

## Original Research

## Sustainable mangrove forest management: mangrove-based business development using second-order confirmatory factor analysis in Prigi gulf of Trenggalek

## Authors:

**Pudji Purwanti,  
Edi Susilo and  
Mochammad Fattah**

## Institution:

Socio-Economics  
Department, Faculty of  
Fisheries and Marine  
Science, Universitas  
Brawijaya, Indonesia.

## Corresponding author:

**Pudji Purwanti**

## ABSTRACT:

Gulf of Prigi in Trenggalek Regency, Jawa Timur Province, Indonesia, has mangrove forests area in Damas beach and Cengkong beach. The mangrove forest area has decreased drastically in the last one decade. Replanting mangrove trees were done in Cengkong beach at 2008. The replantation activities were resumed and followed on 2009 and 2010. The results showed that the mangrove forest area at Cengkong beach began to flourish. This study aimed to describe the productive activities in the management of mangrove forests in Cengkong beach and analyze the mangrove-based business opportunities that can be developed through second-order Confirmatory Factor Analysis (CFA). Currently, the mangrove forests located at Cengkong beach are managed by Supervisory Community Groups of Kejung samudera. Replanting activities of the mangrove forests in Cengkong beach have given impact on the management activities. In 2012, the Department of Fisheries and Marine of Trenggalek regency began to introduce mangrove ecotourism. As the development of ecotourism in the mangrove forest area, it provides opportunities for further development based on the mangrove potentials. Nevertheless, mangrove-based business development should be following the concept of sustainability. Development of sustainable productive activities should be based on human resources, physical resources, natural resources and markets. The second-order CFA analysis indicated that such productive business development opportunities from mangrove-based business consisted of the production of chips, brownies, syrups and dodol (sweet thick porridge). Based on the feasibility analysis in terms of financial aspect, chips, brownies, syrups and dodol are feasible to develop, while the production of batik enterprises cannot be developed as the community still do not have the expertise in producing batik.

## Keywords:

Sustainable management, Mangrove forest, GeSCA method.

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## INTRODUCTION

Gulf of Prigi, located in Jawa Timur Province (Eastern Java), has four beaches namely Karanggongso beach, Prigi beach, Cengkong beach and Damas beach. Based on the report by Susilo *et al.* (2008), mangrove forest once grew well in the entire coastal area in the Gulf of Prigi. However, the current mangrove forest area is only found near of Damas beach and Cengkong beach of Karanggandu Village. While in Prigi beach and Karanggongso beach, mangrove forest areas were no longer found.

Within 1999 to 2000, encroachment upon the mangrove forest area in Damas beach and Cengkong beach occurred. Since 2003 people founded a community group Village Consultative Council on Forestry (LMDH) and utilized the forests around coastal area of Damas beach as plantation area by planting coconuts, durian, chocolate, coffee, quarrel and other gardening plants. The study by Susilo *et al.* (2008) in 2007 reported that the mangrove forest area in Damas beach was in the damaged condition; in Pancer Bang amounted to 1.022 hectares and in Pancer Ngrumpukan of 0.178 ha, and the damaged of mangrove forest in Cengkong beach amounted to 10.057 hectares.

The management of mangrove forest Cengkong beach is better as it is compared to the mangrove forest management in Damas beach. Currently there are 87 ha of mangrove forest area in the Cengkong beach. In 2008, replanting the mangrove trees were carried out by the Department of Marine and Fisheries of Trenggalek Regency in an area of 1 hectare mangrove forest. In order to preserve the mangrove forest ecosystems in Cengkong beach, Marine and Fisheries Agency has established a Supervisory Community Groups (called as POKMASWAS) of Kejung Samudera. The establishment of POKMASWAS in Cengkong beach has given good impact on the condition and also the management of the mangrove forest habitat in this area. Additionally, mangrove planting activities were carried out in the

following years successively in 2009, 2010 and 2011. The results of the replanting mangrove activities showed a positive flourishing growth of the mangrove forest at Cengkong beach. In 2012 the Department of Fisheries and Marine of Trenggalek Regency introduced the concept of mangrove forest ecotourism at Cengkong beach. One of the activities was by building wooden bridge over the mangrove.

