

# INPUT OUTPUT ANALYSIS FOR DEVELOPMENT OF OIL REFINERY IN BOJONEGORO

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## Abstract

To fulfill increasingly demand of oil in Indonesia, the Indonesian government has a policy to build oil refinery to fulfill necessity Indonesian market. Development the oil refinery has decided to build in Bojonegoro because Bojonegoro is close to Cepu the petroleum drilling area. The existence of this development oil refinery will certain make impact for another development sector, the impact will be analyzed using input output analysis.

To measure the impact of the development of oil refinery in Bojonegoro, I071 software will be used to quantify the development for other sectors in East Java in terms of output, income and employment.

The output of this research is the amount of an impact in each sector which influenced with the development of Bojonegoro oil refinery. The direct impacts of this Bojonegoro's oil refinery are output of the nine sector increase by Rp 285 billion, absorb 35.604 employments and create income Rp 228 billion.

## 1. Introduction

Petroleum activity has an important role to the economic growth in Indonesia. Previously, petroleum is one of the main export commodities in Indonesia, which is used as fuel resource and raw material for petrochemical industry. Currently, Indonesia is net importer of oil so the Indonesia government want to build oil refinery to reduce import.

There are some oil refineries in Indonesia, such as:

1. Pertamina Unit Pengolahan I Pangkalan Brandan, North Sumatera (Capacity 5 thousand barels/day). The oil refinery in Pangkalan Brandan has been closed since 2007.
2. Pertamina Unit Pengolahan II Dumai/Sei Pakning, Riau (Kapasitas Kilang Dumai refinery's capacity is 127 thousand barels/day, Sungai Pakning Refinery 50 thousand barels/hari)
3. Pertamina Unit Pengolahan III Plaju, South Sumatera (Capacity 145 thousand barels/day)
4. Pertamina Unit Pengolahan IV Cilacap (Capacity 348 thousand barels/day)

All of those refineries are operated by Pertamina. From those data above, it is known that East Java hasn't had any oil refinery. Whereas there is Blok Cepu, which was one of Indonesia's blocks with a big enough amount of petroleum content.

## 2. Input output Analysis

In this research, input output analysis is used to analyze the impact of the development to the other sectors in East Java economy in terms of output, income and employment.

## 3. Oil Refinery

Oil refinery is factory/industrial facility which process raw oil becomes petroleum product which can be used directly although other products that becomes the raw material for petrochemical industry. The main products that are produced from the oil refinery are: gasoline, diesel, and kerosene. Oil refinery is a very complex industry facility with many kinds of process equipments and supporting facilities.

In the organic chemistry, hydrocarbon compound, especially parafinic and aromatic, have each boiling point, where length of hidrocarbon chain straight proportionate with boiling point and its

density. The longer the hydrocarbon chain so the bigger the boiling point and its density. This physical characteristic later become base in Primary Process.

The amount of carbon atoms in hydrocarbon chain is variative. In broad outline, the outputs from the processing in oil refinery are:

- Gasoline. Gasoline is the most important and the biggest product from oil refinery.
- *Kerosene*
- *LPG (Liquified Petroleum Gas)*
- *Distillate Fuel*
- *Residual Fuel*
- *Coke and asphalt*
- *Solvent*
- Petrochemical raw materials
- Lubricating oil

## **4 The Expenses For Oil Refinery Development**

### **4.1 Direct Cost**

Direct cost is cost related directly or has direct influence to the oil refinery development, among others, land release, land and development permission, refinery development, refinery tank development, non-refinery development, EPC (Engineering Procurement Construction) Cost, and refinery construction. The definition of EPC is the cost or structure building, construction costs and supplying consists of the contract and costs construction for production facility.

### **4.2 Indirect cost**

The amount of indirect cost is not as much as direct cost, In this matter, indirect costs in the development of oil refinery are technical supporting facility cost, and equipment transportation cost. Technical supporting facility cost consists of certificate audit, engineering, building and labor insurance. Equipment transportation costs are transportation cost and transportation facility. (truck, tank truck, car, etc).

### **4.3 Operational Cost**

Operational cost is total expenditure involved into the operational production facility. Furthermore this cost is classified into effort cost with this summary:

- Labor consumption and accomodation
- Pre Production (First setting for machine, equipment, office equipment, and crude oil)
- Service and maintenance
- Overhead cost (electricity cost, telecommunication, etc)

## **5. Calculation of Direct Impact from Oil Refinery Construction**

In this data collection and processing chapter, the needed data is provided as input output table, Region Income Data, employee, costs which are related to the development of oil refinery. Those data is used to get the output wanted such as the impact value, backward linkage value so data interpretation and analysis can be done in the next chapter.

