

## DOMESTIC COMPONENT LEVEL ASSESSMENT FOR A SALT FACTORY AND A SALT PRODUCTION

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### ABSTRACT

The TKDN (Domestic Component Level) assessment of goods and services is a method to determine local manufacturers/industries' capability to create quality products internationally standardized. This study assessed the salt factory's TKDN to increase the NaCl content, based on cost-based analysis stipulated at the Minister Industry Regulation No.16/M-IND/PER/2/2011. Meanwhile, the TKDN of salt production was assessed based on process-based analysis stipulated in Minister Industry Regulation No.16/2020. According to the cost-based analysis results, the goods and services at the pilot project stage had the TKDN value of 27.4%. However, due to an increase in the number of main domestic components at the commercial stage, this value increased to 70.9%. Meanwhile, according to the processed-based analysis results, the salt production had the same processes at the pilot project stage and commercial stages. The TKDN value of 85.5% was obtained for the two stages. The value is relatively high because the raw material is produced locally with the local labor and used work tools owned by the local industry. The cost-based analysis was found to be highly dependent on the equipment component's origin, while the process-based analysis depends on the origin of labor, works tool, and material owner.

**Keywords:** domestic component level; process-based analysis; cost-based analysis; salt factory; salt product.

### INTRODUCTION

Salt is one of the most important necessities in everyday life. In Indonesia, salt is mostly produced traditionally by smallholder farmers, as well as by industrial salt companies. However, in terms of quality, traditional salt production has not met health requirements, and the products have remained below quality, according to the Indonesian National Standard (Standard Nasional Indonesia/SNI) specifications No.140-76 [1].

The types and uses of salt are outlined below,

1. Consumption salt is composed of 94.7% NaCl content (dry weight), with 2% Sulfate, Magnesium, and Calcium impurities, as well as other impurities (mud and sand), as well as water content below 7%, and is divided into three types, as outlined below.

- (a) High grade or high-quality consumption salt has 97% NaCl content, water content below 0.05%, pure white color, as well as fine crystal grains, and is usually used for table salt, and in food seasoning, high-quality food (including snack food, and instant noodles), sausage and cheese, as well as cooking oil industries.
- (b) Medium grade or medium quality consumption salt comprises 94.7-97% NaCl as well as 3-7% moisture and is usually used for table salt and industries with tolerance for medium grade salt, for instance, soy sauce, tofu, animal feed.
- (c) Low grade or low-quality consumption salt has 90-94.7% NaCl content, 5-10% moisture content, dull-white color, and is used for salting fish as well as in agriculture.

2. Industrial salt has comprised 97% NaCl [2], Sulfate, and Calcium impurities below 0.5% and 0.2%, respectively, as well as other impurities below 0.3% and 3-5% moisture content.

The previous study related to salt purification [3] using the deposition method has been conducted. In this study, a precipitating agent was added to the salt solution to precipitate impurities prior to the recrystallization process. However, the research results show that the evaporation and recrystallization processes currently face several challenges and have therefore been unable to meet the industrial salt standard. Meanwhile, several other studies [4],[5] have succeeded in producing industrial salt according to SNI 06-0303-1989, using traditionally produced local salt.

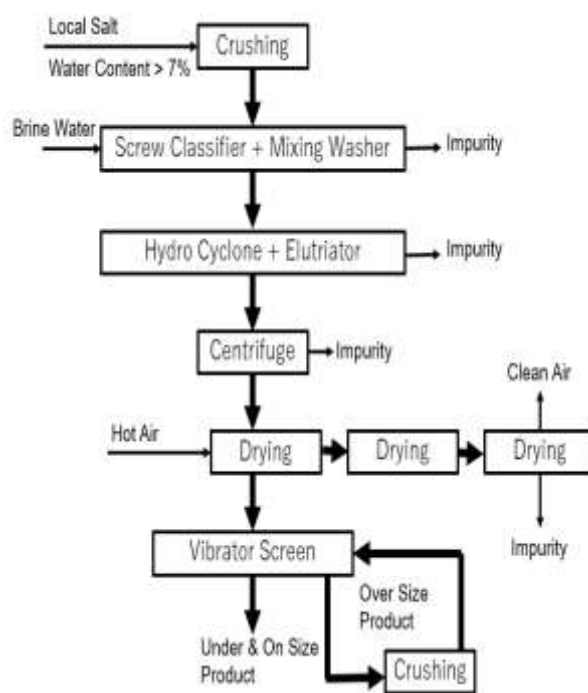
Indonesia has a long coastline; however, the need for industrial salt consumption has not been fulfilled by local salt production. In terms of quality, the local salt production is highly dependent on the solar evaporation process and has been unable to meet industrial salt standards, as the weather factor has a significant influence. To overcome this national salt problem, a pilot project was conducted to produce industrial salt using raw materials from local salt. The salt factory's pilot project was built with a capacity of 40,000 tons/year. Subsequently, the factory was planned to be constructed for commercial purposes in salt centers to produce industrial salt with the technology previously tested in the pilot project.

