

ECONOMIC BASE ANALYSIS OF WATER, ENERGY, AND FOOD RELATED SECTORS: A CASE OF WEST JAVA PROVINCE

ANALISIS BASIS EKONOMI SEKTOR TERKAIT AIR, ENERGI, DAN PANGAN: STUDI KASUS PROVINSI JAWA BARAT

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ABSTRAK

Air, energi, dan pangan adalah sektor yang krusial untuk dibangun karena peran pentingnya bagi kehidupan manusia. Ketersediaan, keterjangkauan, dan kualitas dari ketiga komoditas tersebut harus dapat dipastikan bagi seluruh masyarakat disuatu daerah. Penelitian ini dilaksanakan untuk mempelajari keberadaan sektor-sektor pembangunan khususnya yang terkait air, energi, dan pangan dibandingkan dengan sektor lainnya di Provinsi Jawa Barat dengan menggunakan salah satu pendekatan ekonomi basis yaitu metode Location Quotient (LQ). Dengan menganalisis Produk Domestik Regional Bruto (PDRB) Provinsi Jawa Barat (2011-2015) berdasarkan harga konstan tahun 2010 menurut lapangan usaha, sektor basis dan non-basis di Jawa Barat dapat diketahui. Hasil penelitian menunjukkan bahwa metode sederhana LQ statis, LQ dinamis, dan grafik competitive cluster cukup efektif untuk menggambarkan kondisi umum sektor pembangunan di Jawa Barat. Hasil analisis juga menyebutkan bahwa umumnya sektor dan sub-sektor air, energi dan pangan berada di kuadran III dan IV, yang mengindikasikan bahwa langkah-langkah serius harus diambil oleh pemerintah daerah khususnya, untuk meningkatkan produksi dari tiga sektor vital tersebut. Upaya terintegrasi diharapkan mampu menjaga ketersediaannya ditahun-tahun mendatang. Kombinasi pendekatan dan hasil studi ini diharapkan dapat membantu pemerintah daerah dan stakeholder di Provinsi Jawa Barat dalam melakukan evaluasi pendahuluan, khususnya dalam upaya meningkatkan ketahanan sektor air, energi, dan pangan di daerah ini.

Kata Kunci: location quotient, sektor basis, sektor non-basis, ketahanan air, energi, dan pangan, provinsi jawa barat, produk domestik regional bruto

ABSTRACT

Water, energy, and food are crucial sectors to be developed due to their importance for human life. The availability, accessibility, and quality of those three commodities have to be ensured for the whole people in a region. This research was conducted to evaluate the existence of water, energy and food-related sectors compare with other sectors in West Java Province by using one of economic base approaches so-called Location Quotient (LQ) method. By analysing gross regional domestic products (GRDP) year 2011-2015 at constant 2010 market prices by industrial origin, basic and non-basic sectors have been determined. The results show that the static and dynamic location quotient (SLQ & DLQ) analysis and competitive cluster chart were effective to figure out general situation and characteristic of basic and non-basic sectors in this region. Additionally, water, energy, and food-related sectors are mostly positioned in quadrant III and IV, indicating that serious actions have to be taken particularly by local government to increase production of those basic commodities. Integrated measures are expected to maintain their availability in the forthcoming years. This composite approach is expected to assist local government and stakeholders in undertaking preliminary evaluation in particular water, energy and food sectors to improve their security.

Keywords: location quotient, basic sector, non-basic sector, water-energy-food security, west java province, gross regional domestic product (GRDP)

INTRODUCTION

In the recent global situation, the existence of water, energy, and food (W-E-F) are crucial and irreplaceable for the human being. Integrated management practices of those three components are needed to ensure its availability, accessibility, and quality. Indonesian government has shown strong

commitment to overcome challenges in water, energy, and food security by assigning several related targets in its mid-term national development planning (RPJMN) year 2014-2019 (Bellfield et al., 2016). However, in a decentralized system, it can only be an effective way if the target's achievement is fully supported by each local government both provincial and city/regency level.

In the regional development planning, the concept of economic base approach is prominent for the government to understand correctly which sectors mainly contribute to the economic growth. Although the theory of economic base is a kind of reality simplification, as well as other theories, it can be applied to analyse and evaluate the processes of economic development and its strategies (Wang & Hofe, 2007). The main assumption of the economic base theory is that all economic activities in an area can be classified into basic and non-basic industries or activities (Wang & Hofe, 2007). The basic sector is defined as the sectors that composed by local businesses and resources, has a dependency upon external factors, and the products are used both for domestic and to be exported to another area (Juleff, 1993). On the other hand, the non-basic sector is described as the sectors that has a dependency upon local business and resources but its products mostly used locally. The evaluation of basic or non-basic sector in a local region will give better understanding and insights for government in setting the goals and spending its budget. There are four basic techniques in economic base analysis that can be used, especially if the availability of data becomes obstacles in using complex economic analysis, i.e. survey method, assumption method, location quotient, and minimum requirement method (Wang & Hofe, 2007). According to Leigh (1970), the best measure to determine basic and non-basic sector is primary surveys to each economic activities in a region. Nevertheless, it will be very difficult and costly, in particular for a wide region (Leigh, 1970; Brodsky & Sarfaty, 1977).

The main purpose of this research is to evaluate the existence of water, energy, and food related sectors compare to other sectors in economic development process in West Java Province. The objective has been

reached by employing LQ techniques and competitive cluster chart analysing *gross regional domestic product (GRDP)* data year 2011-2015 of West Java Province, and be compared to gross domestic product (GDP) of Indonesia in the same period. This paper begins with introduction section. The second section will give a brief overview of the study area, while Section 3 is concerning with methodology applied in this research. Computational results will be discussed and reported in section 4. Finally, section 5 summarizes findings and draws the conclusion of this research.

STUDY AREA

West Java is a province in Indonesia with the largest number of population in 2015 (46.7 million inhabitants). The total area is reaching 35,377.76 km², and recently it is divided into 18 regencies and 9 cities. It is situated geographically between 104°48' - 108°48' E and 5°50' - 7°50' S (**Figure 1**). In addition, about two-thirds (66.5%) of people in this province live in urban areas. In terms of employment, 18.79 million workers are employed in trading, manufacturing and other sectors with the composition of 27.1%, 21%, and 19.2% respectively. By 2015, the economic structure of this province dominated by processing or manufacturing industry (43%), trading (15%), agriculture (9%), construction (8%), and other sectors (25%) (BPS-Statistic West Java, 2016b). West Java Province contributes 14.33% of national Gross Domestic Product (GDP), 60% of GDP in the manufacturing industry, 34.46% of national Foreign Direct Investment (FDI), and 17.76% as national rice producer (Pemprov Jabar, 2017). Further information about this province is summarized in Table 1.

Table 1. Description of Study Area

No.	Variable	Description
1	Geographic Location	104°48'-108°48' E and 5°50'-7°50' S
2	Elevation and Slope	Elevation: 0 to >1500 m asl, slope: 9-40%
3	Climate	Annual Rainfall (1500-4000 mm), temperature (17.4-30.7°C), average humidity (74%), Atmospheric Pressure (924 mb), Wind Velocity (4 knot), Duration of Sunshine (67%)
4	Total Area	35,377 km ²
5	Area division	18 regencies & 9 municipalities, 626 sub districts, 2,671 urban villages and 3,291 rural villages
6	Total Population (2015)	467,095,69 inhabitants

No.	Variable	Description
7	Population density (2015)	1,256 inhabitants/km ²
8	Population growth (2014-2015)	1.48%
9	Civil servant (2015)	333,713 personnel
10	Labour force (2015)	Total labour force 863,592: agriculture (16%), manufacturing (21%), trade (27%), services (16%), others (19%)
11	Agricultural area	2,768,414 ha (77%)
12	Non-agricultural area	817,074 ha (22.94%)
13	Number of industry	6,457 units (large industry)
14	Water resource potential ¹	<ul style="list-style-type: none"> 8 local aquifers, 15 cross-regency aquifers, 4 cross-province aquifers, with total area of aquifer 26,307 km²; 14,543 million m³/year (unconfined), and 711 million m³/year (confined) ¹ 6 river basins (total area 37,060 km²; potential surface water resource 48,023 million m³/year Northern coastline 558 km, southern coastline 601 km 200 watersheds; 3,506 rivers; 831 lakes, 20 reservoirs; 23 ponds; total capacity of reservoirs, lakes, and ponds is 7.2 billion m³
15	Energy resource potential	<ul style="list-style-type: none"> Oil and gas, geothermal 6,101 MW (21.7% of national potential), hydropower, solar energy, wind energy
16	Food resource potential	<ul style="list-style-type: none"> Wetland/paddy field 929,094 ha (26.08%); Non-paddy agricultural area 1,839,320 ha (50.98%) Agricultural commodity: (1) Food crops; rice, maize, cassava, banana, tomato, cabbage, ginger, etc. (2) Estate crops; tea, coconut, palm oil, sugar cane, etc. Animal husbandry commodity: cows, buffaloes, horses, goats, lambs, pigs, hen, broiler, and ducks, etc. Fishery commodity: freshwater fish, seawater fish, processed fish product

Source: BPS-Statistic West Java (2016b), ¹ DSDA JABAR (2017)

