

Article

Halal Risk Mitigation And Food Safety In Herbal Medicine Producers Using FMEA And SWOT Methods

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Abstract: Halal supply chain management is halal supply network that managed to ensure halal integrity from raw materials to end consumers. Halal and food safety are important for consumers to choose the food to be consumed. The purpose of this study (1) To determine the priority of halal supply chain and food safety using the FMEA method (2) To determine the strategy to improve the risk of halal supply chain and food safety using the SWOT method. In this study, the highest RPN value of 261 was obtained in the selection of kencur raw materials because the business bought kencur raw materials from collectors in traditional markets so they didn't know the material was safe for consumption or not. In the SWOT method, the results are obtained at quadrant point I, which means that business has many strengths and opportunities, and very possible for businesses to develop and achieve maximum progress.

Keywords: failure mode effect analysis (fmea); severity, weakness, occurrence, threats (swot); halal supply chain; food safety

1. Introduction

Micro and Small Enterprises (MSEs) are community businesses that can boost economic growth in Indonesia. The growth of MSMEs in Indonesia is also capable of building the welfare of the Indonesian people [1]. Indonesia is a country with the largest Muslim population in the world, which prioritizes safe and halal-standard products [2]. Supply chain management is a method to integrate suppliers, manufacturers, warehouses, and stores, so that goods can be produced and distributed efficiently and aim to minimize production and distribution costs [3].

Halal Supply Chain Management is a halal supply network managed to ensure the halal integrity from raw materials to the end consumer. This supply chain involves specific processes related to Islamic law [4]. Halal is a requirement for all products or services. It is mandatory for Muslims to adhere to halal according to Islamic law as a form of their obedience [5]. Halal and food safety are important for consumers when choosing the food they will consume, and halal is a religious requirement that must be adhered to by a believer as a form of their obedience to the religion. Halal and food safety are correlated in terms of ensuring the quality of food that is safe for consumption and in accordance with religious regulations [6].

The results of the research conducted by Asep (2019) propose mitigation strategies. The first strategy is routine inspection and cleaning of equipment to prevent contamination from feces. The second is to create a duty roster for cleaning the production area. The third is to train workers about the halal process periodically. The fourth is to create SOPs for halal production. The fifth is to add facilities and equipment for halal production. The sixth is to expand the production area to prevent cross-contamination. The

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seventh is to replace certified halal suppliers. The eighth is regular machine maintenance [7].

UD Berkah Utama is a business engaged in the food and beverage sector that produces traditional herbal medicine, specifically rice and ginger herbal drink. This business is located in Tenggulunan Village, Pandaan District, Pasuruan Regency. This traditional herbal medicine is highly popular among the local community as well as people from outside the city, such as Malang, Pasuruan City, and other regions. One of the issues faced by UD Berkah Utama is that it does not yet have halal certification for its products. Which affects customer loyalty to purchase the product. Therefore, the business must pay attention to the halal supply chain and food safety from the selection of raw materials to the hands of the consumers.

Each month, they produce 300 barrels, with each barrel containing 30 liters of herbal medicine. As a result of the problem, the production quantity decreased by 1 jar of herbal medicine each month. To gain consumer trust, it's not just about the halal status of the product. However, food safety is also the most important factor in gaining customer trust.

Based on the aforementioned issues, an analysis of the problems that have occurred is needed. The analysis of the issues occurring in the halal supply chain risk and food safety for this herbal medicine producer reveals risks that cause the product to be non-halal and unsafe for consumption. The FMEA method is a technique to identify and eliminate potential failures and errors that arise in the system, design, and process before consumer acceptance [8]. This method was chosen to determine the highest ranking of risks occurring in the mitigation of halal supply chain risks and food safety of herbal medicine products.

SWOT analysis is rooted in the logic of optimizing strengths and opportunities while minimizing weaknesses and threats. Strengths and weaknesses originate from the internal environment of the company, while opportunities and threats come from the external environment [9]. The reason for choosing the SWOT method for this research is to identify resolution strategies for mitigating halal supply chain risks and food safety for herbal medicine producers.

Internal factors or Internal Factors Analysis Strategic (IFAS) within a company are aspects that originate from within the company and can influence the company's performance and culture. These internal factors include various elements such as organizational structure, policies and procedures, employees, organizational culture, and resources [10]. The purpose of IFAS is to uncover the competitive advantages of the organization, including strengths and weaknesses, by analyzing internal conditions [11].

