IDEC Discussion paper 2012, Hiroshima University

Induced Effect Of Government Infrastructure Projects In Indonesia

Dimas Hendra Cipta and Masaru Ichihashi

Graduate School for International Development and Cooperation, Hiroshima University,
1-5-1 Kagamiyama, Higashi Hiroshima, Hiroshima 739-8529, Japan

ABSTRACT

Since there is no clear depiction about the type of infrastructure projects that would enhance more output, income or employment creation, this study aims to give the information of the impact on different kind of construction surge in the economy. Each type of construction uses different resources, therefore, different kinds of cost elements such as materials, equipment and labor, are correlated with diverse economic sectors, and resulting differ impact. Employing the utilization process in the construction projects and Input-Output Analysis, the results show that the typical building-type construction project, could capture overall economic performance in creating output, income and employment generation. This phenomenon is due to the extensively use of the manufacture sector resources. This finding could draw some main policy implication-namely, the necessity to use more local portion of manufacture product in the implementation of construction to enhance the nation productivity.

Keywords : Input-Output Analysis, Government, Infrastructure, Utilization

1. Introduction

The construction sector is a major and essential part of the national output, accounting for a significant proportion of the Gross Domestic Product (GDP) of both developed and developing countries *(Crosthwaite: 2000)*. For this reason, many developing countries are investing in public sector infrastructure projects to enhance their economies. Following this tendency, Indonesia has also developed public infrastructure in the past few decades. As we look at the influences on the output creation in Indonesia, the construction sector always has a significant impact on the whole economy. Using the information in the Input-Output (IO) Table of Indonesia (Table1), the conclusion can be drawn that the construction sector contributes most in national output from 1990 to 2005 period.

In 1990, the total construction output was US$ 4,323,078,222 and became the highest source of output creation. This number almost tripled in 1995, to US$ 11,516,073,000, and trended slightly downward to second rank in 2000. In 2005, the total output rose again to the top position, with a value of US$ 64,271,312,333.This means that the proportion of the national budget allotted for infrastructure projects in Indonesia is becoming a larger policy consideration, with the goal of achieving a higher multiplier effect in economic output, as well as prosperity for the communities.

Table.1 Sector Rank of the highest Output creation in Indonesia

Rank	1990		1995		2000		2005	
	Sector Name	Value (000 US$)	Sector Name	Value (000 US$)	Sector Name	Value (000 US$)	Sector Name	Value (000 US$)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Construction	4,323,078	Construction	11,516,073	Trade	33,424,696	Construction	64,271,312
2	Trade	3,422,306	Trade	8,836,401	Construction	25,297,451	Trade	56,428,246
3	Crude oil, natural gas and geothermal mining	2,791,269	Manf. of machine, electrical machinery and apparatus	6,756,295	Manf. of machine, electrical machinery and apparatus	17,919,951	Manf. of machine, electrical machinery and apparatus	45,442,285
4	Manf. of machine, electrical machinery and apparatus	2,496,372	Real estate and business service	6,340,668	Petroleum refinery	17,110,219	Petroleum refinery	34,729,323
5	Petroleum refinery	2,278,258	Hotel and Restaurant	5,579,021	Crude oil, natural gas and geothermal mining	16,976,325	Crude oil, natural gas and geothermal mining	31,454,763

Although we know the construction sector would likely create greater output in the economy, there is still no information on which types of infrastructure projects will cause higher magnitude change in overall output, income generation, or even employment creation. Since each project will use different materials, equipment and also labor, the correlated sectors in the economy will be differ, as well the resulting output.

This means that projects will create demand in varying sectors, such as manufacturing, trade and services. Therefore, with respect to the construction sector, it is necessary for any analysis to capture the sectoral interdependence of both supply and demand patterns (*Bon : 1988*). In order to capture the economic sector used in each projects, this study will utilize the construction activity into its cost elements and then associated with the IO analysis to obtain the economic impact resulted after induced by the construction projects.

2. Theoretical and Empirical Reviews

2.1. Basic Input-Output (IO) Analysis

Generally, input-output analysis divides the economic system into a number of sectors, and considers the flows of commodities and services in and out of each sector. The basic concepts of IO analysis are detailed in *Miller and Blair (2009)* and *Nazara (2005)*; therefore, the primary equations of this study are only restated briefly. The main requirement for the IO analysis is the transactions table, in which inter-industry transactions (i.e. flows of goods and services between industries) are included, along with final demand transactions.

As an economic tool for the prediction of economic phenomena, certain assumptions and limitations are attached to the IO analysis. According to *Hubacek et al.(2002)*, there are two basic assumptions of IO analysis. First, due to the fixed-proportion Leontief-typed production functions, it assumes that input functions are linear and the marginal input coefficient equals the average. Second, the basic I–O relationship is not responsive to changes in price; they are represented by fixed coefficients given a certain period of time (and therefore only capture economic phenomena in a particular point of time).Also, because of this static form, the flow of capital goods is be addressed in the IO analysis *(Bon: 1988)*. This limitation also reflects in this study. The constructions projects examine in here are multiyear contract, whilst the I-O Table used is in 2005. No breakdown of payment completion on construction activities only in year of 2005 or an adjustment to the I-O Table following the year of the construction completion. This study assumes whole multi years (2 – 5 years) contracts in a single year with the purpose to depict overall immediate impact on the economic sectors after induced by construction projects using the I-O Table structure in 2005.

2.2. Interrelation in the Construction Sector

In terms of the actual process, the construction sector is not a standalone sector, as it needs other sectors for production input. There exists a cyclic process (*Wibowo, Agung: 2009*) whereby money flows from users and passes through the provider (Figure1 in appendix1).

The figure shows that the provider (contractor) will purchase inputs from material suppliers, rent equipment from plant suppliers, and pay labor wages (on-site labor) to finish the work. The funds received from the provider can be used by the material supplier, plant supplier, and labor to purchase goods or services from other industries. These industries, in turn, will generate products used by the industry as an input factor to produce their final product and also paid or absorb employment (off-site labor) as final demand increase.

Referring from the cyclic process, ones could utilize all sectors that correlated with final demand for government infrastructure projects and traced it by use of the I-O Table, to examine economic phenomena resulting from the induced effect.

2.3. Selected Empirical Reviews

The construction sector is always interrelated with other sectors as part of the production process, so that the effects on the economy will also be different. Many studies have tried to elaborate the different impacts of infrastructure projects. One study that examines the impact of alternative investment on the infrastructure sector related to transportation, such as roads, railways, water, and air transport was conducted by Wang and Charles in 2010. Using the I-O Table 2004-2005 for Australia, they found out that the rail and water transport sectors resulted in a significant change in sectoral prices in the resource and energy sectors throughout the economy.

