011)

Problems arise in inaccuracies assessment team in providing an assessment of the type of industry that is suitable for the pesantren. So that the assessment given still uncertain (fuzzy nature = unclear). The existence of inaccuracy in delivering value to the type of creative industries in ICT have an impact on decisions given less precise.

To solve these problems, the methods to be used to select the type of creative industry is Fuzzy Analytical Hierarchy Process (F-AHP). Model F-AHP used is a model Chang (1996) because, according to Lee (2009) this model is closer to conventional AHP model and the model is relatively easier than other approaches.

The purpose of this study is to choose the type of creative industries in ICT are suitable to be developed at the Pesantren and the students are also able to develop, the results of the selection will be community service program that is packaged in the form of science and technology for the Community to improve the competitiveness of pesantren in the field of creative industries.

2. RESEARCH METHODS

Several studies have been carried out using the F-AHP method to solve several problems such as: application of F-AHP to select employees with non-additive weighting models Yudishthira *(Raharjo & Sutapa, 2002)*. F-AHP is also used for an alternative electoral process services provider company in the pre-negotiation phase *(Mikhailov and Tsvetinov, 2004)*.

While the F-AHP research using models Chang (1996), among others: Selection of services catering company uses F-AHP *(Kahraman, et al, 2004)*. F-AHP evaluation model used to determine the value of the intellectual (Lee, 2009). F-AHP is used as a decision support system to select the best employees *(Jasril, et al, 2011)* and the F-AHP is also used to select the winning bidder vessel (*Heru and Hozairi, 2012)*.

2.1. Membership degrees and Scale Fuzzy Logic

F-AHP is a combination of AHP with fuzzy approach *(Raharjo et al, 2002)*. F-AHP cover the weaknesses found in AHP, namely the problem of the subjective nature of the criteria that have more. The uncertainty is represented by a sequence of numbers scale.

Determination of membership degree F-AHP developed by Chang (1996) using the triangle membership function *(Tringular Fuzzy Number/TFN)*. Triangular membership function is a combination of the two lines (linear). Graph triangular membership function curves depicted in the form of triangular as shown in Figure 3.

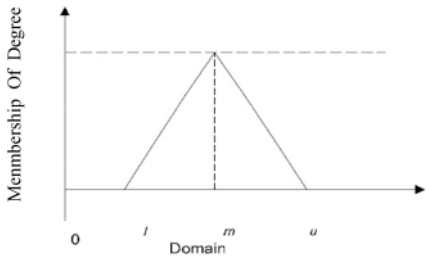

Figure 3. *The triangular membership function (Chang, 1996)*

(Chang, 1996) defines the intensity values AHP into triangular fuzzy scale that divides each fuzzy set with two (2), except for the intensity of the interest of one (1). Triangular fuzzy scale used Chang can be seen in Table 1.

Table 1. Skala Triangular Fuzzy Numbers (TFN)

The intensity of interest AHP	Linguistics Association	Tringular Fuzzy Number	Reciprocal
1	equally important	(1, 1, 1)	(1, 1, 1)
2	mid (equally important)	(1/2, 1, 3/2)	(2/3, 1, 2)
3	quite important	(1, 3/2, 2)	(1/2, 2/3, 1)
4	mid (quite important)	(3/2, 2, 5/2)	(2/5, 1/2, 2/3)
5	strong critical	(2, 5/2, 3)	(1/3, 2/5, 1/2)
6	mid (strong critical)	(1/2, 3, 7/2)	(2/7, 1/3, 2/5)
7	stronger important	(3, 7/2, 4)	(1/4, 2/7, 1/3)
8	mid (stronger important)	(7/2, 4, 9/2)	(2/9, 1/4, 2/7)
9	absolutely more important	(4, 9/2, 9/2)	(2/9, 2/9, 1/4)

2.2. Step by Step F-AHP

Step by step of completion of the F-AHP according to Chang (1996) as follows:

Journal of Theoretical and Applied Information Technology
10th December 2015. Vol.82. No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

a. Creating a hierarchical structure problem to be resolved and determine the matrix of pairwise comparisons between the scale TFN criteria (Table 1).

