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IRRIGATION SYSTEM RELATIONSHIP MODEL ON ECONOMIC GROWTH IN BANTAENG REGENCY: EVIDENCE FROM INDONESIA

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Abstract

The focus of this study is to determine the level of influence and understand the regional growth factors that are affected by the irrigation system; were to understand the system model of irrigation, the variables are drawn from the results of the literature review are irrigation networks, irrigation associations, irrigation water, and irrigation management. So that the results of the research are expected to be a solution to solving problems in the irrigation sector and regional economic growth so that it can encourage the productivity of the agricultural sector and increase the regional economy, which in the future will be the concern of the community and the government to maximize all the potential in the area, this study consisted of three exogenous variables, each of the intermediate and endogenous variables. The results of this study stated that in the demonstration of the direct effect of the irrigation network, the Association of Irrigation and Irrigation Water on Irrigation Management noted that it has a significant impact. This shows that the operation of the irrigation network is an essential indicator in irrigation management. Where farmers understand when the floodgates open. Furthermore, a Demonstration of the Indirect Effect of the Irrigation Network, Irrigation Association, and Irrigation Water on Regional Economic Growth Through Irrigation Management This indicates the accessibility of farmers to obtaining fertilizers, seeds, and public services is a determinant of the economic growth of a region.

Keywords: Irrigation Network, Irrigation Association, Irrigation Water, Irrigation Management, Regional Economic Development

I. INTRODUCTION

Indonesia is an agricultural country where the farm sector has an essential and strategic role in national development, including providing national food. Irrigation is a technology that aims to increase water availability for farming. Therefore, irrigation policy is an essential variable in farming business growth. Farmers' need for irrigation water increases along with the demand to produce quality crops. Irrigation is critical for meeting the food demand of the world's population, which has doubled since the Second World War (WWII). Irrigation as a primary source of agricultural productivity growth is related to suppliers of natural water resources. Ebrahimian et al. (2019)describe that irrigation water availability and quality are essential for crop productivity. Water potential triggers the formation of food security as an

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indicator of the prosperity of a region. However, the world's clean water supply continues to decline due to extensive agricultural demand for irrigated land. In the next decade, it is estimated that more than 40% of the total population will face water stress or scarcity, which significantly impacts water security. Rockstrom and Baron (2017) report that the availability of irrigation water is only around 25% of the water demand for food worldwide. Therefore, additional irrigation systems are needed for rain fed agriculture as a potential solution to the increasing demand for food. Furthermore, Dolan & Sorby(2003)describe how the agricultural sector employs large amounts of human resources, providing the basis for developing other economic fields. So, the need for sustainable water availability for the farming industry and other sectors means an optimal irrigation system has a significant role in regional economic growth. Several studies have proven the hypothesis that the results of irrigation system development contribute to regional economic growth. Liu et al. (2019)describe how water-saving irrigation systems at the local level will have complex impacts on agricultural production, farmer welfare, exploitation, and utilization of water resources.

Furthermore, Hong & Moorman (2005)describe how irrigation water has tremendous economic value in agricultural production factors. The existence of irrigation infrastructure requires enormous costs both in construction and maintenance. Therefore, the use of irrigation with an optimal system is a determinant of the economic development of a region. The existence of an irrigation system causes regional economic growth and practically develops economic growth. So it can be concluded that the irrigation system can affect regional income, production, employment, and income distribution. Developing an irrigation system for the availability of a sustainable water supply will impact various sectors, especially in the agricultural sector, which will increase productivity and further encourage regional economic growth, which is the basis for the food supply commodity sector. The increase in GDP in Uganda occurs because of the effectiveness and increasing potential of their water resources by maximizing their irrigation potential. Based on this, Indonesia, which has had a bitter experience of monetary and economic crises, provides empirical evidence that the agricultural sector is the most resilient in facing the global crisis. The agricultural sector was the only sector that could grow positively by 0.03 percent (1998), while the other sectors grew negatively by -13.7 percent (1998). The fundamental error in development is that the agricultural sector is only treated as a supporting sector that tends only to secure macro interests(Ruf & Gérard, 2001); (Putra, 2022); (Azizah et al., 2022); (Arfah, 2021). The new era of agriculture in the future requires focusing on achieving added value, income, and farmer welfare as the primary reference in regional economic development and development(Suryahadi & Hadiwidjaja, 2011).

Issues that develop with irrigation policy include three things: the selection of irrigation technology, financing and use of resources, and farmers' participation in the maintenance of facilities(Meinzen-Dick et al., 2002); (Meinzen-Dick, 1997); (Hasanuddin, 2021). Furthermore, the Integrated Participatory Development and Management of Irrigation Program (IPDMIP) in 2021 reported that the unreliable irrigation water was indicated by the ability of reservoirs to guarantee 10.7% of irrigation water availability, and the remaining 89.3% relied only on river discharge(Islamiah et al., 2021). The performance of the irrigation

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network is highly dependent on the condition of the river area. The state and function of the national surface irrigation infrastructure are not yet optimal. Indonesia's total surface irrigation area is 7.1 million ha or 78% of the total national irrigation area of 9.136 million ha. An area of 46% or about 3.3 million ha of irrigation infrastructure is in a damaged condition, of which 7.5% is under the central government's authority.

In comparison, 8.26% is irrigation under the power of the province, and 30.4% is under the control of the district/city government. Irrigation management has not been optimally seen of the inefficient use of irrigation water. The current Per Capita Capacity of 56.89 m3/second is still far from ideal (1,979 m3/capita) as well as the increasing conversion of agricultural land into non-agricultural functions, where the rate of conversion of agricultural land functions in the 1981-1999 period was 90,417 ha/year while the 1999-2002 period was 187,720 ha/year. In following up on these conditions, the Provincial Government of South Sulawesi has outlined the Basic Pattern for Regional Development with development priorities in the agricultural sector, making it a provider of national rice granaries(Ahmad et al., 2020).

For this reason, the development of irrigation systems and utilization in increasing food production will ultimately increase people's income. Related to this, Bantaeng Regency partially supports the agricultural and plantation resources supply in South Sulawesi. It has 7,916.1 hectares of irrigated rice fields, consisting of 6,752.1 hectares of irrigated rice fields and 1,164 hectares of non-irrigated rice fields (Bantaeng Regency in figures, 2019). Bantaeng Regency is geographically unique, complete with upstream and downstream problems; on the downstream, there are frequent annual floods (every five years, there is a big flood). In the upstream, there is forest damage, and the community is included in the marginal category(Sari et al., 2020). This area has three sub-watersheds (watersheds), all of which lead to the city of Bantaeng as its downstream. The Lantebong sub-watershed, the Biangloe sub-watershed, and the Sinoa sub-watershed. These three sub-watersheds require special handling to save their ecosystems and the welfare of the people who depend on their sustainability. Especially for irrigation water sources obtained from rivers and springs that spread naturally and then flow through primary, secondary, and tertiary networks, some points of land in Bantaeng Regency are very dependent on climatic conditions because, during the dry season, agricultural land becomes dry, so productivity is very low(Ramadani et al., 2020).

On the other hand, most of the agricultural land in Bantaeng Regency is irrigated land so that the land can produce throughout the year. This is a different obstacle in the irrigation system of Bantaeng Regency because dry areas are less productive in the dry season or during periods of low rainfall. Efforts to provide irrigation to dry land points are complicated because some points of land are at a height, and some issues are located very far from water sources (Strategic Plan of the Bantaeng Regency Agriculture Office 2018-2023).