The interrelation or degree of reliance, in the construction sector can be seen from the input side by transactions among economic sectors, or by final demand. Based on these facts, in 2006, Chiang *et.al.* observed the repercussions of consumption and input in the construction sector by assessing their degree of reliance. Observed using data from Japan I-O Table in 2000, their results showed that in a capital-intensive economy, the construction and real estate sectors did not rely heavily on intermediate demand, as compared to other sectors.

Moreover, the interdependencies in the construction sector over time can also produce a shift in supply and demand, as shown by Bon in 1988. Using the six US I-O Tables compiled since World War II, he compared the construction sector and other sectors in the national economy, which resulted in the complex interdependencies between the construction sector and its main suppliers and clients: manufacturing, services, trade, and transportation sectors in the US.

Utilization of the construction sector is based on the set of inputs, for example, materials, labour, plant, and equipment deployment needed to accomplish the work. Ganesan (1979) observed this phenomenon to understand employment creation and material requirements in Sri Lanka using the data on 88 construction projects obtained from surveys of the building materials and construction industries in Sri Lanka between 1974 and 1975. He showed that differences in employment absorption could arise from the choice of materials in design, including whether such inputs are locally produced or imported, and the choice of construction techniques.

Similarly, the study on employment generation in the construction sector was conducted by Ball in 1981. He broke down the construction process into cost distribution elements, (i.e. labour, material, overhead, and profit) and described the total employment required in the on-site labour (at the construction site) and off-site labour (linked to manufacturing, selling, and transporting materials, equipment, and supplies). In result, he mentioned that the on-site occupational requirements, as well as materials, equipment, and supplies, vary significantly by the type of construction activity. Furthermore, the greater the degree of material prefabrication correlated to a greater number of required off-site hours.

These previous studies which are summarized in Appendix3 will be used as the main references to differentiate the characteristics of the three kinds of construction projects conducted by the government funding program.

3. Data and Methodology

3.1. The Data

This study primarily used data from two institutions; information regarding construction activities was obtained from the Ministry of Public Works in Indonesia about three infrastructure projects, which are : Jatigede dam project, Suramadu bridge project, and Cimahi II modest rental apartment project. Whilst secondary data consists of Indonesia I-O Table 2005 and *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI) 2005 as sector classification reference are obtained from Central Bureau of Statistics Indonesia. In the employment impact analysis, the I-O Table will be aggregated to 9 sectors following the data available on the employment in Indonesia.

3.2. The Methodology

In this study, two steps are used in the methodology. First, cost elements in the construction projects are analysed by the Project Utilization Method. Using this method, costs are broken down for each project. Second, the IO model is used to derive the induced effect resulting from changes in final demand (i.e. government infrastructure projects) to assess the output generated by each project.

3.2.1. Project Utilization Process

Suppose that in the beginning of a project, the government-sector as a user formulates Engineer Estimates (EE), which list all of the necessary cost elements to produce one type of construction project. Each cost element will be comprised of a coefficient quantity, as well as unit measurement and total unit price for each item. (see Appendix4). The unit prices in the EE will be used in this research as a contracted price for both parties (government and the contractor).

Using the example of EE in the appendix4, let *Qu* become the quantity coefficient of cost elements used, which is determined in EE and Pc as the price for those cost elements, the basic equation of total unit prices can be obtained for each working item corresponding with EE as :

$$Un = Qu.Pc \qquad (1)$$

Afterwards, let Qc become the quantity needed in implementation, and Un in equation 1 as the total unit price of each cost element, then a determination can be made about resources used in each unit element for the production of single construction work. This is represented as:

$$R = Qc.\ Un \qquad (2)$$

Further, in the other production processes of construction, the same element or resources are used. This means that there will be overlap in the resources used in some production processes, so the same resources must be analysed as one group. So, R will consists of $R_1, R_2, R_3,...Rk$ in various production processes. Summarizing group Rk will result in the total monetary value of the group, notated as Vk, with equation :

$$Vk = \Sigma\ Rk \qquad (3)$$

Because naming conventions of resources used in construction are not the same as the I-O Table sectors, adjustments must be made using classifications to match these two areas. The KBLI 2005 assists in classifying the construction resources used in the attachment to the I-O Table. The process is given in Figure2 Appendix2.

The matching-principle in the I-O Table will provide information on which economic sectors are utilized in each construction project denote as *Li* with the properties of all economic sectors in the I-O Table that are not correlated with this project is set to 0. In matrix form, the equation will be:

$$M = \begin{bmatrix} Li \end{bmatrix} \qquad (4)$$

The composition in this vector matrix is primarily consist of the type of material and equipment cost elements related in the construction project. Whilst for the economic sector that directly corresponds to the labor used in that project, which named Salary and Wages sector, could also lead to the change in output through the consumption change by the use of wages paid to the labor.

The labor that related to construction activity can be divided into two part. First, total labor at the construction site (on-site labor), second, total employment linked to manufacturing, selling, and transporting materials, equipment, and supplies (off-site labour). *(Ball:1981)*. Correspond with that fact, we can note the on-site labor wages paid by $\Sigma\ Wi$. From that wages paid, we could determine the household consumption change vector matrix (ΔC) using the ratio of consumption composition from the I-O Table. Whilst for the off-site labor impact on the economy can be determined using the income and/or employment multiplier derived from the I-O Table. The on-site procedures are depict in notation as :

$$\begin{bmatrix} HH'_i \end{bmatrix} = HH_i \; / \; \Sigma HH_i$$

where : HH' = vector matrix of ratio of consumption composition
HH = household consumption in sector i
Σ HHi = total household consumption in the final demand

$$\Delta C = \begin{bmatrix} HH'_i \end{bmatrix} . \Sigma W_i \quad ....(5)$$

where : ΔC = vector matrix of the change in consumption due to the construction project
Σ Wi = total wages paid from the construction project

3.2.2. Input-Output Model

To determine the effect of final demand change to total output, the open model of IO is used as :

$$X = (I\text{-}A)^{-1}.Y \qquad ......\ (6)$$

where : X = Total Output in the economy
$(I - A)^{-1}$ = Leontief Inverse
Y = Final Demand

Output created in the economy can be obtained by using Equation6, treating government spending as change in the final demand. Suppose that in the final demand change from government infrastructure projects, *Y* could be substituted with vector matrix *Li* and *ΔC (Equation4 and 5)* to obtain total induced output as :

$$\Delta Fd = \begin{bmatrix} Li \end{bmatrix} \text{ and } \begin{bmatrix} \Delta C \end{bmatrix} \Longrightarrow \quad X' = (I - A)^{-1}. \begin{bmatrix} Li \end{bmatrix} \qquad (7a)$$

$$X'' = (I - A)^{-1}. \begin{bmatrix} \Delta C \end{bmatrix} \qquad (7b)$$

Furthermore, additional income for the community, due to a change in final demand, could be caused by contrasting the proportion of the production sector to the salary and wages paid. In line with these output changes, additional production will also generate the proportion of employment creation. To capture these phenomena, income and/or employment multipliers can be used, derived from the I-O Table.