External factors or External Factors Analysis Strategic (EFAS) in a company refer to factors outside the company's control that can affect business performance and success [10]. External environment analysis examines the company's external situation to identify elements of opportunities and threats [11].

Strategic formulation, which is developed by utilizing the findings of the SWOT analysis, is achieved by combining various indicators encompassed in strengths, weaknesses, opportunities, and threats. This formulation integration model uses the TOWS matrix. However, not all strategic plans generated from this TOWS matrix are fully implemented. The chosen strategy is one that has the capacity to address the organization's strategic issues [12]. S-O strategies represent structured strategies that leverage all strengths to capitalize on opportunities. W-O strategies are structured strategies aimed at minimizing weaknesses to take advantage of existing opportunities. S-T strategy is a strategy formulated to use all strengths in facing threats. W-T strategy is a structured strategy that aims to minimize weaknesses to prevent threats.

The benefit of dividing the area into four quadrants is to facilitate strategic planning. Some recommended steps to take if the SWOT analysis positions the objectives in a certain quadrant are as follows [13]: Quadrant I, the intersection of strengths and opportunities. Quadrant II, the meeting between strength and challenge. Quadrant III, the meeting of weaknesses and opportunities. Quadrant IV, the intersection of weaknesses and threats.

Research objectives: (1) To determine the priorities of halal supply chain and food safety using the FMEA method at the herbal medicine producer UD Berkah Utama (2) To determine improvement strategies for halal supply chain and food safety risks using the SWOT method at the herbal medicine producer UD Berkah Utama.

2. Materials and Methods

Time and Place of the Research

The following are the time and place that are the subjects of the research implementation:

Time: September 2023 – February 2024 Place: UD Berkah Utama

Data Collection

1. Observation: at this stage, direct introduction to the environment at the herbal medicine business location. And, observing the supply chain flow at UD Berkah Utama. Observation was conducted by directly reviewing the business environment to observe the flow of the supply chain process.
2. Interview: At this stage, interviews are conducted using oral questions with relevant parties or experts in the field of the issue to obtain information. In this case, the sources are the owner, production employees, and distributor employees. The informants were chosen due to their direct involvement.
3. Questionnaire: at this stage, the data collection method through a questionnaire is used to obtain assessments from the FMEA method such as severity, occurrence, and detection based on the risks that occur and analysed using SWOT to obtain assessments such as strength, weakness, opportunities, and threats.

FMEA

In the FMEA method, there are eight steps that are used, namely [14]: The first step is to identify the halal supply chain and food safety in herbal medicine producers. Next, identify potential failure modes in the production process. After that, identify the potential effects caused by the failure mode. Identifying the cause (potential cause) of the failure mode in the production process. Identifying the detection mode in the production process. Establishing the Occurrence (O), Severity (S), and Detection (D) ratings on a scale of 1-10. Where scale 1 indicates the lightest impact and scale 10 indicates the highest impact [15]. Like the table below:

Table 1. Occurrence, Severity, and Detection Values

<i>Occurance</i> (O)	1	2	3	4	5	6	7	8	9	10
	Almost impossible						Failure is almost unavoidable.			
<i>Severity</i> (S)	1	2	3	4	5	6	7	8	9	10
	No effect								Dangerous impact	
<i>Detection</i> (D)	1	2	3	4	5	6	7	8	9	10
	Almost sure								Completely unsure	

Source: [16].

After determining the ratings for occurrence, severity, and detection, the next step is to calculate the RPN value using the formula:

$$RPN = S \times O \times D \quad (1)$$

Source: [17], [18], [19], dan [20].

The final step is to provide recommendations for improvement regarding the causes of failure, control tools, and the resulting effects.

