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ARTICLE

Perspective of the Application of Low Impact Development (LID) to Deal with Floods to Strengthen the Economic Structure of Pontianak City

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ABSTRACT
Pontianak city is the capital of West Kalimantan Province, undergoing dynamic growth and development in various sectors. However, it is often hit by inundation or flooding, affecting region development, particularly economic structure. The effort that can be made is the Low Impact Development (LID) Approach to overcome flooding and inundation in urban areas while providing economic value benefits. This research analyzed the economic structure of Pontianak City with an analysis of *LQ*, Typology *Klassen* and *Shifted Share* to look at the growth of the base sector and the movement of economic structures. AHP analysis is used to look at the perspective of LID application in Pontianak City. The results showed that the water procurement, waste management, byproducts, and recycling sectors became one of the base sectors in Pontianak City. However, the results of shift-share analysis on the competitive advantage component (Cij) showed the sector was moving more slowly than the Provincial level. Policies are needed to accelerate the growth of the water management sector, one of which is a policy to overcome the problem of flooding and inundation in Pontianak city and concomitantly strengthen its economic structure. The results of the AHP analysis showed the selected form of LID application, namely water tanks, rain gardens, bioretention, filter strips, infiltration trenches, porous pavement, and infiltration wells that lead to small-scale or self-contained applications. Sensitivity analysis shows that the criteria for land needs are very sensitive and most affect other measures, namely cost, in determining LID application. Therefore, the commitment of the Pontianak City Government as a regulator, dynamic actor, and facilitator is needed to support policies and budgets that strengthen the economic structure of Pontianak City as well as a cross-sectoral working atmosphere and healthy investment to support the implementation of LID.

A. INTRODUCTION

Development is an endeavour in a planned and sustainable manner to support the change in the condition of society for the better. Development encompasses the physical-nonphysical, material-spiritual aspects of people's lives. However, development carried out without environmental sustainability values can be detrimental to the development itself. One example is the physical development carried out by converting land without regard to the hydrological

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function of an area that causes flooding in the built-up area and/or in the surrounding environment due to the loss of water uptake and storage areas.

Pontianak city is the capital of West Kalimantan Province. It has undergone dynamic growth and development. But it has the characteristics of areas that have the potential exposure to flood disasters. Hamid (2020:3) and Yasira (2018:1–2) state that Pontianak city has an abundance of water because it lies on the cross equator that has the characteristics of high rainfall and influenced by sea tides. The elevation of Pontianak City is relatively sloping, ranging from -0.54 to 1.5 m, and the ground slope is 0–2%. Thus, based on the analysis of Kurnia, Mulki, and Firdaus (2019:1) and Purnomo, Mulki, and Firdaus (2019:6), puddles or floods in Pontianak city are very likely to occur if there is a combination of high rainfall. Still, the flow is not quickly drained or combines the rainy season and the river tide period.

The city of Pontianak becomes vulnerable to inundation if there is a high intensity of rain. To the release to Kalbar Meteorological, Climatological, and Geophysics Agency (BMKG, 2019), there was a flood on November 23, 2019, on many roads and housing in most areas of Pontianak city. Recorded rainfall reached 134.8 mm/day with a moderate-heavy category that lasted ± 3 hours since 15.30 WIB. In 2020, it was reported by Manggalani (2020) that on November 19, 2020, some protocol roads in Pontianak City were exposed to inundation reaching 10-30 cm due to heavy rains. Furthermore, Antara (2021), reported on July 14, 2021. Floods also hit the city of Pontianak with a height of 10-30 cm due to rain that occurred from Tuesday night (July 13, 2021) until Wednesday morning (July 14, 2021). Then, on August 18, 2021, Yuniar (2021) reported puddles in all sub-districts in Pontianak city due to heavy overnight rains. Flood conditions due to rainfall will be worse if it coincides with the tidal period in the mouth of the Kapuas watershed. According to BPBD Pontianak City (2021), there were at least 2-3 times the occurrence of floods every year in Pontianak City from 2016 to 2020.

The frequent occurrence of floods in Pontianak city makes floods a strategic issue in the Regional Medium-Term Development Plan (RPJMD) of Pontianak city years 2020-2024 that demands to be addressed immediately. However, the city of Pontianak is still using the old paradigm in dealing with the problem of flooding. Pontianak City Government is still struggling with the formulation, determination, implementation of the environmental drainage policy (Nugraha, 2021:1) Among others, by expanding the capacity or building small reservoirs, normalizing rivers regularly and periodically, and optimizing the functions of trenches to drain rainwater run-off as quickly and as much as possible to outlets end or body of water nearby (Ibrahim, 2020). It is still technical and has not considered environmental, social, economic and cultural factors. According to Farida and Aryuni (2020: 151) this will increase the risk of flooding in downstream areas. While viewed from an economic point of view, the location of inundation and flooding is a minus for investors because it can hamper access to business facilities and infrastructure. At the same time, rainwater run-off can be used as a water reserve and has the potential to be developed related to the water procurement sector.

Green Infrastructure (GI) is a paradigm of sustainable environmental arrangement by managing green open space and natural environmental conditions. Examples of approaches such as maintaining the hydrological cycle, improving soil conditions, rainwater management, to flood mitigation by utilizing vegetation and soil in an area. This concept is considered adequate for mitigation and adaptation of social and ecological changes to changes in ecosystems in a region. The purpose of green infrastructure is to coordinate environmental, social and economic development to support sustainable development (Simatupang and Franklin, 2020: 208; Everett, Lawson, and Lamond, 2015:1; Liu, Xiu, and Ye, 2020:1; Ying et al. 2021:1).

Low Impact Development (LID) is a planning and design engineering approach to managing rainwater run-off as part of green infrastructure. LID is a water run-off management

and land use strategy that seeks to mimic hydrological conditions before development in an area of infiltration. This approach uses conservation and natural conditions in water management to produce a hydrological balance and maintain water quality to be the same before and after development. This strategy emphasizes protection by using natural features, location planning, and implementing water run-off distribution management integrated into a project design. LID strategies can be applied in developing new areas, urban retrofitting, infrastructure improvements and aquatic resource revitalization projects (Coffman 1999:12–13, 16–17; Hintman 2012:10–11; Hanastasia S and Sudradjat 2016:92).