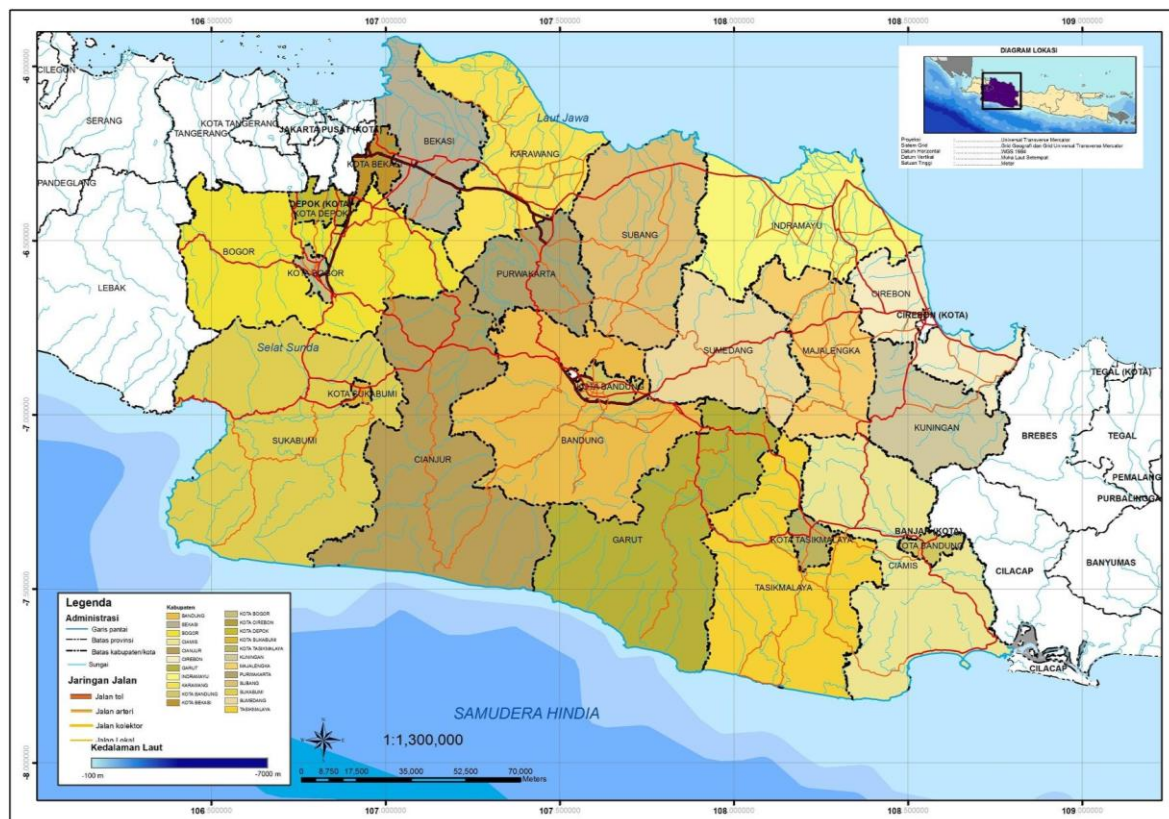


Figure 1. West Java Province

Source: http://appejawa.navperencanaan.com/peta/viewmap?prov_code=jabar

METHODS

Data Source

The data employed in this study were taken from BPS-Statistics of Indonesia report, BPS-Statistics of West Java report, and any related data from West Java Province website, and other sources. Main datasets in the calculation are as follow:

- GDP at 2010 Constant Market Prices by Industrial origin in billion rupiahs, year 2011–2015 (Statistical Year Book of Indonesia 2016, BPS-Statistics Indonesia)
- GRDP at 2010 Constant Market Prices by Industrial origin in billion rupiahs, year 2012-2015 (West Java Province in Figures 2016, BPS-Statistics West Java Province)
- GRDP at 2010 Constant Market Prices by Industrial origin in billion rupiahs, year 2011 (West Java Province in Figures 2015, BPS-Statistics West Java Province)

GDP (in national level) and GRDP (in regional level) are essentially arranged based on production and expenditure approach. GDP/GRDP based on production approach by industrial origin denotes the basic measure of value-added emerging from various kind of economic activities and production. GDP/GRDP by industrial origin has changed since 2010 in the category from 9 main sectors to 17 main sectors, comprises 39 sub-sectors, and 5 sub sub-sectors. The value of GDP/GRDP growth rate is obtained by subtracting the value of GDP/GRDP at constant market prices year n with the value of year $n-1$, divided by the value of GDP/GRDP year $n-1$, then multiplied by 100 percent. It indicates the income growth during the given period. All the data were computed using LQ methods, then visualized in competitive position chart.

Location Quotient (LQ)

One of economic base concepts employed in this study was *Location Quotient* (LQ) techniques both static and dynamic. LQ is not a new one because it has been widely applied in economic geography and regional economics since the 1940s due to the nothingness of data in interregional trade flow. Miller et al. (1991) defined LQ as 'basic analytical tools to yield a coefficient or simple expression of how well represented a

particular industry is in a given study region'. Additionally, as mentioned by (Karsinah et al. 2016), this tool can be applied to compare the role of industrial sectors in a region with the same variable in the higher regional level to understand local potential on basic and non-basic sectors. Recently, this technique has been employed in many various sectors and research such as trade sector (Chiang, 2009), industrial concentration (Billings & Johnson, 2012), road project development (Berawi et al., 2017), economic development (Alhowaish, 2015), marine sector (Morrissey, 2016), agriculture (Hendayana, 2003), mapping crime (Brantingham & Brantingham, 1998), and carbon emission (Trappey & Charles V Trappey, 2013) among others.

Notwithstanding several questions and criticism from some scholars have been raised about the accuracy of LQ method in estimating regional economic impact, this technique has remained a highly popular due to its simplicity (Miller et al., 1991), non-intensive in data, analytical skill, time consumed, budget (Isserman, 1977), and the lack of interregional trade flow and primary data (Richardson, 1985). Furthermore, (Suyatno, 2000) and (Iswandi et al., 2016) used *dynamic location quotient* (DLQ) in combination with SLQ to further analyse the changes or sectoral reposition of each sector by considering GRDP and the annual growth rate of each sector at selected years. The basic formula of SLQ and DLQ can be seen in equation 1 and 2 as follows:

$$SLQ = \frac{X_{in}/Y_n}{X_i/Y} \quad (1)$$

Where SLQ is *static location quotient* value, X_{in} represents GRDP Sector i in provincial region n , and Y_n is the total GRDP in provincial region n . Afterwards, X_i is GDP Sector i in national level, while Y indicates the total GDP in the national level. If the value of SLQ is greater than or equal to 1 ($SLQ \geq 1$), it can be classified as *basic sector*, while if the value of SLQ is less than 1 ($SLQ < 1$), it can be categorized as *Non-Basic Sector*.

$$DLQ = \left\{ \frac{(1+G_{in})/(1+G_n)}{(1+G_i)/(1+G)} \right\}^t \quad (2)$$

Where DLQ is *dynamic location quotient* value, G_{in} represents the average growth rate of GRDP Sector i in provincial region n , and G_n is the average growth rate of GRDP in

provincial region n . In addition, G_i is the average growth rate of GRDP Sector i in the national level, while G indicates the average growth rate of GRDP in national level, while t is total year of analysis. If the value of DLQ is greater than or equal to 1 ($DLQ \geq 1$), it reflects that the growth of this sector is faster than the same sector in provincial level, and still can be expected to be a basic sector in the future. Contrarily, if the value of DLQ is less than 1 ($DLQ < 1$), it means that the growth is potentially slower, and cannot be expected to act as a basic sector in the future.

Competitive Position Chart

One of the improved ways to depict the value of SLQ and its growth effectively is bubble chart with four quadrants so-called *Porter's Cluster* (Goetz et al. 2007) or *Competitive Position Matrix* (Zhao et al. 2016). The horizontal axis (X-axis) reflects the value of SLQ for the year of analysis, while the alteration of SLQ overtime (ΔSLQ) is captured by vertical axis (Y-axis). Bubble size represents the size of the industry. More obvious pictures of potential clusters can be obtained using this composite method (See Figure 1Figure 2).

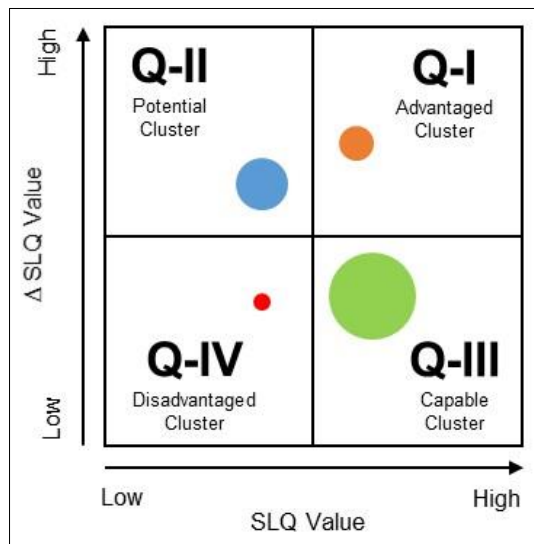


Figure 2. Competitive Position Chart
Source: Modified from (Zhao et al. 2016)

Quadrant I (Q-I) indicates industries with high agglomeration level and high agglomeration growth so-called advantaged or stars group. This top right clusters are strong, advancing, and can be expected to become more dominant in the future. Subsequently, quadrant II (Q-II) represents the potential or emerging group, where the sectors in this position are less concentrated but high in agglomeration growth. This cluster contains sectors that will be shifting ultimately to the first quadrant by certain continuous growth in the future. The third quadrant (Q-III) comprises sectors that highly concentrated in the region yet declining in the growth so-called capable or mature group. There are possibilities to move in less concentrated clusters in the forthcoming years. Quadrant IV (Q-IV) denotes cluster with a low concentration and lack of competitiveness named disadvantaged or transforming group. Additional efforts from all stakeholders are required to anticipate future needs and condition in this cluster.

RESULTS & DISCUSSION

All Development Sectors

With the total average of GRDP in 2011-2015 amounted 1,088,761 billion rupiahs, West Java is the second largest province after DKI Jakarta Province regarding total GRDP in Indonesia. The manufacturing sector has the highest contribution to GRDP of this province with 44%, followed by wholesale and trade sector, agriculture, forestry and fishery sector, and transportation and storage with the proportion of 16%, 8%, and 4% respectively. However, the result of SLQ and DLQ analysis in West Java Province during year 2011-2015 shows that only four sectors i.e. manufacturing, wholesale and retail trade, transportation and storage, and other service activities (excluded agriculture, forestry, and fishery) can be classified as basic sector out of 17, while the rest are categorized as non-basic (see Table 2).