### Salt Factory

The processing of traditionally produced local salt into industrial salt comprises four stages.

- 1) Preparation of new materials for industrial salt.
- 2) Salt washing
- 3) Drying
- 4) Product packaging.

Figure 1 shows the factory's process sequences during the pilot project stage and commercial stages.



**Figure 1.** The Factory's Block Diagram Processes.

In the pilot project stage, the technology developed increases the local salt NaCl content from 88% to 98% and is to be implemented during the commercial stage.

Subsequently, the cost-based and process-based analyses were conducted to determine the salt factory and production's TKDN, respectively.

The cost-based analysis analyzes and calculates the TKDN of materials and salt factory services, performed on the 27 object's main components, civil buildings, human resources (HR), and land.

Meanwhile, the process-based counterpart is used for TKDN analysis and calculation for salt products. This paper is the first to discuss the process-based analysis, as this method was released in 2020.

### Domestic Component Level (TKDN)

The TKDN definition for goods and services are outlined below.

1. The amount of domestic components in goods, services, and a combination of goods and services.
2. Domestic production refers to goods/services, including design and engineering, produced/carried out by companies investing and producing in Indonesia, using a production/processing technique where the use of imported raw materials/components is possible.

To assess a product's TKDN, three aspects, material, labor, and overhead, are usually evaluated. Material is assessed based on the country of origin or production location, employed labor is assessed based on nationality, while overhead refers to work tools/machines and other costs related to producing these goods/services.

The TKDN value of goods and services from salt factories and products is bound to be a parameter for the factories' independence, both in component manufacturing, operation, and salt production. A rise in this value will therefore have the following impacts.

- 1) Increased use of domestically produced components related to the quality of domestic products or components created during the production process.
- 2) Increase/absorption of manpower/HR. In cases where a product or component's quality is successfully improved, an increase in the product's use is bound to occur. This impacts a rise in production and consequently influences labor/human resources absorption.
- 3) Foreign exchange savings from reduced purchases of imported products or components.

According to the previous study result, the TKDN calculations on the planning and development of Geothermal Power Plants/PLTP [6], Biogas Power Plants/PLTBg [7] as well as other power and industrial sectors, show a correlation between the TKDN value and reduced overhead, investment, as well as operating costs. A study by Hidayat *et al*, [8] showed an increase in the TKDN value in the national shipbuilding industry will increase competitiveness against ship production from other countries.

Thus, knowledge of salt factories' TKDN shows the domestic industry's capacity to support production, as well as the dependence on imported components. This dependence has an impact on national resilience and the national industry's progress. Therefore, conducting TKDN analysis and calculation for an industry/product are the steps to identify dependency on imported parts/components and ascertain the domestic manufacturer's ability to support the industry. Efforts to increase this value also help impact local industries' activation and foster new businesses with the ability to reduce component and overhead costs.

This paper, therefore, analyzes the TKDN of salt factories and products, using cost-based and process-based analyses under two stages, the pilot project and implementation, in Indonesia's salt centers. The salt factory being developed at the pilot project stage in Gresik, East Java, has a 40,000 ton/year capacity.

