

## SUPPLY CHAIN MANAGEMENT PERFORMANCE MEASUREMENTS IN OIL COMPANY

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### ABSTRACT

*This paper explains the Supply Chain Operation Reference metrics is used to measure supply chain performance assessment in enterprise and value improvement the oil company when the company runs its business. This value improvement included functional focus, internal integration, external integration, and integration crosses enterprise. The result form SCORcards can be seen by class in supply chain performance consist of (best in class, advantage, medium, disadvantage, and major opportunity), gap analyze between plan and actual condition, also perspective weight in SCORcards. Perspective in SCORcards classified in to five perspectives such as supply chain reliability, supply chain responsiveness, supply chain flexibility, supply chain cost and supply chain assets. The results is the company are on best in class at stage functional focus. The suggestion in order to well-implement the supply chain management system, the company need to form a specific team (both functional and structural).*

**Keywords :** supply chain, performance, assessment, scorecards

### 1. INTRODUCTION

Supply Chain Management drew a lot of interest in its role as a cost reducer initiative in order to maximize profit earned. Every business continuously trying to minimize their Supply Chain cost and improving their performance, as well as reducing their goods to consumer's delivery time. Considering all the attention given to the supply chain activities, a number of companies lacked in performance measurements tools to improve their operational performance effectively, especially in supply chain, i.e. reducing the supply chain cost and improving the customer relation as a way to achieve their company's strategic goals in profit improvement and customer satisfaction. The importance of a management system to achieve its result can be measured using the Supply Chain Management system, and is a strategic key to improve a company's operational achievement. It is so because the company needs a measurement standard in SCM that can help the company to make a decision based on evaluation of various alternatives and criteria. (2004 )

According to Kaplan and Norton ( 1992 ) who introduced the Balance SCORcard (BSC) as an assessment tool, BSC has become a leading measurement tool in measuring the company's performance. In this matter, the company needs to reconsider a BSC concept that can be applied to the Supply Chain Management Performance Assessment.

The effectiveness of the Performance Management is the key to find out the real profit and to obtain an efficient SCM system. BSC can perform as a research and industrial effort in the SCM to become a process-based system that integrates methodology, tools, and technology into a measurement system. The system that is proposed in the balanced BSC approach (as the best industrial practice) and integrates the industrial standards of SCOR Models or Supply Chain Operation Reference Model ( Jurnal. Framework for an Integrated Supply Chain Management Syastem. 2002. University of Texas at Arlington).

SCOR Models in the form of SCORcards (Supply Chain Operation Cards ) measures the performance of SCM from 5

perspectives, i.e. Reliability, Responsiveness, Flexibility, Cost, and Assets.

The SCORcards application can be applied to the company who owns a business process with objectively measurable supply chain. In this matter, the company that produces Motor Oil has its own business process that consists of suppliers, manufacturer, and distributors. This can be seen from its business process flow of receiving raw materials from local and abroad suppliers, than store them into the warehouse. After that, the oil is produced in blending process, followed by filling them in the packaging, and then the finished products are stored in the warehouse, ready to be distributed to the customers all around Jakarta. This research is conducted in a company located in Jakarta that hasn't conducted any integration between its components in its business process' (suppliers, manufacturer, distributors) Supply Chain Management.

## 2. BACKGROUND OF THE RESEARCH

The earlier marketing research conducted on the company showed that the market share is strong and performed as a market leader. However, AFTA might perform a threat since there will be new imported products with higher quality and lower price available in the market. (Tiena and Diah, 2005). The oil inventory research (Tiena and Hiswanta, 2003) was conducted using the information system architectural analysis to control the number of consumer's supply and demand in various numbers to obtain an optimum inventory control.

This oil manufacturing company has never conducted any SCM integration so that it faced difficulties like: high supply chain cost, low customer satisfaction because of low product quality and late deliveries. Another problem faced is the complicated bureaucracy that is slowing some business process lines in making decisions concerning stock. To integrate the business process lines, an implementation of SCORcards that is able to measure the company's performance i.e. the customer

satisfaction and reducing the Supply Chain cost based on criteria of reliability, responsiveness, flexibility, cost, and assets was done.

**Performance measurement** implemented in the SCOR models has parameters like: Key Performance Indicators of Supply Chain Reliability, responsiveness, flexibility, cost, and assets. This research was conducted to create a performance measurement system design using the SCORcards and Gap Analysis.