Table 2. SLQ, DLQ and ΔSLQ Results of All Sectors

No.	Industrial Origin	AVG GRDP (2011-2015) In Billion Rp	AVG SLQ	Category	DLQ	ΔSLQ (2011-2015)
1	Agriculture, Forestry and Fishery	91,029.7	0.61	Non-Basic	0.29	-0.11
2	Mining and Quarrying	27,585.00	0.24	Non-Basic	0.32	0.04
3	Manufacturing	475,202.8	2.01	Basic	0.37	0.03
4	Electricity and Gas	5,767.1	0.47	Non-Basic	0.27	-0.04

No.	Industrial Origin	AVG GRDP (2011-2015) In Billion Rp	AVG SLQ	Category	DLQ	Δ SLQ (2011-2015)
5	Water Supply, Sewerage and Supply	845.4	0.99	Non-Basic	0.41	0.07
6	Construction	86,296.2	0.80	Non-Basic	0.37	-0.04
7	Wholesale and retail trade	174,353.9	1.17	Basic	0.37	0.02
8	Transportation and Storage	48,739.23	1.08	Basic	0.29	-0.29
9	Accommodation, Food & Beverage Services	26,261.93	0.79	Non-Basic	0.36	-0.02
10	Information and Communication	32,401.7	0.81	Non-Basic	0.57	0.24
11	Financial and Insurance Activities	25,674.23	0.61	Non-Basic	0.34	-0.05
12	Real Estate Activities	12,486.0	0.40	Non-Basic	0.38	-0.01
13	Business Activities	4,278.7	0.25	Non-Basic	0.36	-0.02
14	Public Administration & Defence	23,807.6	0.55	Non-Basic	0.27	-0.09
15	Education	26,353.5	0.73	Non-Basic	0.42	0.07
16	Human Health & Social Work Activities	7,095.0	0.62	Non-Basic	0.40	0.06
17	Other Services Activities	20,583.7	1.22	Basic	0.38	-0.06
Total		1,088,761.7				

Source: Own Analysis



Figure 3. SLQ and DLQ Value of All Sectors in West Java Province

Source: Own Analysis

Additionally, the results obtained from the analysis of SLQ and DLQ of all sectors can be compared in **Error! Reference source not found.** below. The value of DLQ in this study reveals the characteristic of sector's growth in West Java Province compares with similar sectors in national level. From the DLQ data in the graph, it is apparent that the DLQ values of all sectors in this province during the year of analysis were less than 1, meaning that they were growing slower than in national level. Furthermore, it can be interpreted that they are not expected to be basic sector or unable to maintain their position as basic sector in the future, without any significant interventions.

As can be seen in **Figure 4** below, the correlation between SLQ values and the change of SLQ (Δ SLQ) of all sectors by the

year 2011-2015 was interesting because most of the sectors were in Quadrant II and IV, while only small parts were in Quadrant I and III. Manufacturing and wholesale and retail trade were the only two sectors occupying first quadrant (strong and advancing cluster), while transportation and storage and other services were the sectors in quadrant III (strong but declining). The single most striking observation to emerge from the analysis was sectors in quadrant IV, where eight sectors were there, including agriculture, forestry, and fishery. They appeared to fall into this class and may warrant further consideration. This figures also send the signals to all stakeholders including government, private sectors and community in this region to pay attention with the targets in maintaining sectors which are

categorized as basic needs such as water, energy, and food-related sectors.



Figure 4. Industrial Cluster Based on SLQ and Δ SLQ Values

Source: Own Analysis

The results in this section indicate the general analysis for 17 main sectors, while the next section will be moving on to discuss more specific analysis on water, energy, and food-related sectors and sub-sectors as the major aim of this study.

Water, Energy, and Food (W-E-F) Related Sectors and Sub-Sectors

Food-related sector in this study is limited to agriculture, forestry, and fishery categories which is divided into three sub-sectors; agriculture, livestock, hunting, & agriculture services (with sub sub-sectors i.e. food crops, horticultural crops, plantation crops, livestock, agriculture services & hunting),

forestry & logging, and fishery. Furthermore, energy-related sector is defined as electricity and gas sector comprises two sub-sectors i.e. electricity, and manufacture of gas and production of ice. Additionally, water-related sector is limited only to water supply and sewerage activities.

According to Statistics Agency of Indonesia, the category of agriculture, forestry, and fishery comprises any exploitation derived from nature and living things whose results can be used to fulfil own needs or to sell to other parties. The coverage of water, energy, and food-related sectors in GDP/GRDP can be seen in

Table 3.

Table 3. Coverage of W-E-F Related Sectors in GDP/GRDP

No.	Sub Sectors	Coverage in GDP/GRDP
(1)	Food Crops	Food commodities e.g. rice, secondary crops (corn, soybean, peanut, cassava, sweet potatoes etc.), and other cereal plants (sorghum, wheat, etc.)
(2)	Horticultural Crops	Seasonal and annual crops e.g. vegetables (potato, cabbage, chili, shallot, tomato, etc.), fruits (mango, banana, orange, watermelon, etc.), medicinal plants (ginger, galangal, turmeric, etc.), and ornamental plants (orchid, chrysanthemum, rose, etc.)
(3)	Plantation Crops	Seasonal and annual plantation crops cultivated by smallholdings or companies (public and private) such as rubber, coconut, oil palm, tea, coffee, cacao, clove, etc.)
(4)	Livestock	All livestock products managed by smallholdings or companies (public and private)

No.	Sub Sectors	Coverage in GDP/GRDP
		such as cow, buffalo, horse, goat, sheep, pig, chicken, duck, egg, milk, etc.
(5)	Agriculture Services & Hunting	Including hunting and cultivating of wild animals to support other agricultural activities.
(6)	Fishery	Comprises all products from capture fisheries (marine and inland open water), and aquaculture (marine culture, brackish water pond, freshwater pond, cage, floating net, and fish breeding in paddy fields) e.g. any types of fish, crustaceans, mollusc, seaweed, etc.
(7)	Electricity	Encompasses all process of electricity generation, transmission, and distribution held by public or private companies. Calculated by applying production approach (multiplying total electricity produced with base constant price per year)
(8)	Manufacture of Gas & Prod. of Ice	Provision of natural gas, artificial gas, fuel, etc. to the consumers through various process, transportation, and distribution method (pipeline or cylinders)
(9)	Water Supply and Sewerage	Including drinking water and raw water supply activities, waste water treatment, solid waste management both from domestic and industrial activities

Source: Adapted from (BPS-Statistic West Java 2016a)

Sectors and Sub-Sectors Analysis

Comparing with general results in previous section, it is clear that in the more details water, energy, and food-related sub-sectors analysis, there were slight differences findings, where three sub-sectors were still categorized as basic sectors in this region, i.e. food crops, horticultural crops, and manufacturing of gas with SLQ values of 1.10, 1.04, and 1.39 successively (see Table

4). With more than 70% rice and non-rice agricultural area, this region still becomes the main producer of food and horticulture commodities not only to be consumed locally but also potentially to be exported to another region. Although livestock and fishery are still classified as non-basic sub-sectors, its supporting climate condition and the availability of the land in this province can be utilized to increase food production from animal husbandry and fisheries activities.

Table 4. SLQ, DLQ and Δ SLQ Results of W-E-F Related Sectors

No.	Industrial Origin	AVG GRDP (2011-2015) In Billion Rp	AVG SLQ	B/NB	DLQ	Δ SLQ (2011- 2015)
1	Agriculture, Forestry and Fishery	91,029.7	0.61	Non-Basic	0.29	-0.11
1)	Agriculture, Livestock, Hunting, & Agri. Serv	80,825.6	0.70	Non-Basic	0.29	-0.12
(1)	Food Crops (1)	41,938.4	1.10	Basic	0.28	-0.24
(2)	Horticultural Crops (2)	17,419.3	1.04	Basic	0.29	-0.14
(3)	Plantation Crops (3)	8,530.3	0.21	Non-Basic	0.31	-0.02
(4)	Livestock (4)	11,482.3	0.67	Non-Basic	0.30	-0.12
(5)	Agriculture Services & Hunting (5)	1,455.3	0.66	Non-Basic	0.29	-0.12
2)	Fishery (6)	9,290.2	0.37	Non-Basic	0.30	-0.06
4	Electricity and Gas	5,767.1	0.47	Non-Basic	0.27	-0.04
1)	Electricity (7)	1,764.4	0.19	Non-Basic	0.32	0.00
2)	Manufacture of Gas & Prod. of Ice (8)	4,002.8	1.39	Basic	0.21	-0.27
5	Water Supply and Sewerage (9)	845.4	0.99	Non-Basic	0.41	0.07

Source: Own Analysis

As well as the main sectors, W-E-F related sub-sectors also have the DLQ values less than one (ranging from 0.27 to 0.41), meaning that the growth level of those sectors was slower than similar sectors in Indonesia during 2011-2015. Interestingly, the electricity sector was ranked as the lowest SLQ value with only 0.19. The result was unexpected because it does not exactly fit with potential electricity production in this province, in particular from hydropower and geothermal. According to Energy and Mineral Resource Agency of West Java Province as

stated in Kurniawan (2015), from the total potential of geothermal sources of 6,101 megawatts (MW) for instance, 1,061 MW has been generated since 2010 from geothermal power plant (PLTP) Kamojang (200 MW), PLTP Awibengkok Gunung Salak (375 MW), PLTP Drajat (259 MW), and PLTP Wayang Windu (227 MW). Additionally, hydropower plants (PLTA) located in West Java Province such as PLTA Cikalong, PLTA Saguling, PLTA Cirata, PLTA Jatiluhur, and other PLTAs generate approximately 1,956 MW.

