ADAPTATION TO CLIMATE CHANGE THROUGH ECONOMIC VALUATION OF COASTAL AND MARINE RESOURCES ECOSYSTEMS TO YELLOWFIN TUNA FISHERIES: EMPIRICAL STUDY IN CILACAP, CENTRAL JAVA

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ABSTRACT

Cilacap is a seaside area, which has the privilege of being ayellowfin tuna-producing area in Central Java Province. This capacity must be used continuously to support development in the Cilacap area and is useful for building community welfare so that it can be created. Therefore, information on the economic value of yellowfin tuna fisheries is needed which will be used as a basis for the development of yellowfin tuna in the future. come. Writing by identifying the benefits of coastal and marine ecosystems, as well as knowing climate change that is happening to the yellowfin tuna fishery in the ultimate objective of writing is Cilacap.. Data that is secondary comprises data on the amount of yellowfin tuna production, which is the type of data needed. Methodology with Benefit Transfer. The research sample used a stratified random approach. The benefit value of yellowfin tuna is Rp. 1,195,475,369, - consisting of a direct use value reaching Rp. 77,000,000, - an indirect use value reaching Rp. 1,070,425,423, the value of the optional benefits reaches Rp. 36,572,823, -Inherited the benefit value of Rp.7,700,000, - shows the results of the analysis. The climate will affect the catch of yellowfin tuna on the welfare of the fishing community in Cilacap seen from the results of the analysis.

Keywords: Adaptation; Benefit Transfer; Climate change.

1. Introduction

In due to the difficulties posed by climate change, this essay seeks to tackle the connection among innovation in agriculture & food sustainability. The farm sector has been greatly affected by climate change, which has an influence on the accessibility & availability of food. In this essay,

we'll talk about how innovation may boost agricultural output, lessen climate change vulnerability to create sustainable food systems.

The sustainability of agriculture throughout the world is seriously threatened by the global issue of climate change. To preserve food security & mitigate the negative effects of climate change as humanity expands, creative agricultural methods are needed. Climate Change's Effect on Agriculture Climate change may result in: Extreme temperature rises - Plant damage and reduced production can result from high heat temperatures, uncertain rainfall patterns - Planting and reaping cycles can be put up by unexpected rainfall or lengthy wet weather, the emergence of new illnesses - Changes in the weather can cause diseases of animals & plants that impair agricultural output to increase.

Numerous scientists have made contributions to the fields of climate change-related food sustainability & agricultural innovation. Here are a few examples: The "Father of the Green Movement" is American agricultural scientist Norman Borlaug. With his high productivity & plant variety development, Borlaug contributed to the era's rise in global food supply, M.S. Swaminathan: A geneticist from India who is renowned for his role in directing the rise of the green revolution across the country in the years 1960 to 1970. Swaminathan taught farmers in India how to employ cutting-edge crops, synthetic fertilizers, & contemporary irrigation systems, Vandana Shiva: A psychologist and feminist thinker who is also an Indian environmental campaigner. Shiva highlighted the value of agroecology & local food sovereignty in achieving food sustainability, as well as criticism of environmentally damaging industrial agricultural models, Jeffrey Sachs: One of the leading development economists who actively advocates international efforts to address global hunger through sustainable development programs. Sachs supports the idea of green technology innovation in the agricultural sector to increase productivity and adaptation to climate change, Louise Fresco: A Dutch agricultural expert and author who advocates a holistic approach to solving global food problems. Fresco argues that technological innovation, resource diversification, and wise environmental management must be combined to long-term food sustainability, & Muhammad Yunus: A Bangladesh economist known for his contribution to the development of microfinance through Grameen Bank. Yunus believes that access to corporate capital for poor farmers can help boost agricultural productivity as well as food security at the local level. They are all key figures in agricultural innovation and food sustainability with climate change.

Elva, 2016 excessive use of energy, especially fossil energy, is the main cause of global climate change. Increasingly damaged forests, both due to natural events and illegal logging, also significantly increase the amount of GHG released into the atmosphere and the function of forests as a sink for GHG emissions. In addition, agriculture and animal husbandry as well as waste play a role as contributors to GHG in the form of methane gas (CH4) which is to have the potential to cause global warming that is 21 times larger than carbon dioxide (CO2).