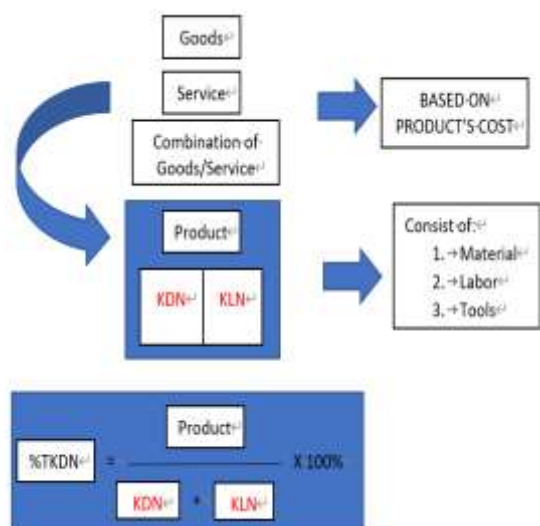
## METHODS

For cost-based analysis, price data was obtained from a salt factory's feasibility study report to increase NaCl levels up to 98%. Meanwhile, additional data and information to support calculations in the cost-based and process-based analysis were obtained from data search on the website and discussing results with the salt factory developer team. However, the main components, R&D, human resources, civil buildings, and land prices, are not included in this paper to protect the salt factory development's confidentiality.

Subsequently, the TKDN analysis was performed using two methods based on the following regulations.

- a) The Indonesian Minister of Industry Regulation Number: 16/M-IND/PER/2/2011, regarding Provisions and Procedures for Cost-based Calculation of Domestic Component Levels [9].
- b) The Indonesian Minister of Industry Regulation Number: Number 16 of 2020, regarding Processed-based Calculation of Domestic Component Level Value for Pharmaceutical Products [10].

Method a) analyzes the TKDN of the salt factory's main components at the pilot project as well as commercial stages and is also known as the cost-based analysis. This analysis also includes research and development costs in cases where a patent certificate or evidence of expenditure costs already exists. These costs are then calculated for the next five years because a patent certificate was issued. Figure 2 shows the TKDN cost-based analysis concept, where the prices of goods and services are separated. The domestic (KDN) and foreign components (KLN) were analyzed to two layers backwards from these goods and services components. Subsequently, each KDN and KLN component was sorted based on material, labor, and work tools.



**Figure 2.** The TKDN Cost-Based Analysis Concept.

The TKDN of goods and services is the ratio between the goods and services from domestic components to the total counterpart from both domestic and abroad. In this study, the TKDN of domestic goods and services was calculated based on reducing the cost price of goods minus the foreign component of goods. Also, the price of goods already contains the goods and service's values.

The cost price refers to the cost incurred in producing goods and includes the following.

- a. costs for direct material.
- b. direct labor costs
- c. factory indirect costs (factory overhead),

excluding profits, company indirect costs (company overhead), and output taxes.

Meanwhile, the domestic components of goods were determined based on the criteria below.

- a. for direct materials, based on the country of origin.
- b. for work tools/facilities, based on ownership and country of origin, and
- c. for labor, based on nationality.

Subsequently, the direct material and labor costs, as well as the indirect factory costs, were calculated up to the working location (factory/workshop) for the product concerned.

The cost-based analysis is carried out at the pilot project and commercial stages to assess the salt factory's TKDN.

After the pilot project was completed and the technology developed at this stage was confirmed to be able to increase NaCl content to 98%, the technology is then implemented

within factories in salt centers across Indonesia. An investigation regarding local manufacturer's ability to produce 27 main components of the salt factory was also conducted to implement this purpose.

To calculate material up to 2 layers backward of the main component, SUS316L's price was calculated using the equation below.

$$HM = \sum_{i=1}^{26} Vol \times BJ \times Price \quad (1)$$

Where,

HM : Material Prices for 26 main components contained in SUS316L.

Vol : The total volume for the 26 main components (m<sup>3</sup>)

i : The main component to i

BJ : 7,930 (kg/m<sup>3</sup>)

Price : 51,765 (Rp/kg)

The TKDN value of goods and services from the main components was then calculated from the main component's price minus the prices of SUS316L material content and imported spare parts, divided by the main component's price, as shown in equation (2).

$$TKDN = \sum_{i=1}^{26} \frac{HEKU - HSKI - HM}{HEKU} \quad (2)$$

Where,

HEKU : Main Component Estimation Price (Rp)

i : The main component to i

HSKI : Spare Part Import Price (Rp)

Meanwhile, Method b) is used for pharmaceutical products, for instance, salt, in this case [11].

The TKDN process-based analysis is applied to the pharmaceutical industry in a bid to the lengthy and costly research and development process. This method's calculation is carried out based on four factors with respective numerical weights (BA), as shown below.

**Table 1.** Table Process-Based Analysis Factors.

No	Factor	Weight (BA)
1	Raw Material	50%
2	Research & Development (R&D)	30%
3	Production Process	15%
4	Packaging Process	5%

Each factor was classified by several criteria with respective numerical weight (AP).