The Integrated Plan and Medium-Term Investment Infrastructure Program (RPI2-JM) Bantaeng Regency for 2015-2019, which adopted the direction of the Bantaeng Regency RTRW, was directed to fulfill irrigation needs by helping to accelerate the increase in production and productivity of agricultural land, especially wetland agriculture (paddy fields) and ground. Potential to be developed on a relatively large scale. In particular, the

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development of irrigation networks is aimed at supporting the acceleration of food self-sufficiency in rice which is expected to be achieved, and even further, it can help support national food security, which tends to weaken day by day due mainly to the conversion of productive land as well as these opportunities. Based on data from the Bappeda of Bantaeng Regency in 2019, an existing irrigation potential can be developed in 60 irrigation areas with a total potential size of 12,510 Ha and an irrigation area of 10,621 Ha. The main factor affecting agricultural productivity in Bantaeng Regency is the availability of irrigation water, but this is highly dependent on global climate change marked by rainfall fluctuations(Simanjuntak, 2021); (Hasrat & Rosyadah, 2021). This condition causes a shift in cropping patterns and calendars and the risk of pest and plant disease explosions, which impact decreasing agricultural production. This condition requires a study of the availability of reliable water following the needs of plants. However, the extensive irrigation network cannot function properly without good water availability. Therefore, the irrigation system in Bantaeng Regency must be supported by a good pattern of water regulation and maintenance of irrigation networks. This can only be achieved with the support of government institutions and community institutions that jointly implement the strategy of increasing agricultural production to support regional economic growth. It has a destructive impact on cropping intensity if no innovation and technological breakthrough can solve the problem, especially in maintaining water resources through irrigation systems for agricultural activities and other sectors. This is also related to research conducted by Alexandratos and Bruinsma (2012), which revealed that to meet the growing demand for agricultural commodities, irrigation areas in the world need to be increased by 15%, and 60% of that needs to be modernized. Increasing pressure on water and energy resources concerns the primary water-consuming sector in many semiarid regions is irrigated agriculture. Significant efforts to modernize irrigation worldwide have resulted in the shift from open channels to pressurized distribution networks (Playán and Mateos 2006). Modernization of agricultural irrigation systems (usually from surface to sprinkler/drip irrigation) has increased irrigation efficiency (Latif et al., 2016); (Playán et al., 2013)but has drastically increased energy consumption(Mushtaq et al., 2013).

Observing the economic growth of the Bantaeng Regency area, the sector that plays an essential role in its development comes from the Agriculture, Forestry, and Fisheries sector, which contributes revenue to a GDP of 30.39%. However, the economic growth rate of Bantaeng Regency for the last six years has been in a fluctuating condition; where in 2013, it touched a growth rate of 9%, then for five years until 2018, it decreased to 8.08%. Then when viewed from the contribution of Bantaeng Regency to the GRDP of South Sulawesi Province, Bantaeng still contributed stagnated at 1.66% of the total GRDP of South Sulawesi Province for five consecutive years. The Agriculture, Forestry, and Fisheries sector is a sector that really determines the economy of Bantaeng Regency, because most of the population has a livelihood by farming, especially gardening, so that it can contribute 31.74%. Agricultural Commodities are trade crops that are quite strategic in Bantaeng Regency, because they are not only a source of foreign exchange income in the agricultural sector, but more importantly are the series of production activities including business and marketing to create jobs so that

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they can absorb the existing workforce. Overall, the dynamics of potential and problems in the Agriculture, Forestry and Fisheries sectors of Bantaeng Regency, their roles and functions are stipulated in the Regional Spatial Plan (RTRW) of Bantaeng Regency as a city strategic area (KSK) from the point of view of the importance of economic growth by becoming an Agropolitan Area. Empowerment of paddy fields and plantations is expected to be able to support increased productivity, income, and welfare of farmers. This is also in line with the spatial planning goal of Bantaeng Regency, namely to create a safe, comfortable, productive and sustainable regional space for Bantaeng Regency through the development of agropolitan and minapolitan based on disaster mitigation, with one of its policies through increasing regional productivity through land intensification and agricultural modernization. environmentally friendly. Maximizing the potential of the agricultural sector in Bantaeng Regency must be supported by the availability of infrastructure, especially the development of an irrigation system as a provider of sustainable water resources.

In this regard, preparations need to be made to face the challenges due to the increase in population and massive urbanization of urban areas, such as Makassar City as the Capital of South Sulawesi Province, which is directly connected to Bantaeng Regency as a food supplier. Various previous studies on irrigation management generally use a technical approach, including (i) research on irrigation water needs with field observations in evapo transpiration, percolation, evaporation, water discharge, and soil physical properties. (ii) Laboratory research in soil testing to determine soil texture and permeability coefficient by comparing results in the laboratory and observations of inflow-outflow, percolation, evaporation, and transpiration in rice fields. (iii) Research on irrigation water needs on critical land through a bamboo channel system to determine the physical condition and texture of the soil in water absorption. (iv) Research on irrigation water supply systems on isolated land to determine irrigation water delivery systems in the dry season by giving minimal application and plant growth with a system of evaporation from dew, and it turns out that from some of these studies, it is still not optimal in finding the proper irrigation management. This is because there are still many latent variables that have not been studied and how much their value can affect the success of irrigation that the community can feel. Irrigation must be viewed in the form of a system. According to the Regulation of the Minister of Public Works No. 30/PRT/M/2015 covers irrigation infrastructure, irrigation water, irrigation management, irrigation management institutions, and human resources. Irrigation systems must be multi-functional, have various functions that can meet the needs of water users, and realize the community's welfare. Furthermore, the Bantaeng Regency Regional Regulation No. 4 of 2010 concerning irrigation revealed that irrigation management is critical for agricultural production and regional food security.

The policy also outlines that the development and management of irrigation systems are carried out by prioritizing the utilization of surface water and the existence of unified management of development and management(Ramireddygari et al., 2000). The development and management of irrigation systems are also carried out to ensure sustainability based on the reliability of irrigation water. This is realized through development activities that pay attention to conservation and preservation aspects in order to ensure the balance of water

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conditions, in the form of utilization and development of lakes, development of reservoirs, field reservoirs, weirs, pumps, and good drainage networks, control of water quality, and reuse of drainage water(Singh, 2019); (Verma, 1993). Furthermore, the reliability of irrigation infrastructure is carried out through activities to improve and manage irrigation networks, including operation, maintenance, and rehabilitation of irrigation networks. With the complexity of problems in the irrigation system and the demand for increased economic growth, researchers in the field of research in irrigation systems are concerned with their influence on regional economic growth. This study will further study "The Model of the Relationship of the Irrigation System to the Economic Growth of the Bantaeng Regency." The outline of this research is to know the level of influence and understand the factors of regional growth that are influenced by the irrigation system; were to understand the model of the irrigation system, the variables are drawn from the results of the literature review are irrigation networks, irrigation associations, irrigation water, irrigation management. Which. So that the results of the research are expected to be a solution to solving problems in the irrigation sector and regional economic growth so that it can encourage the productivity of the agricultural sector and increase the regional economy, which in the future will be the concern of the community and the government to maximize all the potential in the area. This study consisted of three exogenous variables, each of the intermediate and endogenous variables. Based on the above background, the formulation of the problem to be studied can be described as follows: 1. what are the irrigation system description and economic growth in the Bantaeng Regency area? 2. What is the relationship model of the irrigation system to the economic growth of the Bantaeng Regency area? 3. What is an effective strategy for developing an irrigation system to develop economic growth in the Bantaeng Regency area?. The objectives to be achieved in this research are to find answers to the following questions; Describe the profile of the irrigation system and regional economic growth. Bantaeng Regency. To examine the model of the relationship of the irrigation system to the economic growth of the Bantaeng Regency area. They are analyzing effective strategies that can be carried out in the development of irrigation systems to develop economic growth in the Bantaeng Regency area.

II. RESEARCH DESIGN AND METHOD

This type of research is quantitative with descriptive and correlational approaches. In terms of scope, this research is an ex post facto survey research that collects factual data about facts that occur in the field. Specifically, this research is located in Bantaeng Regency. Specifically in areas that receive irrigation services for agricultural cultivation purposes. The total area is 18,268 ha which is divided into eight sub-districts which is presented in table 1.