There are several sectors including energy consumption (Construction, Agriculture, etc.), Biodiversity (Biodiversity), Water Resources, Transportation systems will be disrupted (infrastructure), Coastal areas (increases the potential for storms in coastal areas/many disasters occur), Agriculture (there is a delay in the harvest season both, directly and indirectly, affecting food security), Forests (affecting O2 concentrations), forest fires where in the book the earth is

getting warmer explained Elva, 2016 . 120.3 million hectares of forest, Indonesia offers one of the most forests in the world. (FWI/GFW, 2001). 17% of the land is conservation forest & 23% is mixed forest is protection making trees, while the remainder is forest (FWI/GFW, 2001). Viewed using the various fields Indonesia has a huge diversity of taxa country in variety of life. As a result, the Indonesian Nationally Parks web page, Indonesia approximately a tenth % plant species from all plants in the world, 12% of mammal species (the most worldwide), 16% of reptiles and amphibians, 17% of bird species, and more than 25% of fish species in Indonesia. the whole world. Almost all of these species are endemic or absent in other countries, Health (will affect the frequency of floods and droughts, change the gas and air content).

Efforts to Overcome Climate Change by carrying out activities, namely disaster mitigation activities. Various Local Strategic Issues Among others: Education (access to services, costs of implementation, competitiveness, education based on character and morals, Health (degree of public health, range of service fees, and local health conditions), Public Works (sanitation, tidal floods , smooth flow of goods and services, Housing (slums, house ownership, limited land, Spatial planning matters (land conversion, illegal buildings, spatial mismatch), Development Planning (cross-sectoral coordination, RTRW, Transportation Affairs (mass transportation modes, traffic jams, transportation facilities and infrastructure), Environmental Affairs (erosion, abrasion, reclamation, sand dredging, pollution, excavation, waste management), Women's empowerment (gender, domestic violence, family planning, birth rate, Social affairs (poverty, PMKS, disaster mitigation), Labor, unemployment, labor conflicts), General governance (public services, PAD, regional self-sufficiency ratio, BUMD health), Food Security (food diversity, availability and self-sufficiency), Trade (arrangement of street vendors, market revitalization), Industry (MSME centers, branding, industry dependence), Tourism (tourism destinations, tourist visits, facilities and infrastructure) According to: PPD RPJMD.

Cilacap has a coastal area in Central Java Province that has a wealth of fishery resources. Cilacap BPS data shows the amount of marine fisheries production. Yellowfin tuna production data in Cilacap reaches a fish landing volume of 17,939.14 tons in 2021 with a value of Rp. 441,422,770,000, - when compared to 2020 of 19,241.54 tons and a production value of Rp. 351,948,480,000, - the landing volume decreased by 6.77%, and its value increased by 25.42%. Based on the resource group, production was dominated by the fish resource group of 14,111.23 tons (78.66%), the soft-skinned animal group of 3,541.37 tons (19.75%) then the crustaceans group of 286.55 tons (1.59 %) of total production volume according to Perikanan et al., 2021. The number of fishermen active in 2021 is 9,095 people consisting of longline tuna seekers 2,170 people, drift gill net fishermen 1,536 people, sprang net fish seekers 220 people, monofilament gill net 180 people, three-layer net fishermen 535 people, paying fishermen 108 people, arad fishermen 840 people, hand line fishermen 2,871 people, purse seine fishermen 300 people, squid line fishermen 285 people, fishing nets falling by boat 30 people and transport boat fishermen 20 people Perikanan et al., 2021. The number of fishermen active in 2021 is 9,095 people consisting of longline tuna seekers 2,170 people, drift gill net fishermen 1,536 people, sirang net fish seekers 220 people, monofilament gill net 180 people, three-layer net fishermen 535 people, payang fishermen 108 people, arad fishermen 840 people, hand line fishermen 2,871 people, purse seine fishermen 300 people, squid line fishermen 285 people, fishing nets falling by boat 30 people and transport boat fishermen 20 people (Perikanan et al., 2021). Submarine with a base in 1,004 parts, composed mainly of types of tackle for fishing based on the amount of units, hand line 262 units, Arad 210

units, Long line 154 units, Drift gill nets 128 units, Three-layer nets 107 units, Sirang nets 55 units, monofilament gill nets 45 units, squid lines 19 units, purse seines 10 units, payang 9 units, drop nets for ships and transport boats each 2 units, and traps 1 unit. Compared to 2020, the fishing fleet by fishing unit in 2021 has increased by 133 units or 15.27%, which is 1,004 units. This fleet is dominated by outboard motor boats of 426 units, motor boats of 21-30 GT, namely 390 units, followed by motor boats of 11-20 GT of 88 units, motor boats of 51-200 GT of 57 units, of motor boats of 31 – 50 GT of 19 units and motor boats measuring 5 – 10 of 24 units Perikanan et al., 2021.