The numerical weight of raw material is determined based on the following criteria.

**Table 2.** Material Classification.

Item	AP
Active Raw Material	65%
Additional Raw Material	35%

The classification above ought to fulfill the production criteria comprising the following.

- 1) Labor from an Indonesian citizen.
- 2) Works tolls owned by a domestic company.
- 3) The material is locally sourced.

In addition, the production criteria were assessed based on the production origin and criteria. **Tables 3 and 4** show the items and respective numerical weight (alo and kat).

**Table 3.** Production Origin.

Item	alo
All from domestic	100%
One part from domestic	65%
All from abroad	0%

**Table 4:** Production Criteria.

Item	kat
Only one factor is fulfilled	i=60%
Two factors factor are fulfilled	ii=80%
All factors are fulfilled	iii=100%
Non-category	iv=40%

**Table 5** shows the numerical weight and the research and development (R & R&D) processes.

**Table 5:** R&D classification.

Item	AP
New drug development	25%
Clinical test	30%
Formulation	35%

**Tables 6 and 7** show the product origin and production criteria's items as well as numerical number weights for the research and development process, respectively.

**Table 6:** Production Origin.

Item	alo
All from domestic	100%
One part from domestic	65%
All from abroad	0%

**Table 7:** Production Criteria.

Production criteria	kat
only one factor is fulfilled	i=80%
Two factors factor are fulfilled	ii=100%
Non-category	iv=40%

Meanwhile, **Table 8** shows the production process' item and numerical weight.

**Table 8:** Production Process Classification.

Item	AP
Mixing Processes	60%
Dosage Forming	40%

**Tables 9 and 10** show the product origin and production criteria's items and numerical weights, respectively.

**Table 9:** Production Origin.

Item	alo
All from domestic	100%
One part from domestic	65%
All from abroad	0%

**Table 10:** Production Criteria.

Item	kat
only one factor is fulfilled	i=80%
Two factors factor are fulfilled	ii=100%
Non-category	iv=40%

In addition, **Table 11** shows the packaging process's items and numerical weight.

**Table 11:** Packaging Process Classification.

Item	AP
Batch release	50%
Primary packaging	40%
Secondary packaging	10%

**Tables 12 and 13** show the item and numerical number weight for the product origin and packaging process's production criteria, respectively.

**Table 12:** Production Origin

Item	alo
All from domestic	100%
One part from domestic	65%
All from abroad	0%

**Table 13:** Production Criteria

Item	kat
only one factor is fulfilled	i=80%
Two factors factor are fulfilled	ii=100%
Non-category	iv=40%

The four factors at the pilot project and commercial stages ought to be assessed and classified based on the determination above while assessing the process-based analysis. Each classification also ought to be evaluated based on the product origin and the production criteria considerations. Thus, the process-

based analysis TKDN calculation is the product of the multiplication between the respective numerical weight of factor (BA), classification (AP), production origin (alo), and production criteria (kat).

**RESULTS AND DISCUSSION**

The price of goods comprises the value of goods and services, including material, labor, and indirect costs (factory overhead). In this study, profits, company overhead, and output taxes were included in the calculation, assuming the ratio is infinitesimal compared to the finished good's price.

**Salt Factory at the Pilot Project Stage**

**Table 14** shows each component's TKDN and TKLN ratio of each component, where 100% of the TKLN is known to be contained by the salt factory's 27 main components alone.

**Table 14: TKDN & TKLN Ratio.**

Item	TKDN	TKLN
R&D	100%	0%
Main component	0%	100%
Human Resources	100%	0%
Civil Buildings	100%	0%
Land	100%	0%

Meanwhile, **Table 15** shows the TKDN and TKLN, calculated based on each component's price, compared to the pilot project's total investment, indicating the factory has a TKDN of 27.4%. This value was low due to the TKLN value of about 75%, as the main component being imported from China. Thus, the salt factory's main components at the pilot project stage were all imported, and the TKDN was 27.4%.

**Table 15: TKDN and TKLN Value.**

Item	TKDN	TKLN
R&D	3.2%	0%
Main component	0%	72.6%
Human Resources	3.3%	0%
Civil Buildings	13.8%	0%
Land	7.9%	0%
Total	27.4%	72.6%

**Salt Factory at the Commercial Stage**

**Table 16** shows the TKDN and TKLN ratio components, where the R&D, human resources, civil building, and land price

components have the same ratio of 100%. Thus, the 27 main components comprise 75.9% TKDN and 24.1% TKLN. The TKLN indicates the ratio of the main components domestic manufacturers are unable to produce. However, the main component's transportation costs in the TKLN were neglected because the ratio was minute, compared to the price.