The development in mangrove forests at the Cengkong beach as a tourism destination provided opportunities for mangrove-based business development. In order to have proper mangrove-based business development, such approach like Coastal Livelihood System Analysis (CSLA) have been carried out by considering some aspects. The concept of CSLA has been developed to manage coastal and marine resources. This concept is the development of a Sustainable Livelihood Approach (SLA). SLA is widely used in the fishing community particularly in terms of economic development programs with the goal of reducing poverty (Neiland and Bene, 2004). The SLA employed “capital capability” framework to design some studies on business activities of small-scale fisheries, and it is used to inform policy in promoting small-scale fisheries and fishing communities of food resilience as well as poverty alleviation (Allison, 2005). SLA was used to analyze the mangrove-based business development in Cengkong beach with the intention of achieving the sustainable mangrove forest management.

Ecosystem preservation of mangrove forest provides direct or indirect benefits to the coastal community. Patang (2012) stated that mangrove forest as an ecosystem and natural resources whose utilization used to human’s welfare and sustainable utilization needs to be managed and kept its conservation. There are two major concepts of mangrove forest management i.e. protection and rehabilitation.

Human is the leading factor in mangrove injury, their activities consciously and unconsciously would

**Table 1. Indicating score of sustainable livelihood approach**

S. No	Variables	Indicators	Operational
1	Fiscal capital	Infrastructure for household production, streets, transportation, and communication	Assets related to production, infrastructures
2.	Human capital	Level of education, the availability of work hour of the household	Level of education and work hour availability
3	Natural capital	Mangrove conversion	The wide coverage of mangrove area
4	Market	Market opportunity	Market opportunity

harm the fish source, the livelihood, and the biodiversity. Mangrove injury cause in every country is various: aquaculture activity, forest conversion into housing or industry, converted into agriculture land, commercial cutting, stovewood and charcoal industry and land reclamation (Rahman and Zainora, 2016). The finding of Eleanya *et al.* (2015) stated that mangrove forest of Akassa Nigeria island is the main livelihood of the surrounding people. This causes mangrove forest injury in Nigeria.

Mangrove forest injury caused by human behaviour also brings an impact to the threat of food insecurity and food scarcity especially in the coastal area since mangrove-based commodity is a never-produced-food source by coastal community considered a dangered commodity, poisonous, and cannot be consumed (Baderan *et al.*, 2015). However, the use of mangrove as foodstuffs is only incidental in nature or used in an emergency condition if food crisis attacks. There are several mangrove fruits which could be processed into food sources which are rich in carbohydrate. That kind of mangrove is from the species of *Bruguiera gymnorrhiza* (Lindur). Mangrove fruit types lindur can be explored into an alternative food source (Priyono *et al.*, 2010). Mangrove commodity could also be processed into dodol (traditional fudge), candy, chip, and soap (Djajati and Dedin, 2015). Mangrove fruit types pedada can be processed into syrup, while *Avecienna* sp can be processed into mangrove flour as the base goods to make brownies, chip, dodol and muffin (Purwanti *et al.*, 2016). The utilization of mangrove result potential as a traditional

food product by maintaining mangrove preservation as an effort to increase economic growth of the mangrove area (Sulistiyati and Yunita, 2015).

Based on this background, the study aims to analyze the mangrove-based business development, namely (1) to analyze the condition of mangrove forest resources and conditions of economic activities of coastal community around the mangrove forests; (2) to assess the technical feasibility of mangrove-based business development activities: physical resources, human resources, natural resources, and market opportunities; (3) to analyze the mangrove-based business development opportunities by utilizing CFA Confirmatory Factor Analysis by using GeSCA (Generalized Structured Component Analysis) software. The results of the research can be used as an input for the management of mangrove forests in the study area as well as information material for the Government of Trenggalek Regency to make further policy in the related area.