SWOT

In filling out the IFAS and EFAS matrices, it can be done in several stages, as follows [21]: identification of external factors (opportunities and threats) and internal factors (strengths and weaknesses) in the herbal medicine business. Assigning weights to these factors to determine their degree of importance, with a weight value of 0.0-1 indicating

very important. After assigning weight values, all variables will have each factor's value equal to 1. After determining the ranking scale values, the next step is to assign rating values for each factor. Researchers usually assign a value of 1 for no influence and 5 for very influential. The next step is to calculate the score by multiplying the weight value by the rating. After that, calculate the total score for each factor. Internal factors with a positive connotation are called strengths, while those with a negative connotation are called weaknesses. Meanwhile, the group of external factors with a positive connotation is called opportunities, and those with a negative connotation are called threats. The four groups of factors are arranged to form a two-by-two matrix separated in the middle by the x-axis and y-axis (Cartesian diagram) that intersect at the centre at point 0. The x-axis (horizontal) represents internal factors with W on the left (negative) and S on the right (positive). The y-axis (vertical) represents external factors with O at the top (positive) and T at the bottom (negative) [13]. In the process of determining coordinates on the SWOT matrix, calculations for determining the vertical and horizontal axis points are required. The determination of the points is carried out using the following calculation formula [22]:

1. The coordinates of the internal factor analysis (horizontal) are determined as follows:

$$\text{Koordinat faktor internal} = (\text{skor total kekuatan} - \text{skor total kelemahan}) : 2$$

(2)

Source: [22].

1. The coordinates of the external factor analysis (vertical) are determined as follows:

$$\text{Koordinat faktor eksternal} = (\text{skor total peluang} - \text{skor total ancaman}) : 2$$

(3)

Source: [22].

Research Flow

The following is a flowchart that contains the stages in the implementation of the research as shown in the following figure 1.

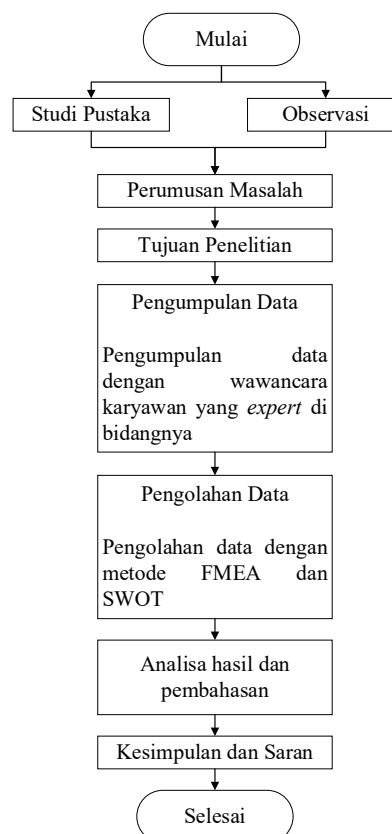


Figure 1. Research Flowchart

3. Results

A. FMEA Method

The following is data processing using the FMEA method obtained from interviews and the distribution of questionnaires to respondents consisting of business owners and employees.

Table 1. Failure Effect and Failure Cause

Risk Identity	Activity	Failure Effect	Failure Cause	Follow-up Plan
Supplier	Selection of sugar raw materials	Herbal medicine uses raw sugar whose halal status is unknown	Buying raw materials from suppliers or agents	Choosing a supplier of sugar raw materials that has been certified halal
	Selection of rice raw materials	Herbal medicine uses raw rice whose halal status is unknown	Buying raw materials from suppliers or agents	Choosing a supplier of rice raw materials that has been certified halal
	Selection of raw materials for kencur	Herbal medicine uses raw materials whose food safety status is unknown	Buying raw materials from collectors in the market	Choosing a supplier of kencur raw materials that has been certified and guaranteed food safety
	Bottle packaging selection	Bottle packaging that is not yet food grade so it is not safe for consumption	Buying bottled packaging from agents or distributors	Choosing a supplier of bottle packaging that has food grade standards so that it is safe to use
Production	The process of cleaning the raw materials of rice and kencur	Raw materials are still not clean enough in the washing process so it is not safe for consumption	The process of cleaning raw rice and kencur materials is not clean enough	Conducting checks before the next process
	The soaking process of rice raw materials	Rice that is soaked for too long becomes very soft so it is not safe for consumption	Soaking raw rice materials for too long	Determining the rice soaking time and routinely conducting checks
	The process of boiling water	Water is still raw so it is not safe for consumption	In the cooking process, the water does not boil and is not long enough	Ensuring that the water is cooked until it is cooked or boiling
	Giving kencur	Herbal medicine feels loose so it is not safe for consumption	Giving too much kencur to the herbal medicine	Using enough kencur
	Giving Sugar	Sugar content that is too high is not safe for consumption for consumers	Giving too much sugar makes the herbal medicine unsafe to consume	Using sugar according to the measurements
	Packaging process	Products are packaged using bottles that are not yet food grade	Using plastic bottles that are not food grade can endanger consumer health	Choosing a supplier of food grade packaging bottles