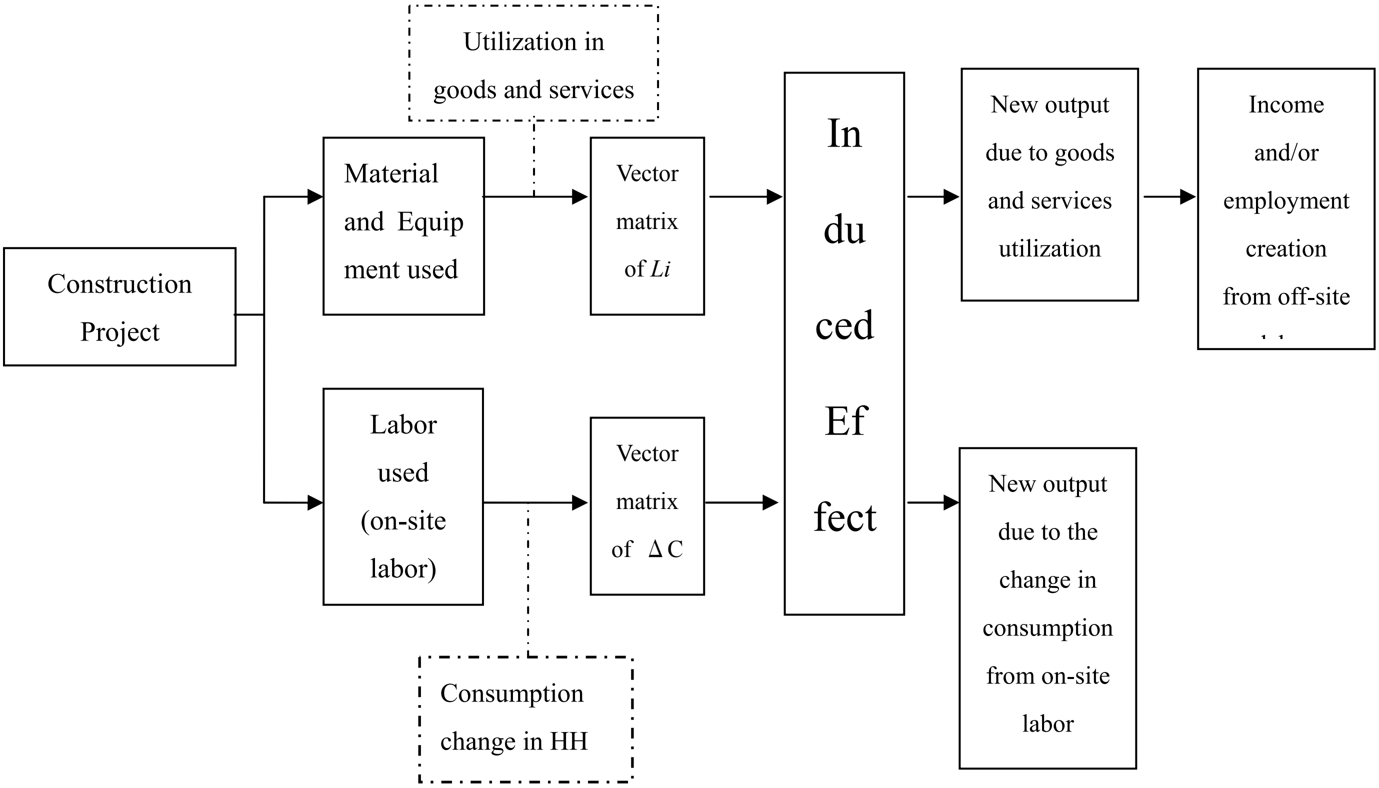
In general, using $m(h)_j$ as the simple household income multiplier for sector j, results in :

$$m(h)_j = \sum_{n}^{i=1} a_{n+1,i} l_{ij} \quad \ldots\ldots (8)$$

Using this income multiplier and incorporated with the total output change from the induced effect (Equation7) will result the income and/or employment creation from the induced effect in correspond with the off-site labor requirement as :

$$\boldsymbol{m' = X'.\, m(h)_j} \qquad \ldots\ldots (9)$$

Overall, the framework of methodology to assess the output, income and/or employment generation after the presence of induced effect can be figured as follow :