## 3. METHOD AND MATERIAL

### 3.1. SUPPLY CHAIN MANAGEMENT

SCM was conducted to ensure the connection between the movement and quantity in the inventory system and involving many things like planning and communication. A simpler way to say it is that the SCM needs to be conducted to ensure that all product items are available in the right place at the right time so that it can bring the best service to the customers. An effective SCM will benefit in lowering the cost since supply chain is conducted at its top speed and customer service will be increased accordingly (cohen, 2003). Macro management gives the importance of the relationship between internal and external business as it brings efficiency to the organization and its related factors to bring the product from the start point to the final sale point. The implementation of macro management in SCM requires company to build a new set of measurement points to measure the efficiency of every operation in the Supply Chain. The five basic principles in SCM are Planning, Sourcing, Manufacturing, Delivery, and Return.

### 3.2. SCOR Model (Supply chain Operations Reference) Model

SCOR is a model approach that provides guidance to the company. This standard guidance helps in explaining, identifying, and metric measuring the supply chain configuration. Besides, SCOR can help adopting the supply chain practices that is appropriate and usually classified as normative approach. The SCOR methodology exists between the normative

approach that provides a standard definition and procedures in metric system. SCOR also provides a global language in communication. SCOR is a model reference process that combines the business process concept (re-engineering), benchmarking, and best practice. SCOR is a model reference process that consists of:

1. The standard description on practical management
2. Relationship concept in supply chain
3. Metric standard in performance measurement process
4. Practical management to achieve the best practice
5. Basic standards in supply chain (functional)

The business process concept (supply chain) will transform the “ as-is it” process into the best practice “ to-be “. The operational benchmarking concept can be obtained by doing the internal target planning with “ best in class “ result or by doing a benchmark with other company in the business. SCOR has been warmly welcomed in various industries. This success has turn SCOR into a development tool in the supply chain field.

**3.3. SCORcards**

SCOR model has been developed to define every activity in relationship to the supply chain. Those relationships include: interaction between all consumers/customers, all physical/material transactions (suppliers, customers, products, etc.), and all in-market interactions (from aggregate to finishing orders perfectly). However, SCOR do not do activities like sales, marketing (demand generation), product development, research, and other elements (Kasi, 2005). AS it is known, in management structure, performance measurement is a measurement equal to the 4 dimensions in the *Balanced SCORcard* approach (as a best practice measurement) i.e. :

- a. Financial Dimension: includes the COGS (Cost of Goods Sold), value added productivity, assets return, cash to cash cycle time, etc.
- b. Internal Dimension (business process): includes the production flexibility, lead time, internal cycle time (supply chain

cycle time). These measurements relate to the supply chain operational.

- c. Customer Dimension: includes the on-time delivery and fill rate. This metric orientation is customer satisfaction.
- d. Development and Innovation Dimension: is the hardest to define since in this matter, the company is learning a new skill i.e. the supply chain management.

The performance attributes in SCOR consist of several Key’s performance indicator explained in the table below:

Table 1. Performance Attributes in SCOR version 6.0

SCORcards	Attribute Definition (Performance)	SCOR Level I Metric (Measurement)
Supply chain Reliability	Delivery performance: the correct product, on time, the correct quality, etc.	Delivery Performance
		fill rate
Supply chain Responsiveness	How supply chain can quickly meet the customers’ needs	Ordering lead time
Supply chain Flexibility	How supply chain can response to the changes in market demand and ability to compete	Production flexibility
		Response time (Supply chain )
Supply chain Cost	Supply chain related costs	COGS
		SCM cost
		HR cost
Supply chain Assets	How the company can manage its assets to satisfy its customers	Cash to Cash Cycle Time
		Inventory Days of Supply
		Assets turns

Source : *Strategic Supply chain Management. Shoshanah Cohen.p.208*

The SCOR Model consists of 5 basic business processes, i.e. plan, source, make, deliver, and return and begin the approach by assuming that everything in the supply chain can be represented by Plan, Source, Make, Deliver, and Return.