	Storage process	Products are stored with non-halal products	Making the product non-halal	Separating storage areas for halal and non-halal products Providing training to workers
	Employee performance	Workers do not yet know the production process that is in accordance with halal provisions	The product does not comply with halal standards	Providing training to workers
	Cleanliness of production site	Production site with toilets in one place	Splashing water from the toilet makes the production site unclean so that the product is not halal	Separating or providing partitions between the production area and the toilet
Distribution	Delivery process	Products are sent together with non-halal products	The product becomes contaminated and becomes non-halal	The shipping process is separated from non-halal products

Table 2. Failure Mode Effect Analysis (FMEA) table

Risk Identity	Activity	S	O	D	RPN	Rank
Supplier	Selection of sugar raw materials	7	5	3	107	13
	Selection of rice raw materials	7	5	3	107	13
	Selection of raw materials for kencur	7	5	7	261	1
Production	Bottle packaging selection	7	6	6	253	2
	The process of cleaning the raw materials of rice and kencur	6	5	7	213	8
	The soaking process of rice raw materials	6	5	7	212	9
	The process of boiling water	5	5	8	218	7
	Giving kencur	5	5	8	204	10
	Giving Sugar	5	5	8	222	5
	Packaging process	6	5	7	248	3
	Storage process	4	5	8	163	12
	Employee performance	5	5	8	222	5
	Cleanliness of production site	6	5	8	236	4
Distribution	Delivery process	6	5	6	190	11

From table 2 above, data processing from the FMEA halal supply chain and food safety methods in the herbal medicine manufacturing process is obtained. So that it can be seen that the highest risk is in the selection of kencur raw materials with an RPN value of 261. Furthermore, the second highest risk is in the selection of bottle packaging with an RPN value of 253 and the third highest risk is in herbal medicine packaging with an RPN value of 248.

Table 3. Improvement Alternative

Type of Failure	Alternative Improvements
Selecting raw materials for kencur	Purchase raw materials directly from farmers. Because you can find out what materials are used in farming and also find out the safety of the food

Selecting bottle packaging	Purchase bottle packaging directly from the production site. Because you can find out that the bottle is food grade
Packaging process	Use semi-automatic machines to reduce contamination caused by packaging
Employee performance	Provide training on production practices that comply with halal and food safety standards
Cleanliness of production site	Between the production site and the raw material washing area or bathroom are separated to avoid water splashes

B. SWOT Method

In the SWOT analysis strategy that has been applied from the results of interviews and questionnaires that have been carried out, as follows.

Table 4. SWOT Analysis

Internal		Eksternal	
<i>Strength</i>	<i>Weakness</i>	<i>Opportunity</i>	<i>Threats</i>
Kekuatan	Kelemahan	Peluang	Ancaman
Using raw materials of sugar and rice that have been certified halal	Raw materials for galangal that do not yet know the food safety status	Taking care of halal certification	Consumer confidence decreases if there is no halal logo on the product packaging
The raw material of rice has been guaranteed halal	Bottle packaging that does not meet food grade requirements	Providing a halal logo on product packaging	Many business competitors make sales online
The finished product is stored in a storage warehouse that is not mixed with non-halal products	Has not yet had halal certification for herbal medicine products	Conducting sales online because so far we have been selling in shops or stalls	
The shipping process is not mixed with non-halal products	Employees who do not yet know how to process production according to halal standards		

The following are the results of the IFAS and EFAS matrix analysis obtained from the results of interviews with respondents.