b. Determining the value of fuzzy synthesis *(Si)* priority by using the formula:

$$S_i = \sum_{j=1}^{m} M_j^i \times \frac{1}{\sum_{i=1}^{n} \square \sum_{i=1}^{m} M_i^j} \quad \ldots\ldots\ldots\ldots (1)$$

Where:

$$\sum_{j=1}^{m} M_j^i = \sum_{j=1}^{m} lj, \sum_{j=1}^{m} mj, \sum_{j=1}^{m} uj, \quad \ldots\ldots\ldots\ldots (2)$$

Whereas:

$$\frac{1}{\sum_{j=1}^{n} \square \sum_{j=1}^{m} M_i^j} = \frac{1}{\sum_{i=1}^{n} ui, \sum_{i=1}^{n} mi, \sum_{i=1}^{n} li} \quad \ldots\ldots\ldots\ldots (3)$$

c. Determining Vector Value *(V)* and the ordinate value defuzzification *(d ')*.

If the results obtained in each matrix fuzzy, $M_2 \geq M_1$ ($M_2 = (l_2, m_2, u_2)$ *dan* $M_1 = (l_1, m_1, u_1)$ then the value of the vector can be formulated as follows:

$$V(M_2 \geq M_1) = \sup\ [\min(\mu M_1(x), \min(\mu M_2(y)))]$$

Or the same as the graph in Figure 3 below:

$$V(M_2 \geq M_1) = \begin{cases} 1, & if\ m_2 \geq m_1, \\ 0, & if\ l_2 \geq \mu_2, \\ \dfrac{l1 - \mu 2}{(m2 - \mu 2) - (m1 - l1)} & lainnya \end{cases}$$

If the result is greater than the value of fuzzy k, M_i (i = 1,2, .. k) then the value of the vector can be defined as follows:

$V(M \geq M_1, M_2, \ldots M_K) = V(M \geq M_1)$ dan
$V(M \geq M_1)$
$V(M \geq M_k) = min\ V(M \geq M_i)$ …….... (4)

It is assumed that:
$d'(A_i) = \min V(S_i \geq S_k)$ …….... (5)

For k = 1,2,…n; k ≠, Then the weight vector values obtained as follows:

$W = d'(A_1), d'(A_2), \ldots\ldots d'(A_n)^T$ …….... (6)

Where $A_i = 1, 2, \ldots\ldots, n$ element of the decision.

d. Normalization fuzzy value of the weight vector (W)

After normalization of equation (6) then the value of the weight vector is normalized as the following formula:

$W = d(A_1), d(A_2), \ldots\ldots d(A_n)^T$ …….... (7)

Where W is the number of non fuzzy

3. RESULT AND DISCUSSION

3.1. Criteria and Sub-Criteria

After interviews with experts in the field of creative industries and the boarding of the obtained the data criteria and sub criteria used to select the type of creative industry the most suitable ICT development in schools, especially in the area of Madura as shown in Table 2. Based on Table 2 shows that there are four (4) criteria and three (3) sub-criteria for each criterion.

Table 2. Criteria And Sub-Criteria

No	Criteria Code	Criteria Name	Sub-Criteria Code	Sub-Criteria Name
1	E	Economics	E1	Asset
			E2	Absorb labor
			E3	Daya Beli Masyarakat
2	T	Technology	T1	Easily found in the market
			T2	Low Cost
			T3	Easy to operate
3	S	Human Resource	S1	Experience
			S2	Motivation
			S3	Interest and talent
4	P	Market	K1	Regional specialties
			K2	Affordable cost
			K3	Unique

Once the data is obtained criteria and sub-criteria, further troubleshooting using FAHP method.

3.2. Fuzzy AHP

3.2.1. Structure Hierarchy

Hierarchical structure of problems of choice of creative industries in ICT are suitable to be developed in Pesantren can be seen in Figure 4. While the matrix of pairwise comparison table between criteria with TFN scale can be seen in Table 2.