**3.4. SCOR metric (SCORcards) Stages**

*Phase I:* predict i.e. defining the business strategy. This is the initial component in determining the background of the business strategy in supply chain, explaining about the company, business process, and

competitions (Peter Bolsstorf, *Supply chain Excellence*, p.28-30) .Metric Model in SCORcards can be defined using a definition of a staged business metric methodology (Amr abu Suleiman, et.al. *Journal of framework for an integrated Supply chain performance management system. Balanced matrices .p 4*)

Phase II: performance i.e. the implementation in measurement using the SCORcards models in each perspective. Measurement is conducted using the calculation of each perspective based on the definition defined by the SCOR models (Peter Bolsstorf, *Supply chain Excellence*, 2003, p.50). The calculation made based on the SCORcards perspectives are *Supply chain reliability, Supply chain responsiveness, Supply chain flexibility, Supply chain cost*

Phase III : Asses i.e. performance assessment

**Gap Analysis**

Gap Analysis is an analysis of the difference between achievements achieved and the needs in the strategic goals i.e. maximum achievement in Best in Class in the supply chain application, in this case SCORcards obtained to achieve the Best in class target, based on the benchmarking conducted internally within the company (Peter Bolsstorf. *Supply chain Excellence*. 2003. AMACOM) Gap Analysis can be conducted by counting the difference between the actual condition and the best in class target, then giving weighted ratios by adding the gap analysis. The result is then divided by each perspectives to determine the weights of each strategic goal. If the gap analysis result is negative, then it must be turned into a positive number since the weight is not or yet not significantly affecting the perspective functions in the SCORcards, in this case the best in class target.

Table 2. SCORcards Calculation Model

Perspective	Measuremet	Definition	Calculation
<b>Supply Chain Reliability</b>	<i>Delivery performance</i>	Delivery performance percentage (on-time, to the correct place, the correct quality)	<i>Number of orders delivered/number of orders (%)</i>
	<i>Approximate filling</i>	Stock filling approximate rate percentage in supply chain	<i>Mean of inventory filling based on orders</i>
<b>Supply chain Responsiveness</b>	<i>Ordering lead time</i>	Waiting time from ordering to receiving goods in days	<i>Consumer's lead time in days</i>
<b>Supply chain Fleksibilitas</b>	<i>Supply chain response time (business process)</i>	Supply chain response time in days, i.e. plan, source, make, deliver, and return	<i>Supplier's lead time + manufacturing cycle time + inventory lead time</i>
	<i>Production flexibility</i>	Momentarily production capacity min. 20 %	<i>The number of days to produce without planning min 20 (%)</i>
<b>Supply chain Cost</b>	COGS	Cost of goods sold	COGS
	SCM costs	Supply chain related costs	<i>Costs related to information flow, material, and financial like order management, material cost, inventory cost, IT cost, distribution cost, based on the company's condition</i>
	<i>HR productivity cost</i>	HR related costs needed to improve HR's productivity in relation to SCM like SCM training cost	<i>Productivity training cost</i>
<b>Suppy Chain Assets</b>	<i>cash to cash cycle time</i>	The number of days an order turns into cash	$[(\$inventory:(cogs/365))+ [(\$receivables/(earnings:365))- [\$liabilities/(material costs:365)]]$
	<i>inventory days of supply</i>	The number of days an inventory turns into cash	$[inventory costs/(cogs:365)]$
	<i>assets turns</i>	Assets returns	<i>earnings / total net asset</i>

Source : *Supply Chain Excelence Peter Bolstorf p.50 , AMACOM*

**4. RESULT AND ANALYSIS**

**SUPPLY CHAIN OF THE OIL COMPANY IN JAKARTA**

In the supply chain concept, the process above can be simplified in 3 items:

1. *Source* : in this case receiving and bunking process.
2. *Make* ( manufacture ) : in this case there are blending process and filling process.
3. *Deliver* : in this case there is the product delivery process to the national warehouse.