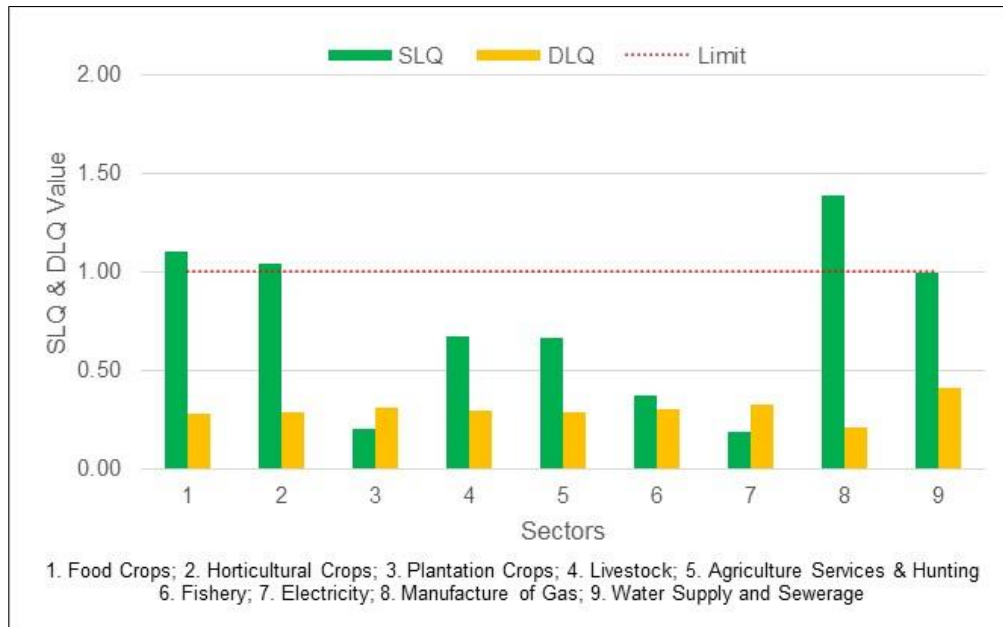


Figure 5. SLQ and DLQ Values of W-E-F Related Sectors in West Java Province
Source: Own Analysis

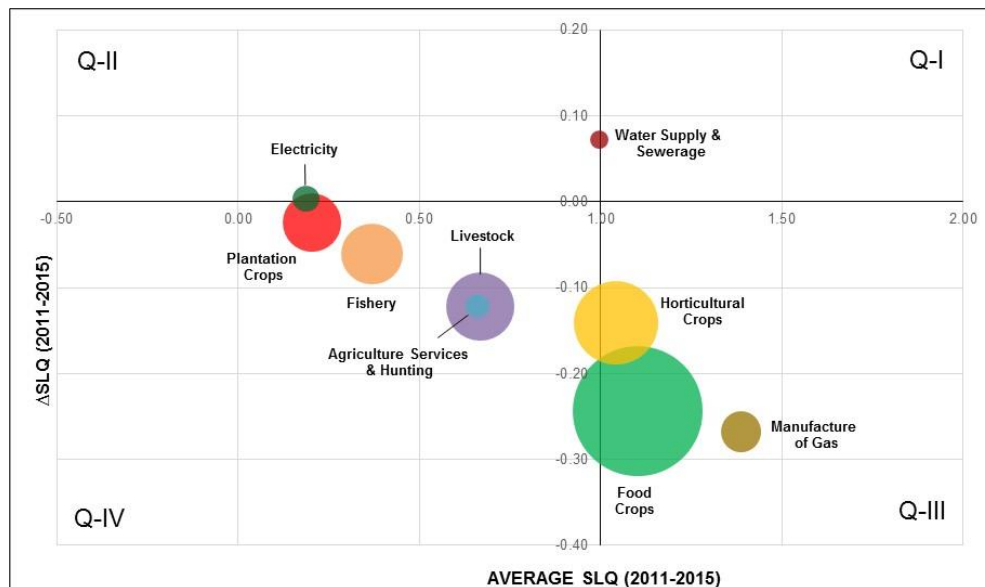


Figure 6. W-E-F Related Clusters Based on SLQ and Δ SLQ Values
Source: Own Analysis

From the graph in **Figure 6**, we can see that the majority of water, energy, and food-related sub-sectors emerged in quadrant III and IV, whereas only water supply and sewerage, and electricity sub-sectors which were positioned in quadrant II.

Food and horticulture crop sub-sectors were the highest contributors to GRDP year 2011-2015 in this group with 41,938 billion rupiahs (43%) and 17,419 billion rupiahs (18%).

However, their position in the third quadrant implied that they started to decline over time as well as gas manufacturing in energy sector. A possible explanation for these results may be the lack of adequate attention in maintaining the growth and keeping their production. The negative growth may cause potential concentration deflation then fall into even the lowest quadrant if there are no significant positive interventions to this cluster. This finding is in agreement with

Kurniawan (2015) findings which showed the decreasing of paddy field in this province approximately 82,477 Ha by 2025 without extension of new paddy fields.

Animal husbandry and fishery products are the next largest contributor to GRDP of West Java with 11,482 billion rupiahs (12%), and 9,290 billion rupiahs (10%). Unfortunately, these sectors were in the disadvantaged group (quadrant IV). They can be interpreted as industries with a low concentration and lack of competitiveness. Possible actions to be undertaken by the authority to this group are managing the decline, preparing option for transformation, or implementing extraordinary efforts and policies to support and lift back to become a leading sector in the forthcoming years.

Another attractive result in this analysis was the position of water supply and sewerage and electricity sub-sector which were in quadrant II. Although the sectors in this group were less concentrated in the region, they show positive growth that may bring them into the higher position in quadrant I rapidly with certain continual growth rate. The development of new water resources (reservoirs, lakes, and ponds) and power plants (PLTP, PLTA, and PLTU) as already stated in RPJPD 2005-2025 of West Java Province, are expected to increase production, meeting domestic demand, or even to be exported to other regions.

W-E-F Security Challenges and Actions to be Taken

The development of industrial estate in West Java Province by increasing manufacturing sectors investment has positive implication to escalating household income and reducing poverty rate (Winardi et al., 2017). On the other hand, manufacturing sector development will also potentially cause direct and indirect effects to the agricultural sector. This sector is not only boosting other economic activities e.g. trade, services, transportation, and housing development, but also stimulating social-based changes such as population growth, urbanization, dietary change, culture, and increased demand of basic needs. The trade-offs should be managed carefully by all stakeholders to avoid an unbalanced situation of supply and demand of basic needs, in particular water, energy, and food. Therefore, Winardi et al.

(2017) recommended building local-based resource industrial estates such as rural industrial estate, local industrial park, and agricultural industrial park in order to foster local production.

West Java Province is one of national food granaries with 22% contribution of national rice production. However, approximately 20,502 hectares or 2.2% of wetland area for paddy has been dwindling during the period of 2008 to 2013 (Nuryartono et al., 2017). Meanwhile, the land is of the important factors in producing foods. Another significant challenge to be faced by this province is population growth and urbanization. The higher the population the harder the effort to be taken by the government in meeting the needs of people to housing, water, energy, food etc. Kurniawan (2015) identified several water, energy, and food-related challenges in West Java Province such as, low utilization of surface water (41% from total potential), piped water supply (35,32% of total population), depletion of groundwater resources overtime, electrification ratio 70.72% in 2011 (lower than national average), and agricultural land conversion among others.

Focusing to water, energy, and food security attainment, many scholars suggested not to solve it in business as usual or silo approach due to their strong interconnection. Resolving one problem partially without considering its interlink age will only shift problems from one resource perspective to another and may cause unexpected effects (Kenway et al., 2011; Bizikova et al., 2013; El Gafy et al., 2016). Additionally, focusing only to a certain aspect of security, without considering others may also cause unbalanced supply and ineffective target achievement.

In principle, the government of West Java Province also has a robust commitment in developing water, energy, and food sectors as listed in its regional long-term planning (RPJPD) year 2005-2025 (Pemprov Jabar, 2010). Based on the vision to bring West Java as the most advanced province in Indonesia, which then elaborated into several development priorities, W-E-F related sectors have been pointed out as priority sectors among seven other sectors (see Annex D). The policies related to water, energy, and food sectors are as following:

1. Water resource infrastructures and environment protection; fulfilling raw water from surface, water resource conservation, sustainable utilization, potential damage control, and community empowerment;
2. New and renewable energy; meeting energy and electricity demand from potential new and renewable energy, and rising the use technology;
3. Agriculture and marine management; increasing production, availability of resources, availability of processing facilities and infrastructures, application of technology.

By relying on natural, human, and financial resources which are owned by West Java Province, this region is potentially capable in building self-reliance in producing water, energy, and food either for local needs or to be exported to other regions, even to foreign countries. The ability to develop any sectors to be basic sector (export-oriented) will increase domestic income, bring investment into regional economy, enhance domestic good and service production, and boost local economic growth (Wang & Hofe, 2007).

Possible actions to be implemented in collaboration with local regions (regencies/cities) and national government to enhance water, energy, and food production are as follow:

- *General intervention*; (1) creating continuous water, energy, and food balance of each regencies/cities comprises supply, demand, existing, potential resources, etc. to be used as evaluation and planning tool in development process, (2) enforcement of water, energy, and food-related regulations, and (3) linking water, energy, and food sectors with other sectors e.g. manufacturing, trade and services, transportation, infrastructures, and vice versa;
- *Water-related interventions*; (1) constructing new reservoirs, artificial lakes/ponds, infiltration wells, and promoting rainwater harvesting, and (2) water conservation in upstream and downstream area;
- *Energy-related interventions*; (1) urban and rural solar energy application, (2) optimizing other potential new and renewable energy development and utilization

- *Food-related interventions*; enforcing the planned sustainable agricultural cropland (*Lahan Pertanian Pangan Berkelanjutan/ LP2B*), (2) optimizing food diversification and food production (crops, meat, fish), and (3) creating new centres of agricultural production.