Table 5. IFAS Strength Matrix Analysis

<i>Strength (Kekuatan)</i>	Responden			Total	weight	Rating	Skor
	1	2	3				
Using raw materials of sugar and rice that have been certified halal	5	4	5	14	0,24	5	1,21
The raw material of rice has been guaranteed halal	5	5	5	15	0,26	5	1,29
The finished product is stored in a storage warehouse that is not mixed with non-halal products	5	4	5	14	0,24	5	1,21
The shipping process is not mixed with non-halal products	5	5	5	15	0,26	5	1,29
Total				58	1	20	5

Tabel 6. Analisis Matriks IFAS Weakness

<i>Weakness (Kelemahan)</i>	Responden			Total	weight	Rating	Skor
	1	2	3				
Raw materials for galangal that do not yet know the food safety status	3	4	4	11	0,27	4	1,07
Bottle packaging that does not meet food grade requirements	4	3	4	11	0,27	4	1,07
Has not yet had halal certification for herbal medicine products	3	3	4	10	0,24	3	0,73

Employees who do not yet know how to process production according to halal standards	3	3	3	9	0,22	3	0,66
Total				41	1	14	3,54

Berdasarkan tabel 5 dan 6 di atas didapatkan matriks *Internal Factors Analysis Strategic* (IFAS) faktor kekuatan sebesar 4,84 dan faktor kelemahan sebesar 3,44.

Table 7. EFAS Opportunity Matrix Analysis

<i>Opportunity (Peluang)</i>	Responden			Total	weight	Rating	Skor
	1	2	3				
Taking care of halal certification	5	5	5	15	0,35	5	1,74
Providing a halal logo on product packaging	5	5	5	15	0,35	5	1,74
Conducting sales online because so far we have been selling in shops or stalls	5	4	4	13	0,30	4	1,21
Total				43	1	14	4,70

Table 8. EFAS Threats Matrix Analysis

<i>Threats (Ancaman)</i>	Responden			Total	weight	Rating	Skor
	1	2	3				
Consumer confidence decreases if there is no halal logo on the product packaging	4	4	5	13	0,46	4	1,86
Many business competitors make sales online	5	5	5	15	0,54	5	2,68
Total				28	1	9	4,54

Based on tables 7 and 8 above, the External Factors Analysis Strategic (EFAS) matrix shows that the opportunity factor is 5 and the threat factor is 4.69.

Table 9. SWOT Matrix Analysis

Internal	Strength (Kekuatan)		Weakness (Kelemahan)	
	Using raw materials of sugar and rice that have been certified halal		Raw materials for galangal that do not yet know the food safety status	
	The raw material of rice has been guaranteed halal		Bottle packaging that does not meet food grade requirements	
	The finished product is stored in a storage warehouse that is not mixed with non-halal products		Has not yet had halal certification for herbal medicine products	
	The shipping process is not mixed with non-halal products		Employees who do not yet know how to process production according to halal standards	
Eksternal	S-O Strategy		W-O Strategy	
Opportunity (Peluang)				
Taking care of halal certification	1	Business development by taking care of halal certificates	1	Buying raw materials for kencur directly from farmers
Providing a halal logo on product packaging	2	Business development by opening online sales	2	Buying bottled packaging directly from the producing company so that its safety is guaranteed
Conducting sales online because so far we have been selling in shops or stalls				

				3	Halal certification management to increase consumer confidence
				4	Human resource development
<i>Threats (Ancaman)</i>		<i>S-T Strategy</i>		<i>W-T Strategy</i>	
Consumer confidence decreases if there is no halal logo on the product packaging Many business competitors make sales online	1	Herbal medicine product innovation such as powder models		1	Adding suppliers of raw materials for kencur whose food safety is guaranteed
				2	And adding suppliers of bottled packaging so that the safety of the product is guaranteed

1. S-O Strategy (Strength Opportunity)

S-O strategy is a strategy that uses the internal strengths of the business to seize opportunities outside the business. The right strategy for this business is to develop the business such as taking care of halal certification and making online sales.

2. W-O Strategy (Weakness Opportunity)

W-O strategy is a strategy to minimize the internal weaknesses of the business by utilizing the opportunities that the business already has.

3. S-T Strategy (Strength Threat)

S-T strategy is a strategy that uses strengths to avoid the impact of external threats by innovating products.

4. W-T Strategy (Weakness Threat)

W-T strategy is a strategy to survive by reducing the internal weaknesses of the business and avoiding external threats to the business.

After obtaining the results of the IFAS and EFAS matrix analysis and the results of the SWOT analysis, the next stage is the decision-making stage by using a Cartesian diagram or a SWOT analysis quadrant diagram. The analysis was obtained from the results of the IFAS and EFAS strength, weakness, opportunities, and threat analysis which is an analysis of internal and external factors in the MSME.