**4.1. SCORcards DESIGN**

Table 3. SCORcard's Design

<b>SCORcards</b>	<b>Vision</b> : to be lubricating solution partner <b>Mission</b> : Marketing the oil, baVXCZse oil and paraffin based products in the national market and selectively in the international ( ASEAN ) market through delivering added value to the customers and company
	<b>Strategic goals</b> : 1. Conducting intensive strategy (market and product development) 2. Conducting supply chain integration 3. Cost rationalization
<b>Perspectives</b>	<b>KPI's</b>
<b>Supply Chain Reliability</b>	Delivery performance and fill rates
<b>Supply Chain responsiveness</b>	Ordering lead time
<b>Supply Chain fleksibilitas</b>	Production flexibility and supply chain response time (business process)
<b>Supply Chain cost</b>	SCM costs , HR development-related to SCM costs, COGS
<b>Supply Chain assets</b>	cash to cash cycle, inventory days of supply, and asset turns

**4.2. Business Strategy Formulation: determining company's positioning based on the EFE and IFE Matrix**

Table 4. Internal – External Matrix

		Total IFE			
		<i>strong</i> 3-4	<i>average</i> 2-2,99	<i>weak</i> 1-1,99	
Total EFE	<b>Positioning</b>				
	<i>high</i> 3-4	1	<b>2 (position)</b>	3	
	<i>medium</i> 2-2,99	4	5	6	
	<i>low</i> 1-1,99	7	8	9	
	<b>Position</b>	<i>Strategy</i>			
	1,2,4 Intensive (market penetration, market development or product development) or integration (to grow and to develop)				
	3,5,7 Market penetration and product development (retain and maintain)				
	6,8,9 Harvest or divest				

Note:  
EFE = 3,3  
IFE = 2,5

4.3. Map Strategy

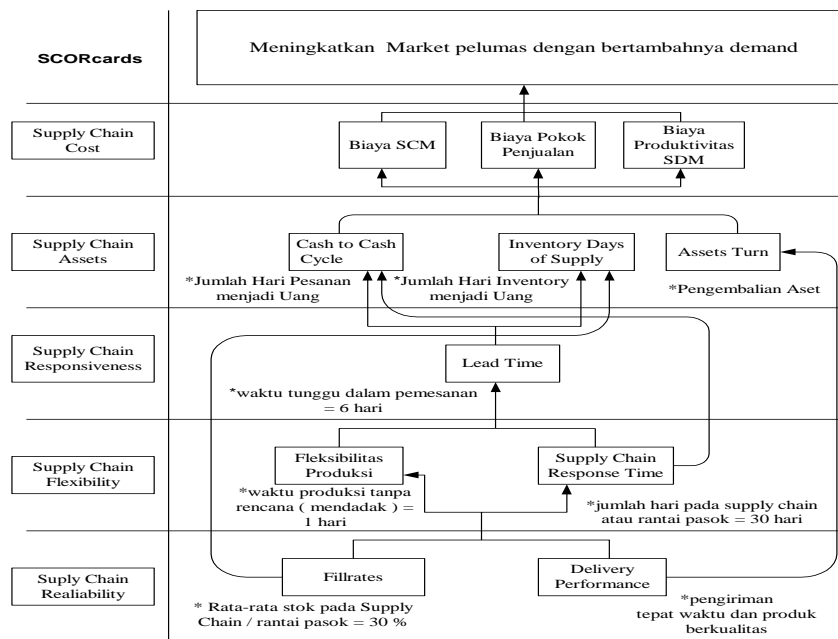


Figure 1. Mapping Strategy for SCOR cards

4.4. SCORcards Measurement System Design

Table 5 SCORcards Measurements

Perspektive SCORcards (Critical Factors)	Measurement	Target	Initiative	
<b>Supply Chain Reliability</b>				
Delivery performance	Oil product percentage	100 %	1. product quality improvement 2. information system improvement	
fill rate	Average stock filling rate (percentage)	30%	1. product marketing development 2. market strategy development	
<b>Supply Chain Responsiveness</b>				
Ordering lead time	Lead time	6 days	1. customer relationship management development 2. ordering information system development	
<b>Supply Chain Flexibility</b>				
Production flexibility	Production time ( unplanned)	1 day	1. supplier relationship management development 2. integrated information system implementation	
Response time (Supply Chain )	Supply Chain process time	31 days	1. integrated information system implementation 2. HR skill development 3. supply chain management integration	
<b>Supply Chain Cost</b>				
SCM cost	SCM cost	31.01%		1. Well designed SCM plan 2. Rationalization of SCM supporting costs
HR cost	HR cost	Rp.51.530.000		1. SCM function trainings for HR personnel

Table 5 SCORcards Measurements (cont.)