## MATERIALS AND METHODS

This research was conducted in the area of mangrove forest at the Prigi gulf of Cengkong beach. Quantitative method was applied for the analysis. According to Sugiyono (2010), quantitative method is based on positivism philosophy, fulfilling scientific rule empirically, objective, measurable, rational and systematical in form of the number and statistical analysis so that can find and develop IPTEK (Science and Technology). The object of this research was mangrove forest and its management as well as surrounding people whose livelihood was from

mangrove forest. The respondent was determined by the user and mangrove forest manager. Mangrove forest manager was Kejung Samudra's POKMASWAS (Maritime and Fisheries Monitoring Society) and the user was the community utilizing mangrove forest for productive economic activity by 122 respondents.

The principles underlying the SLA approach in the management of mangrove forest are the social and economic activities of society which become the center of the analysis. SLA approach is to develop both micro and macro linkages. The approach towards the livelihood of the local community may provide explicit considerations of the relationship between local issues (such as the allocation of resources among the various types of resource use in coastal areas), the meso-level process (such as the decentralization of development planning by the government and financial management) and wider policy, including policies on national and economic or social change (such as the adoption of new policies on fisheries or fisheries legislation, market liberalization and the withdrawal of subsidies related to fisheries production). Descriptive analysis of the condition of mangrove forests and the conditions of economic activities around the mangrove forest was used to support mangrove-based business development.

Technical analysis refers to the analytical framework of the Sustainable Livelihood Approach (SLA) which was identified on the basis of five forms of capital namely human capital, natural resources capital, financial capital, physical capital and social capital (Table 1). Focus group discussion of the results have been generated based on the type of business chosen by the coastal communities surrounding the mangrove forest. The results of the selected commodities would be used as a basis for analyzing business opportunities in the SLA framework that is based on four forms of capital, namely the analysis of human capital, natural capital and physical capital and market variables, while financial capital is analyzed based on the mangrove-based

business as financial feasibility. In order to analyze the opportunity of mangrove-based business development, applied second-order Confirmatory Factor Analysis (CFA) using Software GeSCA (Generalized Structured Component Analysis) was used. It can be considered as component based SEM developed by Hwang and Takane. GeSCA program can be run through a website at [www.sem-gesca.org](http://www.sem-gesca.org) (Aprilia and Imam, 2013). The equation of second-order CFA (Figure 1) (Laili and Bambang, 2014) was as follows:

$$\eta = B\eta + \Gamma\xi + \zeta$$

$$x = \Lambda_x\eta + \varepsilon$$

where, B : loading coefficient;  $\Gamma$  dan  $\Lambda$ : first and second-order loading factor;  $\xi$ : vector for nx1 latent variables;  $\zeta$ : single variable vector; x : vector for px1 indicator variables;  $\delta$  : vector for px1 measurement error;  $\varepsilon$ : vector for nx1 measurement error;  $\lambda$ : loading factor value.

This second-order CFA was a proper analysis tool to develop a model under the criteria of right model selection using the goodness of fit: FIT, AFIT, GFI, SRMR and NPAR (Latan, 2014) as explained below:

#### **FIT**

FIT value ranges between 0 until 1, the higher the FIT value, the bigger the variances and variable can be explained by the specification of the model and FIT value recommended was  $> 0.5$

$$FIT = 1 - \frac{SS(E)}{N.T} \times fGSCA$$

#### **AFIT**

AFIT value was bigger for a constrained model than the unconstrained model so that can be concluded that the compared model is identical.

$$AFIT = 1 - (1 - FIT) \frac{d_0}{d_1}$$

#### **GFI (Goodness of FIT index)**

GFI was used to determine the difference among the sample of covariances resulted from the estimation parameter of GesCA. GFI value would be good if

approaching 1.

**SRMR (Standardized Root Mean Square Residual)**

Good SRMR would result in value approaching 0 and being recommended by  $\leq 0.80$ .