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Table 1: Name and Area of Irrigation Area

No.	Subdistrict	Number of Irrigation Areas	Area (Ha)
1	Bantaeng	10	894
2	Bissappu	14	911
3	Eremerasa	7	1672
4	Gantarangkeke	12	4182
5	Pajukukang	15	2226
6	Sinoa	9	1889
7	Tompobulu	20	4636
8	Uluere	13	1858

Data source: Central Bureau of Statistics, 2020

The research population is all farmers who manage the land and are domiciled in Bantaeng Regency. The total population in this study comprised 18,278 farmers who managed the land. Researchers determine a sample of 300 people based on the minimum number of samples sent for the SEM method according to Solimun (2002:78): 1). Suppose the parameter estimation uses the maximum likelihood estimation method. In that case, the recommended sample size is between 100 and 200, with a minimum of 50. a total of 5–10 times the number of parameters in the model. It is equal to 5–10 times the number of manifest variables of all latent variables. The total manifest variables in this research model are 25 variables; referring to the third point above, the maximum required sample size is 10 x 25 or 250 samples.

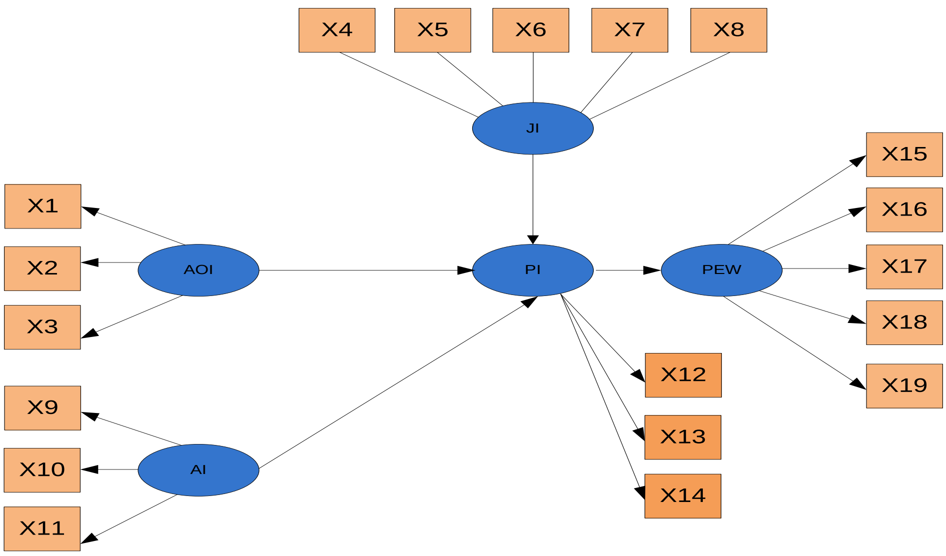

Figure 1. Conceptual Framework

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To measure the study variables as shown in Table 2, an instrument with five answer options was used, namely 1 strongly disagree, 2 disagree, 3 disagree, 4 agree, and 5 strongly agree.

Table 2: Operational Definitions and Variable Measurement

Variables	Indicators	Mean Validity	Estimate
Irrigation Association (AOI)	(X1) Input on evaluation of irrigation asset management	0.562	0.883
	(X2) Efforts to maintain the reliability and sustainability of the irrigation system	0.574	0.884
	(X4) The role of farmers in the construction and maintenance of irrigation structures	0.655	0.285
Irrigation Water (AI)	(X9) Use of irrigation water	0.646	0.950
	(X10) Water distribution	0.657	0.922
	(X11) Handling of complaints and conflicts on irrigation water regulation in the field	0.771	0.892
Irrigation Management (PI)	(X12) Operation of irrigation network	0.631	0.962
	(X13) Professional workers in irrigation management	0.642	0.767
	(X14) Operational and maintenance fund for irrigation	0.659	0.458
Regional Economic Development (PEW)	(X15) Labor force participation	0.671	0.923
	(X16) Production yield	0.631	0.947
	(X17) Accessibility	0.618	0.955
	(X18) Capital formation	0.614	0.948
	(X19) Technological development	0.771	0.885
Irrigation Network (JI)	(X4) Irrigation channel condition	0.661	0.386
	(X5) Security and irrigation building channels	0.650	1.00
	(X6) Functions of irrigation canals and structures	0.666	0.865
	(X7) Classification of irrigation networks	0.619	0.856
	(X8) Completeness of irrigation infrastructure	0.607	0.424

The research plan was carried out in Bantaeng Regency, South Sulawesi Province. The scope of the research material is the construction of irrigation networks that have been carried out in Bantaeng Regency, agricultural productivity, and the GRDP of Bantaeng Regency, which is focused on point 1 (agriculture, forestry, and fisheries). To find out and understand the level of influence and correlation and the model of the relationship of the irrigation system to the regional economy of Bantaeng Regency, path analysis is used. Structural Equation Modeling (SEM). SEM is a statistical technique used to build and test statistical models, which are usually in the form of causal models. SEM is a hybrid technique that includes confirmatory aspects of factor analysis, path analysis, and regression, considered exceptional cases in SEM. SEM has developed and has a function similar to multiple regression. However, SEM is a more vigorous analytical technique because it considers interaction modeling,

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nonlinearity, correlated independent variables, measurement errors, and interference with correlated errors. Terms), latent independent variables are measured using many indicators, and several indicators measure one or two latent dependent variables. At first, the data was processed through hypothesis testing using the Structural Equation Model with an alternative method based on covariance or Component Base SEM with Smart PLS software, PLS Graph. Besides, SEM can combine measurement models with structural models simultaneously and efficiently when compared to other multivariate techniques (Hair, 1998), and the determination of strategy formulation with SWOT based on logic can maximize strengths and opportunities but can simultaneously minimize weaknesses (weaknesses) and threats (threats) (Rangkuti, 1998).

III. RESULT AND DISCUSSION

The total area of production land in each sub-district is different. As presented in table 3 below:

Table 3: Irrigation Area and Production Results of Bantaeng Regency

No.	Subdistrict	Number of Irrigation Areas	Area (Ha)	Production (tons)
1	Bantaeng	10	894	64,15
2	Bissappu	14	911	88,15
3	Eremerasa	7	1672	47,83
4	Gantarangkeke	12	4182	74,55
5	Pajukukang	15	2226	94
6	Sinoa	9	1889	58,92
7	Tompobulu	20	4636	125,62
8	Uluere	13	1858	85,1

Source: Bantaeng Regency Statistics, Year 2020

3.1 Potential of Bantaeng Regency's Agricultural Sector

The natural wealth of the Bantaeng Regency produces biological and animal diversity that can be of economic value. With natural conditions that are very suitable for various types of animals and plants, it provides an opportunity for the Bantaeng area to be developed into a production center for several commodities. Several agricultural sector commodities that have been successfully developed are food crops, namely rice, corn, taro, cassava, green beans, and peanuts. In contrast, vegetable crops developed, such as cabbage, potatoes, carrots, onions, and garlic, have made Bantaeng Regency a supplier of commodities in the southern region of South Sulawesi. Fruit plants that have been successfully developed include mango, strawberry, and apple. Apart from chickens, this area is suitable for developing cattle, horses, and goats in the livestock sector. In the field of plantations, the climate in most areas of Bantaeng Regency is suitable for cocoa, kapok, coffee, cloves, and coconuts. In fisheries, especially seaweed cultivation, this area has succeeded in changing the economies of coastal

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communities, which are identical to low-income communities, into people who have an adequate income. In addition, to cultivate freshwater fish in the future, Bantaeng Regency will become regency with a producer of freshwater fish seeds. The amount of agriculture's contribution to GRDP is presented in table 4 below:

Table 4: Contribution of the agricultural sector to GRDP at current prices by business field in 2016-2020

GDP by Sector (Million Rupiah)	2016	2017	2018	2019	2020
Agriculture Forestry and Fisheries	20.493.380,3	22.096.798,0	23.641.863,0	25.052.169,0	25.452.508,7
ADHB GDP	62.838.879,8	69.424.560,0	77.695.018,0	87.810.445,0	89.704.767,7
	32.6%	31.8%	30.4%	28.5%	28.3%

Source: Central Bureau of Statistics Bantaeng Regency, 2020

Table 5: Contribution of the agricultural sector to GRDP at constant prices Sector in 2016-2020 (Million IDR)

PDRB Lapangan Usaha (Juta Rupiah)	2016	2017	2018	2019	2020
Agriculture Forestry and Fisheries	14.110.948,2	14.899.895,5	15.657.080,0	16.368.120,0	16.358.126,6
ADHK GDP	43.736.521,3	46.941.583,0	50.758.370,0	56.215.230,0	56.505.351,6
	32.2%	31.7%	30.8%	29.1%	28.9%

Source: Central Bureau of Statistics Bantaeng Regency, 2020

The description of the data in tables 4 and 5 shows that in the last five years, the agricultural sector has contributed more than 28% of GRDP. This indicates that the growth of the agricultural sector is an essential strategy for increasing regional economic growth. Irrigation in Bantaeng Regency consists of 100 irrigation areas spread over eight sub-districts. The Tompobulu sub-district has the largest irrigation area. However, this does not support crop yields because the percentage of irrigation networks that are heavily damaged in this sub-district is 70%. Meanwhile, Pajukukang and Ererasa sub-districts have an excellent irrigation network, as shown in Tables 6 and 7.

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Table 6: Irrigation Network Condition

Subdistrict	Percentage		
	Heavy Damage	Light Damage	Good Condition
Bantaeng	57	0	43
Bisappu	42	5	54
Eremerasa	17	17	66
Gatarangkeke	48	0	52
Pajukukang	19	9	73
Sinoa	53	0	47
Tompobulu	70	0	30
Uluere	18	0	82

Table 7: Number, Area of DI and Agricultural Production by District

No.	Subdistrict	Number of Irrigation Areas	Large of Area (Ha)	Production (Ton)
1	Bantaeng	10	894	6.42
2	Bissappu	14	911	6.3
3	Eremerasa	7	1.672	6.83
4	Gantarangkeke	12	4.182	6.21
5	Pajukukang	15	2.226	6.27
6	Sinoa	9	1.889	6.55
7	Tompobulu	20	4.636	6.28
8	Uluere	13	1.858	6.55

Data on rice production in each sub-district shows a figure higher than 6 tons/hectare/harvest. This becomes a strength for the government because the amount of production is relatively high.

3.2 Potential of Bantaeng Regency's Economic Sector

Economic growth in Bantaeng Regency from 2016 to 2021, which refers to gross regional domestic product and per capita income, is presented in the following table:

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Table 8: Gross Regional Domestic Product and Per capita Income of Bantaeng Regency

Description	2016	2017	2018	2019	2020
GDP at current prices (Million rupiah)	6.283.888	6.942.456	7765065	8781045	8970476.77
Economic growth (%)		10.5	11.8	13.08398	2.1572863
GDP Based on 2010 constant prices (Million Rupiah)	4.373.652,1	4.694.158,3	5.073.381	5.621.523	5.650.535,16
		7.4%	8.1%	10.8%	0.5%
Income per capita at current prices (million rupiah)	34.058,75	37.409,3	41.610,75	46.800,79	47.590
		9.83%	11.23%	12.47%	1.68%

Source: BPS Bantaeng Regency, 2020

3.3 Characteristics of Respondents

The characteristics of respondents are a description of the state of the research subject. Respondents who are the primary source of research data are the key to the level of accuracy. The subjects who became respondents in this study were as many as 300 people who worked as farmers working in the irrigation areas of Moti, Biangloe IV, Biangloe V/VI, Biangkeke V, and Palaguna. The following are the results of calculations based on the characteristics of the respondents. The gender category of the respondents consisted of men and women. For the female category, the result was 31%. Then in the male category, the results were 69%. From these results, it can be concluded that most respondents in the gender category of this study are male. The respondent's age category comprises five age categories from 17 years to > 52 years. Respondents with the most miniature age were aged > 52 years with a value of 7%. At the same time, the respondents with the most age were between 37-46 years, with a value of 42%. The respondent's last education level category consists of four education level categories, starting from elementary school (SD) to undergraduate level (S1). The lowest level of education is in the elementary school (SD) category, with 12%. At the same time, the highest level of education is in the high school category with 35%. The respondent's land area category comprises four categories starting from < 1 Ha - > 2 Ha. Respondents with the smallest land area are > 2 Ha with a value of 5%. The land area dominated between 1 – 1.5 Ha is 60%.

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3.4 Description of Research Variables

Descriptive description of the respondents' answers to research instruments includes regional economic growth variables, irrigation networks, associations, water, and irrigation management.

a. Regional Economic Growth

Public perception of regional economic growth in Bantaeng Regency is in the high category with a frequency value of 181, or 60%. These results indicate that the community sees benefits and additional income from the use of agricultural land supported by the availability of irrigation. Furthermore, the researchers conducted an analysis of each variable indicator of regional economic growth. The results of the analysis of regional economic growth indicators are presented in the following table:

Table 9: Regional Economic Growth Assessment Indicators

Indicators/ Variables	Average value	Category
Labor Force Participation	3.59	High
Production result	3.96	High
Accessibility	3.35	Moderate
Capital Formation	2.33	Low
Technology Development	3.87	High

Source: Data Analytics, 2022

The table above shows that respondents think labor force participation shows a high category or supports regional economic growth in Bantaneg Regency. In almost all areas of the Bantaeng Regency, agricultural activities involve female and male workers. Furthermore, the involvement of workers aged over 64 years is also still revealed in observations in several irrigation areas in the Bantaeng Regency. Furthermore, respondents considered that the wider the rice field area, the more the number of workers used. Thus, agricultural activity in terms of labor force participation becomes an important indicator of regional economic growth.

Furthermore, production results support regional economic growth because respondents generally think that agricultural production can improve people's welfare. The benefits of agricultural production can meet basic needs, education, and fulfillment of health standards. The accessibility indicators are considered moderate by respondents, or several aspects are not following the needs of farmers, such as the ease of obtaining subsidized fertilizers and superior seeds.

On the other hand, farmers generally assess the ease of obtaining health services, education, and clean water services. Respondents considered that capital formation with agricultural activities was in a low category. This idea is that it is difficult for farmers to get credit facilities for capital for agricultural activities, and the value of land assets does not increase

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from year to year. The indicator of capital formation is also marked by the low ability of farmers to develop side businesses. Agricultural technology development shows a high category characterized by technology for land management, plant maintenance, and harvesting activities. In addition, farmers also use information technology to increase the selling value of their crops.

b. Irrigation Network

The irrigation network in Bantaeng Regency is in the high category, with a frequency value of 300 or 100%. All respondents gave a high rating of the irrigation network. These results indicate that farmers participate in channel maintenance to prevent damage to irrigation canal buildings. Study of indicators of irrigation network variables with the average value of each indicator, namely:

Table 10: Irrigation Network Assessment Indicators

Indicators/ variables	Average value	Category
Irrigation Channel Condition	3.83	High
Drain Protection and Irrigation Building	3.71	High
Functions of Irrigation Channels and Buildings	4.31	Very High
Irrigation Network Classification	4.53	Very High
Irrigation Facilities	2.59	Moderate