The use of LID is expected to deal with the problem of inundation and flooding in Pontianak city. The application of LID to provide maximum results must pay attention to local, regional conditions such as topography and weather (Pour et al., 2020:29). Applying LID in a region requires a region-specific in-depth study to provide maximum results. The initial stage needed is the view of stakeholders who play a role in regional development. At the same time, understanding the region's condition and the community's condition gives fundamental consideration to the planning process of implementing LID as an alternative to the utilization of the potential of inundation and flooding into a sustainable source of water in the city of Pontianak.

The implementation of LID is also expected to support economic growth in Pontianak City in the base sector (Helvira, 2019: 24). RPJMN policy 2020-2024 strengthens economic growth and competitiveness pillars in supporting sustainable development goals, especially industry, innovation and infrastructure (Ministry of National Development Planning/ BAPPENAS, 2020: 8). Therefore, this study analyzed the perspective of the form of the application of Low Impact Development (LID) in rainwater run-off management planning to support economic growth and strengthen the economic structure of Pontianak City through sustainable urban environmental management.

B. LITERATURE REVIEW

Pontianak city is the capital of West Kalimantan Province, undergoing dynamic development. In terms of population increase, according to Indonesian Statistics (BPS) data of Pontianak city (2021: 371), the population and the level of population density in this city are getting higher every year. In 2020, the people of Pontianak city were estimated to have reached 670,859 people (Irni, 2020: 1), with a population density of around 5,567 people / km^2. To support community activities and economic development, the construction of public facilities, financial infrastructure and settlements in some areas in Pontianak city becomes inevitable. The scope of Pontianak city is only 102.82 km^2 (Pontianak City Government, n.d: 1). Makes the development can certainly impact economic growth and the surrounding environment. The economic growth of Pontianak City can be seen in various sectors. According to Julianti & Martha (2016: 19), there are several sectors of Pontianak city base that have the opportunity to be developed, consisting of electricity, gas and drinking water sector, building sector, trade sector, hotel and restaurant, transportation and communication sector, financial sector, rental and corporate services, and service sector. But the condition of this sector is influenced by various factors and problems in Pontianak, so a review is needed to strengthen previous research.

Based on the RPJMD of Pontianak City year 2020-2024, floods in Pontianak City have become a strategic issue in the region. Flooding is caused by increased infrastructure development and waste volume due to increasing urban population, narrowing and siltation of drainage channels and tides (Pontianak City Government, 2020:IV.3). Improper drainage conditions cause drainage capacity to be unable to withstand the volume of rainwater run-off, so the city of Pontianak experiences puddles or floods when raindrops within 3-7 hours. Urban

drainage systems are part of the environmental disaster adaptation strategy. They have been arranged to channel surface run-off, regulate surface water needs, replenish groundwater, and maintain soil level decline. However, a good drainage function must be followed by public awareness in maintaining and caring for it because otherwise, it will cause problems of puddles around the drainage area (Silitonga, 2019: 35; Rustan et al. 2020:10).

The drainage function in the Green Infrastructure (GI) concept is to control excess water run-off as raw water supply and maintain water resources. GI is considered an adequate effort in dealing with water run-off in urban areas. The results of Martínez et al. (2018:1) show that proper GI implementation will significantly lower water run-off at a low cost, even providing additional effects such as decreased water pollution and peak discharge of run-off and volume run-off water in urban areas. When viewed on the economic side, (Yasa, 2010: 285) states that in the short term, the implementation of GI can reduce economic growth but will increase economic growth and environmental quality in the long term. This concept seeks to integrate ecosystem functions with development within a region while still maintaining and creating landscape features that ensure the availability of water and soil resources so that the implementation of GI can support the economic and social growth of the community while contributing significantly to nature and climate

LID application technique is the management of rainwater around the rainwater catchment area with a micro-scale done in the location or by utilizing the integration between small-scale local drainage systems. The engineering principle is to control surface run-off discharge to keep it low and maintain or prolong the concentration-time of run-off in an area by maintaining and increasing the intensity of infiltration, filtration, storage, evaporation, transpiration, and surface roughness in a region. The needs of an area carry out the application of LID. It can be applied in various forms such as bioretention, infiltration wells, filter strips, grass channels, and others (Coffman 1999: 1.5-1.6; Darsono 2007:258–59; Budinetro et al., 2012:100-101). The results of Siregar, N, and Indrawan (2020:10) study mention that LID can be utilized by combining it with existing drainage in an area.

Some research related to the application of LID included by Li et al. (2016:12) analyzes the effects of four forms of LID application, namely bioretention, green roof, porous pavement and filter strip and its combined application in rainwater management and run-off. The results showed that both individual and combined applications effectively controlled non-heavy and moderate rainfall, but heavy rains were likely to cause flooding in urban areas. According to Zhang et al. (2021:1), applying LID in the porous pavement, bioretention, rain gardens, and grassed pitches reduces flood risk and maintains water quality in a residential area. At the same time Samouei & Özger (2020: 1517–1518) stated that the transfer of closed sites combined with the application of LID such as green roofs, bioretention and porous pavement could reduce the peak discharge and volume of water run-off in an area.

The use of LID and reasonable environmental solutions also positively impact economically. Roseen et al. (2012:1–2), EPA (2013:23), Usaach (2015: 1-2, 4-5) mention that the use of LID economically can provide environmentally sustainable benefits and save grey infrastructure budgets because it can save costs from 6% to 49%. This calculation is based on the cost of construction and maintenance costs. Savings reached 6% for housing and 26% for the scale of commercial projects. Even at the urban level, savings went from 21% to 44%. The use of LID can also cut the use of culverts. The use of LID benefits the water management sector by improving water quality, improving watershed quality, filling groundwater, and reducing drainage infrastructure costs.