**NPAR**

NPAR was the number of dependent parameter estimation, loadings and coefficient path. While measurement model evaluation (test validity and reliability) with AVE and composite reliability (Aprilia and Imam, 2013) was as follow:

**AVE**

The latent variable was said reliable if AVE value s as recommended by  $> 0.5$ .

$$AVE = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum 1 - \lambda_i^2}$$

**Composite reliability**

The latent variable was said reliable if the value of composite reliability was as recommended by  $> 0.7$

$$pc = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum 1 - \lambda_i^2}$$

**RESULTS AND DISCUSSION**

**Condition and management of mangrove forest**

Mangrove forest at Cengkronng village was managed by Kejung Samudra’s POKMASWAS. The area of mangrove forest there is 87 ha. The type of mangrove grown is: (1) *Avicenna* sp (2) *Sonneratia* sp (3) *Burguiera* sp (4) *Ceriops tagal* sp (5) *Lumnitzera racemosa* (6) *Rhizophora mucronata* and (7)

*Xylocarpus* sp In the management development, kejung Samudra’s POKMASWAS has a productive economy activity at a mangrove forest ecosystem among other the activity of ecotourism, mangrove crab cultivation, Annadara sp clam cultivation, and mangrove nurseries. Ecotourism activities started from the replanting activities done by the Marine and Fisheries Agency in 2008.

That program was followed by successive planting of mangrove activities either independently by the community service such as POKMASWAS Kejung Samudera as well as with relevant agencies in 2009, 2010 and 2011. The results of replanting mangroves began to appear successful mangrove forest that thrives in coastal area of Cengkrong beach. The concept of mangrove forest ecotourism in Cengkrong beach was introduced by the Department of Fisheries and Marine of Trenggalek Regency in 2012, through the construction of wooden bridge over the mangrove forest. Mangrove plants that have not grown quite tall can be enjoyed by the visitors through the wooden bridges that have been built over the plants. The construction of the wooden bridge is to introduce the functions and benefits of the mangrove forests, which is as a medium of education for the community, at the same time as to protect flora and fauna in the mangrove areas. Ecotourism activities in Cengkrong beach area and mangrove forest area provides opportunity for the board of Pokmas was Kejung Samudera to start opening kiosks as well as food and drink stalls in the area of the entrance of the