**Table 16: TKDN and TKLN Ratio.**

Item	TKDN	TKLN
R & D cost	100%	0%
Main component	75.9%	24.1%
Human Resources	100%	0%
Civil Building	100%	0%
Land Price	100%	0%

Furthermore, **Table 17** shows the salt factory's TKDN increased to 70.9% at the commercial stage. This was because 26 of the factory's main components are manufactured domestically. However, the R & D components, human resources, civil buildings, and land had the TKLN value as the pilot project stage.

**Table 17: TKDN and TKLN, at the Commercial Stage.**

Item	TKDN	TKLN
R & D cost	3.2%	0%
Main component	42.7%	18.1%
Human Resources	3.3%	0%
Civil Building	13.8%	0%
Land Price	7.9%	0%
Total	70.9%	18.1%

**Salt Production at the Pilot Project and Commercial Stages.**

**Table 18** shows the raw material factor's calculation result to be 50%.

**Table 18: Raw Material Factor Value.**

Item	AP	Alo	Kat	BA	Value
Active	65%	100	100	50%	32.5%
Additional	35%	100	100	50%	17.5%
Total					50.0%

Meanwhile, **Table 19** shows the research and development (R&D) factor to be 18.0%.

**Table 19: R&D Factor.**

Item	AP	Alo	Kat	BA	Value
New Drug	25	100	100	30%	7.5%
Formulation	35	100	100	30%	10.5%
Total					18.0%

**Table 20** shows the production process factor calculation result to be 15.0%.

**Table 20:** Production Process Factor.

Item	AP	Alo	Kat	BA	Value
Mixing	60%	100%	100%	15%	9.0%
Dosage forming	40%	100%	100%	15%	6.0%
Total					15.0%

Meanwhile, **Table 21** shows the packaging process calculation results to be 2.5%.

**Table 21:** Packaging Process Factor.

Item	AP	Alo	Kat	BA	Value
Primary	40%	100%	100%	5%	2.0%
Secondary	10%	100%	80%	5%	0.5%
Total					2.5%

**Table 22** shows the salt production's TKDN value at the pilot project and commercial stages to be 85.5%.

**Table 22:** TKDN of Salt Production at the Pilot Project

Item	Total Value
Raw Material Content	50%
Research & Development	18%
Process Production	15%
Packaging Process	2.5%
TKDN value	85.5%

## Discussion

In the pilot project stage, no domestic manufacturer was able to manufacture the main components for a limited time at the pilot project stage, therefore, the procurement of all main components comprising the 27 main components imported from Chinese manufacturers. Meanwhile, Table 1 indicates the human resources, building and civil facilities' constructions, as well as land, were domestic. Therefore, the 27 main component's TKDN is 0%, while the R&D, human resources, building, and civil facilities' construction counterpart is 100%. Table 2 shows the TKDN and TKLN to be 27.4% and 72.6%, respectively, using a comparison of each component's price with the total investment.

Subsequently, an investigation was conducted regarding the main component domestic supplier's ability to build the salt

factory in salt production centers, and the following conclusions were attained.

- a) Domestic manufacturers are unable to produce only one main equipment component.
- b) SUS316L material, as a corrosive-resistant material and the main component material, remains imported goods and is not produced by domestic manufacturers.
- c) Several electronic components/sensors, electric motors, and some control devices are currently not produced by domestic manufacturers and are therefore imported.

The first conclusion shows only one main component has a 0% TKDN ratio because the component is imported and not manufactured by any domestic supplier. Based on the developer team's interview, this main component is a critical component used in the salt factory's technology to increase NaCl content.

Meanwhile, the second conclusion shows domestic manufacturer's main components (26 components) ought to be separated backwards, up to the second layer. The 26 main components of imported material are known to be SUS316L material; thus, there is a need to know the SUS316L material content's price. To determine this price, each main component's SUS316L volume content was calculated by multiplying with the SUS316L density (BJ) and market price, as shown in equation (1). This material price comprises a material, labor, and indirect costs (factory overhead).

For the third conclusion, in addition to the SUS316L's material content, the price of imported spare parts such as sensor components, electric pumps, controls are also analyzed and estimated.