According to Zuniga-Teran et al. (2020:710) the challenges in implementing green infrastructure (LID) are stakeholders' views on the technology to be applied and their commitment to development funds and infrastructure maintenance built and made an effort so that people can receive the technology. Pontianak City Government needs to create value for

the implementation of LID, a consistent and integrated approach to assessing and increasing the benefits of public investment in infrastructure (Asian Development Bank, 2021:6). The increase in the public value of LID application is related to economic, social and environmental impacts. In the end, the implementation of LID requires the role of the Pontianak City Government as a regulator, dynamic actor and facilitator (Rismawati et al., 2015: 171). Implementing LID in the future requires a clear policy either as environmental mitigation or as part of investment in the efficient water procurement sector. Multi-party participation in the planning, implementation, monitoring and maintenance of LID must also be encouraged by the government to strengthen the economic structure of Pontianak City. Finally, as a facilitator, the Pontianak City Government must create LID acceptance among stakeholders to apply LID.

According to Pritasari & Kusumasari (2019: 181), a good policy should be able to predict the impact or implications when a policy is implemented. Stakeholder perception information is needed for a plan or solution to a problem that can develop into a policy in the future. This research will analyze stakeholders' perceptions of the application of LID to deal with floods to strengthen the economic structure in Pontianak City.

C. METHOD

The research began with a quantitative approach with a typology analysis of Klassen, LQ. It Shifted Share to analyze the economic structure of Pontianak City so that the base sector can be developed in Pontianak City. Data come from Pontianak city PDRB from 2016-to 2019. The condition of the next industry is adjusted to the problems that occur in the city of Pontianak, namely flooding.

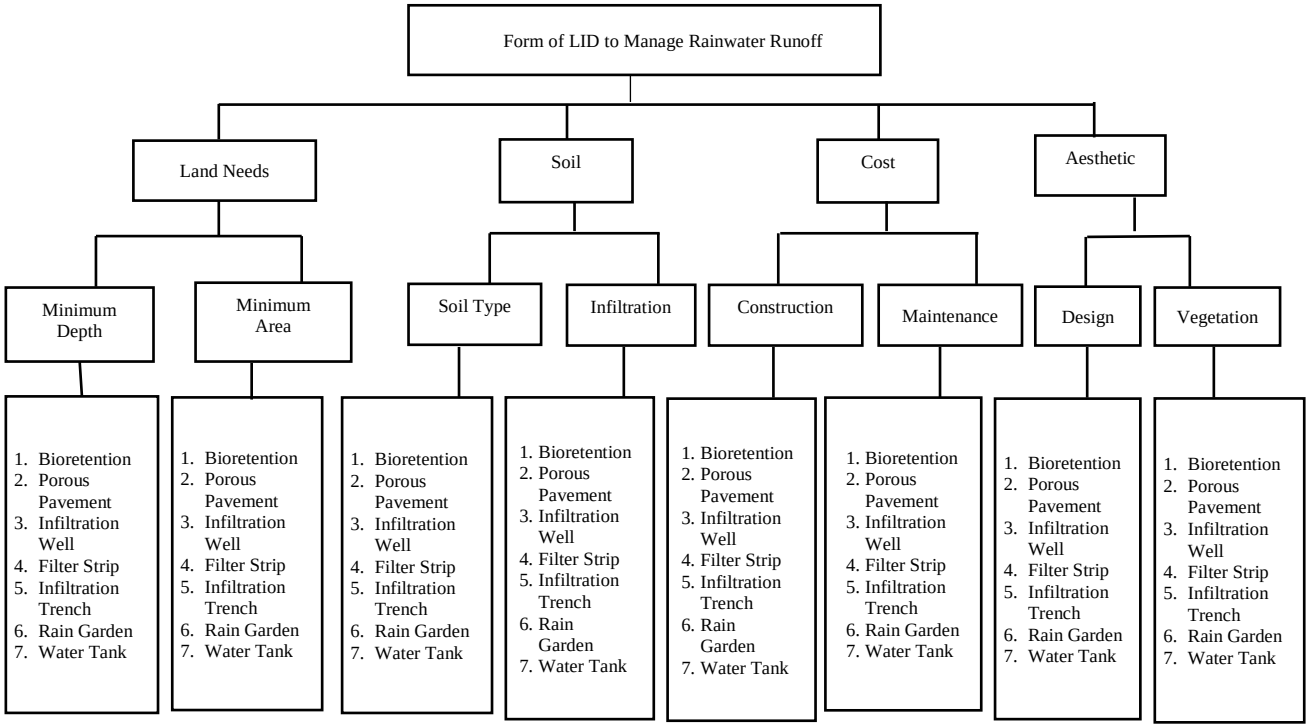
The LID approach is used as a solution in dealing with urban flooding. This study looked at the perspective of applying LID in Pontianak City using the Analytical Hierarchy Process (AHP). AHP is an analytical model that can break complex problems into a simple hierarchy to support decision-making. Hierarchy is a form of representation of complex issues on structured levels. The first level is the goal, then the level of factor, criteria, sub-criteria and so on, down to the last level of the alternative. With hierarchy, problems will appear more structured and systematic (Saaty, 2016:5–7). The AHP analysis used primary data from the filling of a structured questionnaire containing criteria, sub-criteria and alternatives to the application of LID forms in dealing with inundation and flooding and strengthening the economic structure of Pontianak City. Weighting for criteria and sub-criteria is conducted based on the following levels of importance: 1 (both criteria are equally important), 3 (criterion (A) is slightly more important than criterion (B)), 5 (measure (A) is more important than criterion (B)), 7 (criterion (A) is essential than criterion (B)) and 9 (Criterion (A) more important than criterion (B)), and vice versa.