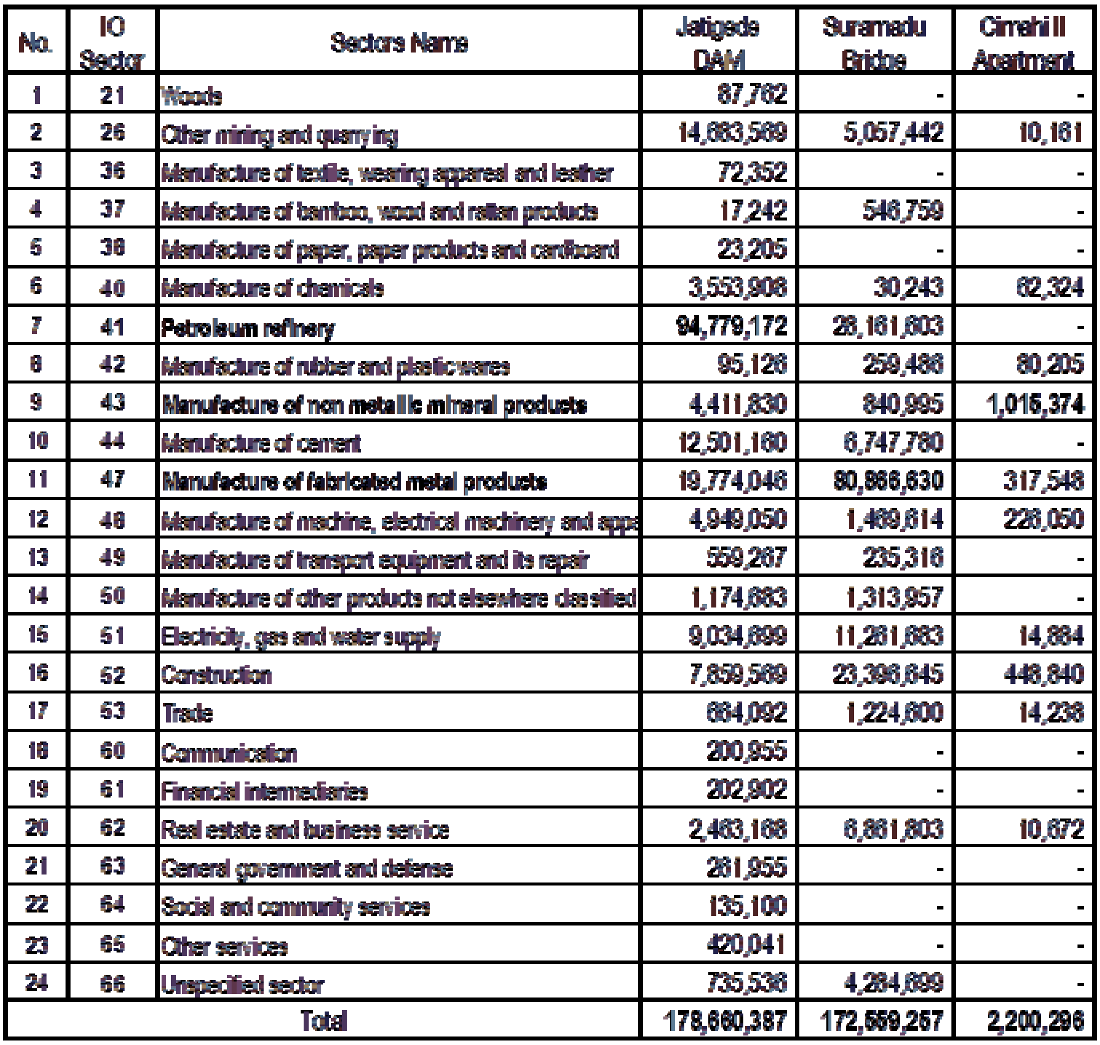
Source : Author analysis

4. Result and Analysis

4.1. Typical Characteristic of Each Project

The utilization process conducted in this study will depict the tendencies of each project in term of the resources used in its implementation. As illustrate in Table2 which depicts the vector matrix of *Li,* the largest sector supporting this construction is the Petroleum Refinery sector in the amount of US$ 94,779,172. This was caused by the massive use of heavy vehicles in the implementation of the project, which necessitated

Table2. Vector matrix of Li



No.	IO Sector	Sectors Name	Jatigede DAM	Suramadu Bridge	Cimahi II Apartment
1	21	Woods	87,762	-	-
2	26	Other mining and quarrying	14,683,569	5,057,442	10,161
3	36	Manufacture of textile, wearing apparel and leather	72,352	-	-
4	37	Manufacture of bamboo, wood and rattan products	17,242	546,759	-
5	38	Manufacture of paper, paper products and cardboard	23,205	-	-
6	40	Manufacture of chemicals	3,553,908	30,243	62,324
7	41	**Petroleum refinery**	**94,779,172**	28,161,603	-
8	42	Manufacture of rubber and plastic wares	95,126	259,486	80,205
9	43	**Manufacture of non metallic mineral products**	4,411,830	840,995	1,016,374
10	44	Manufacture of cement	12,501,160	6,747,780	-
11	47	**Manufacture of fabricated metal products**	19,774,046	80,866,630	317,548
12	48	Manufacture of machine, electrical machinery and app	4,949,050	1,469,614	228,050
13	49	Manufacture of transport equipment and its repair	559,267	235,316	-
14	50	Manufacture of other products not elsewhere classified	1,174,683	1,313,957	-
15	51	Electricity, gas and water supply	9,034,699	11,281,683	14,884
16	52	Construction	7,859,569	23,396,645	448,840
17	53	Trade	664,092	1,224,600	14,238
18	60	Communication	200,955	-	-
19	61	Financial intermediaries	202,902	-	-
20	62	Real estate and business service	2,463,168	6,861,803	10,672
21	63	General government and defense	261,955	-	-
22	64	Social and community services	135,100	-	-
23	65	Other services	420,041	-	-
24	66	Unspecified sector	735,536	4,284,699	-
Total			178,660,387	172,559,257	2,200,296

substantial use of gasoline from the Petroleum Refinery sector.

Whilst in the Suramadu bridge project, the manufacture of fabricated metal products was the largest supporting sector, totalling US$ 80,866,630, as bridge construction consumes more steel fabrication in its implementation. Moreover, the implementation of Cimahi II apartment project was largely supported by the manufacture of non-metallic mineral products, totalling US$ 1,015,374. This project is associated with the use of precast structures (i.e. precast columns and blocks), which are provided by Manufacture of structural cement and lime plaster products, classified as the Manufacture of non-metallic mineral products in I-O Table 2005.

These utilization of economic sectors as the primary need in the accomplishment of that construction can be seen as the characteristic of each project. The dam type project will utilize more gasoline, the bridge type project will consume more steel structures, and the building type project will employ more precast fabrication structures.

4.2. Total Output Gained From The Induced Effect

The total induced outputs from construction project are resulted from two channels, which are from the evaluation of the vector matrix Li, and vector matrix ΔC. Table3 will illustrate the top 10 highest sectors in the economy after the induced effect due to the utilization of capital goods (material and equipment) projects. On the other hand, Table4 will depict the economic impact caused by the change in household consumption from on-site labor paid.

In the Jatigede Dam project, as seen in Table3, the Petroleum refinery sector will be most affected by the induced effect, in the amount of US$ 105,016,000; which represents 33.7% of the output gain. Whilst for Suramadu bridge project, Manufacture of fabricated metal products is the most affected sector, in the amount of US$ 86,638,000, or 24.3% of all resulting output. Meanwhile, in the Cimahi II apartment project, Manufacture of non-metallic mineral products yields the highest return, US$ 1,061,000 or 22.7% of all output resulted.

Moreover, the total output change due to the household consumption in Table4, the affected sectors are the same in all project. The highest sector affected is Trade sector comprise for US$ 5,252,536; US$ 3,189,697 and US$ 1,263 for Jatigede dam project, Suramadu bridge project and Cimahi II apartment project respectively.

In order to identify which kind of infrastructure project that will generate more output alleviation in the economy, identification of the total output ratio from each project, before and after the induced effect is necessary. From Table5, it can be concluded that the Cimahi II apartment project (or typical building construction of this type) has the highest output ratio of the three construction types.