CONCLUSION

Returning to the purpose stated at the beginning of this study, it is now possible to conclude that the existing condition of water, energy, and food-related sectors/sub-sectors are mostly in disadvantaged condition compare to others sectors, particularly manufacturing sector. More specifically, water, energy, and food sub-sectors lie on the disadvantaged cluster, except water supply and sewerage. Food crops, horticultural crops, and gas manufacturing positioned in a group that strong but declining over time. This single study is of course inadequate and limited, but it is possible to be used as preliminary analysis for planners and decision makers in doing the planning and executing programmes related to water, energy, and food development. It is recommended that further research can be undertaken in the combination of more than one approach in economic base analysis.

Water, energy, and food sectors are immensely complex. The interaction among water, energy, and food systems internally and interconnection with the environmental condition, social, governance, and even political situation make these challenges should be solved comprehensively. Regional economic growth in water, energy, and food sectors should be encouraged strongly by empowering local potential, promoting export-oriented activities, and reducing import.

Considering these findings, there are several general courses of action that can be undertaken by provincial government to support local governments (regencies/cities) by providing guidance, supporting policies and facilities, subsidies, and other technical and financial support. Complying with long-term development planning (RPJPD) year 2005-2025 in a good manner will assist provincial government in achieving its targets both in local and national level, and increase the performance of water, energy, and food-related sectors in regional economic development.

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REFERENCES

- Alhawaish, A.K., 2015. Location Quotient Technique and Economy Analysis of Regions: Tabuk Province of Saudi Arabia as a Case Study. , 4(12), pp.1756–1761.
- Bellfield, H. et al., 2016. *How Can Indonesia Achieve Water, Energy and Food Security without Eroding Its Natural Capital?*, Indonesia. Available at: www.globalcanopy.org.
- Berawi, M.A. et al., 2017. Producing Alternative Concept for the Trans-sumatera Toll Road Project Development using Location Quotient Method. *Procedia Engineering*, 171, pp.265–273.
- Billings, S.B. & Johnson, E.B., 2012. The location quotient as an estimator of industrial concentration. *Regional Science and Urban Economics*, 42(4), pp.642–647. Available at: <http://dx.doi.org/10.1016/j.regsciurbeco.2012.03.003>.
- Bizikova, L. et al., 2013. *The Water–Energy–Food Security Nexus: Towards a practical Planning and Decision-Support Framework for Landscape Investment and Risk Management*, Manitoba: International Institute for Sustainable Development (IISD).
- BPS- West Java, 2016a. *Gross Regional Domestic Product of West Java Province by Industrial Origin 2011-2015 (in Bahasa Indonesia)*, Bandung: BPS West Java Province.
- BPS- West Java, 2016b. *West Java Province in Figures 2016*, Bandung: BPS West Java Province.
- BPS-RI, 2016. *Statistical Year Book of Indonesia 2016*,
- Brantingham, P.L. & Brantingham, P.L., 1998. Mapping crime for analytic purposes: location quotients, counts and rates. *Crime mapping and crime prevention*, (8), pp.263–288.
- Brodsky, H. & Sarfaty, D.E., 1977. Measuring the Urban Economic Base in a Developing Country. , 53(4), pp.445–454. Available at: <http://www.jstor.org/stable/3145988>.
- Chiang, S.H., 2009. Location quotient and trade. *Annals of Regional Science*, 43(2), pp.399–414.
- DSDA JABAR, 2017. *Water Resources Book of West Java Province (in Bahasa Indonesia)*, Bandung.
- El Gafy, I., Grigg, N. & Reagan, W., 2016. Dynamic Behaviour of the Water-Food-Energy Nexus: Focus on Crop Production and Consumption. *Irrigation and Drainage*.
- Goetz, S., Deller, S. & Harris, T., 2007. Targeting Regional Economic Development: An Outline of a National Extension Educational Program. In *The 2007 CDS Annual Meetings*. Pennsylvania: The Northeast Regional Center for Rural Development.
- Hendayana, R., 2003. Aplikasi metode location quotient (LQ) dalam penentuan komoditas unggulan nasional. *Informatika Pertanian*, 12(2003), pp.1–21. Available at: <http://www.litbang.pertanian.go.id/warta-ip/pdf-file/rahmadi-12.pdf>.
- Isserman, A.M., 1977. The Location Quotient Approach to Estimating Regional Economic Impacts. *Journal of the American Planning Association*, 43(1), pp.33–41. Available at: <http://dx.doi.org/10.1080/01944367708977758>.
- Iswandi, R.M., Yunus, L. & Sudarmo, H., 2016. Study of Local-Based Excellent Potency in Bombana District. *IJABER*, 14(14), pp.10299–10309.
- Juleff, L., 1993. *The Implication of Export Base Theory for The Study of Advanced Producer Services(1): Location Quotient Analysis*, Edinburgh: Department of Economics, Napier University.
- Karsinah, K. et al., 2016. The Profile of Pekalongan as a Center of Economic

- Growth at Tangkallangka Strategic Areas. , 6(Table 1), pp.105–109.
- Kenway, S.J. et al., 2011. The connection between water and energy in cities: A review. *Water Science and Technology*, 63(9).
- Kurniawan, T.F., 2015. *Natural Resources Carrying Capacity to Support Economic Growth and Population Dynamics in West Java (Master Thesis in Bahasa Indonesia)*. Bogor Agriculture Institute (IPB).
- Leigh, R., 1970. The Use of Location Quotients in Urban Economic Base Studies. *Land Economics*, 46(2), pp.202–205.
- Miller, M.M., Gibson, L.J. & Wright, N.G., 1991. Location Quotient: A Basic Tool for Economic Development Analysis. *Economic Development Review*, (50), p.65. Available at: <http://search.proquest.com/openview/d6011b83d027b7ad1dba29bb96b74a53/1.pdf?pq-origsite=gscholar&cbl=38209>.
- Morrissey, K., 2016. A location quotient approach to producing regional production multipliers for the Irish economy. *Papers in Regional Science*, 95(3), pp.491–506. Available at: <http://dx.doi.org/10.1016/j.ocecoaman.2014.02.006>.
- Nuryartono, N. et al., 2017. Land conversion and economic development in West Java Province: Trade off or Synergy? In *IOP Conference: Earth and Environmental Science*. IOP Publishing. Available at: <http://iopscience.iop.org/1755-1315/54/1/012017>.
- Pemprov Jabar, 2017. West Java Province's Contribution to National. Available at: <http://www.jabarprov.go.id/infografis/> [Accessed April 3, 2017].
- Pemprov Jabar, 2010. *Regional Long Term Planning of West Java Province Year 2005-2025*, Indonesia.
- Richardson, H.W., 1985. Input-Output and Economic Base Multipliers: Looking Backward and Forward. *Journal of Regional Science*, 25(4), pp.607–661.
- Suyatno, 2000. Analisa Economic Base Terhadap Pertumbuhan Ekonomi Daerah Tingkat II Wonogiri: Menghadapi Implementasi UU No. 22/1999 dan UU No. 5/1999.
- Trappey, A.J.C. & Charles V Trappey, P.H.Y.L., 2013. Location Quotient EIO-LCA Method for Carbon Emission Analysis. , pp.1081–1092. Available at: <http://link.springer.com/10.1007/978-1-4471-4426-7>.
- Wang, X. & Hofe, R., 2007. *Research Methods in Urban and Regional Planning*, Tsinghua University Press.
- Winardi et al., 2017. Impacts of Industrial Estate Development Policy on Household Poverty in West Java Province. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, 4531, pp.308–317.
- Zhao, Z. et al., 2016. Agglomeration and Competitive Position of Contractors in the International Construction Sector. *Journal of Construction Engineering and Management*, pp.1–9.

ANNEXES

A. Gross Domestic Product (GDP) of Indonesia at Constant 2010 Market Prices by Industrial Origin Year 2011-2015 (in Billion Rupiahs)