1.1 Variable

1.1.1 The reliant variable is

Food sustainability is a factor that takes into account a region's food supply, accessibility, stability, and sustainability. This can be assessed using indicators including the prevalence of hunger, inadequate nutrition, unequal distribution of food, and susceptibility to changes in food prices.

1.1.2 The unrelated variables are:

Innovation in Agricultural Technology: This variable refers to the creation and uptake of new technology intended to boost agricultural productivity and lessen the adverse effects of warming temperatures on the agricultural industry. Plant cultivars that are extremely resistant to harsh weather conditions or ones that use irrigation more effectively are two examples of technical innovation, & Pro-Agriculture Public Political: In light of climate change, this variable covers public policy initiatives that encourage creativity in agriculture and food security. This might take the form of financial incentives for producers to adopt sustainable farming methods or research money for the creation of cutting-edge technologies.

2. Literature Review

Climate stressors influence traveling choices & the scope place migration increases China's elastic abilities lies in China's vulnerability & Climate-related sensitivity. The information reveals the different HH profiles of susceptibility & resilience for the first ever in a world-wide comparable assessment (Warner & Afifi, 2014). Capture fisheries are the largest source of wild food for human extraction which will be difficult to replace but, despite their unique value, blue foods are often overlooked in food system analysis, policy, and investment (Tigchelaar et al., 2022).

Climate change is negatively impacting agriculture & farming, behaviors & sabotaging the local food systems supply of inputs. Intermediaries like dealers and consolidators play a key role in the economy. very important in the Western Dry Zone's food distribution and supply. Better & better-connected roads are necessary for the transportation of food. to villages. Illegal market stalls act as the main a supply of food or point of a home sale. Domestic food is insufficient as long as there is a population, in quantity heavily their reliance on their agriculture food owing to the related incomes. To minimize the long-term effects of global warming on food production, adaptation to climate change must be included into local management (Thant et al., 2022).

Food security will be achieved if everyone is physically able to always meet their food needs. However, this situation cannot always be met, especially for poor households. Poor people have a higher level of food insecurity in terms of their ability to survive. Poverty is a sign of sufficient supplies of food, especially from the aspect of meals access. Poverty is a factor that directly affects food insecurity(Misselhorn, 2005). Several studies have examined the relationship between the two, among others (Pangaribowo, E., & Tsegai, 2011), (Warr, P., & Yusuf, 2013), (Vu, L., & Glewwe, 2011), (Piaseu, N., & Mitchell, 2004) which shows the relationship between poverty and food security in (Yuniarti et al., 2022). Furthermore (Shahid, A., & Siddiqi, 2010) in (Yuniarti et al., 2022) states that food insecurity is the result of poverty and insufficient food availability. In addition, poor communities are more vulnerable to climate change because of limited options to deal with it (Gregory, P. J., Brklacich, M., & Ingram, 2005). This is related to the El Nino climate change phenomenon in the form of a long dry season and La Nina in the form of a very wet rainy season. The phenomenon of climate change affects food security in the journal (Yuniarti et al., 2022).

The climate change factor changes through the causes of climate change in 4 stages: melting of polar ice caps, changing seasons, raising water levels, and other causes. Some of the causes of climate change include forestry, energy, agriculture and animal husbandry, and waste. The changing climate and its effects on Indonesia include: Geographical Position of Indonesia and the effects changing climate on Indonesia, including Rising temperatures and changing seasons, rising water levels are the effects in the Fisheries Sector, the effects on the Forestry Sector, the effects on the Agriculture Sector, the effects on Health Sector, Social and Economic effects (Elva, 2016).