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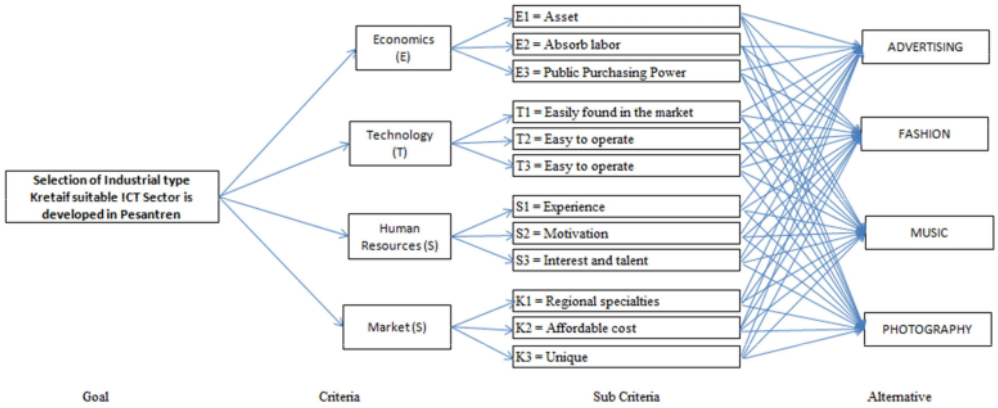

Figure 4. The Structure Of The Hierarchy Of The Selection Of Creative Industries In The ICT Field Pesantren

3.2.2. Determination of Value Synthesis *(SI)*

Calculating the value of fuzzy synthesis leads to the overall assessment of the value of each criterion, sub-criteria and the desired alternative. Based on Table 3, the process to obtain the value of the number of rows and columns using equation (2) and (3), results can be seen in Table 4.

Table 3. Matrix of pairwise comparison F- AHP criteria

Criteria	Economics (E)			Technology (T)			Human Resource (S)			Market (P)		
	L1	M1	U1	L2	M2	U2	L3	M3	U3	L4	M4	U4
Economics (E)	1.000	1.000	1.000	1.000	1.500	2.000	1.000	1.000	1.000	0.667	1.000	2.000
Technology (T)	2.000	0.667	1.000	1.000	1.000	1.000	0.500	0.667	1.000	0.250	0.500	0.667
Human Resource (S)	1.500	2.000	2.500	1.000	1.500	2.000	1.000	1.000	1.000	0.667	1.000	2.000
Market (P)	0.500	1.000	1.500	1.500	2.000	1.500	0.500	1.000	1.500	1.000	1.000	1.000

Tabel 4. Calculation of the number of rows of each column and inverse

Criteria	Number of rows		
	L	M	U
Economics (E)	3.667	4.500	6.000
Technology (T)	3.750	2.833	3.667
Human Resource (S)	4.167	5.500	7.500
Market (P)	3.500	5.000	5.500

Number of columns		
L	M	U
15.083	17.833	22.667

Invers		
L	M	U
0.044	0.056	0.066

Once the value of the number of rows and columns is obtained, then using equation (1) obtained by synthesis fuzzy value of each criterion (SK_i) where i = 1,2 ... 4, as follows:

$\mathbf{SK_E}$ = ((3,667,4.5,6) * Invers (0.044,0.056,0.066))
= (0.162, 0.252, 0.398)

$\mathbf{SK_T}$ = ((3,750, 2.833, 3.667) * Invers (0.044, 0.056, 0.066))
= (0.165, 0.159, 0.243)

$\mathbf{SK_S}$ = ((4,167,5.5,7.5) * Invers (0.044,0.056,0.066))
= (0.184, 0.308, 0.497)

$\mathbf{SK_P}$ = ((3,50, 5.00, 5.50) * Invers (0.044, 0.056, 0.066))
= (0.154, 0.280, 0.369)

Fuzzy synthesis value calculation can be summarized in Table 5.

Table 5. Conclusion fuzzy synthesis value calculation (Si) criteria.