No.	Industrial Origin	GRDP 2011	GRDP 2012	GRDP 2013	GRDP 2014*	GRDP 2015**
1	Agriculture, Forestry and Fishery	1,058,245.3	1,152,262.1	1,275,048.4	1,409,655.7	1,560,399.3
	1) Agriculture, Livestock, Hunting, & Agriculture Services	832,513.6	902,125.9	994,778.4	1,089,549.7	1,186,520.6
	(1) Food Crops	270,977.4	305,670.5	332,111.9	343,252.3	393,371.7
	(2) Horticultural Crops	125,286.1	125,107.9	137,368.8	160,568.6	175,164.5
	(3) Plantation Crops	303,402.9	323,361.6	358,172.4	398,260.7	411,863.4
	(4) Livestock	117,256.6	130,614.2	147,981.9	167,008.0	183,444.1
	(5) Agriculture Services & Hunting	15,590.6	17,371.7	19,143.4	20,460.1	22,676.9
	2) Forestry & Logging	62,247.7	65,882.2	69,599.2	74,618.0	81,743.1
	3) Fishery	163,484.0	184,254.0	210,670.8	245,488.0	292,135.6
2	Mining and Quarrying	924,813.4	1,000,307.6	924,813.4	1,000,307.6	1,050,745.8
	1) Crude Petroleum, Natural Gas, & Geothermal	444,067.8	492,894.2	520,088.1	508,911.1	382,680.9
	2) Coal & Lignite Mining	253,025.5	270,519.1	282,193.1	257,236.2	198,881.8
	3) Iron Ore Mining	104,283.9	100,844.8	98,468.4	93,897.9	80,286.3
	4) Other Mining & Quarrying	123,436.2	136,049.5	149,996.2	182,855.7	217,550.6
3	Manufacturing	1,704,250.5	1,848,150.9	1,704,250.5	1,848,150.9	2,007,426.8
	1) Coal & Refined Petroleum Products	284,098.7	298,402.9	314,215.5	329,058.0	307,703.8
	2) Food Products & Beverages	410,387.4	457,773.4	491,142.4	562,016.6	647,002.2
	3) Tobacco Products	71,735.4	79,340.0	82,684.3	95,668.1	108,859.6
	4) Textiles & Wearing Apparel	108,192.1	116,557.8	129,912.0	139,031.6	139,393.9
	5) Leather & Related Products, & Footwear	22,045.0	21,686.7	24,810.0	28,600.2	31,444.8
	6) Wood & Products of Wood & Cork	59,501.0	60,628.6	66,958.0	76,071.9	77,821.2
	7) Paper & Paper Products	75,308.0	73,664.8	74,319.0	84,372.5	87,800.6
	8) Chemicals, Pharmaceuticals, & Botanical Products	124,716.9	143,460.2	157,042.1	180,037.2	209,288.1
	9) Rubber Products & Plastics Products	72,006.0	76,425.0	76,466.3	80,262.9	85,961.9
	10) Other Non-Metallic Mineral Products	55,606.4	63,028.2	69,400.6	76,852.0	83,491.6
	11) Basic Metals	62,846.1	64,557.3	74,495.1	82,118.8	90,389.4
	12) Fabricated Metal Products	142,059.4	162,969.7	186,194.9	198,080.6	226,661.9
	13) Machinery & Equipment	23,376.4	24,832.1	25,504.2	33,078.8	37,255.3
	14) Transport Equipment	154,863.9	166,390.7	192,768.0	207,401.4	220,360.3
	15) Furniture	21,984.5	22,486.5	24,930.6	28,117.7	31,280.9
	16) Other Manufacturing;	15,523.3	15,947.0	16,583.8	18,673.1	20,693.4
4	Electricity and Gas	91,721.9	95,637.8	91,721.9	95,637.8	98,686.8
	1) Electricity	72,815.80	73,349.8	74,358.3	83,841.9	102,082.9
	2) Manufacture of Gas & Production of Ice	18,906.10	22,288.0	24,328.5	30,776.0	29,181.3
5	Water Supply and Sewerage	6,208.8	6,603.8	6,208.8	6,603.8	7,209.0
6	Construction	712,184.4	805,208.1	712,184.4	805,208.1	905,990.5
7	Wholesale and retail trade	1,066,092.1	1,138,484.4	1,066,092.1	1,138,484.4	1,261,145.6
	1) Wholesale, Retail of Motor Vehicle/Motorcycles	208,944.30	228,666.5	258,942.3	292,839.2	312,068.9
	2) Wholesale, Retail Except of Motor Vehicles & Motorcycles	857,147.80	909,817.9	1,002,203.3	1,127,215.1	1,221,998.4
8	Transportation and Storage	276,122.4	313,156.2	276,122.4	313,156.2	375,305.9
	1) Railways Transport	2,408.30	2,782.9	3,142.5	4,227.9	6,261.8
	2) Land Transport	148,061.60	159,225.7	190,200.7	225,881.6	283,222.3
	3) Sea Transport	24,082.70	26,614.7	30,061.9	36,074.9	39,306.8
	4) River, Lake, & Ferry Transport	9,202.30	9,780.0	11,164.6	13,137.3	14,266.8
	5) Air Transport	47,029.10	62,201.1	77,721.8	108,791.9	142,536.4
	6) Warehousing & Support Services for Transportation;	45,338.40	52,551.8	63,014.4	78,855.3	93,369.8
9	Accommodation, Food and Beverage Services	224,215.3	252,612.3	224,215.3	252,612.3	289,498.3
	1) Accommodation	41,102.40	51,052.4	63,489.0	74,255.1	81,237.7
	2) Food & Beverage Service Activities	183,112.90	201,559.9	226,009.3	246,807.0	260,552.5
10	Information and Communication	281,777.6	311,362.4	281,777.6	311,362.4	341,009.4
11	Financial and Insurance Activities	270,586.3	320,534.3	270,586.3	320,534.3	370,131.9
	1) Financial Intermediary Services	167,456.30	204,479.4	237,169.6	256,028.9	291,510.3
	2) Insurance & Pension Fund	58,759.30	65,882.2	76,004.5	87,336.5	99,041.1
	3) Other Financial Services	37,760.80	42,687.6	48,278.5	55,244.7	63,180.0
	4) Financial Supporting Service	6,609.90	7,485.1	8,679.3	9,828.7	11,003.2
12	Real Estate Activities	218,796.6	237,913.9	218,796.6	237,913.9	264,275.0
13	Business Activities	113,975.3	127,724.2	113,975.3	127,724.2	144,604.1
14	Public Administration & Defence	304,755.7	340,567.6	304,755.7	340,567.6	372,195.0
15	Education	232,726.8	270,372.3	232,726.8	270,372.3	307,862.3
16	Human Health & Social Work Activities	76,404.9	86,235.4	76,404.9	86,235.4	96,881.3
17	Other Services Activities	113,022.0	122,566.2	113,022.0	122,566.2	140,315.6
	Total	7,675,899.3	8,429,699.5	7,675,899.3	8,429,699.5	9,308,331.6

Source: 2016 (BPS-RI 2016), Central Statistical Agency of Indonesia

Notes:

* Preliminary figures

** Very preliminary figures

B. Gross Regional Domestic Product (GRDP) of West Java Province at Constant 2010 Market Prices by Industrial Origin Year 2011-2015 (in Billion Rupiahs) and SLQ Calculation