Development oil refinery cost will affect the output demand at other sectors in East Java economy. The direct impact of the development of oil refinery can be seen on Table 1.

Table 1 Detail Cost Calculation for The Development of Oil Refinery

Detail Cost		Cost Explanation		Related Sectors
Direct Cost		Explanation	US \$	
a	Land Exemption	7 hectares x Rp 130.000/m <sup>23</sup>	957,895	Services
b	Land and Development Permission	5% from the cost land release	47,895	Financial, Rental and Company Services
c	Refinery Development	Machine, pipe	10,000,000	Industry, Mining
d	Refinery Tank Development	Tank Storage	3,000,000	Industry, Mining
		Production Tank	3,000,000	Industry, Mining
e	Non-Refinery Development	Office building, <i>Filling Station</i> , Road Construction	736,842	Construction
f	EPC ( <i>Engineering Procurement Construction</i> ) Costs	Master Plan Refinery Design	1,052,632	Financial, Rental, and Company Service, Services, Industry
		Survey	15,789	
		Purchase of crude oil, technical equipment, such as piping, drill strings, joints, catalysts, cladding, molecular sieves, laboratory supplies, individual items of security equipment, spare parts)	526,316	
g	Refinery Construction	Tank, pipe, <i>tools</i> and <i>equipment</i> installation	3,684,211	Construction
<b>sub total direct cost</b>			<b>23,021,579</b>	
Indirect Cost		Explanation	US \$	
a	Technical Supporting Facility	Certificate audit, <i>engineering</i> , <i>Building Assurance</i> , Labor	842,105	Financial, Rental, and Company Service
b	Equipment Transportation	Transportation Cost and Transportation Facility (tank truck, car, etc)	1,578,947	Transportation and Communication, Industry
<b>sub total Indirect Cost</b>			<b>2,421,053</b>	
Operational Cost		Explanation	US \$	
a	Labor Consumption	Labor Accommodation (food, drink, house)	362,368	Trading, Hotel and Restaurant, Services, Agriculture
b	Pre-Production	Machine setting, Equipment, Office Needs, Crude Oil First Setting	1,075,000	Financial, Rental and Company Service, Mining
c	Service and maintenance	Equipment	1,000,000	Industry, Financial, Rental and Company Service
d	Overhead cost	Electricity, Water, Telecommunication Cost, etc	2,120,000	Transportation and Communication; Electricity, Gas, Clean Water
<b>sub total operating cost</b>			<b>4,557,368</b>	
<b>TOTAL COST</b>			<b>30,000,000</b>	

### 5.1 Impact Analysis Final Demand (Output)

After calculating the costs in (\$) dollars which needed and determine the relationship between the expense for certain sectors, the next step is summarizing total expenses which are used for each sector and converting it into billion Rupiahs (1 US\$ = Rp. 9500). The cost percentage calculation which is compared with total costs is also done for each sector.

This impact value (billion Rupiahs) will take as the input to calculate the final demand output impact in the opened model (only considering 9 sectors without household consumption and income).

Table 2 Output Cost Recapitulation at Nine Sectors

Sector Output	Impact Value (\$)	Impact Value (Billion Rp)	Percentage
Agriculture	7,247	0.069	0.02
Mining	3,275,000	31.11	10.92
Industry	14,639,474	139.08	48.80
Electricity, Gas, Clean Water	1,484,000	14.10	4.95
Construction	4,421,053	42.00	14.74
Trading, Hotel and Restaurant	253,658	2.41	0.85
Transportation and Communication	1,662,316	15.79	5.54
Financial, Rental, and Company Service	2,351,316	22.34	7.84
Services	1,907,474	18.12	6.36
Total	30,000,000	285.02	

Data input stage for impact analysis based on output change for each sector is described in input data table IO71 software shown below,

Table 3 Input for IO71 for changing of Final Demand Output

DATA INPUT	
1: Pertanian	0.1
2: Tambang	31.1
3: Industri	139.1
4: LGA	14.1
5: Konstruksi	42.0
6: PHR	2.4
7: P&K	15.7
8: Keuangan	22.3
9: Jasa	18.1
10: TOTAL	0.0
11: P1	0.0

Then, we can get the calculation result for impact analysis calculation output change in the software as shown in the table below.