Criteria	Si		
	L	M	U
Economics (E)	0.162	0.252	0.398
Technology (T)	0.165	0.159	0.243
Human Resource (S)	0.184	0.308	0.497
Market (P)	0.154	0.280	0.365

3.2.3. Determination Vector Value *(V)* and Value Ordinate defuzzification

This process uses fuzzy approach is the function of the implications of minimum (min) fuzzy. After comparison of fuzzy synthesis, ordinate value will be defuzzification (d') value and a' minimum. Based on Table 5 and equation (3) and (4), the obtained value of the vector and defuzzification ordinate value of each criteria:

a. Criteria 1 is Economics ($K1_E$), vector values are:

$(V_S K1_E) \geq (V_S K2_T, V_S K3_S, V_S K4_P)$

Because the value of $m_1 \geq m_2$ and $u_2 \geq l_1$ then used by equation (4) value $V_S K1_E \geq V_S K3_S$ use the formula:

$$= \frac{0.184 - 0.348}{(0.252 - 0.398) - (0.308 - 0.184)}$$
$$= 0.792$$

While the value $V_S K1_E \geq V_S K2_T$ 1 and $V_S K1_E \geq V_S K4_P$ value is 0.897. thus obtained value *(d')* by equation (5) is:

$d'(V_S K1) = \min(1, 0.792, 0.897)$
$d'(V_S K1) = \mathbf{0.792}$

Journal of Theoretical and Applied Information Technology
10th December 2015. Vol.82. No.1

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

So in the same way as criterion 1 (economic) then to the value vector to the criteria 2,3 and 4 used the same way.

b. Criteria 2 are Technology ($K2_T$).

$(V_SK2_T) \geq (V_SK1_E, V_SK3_S, V_SK4_P)$
$V_SK2_T \geq V_SK1_E = 0.465$
$V_SK2_T \geq V_SK3_S = 0.284$
$V_SK2_T \geq V_SK4_P = 0.422$

Thus obtained ordinate value d'.
$d'(V_SK2_T) = \min(0.465, 0.284, 0.422)$
$d'(V_SK2_T) = \mathbf{0.284}$

c. Criteria 3 is Human Resource ($K3_S$).

$(V_SK3_S) \geq (V_SK1_E, V_SK2_T, V_SK4_P)$
$V_SK3_S \geq V_SK1_E = 1$
$V_SK3_S \geq V_SK2_T = 1$
$V_SK3_S \geq V_SK4_P = 1$

Thus obtained ordinate value d'.
$d'(V_SK3_S) = \min(1, 1, 1)$
$d'(V_SK3_S) = \mathbf{1}$

d. Criteria 4 is market ($K4_P$).

$(V_SK4_P) \geq (V_SK1_E, V_SK2_T, V_SK3_S)$
$V_SK4_P \geq V_SK1_E = 1$
$V_SK4_P \geq V_SK2_T = 1$
$V_SK4_P \geq V_SK3_S = 0.866$

Thus obtained ordinate value d '.
$d'(V_SK3_S) = \min(1, 1, 0.866)$
$d'(V_SK3_S) = \mathbf{0.866}$

Based ordinate values K1, K2, K3 and K4, then the value of the weight vector can be determined according to equation (6) as follows:

$\boldsymbol{W' = (0.792, 0.284, 1, 0.866)^T}$

3.2.4. Weight vector normalization value (W)

Normalization is obtained from the weight vector value divided by the total sum of the weights vector itself as in equation (6).

$$\boldsymbol{W_{lokal} = (0.792, 0.284, 1, 0.866)}$$

Weight calculations to obtain weighting factors and sub-criteria alternatives locally enforced the same way with the criteria.

Table 6. The value of the weight vector (W).

Criteria	Min of degree	Normalisasi
Ekonomic (E)	0.792	0.408
Teknology (T)	0.284	0.146
Human Resource (S)	1	0.515
Market (P)	0.866	0.446
	1.942	

3.2.5. Ranking of Alternatives and Decision Results

The process of ranking of alternatives is done by using the following formula:

Weight = Weight K * Weight SK * Weight AL * Value

The process of ranking is done by simulating the process of giving value for each alternative by 30 studens of different people, using the intensity of interest based on sub-criteria in Table 7.

Once obtained, the weight of the weights are added to produce a global weighting of each alternative, after the global weighting and ranking obtained in search of an average weight of fuzzy AHP of each alternative and normalized value to determine the rank of each alternative, perangkingan process shown in Figure 5.

Tabel 7. Range value interest

Range Value	Description
50-64	Less Important
65-80	Important enough
81-90	Important
91-100	Very important

Of the process of calculating the F-AHP criteria and sub-criteria weights obtained locally (W_{lokal})which will be multiplied by weighting the results of the calculation of the alternative ($W_{prioritas}$). Table 8 is the result of global weight alternative conclusion.