Data collection techniques are document review, in-depth interviews and questionnaire filling. The discussion aims to explain the management of inundation and flooding in Pontianak city and the view of the implementation of LID in the future in Pontianak city. The speakers were selected in purposive sampling from stakeholders. They are authorized experts that understand the concept of LID in Pontianak City. Consists of the Pontianak City Public Works and Spatial Planning Office, The Public Housing Office and Pontianak City Residential Area, Pontianak City Regional Planning and Development Agency and Lecturers of the Faculty of Civil Engineering, Tanjungpura Pontianak University.

Rahmasari (2017: 39-40) stated that the development of green infrastructure should pay attention to the environmental value system that is easy in design, the right location, performance of the ecosystem, esthetic design, and cost-effectiveness. According to Sutrisno (2011:34–35), the form of application of LID needs to pay attention to land needs (minimum surface area, minimum width, minimum length and minimum depth), soil (soil type and

infiltration speed), slope, groundwater level or hard soil layer, distance to building foundation, maximum depth and maintenance. As for the criteria variety, sub-criteria and forms of LID that are alternatives to the analysis of the research perspective can be seen in Figure 1 below:

Figure 1. Hierarchy *of Analitycal Hierarchy Process (AHP)* Research



Source: Modified by Researchers, 2021

D. RESULT AND DISCUSSION

Economic Structure of Pontianak City

According to Tarigan (2005: 27), the region's economic growth rate is determined by increased exports from one area to another, better known as the base theory. These economic activities are grouped into 2, namely base and non-base activities. In Table 1, it can be seen the following results of the LQ analysis of the base sector for Pontianak City.

Table 1. LQ Analysis Results Years 2016 – 2019

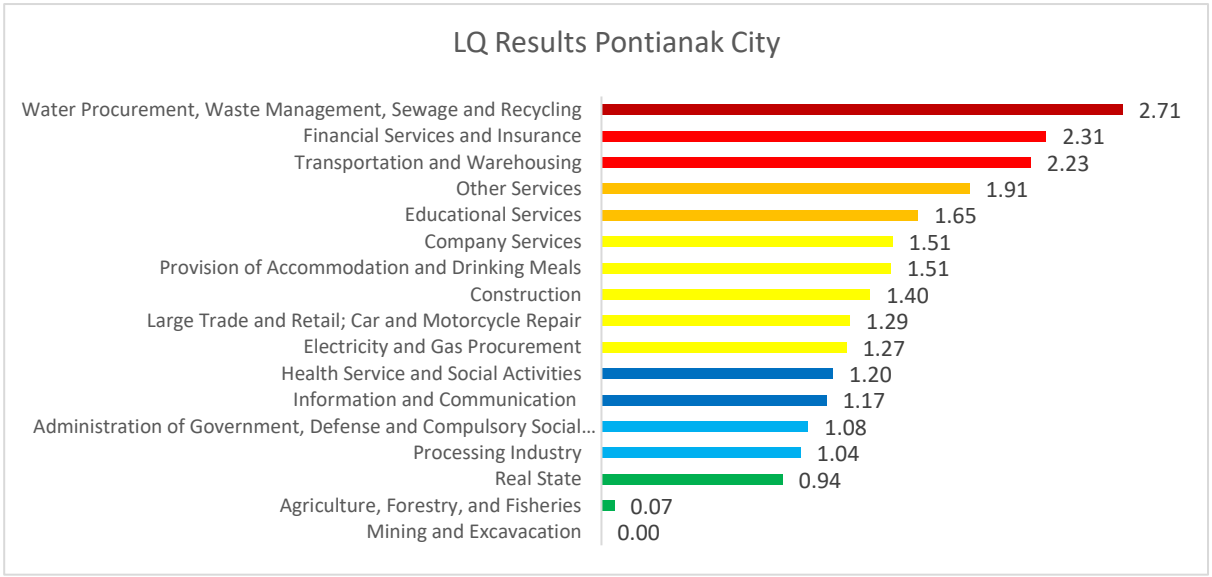
Business Field	Year				
	2016	2017	2018	2019	LQ Average
Mining and Excavation	0.00	0.00	0.00	0.00	0.00
Agriculture, Forestry, and Fisheries	0.07	0.07	0.07	0.07	0.07
Real State	0.95	0.95	0.94	0.93	0.94
Processing Industry	1.02	1.04	1.04	1.05	1.04
Administration of Government, Defense and Compulsory Social Security	1.04	1.05	1.09	1.13	1.08
Information and Communication	1.10	1.14	1.19	1.24	1.17
Health Services and Social Activities	1.20	1.20	1.19	1.22	1.20
Electricity and Gas Procurement	1.26	1.26	1.29	1.30	1.27

Large Trade and Retail; Car and Motorcycle Repair	1.30	1.30	1.30	1.26	1.29
Construction	1.40	1.39	1.39	1.41	1.40
Provision of Accommodation and Drinking Meals	1.51	1.50	1.50	1.51	1.51
Company Services	1.46	1.50	1.53	1.57	1.51
Educational Services	1.66	1.65	1.63	1.64	1.65
Other services	1.93	1.90	1.91	1.93	1.91
Transportation and Warehousing	2.28	2.23	2.17	2.24	2.23
Financial Services and Insurance	2.29	2.27	2.33	2.36	2.31
Water Procurement, Waste Management, Sewage and Recycling	2.75	2.74	2.72	2.63	2.71

Source : Processed Data, 2021

The table above shows that the water procurement, waste management, and recycling sectors have the highest LQ value of 2.71. The sector has a high potential for comprehensive development (see Graph 1).

Chart 1. Pontianak City LQ Calculation 2016 – 2019



Source : Processed Data, 2021

These results are also in line with the Analysis of Klassen Typology shown in Table 2, where this sector is categorized as a potential sector.