Table 4 Estimated Output Effects

ESTIMATED OUTPUT EFFECTS (Rm)							
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SECTOR	F. DEMAND	INDUST	CONS'M	TOTAL	<x>	FLOW-ON	<x>
Pertanian	0.07	69.47	43.50	113.04	11.5	112.97	16.3
Tambang	31.10	15.38	2.10	48.57	5.0	17.47	2.5
Industri	139.10	140.91	79.12	359.13	36.7	220.03	31.7
LGA	14.10	10.22	4.18	28.50	2.9	14.40	2.1
Konstruksi	42.00	0.00	0.97	42.97	4.4	0.97	0.1
PHR	2.40	139.19	62.30	203.88	20.8	201.48	29.0
P&K	15.70	26.42	11.08	53.19	5.4	37.49	5.4
Keuangan	22.30	22.33	11.24	55.87	5.7	33.57	4.8
Jasa	18.10	37.60	18.85	74.55	7.6	56.45	8.1
TOTAL	284.87	461.51	233.33	979.71	100.0	694.84	100.0
RATIO	1.00	1.62	0.82	3.44		2.44	

### 5.2 Impact Analysis Final Demand (Employee)

The next impact analysis is the increase of total employee as the impact of the refinery development in Bojonegoro. The steps will be done to get the total employee increasing or changing are, (1). Recapitulating data of job opportunity value at Nine Sectors

in Bojonegoro in 2004-2007; (2). With using the assumption that the increasing output at each sector at the moment the Bojonegoro Oil Refinery Development as equal as the increasing total employee percentage in 2008 in Bojonegoro, then we can get the job opportunity value in Bojonegoro in 2008 and we can find the differences between the value of each sector in 2007 and 2008 so those differences will be increasing total employee value at each sector.

Table 5 Job Opportunity Development Data  
Based On Field of Work in 2004 – 2006

<b>Job Opportunity Development Based On Field of Work in 2004 – 2006</b>				
<b>DESCRIPTION</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
1, Agriculture	290,780	290,795	291,014	291,123
2, Mining	1,900	1,903	1,905	1,908
3, Industry	36,763	36,781	36,809	36,837
4, Electricity	7,998	8,003	8,009	8,015
5, Building	74,111	74,162	74,218	74,274
6, Trading	100,629	100,685	100,761	100,837
7, Transportation	8,299	8,306	8,312	8,318
8, Financial	4,445	4,450	4,453	4,456
9, Service, etc.	68,217	68,268	68,319	68,377
Source: Bojonegoro Region Employee Service				

Table 6 Employee Increasing Data In 2007-2008

<b>DESCRIPTION</b>	<b>Growth Percentage</b>	<b>2007</b>	<b>2008</b>	<b>Increase of Employee</b>
1, Agriculture	0.00024	291,123	291,193	<b>70</b>
2, Mining	0.10916	1,908	2,116	<b>208</b>
3, Industry	0.48796	36,837	54,812	<b>17,975</b>
4, Electricity	0.04946	8,015	8,411	<b>396</b>
5, Building	0.14736	74,274	85,219	<b>10,945</b>
6, Trading	0.00845	100,837	101,690	<b>853</b>
7, Transportation	0.05541	8,318	8,779	<b>461</b>
8, Financial	0.07837	4,456	4,805	<b>349</b>
9, Service, etc.	0.06358	68,377	72,724	<b>4,347</b>

The input step for impact analysis based on changing total employee for each sector is described in input data table *I071* software below.

Table 7 Input for IO71 for changing of Employee

DATA INPUT		
1:	Pertanian	70.0
2:	Tambang	208.0
3:	Industri	17975.0
4:	LGA	396.0
5:	Konstruksi	10945.0
6:	PHR	853.0
7:	P&K	461.0
8:	Keuangan	349.0
9:	Jasa	4347.0
10:	TOTAL	0.0
11:	HH1	0.0

Then, we can get the impact analysis calculation result for changing employment from the software as shown in the table below,