Based on the table above, the respondents value the condition of the irrigation network channel as a suitable category or that the distribution of irrigation water and disposal of rice fields can be done quickly. The availability of water also marks this condition during the growing season. Securing irrigation canals and buildings shows the high category of farmers and their institutions in determining the distribution of water and maintenance of irrigation network facilities. Furthermore, farmers also work together to clean irrigation canals. The function of irrigation canals and buildings is considered very high because the irrigation infrastructure is in good condition, and if there is damage, the farmer will repair it. The classification of irrigation networks is also considered good because the maintenance of primary, secondary, and tertiary irrigation networks involves farmers. The completeness of irrigation infrastructure is considered low by respondents because complementary buildings such as irrigation canal walls, weirs, and sluice gates indicate unfavorable conditions. However, the function of the network goes well.

c. Irrigation Association

Irrigation associations in Bantaeng Regency are in the very high category, with a frequency value of 258 or 86%. These results indicate that in addition to P3A officers, farmers also participate in conducting inspections on irrigation canals. In addition, farmers' organizations also often carry out control to prevent water use conflicts. The study of indicators of irrigation association variables with the average value of each indicator, namely:

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Table 11: Irrigation Association Assessment Indicators

Indicator/ variable	Average value	Category
Input on Evaluation of Irrigation Asset Management	4.23	Very high
Efforts to Maintain the Reliability and Sustainability of the Irrigation System	4.37	Very high
The Role of Farmers in the Construction and Maintenance of Irrigation Buildings	4.35	Very high

Table 11 shows that the input for evaluation of irrigation asset management is in the very high category, or the WUA organization plays a good role in regulating irrigation water and preventing conflict. Likewise, efforts to develop irrigation water management are ongoing. The indicator of efforts to maintain the reliability and sustainability of the irrigation system also shows a very high category where farmers try to maintain irrigation facilities so that the water flow is sufficient for agricultural purposes. Furthermore, the indicator of the role of farmers in the construction and maintenance of irrigation buildings is also considered very high because farmers are involved in planning the distribution of irrigation water, irrigation maintenance, and maintenance of complementary irrigation buildings. With this involvement, the role of farmers is significant in achieving a good irrigation system function.

d. Irrigation Water`

Irrigated water in Bantaeng Regency is in the high category with a frequency value of 158 or 52%. These results illustrate that farmers have understood the importance of providing water reservoirs, such as reservoirs or water reservoirs used during the dry season. The study of indicators of irrigation water variables with the average value of the indicators, namely:

Table 12: Irrigation Water Assessment Indicators

Indicator/variable	Average value	Category
Use of Irrigation Water	4.04	High
Water Distribution	4.30	Very High
Handling of Complaints and Conflicts on Irrigation Water Arrangements in the Field	3.64	High

Table 12 shows that the indicator of irrigation water use is in the high category because of the ease of getting water during the growing season. Farmers can take advantage of water stored in reservoirs or water reservoirs even in dry season conditions. In addition, in some irrigated areas, groundwater pumps are available to meet crop water needs during the dry season. The water distribution indicator is very high, marked by the ability of farmers to regulate the distribution of water according to the needs of the plants, and even the water is evenly distributed to most agricultural lands in Bantaeng Regency. Furthermore, the indicators for handling complaints and conflicts regarding irrigation water regulation in the field are also high. This is due to the ability of farmer associations and local governments to handle farmer

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complaints about damage to irrigation facilities. Furthermore, farmer associations and communities also try to deal with conflicts between farmers.

e. Irrigation Management

Irrigation management in Bantaeng Regency is in the medium category with a frequency value of 202 or 67%. These results illustrate that farmers already know the opening and closing times of the floodgates. The study of indicators of irrigation management variables with the average value of each indicator, namely:

Table 13: Irrigation Management Assessment Indicators

Indicator/variable	Average value	Category
Irrigation Network Operation	3.50	High
Professionalism of Workers in Irrigation Management	2.88	Moderate
Irrigation Operationalization and Maintenance Fund	2.9	Moderate

Table 13 shows that the indicators for the operation of irrigation networks are in the high category. This is due to the floodgates' opening following the farmers' planning and understanding regarding the opening and closing times of the floodgates. This operationalization has been well achieved, supported by the management capabilities of farmer institutions. Indicators of workers' professionalism in irrigation management are at moderate levels due to the absence of irrigation canal inspection officers responsible for monitoring damage to infrastructure and other complementary buildings. To fulfill this, farmer groups always coordinate with the government to improve irrigation management. Furthermore, the indicators for the operationalization and maintenance of irrigation funds are considered moderate due to the lack of funds provided by the government for the maintenance of irrigation networks and the absence of a particular budget aimed at maintaining the sustainability of irrigation water. However, on the other hand, farmers understand that irrigation maintenance requires funding, and they are willing to contribute to efforts to maintain irrigation networks, even on a small scale.

3.5 Descriptive SEM Result Data

The suitability of the model was evaluated through various goodness-of-fit criteria. The first step is to evaluate whether the data used can meet the SEM assumptions: sample size, normality and linearity, outliers, and multicollinearity and singularity. Several conformity indices and cut-off values test whether a model is accepted or rejected.

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Table 14: Goodness-Of-Fit Performance Evaluation

Measurement	Standard	Value
Chi Sguare/df (cmin/df)	<3 baik; <5 diizinkan	0.967
p-value for the model	> .05	0.05
CFI	>.95sangat baik; >.90 baik; >80 diizinkan	0.950
GFI	>.95	0.953
AGFI	>.80	0.914
RMSEA	<.05 baik; .05 - .10 sedang; >.10 buruk	0.024
PCLOSE	>.05	0.020

Table 14 shows that the evaluation requirements for goodness-of-fit have met the standards described by Hair et al. (2010). The evaluation results of SEM analysis serve as a reference for the evaluation of SEM analysis. So that the model presented can be accepted.

3.6 SEM Analysis Results

Structural Equation Modeling (SEM) analysis in this study was conducted with three independent variables, namely irrigation networks (J1), irrigation associations (AOI), and irrigation water (AI). In contrast, the intervening variable was irrigation management (PI), and the dependent variable was economic growth—region (PEW). The results of SEM analysis show that irrigation associations have a significant influence on the irrigation network with a value of 0.93. This indicates that the P3A organization's thinking that comes from member agreements to maintain the sustainability of the irrigation system and the building will lead to optimal use of irrigation water and follow the needs of farmers. If the WUA organization intensively examines irrigation canals, then the water is evenly distributed on agricultural land. Likewise, the existence of mutual agreement by farmers in water management causes few conflicts in irrigation water regulation. The high linkage between irrigation associations and irrigation networks indicates that network optimization can be achieved with the role of farmer organizations, in this case, WUA.

Irrigation associations also have a significant effect on irrigation water. This indicates that the WUA's organizational capability in formulating irrigation asset management will result in a good understanding of farmers' how to distribute water. Furthermore, the WUA organization also continues to maintain the reliability and sustainability of the irrigation system, which will reduce the risk of farmers' complaints about irrigation water regulation. Thus, optimizing the use of irrigation water and water distribution and handling complaints and conflicts over water regulation is highly dependent on the ability of farmer institutions to organize their members in irrigation management. Irrigation associations affect irrigation water management with a low correlation value. The low correlation between the two variables is indicated by the WUA organization's inability to improve the irrigation network's operation. WUA does not have sufficient capacity to properly train farmers to manage network operations, such as regulating water discharge to irrigation canals or planning the timing of

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opening sluice gates according to farmers' needs.Furthermore, farmer organizations do not have the authority to regulate government officials in evaluating irrigation networks—likewise, the inability of WUAs to access extensive irrigation system operational funds. The irrigation network has very little influence on irrigation management, with a value of 0.08. This is indicated by the existence of irrigation networks that do not affect the ability of farmers to manage irrigation. In other words, the addition of irrigation infrastructure does not contribute to workers' professionalism in irrigation management or the willingness of farmers to provide maintenance budgets.