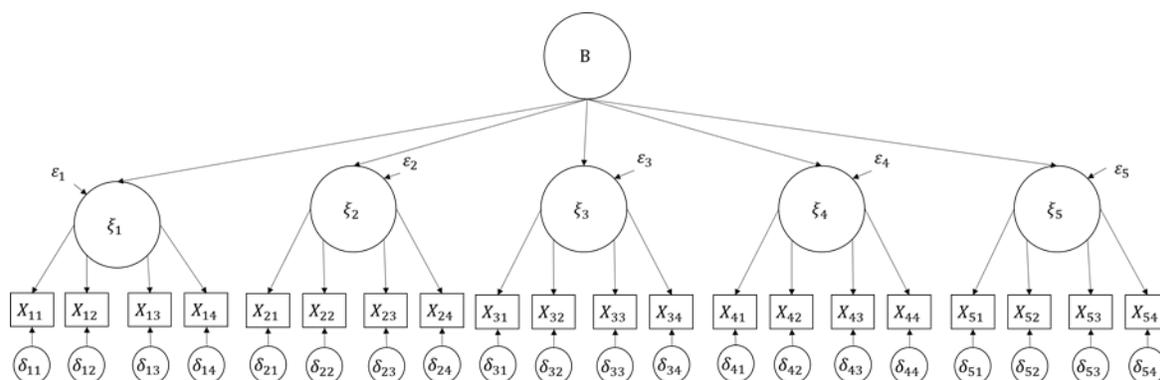
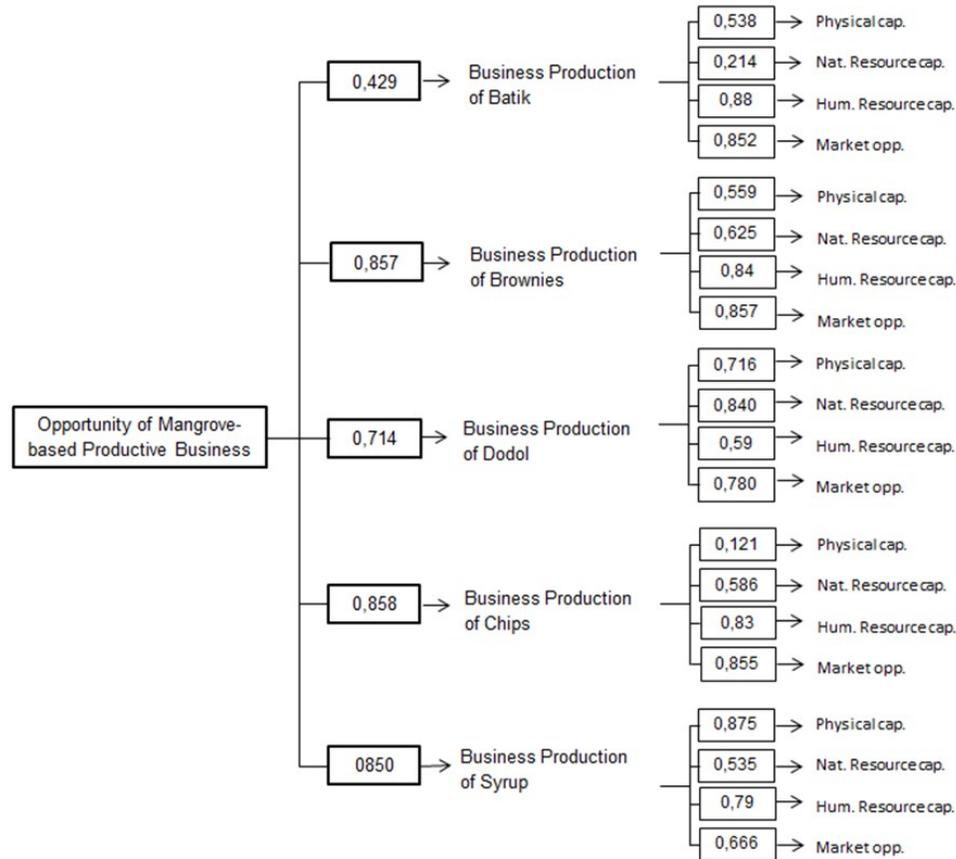


Figure 1. CFA Second order



**Figure 2. The opportunity of development of mangrove-based productive business**

bridge as well as in the parking management.

### **Technical appropriateness of mangrove-based business development activities**

The development of mangrove-based productive activities is the solution in increasing the economic incentives of the households in the mangrove forest management. Additional income from productive business is obtained through the optimization of free time. Based on the analysis of the availability of free time and households mangrove forest communities, especially women wives of the board still have time for mangrove-based business development.

Based on the results of Focus Group Discussion (FGD), such businesses based on mangrove that can be developed are namely batik, brownies, dodol, chips and syrup. Some considerations to develop mangrove-based business are namely: (1) the mangrove forest area becomes a tourism destination, so it is easy in marketing

their businesses; (2) public interest in mangrove-based products; (3) the availability of raw materials in the area; (4) the availability of free time which can be exploited (human resource). In order to make the mangrove-based production as a well-developed business, technical feasibility analysis should be conducted. Some of the parameters that are used to measure the technical feasibility include physical capital, human capital, natural resources capital and market opportunities.

### **Physical capital**

The mentioned physical capital is the ability of the provision of facilities as a means of production. Some types of physical capital in Cengkong beach include road infrastructure, which means transportation and communication that have been adequate. Cengkong beach and mangrove forest in Cengkong become tourism destinations that have developed in the area of Trenggalek Regency. Physical capital is meas-

**Table 2. Technical feasibility of physical capital**

S. No	Types of business	Respondents' ability (%)	Information
1	Batik	33.91	Less feasible (< 50%)
2	Brownies	54.78	Feasible (> 50%)
3	Dodol	60.87	Feasible (> 50%)
4	Chip	53.91	Feasible (> 50%)
5	Syrup	50.43	Feasible (>50% )

ured by the ability of communities to provide facilities and production in the business development. Respondents' answer to physical capital are presented in Table 2.