Perspektive SCORcards (Critical Factors)	Measurement	Target	Initiative	
COGS	COGS	Rp11000		1. Appling SCM in the company
<i>Supply Chain Assets</i>				
Cash to Cash Cycle Time	Time to create profit from order	76 days	1. Well designed SCM plan 2. elimination of doubled or non SCM related divisions 3. logistic functions integration	
Inventory Days of Supply	Time to create profit from inventory	33 days	1. product quality development 2. Market development with possible discount value	
Assets turns	Earnings divided by total assets	7.14 %	1. oil product development 2. quality and customers' added values development	

**4.5. Performance Measurement Scale Determination**

In measuring the company's performance, a set of rules are needed, including a measurement scale. This research uses the Likert scale with marks as followed: 5 : Best in class, 4 : advantage, 3 : medium, 2 : disadvantage, 1 : major opportunity

The gap analysis result is:

Tabel Gap 6. Analysis ( Best in Class, Advantage, Medium and weights.)

Measurement	Best in Class Gap	Weight	Advantage Gap	Weight	Medium Gap	Weight	Perspective
Delivery performance	14%	0.41	34%	0.46	44%	0.42	Supply Chain Reliability
Fill Rate	20%	0.59	40%	0.54	60%	0.58	
<b>Total</b>	<b>34%</b>	<b>1</b>	<b>74%</b>	<b>1</b>	<b>104%</b>	<b>1</b>	
Ordering lead time	0	1	0 day	1	1 day	1	Supply Chain Responsiveness
Production flexibility	0	0	1	0,08	1	0,07	Supply Chain Flexibility
Supply Chain Response time	9	1	11	0,92	13	0,93	
<b>Total</b>	<b>9</b>	<b>1</b>	<b>12</b>	<b>1</b>	<b>14</b>	<b>1</b>	
SCM cots	0	0	4%	0.06	23,76%	0,2	Supply Chain Cost
COGS	0	0	16%	0.27	36%	0,3	
HR costs	19	1	39%	0.67	59%	0,5	
<b>Total</b>	<b>19</b>	<b>1</b>	<b>59%</b>	<b>1</b>	<b>118,76%</b>	<b>1</b>	
Cash To Cash Cycle Time	8%	1	28%	0.47	48%	0.4	Supply Chain Assets
Inventory Days Of Supply	0	0	18%	0.31	38%	0.32	
Assets Turns	0	0	13%	0.22	33%	0.28	
<b>Total</b>	<b>8%</b>	<b>1</b>	<b>59%</b>	<b>1</b>	<b>119%</b>	<b>100%</b>	

Based on the SCORcards result, a number of measurements in each perspective were located in the best in class so that the SCORcards implementation can be done at the best in class level and the gap analysis, is as shown in the tables and figures below:

Table 7. Best In Class, Gap Analysis, and Weights

Measurement	Best in Class			
	Plan	Actual	Gap Analysis	Weights
Delivery Performance	100	114	14	0,41
Fill rate	100	120	20	0,59
Ordering Lead time	6	7	-1	0
Production Flexibility	1	3	-2	0
Supply chain Response Time	31	21	10	1
SCM Costs	100	83,76	-16,26	0
HR Costs	100	119	19	1
COGS	100	96	-4	0
Cash to Cash cycle time	100	108	8	1
Inventory Days of Supply	100	92	-8	0
Assets turns	100	93	-7	0

Table 8. Performance Vs Competition (Best in Class)

Measurement	Performance (as-is)	Competition (to-be)
Delivery Performance	best in class	best in class
Fill rate	best in class	best in class
Ordering Lead time	advantage	best in class
Production Flexibility	medium	best in class
Supply chain Response Time	best in class	best in class
SCM Costs	best in class	best in class
HR Costs	best in class	best in class
COGS	best in class	best in class
Cash To Cash Cycle Time	best in class	best in class
Inventory Days Of Supply	best in class	best in class
Assets Turns	best in class	best in class

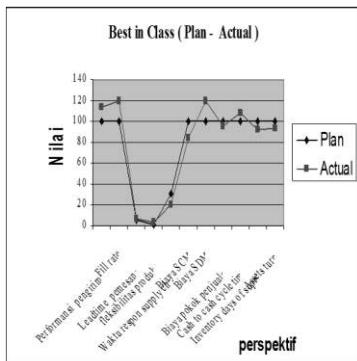


Figure 2. Best In Class (Plan and Actual)

