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Blue Economy Approach-Based Mangrove Resources Conservation for Coastal Community's Prosperity in Sidoarjo Regency, East Java, Indonesia

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Abstract This study was aimed at analyzing variables affecting mangrove resource conservation based on blue economy concept. The model component analysis applied Spearman Rank Correlation test. Result showed that Z-calc.was bigger than Z-tab. (1.64) at 95% confidence level, and therefore, Ho was rejected. This study concluded that resource efficiency, without wastes, social awareness, cyclic system of production, innovation and adaptation, and institution were blue economy concept-based variables. In this case, institutional management of good governance is highly needed. Nevertheless, this study has still focused on limited issues, and therefore, more variables should be added in future studies in relation with their impacts on the blue economy management.

Keywords Blue economy, Resource, Mangrove

1. Introduction

Sidoarjo Regency is one of the Indonesian areas holding damaged mangrove forests. According to Marine and Fisheries Services Report of Sidoarjo [1], mangrove forest area of Sidoarjo Regency is 1,236.42 hectares, with a total damage of 534.74 hectares. The widest damage is 131.37 hectares in Jabon and 137.58 hectares in Sedati, respectively. Looking at the extent of mangrove area, Jabon and Sedati are potential to be denudated. Mangrove forests of Sidoarjo coast have been ruined from illegal logging for timber market since 2004. Beside that, it was converted to fish ponds.

Mangrove forest decline and damage have caused (a) abrasion increment to loss of Tapak Kuda island, (b) decline in biodiversity and fish catch of the coastal fishermen, and (c) finally income decline of fishermen in particular and coastal communities in general [2]. Crustacean diversity and abundance in damaged mangrove forest are entirely categorized as low [3].

Mangrove forest damages result in decline in catch volume and diversity, in which 56.32% of fish species used to be caught by local fishermen are hardly gained, and 35.36% of them have never been caught anymore. Consequently, lower income of the respondents (fishermen) occurs as much as IDR. 667,562,-/mo. in average or 33.89% of that from fewer fish catch in the waters of damaged mangrove forest than that before the damage [4]. In Aceh Province, mangrove ecosystem contributes to 27.21% of fisheries resources production. Mangorve ecosystem contributes also more than 25% of small pelagic fish production. It means that mangrove ecosystem has sufficiently important role in determining fishing fisheries production., particularly small pelagic fish, shrimps and shells [5].

It was also found that 48.8% of the respondents in Teluk Pakedai Coastal District possess enough knowledge on benefits, damages from exploitation and necessities of mangrove forest damage prevention [6], but they are not aware of it. Local government policy in mangrove forest management has also been negatively responded by the local communities. It could result from no clear and firm mangrove forest management effort. Thus, local government should immediately make an integrated mangrove forest management plan and socialize it to the people around the mangrove forest.

The success of mangrove resources management policy implementation is affected by environmental education participation covering the objectives of environmental education, curriculum, activity process, and evaluation [7]. Mangrove forest management could be accomplished through private and community sinergy [8]. People awareness and management program will raise people

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comprehension and policy maker on the importance of mangrove ecosystem. Mangrove management strategy involves community education in association with functions and benefits of mangrove ecosystem, human resources development, law enforcement against illegal logging, national and international network development, science and technology development, and community's economic empowerment development [9].

The success of mangrove management policy implementation is also determined by regulation enforcement in the coastal areas, collaboration among scientists, politicians, government, communities, conservational stakeholders, mangrove management, damaged mangrove area restoration [10]. Mangrove restoration could result in mangrove resources development potential, job opportunity, coastal line protection and possible biodiversity and fisheries productivity development [11]. In relation with mangrove forest conversion to fish ponds, the policy management can be done through semi-intensive fish culture [12].

Decline in mangrove forest area could results from that mangrove resources management model has not been based on blue economy concept. Excessive use of mangroves, such as illegal logging and land conversion to fish/shrimp ponds, has threatened the mangrove resources. It is expected that blue economy-based management principles, including resource efficiency, waste free, cyclic system of production, social awareness, innovation and adaptation, and good governance of mangrove resources management institutions, will increase economic growth, welfare distribution, and mangrove resources sustainability in Sidoarjo Regency.