Furthermore, the irrigation network does not affect irrigation water. This is indicated by the increasing number of irrigation networks that do not affect the availability of irrigation water. However, the irrigation network is one of the suggestions to maintain water availability. The results of SEM analysis show that irrigation water has a significant effect on irrigation management. This indicates that if the water discharge is available at the water source, the irrigation manager will efficiently distribute the water according to the needs of the farmers. However, farmers cannot maintain the irrigation system's reliability if the water discharge is not available. This happened in several irrigation areas of Bantaeng, which rely on water as a source of irrigation water. The water flow rate is meager in the dry season, making it difficult for P3A to distribute water in all areas. The results of SEM analysis show that irrigation management has a significant effect on regional economic growth. These results indicate that irrigation operations characterized by the excellent distribution of irrigation water, maintenance of irrigation, and coordination between farmer groups and the government, will cause labor to be absorbed in agricultural activities. The fact related to the increase in labor force participation is that the more intensive the agricultural pattern, the more workers are involved. Furthermore, intensive and optimal irrigation management will produce optimal agricultural production to meet their families' education and health needs; in other words, the better irrigation management, the more prosperous farmers will be. The accessibility of farmers as an indicator of regional growth is also getting better with optimal irrigation management.

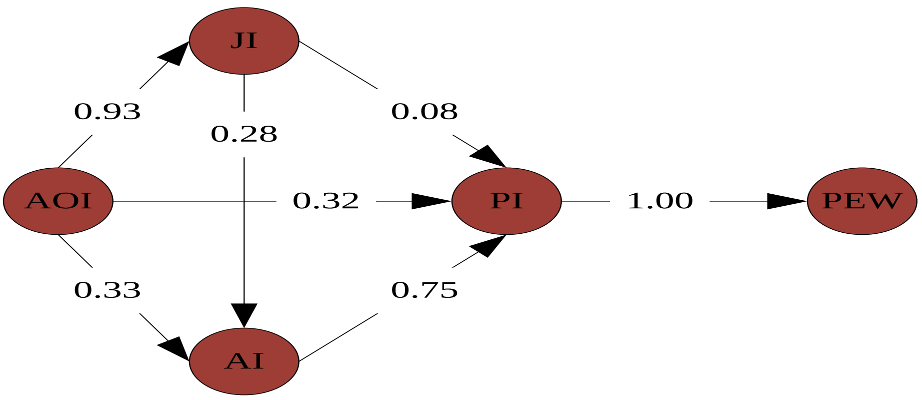

Figure 2: Analisis Pengaruh Antar Variabel

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3.7 Influence of Indicators on Variables

a. Irrigation Association Indicator

The indicators that have the most influence on the irrigation association variable are the effort to maintain the reliability and sustainability of the irrigation system, with a value of 0.884, and the input evaluation of irrigation asset management, with a value of 0.883. These results indicate that the success of irrigation associations depends on the active role of WUA organizations in carrying out irrigation management. The role of P3A can encourage public awareness to make efforts to protect irrigation buildings. Furthermore, the role of farmers in the construction and maintenance of irrigation buildings has the most negligible effect, with a value of 0.285. This illustrates that farmers are not involved in the distribution and supply of water in irrigation areas and do not receive training on how to maintain irrigation buildings. The results of observations by researchers in several irrigation areas in the Bantaeng Regency illustrate that the role of farmer organizations is very high in managing irrigation networks. The Water User Farmers Association or P3A intensively communicates with its members regarding planning for water distribution and maintenance of irrigation networks. Thus, farmer institutions are critical in optimizing the irrigation system.

b. Indicators Against Irrigation Network

Furthermore, the indicator weight regression results on the irrigation network variable show that the safety of irrigation canals and buildings has a very high contribution to the irrigation network. The estimated value of 1.00 means that the reliability of the irrigation network is highly dependent on the safety of irrigation canals and buildings. Furthermore, the function of irrigation canals and buildings and the classification of irrigation networks have a lower contribution value to the irrigation network variable. In addition, two indicators have a small contribution to the irrigation network, namely the condition of irrigation channels and the completeness of irrigation infrastructure. The analysis results illustrate that the irrigation network's reliability can be achieved even if the irrigation channel conditions are not optimal. Likewise, inadequate irrigation facilities have no more negligible effect on the reliability of the irrigation network. Therefore, irrigation networks can function adequately if farmers are involved in maintaining irrigation facilities and preventing the risk of damage to irrigation structures. In addition, the involvement of farmers in maintenance can also prevent misuse of irrigation network utilization.

c. Irrigation Water Indicator

Furthermore, the indicator weight regression results on the irrigation water variable show that all indicators have a positive effect on irrigation water. The reliability of irrigation water is characterized by an even distribution of water on all agricultural land. This can be seen by the number estimated at 0.950. Meanwhile, irrigation water use also strongly influences the reliability of irrigation water, with an estimated value of 0.922. This value illustrates that the higher the use of irrigation water, the better the reliability of irrigation water is.

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Furthermore, irrigation water is also marked by handling complaints and conflicts in water regulation in the field, with an estimated value of 0.892. This indicates that the irrigation association's ability to handle complaints and conflicts regarding irrigation water arrangements will result in good irrigation water reliability. Thus, the reliability of irrigation water can be seen in farmers' satisfaction with the use of irrigation water, distribution, and handling of conflicts.

d. Irrigation Management Indicators

Furthermore, the results of the regression weight indicator on the irrigation management variable show that the operation of the irrigation network has the most significant influence with a value of 0.962, or irrigation management can operate properly if the opening of the floodgates is following the drainage plan and the officers routinely carry out regular channel checks. Furthermore, workers' professionalism shows an estimated value of 0.767; in other words, the more professional workers are in managing irrigation, the more the irrigation system will run well. Furthermore, operational funds only contributed 0.458; in other words, the workers' professionalism and irrigation network management contributed more than the provision of funds.

e. Regional Economic Growth Indicators

Furthermore, the indicator weight regression results on regional economic growth variables show that all indicators contribute positively to regional economic growth. Regional economic growth is characterized by the ability of farmers to access public services, develop business capital, and increase their production yields. These three indicators, respectively, contributed to 0.955, 0.948, and 0.947. Furthermore, regional economic growth is marked by increased labor force participation in agriculture and agricultural technology development. These results indicate that the greater the accessibility of farmers, the greater the region's economic growth will increase. In other words, the easier it is to get fertilizer or good quality seeds, the better agricultural production results. In addition, increased production yields are supported by farmers' understanding of new plant management and maintenance technologies. The researcher's observations show that agricultural activities in land processing activities generally use agricultural machines such as hand tractors. Likewise, in rice harvesting activities, farmers generally collectively use harvesting machines rented together. By utilizing agricultural technology, farmers can get better production results to increase their welfare. Based on the results of the analysis above, the results of the SEM analysis are presented in Figure 3.