Table3. Top 10 List of Total Output Gained After The Induced Effect due to utilization of capital goods & services

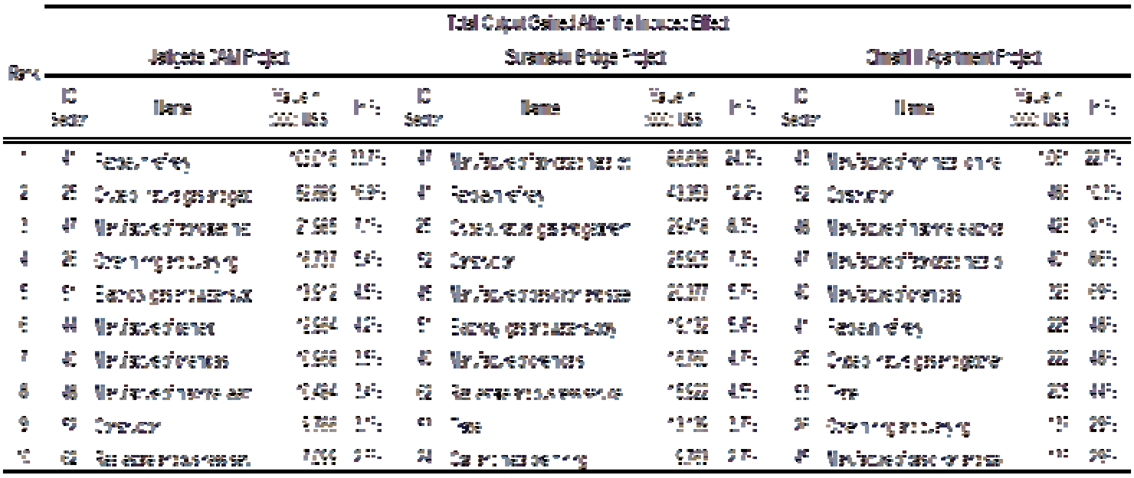
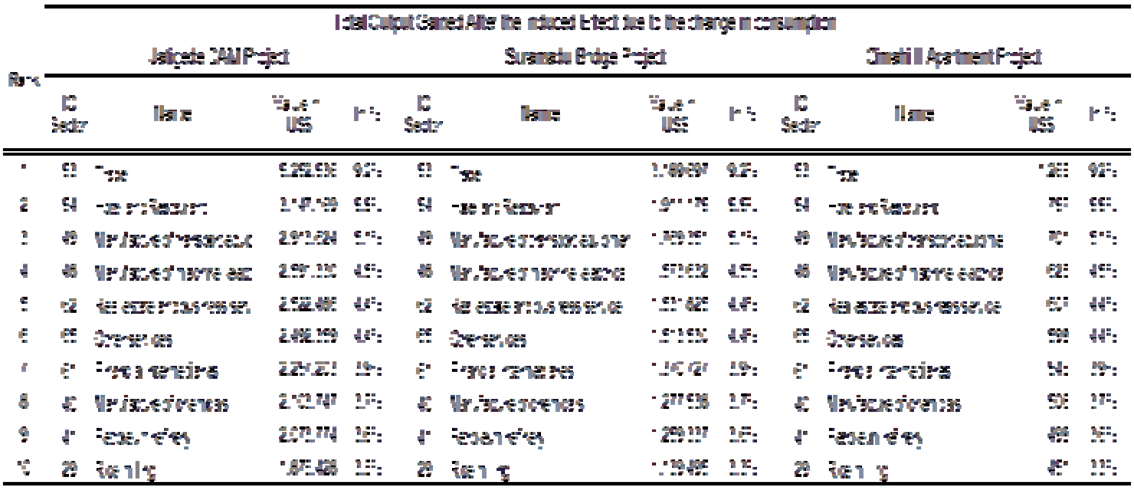


Table4. Top 10 List of Total Output Gained After The Induced Effect due to change in household consumption of on-site labor



With a final demand change of US$ 2,200,296 it results in total output of US$ 4,669,503, or a ratio of 2.102 from final demand change. This output is higher than the Suramadu bridge project, which has a ratio of 2.066 for total output, and 0.379 higher than the ratio of the Jatigede Dam Project.

Meanwhile, the ratio of output created due to the consumption change from the use of wages by on-site labor in construction project are the same in each project for 1.936

to final demand change. These results only differ in its value with the Jatigede dam project provide more output for US$ 57,256,603.

Table5. Comparison of the Total Output Created Through The Induced Effect

Description	Infrastructure Projects from Government Sector		
	Jatigede DAM	Suramadu Bridge	Cimahi II Apartment
Change in final demand from goods and services utilization	178,660,387	172,559,257	2,200,296
Change in final demand from household consumption	29,577,514	17,961,478	7,113
Output after the induced effect from goods and services utilization	311,470,356	356,580,629	4,669,503
Output after the induced effect from household consumption	57,256,603	34,770,104	13,770
Ratio of output created from goods and services utilization to ΔFd	1.743	2.066	2.122
Ratio of output created from HH consumption to ΔFd	1.936	1.936	1.936

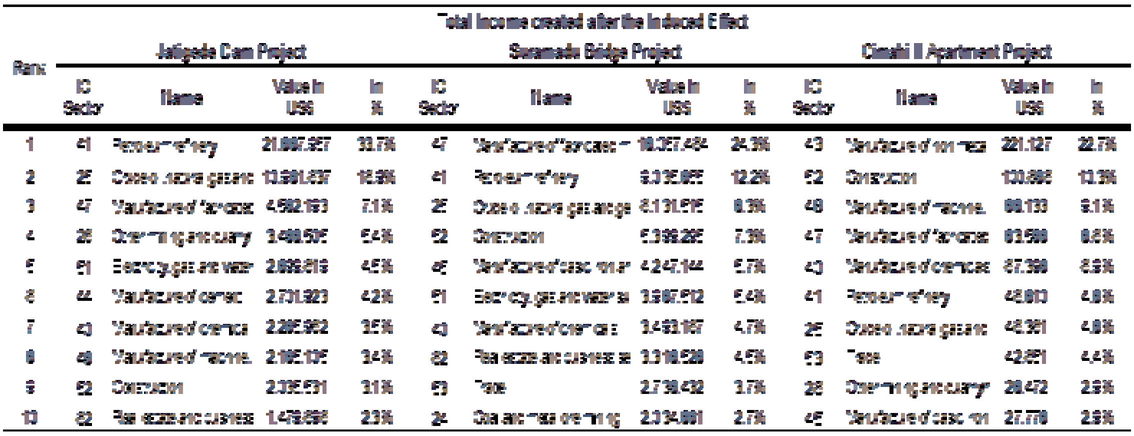
The larger output creation in this building type construction is likely due to a higher utilization of the manufacturing sectors, in this case, Manufacture of non-metallic mineral products. The manufacturing sector, in many studies, is seen to promote overall productivity growth (*Dasgupta and Singh: 2006; Atesoglu: 1993; Felipe: 1998*). In light of this, the increased use of inputs from the manufacturing sector in construction activity would likely encourage more output in the economy.

4.3. Total Income Generated After The Induced Effect

The mechanism of income creation in the IO relationship identifies household income as the wages or salary of an off-site employee, which is, in fact, a proportion of each sector's output. The induced effect from the utilization of goods and services in construction sector will increase output in sector *i*, some portion of which will pay wages or salaries. The simple household multiplier can be determined for each economic sector. These are then multiplied with output gained from the induced effect.