Blue economy studies have not been enough done in Indonesia. Several blue economy- themed studies, one of which entitled Local Potential Analysis of Kendal Regency Coastal Area In Achieving Blue Economy [13]. Other study was also done on blue economy principle implementation in coastal communities in Brebes Regency, Central Java [14].

Blue economy concept was popularized by Pauli [15] in his book "The Blue Economy: 10 Years, 100 Innovations, and 100 million Jobs". He mentioned that blue economy as green 2.0 orenhanced green economy. Blue economy components cover1)Sustainability, a) nature efficiency; b) zero waste; c) Social inclusiveness; d) Cyclic systems of production; and e) Open–ended innovation and adaption; and 2) Shifting economic paradigm, meliputi: a) system thinking: learning from nature- using the logic ecosystems; and b) changing the way of doing business: *) redefining core business: core business defined by core competence; *) endless innovation: innovation creates opportunities; and *) vision and creativity [16].

Blue Economy is a concept addressing economic activities that not only reduce wastes, but also increase the community's economy. It is also meant as Blue Ocean Economy that makes ocean as an ecosystem that must be protected and whose usefulness be optimized in order to increase people's economy [16].

Model in this study was situated with the mangrove condition in the study site, in spite of some limitations, such as the model is not used for mangrove and mangrove ecosystem management. This study was directed to answering the issues of mangrove ecosystem management based on blue economy concept.

This study is expected to be able to provide recommendation on mangrove resources variables based upon blue economy concept focused on economic, ecological, and social factors.

2. Method

Method used in this study was descriptive through quantitative approach unsing survey method. The study was carried out in June to December 2014 in Jabon and Sedati districts, SidoarjoRegency, East Java Province. Study site was selected based on the widest damage level of mangrove forest in the coastal areas of Sedati and Jabon districts caused by illegal logging activities and mangrove forest conversion to shrimp ponds.

Sampling method was non probability samplingusing purposive sampling procedure. Population covered community (fishermen and fish farmers who got direct impact of mangrove forest damage), environmentalists, aquaculturists, and fishers. Primary data were collected through questioneers. Number of respondents was based upon proportional random samplingtechnique following the requirements of Slovin's form Type equation here. ula, 309 respondents. This study used both primary and secondary data.

Variable analysis used correlation addressing the effect and the relationship between research variables and tested the hypothesis. Raw data, as ordinal data, were non-parametric data, and the correlation test used Spearman Rank correlation test, with correlation (r)range between -1 and +1:

r > 0 there is positive linear relationship or negative correlation, the larger the X variable (*independent*), the larger the Y variable (*dependent*), vice versa.

r < 0 there is negative linear relationship or negative correlation, the smaller the value of X variable (independent), the bigger the value of Y variable (dependent), and vice versa.

Spearman Rank correlation coefficient can be calculated as follows [17]:

$$rs = \frac{\sum X^2 + \sum Y^2 + \sum di^2}{2\sqrt{\sum X^2 \sum Y^2}}$$

where:

rs = Spearman Rank Correlation coefficient

d = ranking difference between first and second variables

n = number of samples

The correlation strength between variables studied was determined using the criteria table of correlation coefficient [17] as follows:

r = 0, no correlation between variables

r = 1 or r = -1, proper linear correlation

r = 0.00 – 0.20, very low correlation, nearly neglected

r = 0.20 – 0.40, low correlation, obvious relationship but small

r = 0.40 – 0.70, moderate correlation, sufficiently related

r = 0.70 - 1.00, high correlation, very strong relationship

For significance test of correlation (rs) was calculated as follows [17]:

$Z = rs \sqrt{N - 1}$

If $Z_{calc.} > Z_{tab.}$, H_0 is rejected and H_1 is accepted

If $Z_{calc.} \leq Z_{tab.}$, H_1 is rejected, and Ho is accepted

The value of Z_{tab} used the degrees of freedom of 305 and ½α = 5%: 2 = 2.5% at 95% confidence level, 1.645.

The value of t_{tab} used the degrees of freedom of 305 and ½α = 5%: 2 = 2.5% at 95% confidence level, 1.645.

The hypothesis tested in this study was:

- H_0: There is no effect of resources effeciency components, waste free, social awareness, cyclic system of production, innovation and adaptation and institution on blue economy concept-based mangrove resources management.
- H_1: There is effect of resources efficiency component, zero waste, socisal awareness, cyclic system of production, innovation and adaptation and institution on blue economy-concept-based mangrove resources management.