Table 8. Result On Ranking

Criteria and Sub-Criteria	Weight Criteria / Sub-Criteria	Alternative A	F	M	P
Economics (E)	**0.201**	**Weight A1**	**Weight A2**	**Weight A3**	**Weight A4**
Asset (E1)	0.222	0.563	0.461	0.293	0.245
Absorb labor (E2)	0.284	0.562	0.563	0.415	0.392
Public Purchasing Power (E3)	0.210	0.546	0.563	0.467	0.404
	Total	**0.08027**	**0.07655**	**0.05653**	**0.11635**
Technology (T)	**0.072**	**Weight A1**	**Weight A2**	**Weight A3**	**Weight A4**
Easily found in the market (T1)	0.222	0.563	0.461	0.293	0.245
Easy to operate (T2)	0.284	0.562	0.563	0.415	0.392
Low Cost (T3)	0.210	0.546	0.563	0.467	0.404
	Total	**0.02876**	**0.02742**	**0.02025**	**0.01805**
Human Resource (S)	**0.254**	**Weight A1**	**Weight A2**	**Weight A3**	**Weight A4**
Experience (S1)	0.222	0.563	0.461	0.293	0.245
Motivation (S2)	0.284	0.562	0.563	0.415	0.392
Interest and talent (S3)	0.210	0.562	0.563	0.415	0.392
	Total	**0.10219**	**0.09661**	**0.06861**	**0.06293**
Market (P)	**0.220**	**Weight A1**	**Weight A2**	**Weight A3**	**Weight A4**
Regional specialties (P1)	0.222	0.563	0.461	0.293	0.245
Affordable cost (P2)	0.284	0.562	0.563	0.415	0.392
Unique (P3)	0.210	0.546	0.563	0.467	0.404
	Total	0.08771	0.08364	0.06177	0.05505
		A	**F**	**M**	**P**
	total weight alternative	**0.29894**	**0.28423**	**0.20717**	**0.25238**
	Ranking	**1**	**2**	**4**	**3**

Description:
A = Advertising
F = Fashion
M = Music
P = Photography

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Based on Table 8 above, can be concluded that the alternative (A = Advertising) has the most optimum weight value compared to other alternatives. Therefore, it can be concluded that (A = *Advertising*) was elected as the creative industry in ICT is most suitable to be developed in schools especially in Madura. But the result of this decision only as a recommendation only to assist researchers in taking the decision to design a community service program activities, especially for the students who live in boarding school.

Perangkingan weight results in Table 8 above can be described in detail, as shown in Chart 1.

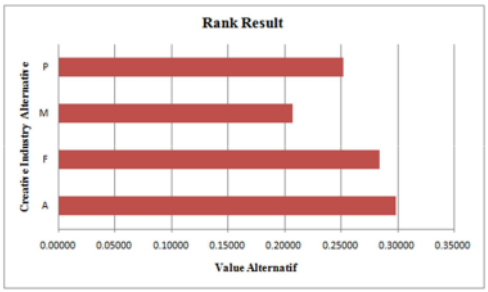

Figure 5. Graph the results perangkingan alternative creative industries ICT

4. CONCLUSION

Based on trial results and analysis of the results of ranking the criteria and sub-criteria, it can be concluded as follows:

- F-AHP method has helped solve the problems of creative industries selecting a suitable field of ICT for development in Madura Pesantren.
- The criteria used to select the creative industries in ICT are suitable to be developed in Pesantren as follows: Economics, Technology, Human Resources and Markets.
- Alternative choice of creative industries in ICT that will be developed at the boarding school there are four types of creative industries, namely: Advertising, Fasion, Music and Photography.
- Results of the weighting of alternative types of creative industries on each criteria and sub-criteria derived sequence of ranking as follows: Rank 1 (one) is the Advertising = 0.299, Rank 2 (two) is Fasion = 0.284, Rank 3 (three) is Photography = 0.252 and Ranking 4 (four) is Music = 0207.
- The ranking results only a recommendation that a decision could be used to develop creative industries in the ICT field Pesantren Madura.

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