Problems due to climate change: The International World responds to the Issue of Climate Alteration, the inclusion of the Issue of Climate Change in the International Agenda, the Climate Change Convention, the Kyoto Protocol, and the CDM (Clean Development Mechanism). Ways to deal with climate change: Efforts have been made such as the Government, as well as Industry, and Society, as well as what must be done in the future, such as Government, Industry, and Society (Elva, 2016). The author chose the reference journal in Jayapura, because they both have similar views, have beaches, and eat fish, but the area is different, so the author scales the results from Jayapura first so that the area is the same, then looks for the results of these benefits. The author is interested in doing this in Cilacap, because no one has used the transfer benefits in Cilacap yet. The author obtained data from regional planning, which has a percentage scale, equal to 2.3% of the different area sizes, then 14.9% of other factors, so that 82.8% is obtained, so that results are found that are by the area in Jayapura. The area of Cilacap is 2124.5 km2 (BPS, 2021), while the area of Jayapura is 940 km2 (BPS, 2019). Writing by identifying the value of the benefits of seaside and seaside ecosystems, and knowing climate change that is happening about the yellowfin tuna fishery in Cilacap is the 'purpose' of writing. The discussion on the indirect benefits of coastal and marine ecosystem services in this study is related to mangrove ecosystems, seagrass beds, and coral reefs which are related to the sustainability of yellowfin tuna fisheries. The resulting ecosystem services include: absorbing carbon dioxide (CO2), deposition of silt thereby adding nutrients and toxins, providing food through marine plants (algae and sea grapes), functioning as a climate regulator, protecting areas and life support systems as well as physiological functions other (FAO, 2015;UNEP, 2007); TEEB 2010:35) dalam (Hutajulu et al., 2022).

3. Research Methodology

The ecological function of mangroves to store positive carbon is very instrumental in lowering the earth's surface temperature and reducing global warming. The analysis used uses the value of transfer benefits from mangroves in CO2 absorption. Sumarto 2001, the value of carbon absorption is that 1 ton of carbon ranges from US$ 1-28 with an average of US$ 15 per ton equivalent to IDR 234,255 per ton (1 US$ = IDR 15,617 Exchange rate in December 2022). Benefit Transfer is an Analysis Tool used to answer writing problems, namely: with the value of inherited benefits calculated based on ± 10% of the direct use value available from the various ecosystems above (Hutajulu et al., 2022). An example of a tertiary valuation method is benefit transfer because It lacks personal data collection/primary economic studies. Application of value estimations, operates, data, or models is a component of benefit transfer built from afar context that addresses the same SDAL valuation question. The value transfer must be adjusted to take into account the different features of the product flow assessed in the current study vs The aspects of the assessment site's service flow.

Factors that are useful in determining appropriate adjustments require an further literature analysis to assess the link between the value per day a single kind of capturing fishery vs alternatives to capture fisheries. Benefit Transfer This technique is used to estimate the cost of deforestation using the total economic value approach. Where is used and not used? Assessing estimated benefits from other places, then transferring the value of benefits from the environment is a benefit transfer method(Choirunnisa & Gravitiani, 2022).

Indirect benefit values come from natural resources that can be used in the future with the assumption that these resources are not destroyed or permanently damaged. Optional benefit values that will be discussed in this study, namely mangrove resources, seagrass beds, and coral reefs which produce various benefits for the life of fish resources and other resources, which are calculated using the benefits transfer formula, is by estimating the original use and the use value is transferred to obtain a rough estimate of the utility of the environment.

The complete calculation is: The value of mangrove benefits is: In mangrove forests, the importance of biodiversity is Indonesia is US$ 15/hectare/year (Ruiteenbek 1992). The benefit value of the mangrove ecosystem is by multiplying the benefit value by US$ 15/hectare/year and converted into the rupiah to US dollar conversion rate in December 2022 of Rp. 15,617, - so that a value of Rp. 234,255/hectare/year. This amount is then multiplied given that the area of the mangrove Cilacap's forest habitat, which is 10 hectares. Therefore, the total use value for the mangrove forest ecosystem in Cilacap is Rp. IDR 2,350,650 / year.