Variables used in creating the sustainable blue economy-based management variables of mangrove resources were dependent and independent variables.

1) Dependent variable of resources efficiency (Y1) consisted of independent variables of investment in mangrove fruit utilization (Ef1), investment in mangrove ecosystem service utilization as ecotourims (Ef2), investment in mangrove ecosystem service utilization as mangrove crab, milkfish, and shrimp habitats (Ef3), investment in mangrove ecosystem service utilization as abrasion prevention (Ef4), investment in mangrove ecosystem service utilization as silvofishery support (Ef5), investment in mangrove ecosystem service utilization as carbon sinks (Ef6), efficient mangrove fruit utilization as production input (Ef7), efficient product distribution of mangrove fruit raw material (Ef8), and cunsumption efficiency of mangrove fruit raw material in production process (Ef9).
2) Dependent variable of waste free (Y2)consisted of independent variables of production residual wastes of mangrove fruit material as compost (Tl1), production residual wastes of mangrove fruit material as cattle feed (Tl2), and production residual wastes of mangrove fruit material as energy source for other production (Tl3).
3) Dependent variable of social awareness (Y3) comprised independent variables of equitable/easily accessable natural resources utilization distribution (Ks1), private distribution in mangrove ecosystem service utilization as an equitable ecotourism (Ks2), and mangrove utilization as public tenacity effort against issues of food insecurity, energy, disaster impact, adverse impact of climate change (Ks3).
4) Dependent variable of cyclic system of production (Y4) consisted of independent variables of minimum-waste or low carbon emission implementation through production cycle, distribution and efficient consumption (Sp1) and rational resource use to keep the natural recovery ability of the resources (Sp2), and cost, benefit and risk (resource economic valuation) internalization in investment and pro-growth policy making(Sp3).
5) Dependent variable of innovation and adaptation (Y5) comprised independent variables of mangrove fruit product innovation to create business opportunity (In1), innovation in mangrove ecosystem service utilization as ecotourism to make business opportunity (In2), innovation in mangrove ecosystem service utilization as mangrove crab, milkfish, and shrimp habitat to be business opportunity (In3), utilization innovation of production residual wastes of mangrove material to create business opportunity (In4), and processed mangrove fruit adaptation as community's source of food (In5).
6) Dependent variable of the institution (Y6) consisted of independent variables of independent good governance (L1) and resources sustainability (L2).

3. Results and Discussion

Blue economy-based mangrove resource management variables in Sidoarjo coast consisted of resource efficiency, without waste, social awareness, cyclic system of production, innovation and adaptation, and institution.

1. Resource Efficiency

Correlation coefficients of the variables range from 0.439 to 0.963, meaning that there are moderate to strong relationship, and $Z_{calc.}$ range from 7.712 to 16.908 higher than $Z_{tab.}$, so that Ho is rejected and the research hypothesis is accepted (**Table 1).**

Table 1 shows that resource efficiency based on sustainable blue economy concept is the use of mangrove fruit for consumption, the efficient use of mangrove ecosystem services as silvofishery support, abrasion prevention, mangrove crab, milkfish, and shrimp habitats, and ecotourism. People in Sedati and Jabon districts have not taken advantages of mangrove fruits, and therefore, the government needs to promote the community's empowerment effort to use the mangrove fruit.

Table 1. Spearman Rank Correlation of Resource Efficiency

Independent Variables	Correlation	Remarks	Z-value	Remarks
Investment in mangrove fruit utilization (X1)	0.439	Sufficiently correlated, sufficient relationship	7.712	H_1 is accepted
Investment in mangrove ecosystem service utilization as ecotourism (X2)	0.451	Sufficiently correlated, sufficient relationship	7.920	H_1 is accepted
Investment mangrove ecosystem service utilization as mangrove crab, milkfish and shrimp habitats (X3)	0.481	Sufficiently correlated, sufficient relationship	8.440	H_1 is accepted
Investment in mangrove ecosystem service utilization as abrasion prevention (X4)	0.607	Sufficiently correlated, sufficient relationship	10.658	H_1 is accepted
Investment in mangrove ecosystem service utilization as Silvofishery support (X5)	0.796	Strongly correlated, very strong relationship	13.976	H_1 is accepted
Investment in mangrove ecosystem service utilization as carbon absorber (X6)	0.865	Strongly correlated, very strong relationship	15.178	H_1 is accepted
Mangrove fruit utilization as efficient production input (X7)	0.900	Strongly correlated, very strong relationship	15.798	H_1 is accepted
Efficient product distribution of mangrove fruit raw materials (X8)	0.910	Strongly correlated, very strong relationship	15.963	H_1 is accepted
Consumption efficiency of mangrobe fruit raw materials in production process (X9)	0.963	Strongly correlated, very strong relationship	16.908	H1 is accepted