Based on the analysis of physical capital, the community has the ability to provide good production facilities for the business of making dodol, brownies, chips, and syrup. The most important ability is the production of dodol, then production of brownies, chips and syrup. The reason from the respondent for the capability of dodol production process is that, it is easier than the others and it requires low working capital. While the production of batik is less feasible to be developed for the community as it requires high working capital, while the community's ability for batik production is still low.

#### **Human resource capital**

Human resource capital is measured from the public interest to develop mangrove-based business. For this, the availability of time from the households are measured to develop new businesses. Factor of interest is the basis of human resource capital to produce one product or service. The interest of the community as measured in this study was the use of raw materials to produce the mangrove-based products such as from the mangrove fruits. If the public interest in the mangrove-based products processing is high, the mangrove fruits

as required, raw materials is also higher. Thus as the consequence, the public will preserve mangrove forests so that the process of mangrove-based product such as mangrove fruits are sustainable. Table 3 shows the results tabulation of respondents' interest in mangrove business development.

Business development opportunities that can be developed by the community are namely: batik, brownies, dodol, chips and syrup. The majority of people have interest in developing syrup business because people have had experience and training program to produce syrup. The next interest of business development opportunities are chips, brownies, dodol and batik. Community's interest in batik production has a low percentage compared to other production. The reason is because the production of batik requires precision and long period.

#### **Natural resource capital**

Extensive width of mangrove forests in the Karanggandu village, District of Watulimo in Trenggalek Regency of 87 ha, with the land use as much as 20% for public facilities such as roads, rivers, and supporting buildings for tourism; shows that most of the area are planted with mangrove trees of 69.6 ha. Mangrove species found in the region, namely: *Celocarpus* of 34.8 hectares, or as many as about 139,200 trees; *Ceriops* of 21.75 hectares, or about 87,000 trees, *Avicennia* sp of

**Table 3. Technical feasibility of human resource capital**

S. No	Types of business	Interest in business development (%)	Information
1	Batik	64.35	Feasible (> 50%).
2	Brownies	76.52	Feasible (> 50%).
3	Dodol	66.96	Feasible (> 50%).
4	Chips	77.39	Feasible (> 50%).
5	Syrup	78.26	Feasible (> 50%).

8.7 hectares, or about 34,800 trees; *Sonneratia Alba* of 4.35 hectares of trees, or about 17,400 trees; *Bruguiera* sp of 4.35 hectares of trees, or about 17,400 hectares; and 13.05 hectares of *Rhizophora* by the number of trees about 52,200 trees. Table 4 presents the technical feasibility of natural resources for each type of business.

### Market opportunity

Cengkong beach and mangrove area become tourism destination that has been developed in the Trenggalek Regency. The products of processed mangrove have marketing opportunities which are quite high, as the food of local communities. The existence of edu-ecotourism in the area of mangrove forest in Cengkong beach is a means of product promotion becomes easier and faster in introducing mangrove-based products to the consumers. Tourism in mangrove forest in Cengkong beach is widely known of the campaign carried out by the Department of Tourism, Youth and Sports through online media. Tourism promotion of mangrove-based product in Cengkong beach is also carried out by Kejung Samudera groups and also the visitors of the mangrove tourism.

In general, the market demand for batik products, brownies, dodol, chips and syrup are quite high because of the types of the processed mangrove prod-

ucts that are popular among the public in general. Therefore the opportunity of business development of batik, brownies, dodol, chips and syrup can be implemented. This mangrove-based product innovation is one of the attractions of consumers to buy in the tourism area.

### Opportunity of business development based on CFA analysis (Confirmatory Factor Analysis)

#### Model Testing

There are five businesses of mangrove-based productive businesses that have been selected by respondents. In order to test the model requires the data have been obtained and processed by using GeSCA software. Model testing was conducted to determine the ability of research model to explain the variables studied (Table 5).