The value of the benefits of the choice of seagrass ecosystems was analyzed based on the biodiversity value transfer benefit method by (Ruiteenbek, 1992) in Hutajulu et al., 2022 in the territory of Indonesia, which is US$ 15/hectare/year or converted to rupiah, which is Rp. 15,617 (exchange rate of 1 USS/Rp in December 2022), so that a value of Rp. 234,255 / hectare / year. This value will be multiplied by the total area of the seagrass ecosystem in Cilacap which is 10 hectares, so that the total value of the benefits of choosing the seagrass ecosystem in Cilacap is Rp. 1,426,472.586 / person / year. The use value of the choice of coral reef ecosystems was

analyzed based on the biodiversity value transfer benefit method by (Cesar HJS,2000) i.e. US$ 100/hectare/year or converted to rupiah Rp. 15,617 (exchange rate of 1 USS/Rp in December 2022), so that a value of Rp. 1,561,700/person/ hectare/ year. This value will be multiplied by the total area of coral reef ecology in Cilacap, which is 210 hectares (DKP Cilacap 2021), then multiplied by , so that the total value of the benefits of the choice of coral reef ecosystems is Rp. 36,572,823,- / hectare / year. The value of the benefits of choosing coral reefs at Bangsring Banyuwangi Beach is Rp. 22,012,380 / person / year (Asadi MA, 2017), as well as the value of the benefits of the city of Jayapura Rp.207,284,100/person/year. This means that the existence of coral reef ecosystems is very useful in the lives of communities around the Cilacap coast, Jayapura City and Banyuwangi.

3.1 Inheritance Benefit Value (Bequest Value)

Inheritance benefit values in the advantages both direct & indirect of mangrove utilization are examined in this study forest resources, seagrass beds and coral reefs, which are difficult to assess using the market value approach. Analysis of the value of inherited benefits of ± 10% of the direct use value received from the various ecosystems above. Analysis of the value of inherited benefits, namely: 10% X the amount of yellowfin tuna fishery production in 2022, namely Rp. 77,000,000,-= Rp. 7,700,000. (Widiastuti, 2016) value of mangrove heritage benefits in Merauke Regency Rp.2.728.107.120. The findings above show that the value of the existence of these resources is very important in regional development in these various regions and can also function to support the improvement of people's welfare. The value of the inherited benefits of these various ecosystems must be based on an ecologically & socially sustainable development plan, as a feature of sustainable development in Cilacap & overcoming climate change.

3.2 Total Economic Value of Benefits of Marine Resources in Cilacap

The sum of all the economic values of coastal and marine benefits contained in Jayapura City will be shown by the total economic value (NET). Overall economic value as a combination of the value of direct benefits, indirect benefits, and non-use values (Pearce, 1992). The total economic utility value of Cilacap's coastal and marine resources is Rp. 1,195,475,369, -/year compared to the city of Jayapura Rp. 9,370,544,310,-

4. Results

4.1 General Condition of the Area

Cilacap is situated between latitudes 7 30 7 45 20 and longitudes 108 4-30 -109 30 30 east. Geographically Cilacap has an area of 225,360.840 Ha. The fishing grounds for fishermen using hand line and drift gill nets cover the waters of the Yogyakarta coast (110 east longitude) to Pelabuhan Ratu waters (107 east long) with a duration of operation of 15-25 days per trip. Meanwhile, vessels with longline tuna fishing gear cover the waters south of Yogyakarta (110 east longitude) to Bengkulu (100 east longitude) with a length of operation of longline tuna between 5 months and 7 months. Fish caught which are the main commodities are Tuna as much as 6,260.72 tons (34.90%), Skipjack 3,003.25 tons (16.74%), Sharks 316.46 tons (1.76%), Shrimp 286.55 tons

(1.60%), Long Beak Fish 226.37 tons (1.26%), and other fish 7,845.80 tons (43.74%) of the total production of 17,939.14 tons (Perikanan et al., 2021).

Of the total production of caught fish that was landed, around 15.34% was marketed in fresh form, 2.48% in the form of pemindangan, dried (salted fish and trasi) by 0.75%, frozen fish by 79.27%, in fish form burn/bake 0.76%, canning 1.20% and 0.10% live. Marketing of landed fish production, 5% for the local market in Central Java, 15% for West Java, 30% for East Java and 50% for Jakarta. Fish marketed to Jakarta consist of frozen and fresh tuna and the like (skipjack and long-beak), specifically for tuna exported to Japan in fresh form(Perikanan et al., 2021).