Source: Processed Data (2015)

Direct benefit value of the holy mangrove (*Acanthus ilisifolius*) leaf as raw material of crackers and mangrove apple (*Sonneratia alba*) fruit as syrup raw material from 700 ha of mangrove forest in Margasari, Labuhan Maringgai District, East Lampung Timur, was IDR. 957,600,000.00 per year [18]. The development of this mangrove fruit processing will be potential to yield good amount of additional income.

The effort of regency government of Sidoarjo to encourage the use of mangrove ecosystem services for ecotourisms is through establishment of east coast of Sedati district as nature conservation area by 1) maintaining the ecosystem through integrated conservation area development, 2) controlling the change in land use as an instrument of coastal ecosystem maintenance, 3) increasing the tourism infrastructures to support the ecotourism, and 4) active involvement of fishermen communities in nature tourism areal development efforts.

Moreover, Ariftia *et al.* (2014), under travel cost method, estimated the direct benefit value of 700 hectares. mangrove forest in Margasari, Labuhan Maringgai District, East Lampung as ecotourism site IDR. 10,660,000.00 per year. Hence, the government of Sidoarjo Regency is expected to be able to develop mangrove ecotourism as an opportunity to increase the the regional revenue.

Investment activities in utilizing mangrove ecosystem services as abrasion prevention carried out by Sidoarjo government were mangrove forest rehabilitation of 40 hectares in Jabon coast through replanting 70,000 seedlings in 2002.

Investment activities in utilizing the mangrove ecosystem services as silvofishery support were mangrove forest rehabilitation program along the pond dykes of Jabon covering 140 hectares through replanting 40,000 seedlings in 2002.

The use of mangrove ecosystem services as habitats of mangrove crabs, milkfish, and shrimps, and as carbon sinks was done through mangrove ecosystem rehabilitation routine as part of coastal area conservation development. Coastal area is crucial for spawning area of various fish species, and therefore, it should be protected from environmental damages. Total mangrove area in Sidoarjo regency was about 16,638.4 hectares, consisting of 1,108 hectares of beaches and 15,530.4 hectares of shrimp ponds.

Mangrove forest of 700 hectares. in Margasari, Labuhan Maringgai district, East Lampung regency had direct benefit value of IDR 647, 580,000.00 per year from shrimp and crab fishing [18].

Sidoarjo regency government has also encouraged local people to make use of mangrove fruits as food materials through training activities. For instance, *Bruguiera gymnorrhiza* fruit was processed to make cookies, and *Sonneratia alba* (pedada) fruit was processed to produce syrup and candy. This activity is part of mangrove fruit utilization as efficient production input done by Fisheries and Marine Services of Sidoarjo Regency in 2013 for coastal women development. Continuous upgrading is expected to be able to help the communities develop their mangrove fruit-materialized food business.

In mangrove fruit utilization efficiency, the use of

Bruguiera gymnorrhiza for cake material and *Sonneratia alba* (pedada) as syrup and candy material is expected to be able to give additional value of the product to increase the coastal community's income. To promote efficient distribution of these products, the government of Sidoarjo regency should 1) socialize the economic value of processed mangrove; 2) carry out business training and development; 3) provide capital support either in the form of grant or revolving fund; and 4) help promotion and marketing.

2. Without Waste

Correlation coefficient of the variables ranges from 0.728 to 0.981 reflecting a high correlation and strong relationship, while t_{cal}. of the variables ranges from 18.596 to 89.106, meaning that Z_{calc}. is higher than $Z_{tab.}$, Ho is rejected and the hypothesis is accepted (**Table 2).**

Table 2 shows that waste free in sustainable blue economy concept-based mangrove resource management Sidoarjo Regencyis the use of production residual wastes of mangrove fruit material as compost, cattle feed, and energy source for other production. These have not been done yet by people of Jabon and Sedati districts. There is no people awareness of utilizing the mangrove fruit as alternative food source and does not encourage the people to use the mangrove wastes yet. Training on processing residual wastes of processed mangrove as natural liquid soap, bricket, and compost was provided for Ubaya students in 2013 as Ubaya Summer Programe.