To be able to find out the location of the quadrant, the strategy in the SWOT analysis quadrant diagram is divided into two formulas, the X and Y axes. On the X axis, namely IFAS which consists of strength and weakness and the Y axis, namely EFAS which consists of occurrence and threat.

Based on the results of data processing on internal and external factors, the internal strength factor matrix value is 4.84 and weakness is 3.44. On the external factor, opportunity is 5 and threats are 4.69. The following is the determination of the values on the X and Y axes.

Internal factor coordinates = (total strength score - total weakness score): 2

= (5 - 3.54): 2

= 0.73

External factor coordinates = (total opportunity score - total threat score): 2

= (4.70 - 4.54): 2

= 0.08

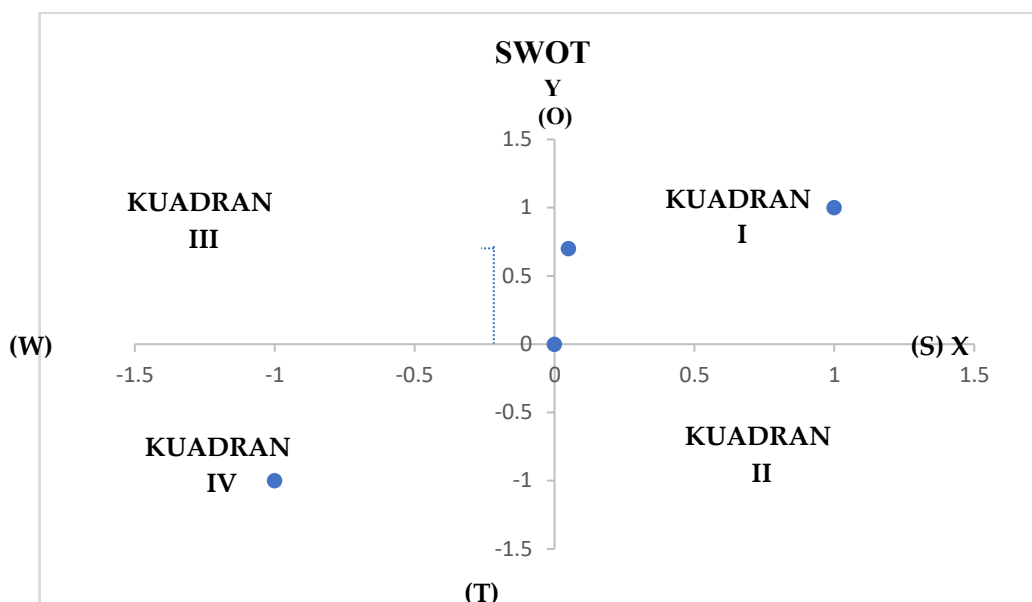


Figure 2. SWOT Diagram

From the graph above, it can be seen that the business is in quadrant I, which shows that the business has many strengths and opportunities. The business is recommended to implement a growth strategy, which means it is in good condition, so that it is possible for the business to develop and achieve maximum progress. The strategy of picking up the ball is obtained from utilizing strengths to get opportunities.

4. Discussion

The development strategy that can be carried out by UD Berkah Utama to grow its business includes obtaining halal certification from MUI. Currently, the halal industry is gaining significant attention, especially considering the large number of Muslims in Indonesia. In particular, the halal supply chain must be managed to ensure that everything from raw materials to end consumers complies with Islamic principles. Another business development effort is to open online sales channels by creating e-commerce accounts and conducting online promotions. As technology advances and the digital era continues to grow, online sales can be a great opportunity to boost sales and reach a wider market.

5. Conclusion

Measurement using the FMEA method on the MSME UD Berkah Utama obtained the highest ranking in the selection of raw materials for kencur with an RPN value of 261. This is because the business purchases its galangal raw materials from collectors in the traditional market. So, they do not know whether the ingredient is safe to consume or not. Meanwhile, the strategy that can be derived from the SWOT analysis is the S-O analysis. Because the results of this research are in Quadrant I, which means that the business has many strengths and opportunities, and it is very likely for the business to grow and achieve maximum progress.

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