Table 2. Analysis of Typology Klassen Economic Structure of Pontianak City in 2016-2019

Average Rate Sectoral Growth \ Average Contribution Sectoral Against PDRB	Kij≥Kin	Kij<Kin
Rij≥Rin	Processing Industry Electricity and Gas Procurement Information and Communication Company Service Government Administration, Defense and Compulsory Social Security	-
Rij<Rin	Water Procurement, Waste Management, Sewage and Recycling Construction Large and Retail Trade, Car and Motorcycle Repair Provision of Accommodation and Food and Drink Education Service Health Service and Social Activities Other Services	Agriculture, Forestry and Fisheries Mining and Excavation Real Estate

Source : Processed Data, 2021

Grouping the water procurement, waste management, sewage and recycling sectors into potential sectors is considered an ability of the Pontianak City Government to develop this sector. In addition, this sector has the potential to become the livelihood of local people and can help the sustainable regional economy. The development of the water procurement, waste management, sewage and recycling sectors can also be known simply by the following Shift Share analysis.

Table 3. Analysis *of shift share* sectors of water procurement, waste management, sewage and recycling of Pontianak City Economic Structure Years 2016-2019

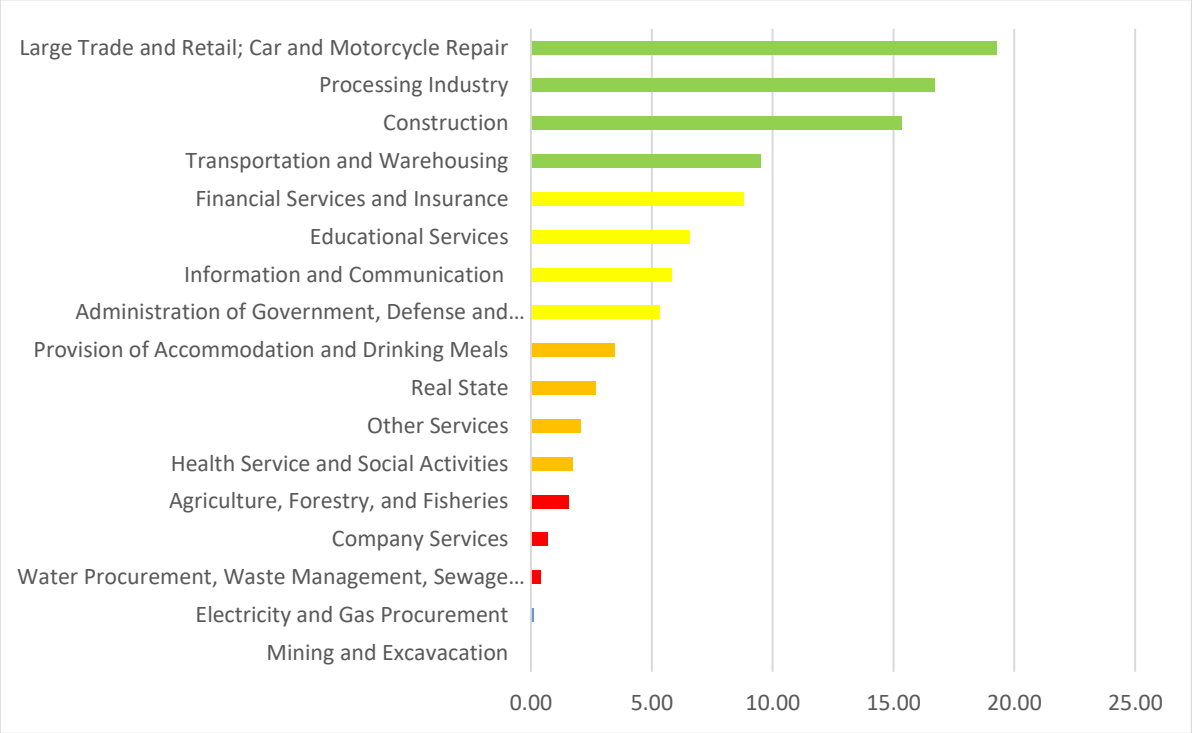
No.	Contribution	N_{ij}	M_{ij}	C_{ij}	D_{ij}
1	Water procurement sector, waste management, sewage and recycling	3,72	-0,34	-0,80	2,58

Source : Processed Data, 2021

In Table 3, the role of *economic performance* (Nij) in the water procurement sector, waste management, sewage and recycling of West Kalimantan Province to the economic performance of the sector in Pontianak City is relatively low 3.72. The calculation *of Proportional Shift* (Mij) shows that the sector has decreased by -0.34. In line with this, the *differential shift* (Cij) calculation result is negative at -0.80. It means that the influence of the water management sector's competitive advantage component (Cij) has a negative effect. Economic growth in Pontianak city is -0.80 slower than the growth of the same sector in the province. Based on the results of the LQ and Klassen Typology analysis, the water procurement, waste management,

sewage and recycling sectors are considered potential. However, the results of the Shift Share analysis are also supported by the average contribution value of 17 sectors in Pontianak City in Chart 2 as follows:

Chart 2. Calculation of The Average Value of Contributions of 17 Sectors in Pontianak City Years 2016-2019



Source : Processed Data, 2021

Based on the percentage of sector contributions (Chart 2), the water procurement, waste management, and recycling sectors only reached 0.38% of the average total GDP in 2016-2019. The value of this contribution is relatively low compared to other sectors. It is inseparable from the policy of the Pontianak City Government, which relies heavily on drainage to reduce floods. Nurdin et al. (2014: 8) said that the use of pump houses that serve to pump excess water into the sea is a temporary solution to reducing flooding.

Water management through waste management, waste and recycling has not been optimal. Then water management activities can be carried out by the private sector by providing raw water commercially or stakeholders using rainwater for various purposes.

According to data from BPS of Pontianak City (2021: 16), the level of rainfall in Pontianak City is quite varied, with an average annual rainfall of 321.8 mm/capita. Floods and inundation in Pontianak City that occur due to rainwater run-off, if handled appropriately, can be an opportunity to improve the economy and community welfare. In Wulandari and Purnomo research (2018: 398), 66.18% of rainwater is used as drinking water and processing food, so it is very beneficial to the economic activity of the people of Pontianak City. If appropriately managed, this rainwater run-off by reducing pollutants and maximizing their absorption and collection can be a reserve of water sources for the community that can be used daily.