Net roduction focused on prevention effort of waste production is one of the inefficiency indicator [19]. Thus, the prevention effort should have been done from early production process by reducing the waste production and utilizing the waste through recycling. This effort could result in good savings due to significant production cost reduction and could become an income source.

3. Social Awareness

Correlation coefficient of the variables ranges from 0.619 to 0.937, reflecting moderate to high correlation, while Z_{calc} ranges from 12.773 to 17.220 higher than Z_{tab}. meaning that Ho is rejcted and research hypothesis is accepted (**Table 3).**

Table 3 demonstrates that social awareness in sustainable blue economy concept-based mangrove resource management Sidoarjo regency is distribution to private sectors in mangrove ecosystem service utilization as ecotourism, equitable/easily accessible natural resource utilization distribution as community's security effort to issues of food insecurity, energy, hazard impact, equitable climate change adverse impact. Private sector distribution in utilizing mangrove ecosystem services as fair ecotourism and fair natural resources and easily accessed to the community has significant relationship with social concern. Therefore, Sidoarjo government could push the private sectors to develop business in mangrove tourism by facilitating the permit and promote the tourism development infrastructures.

Table 2. Spearman Rank Correlation of Without Wastes

Independent Variables	Correlation	Remarks	Z-value	Remarks
Production residual wastes of mangrove fruit material as compost (X1)	0.728	Highly correlated, very strong relationship	12.773	H_1 is accepted
Production residual wastes of mangrove fruit material as cattle feed (X2)	0.942	Highly correlated, very strong relationship	16.531	H_1 is accepted
Production residual wastes of mangrove fruit material as energy source for other production (X3)	0.981	Highly correlated, very strong relationship	17.220	H_1 is accepted

Source: Processed data (2015)

Table 3. Spearman Rank Correlation of Social Awareness

Independent Variables	Correlation	Remarks	Z-value	Remarks
Equitable/easily accessed natural resource use distribution (X1)	0.884	Highly correlated, very strong relationship	15.513	H_1 is accepted
Private distribution in mangrove ecosystem service use as equitable ecotourisms (X2)	0.937	Highly correlated, very strong relationship	16.436	H_1 is accepted
Mangrove use as public security effort on issues of food insecurity, energy, disaster impact, and climate change edverseimpact (X3)	0.619	Highly correlated, very strong relationship	10.862	H_1 is accepted

Source: Processed Data (2015)

Total economic value of mangrove forest in the coastal area of Tlanakan, Madura,is IDR 280,712,310,416.00/ hectares/year in good condition [20]. This value was obtained from direct value of IDR 268,867,261,273.00, indirect value of IDR 5,558,554,467.00, optional value of IDR 8,468,232.00, heritage value of IDR 6,841,200,000.00, and existence value of IDR 5,003,849,143.00, respectively. Mangrove species growing in this area is *Rhizoporasp*, *Bruguierasp*, and *Avicenia sp*. Meanwhile, mangrove forest of damaged condition has total economic value of IDR 52,672,513,290.00, consisting of direct benefit value of IDR 20,183,079,000.00, indirect value of IDR 23,213,053,409.00, optional value of 9,084,019,871.00, existence value of IDR 185,571,010.00, and heritage value of IDR 6,790,000.00 (Baderan, 2013) [21].

Coastal border areas in Sedati district of 185.73 hectares landward and 742.92 hectares seaward, and Jabon district of 125.66 hectares landward and 502.64 hectares seaward were the area established as local conservation area. Coastline shift of the border from sedimentation has naturally become an integrated conservation area with the coastal border. Management effort was done through reforestration of damaged areas and sanction penalty for any violations following the land use regulations.