No.	Industrial Origin	GRDP 2011	SLQ 2011	GRDP 2012	SLQ 2012	GRDP 2013	SLQ 2013	GRDP 2014*	SLQ 2014	GRDP 2015**	SLQ 2015	AVG SLQ	CATEGO RY	Δ SLQ
1	Agriculture, Forestry and Fishery	88,386.5	0.66	88,409.5	0.63	92,390.1	0.62	92,926.2	0.59	93,036.1	0.55	0.61	Non-Basic	-0.11
1)	Agriculture, Livestock, Hunting, & Agriculture Services	79,271.9	0.76	78,883.0	0.72	82,302.8	0.70	82,113.9	0.68	81,556.4	0.64	0.70	Non-Basic	-0.12
(6)	Food Crops	41,391.7	1.21	40,669.1	1.09	43,550.1	1.12	42,858.3	1.12	41,223.1	0.97	1.10	Basic	-0.24
(7)	Horticultural Crops	17,304.4	1.10	17,162.7	1.12	17,106.1	1.06	17,425.3	0.97	18,097.9	0.96	1.04	Basic	-0.14
(8)	Plantation Crops	8,217.4	0.22	8,560.2	0.22	8,844.8	0.21	8,541.1	0.19	8,488.0	0.19	0.21	Non-Basic	-0.02
(9)	Livestock	10,936.5	0.74	11,076.0	0.70	11,328.0	0.65	11,801.3	0.63	12,269.6	0.62	0.67	Non-Basic	-0.12
(10)	Agriculture Services & Hunting	1,421.9	0.72	1,415.0	0.67	1,473.9	0.66	1,487.9	0.65	1,477.8	0.60	0.66	Non-Basic	-0.12
2)	Forestry & Logging	948.0	0.12	946.5	0.12	907.6	0.11	889.8	0.11	877.7	0.10	0.11	Non-Basic	-0.02
3)	Fishery	8,166.7	0.40	8,580.0	0.38	9,179.7	0.37	9,922.5	0.36	10,602.0	0.34	0.37	Non-Basic	-0.06
2	Mining and Quarrying	29,105.5	0.25	27,213.6	0.22	26,872.5	0.22	27,293.4	0.23	27,440.1	0.29	0.24	Non-Basic	0.04
1)	Crude Petroleum, Natural Gas, & Geothermal	22,442.7	0.40	20,686.6	0.34	20,325.2	0.33	20,595.8	0.36	20,736.6	0.50	0.39	Non-Basic	0.10
2)	Coal & Lignite Mining	-	-	-	-	-	-	-	-	-	0.00	-	Non-Basic	0.00
3)	Iron Ore Mining	1,201.2	0.09	1,087.1	0.09	1,094.7	0.09	1,050.2	0.10	1,021.1	0.12	0.10	Non-Basic	0.03
4)	Other Mining & Quarrying	5,461.6	0.35	5,439.9	0.33	5,452.6	0.31	5,647.4	0.28	5,682.3	0.24	0.30	Non-Basic	-0.11
3	Manufacturing	426,184.9	1.99	445,675.3	1.98	477,714.1	2.03	502,124.4	2.03	524,315.2	2.02	2.01	Basic	0.03
1)	Coal & Refined Petroleum Products	22,188.6	0.62	22,003.0	0.60	21,985.0	0.60	23,280.6	0.63	23,156.8	0.70	0.63	Non-Basic	0.08
2)	Food Products & Beverages	37,859.3	0.73	39,459.5	0.71	43,878.3	0.76	48,525.1	0.77	53,215.4	0.76	0.75	Non-Basic	0.03
3)	Tobacco Products	2,004.6	0.22	2,021.5	0.21	2,032.1	0.21	2,196.0	0.21	2,390.9	0.20	0.21	Non-Basic	-0.02
4)	Textiles & Wearing Apparel	57,758.9	4.24	59,699.2	4.20	64,926.9	4.25	70,220.9	4.53	75,448.9	5.01	4.45	Basic	0.77
5)	Leather & Related Products, & Footwear	5,827.0	2.10	5,404.4	2.04	5,722.5	1.96	5,956.1	1.87	6,425.0	1.89	1.97	Basic	-0.21
6)	Wood & Products of Wood & Cork	4,479.5	0.60	4,202.0	0.57	4,516.3	0.57	4,324.2	0.51	4,189.1	0.50	0.55	Non-Basic	-0.10
7)	Paper & Paper Products	12,512.0	1.32	12,635.8	1.41	12,721.0	1.46	11,924.2	1.27	12,092.4	1.28	1.35	Basic	-0.05
8)	Chemicals, Pharmaceuticals, & Botanical Products	24,505.3	1.56	27,309.1	1.56	28,380.8	1.54	27,198.7	1.35	28,360.5	1.25	1.45	Basic	-0.31
9)	Rubber Products & Plastics Products	15,845.5	1.75	16,054.5	1.72	15,737.5	1.75	16,589.5	1.85	16,636.2	1.79	1.77	Basic	0.04
10)	Other Non-Metallic Mineral Products	8,969.9	1.28	9,422.4	1.23	9,492.8	1.16	8,750.4	1.02	8,919.8	0.99	1.14	Basic	-0.29
11)	Basic Metals	14,310.4	1.81	14,269.9	1.81	15,921.7	1.82	16,016.7	1.75	15,785.7	1.62	1.76	Basic	-0.19
12)	Fabricated Metal Products	99,268.3	5.55	110,495.0	5.56	118,060.6	5.40	119,562.5	5.41	125,268.4	5.12	5.41	Basic	-0.44
13)	Machinery & Equipment	38,096.6	12.95	37,686.6	12.44	35,968.2	12.00	40,468.7	10.97	42,398.5	10.54	11.78	Basic	-2.42
14)	Transport Equipment	75,776.0	3.89	78,872.0	3.89	92,123.1	4.07	100,138.3	4.33	102,759.4	4.32	4.10	Basic	0.43
15)	Furniture	1,929.9	0.70	1,761.6	0.64	1,891.3	0.65	2,046.2	0.65	2,110.1	0.62	0.65	Non-Basic	-0.07
16)	Other Manufacturing;	4,853.3	2.49	4,378.7	2.25	4,356.0	2.24	4,926.4	2.37	5,158.1	2.31	2.33	Basic	-0.18
4	Electricity and Gas	5,126.00	0.44	5,571.3	0.48	6,025.2	0.52	6,313.7	0.49	5,799.5	0.41	0.47	Non-Basic	-0.04
1)	Electricity	1,519.16	0.17	1,719.7	0.19	1,825.8	0.21	1,892.8	0.20	1,864.4	0.17	0.19	Non-Basic	0.00
2)	Manufacture of Gas & Production of Ice	3,606.84	1.52	3,851.5	1.42	4,199.5	1.47	4,421.0	1.29	3,935.1	1.25	1.39	Basic	-0.27
5	Water Supply and Sewerage	741.34	0.95	794.3	0.99	846.0	1.00	896.3	1.02	949.0	1.02	0.99	Non-Basic	0.07
6	Construction	71,723.22	0.80	81,197.7	0.83	87,818.6	0.83	92,603.5	0.80	98,138.0	0.76	0.80	Non-Basic	-0.04
7	Wholesale and retail trade	151,107.16	1.13	168,938.9	1.22	177,747.5	1.20	183,626.1	1.16	190,349.8	1.15	1.17	Basic	0.02
1)	Wholesale, Retail of Motor Vehicle/Motorcycles	20,138.68	0.77	22,436.1	0.80	24,059.5	0.79	25,274.3	0.77	26,075.4	0.77	0.78	Non-Basic	0.01
2)	Wholesale, Retail Except of Motor Vehicles & Motorcycles	130,968.47	1.21	146,502.8	1.32	153,688.0	1.31	158,351.8	1.26	164,274.4	1.24	1.27	Basic	0.03
8	Transportation and Storage	41,660.01	1.20	45,721.40	1.20	47,965.85	1.09	51,697.90	0.99	56,650.97	0.91	1.08	Basic	-0.29
1)	Railways Transport	343.98	1.14	318.0	0.94	337.4	0.91	382.0	0.81	391.7	0.58	0.88	Non-Basic	-0.56
2)	Land Transport	37,741.35	2.03	40,620.0	2.09	42,541.6	1.90	45,888.1	1.82	50,182.6	1.64	1.90	Basic	-0.39
3)	Sea Transport	153.59	0.05	143.6	0.04	139.8	0.04	148.1	0.04	154.4	0.04	0.04	Non-Basic	-0.01
4)	River, Lake, & Ferry Transport	1.05	0.00	1.1	0.00	1.0	0.00	1.0	0.00	1.0	0.00	0.00	Non-Basic	0.00
5)	Air Transport	1,582.42	0.27	2,621.4	0.35	2,807.5	0.31	3,000.8	0.25	3,440.0	0.22	0.28	Non-Basic	-0.04

No.	Industrial Origin	GRDP 2011	SLQ 2011	GRDP 2012	SLQ 2012	GRDP 2013	SLQ 2013	GRDP 2014*	SLQ 2014	GRDP 2015**	SLQ 2015	AVG SLQ	CATEGO RY	Δ SLQ
	6) Warehousing & Support Services for Transportation;	1,837.63	0.32	2,017.4	0.31	2,138.4	0.29	2,277.9	0.26	2,481.2	0.25	0.29	Non-Basic	-0.08
9	Accommodation, Food and Beverage Services	23,196.04	0.82	24,806.72	0.80	25,985.30	0.76	27,545.03	0.77	29,776.55	0.81	0.79	Non-Basic	-0.02
	1) Accommodation	3,651.33	0.71	4,015.2	0.64	4,488.3	0.60	4,716.4	0.57	4,911.7	0.56	0.62	Non-Basic	-0.15
	2) Food & Beverage Service Activities	19,544.71	0.85	20,791.5	0.85	21,497.0	0.81	22,828.7	0.83	24,864.8	0.88	0.84	Non-Basic	0.04
10	Information and Communication	25,378.26	0.72	28,094.0	0.74	30,651.8	0.77	36,005.4	0.87	41,878.8	0.95	0.81	Non-Basic	0.24
11	Financial and Insurance Activities	21,567.18	0.63	23,437.32	0.60	26,347.77	0.61	27,497.25	0.60	29,521.63	0.59	0.61	Non-Basic	-0.05
	1) Financial Intermediary Services	16,756.71	0.80	18,413.3	0.74	21,091.1	0.76	21,722.0	0.76	23,317.4	0.74	0.76	Non-Basic	-0.05
	2) Insurance & Pension Fund	1,796.15	0.24	1,860.1	0.23	1,942.7	0.22	2,188.0	0.22	2,365.8	0.22	0.23	Non-Basic	-0.02
	3) Other Financial Services	2,637.96	0.56	2,775.3	0.53	2,911.7	0.51	3,150.0	0.51	3,365.8	0.49	0.52	Non-Basic	-0.06
	4) Financial Supporting Service	376.36	0.45	388.6	0.43	402.2	0.39	437.2	0.40	472.6	0.40	0.41	Non-Basic	-0.05
12	Real Estate Activities	10,992.68	0.40	11,916.8	0.41	12,561.5	0.40	13,121.3	0.40	13,837.7	0.39	0.40	Non-Basic	-0.01
13	Business Activities	3,676.30	0.26	3,957.5	0.25	4,265.9	0.25	4,561.1	0.25	4,932.6	0.24	0.25	Non-Basic	-0.02
14	Public Administration & Defence	22,940.00	0.60	23,901.3	0.58	23,568.0	0.54	23,676.9	0.52	24,951.9	0.51	0.55	Non-Basic	-0.09
15	Education	20,596.76	0.70	23,608.2	0.72	25,715.3	0.71	29,424.9	0.77	32,422.2	0.77	0.73	Non-Basic	0.07
16	Human Health & Social Work Activities	5,790.04	0.60	6,303.7	0.60	6,720.2	0.59	7,780.5	0.64	8,880.8	0.67	0.62	Non-Basic	0.06
17	Other Services Activities	17,450.14	1.23	18,862.2	1.26	20,347.9	1.23	22,137.5	1.21	24,120.8	1.17	1.22	Basic	-0.06
Total		965,622.06		1,028,409.7		1,093,543.5		1,149,231.4		1,207,001.5				

Source: own analysis

Notes:

* Preliminary figures

** Very preliminary figures

C. GDP Growth Rate of Indonesia and GRDP Growth Rate of West Java with DLQ Calculation

Industrial Origin	GDP Growth Rate of Indonesia (%)					Gi	GRDP Growth Rate of West Java (%)					Gin	DLQ
	11	12	13	14	15		11	12	13	14	15		
1. Agriculture, Forestry and Fishery	11	9	11	11	11	10	-1	0	5	1	0	1	0.29
1) Agriculture, Livestock, Hunting, & Agriculture Services	10	8	10	10	9	9	-1	0	4	0	-1	0	0.29
(11) Food Crops	7	13	9	3	15	9	-2	-2	7	-2	-4	0	0.28
(12) Horticultural Crops	13	0	10	17	9	10	-2	-1	0	2	4	1	0.29
(13) Plantation Crops	13	7	11	11	3	9	4	4	3	-3	-1	1	0.31
(14) Livestock	8	11	13	13	10	11	0	1	2	4	4	2	0.30
(15) Agriculture Services & Hunting	11	11	10	7	11	10	-1	0	4	1	-1	1	0.29
2) Forestry & Logging	7	6	6	7	10	7	-4	0	-4	-2	-1	-2	0.28
3) Fishery	14	13	14	17	19	15	5	5	7	8	7	6	0.30
2. Mining and Quarrying	29	8	5	-1	-16	5	-3	-7	-1	2	1	-2	0.32
1) Crude Petroleum, Natural Gas, & Geothermal	32	11	6	-2	-25	4	-6	-8	-2	1	1	-3	0.32
2) Coal & Lignite Mining	57	7	4	-9	-23	7	-	-	-	0	0	0	0.31
3) Iron Ore Mining	-5	-3	-2	-5	-14	-6	-12	-9	1	-4	-3	-5	0.46
4) Other Mining & Quarrying	10	10	10	22	19	14	10	0	0	4	1	3	0.26
3. Manufacturing	13	8	9	11	8	10	6	5	7	5	4	5	0.37
1) Coal & Refined Petroleum Products	22	5	5	5	-6	6	1	-1	0	6	-1	1	0.36
2) Food Products & Beverages	14	12	7	14	15	12	8	4	11	11	10	9	0.38
3) Tobacco Products	7	11	4	16	14	10	-2	1	1	8	9	3	0.33
4) Textiles & Wearing Apparel	12	8	11	7	0	8	5	3	9	8	7	6	0.42
5) Leather & Related Products, & Footwear	12	-2	14	15	10	10	5	-7	6	4	8	3	0.32
6) Wood & Products of Wood & Cork	5	2	10	14	2	7	-7	-6	7	-4	-3	-3	0.29
7) Paper & Paper Products	11	-2	1	14	4	5	5	1	1	-6	1	0	0.35
8) Chemicals, Pharmaceuticals, & Botanical Products	9	15	9	15	16	13	8	11	4	-4	4	5	0.31
9) Rubber Products & Plastics Products	8	6	0	5	7	5	8	1	-2	5	0	3	0.40
10) Other Non-Metallic Mineral Products	9	13	10	11	9	10	4	5	1	-8	2	1	0.28
11) Basic Metals	15	3	15	10	10	11	11	0	12	1	-1	4	0.33
12) Fabricated Metal Products	9	15	14	6	14	12	4	11	7	1	5	6	0.34
13) Machinery & Equipment	-2	6	3	30	13	10	4	-1	-5	13	5	3	0.33
14) Transport Equipment	15	7	16	8	6	10	10	4	17	9	3	8	0.41
15) Furniture	10	2	11	13	11	9	3	-9	7	8	3	3	0.33
16) Other Manufacturing;	3	3	4	13	11	7	-1	-10	-1	13	5	1	0.35
4. Electricity and Gas	26	4	3	16	15	13	-4	9	8	5	-8	2	0.27
1) Electricity	24	1	1	13	22	12	4	13	6	4	-1	5	0.32
2) Manufacture of Gas & Production of Ice	38	18	9	27	-5	17	-7	7	9	5	-11	1	0.21
5. Water Supply and Sewerage	6	6	9	9	9	8	6	7	7	6	6	6	0.41
6. Construction	14	13	13	15	15	14	14	13	8	5	6	9	0.37
7. Wholesale and retail trade	15	7	11	13	8	11	8	12	5	3	4	6	0.37
1) Wholesale, Retail of Motor Vehicle/cycles	15	9	13	13	7	11	7	11	7	5	3	7	0.36
2) Wholesale, Retail Except of Motor Vehicle/cycles	16	6	10	12	8	11	8	12	5	3	4	6	0.37
8. Transportation and Storage	13	13	20	24	24	19	12	10	5	8	10	9	0.29
1) Railways Transport	1	16	13	35	48	23	-3	-8	6	13	3	2	0.18
2) Land Transport	9	8	19	19	25	16	13	8	5	8	9	8	0.32
3) Sea Transport	11	11	13	20	9	13	3	-6	-3	6	4	1	0.26
4) River, Lake, & Ferry Transport	13	6	14	18	9	12	-1	0	-1	-2	-2	-1	0.24
5) Air Transport	23	32	25	40	31	30	-13	66	7	7	15	16	0.26
6) Warehousing & Support Services for Transportation	15	16	20	25	18	19	16	10	6	7	9	9	0.30
9. Accommodation, Food & Beverage Services	12	13	15	11	6	11	7	7	5	6	8	7	0.36
1) Accommodation	15	24	24	17	9	18	-3	10	12	5	4	6	0.26
2) Food & Beverage Service Activities	11	10	12	9	6	10	9	6	3	6	9	7	0.39
10. Information and Communication	10	10	10	8	10	10	22	11	9	17	16	15	0.57
11. Financial and Insurance Activities	13	18	15	10	14	14	7	9	12	4	7	8	0.34
1) Financial Intermediary Services	12	22	16	8	14	14	7	10	15	3	7	8	0.34
2) Insurance & Pension Fund	14	12	15	15	13	14	5	4	4	13	8	7	0.32
3) Other Financial Services	15	13	13	14	14	14	6	5	5	8	7	6	0.31
4) Financial Supporting Service	14	13	16	13	12	14	3	3	3	9	8	5	0.30
12. Real Estate Activities	10	9	11	11	12	11	12	8	5	4	5	7	0.38
13. Business Activities	15	12	13	15	15	14	14	8	8	7	8	9	0.36
14. Public Administration & Defence	17	12	9	9	11	12	-3	4	-1	0	5	1	0.27
15. Education	15	16	14	11	14	14	15	15	9	14	10	13	0.42
16. Human Health & Social Work Activities	15	13	12	13	13	13	9	9	7	16	14	11	0.40
17. Other Services Activities	12	8	14	17	17	14	16	8	8	9	9	10	0.38
Total	15	10	10	11	9	11	7	7	6	5	5	6	0.36

D. Development Priority of Water-Energy-Food Related Sectors in Long-Term Development Planning (RPJPD) West Java Province Year 2005-2025 (Local Regulation No. 24 Year 2010 Jo. No. 9 Year 2008)

No.	Sector	1st Stage (RPJMN 2005-2008)	Stage 2 (RPJMN 2008-2013)	Stage 3 (RPJMN 2013-2018)	Stage 4 (RPJMN 2018-2023)	Stage 4 (RPJMN 2018-2023)
		Set up and preparation of supporting institutional, human resources and regulations	Preparing People Self-Reliance of West Java Province	Strengthening The Whole Development Process	Achieving People Self-Reliance of West Java Province	Pursuing People Primacy of West Java Province in All Sectors
1	Water	<ul style="list-style-type: none"> Regulation establishment of water infrastructures development Strategic planning, institutional and human resource development Cooperation among government, private sector, and community 	<ul style="list-style-type: none"> Proceeding and performing infrastructures development to support (1) improvement of raw water availability for any purposes, (2) optimization of flood and droughts control (3) optimization of irrigation network availability, (4) improvement of clean water and sanitation availability Completion of Jatigede Reservoir; Development planning of Sukahurip, Cikembang, Leuwikeris, Citepus, Santosa, Cibatarua Reservoir; Preparation and development of Irrigation Area (DI) Leuwigoong etc. Water pollution control 	<ul style="list-style-type: none"> Improved raw water availability for any purposes, optimized flood and droughts control, optimized irrigation network availability, improved of clean water and sanitation availability Development of Sukahurip, Cikembang, Leuwikeris, Citepus, Santosa, Cibatarua Reservoir; Preparation and development of Cipanas and Sadawarna Reservoir; Preparation and development of Irrigation Area (DI) Leuwigoong etc. Water pollution control 	<ul style="list-style-type: none"> Self-reliant raw water availability for any purposes, reliable flood and droughts control, reliable irrigation network availability, self-reliant clean water and sanitation availability Completion of Cipanas and Sadawarna Reservoir; Preparation and development of Irrigation Area (DI) Leuwigoong etc. Water pollution control 	<ul style="list-style-type: none"> sustainable raw water availability for any purposes, robust flood and droughts control, sustainable irrigation network availability, steady clean water and sanitation supply
2	Energy	<ul style="list-style-type: none"> Institutional preparation, human resources development, and regulation establishment Energy demand provision; improvement of energy conservation and saving; outset of alternative energy development 	<ul style="list-style-type: none"> Improved institution, human resource, and regulation in energy sector Preparation of regional master plan of energy in West Java Province; development planning of energy self-reliant village; improved energy conservation and saving; improved energy supply and access; increased people participation Improvement of energy infrastructure; capacity improvement of PLTA, PLTP development, support alternative energy PLTMH, PLTS, PLTB, and LISDES 	<ul style="list-style-type: none"> Reliable institution, human resource, and regulation in energy sector Reliable energy supply, Energy self-reliant village, improved energy efficiency, reliable energy conservation and saving, Private sector engagement in new and renewable energy by incentive scheme 	<ul style="list-style-type: none"> Self-reliant energy by reliable energy infrastructures, energy self-reliant village, reliable energy supply, energy conservation and saving Improved private sector and community participation in new and renewable energy provision 	Sustainable energy supply, excellence energy self-reliant village, reliable participation of private sector and community in energy development
3	Food	<ul style="list-style-type: none"> Outset of agribusiness development through strengthening of; human resource, business, supporting environment, facilities and infrastructure, research and development, institutional Outset of marine business development through strengthening of: facilities (TPI/PPi), aquaculture system, people empowerment, human resource, database, spatial planning, law enforcement, technology, etc. 	<ul style="list-style-type: none"> Agriculture development focusing on: Farmer's welfare, rehabilitation of supporting infrastructures, education and culture improvement, land conversion control Agri-business development through: increasing productivity, sub-system improvement, business revitalization, increasing value added in economic structure, resources reallocation, financing, and village agri-business development Marine and fishery business development through: commercial fishery development, production facilities, communication technology, business networking, product processing, and downstream industry 	<ul style="list-style-type: none"> Agriculture development focusing on: Quality improvement through technology from upstream to downstream Marine and fishery business development through: intensive control of commercial fishery business, recreational fishery, fishing vessel business, market strengthening, fishery product processing 	<ul style="list-style-type: none"> Agriculture development focusing on: business network expansion (vertical and horizontal agriculture system integration) through: holding company establishment, and cross-level business collaboration Marine and fishery business development through: improvement of commercial fishery business, recreational fishery, fishing vessel business, market strengthening, fishery product processing, marine culture and coastal cities development 	<ul style="list-style-type: none"> Agriculture development focusing on: winning the competition through competitive primacy, regional self-reliant food supply, international high-acceptance of the products, high-value added of export Marine and fishery business development through: reliable of commercial fishery business, recreational fishery, fishing vessel business, market, fishery product processing, marine culture and coastal cities development

Source: adapted from (Pemprov Jabar 2010)