Managing rainwater with LID and using water tanks (on a small scale) can also be done by making infiltration wells and retention ponds for maximum rainwater storage (large scale). The use of infiltration wells and retention ponds in large capacities has the potential to produce commercialized water reserves. However, the implementation of LID in Indonesia is still

relatively rare, so evaluations related to the economic impact of implementing LID have still not been carried out, especially those that directly impact the water procurement sector, waste management, sewage, and recycling. Nevertheless, Zhan and Chui's (2016) research in Xu et al. (2019: 1109) managed to quantitatively present the benefits of applying LID for 30 years, which is ±5.3 billion USD. In the study (Xu et al., 2019: 1110), the application of LID provides considerable economic benefits, such as reducing the cost of rainwater run-off management, flood control and rainwater purification. It aligns with EPA research (2007: 13) where LID implementation can save costs ±29% compared to conventional water run-off management.

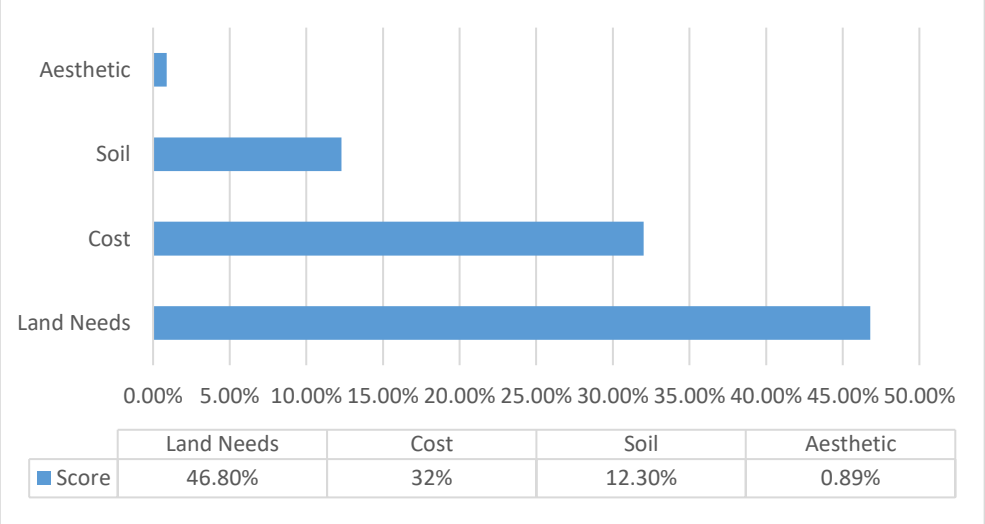
According to Pratikno and Handayani (2014: 312), the higher and more prolonged the inundation time will affect the community's economy and social activities. The implementation of LID will certainly impact economic improvement while reducing the incidence of floods and inundation to reduce economic and social losses to the community. Therefore, the Pontianak City Government has an important role to include disaster management plans in the Short-, Medium-, and Long-Term City Development Plan (RPJP, RPJM and RKP Kota). In addition, make contingency plans, emergency operations, post-disaster recovery, and combine disaster management plans with Regional Spatial Plans.

Perspective on The Implementation of *Low Impact Development (LID)* in Pontianak City

According to the informant, reduced water catchment areas and increased land cover are the causes of flooding problems in Pontianak City. It causes the discharge of rainwater run-off to be greater than rainwater absorbed and retained in the ground. Management of stormwater run-off insignificant and minor drainage channels to drain as much and as quickly as possible run-off into rivers or seas to minimize inundation and flooding. However, drainage channels at the tertiary and quaternary levels are poorly preserved and maintained, so they are not optimal in accommodating rainwater run-off that causes the inundation of low-topography areas and ramps.

Given the frequent flood events in Pontianak City, the management of rainwater run-off that rests on drainage channels is certainly insufficient. Alternative rainwater run-off management strategies are needed, such as applying LID in areas that have not been built or that have been built. LID can be included when drawing up a development plan for an undeveloped area. In areas that have been made, LID can still be applied by integrating it into site planning, architecture, engineering and construction (Delaria, 2008: 8–10).

