

Perencanaan Peningkatan TKDN Menggunakan Metode FTA, QFD Dan KPI Pada Material Wellhead & Christmas Tree pada PT Pertamina EP

Planning For Increasing The Value Of TKDN Using FTA, QFD, And KPI Methods On Material Wellhead & Christmas Tree at PT Pertamina EP

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Abstrak. Perusahaan minyak di Indonesia didorong untuk meningkatkan penggunaan kandungan lokal sesuai roadmap. Perusahaan minyak dan gas dalam negeri (PT. Pertamina EP) dituntut untuk menjadi contoh dalam mematuhi dan mewujudkan aturan tersebut. Aturan ini berlaku bagi pemasok jika mereka ingin berpartisipasi dalam tender barang dan jasa. Dari metode QFD prioritas utama yang harus ditingkatkan nilai kandungan lokal pada material Wellhead & Christmas tree adalah komponen material dalam negeri dengan bobot 110. Hasil identifikasi dengan metode FTA didapatkan 22 kejadian penting yang menyebabkan kandungan lokal material wellhead & christmas tree tidak terpenuhi. Hasil pengukuran dari key performance indicator pada perusahaan minyak dan gas dalam negeri yaitu PT. Pertamina EP tahun 2024-2025 dapat memenuhi target Kementerian ESDM sebesar 73,15% dan 76,3% pada material wellhead & christmas tree.

Kata kunci: Konten Lokal, Strategi konten lokal, Fault Tree Analysis, Quality Function Deployment, KPI.

Abstract. Oil companies in Indonesia are encouraged to increase the use of local content according to the roadmap. The Oil and Gas Company (PT. Pertamina EP) must be an example to comply with and realize these rules. These rules apply to suppliers if they wish to participate in tenders for goods and services. From the QFD method, the main priority that must be increased is the material component wellhead & Christmas tree with a weight of 110. The identification results with the FTA method obtained 22 important events that caused the local content wellhead & Christmas tree not to be fulfilled. The measurement results from key performance indicators in 2024-2025 PT Pertamina EP can meet the Ministry of Energy and Mineral Resources targets of 73.15% and 76.3% in wellhead & Christmas tree material.

Keywords: Local Contents, Strategy Local Contents, Fault Tree Analysis, Quality Function Deployment, KPI

INTRODUCTION

Government efforts to increase and fulfill local product components by making policies include legal protection, renegotiation, and incentives to local suppliers to achieve goods in the oil and gas industry [1]. The 2001 oil and gas law stipulates using local products or domestic components to procure goods or services [2]. Every oil and gas company in Indonesia in its activities is required to use, maximize, and manipulate goods or services [3]. Increasing the use of domestic products allows local companies to grow and develop properly. Implementing the Policy for the benefit of domestic products has a positive influence and directly impacts economic development in Nigeria through serious supervision [4]. In several procurements that have been carried out, local content components are below a predetermined percentage. Another problem is that the discrepancy in performance occurs because there are no substitutes for these goods, and their use is needed. One example of the results of local components of the NYM cable type is the local content value is 43%, with a domestic value ratio of 25% to the production of 75% foreign goods in sheathing [5].

Policies are needed from the relevant ministries through oil and gas contractors to increase the value of local content. Procurement of goods to suppliers or producers requires binding regulations to meet the achievement of the target percentage set by the Ministry of Energy and Mineral Resources [3]. The percentage calculation of local content components includes human resources, work tools, materials, and general services. Due to the small percentage of the local component's value, stakeholders' stimulation is needed to support the use of goods and services in the country. Long-term contract policies must be implemented to fulfill local components in the oil and gas and mining industries, especially in low-income countries but rich in natural resources [6]. The restrictions on foreign products impacted the increasing demand for local components in procuring goods and services [7]. Producers must prioritize partners continuously committed to using local ingredients such as materials, manufacturing, processes, services, and assembly services for delivery.

Decision-making in combining design products and processes to increase the strength of business-oriented wood products with a multi-step Quality Function Deployment (QFD) method approach [8]. QFD is applied to measure social-environmental influences on food product development and can improve sustainable organic food quality planning [9]. QFD modeling is used to measure satisfaction with industrialized building systems; the development of design management automatically impacts overcoming economic recession and can expand the reach of construction globally [10]. The framework for the success and maintenance of infrastructure quality involves local communities for decision-making using the QFD method [11]. The QFD method in the manufacture of new techniques of suntar embroidery without losing the original design of the traditional Dayak tribal clothing in East Kalimantan province [12]. Integrating the QFD method in engineering techniques involves accurate cost conditions for improving new products for the Hilla textile factory [13]. Quality Function Deployment is a method to translate consumer desires or needs into the company's technical requirements for product development.