4. Cyclic System of production

Correlation coefficients of the variable range from 0.969 to 0.998 reflecting high correlation, $Z_{calc.}$ range from 16.930to 17.515, bigger than $Z_{tab.}$, so that Ho is rejected and H1 is accepted (**Table 4).**

Table 4 demonstrates that cyclic system of production in sustainable blue economy concept-based mangrove resource management in Sidoarjo regency is minimum waste or low carbon emission implementation through efficient production cycle, distribution and consumption, mangrove resource utilization supporting the natural recovery ability of the resources, andcost, benefit, and risk (resource economic valuation) internalization in investment and pro growth policy making. Several attempts could be done by the government of Sidoarjo regency: 1) the use of residual waste of mangrove fruit as raw material of other products, such as liquid soap, bricket, and compost, is an implementation of this theory, beside giving economic benefit and being environmental friendly; 2) Sedati district of 635.94 hectares and Jabon of 314.21 hectares were established as mangrove forest coastal area. The rational use of the resources would maintain their sustainability; and 3) Policy making of mangrove resource utilization in Sidoarjo regency should consider the resource economic valuation in order to maintain the resource conservation.

5. Innovation and Adaptation

Correlation coefficients of the variables range from 0.753 to 0.987 reflecting high correlation, while Z_{calc}. ranges from 13.215 to 17.330, meaning that Z_{calc}. is $Z_{tab.}$, so that Ho is rejected and H1 is accepted (**Table 5).**

Table 4. Spearman Rank Correlation of Cyclic system of production

Independent Variables	Correlation	Remark	Z-value	Remark
Implementation of Minimum Waste or low carbon emission through production cycle, distribution and efficient consumption (X1)	0.969	Highly correlated, very strong relationship	17.003	H_1 is accepted
Resource utilization does not exceed the carrying capacity/natural recovery ability (X2)	0.965	Highly correlated, very strong relationship	16.930	H_1 is accepted
Cost, benefit, and risk(resource economic valuation) internalization in investment and pro growth policy making (X3)	0.998	Highly correlated, very strong relationship	17.515	H_1 is accepted

Source: Processed Data (2015)

Table 5. Spearman Rank Correlation of Innovation and Adaptation

Independent Variables	Correlation	Remark	Z-value	Remark
Manrove fruit product innovation to make business opportunity (X1)	0.753	Highly correlated, very strong relationship	13.215	H_1 is accepted
Innovation in mangrove ecosystem service utilization as ecotourisms making business opportunity (X2)	0.825	Highly correlated, very strong relationship	14.479	H_1 is accepted
Innovation in mangrove ecosystem service utilization as mangrove crab, milkfish and shrimp habitats to make business opportunity (X3)	0.856	Highly correlated, very strong relationship	15.017	H_1 is accepted
The use of production residual wastes of mangrove material to make business opportunity (X4)	0.913	Highly correlated, very strong relationship	16.022	H_1 is accepted
Processed mangrove fruit adaptation as community's food source (X5)	0.987	Highly correlated, very strong relationship	17.330	H_1 is accepted

Source: Processed Data (2015)

Table 5 shows that innovation and adaptation in mangrove resource management in Sidoarjo Regency based on sustainable blue economy concept are product innovation of mangrove fruit, innovation in mangrove ecosystem service use as ecotourism, mangrove crab, milkfish, and shrimp habitats, production residual waste use of mangrove fruit material, processed mangrove fruit adaptation as community's food source to create business opportunity. Previous study(Ariftia et al., 2014) on direct benefit value of holly mangrove (*Acanthus ilisifolius*) as basic material of crackers and mangrove apple (*Sonneratia alba*) as basic material of syrup collected from mangrove forest of 700 hectares. in Margasari, Labuhan Maringgai district, East Lampung Regency found IDR 957,600,000.00 per year. This result indicates that mangrove fruit processing development business is potential to give the coastal communities more additional income.

The existence of mangrove forest can raise fishermen's income from crab, shrimp, and fish catches. Fisheries products, such as smoked milkfish, fish and shrimp crackers, and unspined milkfish crispy, are mainstay products of Sidoarjo regency as an attempt to increase the additional value of the products.

The use of mangrove fruit to produce food, such as crackers, syrup, candy, and cookies could become food source of the people. In the coastal area of Sidoarjo regency, nearly all mangrove species of Indonesia can be found, such as black mangrove, *Bruguieragymnorhiza, Rhizopora apiculata, Avicennia alba, Avicennia marina, Sonneratia alba,* and*Achanthus sillicifolius*.