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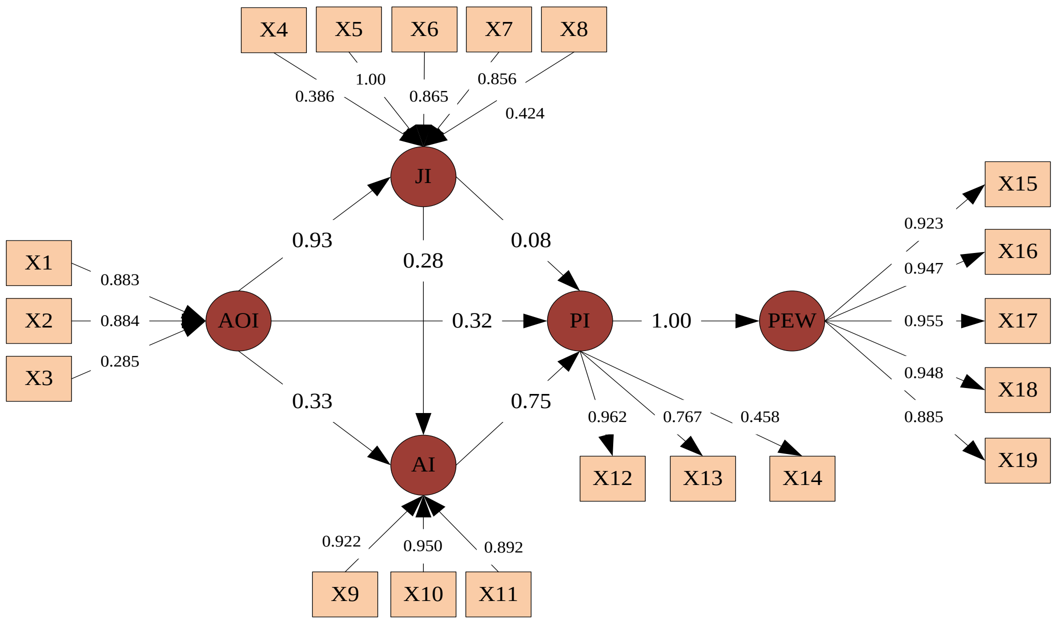

Figure3. Analysis of Indicators on Variables

Based on the picture above, the direct and indirect effects between variables are described as follows:

3.8 Direct Effects of Exogenous Variables on Irrigation Management

At this stage, the researcher analyzes the hypothesis based on the results of the SEM analysis presented in the following table:

Table 15: Direct Effects of Latent Variables on Irrigation Management

No				Estimate	S.E.	C.R.	P
1	Irrigation Management	<--	Irrigation Network	-0.129	0.069	-1.872	0.061
2	Irrigation Management	<--	Irrigation Association	0.589	0.071	8.325	***
3	Irrigation Management	<--	irrigation water	1.024	0.073	14.003	***

Table 16: Standardized Regression Weights: (Group Number 1-Default Model)

No				Estimate
1	Irrigation Management	<--	Irrigation Network	-0.079
2	Irrigation Management	<--	Irrigation Association	0.317
3	Irrigation Management	<--	Irrigation water	0.746

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Based on the results of the SEM analysis, the probability value (p) is 0.061 > 0.05. These results illustrate that H1 is rejected or the irrigation network has no direct effect on irrigation management. Furthermore, this decision is also supported by the CR value of 1.872 < 1.96, which indicates no influence between the two variables. Furthermore, the irrigation network contributes to irrigation management by 7.9%. Based on the results of the SEM analysis, the probability value (p) is 0.000 < 0.05. These results illustrate that H1 is accepted or irrigation associations directly affect irrigation management. Furthermore, this decision is also supported by the CR value of 8.325 > 1.96, indicating an influence between the two variables. Furthermore, irrigation associations contribute to irrigation management by 32%. If irrigation associations increase, irrigation management also increases. Based on the results of the SEM analysis, the probability value (p) is 0.000 < 0.05. These results illustrate that H1 is accepted or irrigation water directly affects irrigation management. Furthermore, this decision is also supported by the CR value of 14.03 > 1.96, indicating an influence between the two variables. Furthermore, irrigation water contributes to irrigation management by 75%. If the availability of irrigation water increases, then irrigation management will also automatically increase. These results indicate that the availability of irrigation water is very influential on the irrigation management system.

3.9 Indirect Effect of Exogenous Variables on Regional Economic Growth

The indirect effect of exogenous variables on regional economic growth was analyzed based on the magnitude of the effect of exogenous variables on intervening variables. The results of the SEM analysis are presented in the following table:

Table 17: Regression Weights: (Group Number 1-Default Model)

No				Estimate	S.E.	C.R.	P
1	Irrigation Management	<--	Irrigation Network	-0.129	0.069	-1.872	0.061
2	Irrigation Management	<--	Irrigation Association	0.589	0.071	8.325	***
3	Irrigation Management	<--	irrigation water	1.024	0.073	14.003	***
4	Regional Economic Growth	<--	Irrigation Management	0.456	0.122	3.75	***

Table 18: Standardized Regression Weights: (Group Number 1-Default Model)

No				Estimate
1	Irrigation Management	<--	Irrigation Network	-0.079
2	Irrigation Management	<--	Irrigation Association	0.317
3	Irrigation Management	<--	irrigation water	0.746
4	Regional Economic Growth	<--	Irrigation Management	1.009

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Based on the results of the SEM analysis, the probability value (p) is 0.000 < 0.05. These results illustrate that H1 is accepted or irrigation management directly affects regional economic growth. Furthermore, this decision is also supported by the CR value of 3.75 > 1.96, indicating an influence between the two variables. Furthermore, irrigation management contributes to regional economic growth by 100%. Regional economic growth will also increase if the irrigation management system improves. Based on the management effect, the indirect effect analysis can be continued. The following is the indirect effect of exogenous variables on endogenous variables through intervening variables. Based on the three analyses, it can be seen that the indirect effect of exogenous variables on regional economic growth is dominated by the influence of irrigation water on regional economic growth. Therefore, the irrigation water variable has become essential in regional economic growth.

Table 19: Recapitulation of Indirect Effects

Variable Relationship Demonstration	Relationship Value	Conclusion
Jaringan Irigasi – Pengelolaan Irigasi – Pertumbuhan Ekonomi Wilayah	0.08	There is no indirect effect
Asosiasi Irigasi – Pengelolaan Irigasi – Pertumbuhan Ekonomi Wilayah	0.32	There is an indirect influence
Air Irigasi – Pengelolaan Irigasi – Pertumbuhan Ekonomi Wilayah	0.75	There is an indirect influence

Table 20: Total Effects of the influence of variables on behavior

Variable Relationship Demonstration	Category	Contribution Value	%
Indirect influence on behavior	Irrigation Network – Irrigation Management – Regional Economic Growth	- 0.08	-8%
	Irrigation Association – Irrigation Management – Regional Economic Growth	0.32	32%
	Irrigation Water – Irrigation Management – Regional Economic Growth	0.75	75%
TOTAL			**99%**

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3.10 Discussion of SEM Research Results

The analysis results show that all indicators have construct values that contribute significantly to irrigation association variables. The indicator of efforts to maintain the reliability and sustainability of the irrigation system has the most significant value of 0.884, while the smallest value of the role of farmers in the construction and maintenance of irrigation buildings is 0.285. This indicates that the critical role of the association is to maintain the reliability and sustainability of the irrigation system. Irrigation associations or WUAs always prevent conflicts in water use. In addition, P3A also maintains the reliability of irrigation canal functions, such as removing sediment and garbage contained in irrigation canals. The analysis results also show that all indicators contribute significantly to the irrigation network. The safety of irrigation canals and buildings has the most significant contribution with a value of 1.001, and the condition of irrigation canals has the most negligible contribution with a value of 0.386. This indicates that farmers assess the effectiveness of irrigation networks in terms of equitable distribution of water, know the methods of maintaining irrigation networks and maintain the risk of damage to irrigation buildings.

On the other hand, all indicators contribute to the irrigation water variable. The distribution of water with the most significant contribution value is 0.950. The lowest value is handling complaints and conflicts in irrigation water regulation in the field, with 0.892. farmers consider that water distribution is the essential indicator or that all rice fields get sufficient water according to their needs. The analysis of the direct influence between variables shows that all indicators contribute to the irrigation management variable. The operational irrigation network becomes a significant indicator with a value of 0.962.

Furthermore, the one with the lowest contribution is the operationalization and maintenance fund for irrigation, with 0.458. This shows that the operation of the irrigation network is an essential indicator in irrigation management where farmers understand when the floodgates open.