Referring to the Table6, related to the Jatigede Dam project, the Petroleum Refinery sector shows the highest proportion of income created, at US$ 21,887,957; 33.7 % from all the income gained. For the Suramadu bridge project, the Manufacture of fabricated metal products sector also receives the most benefit in income creation, at US$ 18,057,464, 24.3% of all income generated. Whilst, in the Cimahi II apartment project, Manufacture of non-metallic mineral products is the highest yielding sector, reaching US$ 221,127 or 22.7% of all income.

Table6. Top 10 List of Total Income Created After The Induced Effect



Rank	Total Income created after the Induced Effect											
	Jatigede Dam Project				Suramadu Bridge Project				Cimahi II Apartment Project			
	IO Sector	Name	Value in US$	In %	IO Sector	Name	Value in US$	In %	IO Sector	Name	Value in US$	In %
1	41	Petroleum refinery	21,887,957	33.7%	47	Manufacture of fabricated m	18,057,464	24.3%	43	Manufacture of non-meta	221,127	22.7%
2	25	Crude oil, natural gas and	10,981,637	16.9%	41	Petroleum refinery	9,035,055	12.2%	52	Construction	130,695	13.3%
3	47	Manufacture of fabricated	4,592,163	7.1%	25	Crude oil, natural gas and ge	6,131,515	8.3%	48	Manufacture of machine	88,133	9.1%
4	26	Other mining and quarry	3,490,505	5.4%	52	Construction	5,396,285	7.3%	47	Manufacture of fabricated	83,598	8.6%
5	51	Electricity, gas and water	2,898,819	4.5%	45	Manufacture of basic iron ar	4,247,144	5.7%	43	Manufacture of chemicals	67,390	6.9%
6	44	Manufacture of cement	2,731,923	4.2%	51	Electricity, gas and water su	3,987,512	5.4%	41	Petroleum refinery	46,803	4.8%
7	43	Manufacture of chemica	2,285,962	3.5%	43	Manufacture of chemicals	3,493,167	4.7%	25	Crude oil, natural gas and	46,301	4.8%
8	48	Manufacture of machine	2,195,135	3.4%	62	Real estate and business se	3,310,528	4.5%	53	Trade	42,851	4.4%
9	52	Construction	2,035,531	3.1%	53	Trade	2,738,432	3.7%	26	Other mining and quarry	28,472	2.9%
10	62	Real estate and business	1,478,696	2.3%	24	Coal and metal ore mining	2,034,881	2.7%	45	Manufacture of basic iron	27,778	2.9%

To determine which type of construction projects that will generate more income than others; a calculation must be made concerning the ratio of change in final demand due to utilization of goods and services to subsequent income. In result, as seen on Table7, the highest income ratio after the induced effect is achieved by the Cimahi II apartment project. Comprising a final demand change of US$ 2,200,296 to a created income of US$ 973,242, this project increases 0.44 incomes in the society. The ratio of the other two projects accounted for 0.43 in the Suramadu bridge project and 0.36 in the Jatigede dam project.

Table7. Comparison of the Total Income Created After The Induced Effect

Description	Infrastructure Projects from Government Sector		
	Jatigede DAM	Suramadu Bridge	Cimahi II Apartment
Change in final demand from goods and services utilization	178,660,387	172,559,257	2,200,296
Income created after the induced effect	64,918,268	74,320,385	973,242
Ratio of income created after induced effect to ΔFd	0.36	0.43	0.44

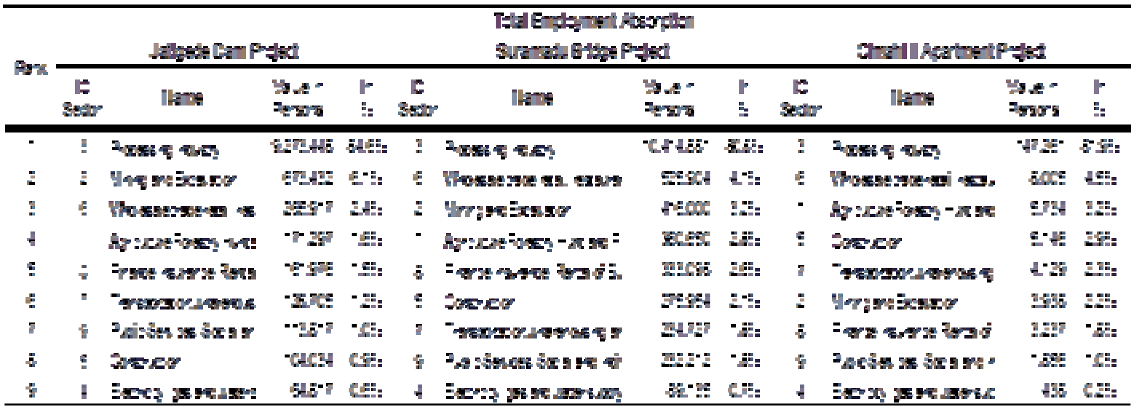
From this result, the higher degree of utilization on manufacture sectors seems to be the reason why the Cimahi II apartment project is expected to generate more income. With the presence of manufacture process, there will be higher value added created and eventually could alleviate the income in the society.

4.4. Total Employment Created After The Induced Effect

As final demand in the construction sector increases due to government programs, there exists a proportional connection between outputs produced and the amount of employment used in each sector (i.e. off-site labor). In contrast to previous income calculations, however, in this case, physical measurement is used in the unit analysis. Before the employment multiplier is calculated, the I-O Table 2005 should be aggregated to 9 sectors, adjusted to the employment data available for Indonesia.

The result in Table8 depicts that the Processing industry sector is the highest employment creator due to the induced effect. Off-site employment absorption in the Processing industry varies between the three projects. This sector shows total employment generation of 84.6%, 80.8%, and 81.9% for the Jatigede Dam project, Suramadu bridge project, and Cimahi II apartment project, respectively.

Table8. Employment Creation After The Induced Effect



	Total Employment Absorption											
Rank	Jatigede Dam Project				Suramadu Bridge Project				Cimahi II Apartment Project			
	IO Sector	Name	Value Persons	In %	IO Sector	Name	Value Persons	In %	IO Sector	Name	Value Persons	In %
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

As for the ratio of change in final demand to employment absorption, given in Table9, the increase in employment creation can be seen most clearly in the Cimahi II apartment project. With a change in final demand of US$ 2,200,296, this project will generate 179,745 employees or 0.08 in its ratio. This is higher than the two other projects, which account for 0.07 for the Suramadu bridge project, and 0.06 for the Jatigede Dam project.