The number of fishing households / fishing companies according to the size of the business in the period 2017 - 2021 experienced an average increase of 17.93% in the category of business size for motor boats, for the outboard motor business it experienced an average increase of 6.23%. In the last five years, the total number of fishermen has grew by 12.96% annually on average from 5,626 people in 2017 to 9,095 people in 2021, purse seines and drift gill nets each experienced an average increase per year of 146.88%, 134.81%, 113.16%, 19.17 and 3.59% However, the number of fishermen in transport boats, traps, monofilament gill nets , squid, payang, longline tuna and three-layer nets decreased by an average of 37.50%, 25%, 16.79%, 9.17%, 6.25%, 2.19%, and 0.68 % per year (Perikanan et al., 2021).

The highest fishing season for 2021 starts in March – November, then usually experiences a decline in the following months, as a result, because the fishing season period has ended (Perikanan et al., 2021).

4.2 Inheritance Benefit Value (Bequest Value)

In this study, inheritance benefit values are mangrove's direct and indirect usage values. forest, seagrass beds and coral reef resources, which are difficult to assess using a market appraisal strategy. Analysis of estimated inheritance benefits of ± 10% of the direct use value received from the various ecosystems above. Analysis of the value of inherited benefits, namely: 10% X the amount of yellowfin tuna fishery production in 2022, namely Rp. 77,000,000,-= Rp. 7,700,000, - Research (Widiastuti MMD, Ruata NN, 2016) in (Hutajulu et al., 2022) value of benefits inherited from mangroves in Merauke Regency Rp.2,728,107,120, - the findings above show that the value of these resources is very important in regional development in these various areas and can also function to support the improvement of community welfare. The value of the inherited benefits of these various ecosystems must be based on an ecologically and socially sustainable development plan, as a feature of sustainable development in Cilacap.

5. Discussion

5.1 Total Economic Value of Benefits of Marine Resources in Cilacap

The sum of all the economic values of coastal and marine benefits contained in Cilacap will be shown by the total economic value (NET). Total economic value as a combination of the value of direct benefits, indirect benefits, and non-use values (Pearce, 1992). The value of the total

economic use of coastal and marine resources in Cilacap City is Rp. 1,195,475,369/year. Further information on the total the coast's economic potential & sea of Cilacap City.

Table 1. Total Economic Value (NET) of Cilacap coastal and Marine Ecosystems Types of Ecosystem

No.	Benefits Direct benefit values as producers of yellowfin tuna Indirect benefit values:	Amount (IDR)
1.	The value of direct benefits as a producer of yellow fin tuna	77.000.000
2.	Indirect benefit value:	
2.1.	Mangrove ecosystem	
a.	Mangrove physiological/ecological value	204.257.760
b.	Regulatory function of mangrove climate change	1.502.933
c.	Carbon storage function	585.637.500
d.	Nitrogen nutrient producer	11.104.320
2.2.	Seagrass ecosystem	
a.	Producing nutrients (silica)	2.968.360
b.	Producing nutrients (nitrate and phosphate)	51.782.500
2.3.	Coral reef ecosystem	
a.	Climate change regulator	213.172.050
3.	Option value	
a.	Mangrove forest	2.350.650
b.	Seagrass	1.426.472,59
c.	Coral reefs	36.572.823
4.	Inheritance value	7.700.000
Amount		1.195.475.369

Source: Results of Data Analysis (2022).

6. Conclusion

An analysis of the value of the benefits of yellowfin tuna on the welfare of the fishing community in Cillacap shows that the total economic value of the benefits of coastal and marine ecosystems in Cillacap reaches Rp. 1,195,475,369, -. The highest fishing season for 2022 starts in March – November, then usually decreases the following month, this is due to the conclusion of fishing season. As a result, the climate will affect the yield of yellowfin tuna on the welfare of fishing communities in Cilacap.

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perspectives during interviews or surveys conducted as part of our data collection process. Our families and friends for their unwavering support, patience, understanding during moments when we were engrossed in research work. This paper is still far from being perfect, but it is hoped that it will be useful not only for researchers, but also for readers. For this reason, suggestions and constructive criticism are most welcome“R. B. G. thanks

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