6. *Blue Economy Management*

Correlation coefficients of the variables range from 0.780 to 0.841 reflecting high correlation, while Z_{calc}. ranges from 13.693 to 14.759, meaning that Z_{calc}. is bigger than Z_{tab}., so that Ho is rejected and H1 is accepted (**Table 6).**

Based on **Table 6**, it is found that economic growth and welfare equalization are blue economy management variables. Development approach with blue economy model will synergize with pro-poor, pro-growth, pro-job and pro-environment program implementation.

7. Institution

Correlation coefficients of the variables range from 0.908 to 0.999 reflecting high correlation, while Z_{calc}. ranges from 15.942 to 17.527, meaning that Z calc. is bigger than Ztab., so that Ho is rejected and H1 is accepted (**Table 7**)**.**

Based on **Table 7**, it is found that institution in blue economy-based mangrove resource management in Sidoarjo Regency is good governance and resource sustainability. Stakeholders involved in resources exploitation of coastal Sidoarjo are 1) *Stock holder*, the community groups permanently staying and economically and sociologically depending their life upon the natural coastal resources; 2) *Share holder*, those who occupy the land ownership for fsh/shrimp farming and other fisheries activities in the coastal area; and 3) *Stake holder*, wide audience, including government, entrepreneurs, and other communities outside the coastal area who are interested in coastal resources. Resource management mechanisms involve government and non-government, such as mangrove resources monitoring activities of the Controlling Community Group Organization. Nevertheless, lack of government interest has caused local Controlling Community Group Organization be less effective. Hence, the synergy of communities and government should be built to achieve good governance, one of which is to provide supporting infrastructures for CCGO's activities.

The rule expected to be able to implement in Sidoarjo regency mangrove forest management is Regulation numbered 16/ 2003 concerning Land Use Plan of Sidoarjo regency in relation with problems of mangrove forest conversion as public facilities. On the other hand, the policy expected to work is the regional regulation numbered 17/ 2003 concerning protected area in Sidoarjo Regency, under the authority of the regency government, and with priority of ecological aspects.

Table 6. Spearman Rank Correlation of Blue Economy Management

Independent Variables	Correlation	Remark	Z-value	Remark
Economic Growth (X1)	0.780	Highly correlated, very strong relationship	13.693	H_1 is accepted
Welfare Equalization (X2)	0.841	Highly correlated, very strong relationship	14.759	H_1 is accepted

Source: Processed Data (2015)

Table 7. Spearman Rank Correlation Analysis of Institution

Independent Variable	Correlation	Remark	Z-value	Remark
Good governance (X1)	0.908	Highly correlated, very strong relationship	15.942	H_1 is accepted
Resources Sustainability (X2)	0.999	Highly correlated, very strong relationship	17.527	H_1 is accepted

Source: Processed data (2015)

4. Conclusions

This study concluded that resources efficiency, waste free, social awareness, cyclic system of production, innovation and adaptation, and institution were mangrove resources management model components of Sidoarjo coast based upon blue economy concept. The possible efforts that could be done by the government of Sidoarjo regency to conserve the mangrove resources through blue economy approach are 1) community empowerment in mangrove resource monitoring and control; 2) Optimization of mangrove resource production management and marketing; and 3) fisheries production development. Environmental friendly fish/shrimp culture concept or pond culture of mangrove conservation as green belt (*silvofishery*) needs to be done. Institutional management of good governance is also highly needed to meet *blue economy* in Sidoarjo regency. Inter-institutional coordination in mangrove resources management, task and responsibility distribution, and law enforcement become the key of the program success. Since the issues covered in this study are still limited, future studies need to develop model involving more variables that could affect the sustainable blue economy management.

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REFERENCES

[1] Marine and Fisheries Service of Sidoarjo Regency, 2012. Final Report: Basic analysis of coastal area data to develop conservation area in Sidoarjo regency.

[2] Onrizal. 2010. Change in mangrove forest cover in east coast of North Sumatera, Period of 1977-2006. J. Biologi Indonesia. Department of Forestry, Faculty of Agriculture, Sumatera Utara University 6(2): 163-172.

[3] Pratiwi, R., 2009. The composition of crustacea occurrence in Delta Mahakam mangrove East Kalimantan.MakaraSains, Vol. 13, No. 1: 65-76.

[4] Purwoko, A., 2005. Impact of mangrove forest ecosystem damage on coastal community income of Secanggang district, Langkat regency.http://www.researchgate.net/publication/42322012_Dampak_Kerusakan_Ekosistem_Hutan_Bakau_%28Mangrove%29_Terhadap_Pendapatan_Masyarakat_Pantai.