The value FIT has a range of values ranging from 0 (zero) to 1 (one) (Aprilia and Imam, 2013). The value of FIT measures the total variance of all the variables that can be explained by the model. The calculations showed that the value of FIT of 0.518 which means that 51.8% of variance of all the variables can be explained by the model. This value explains that production of batik business ( $X_1$ ), the production brownies business ( $X_2$ ), the production of dodol business ( $X_3$ ), the

**Table 4. Technical feasibility of natural resource capital**

S. No	Type of business	Interest in business development (%)	Information
1	Batik	Leave and fruit skin of <i>Bruguiera</i> sp	Feasible. Vegetation coverage of <i>Bruguiera</i> sp is 4.35 ha. There are about 17,400 trees.
2	Brownies	Fruit flour of <i>Bruguiera</i> sp and <i>Avicennia</i> sp	Feasible. Vegetation coverage of <i>Bruguiera</i> sp is 4.35 ha. There are 17,400 trees. Vegetation coverage of <i>Avicennia</i> sp is 8.7 ha. There are about 34,800 trees.
3	Dodol	Fruit flour of <i>Bruguiera</i> sp and <i>Avicennia</i> sp	Feasible. Vegetation coverage of <i>Bruguiera</i> sp is 4.35 ha. There are about 17,400 trees. Vegetation coverage of <i>Avicennia</i> sp is 8.7 ha. There are about 34,800 trees.
4	Chips	Fruit flour of <i>Bruguiera</i> sp and <i>Avicennia</i> sp	Feasible. Vegetation coverage of <i>Bruguiera</i> sp is 4.35 ha. There are about 17,400 trees. Vegetation coverage of <i>Avicennia</i> sp is 8.7 ha. There are about 34,800 trees.
5	Syrup	Fruit of <i>Sonneratia alba</i>	Feasible. Vegetation coverage of <i>Sonneratia alba</i> is 4.35 ha. There are about 17,400 trees.

**Table 5. Model fit**

S. No	Model fit	Score
1	FIT	0.518
2	AFIT	0.466
3	GFI	0.990
4	SRMR	0.185
5	NPAR	47

production of chip business ( $X_4$ ), and production of syrup business ( $X_5$ ) can be explained by the model as much as 46.5%, while 53, 5% is other variables outside the model. The greater the value of FIT obtained in the existing model, the better result of the analysis because of the value of AFIT (Adjusted FIT) generated from this model is by 46.5%.

The value of GFI that is close to the value of 1 (one) and SRMR approaching the value of 0 is an indication of a good fit (Aprilia and Imam, 2013). Recommended value of GFI is  $> 0.90$ . The calculation results of GFI amounted to 0.990, indicating a good fit. While the value of SRMR of 0.185, indicating good enough condition for a recommendation from SRMR was  $\leq 0.80$ .

NPAR is found to be and 47 means the estimated number of parameters are weight, loading and path coefficient. The results of the FIT, AFIT, GFI, SRMR and NPAR in this research model showed a good level of fitness. Thus, measurement of goodness of fit indicates that the model in this study can be accepted.

**Measurement model of livelihood**

Term value of AVE  $> 0.50$  Cronbach Alpha  $> 0.70$  is used to determine the level of reliability. While the validity of the terms is the value corresponding load-

ing factor is  $> 0.5$ . In Table 6, the reliability value is high which shows that it can be concluded as reliable. As a comparison value, the calculated value is of composite reliability, the results of calculation of composite reliability values were above 0.7, showing that batik, brownies, dodol, chips, and syrup products have already qualified recommendation.

Based on the results of the value of Loading (L), the invalid value is only found in batik business in terms of natural resources indicator and ships in terms of physical indicator and all other variables can be considered valid (Table 7). The highest value of the variable is as an indicator of the dominant underlying society to produce a product. The highest value of batik products are human capital (88.4%), brownies products are market opportunities (85.7%), dodol products are natural resource capital (84%), chip products are market opportunities (85.5%) while the syrup product is physical capital (87.5%), so that the highest value of the underlying society produce these products (Table 7).

The value of Critical Ratio (CR) in Table 7 is to determine whether one indicator is able to produce a product or not. The value of CR explains that the brownies, dodol and syrup products require four indicators in order to be able to produce a product, while batik product requires human capital and market opportunities. Chip products require human resources capital, natural resource capital, and market opportunities.