Based on Table 17, the salt factory's TKDN increased to 70.9% at the commercial stage due to one main component, and all SUS316L material is imported. Meanwhile, Tables 16 and 17 show the TKLN ratio and values are 24.1% and 18.1%, respectively.

## Salt Production at the Pilot Project and Commercial Stages.

The salt raw material used at the pilot project and commercial stages is local salt.

In the raw material assessment, BA=50%, the calculation result value of a raw material factor is 50%, calculated from the sum of active raw material, AP=65%, and additional raw material, AP=35%. In addition, a local salt factory produces both the active and additional raw material, alo=100%; thus all production

criteria are fulfilled, and  $kat=100\%$ . Salt possesses pharmacological properties and is therefore regarded as an active material. A study by Nuryati [12] also shows salt impacts the human body upon entering the bloodstream. Meanwhile, water has no pharmacological effect and is therefore regarded as a raw material. Therefore, improving salt quality through the refining process is considered as new drug development,  $AP=25\%$  and the new formulation development,  $AP=35\%$  to increase NaCl content to 98%.

Based on these considerations, the R&D process factors,  $BA=30\%$ , comprises the new drug development and formulation processes. Each process factor's numerical weight is multiplied by the domestic production's numerical weight,  $alo=100\%$ , and the production criteria are fulfilled,  $kat=100\%$ . Table 6 shows both calculations produced a total of 18%.

In the production process,  $BA=15\%$ , two processes are determined based on the following considerations. Active (salt) and additional (water) raw materials are mixed, then evaporated to obtain salt crystals. This is considered as the mixing process,  $AP = 60\%$ . Meanwhile, the dosage forming process,  $AP=40\%$ , is the process of forming drugs, and in this case, the salt is ready to be marketed. Therefore, each production factor's numerical weight is multiplied by the domestic production's numerical weight,  $alo=100\%$ , and the production criteria are fulfilled,  $kat=100\%$ . Table 7 shows both calculations gave a total of 15%.

In the packaging process,  $BA=5\%$ , two processes are determined based on the following considerations. The primary packaging process refers to packaging in contact with pharmaceutical ingredients/salt, while the secondary counterpart,  $AP = 40\%$ , refers to complementary packaging from the primary process. Each packaging process is conducted in domestic development ( $alo = 100\%$ ), and the production criteria are fulfilled,  $kat=100\%$ . Table 8 shows each numerical weight's multiplied result is 2.5%.

Meanwhile, **Table 9** shows the TKDN is the sum of multiplied results from each factor, with a value of 85.5%. This result is relatively high, indicating domestic manufacturers have a significantly high ability for salt production.

According to the description above, the conditions for making industrial salt, from the process-based analysis at the pilot project and the commercial stages, were in the same condition. The total TKDN indicates the same value of 85.5%. The salt factory's main components at the pilot project stage were the import components, and a domestic company owned the imported component's owner. Thus, both conditions did not reduce the assessment value's allocation of 100%.

## CONCLUSION

The salt factory's good and service's TKDN value from the cost- and process-based analyses indicates the factory's use of technology to increase NaCl content to 98% currently depends on the imported main component. In addition, the salt factory development at the commercial stage is estimated to increase the TKDN value to 70.9%. However, a further increment is not possible because one main component and the main SUS316L component's material are not produced by domestic manufacturers due to inadequate technical capability for fabrication. Thus, the cost-based analysis TKDN is strongly influenced by the salt factory equipment/component's origin. It was revealed by the TKDN assessment of the salt factory at the pilot project stage and at the commercial stage, which increased the local content of the main components from 27.4% to 70.9%.

However, the salt production assessed by the process-based analysis obtained a high value of 85% and based on this result, salt production was concluded to be completely carried out domestically. The assessment indicates raw materials, research, and development, production, as well as packaging processes are significantly influenced by Indonesian workers, work tools owned by domestic companies, and local materials.

This study, therefore, showed a rise in domestic component content increases the domestic manufacturers/industrie's capacity to support spare parts and maintenance procurement.

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### Author Contribution

The first author calculated and analyzed the TKDN for salt and salt production, while the other author contributed to data collection, information, and component price analysis.

### ACKNOWLEDGMENT

The authors are grateful to the development team from the Center for Technology for the Development of Energy Resources and the Chemical Industry (PTSEIK)'s Integrated Salt Factory for providing support information and discussion, regarding the salt factory and salt production, during the TKDN assessment.

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