Graph 2. *LID* Criteria Analysis Results

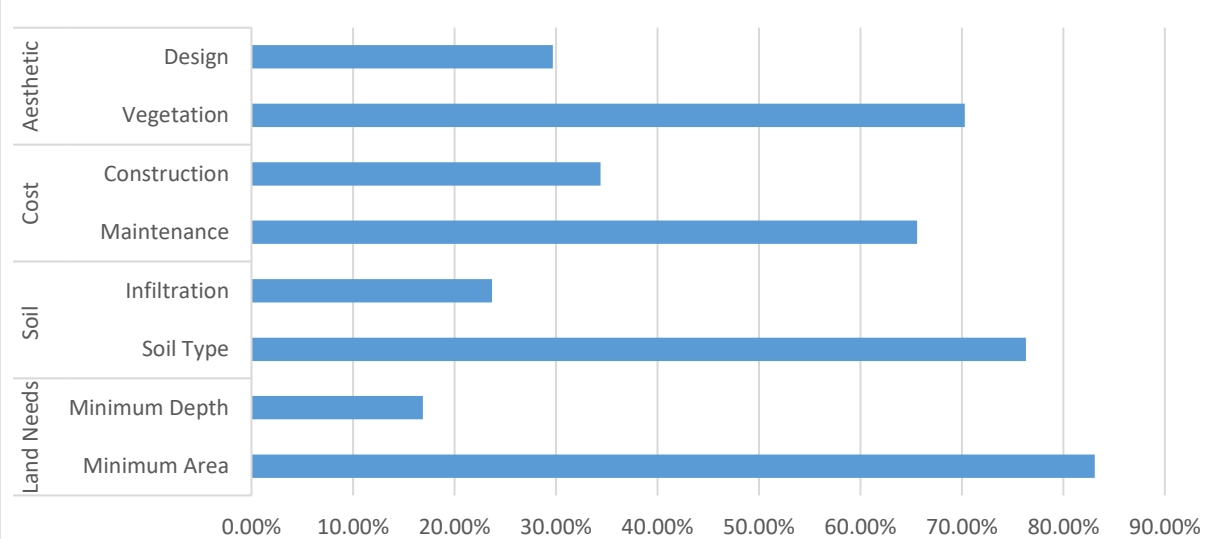


Source : Processed Data, 2021

In the AHP results, it is known that the criteria for land needs of 46.8% are the primary consideration factors in deciding the application of LID in Pontianak City, followed by the cost criteria of 32%, land 12.3% and aesthetics of 8.9%. The source said the land needs and costs were the primary considerations due to the high use of developed land in Pontianak City and the limited government budget to build and maintain infrastructure. In fact, according to Latief et al. (2021: 57), the use of built-up land has a substantial and significant effect on increasing the area of floodwaters in a room. The Pontianak City Government needs to enforce the Regional Spatial Plan (RTRW) regulations and implement the Building Design and Environmental Planning Plan (RTBL) to prevent uncontrolled development that impacts the environment.

The results of the analysis at the subcriteria level (Figure 3) showed 1) land needs criteria, a minimum area (83.1%) is more important than the minimum depth (16.9%). 2) soil criteria, soil type (76.3%) is more important than soil infiltration (23.7%). 3) the cost criteria, maintenance costs (65.6%) are more important than construction costs (34.4%). 4) aesthetic criteria, vegetation (70.3%) is more important than design (29.7%). The informants revealed that the condition of high groundwater levels causes the width or area of the channel. The suitability of soil types that affect infiltration and soil carrying capacity needs to be considered in determining the application of LID in Pontianak City. According to them, the LID used should be low cost, absorb water and have an aesthetic value (vegetation). Maintenance costs are also needed, so LID infrastructure functions well in the long term. This consideration is supported by Iskandar et al. (2020: 1), who stated that the factor of land subsidence influences the widespread flooding of rob. Farida and Aryuni (2020: 155) also indicated that vegetation and open land in an area can increase the absorption of rainwater by 70%, so the use of vegetation in LID is expected to reduce water run-off.

Graph 3. *LID* Sub-criteria Analysis Results



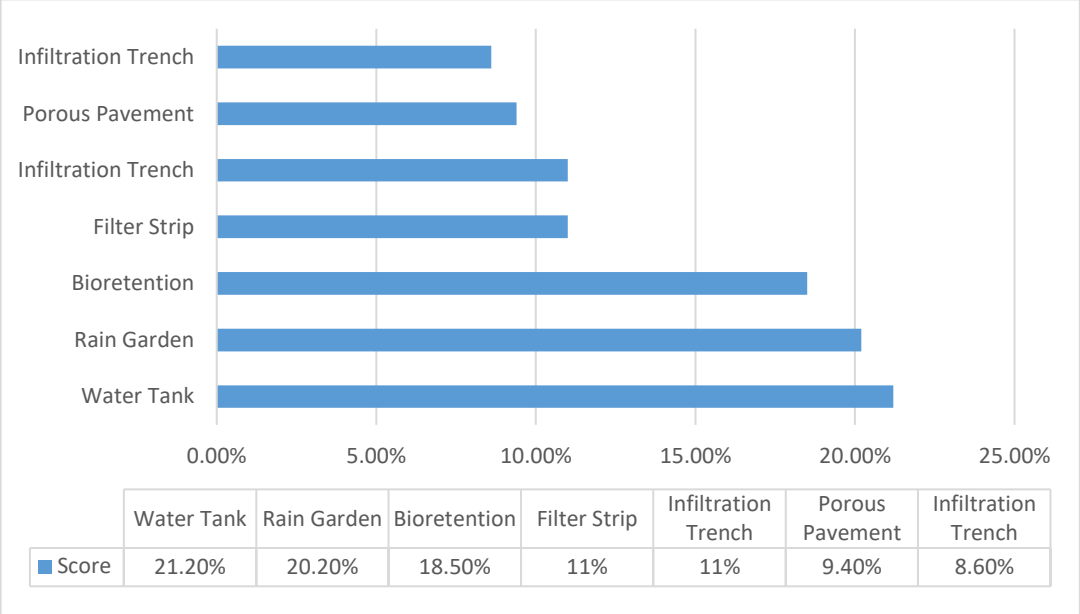
	Land Needs		Soil		Cost		Aesthetic	
	Minimum Area	Minimum Depth	Soil Type	Infiltration	Maintenance	Construction	Vegetation	Design
Score	83.10%	16.90%	76.30%	23.70%	65.60%	34.40%	70.30%	29.70%

Source : Processed Data, 2021

The application of LID, which has various shapes, sizes and technologies, must pay attention to conditions and requires continuous care to maintain its function in the long term (Hintman, 2012: 15). The difference in LID techniques used has different hydrological abilities and cost results (Li et al., 2020: 1). It makes it easier for stakeholders to choose the form of LID used to match the characteristics of the region and its financing capabilities.

Alternative applications of LID techniques (Figure 4) consist of bioretention, porous pavement, infiltration wells, filter strips, infiltration trenches, rain gardens and water tanks. The analysis results showed that water tanks at 21.2% were the primary choice, followed by the application of rain garden at 20.2%, bioretention at 18.5%, filter strip at 11%, infiltration trenches at 11%, porous pavement at 9.4%, and infiltration wells 8.6%. The selected LID alternative leads to small-scale or self-contained applications.