Table9. Comparison of Total Employment Created After The Induced Effect

Description	Infrastructure Projects from Government Sector		
	Jatigede DAM	Suramadu Bridge	Cimahi II Apartment
Change in final demand from goods and services utilization	178,660,387	172,559,257	2,200,296
Off-site employment generated after the induced effect	10,957,444	12,882,560	179,745
Ratio of employment created after induced effect to ΔFd	0.06	0.07	0.08

One explanation of the higher ratio for the Cimahi II apartment project, or building-type projects in general, is that this kind of project utilizes more manufacture sector resources in its realization. As stated by *Ball (1981)*, generally, the greater the degree of prefabricated materials used, or the more inclusion of built-in equipment (i.e. precast fabrication in the Cimahi II apartment project), the more costs and manufacturing hours will increase. The increased demand in output would likely promote additional employment in the Manufacturing sector.

In summary, as illustrate in appendix5, the Cimahi II apartment project, as representative of all similar building projects, is performing well in overall economic indicator. For the output ratio, it creates 2.122 higher than the other two projects. Further, this project also induces more on income and employment absorption with a ratio of 0.44 in income generation and 0.08 in employment creation. This overall performance seemingly indicates that the more construction sector utilize manufacture sectors, the economic alleviation would likely also higher.

5. Conclusions And Policy Implications

5.1. Conclusions

The construction sector in the economy is seen as the root of national productivity. Indonesia, as do many other developing countries, considers this area the best way to stimulate economic output. Using three examples of government infrastructure projects, the varying impact of such project implementation can be examined.

According to the results of this analysis, the provision of building-type infrastructure project will benefit more for the economy since it has better performance on output, income and employment generation. This fact can also be referred as the construction project which has strong dependency in the products with higher value added coming from manufacture process would likely to enhance the economy as a whole. This phenomenon shows that this type of project should be considered the best option to maximize all possible economic impact created through one project.

5.2. Policy Implication

Without ignoring the necessity of other construction project, the accentuation of this kind infrastructure project will help the policy maker to gain more economic development, since this project work in the same path with the development of industry or manufacture sector.

One policy suggested in regard with the necessity of strong interdependency between manufacture sector and construction sector is to give some incentives for the contractor to use more local contents of manufacture products in the construction activity. This policy will help the conservation of certain industry in that region and eventually create better development in the economy.

References

Ball, R.(1981).Employment Created by Construction Expenditures. *Monthly Labor Review104* (12), 38-44.

Bon, R.(1988).Direct and Indirect Resource Utilisation by the Construction Sector, The case of the USA since World War II. *Habitat Intl. 12*(1).

Crosthwaite, D.(2000).The Global Construction Market: a Cross Sectional Analysis. *Construction Management and Economics18,* 619-627.

Dasgupta, S.and Singh, A. (2006). Manufacturing, Services and Premature Deindustrialization in Developing Countries, A Kaldorian Analysis. Retrieved from http://www.wider.unu.edu/stc/repec/pdfs/rp2006/rp2006-49.pdf.

Felipe, J. (1998).The role of the manufacturing sector in Southeast Asian development: a test of Kaldor's first law. *Journal of Post Keynesian Economics* , Vol. 20, No. 3 (Spring, 1998), pp. 463-485.

Ganesan, S.(1979).Growth of Housing and Construction Sectors: Key to Employment Creation. *Progress in Planning* Volume 12, Part 1, 1979, Pages 1-79.

Hubacek, K., Erickson, J., and Duchin, F. (2002). Input–output modeling of protected landscapes: the Adirondack Park.*The Review of Regional Studies32*(2), 207–22.

H. Sonmez Atesoglu (1993).Manufacturing and Economic Growth in the United States.*Applied Economics*, *25*, 67-69.

Miller, R. and Blair, P. (2009). Input-Output Analysis: Foundations and Extensions (2nd ed.).New York: Cambridge University Press.

Nazara, S. (2005). Analisis Input-Output.Jakarta, Indonesia: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia.

United Nations Department of Economic and Social Affairs. (1999). Handbook of Input-Output Table Compilation and Analysis (Series F No. 74). New York: United Nations.

Wang, J. and Charles, M. (2010). IO Based Impact Analysis: A Method for Estimating the Economic Impacts by Different Transport Infrastructure Investments in Australia : *Australasian Transport Research Forum*. Canberra, Australia. Retrieved from http://www.atrf.info/papers/2010/2010_Wang_Charles.pdf.

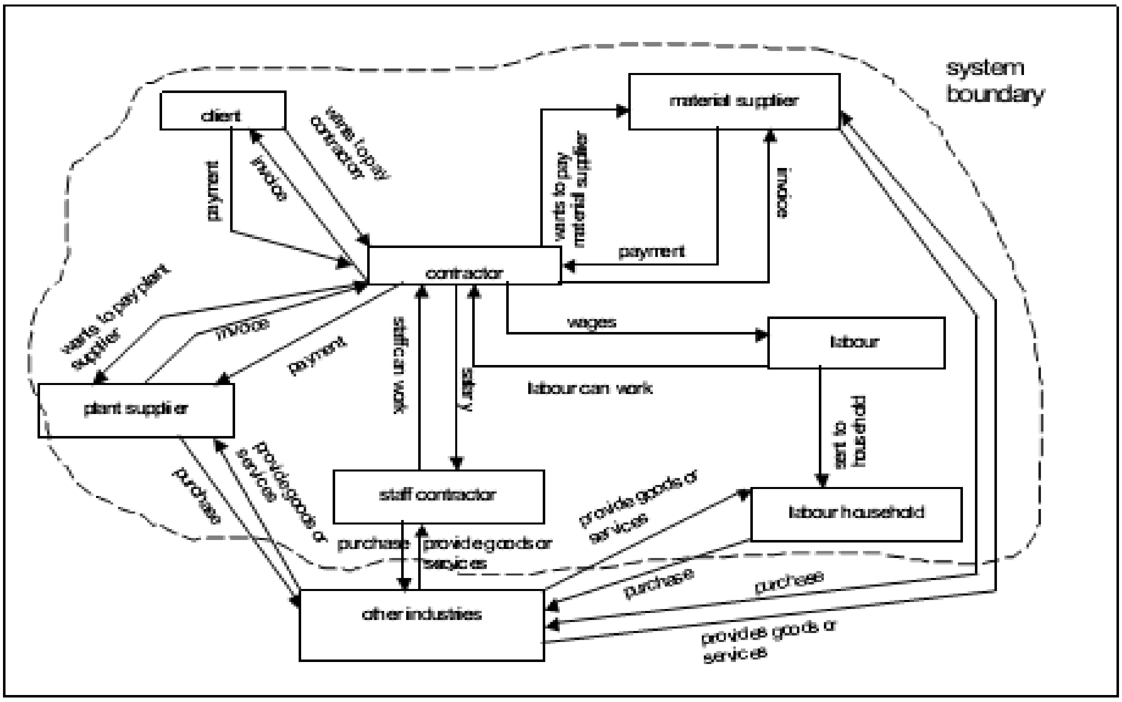
Wibowo, A, (2009). The Contribution Of The Construction Industry To The Economy Of Indonesia: A Systemic Approach. Retrieved from http://eprints.undip.ac.id/387/1/Agung_Wibowo.pdf

Wibowo, M.and Mawdesley, M. (2004).The Effects Of The Construction Process On The Local Economy In Indonesia. *Media Komunikasi Teknik Sipil,* Volume 12, No. 3, Edisi XXX Oktober 2004.