Fault Tree Analysis (FTA) is a tool for graphically translating combinations of errors that cause failure in a system. The FTA method is a reliable analysis for preventing and analyzing errors in programming processes and computer simulations [14]. The basic model of FTA can support the mitigation process and verify the gateway system of safety and security in aviation software reliably [15]. FTA can also be used in risk-based location determination in disaster management [16]. Evaluation and management of potential risks

using the FTA method in oil and gas pipelines onshore or offshore fields can help safety professionals. A key performance Indicator (KPI) is one of the performance measurement tools in a company in determining the policies to be carried out. Evaluation of management performance measurements using KPIs in the manufacturing sector is reviewed from the level of customer satisfaction and delivery reliability to compete at the world level [17]. This study examines increasing the local value of content with the FTA, QFD & KPI methods.

Table.1 advantages and disadvantages of applying KPI, QFD and KPI

Method	Advantage	Disadvantage
Fault Tree Analysis	<ol style="list-style-type: none"> 1. Prepared in the early stages of design and details developed further simultaneously with design development. 2. Systematically identify and record logical error paths from specific effects to root causes. 3. Easily converted to probability measurements 	<ol style="list-style-type: none"> 1. Can cause the fault tree to become very large if the analysis is deepened. 2. Depends on analyzing ability 3. Difficult to implement on systems with partial success. 4. The costs required for implementation can be expensive. When compared with similar analysis methods, FTA has advantages
Quality Function Deployment	<ol style="list-style-type: none"> 1. Increase consumer satisfaction. 2. Improving the quality of a product. 3. Increase productivity. 4. Increase company profits. 5. Reduce design costs. 6. Facilitate communication regarding product development 	<ol style="list-style-type: none"> 1. The work takes a long time. 2. Differences in concepts between consumers and companies. 3. It is difficult to differentiate between conflicting consumer needs. 4. It is difficult to meet the needs of different consumer groups. 5. It is difficult to reach agreement on conflicting technical requirements
Key Performance Indicator	<ol style="list-style-type: none"> 1. KPI help inform management about specific issues 2. KPIs help hold employees accountable 3. KPI is also the bridge that connects operations and actual business goals 	<ol style="list-style-type: none"> 1. it takes a long time frame for KPIs to provide meaningful data 2. KPI requires constant monitoring and follow-up to be useful 3. KPI opens the possibility for managers to "game" KPI

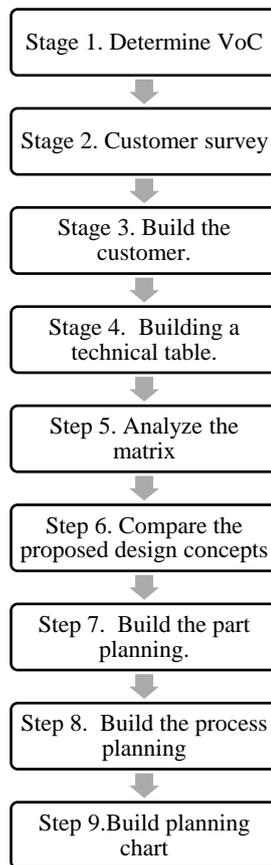
The QFD method increases the local value of content on the wellhead & Christmas tree in the local material capacity building section gets a weight of 110. Utilizing domestic manufacturing gets a weight of 48. Requiring to use service/maintenance receives a weight of 35.1, and optimizing domestic work tools gets a weight of 28.4. Increasing the capacity of developing domestic human resources receives a weight of 9. The Fault Tree Analysis identifies 22 causes of non-fulfillment of the increase in the value of local content.

Using the key performance indicator, fulfillment of material components can exceed the achievements of the Ministry of Energy and Mineral Resources in 2024-2025.