Moreover, the analysis results on the indirect test show that all the values of the indicator constructs contribute significantly to the regional economic growth variable, with the lowest value of 0.885 for technology development and the most considerable value on accessibility with a value of 0.955. This indicates that the accessibility of farmers to obtain fertilizers, seeds, and public services is a determinant of the economic growth of a region. If the community feels better accessibility, the regional economic growth will also increase. Thus, one of the efforts that can be made is to increase the availability of fertilizers and seeds during each planting period. In addition, health and education services should be easily accessible to farming families. Suppose it is associated with irrigation conditions in Bantaeng Regency, mainly in the form of tertiary networks. In that case, P3A plays a role in building new irrigation networks or improving existing irrigation networks. In carrying out the irrigation system development, WUA participates in initial thinking, decision making, construction activities, and irrigation operations and maintenance. WUA participation is carried out voluntarily and based on the results of deliberation and consensus. In addition, the development of irrigation networks is carried out according to the community's needs and

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socio-economic and social conditions. Furthermore, P3A also has a role in providing input in the planning of irrigation systems and voluntarily donating their land for the construction or improvement of irrigation networks.

Furthermore, the operation of the irrigation network also involves P3A in terms of the planting plan and the submission of water requirements. With this proposal, the local government is obliged to allocate irrigation water and maintain the canal's function. In addition, P3A also plays a role in tracing damage to irrigation networks and maintenance work on irrigation networks. Furthermore, the analysis of factors that affect irrigation management results in the finding that irrigation water has the most considerable contribution to irrigation management. In other words, equitable water use and availability according to farmers' needs will result in good network operations.

Meanwhile, irrigation associations also influence irrigation operations with a moderate level of correlation. In other words, a sound WUA work system will result in good management. The work system is characterized by professionalism in inspecting irrigation canals and maintaining the operation of buildings and irrigation networks. P3A, as an irrigation association, can also coordinate with local governments regarding the provision of irrigation network maintenance funds. In addition, P3A must also be able to make suggestions about the urgency of developing irrigation networks.

Furthermore, the irrigation network does not provide influence irrigation management. This is indicated by the condition of irrigation networks and other buildings that do not contribute to irrigation management. The condition of irrigation networks in several irrigation areas is in disrepair or cannot drain water optimally. However, WUA always strives to carry out good management. However, the condition of the building is not of good quality affecting the reliability and availability of irrigation water.

The use of water for agricultural production in water-scarce areas requires innovative and sustainable research and appropriate technology transfer. This paper discusses some of these aspects, especially those related to irrigation management in agricultural land, including treated wastewater and saltwater. First, this paper proposes several concepts related to water scarcity regarding drought, desertification, water shortages, and policies to address these water stress regimes. The conceptual approach to irrigation performance, water use, and water-saving are reviewed from a broad perspective. Followed by a discussion on supply management to address water scarcity, paying particular attention to the use of wastewater and low-quality water, including their respective impacts on health and the environment as water scarcity requires increasing low-quality water. They are used for irrigation. The paper then focuses on demand management, starting with aspects related to improving irrigation methods and their respective performances, especially distribution uniformity (DU) as a fundamental tool for reducing water demand at the farm level and for controlling negative impacts. Environmental impact of excessive irrigation, including salt stress areas. Recent research results support the discussion. The suitability of the irrigation method for using treated wastewater and saltwater was analyzed. Supplemental irrigation (SI) and deficit irrigation strategies are also discussed, including limitations on applying related practices.

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This paper also identifies the need to adopt emerging technologies for water management and develop appropriate methodologies to analyze the social, economic, and environmental benefits of better irrigation management.

Theoretically, the irrigation commonly found in Bantaeng Regency is surface irrigation, an irrigation system in which water is pooled on plants and flows through the soil surface. Furthermore, based on the water source, the irrigation network used is a pump irrigation network, or the water that flows from groundwater is raised to the surface using a water pump. In addition, there is also an irrigation network that utilizes rivers as a water source and reservoirs that accommodate excess rainwater. However, water availability is not evenly distributed throughout the irrigation area due to differences in flow rates. Therefore, it is necessary to maintain the sources of water availability and make reservoirs appropriate water reservoirs. The urgency of water availability in irrigation management is the driving force for planning the development of an optimal irrigation system. English et al. (2002) describe that irrigation contributes significantly to increasing food security, but land dependence on irrigation impacts water use. Therefore, a new paradigm in irrigation management is needed to achieve maximum yields per unit of land. Irrigation is held to meet the water needs of plants. The water flow model adapted to the discharge of plant needs is a form of irrigation efficiency. This is the goal of irrigation management in irrigated agricultural areas. The same thing was conveyed by Turner (1990) that limited water significantly affects plant productivity. Therefore, irrigation water must be managed carefully so that services can take place in the long term and broadly. Furthermore, Sakkon (2018) describes that irrigation management must refer to the calculation of the adequate amount of water needed by plants and the cumulative water balance calculation, including how much water comes and flows during the planting period. Various scenarios can be considered in irrigation development decision-making, including the effects of climate change.

Based on the description above, as the party responsible for planning network rehabilitation and monitoring irrigation functions, the district government should carefully consider the irrigation water deficit because little water will affect irrigation water management and regional economic growth. The study results indicate that there is a strong relationship between the irrigation system and regional economic growth. Irrigation systems have a reciprocal relationship in producing irrigation water management and services. The elements referred to are irrigation networks, associations, irrigation water, and irrigation management. The four elements will run optimally with the management. The elements in the irrigation system are interrelated in a complex manner. They are not only material in nature, but these elements are also closely related to the management function of the management agency, in this case, the government, WUA, and farmers.

Based on the description above, the irrigation system includes three aspects, namely aspects of mental patterns, social aspects, and material aspects. The first aspect is the mindset which is the knowledge, awareness, intention, and motivation of farmers to optimize irrigation management. The two social aspects are the strength of the farmer's institution or P3A in developing democratic processes related to rice cultivation, including cropping patterns and

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water distribution. The third aspect is the material aspect which includes irrigation infrastructure and the condition of farmers' rice fields (Windya et al., 2005). With good irrigation management, it will produce regional economic growth. Valipour (2017) describes that the trend of increasing crop yields, human development index, irrigation needs, and total agricultural area increases in line with population growth in rural areas. This condition is achieved by managing the volume of rainwater that can be accommodated following irrigation water needs.

Furthermore, good irrigation management will also result in welfare for local communities. This is expressed by Calzadilla et al. (2011) that water policies directed at increasing irrigation efficiency will result in the effective use of costs; in other words, minimal irrigation financing efficiency will result in efficient programs. So that this program will impact two aspects, namely optimizing water use which results in high crop production, and the opportunity to provide services that are more equitable for the community. Therefore, irrigation management is an essential aspect of regional economic growth.

IV. CONCLUSION

This study found that optimal irrigation management is strongly influenced by the reliability of the water discharge obtained and the institutional strength of farmers. Farmer institutions can be strengthened by maintaining the social norms adopted by their members and the managerial capabilities of their management. Thus, social capital is the main component of successful irrigation management. Social capital refers to the relationship between individuals to strengthen social networks and irrigation governance. The strength of social capital will affect the productivity of these individuals and institutions.

Furthermore, the reliability of irrigation water discharge is strongly influenced by the quality of the water source. Facts found in the field are that irrigation water sources are rivers and groundwater. The reliability of river water and groundwater sources is influenced by conservation activities or the ability to absorb water optimally. Availability of forest as water absorption and balancing hydrological potential. The existence of water is very dependent on the extent of tree vegetation cover. Trees can absorb water to prevent flooding in the rainy season and drought in the dry season. With water availability throughout the year, the intensification of agricultural patterns will be better and produce abundant agricultural production. This mechanism causes an increase in economic growth in Bantaeng Regency. The findings of this study are briefly described that social capital in farmer institutions and forest conservation efforts encourage regional economic growth.

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