[5] Indra, 2005. Mangrove and fisheries resources interaction in Aceh Province. http://www.academia.edu/3063287/Interaksi_antara_Hutan_Mangrove_dengan_Sumberdaya_Ikan. Accessed on June 6th, 2013.

[6] Ritohardoyo Su and Galuh Bayu Ardi. 2011. Mangrove forest management policy guidelines: Case of TelukPakedai Coastal District, Kubu Raya Regency, West Kalimantan Province. J. Geography: Vol. 8 No. 2 July 2011, 83-94.

[7] Kigpiboon, Ch., 2013. The Development of Participated Environmental Education Model for Sustainable Mangrove Forest Management on Eastern Part of Thailand. http://www.Emeral dinsight.com /journals.htm?articleid=871457&show=html. International Journal of Sustainable Development and World Policy 2 (3): 33-49.

[8] Jusoff, K., 2008. Managing Sustainable Mangrove Forests in Peninsular Malaysia. Journal of Sustainable Development.www.ccsenet.org /journal/index.php /jpl/article/download /15303/10366.Vol 1. No 1. March.

[9] Kustanti, A., B. Nugroho, D. Darusman, and C. Kusmana. 2012. Integrated Management of Mangrove Ecosystem in Lampung Mangrove Center (LMC) in East Lampung Regency Indonesia. Journal of Coastal Development.Volume 15, Number 2 Februari 2012.209-216.

[10] Hema and Indira Devi. 2012. Socioeconomic Impacts of The Community- Based Management of The Mangrove Reserve in Kerala India. http://www.sljol.info/index.php/ JEPSL/ article/view/5146/4112. Accessed on June 6, 2013.

[11] Kairo, D. Guebas, J Bosire and N Koedam. 2001. Restoration and Management of Mangrove Systems: a lesson for and from the east African Region. http://www.mangroverestoration.com/restmmnt.pdf. South African Journal of Botani. 67: 383-389.

[12] Padilla, J. and R. Janssen. 1996. Extended Benefit-Cost Analysis of Management Alternative: Pagbilao Mangrove Forest. http://dirp4 .pids.gov.ph/ ris/pjd/ pidsjpd96-2mangrove .pdf Journal of Philippine Development.Number 42, Volume XXIII No 2 Second Semester 1996.

[13] Apriliani, K.F., 2014. Local potential analysis of Kendal regency coastal area in the effort of achieving blue economy. Economic Development Analysis Journal. http://journal.unnes.ac.id/sju/ index.php/ edaj.Accessed on August 4th, 2015.

[14] Mira, M. Firdaus and E. Reswati. Blue Economy Principle Implementation onCoastal Communities in Brebes Regency, Central Java. http://bbpse.litbang.kkp.go.id/index.php/download-new/download/18-vol-9-no-1-tahun-2014/44-penerapan-prinsip-blue-economy-pada-masyarakat-pesisir-di-kabupaten-brebes-jawa-tengah. Accessed on December 2nd, 2015.

[15] Pauli, G., 2010. The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs. Paradism Publication, Taos, New Mexico.

[16] Sutardjo, S. C., 2012. Blue Economy: Toward sustainable marine and fisheries development. Paper on National Seminar of Blue Economy andSustainable Development.IPB. Bogor. November 28, 2012.

[17] Sugiyono. 2008. Statistics for research. Alfabeta. Bandung.

[18] Ariftia, R.I., Rommy, Q., Susni, H. 2014. Total Economic Value of Mangrove Forest in Margasari, LabuhanMaringgai District, Lampung Timur Regency.Jurnal Silva Lestari Vol. 2 No. 3 September 2014 (19-28).

[19] Indrastiand Fauzi, A. 2009. Net production. IPB Press. Bogor.

[20] Fatimah, A. 2011. Total economic value of mangrove forest

post-rehabilitation in the coastal area of Tlanakan, Pamekasan regency, East Java. http://repository.ipb.ac.id/handle/123456789/55770. accessed June 6, 2013.

[21] Baderan, DW . 2013. Economic Valuation Model as Basis for Rehabilitation of Mangrove Forests in Kwandang Coastal Areas of North Gorontalo District. Gorontalo Province . Unpublished dissertation . Faculty of Geography . UGM . Yogyakarta.