Yat-Hung, C., Eddie, W., and Cheng, B. (2006).Examining repercussions of consumptions and inputs placed on the construction sector by use of I-O Tables and DEA. *Building and Environment 41*, 1–11.

Appendix1：

Figure 1.Cyclical Flow In Construction Sector



Source：Wibowo, M.A.and M.J. Mawdesley. 2004

Appendix2：

Figure2. The Matching Principle in I-O Table

Vk ⇨ **KBLI 2005** ⇨ **I-O Table 2005**

Classified with Attached to

Appendix3. Summary of previous studies

No.	Author	Title	Methodology	Result
1	Jian Wang and Michael B. Charles (2010)	*IO Based Impact Analysis: A Method for Estimating the Economic Impacts by Different Transport Infrastructure Investments in Australia*	Using IO simulation with different type of transport investment with two measurement : - Price impact - Economy wide impact	1. The rail and water transport sectors resulted in a significant change in sectoral prices in the resource and energy sectors throughout the economy 2. The agricultural sectors were among the sectors that would experience significant changes in sectoral prices in the event of a change in the road and air transport input prices
2	Bon, Ranko (1988)	*Direct and Indirect Resource Utilisation by the Construction Sector, The case of the USA since World War II*	- Comparative analysis of six US input-output tables compiled since World War II - Classified in two groups: (1) indicators taken directly from direct-input or direct-output and total-input or total-output coefficient matrices, and (2) ratios formed from the raw data.	- Exist complex interdependence between the construction sector and its main suppliers and clients; manufacturing, services, and trade and transportation sectors - The secular decline of the manufacturing sector and the growth of services in the US strongly affects the construction sector, which purchases a large proportion of its input from manfacturing and sells a large proportion of its intermediate output to services.
3	Chiang,Yat-Hung ; Eddie W.-L. Cheng, Bo-Sin Tang (2006)	*Examining repercussions of consumptions and inputs placed on the construction sector by use of I–O tables and DEA*	Incorporating the DEA method into I–O table to : examine the relative degree of reliance of the construction sector in terms of demands so that it is able to disclose the consumption pattern for construction; and examine the relative degree of reliance of the construction sector on other sectors in terms of inputs so that it is able to reveal the production factors for the construction sector	Using I–O tables of Japan for the year of 2000 they found : - the construction and the real estate sectors did not rely much of its business on intermediate demands as compared to other sectors - the construction sector has a more substantial role in providing products for final demands than intermediate demands - construction products were produced efficiently by the use of inputs from various sectors (i.e. capital intensive economy)
4	Ganesan, S (1979)	*Growth of Housing and Construction Sectors: Key to Employment Creation*	Using the data obtained from the surveys of the building materials and construction industries in Sri Lanka during 1974-1975 from 88 construction projects. With this data, he compiled 23 different inputs absorbed by 20 different construction sub-sectors to create the IO Table that he used to derive the principal construction indicators in Sri Lanka	The differences in employment absorption could arise from the choice of materials in design, materials that are locally produced or imported and the choice of techniques used in the construction
5	Ball, Robert (1981)	*Employment Created by Construction Expenditures*	The construction process is broken down to the cost distribution elements such as labour costs, material costs, overhead and profit and correspond it to the IO Table.	1. The onsite occupational requirements and also the materials, equipment, and supplies are varying significantly by the type of construction activity 2. The offsite labour requirements, the greater the degree of prefabrication of materials used lead to the greater number of offsite hours required

Appendix4：Example of Engineer's Estimate (EE) in Suramadu bridge project

BOQ Item No.	**6.3.2b**	Unit	m2	Qty	**18,000.00**	Tot. Unit Price (Rp)	126,700.86
Construction Work	**Asphalt concrete WC for surface 8cm**					Local Currency %	100.00
Unit Rate	–	Foreign	126,700.86		Local	Foreign Currency %	–
No.	Description of Cost Element	Quantity	Unit	Price / Unit		Total Price	
				Local	Foreign	Local	Foreign
A.	DIRECT COST						
1	Labour Cost						
	Labour	0.0120	day	61,589.55		739.07	–
2	Material Cost						
	Bitumen	0.01010	ltr	3,048,100.00		30,785.81	–
	Other Material Cost	39.68000	ls	1,613.70		64,031.62	–
3	Machinery cost						
	Air compressor	0.00060	shift	1,667,490.00		1,000.49	–
	Asphalt Mixing Plant	0.00080	shift	9,449,110.00		7,559.29	–
	Asphalt paver	0.00080	shift	3,406,700.00		2,725.36	–
	Roller	0.00160	shift	3,048,100.00		4,876.96	–
	Dump truck	0.00080	shift	3,137,750.00		2,510.20	–
	Generator	0.00080	shift	1,192,250.00		953.80	–
	Small tools & devices	–				–	–
B.	Sub Total					115,182.60	–
	Overhead					11,518.26	–
	Unit Cost					126,700.86	–

Appendix5：Comparison of Overall Project Performance

Description	Jatigede DAM	Suramadu Bridge	Cimahi II Apartment
Change in final demand from goods and services utilization	178,660,387	172,559,257	2,200,296
Change in final demand from household consumption	29,577,514	17,961,478	7,113
The output sector that has gained most after the induced effect	Petroleum refinery (41) *105,015,892*	Manf. of fabricated metal products (47) *86,637,627*	Manf. of non metallic mineral products (43) *1,060,941*
Output after the induced effect from goods and services utilization	311,470,356	356,580,629	4,669,503
Output after the induced effect from household consumption	57,256,603	34,770,104	13,770
Ratio of output created from goods and services utilization to ? Fd	1.743	2.066	2.122
Ratio of output created from HH consumption to ? Fd	1.936	1.936	1.936
Total income created after the induced effect	64,918,268	74,320,385	973,242
Most sector that has advantage in the income generation after induced effect	Petroleum Refinery (41) *21,887,957*	Manf. of fabricated metal products (47) *18,057,464*	Manf. of non metallic mineral products (43) *221,127*
Ratio of income created after induced effect to ? Fd	**0.36**	**0.43**	**0.44**
Total off-site employment generated after the induced effect	10,957,444.26	12,882,560.03	179,744.52
Most sector that has advantage in the employment creation after induced effect	Processing Industry (3) *9,273,448 person*	Processing Industry (3) *10,414,881 person*	Processing Industry (3) *147,261 employee*
Ratio of employment created after induced effect to ? Fd	**0.06**	**0.07**	**0.08**