Table 8 Estimated Employment Effects

ESTIMATED EMPLOYMENT EFFECTS (u)								
Jatim0018								
SECTOR	F.DEMAND	INDUST	CONS'M	TOTAL	<v>	FLOW-ON	<v>	
Pertanian	4214.68	528176.58	327196.00	859587.34	30.9	855372.66	41.6	
Tambang	1378.95	14146.10	1736.32	17261.36	0.6	15882.41	0.8	
Industri	155901.98	162473.88	85722.54	404098.40	14.5	248196.42	12.1	
LGA	1094.90	3396.03	1444.80	5935.73	0.2	4840.83	0.2	
Konstruksi	1342667.42	0.00	3797.82	346465.25	12.5	3797.82	0.2	
PHR	16757.02	338232.43	152881.03	507870.49	18.3	491113.46	23.9	
P&K	10725.01	77044.14	32191.74	119960.89	4.3	109235.88	5.3	
Keuangan	1954.61	14369.64	7861.93	24186.17	0.9	22231.56	1.1	
Jasa	189641.61	203189.31	102740.43	495571.35	17.8	305929.74	14.9	
TOTAL	724336.25	1341028.00	715572.75	2780937.00	100.0	2056600.75	100.0	
RATIO	1.00	1.85	0.99	3.84		2.84		

### 5.3 Impact Analysis Final Demand (Income)

Analysis of the impact of final demand to the income for household in East Java, need information about income generated from the development of Bojonegoro oil refinery. The additional income is calculated from output of each sector minus 20% as profit margin.

Table 9 Increase of Income Data

Income for Each Sector	Impact Value (Billion Rp)	Profit Margin	Income
Agriculture	0.06884992	0.013769984	0.055
Mining	31.1125	6.2225	24.89
Industry	139.075	27.815	111.26
Electricity, Gas, Clean Water	14.098	2.8196	11.28
Construction	42	8.4	33.60
Trading, Hotel and Restaurant	2.4097472	0.48194944	1.928
Transportation and Communication	15.792	3.1584	12.63
Financial, Rental, and Company Service	22.3375	4.4675	17.87
Services	18.1209992	3.62419984	14.50
Total	285.0145963	57.00291926	228.01

The input data steps for impact analysis based on the changing income value for each sector is described at input data table IO71 software below,

Table 10 Input for IO71 for changing of Income

DATA INPUT		
1:	Pertanian	0.1
2:	Tambang	24.9
3:	Industri	111.3
4:	LGA	11.3
5:	Konstruksi	33.6
6:	PHR	1.9
7:	P&K	12.6
8:	Keuangan	17.9
9:	Jasa	14.5
10:	TOTAL	0.0
11:	HHI	0.0

Then we can get the impact analysis for changing income from the software as shown in the table below.

Table 11 Estimated Income Effects

SECTOR	F. DEMAND	INDUST	CONS 'M	TOTAL	(%)	FLOW-ON	(%)
Pertanian	0.01	7.68	4.81	12.50	17.8	12.49	26.3
Tambang	2.47	1.22	0.17	3.86	5.5	1.39	2.9
Industri	6.80	6.89	3.87	17.56	25.0	10.76	22.7
LGA	1.17	0.85	0.35	2.37	3.4	1.20	2.5
Konstruksi	5.89	0.00	0.14	6.03	8.6	0.14	0.3
PHR	0.12	6.86	3.07	10.04	14.3	9.93	20.9
P&K	0.90	1.52	0.64	3.06	4.4	2.15	4.5
Keuangan	4.51	4.50	2.27	11.28	16.1	6.77	14.3
Jasa	0.84	1.74	0.87	3.45	4.9	2.61	5.5
TOTAL	22.71	31.26	16.17	70.15	100.0	47.43	100.0
RATIO	1.00	1.38	0.71	3.09		2.09	

## 6. Conclusion

- The direct impacts of this Bojonegoro's oil refinery are output of the nine sector increase by Rp 285 billion, absorb 35.604 employments and create income Rp 228 billion.
- From the cost value at certain nine sectors, can be known that the biggest cost value is located in industrial sector by Rp.139,075 billion, so that the estimated output effect output can also be known that the industrial sector gets the biggest percentage from the impact calculation which the result is 36,7%.
- Total employee impact with the biggest value is located in agriculture sector. This is caused by the increasing labors to fulfill the need of food during the development project is done that certainly absorb many labors. Whereas the sector with the smallest labor percentage is LGA sector because it is related with the small amount of project cost which is expensed to fulfill the needs of LGA.
- At the estimated income effect table, we can conclude that the biggest sector which gives the income value impact is industrial sector. This can be related the impact value of output value in the biggest industry, so the big amount of *output* value in a sector will impact the increasing of sector income. The sector with the smallest output impact is LGA sector. This is caused by the small amount of value output in this sector.

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