Chart 4. Results of Alternative Analysis of *LID* Application Forms



Source : Processed Data, 2021

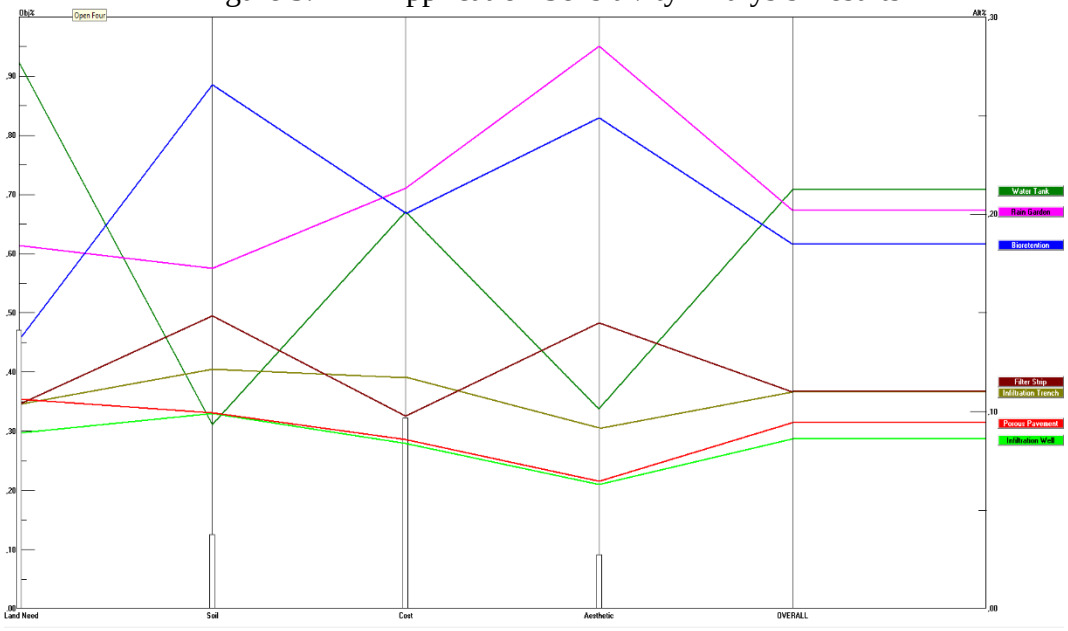
This result is in the opinion of the persons who mentioned land limitations and costs. Implementing LID should be done on a small or independent scale, such as in residential areas, offices and trade centres. It is supported by Budinetro et al. (2012: 110) which state that the community's contribution will be more significant if hydrological problems are handled on a small scale and low cost. Although seen as a small effort, if done by the majority of the community, it will impact reducing water run-off in drainage channels.

The government can make LID applications on a small scale by using water tanks, building a rain garden and bioretention in the yard, and applying porous pavement. Shafique & Kim research (2015: 543) mentioned that to manage rainwater run-off can use bioretention, porous pavements, rain gardens and filter strips, improving water quality and maintaining the environment in the hydrological aspects of an area. Bioretention is effective for withstanding large volumes of water run-off and pollutants, while the porous pavement is very effective for absorbing rainwater run-off in areas where rain occurs.

The implementation of LID in the future is expected to have implications for reducing the incidence of floods and inundation to minimize the impact of losses and contribute positively to the economic structure of Pontianak City. Local government involvement consisting of local governments, communities, and the private sector is needed to implement LID, which has a systematic and synergistic link to the implementation and sustainability of

programs or policies (Faturahman, 2017: 200). Its participation is in the form of concern, awareness, role, commitment and cooperation to flood and inundation mitigation efforts through LID to strengthen the economic structure of Pontianak City.

Figure 5. LID Application Sensitivity Analysis Results



Source : Processed Data, 2021

Based on sensitivity analysis, it can be seen that the criteria for land needs are very sensitive and most affect other criteria in determining the application of LID. The large-scale application of LID in Pontianak City with infiltration trenches, filter strips and infiltration wells is challenging due to land limitations, low soil carrying capacity, high groundwater level and cost constraints. If the criteria for land needs are lowered, the implications of cost criteria will rise significantly because minimal and low-support land use requires complex design engineering and complex techniques.

The implementation of LID requires a high cost but has a long continuity. Investment from both abroad and domestic is an alternative to long-term urban development. According to Putri (2014: 109), investment affects economic growth, so the Pontianak City Government is expected to attract more investors so that long-term regional development is more optimal and can strengthen the economic structure. Pratiwi (2021: 150) said that local governments must be more intensive in coordinating, cooperating and marketing the superior economic potential to attract many investors.

Political stability factors also affect investors' interests. Swainson & Mahanty (2018:290–291) said the government needs to ensure political stability to maintain investor confidence in investing. Therefore, the Pontianak City Government must organize an institutional system based on Good Governance to have more opportunities to get investors.

E. CONCLUSION

The water procurement, waste management, sewage and recycling sectors are one of the base sectors in Pontianak City. However, the results of shift-share analysis on the competitive advantage component (Cij) show that this sector is moving more slowly than the same sector at the provincial level. So policies are needed to accelerate the growth of the water procurement

sector, one of which is by making policies to overcome flood and inundation issues in Pontianak City with LID.

The results showed that the application of LID in Pontianak City must take into account land needs and costs. The LID alternatives chosen tend to be applicable on a small or independent scale, namely 21.2% water tanks, 20.2% rain garden, 18.5% bioretention, 11% infiltration belts, 11% infiltration trenches, 9.4% porous pavement and 8.6% infiltration wells.

Therefore, the author compiled several recommendations to be considered in supporting the implementation of LID in Pontianak to strengthen the economic structure of Pontianak. First, the Pontianak Government needs to include LID elements in developing its territory through RTRW, RTBL and RPJM regulations. Second, the implementation of LID on a broad scale to strengthen the economic structure of Pontianak City in the water procurement sector, waste management, sewage, and recycling requires high costs. So the Pontianak Government needs to ensure legal certainty that can be socialized and not politicized for group or personal interests. In addition, the government needs to cut licensing procedures in investing and seek tax breaks or tax components so that investors receive more profits and interest in investing is greater. The follow-up of the two suggestions above relates to Regional Development Plan (Bappeda), Regional Finance Agency, Law Bureau, BPBD, DPMT-PTSP and PUPR Office, Public Housing Office and Pontianak Residential Area.

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