RESEARCH METHODS

The *Quality Function Deployment* (QFD) method aims to develop products that satisfy consumers. Consumer satisfaction is obtained by translating consumer desires into technical characteristics. Design and quality control elements can be used in the production process. The ability to produce products according to the needs and desires of consumers is an essential factor that must be owned if the resulting product is highly competitive. The goal of the QFD principle is to ensure that the needs and wants of customers can be fulfilled in the process of product improvement. It can be said that QFD starts from the voice of the customer (VOC = voice of customer) or customer-driven product development.

Steps to Use QFD :



Of the nine QFD implementations above, they can be categorized into 4 (four) stages, such as:

Stage 1 (HoQ) Product planning consists of the customer and technical responses/requirements.

Stage 2 Design planning (Proces Planning) consists of technical requirements and part characteristics.

Stage 3 Process planning (Proces Planning) consists of parts and process characteristics.
Stage 4 Production planning (Part Manufacturing) consists of process characteristics and production requirements.

The relationship between causal factors is also determined using *fault tree analysis* (FTA), which is shown as a fault tree. Because fault tree analysis begins at the system level (TOP) and moves below, it is function-oriented and "top-down." The initial step in this study is to identify functional failure modes at the system or subsystem level. FTA is frequently used for research on engineering risk and dependability. FTA can be used to identify events that lead to an engineering system's failure and their likelihood of happening. To create an FTA, a TOP event, the definition of a system failure must be identified beforehand. The system is next examined to discover every possibility listed in the TOP event. A fault tree is a graphical representation of various combinations of errors that may lead to the actual failure event. Following the discovery of the TOP event, the events that contributed directly to its occurrence are located and connected to the TOP event via logical linkages. Failure trigger situations are described using logic gates. The AND and OR gates can depict a single state or a set of failures and their reasons.

A key performance indicator (KPI) is a system or technique for monitoring essential elements influencing an organization's success. The Key Performance Indicator must also reflect the objectives the organization wants to accomplish or achieves since KPI may also be understood as a performance measurement tool in a business. Matrix the key performance indicator explains the performance to be performed by an organization as well as what steps are taken to realize the company's strategic objectives. A matrix is said to be a key performance indicator when it meets the following criteria:

A matrix is said to be a key performance indicator when it fulfills the following criteria:

1. Has a target, namely what target is to be achieved and the time required.
2. Oriented to outcomes, it is not just output (results of the process) because outcomes have a significant effect.
3. Has a threshold to distinguish between the target and actual values.

If Key Performance Indicators can function optimally, Key Performance Indicators must meet measurable, achievable principles, be reliable, and be time-bound (SMART).

Stages in preparing Key Performance Indicator :

1. Process identification aims to plan performance indicators for company mapping.
2. The validation of performance indicators aims to make the performance indicators that genuinely match the company's needs. Stakeholders in the company carry out the validation process.
3. This performance formulation aims to facilitate the assessment of the increase in the objective matrix to be measured, such as targets, *outcomes*, and thresholds.
4. Performance measurement aims to determine the company's targets to be carried out or achieved, which can be seen using a diagram.

RESULTS AND DISCUSSION

Matrix House of Quality to determine the level of relationship between customer needs and technical requirements. The key to building HoQ is to focus on user needs so that the design and development process is more aligned with what is desired. Oil and Gas Company as a customer, must encourage suppliers to meet standards if they wish to participate in tenders. Suppliers are required to achieve the target of increasing local content.

The components Wellhead & Christmas tree that will be supplied to users must meet the following criteria:

1. Increasing the skills of domestic workers
2. Limiting foreign materials
3. Prioritizing domestic manufacturing
4. Prioritizing domestic work tools
5. Limiting the use of quality control in finishing & Christmas trees overseas

At the end of all HoQ stages, the highest weight/goal will be the primary concern in planning the company's strategy. Materials on local content focused on Wellhead & Christmas Tree must comply with the API-6A spec (material classes AA, BB, CC, DD, EE, FF & HH). The material component with a weight of 110 represents the most significant value and is depicted as follows in Figure 1:

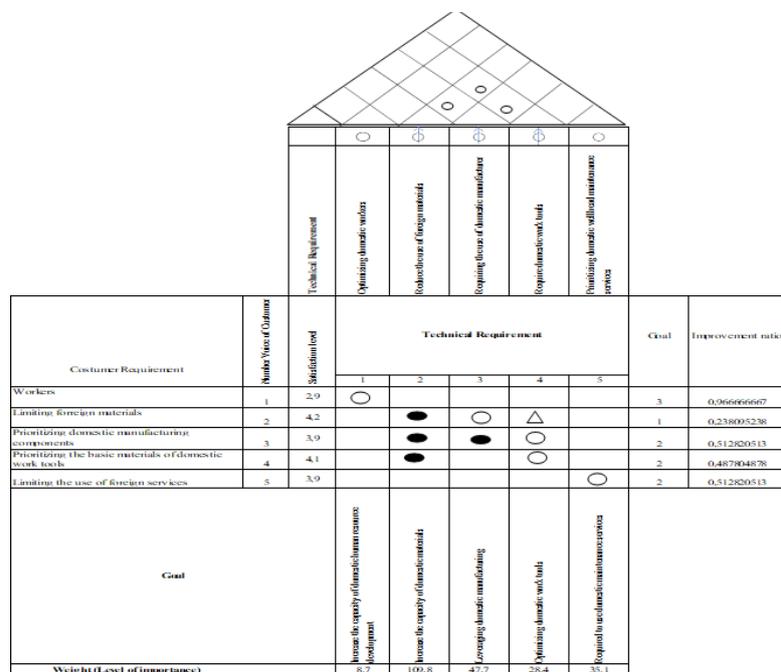


Figure 1. HoQ Wellhead & Christmas Tree Local Content Value Planning (imron,2023)

Figure 1 above explains the metric HoQ. The results of the HoQ matrix weighting domestic materials receive a weight of 110, utilizing domestic manufacturers to gain a weight of 48. Requiring to use service/maintenance receives a score of 35. Optimizing

domestic work tools gets a score of 28. They are increasing their capacity to use domestic resources by getting a score of 9.

The second part of the QFD stage, the deployment part used to create a strategic model for increasing local content. The deployment part is combined with a check sheet to determine the causes of discrepancies from the achievement targets. Constraints on not achieving targets in the process of procuring goods for the user can be seen from the *check sheet* Table 1. as follows:

Table 2. Check Sheet Category Of Non-Fulfillment Of Local Contents Increase

No	Subject	Non-Conformance Problems in Increasing local content	Ranking	Detection Method
1	Human Resources (HR)	HR is not skilled	6	Interview
		The priority policy for domestic workers is still only a discourse	4	
		Academic graduates are not certified in expertise	3	
		Lack of skilled domestic workers	4	
		Education that has not focused on improving skills	3	
		The education curriculum is not under the industrial world	3	
		Government policies that have not taken sides with domestic human resources	4	
		The allocation of funds for material purchases is still small	6	
2	Material	Materials are still imported	9	Interview, data from Ministry of energy mineral resources (K.ESDM)
		Local materials have not been produced domestically	7	
		The difficulty of material substitution	6	
		The development of primary materials is still a bit	7	
		The allocation of funds for material purchases is still small	6	
		Local work tools are complex to compete	9	
3	Work Tools	The rules for prioritizing domestic work tools have not been maximized	7	Interview
		Better foreign work tools	7	
		The domestic manufacturing industry for the manufacture of work tools is still limited	6	
		The rules for prioritizing domestic work tools have not been implemented	7	
		Not many work tools produced domestically are unlicensed	6	
		Cheaper overseas work tools	7	
4	Public Services	Better overseas wellhead service	9	Interview
		There are still a few domestic product test services	6	
		There is no policy to improve domestic services	7	
		Service partnerships are still few domestically and abroad	6	
		Overseas insurance for better wellhead service	8	

From the check sheet above, the results of interviews with the strategic supply chain team obtained the highest to lowest weight. The highest importance is the main problem that must be resolved. The four main problems of the local content calculation component are unskilled resources, materials dominated by imported goods, local heavy equipment challenging to compete, and general services still dominated by foreign services. A new description of each of these significant issues will be provided. In Figure 2. an FTA chart of the four criteria will be made.