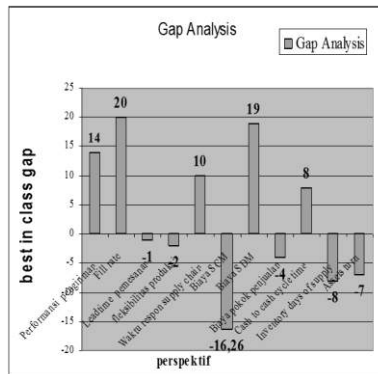


Figure 3. Gap Analysis (Best In Class)

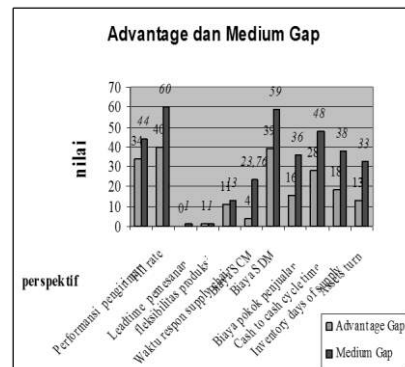


Figure 4. Gap Analysis (Advantage and Medium)

Table 9. SCORcards Performance Measurement Result

Best in Class SCOR cards	Perspective	Gap	Weight	Result	Result x Weight	Score
Supply Chain Reliability	Delivery performance	14%	0.41	5	2,05	5
	fill rate	20%	0.59	5	2,95	
	Total	34%	1	Total	5	
Supply Chain Responsiveness	Ordering lead time	0	0	4	0	0
	Production flexibility	0	0	3	0	5
Supply Chain Flexibility	Supply chain response time	9	1	5	5	
	Total	9	1	Total		
	SCM costs	0	0	4	0	5
Supply Chain Cost	HR costs	0	0	5	0	
	COGS	19	1	5	5	
	Total	19	1	Total	5	
Supply Chain Asset	Cash to Cash cycle time	8%	1	5	5	5
	Inventory Days of Supply	0	0	5	0	
	Assets turns	0	0	5	0	
	Total	23%	1	Total	5	20
Score						4



With a final score of 4, it is shown that the company's supply chain performance is running well.

## 5. CONCLUSION

The score and weights of each strategic goals in the five perspective in SCORcards at the supply chain management department of the company in Jakarta showed that:

1. Supply chain Reliability consisted of delivery has score of 5, weight 0.41, gap analysis 14% and Fill rate has score 5, weight 0.59 and gap analysis 20 %.
2. Supply Chain Responsiveness consisted of Lead time has a score of 4, weight 0, gap analysis minus 1 day.
3. Supply Chain Flexibility consisted of production flexibility has a score of 3, weight 0, gap analysis minus 2 days. Supply chain response time has a score of 5, weight 1, gap analysis positive 9 days.
4. Supply Chain Cost consisted of SCM costs has a score of 5, weight 0, gap analysis 16,26 %, COGS has a score of 5, weight 0, gap analysis 19 % and HR productivity costs has a score of 5, weight 1, gap analysis 4%.
5. Supply Chain Assets consisted of Cash to cash cycle time has a score of 5, weight 1, gap positive 8 %, Inventory days of supply has a score of 5, weight 0, gap analysis minus 8 % and Assets turn has a score of 5, weight 0, gap analysis minus 7 %.

Based on the score calculation, the work measurements score for each perspective is as followed:

1. Supply Chain Assets has a score of 5 that means very well done (best in class)
2. Supply Chain Cost has a score of 5 that means very well done (best in class)
3. Supply Chain Flexibility has a score of 5 that means very well done (best in class)
4. Supply Chain Responsiveness has a score of 0 that means that its performance still needs to be improved (inadequate to achieve best in class title)
5. Supply chain Reliability has a score of 5 that means very well done (best in class)

The position was considered in the best in class on the baseline / functional focus stage.

Suggestion:

The SCORcards result that showed that the best in class was achieved in the baseline / functional focus stage can be improved by conducting a supply chain management planning so that it can be well-integrated in the next stages. The company also needs to try to develop the business processes in other divisions that hasn't achieve the best in class title.

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