While CR value in Path Coefficients in Table 8 is a consideration to determine the ability to measure the factor of mangrove-based business development. The value of CR in the structural model is a consideration

**Table 6. Value and analysis of AVE, Alpha and composite reliability**

S. No	Types of Business	AVE	Results	Alpha	Results	Composite reliability	Results
1	Batik	0.461	Good enough	0.578	Good enough	0.742	Good
2	Brownies	0.538	Good	0.687	Good enough	0.819	Good
3	Dodol	0.545	Good	0.703	Good	0.825	Good
4	Chips	0.447	Good enough	0.552	Good enough	0.723	Good
5	Syrup	0.553	Good	0.660	Good enough	0.815	Good

Table 7. Value of Loading and CR

S. No	Indicators	Batik		Brownies		Dodol		Chips		Syrup	
		L	CR	L	CR	L	CR	L	CR	L	CR
1	Physical capital	0.538		0.559	2.86*	0.716	4.69*	0.121		0.875	19.24*
2	Natural resource capital	0.214		0.625	3.03*	0.84	10.95*	0.586	2.72*	0.535	2.65*
3	Human resource capital	0.884	10.12*	0.846	15.73*	0.595	2.04*	0.837	15.09*	0.797	6.09*
4	Marketing opportunity	0.852	14.22*	0.857	19.97*	0.78	6.9*	0.855	14.47*	0.666	4.73*

for determining the ability to measure the factors of mangrove-based development of productive enterprises. Development of mangrove-based productive enterprises that have significant value are namely the production of brownies (12.38), the production of dodol (6.82), the production of chips (19.9) and syrup (16.34). Thus it is otherwise be able to measure the factors of development of productive enterprises, while batik business development was not significant (1.89).

The path coefficients of the development of the productive business to the production of batik business amounted to 0.429 which means that the development of productive enterprises has positive effect on the business of batik production. The second path coefficients of the development of the productive business to the business of brownies production amounted to 0.857, which means that the development of productive enterprises has positive effect on the production business of brownies. The third path coefficients of the development of the productive business to the business of dodol production is amounted to 0.714, which means that the development of productive enterprises has positive effect on the production business of dodol. The fourth

path coefficients of the development of the productive business to the business of chip production amounted to 0.858, which means that the development of productive enterprises has positive effect on the production of business chips. The fifth path coefficients of the development of the productive business to the business of syrup production is amounted to 0.850, which means that the development of productive enterprises have positive effect on the production business of syrup. Based on the result coefficient values generated by the development of productive business relationships the most significant high in sequence is the business production of chips, brownies, syrup and dodol (Figure 2).

R square value was used to explain variability. If R square value approaches 1 (one) so that the ability to explain variability was getting higher. R Square value of chip production business, brownies production business, syrup production business and dodol production business can explain opportunity variability of business development by 73.6%, 73.5%, 72.3% and 51% respectively. While batik production business could explain opportunity variability of business development which was small enough by 18.4%.

Table 8. Path coefficients

S. No	Variable relationship	Estimate	CR
1	Productive Business -> Batik Business	0.429	1.89
2	Productive Business -> Brownies Business	0.857	12.38*
3	Productive Business -> Dodol Business	0.714	6.82*
4	Productive Business -> Chips Business	0.858	19.9*
5	Productive Business -> Syrup Business	0.850	16.34*

The average analysis calculation result of each variable having highest average value is syrup production business. The community chooses syrup production business as having an experience in producing syrup (3.655). The highest average was then followed by chip production business (3.65), dodol production business (3.452), brownies production business (3.542) and batik production business (2.937).

## CONCLUSION

The result of second-order Confirmatory Factor Analysis gives a recommendation of mangrove-based productive business opportunity which can be developed sequentially i.e chip, brownies, syrup and dodol. While batik cannot be developed since the community still have no ability yet to produce it.

## SUGGESTION

Mangrove-based business development needs to be improved to minimize an activity which can damage mangrove forest. It needs training and accompaniment during the production of brownies, chip, dodol, and syrup in terms of the business development of the coastal community.

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