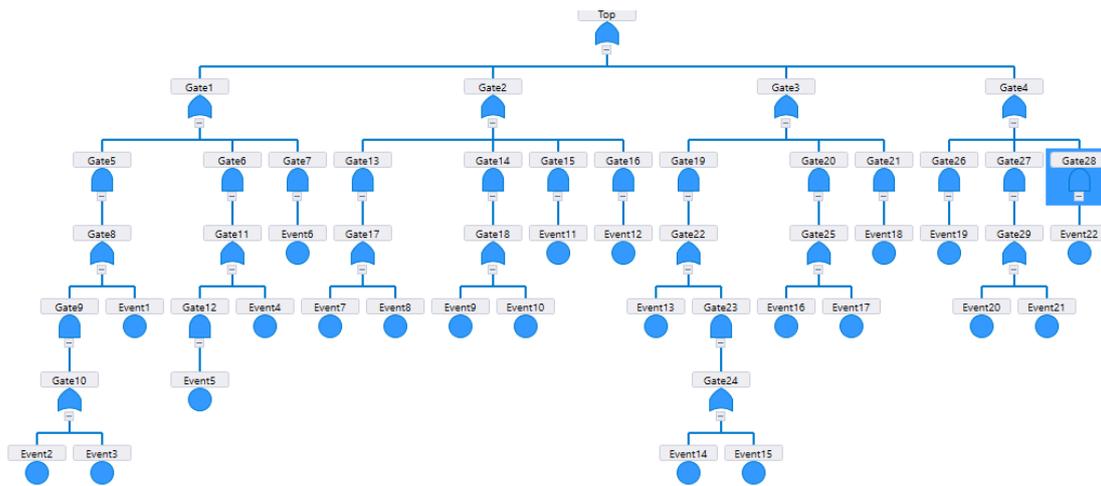


Figure 2. Fault Tree Analysis Chart (imron, 2023)

Based on the fault tree analysis in Figure 2. above, 22 basic events. The basic event is causing local content non-compliance. Among the non-conformances are unskilled workers, workers under the user's specifications, and technology needs to meet the needs. Expensive technology, non-existent material, difficult to substitute, and no technology transfer do not comply with API spec. Existing materials must meet predetermined specifications, particular expertise is required, and building a domestic work tool factory is challenging. Domestic work tools are not standard, and human resources are still from abroad. Domestic test equipment does not comply with API specifications, requires high technology in quality control and skilled local workers, and must be checked with software. Human resources do not match company needs, and workers still need to be capable; workers are still from abroad and require special skills.

Table 2. Below is a comparison of local content values from the Ministry of Energy and Mineral Resources with users if the user's plan is greater than the provisions of the Ministry of Energy and Mineral Resources, the better because the minimum limit from the Ministry of Energy and Mineral Resources can be met with the target set.

Table 2. Timeline Local Comparison Of Ministry Of Energy And Mineral Resources Content Against User

Value Target Local Contents K.ESDM		Planning to Increase Local Contents Oil Company X		Gaps %
Years	Local contents (%)	Years	Local Contents (%)	
2017	55	2017	25.5	-29.5
2018	55	2018	35.79	-19.21
2019	55	2019	40	-15
2020	55	2020	50.05	-4.95

2021	70	2021	55.26	-14.74
2022	70	2022	61.57	-8.43
2023	70	2023	66.84	-3.16
2024	70	2024	73.15	3.15
2025	70	2025	76.31	6.31



Figure 3. Comparations Local Planning Contents Wellhead & Christmas Tree

The blue bar chart above explains comparison targets and forecasting from the Ministry that the user must implement. The bar chart in red is the local content enhancement plan by PT. Pertamina EP to suppliers. Key Performance Indicator describes the performance that a company wants to achieve to be realized. In Figure 6, in the short term, in 2022-2023, oil and gas companies could not meet the set targets. Meanwhile, in the medium time, in the 2024-2025 period, PT. Pertamina EP can complete the achievement targets the Ministry of Energy and Mineral Resources set.

CONCLUSIONS

From the QFD method, the main priority is to increase the local content value in the wellhead & Christmas tree, namely the fulfillment of domestic materials with API standards. The Fault Tree Analysis identified 22 root causes of the non-achievement of targets with realization after the tender was held. The results of calculating the performance indicator for the local value of Wellhead & Christmas Tree achievements of the Ministry of Energy and Mineral Resources should be noticed in 2024-2025, the medium-term target period.

Additional policies are needed if the strategy can be realized from the user to the supplier/manufacturer to limit the use of foreign materials. They are qualifying by substituting foreign materials and improving the quality of domestic materials according to *spec* (material class AA, BB, CC, DD, EE, FF, HH) so that the use of domestic material components can increase both in quality and quantity. PT. Pertamina EP must award long-term contracts to suppliers who meet the required milestones or comply with local content commitments. The Ministry of Energy and Mineral Resources must provide rewards to oil companies that can meet or exceed the local content set.

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