

## Conference Paper

# Sea and Coast Sustainable Management Strategy

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### Abstract

Coastal and small islands (KDP) are faced with significant challenges owing to the risks of habitat destruction, changes in natural ecosystem processes, and pollution. Coastal areas and KDP are increasingly complex as conflicts of interest arise within communities and at government levels. Therefore, activities in this area must pay attention to balancing the needs and capabilities of the area in providing resources. This study aims to develop a management strategy for utilizing natural resources on a small, uninhabited island. The research was conducted through a descriptive evaluative survey method, using spatial analysis to get the suitability of waters and the carrying capacity of the area with the ArcGIS 10.3 application, while the management strategy uses the Analytical Hierarchy Process (AHP) model. Ecological potential contained in the Journal of Regional and Rural Development Planning, February 2018, 2 (1): 1-22 I. Marasabessy, A. Fahrudin, Z. Imran & SB Agus 2 Nusa Manu Island and Nusa Leun Island are diving tours, snorkeling, mangrove tracking and beach tourism, grouper cultivation in floating net cages (KJA) and fishing ground. The potential of the two islands is suitable and can be utilized for various activities with priority being conservation-based marine ecotourism. This management strategy, can truly side with the people,

**Keywords:** Sustainable; Management; Small Islands.

## 1. Introduction

Management of coastal and marine areas in small islands (KDP) is currently a crucial issue. In general, KDP has the potential to experience habitat destruction, changes in natural ecosystem processes and pollution. In particular, KDP is also vulnerable to natural disasters and human activities, such as; sand mining and destructive fishing practices (poison fishing and fish bombs). KDP's vulnerability is caused by its remote location, limited resources, high dependence on imported goods, high transportation costs and prone to natural disasters. (Adrianto. L., & Matsuda, Y. (2002). Developing Economic Vulnerability Indices of Environmental Disasters in Small Island Regions. Journal Envir Imp Ass Rev., 22 (4), 393–414) KDP management is increasingly complex as conflicts of interest arise internally within the community and at government levels.

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Nusa Manu Island and Nusa Leun Island are small islands with an area of approximately 0.31 km<sup>2</sup> and 0.73 km<sup>2</sup> respectively, located in the north of Seram Island, uninhabited, only occupied by a few resort managers and fishermen who stop by for a while waiting for their return trip. The two islands are unique from several islands around them, even different from most of the islands in Indonesia. The unique island landscape has become a capital for marine tourism development, (Ayal, F.W. (2009). *Kajian Perairan Pesisir Desa Sawai Kabupaten Maluku Tengah Bagi Pengembangan Ekowisata*. Tesis. Bogor: Institut Pertanian Bogor. p.35) its location is protected because it is located in the waters of the Bay of Sawai, so it is good for marine cultivation activities (Minggawati et al., 2012), (Minggawati, I., & Lukas. (2012). *Water Quality Research for Fish Farming Keramba in the Kahayan River*. *Media Sains*, 4(1), 87-91.) has also been a fishing ground for a long time potential communities around the area. The number of activities that will be placed in a space in the coastal and marine areas of Nusa Manu Island and Nusa Leun Island as one of the closest small islands to the mainland (mainland), it is necessary to pay attention to the compatibility between the needs and capabilities of the two islands in providing resources. The availability of resources in the KDP area is an indicator or basis for the carrying capacity of the area to support all activities to be allocated. This is in accordance with the statement (Dahuri et al., 2008) that the carrying capacity of coastal areas is an area management approach that takes into account the comparison of aspects of the availability and capacity of resources to the number of populations and activities that are above it. (Dahuri, R., Rais, J., Ginting, S.P., & Sitepu, M.J. (2008). *Pengelolaan Sumberdaya Pesisir dan Lautan Secara Terpadu*. Pradnya Paramitha Press. p.13)

This is expected to ensure the sustainability of human resources and activities in the future. Based on these conditions, implied a scientific question, what is the ideal management concept in the development of the two islands? For this reason, this research is conducted with the aim of developing a management strategy for small, uninhabited islands in the utilization of natural resources for marine tourism activities, KJA cultivation and fishing areas.

## 2. Research Methods

The research was carried out from September to December 2016, on Nusa Manu Island and Nusa Leun Island which are representative of other islands in North Seram District, Central Maluku Regency. Geographically, the two islands are bordered; the North with

North Seram Sea, the South with *Negeri Sawai*, the West with Saleman Village and the East with Opin Village.

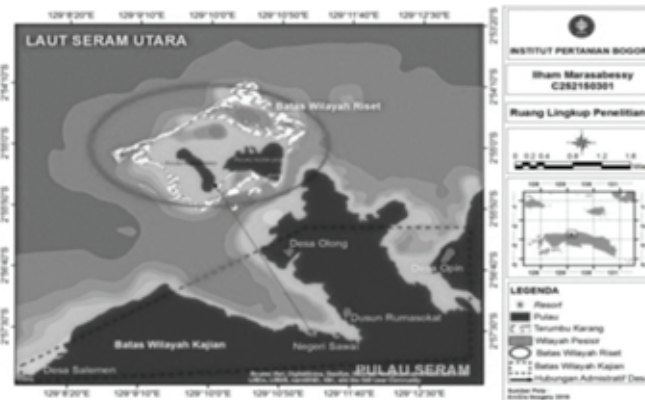


Figure 1

The types of data used in this study include primary data and secondary data. Primary data obtained by direct measurements in situ include oceanographic data such as; tides, bathymetry, currents, salinity, temperature and brightness, observation data on mangrove ecosystems (mangroves), coral reef ecosystems and coastal ecosystems for marine ecotourism, data for KJA cultivation locations and fishing ground. Secondary data includes data on Regional Spatial Planning (RTRW), potential and utilization of existing natural resources (SDA), obtained from several related agencies such as; offices of the Regional Development Planning Agency (BAPPEDA), the Central Statistics Agency (BPS), the Culture and Tourism Office, the Public Works Service (PU).

For map data used are satellite imagery maps obtained from Landsat 8 and Arcgis Imagery 2016 imagery, as well as base maps obtained from the Information and Geospatial Agency (BIG). The tools used include: meter, current kite, tide palm, refractor meter, sechi disc, GPS, digital thermometer, pH meter, DO meter and underwater camera. Equipment for coral reef observation: snorkel and a set of scuba diving, long boat for observation during data collection and other supporting tools.

### 3. Results and Discussion

The landscape characteristics of the two islands which are small and uninhabited islands give different entities to the coast and the surrounding sea. Various activities in these two islands are integrated with the *Negeri Sawai* as the mainland (mainland) within the administrative boundaries. All activities that take place in the area of the two islands will be directly related to the social, cultural and economic dimensions of the people in the *Negeri Sawai*. The natural resource potential of the two islands is very large,

ecologically unique in both the coast and the sea. The two islands are surrounded by exotic fringing reefs, (Loc.cit) a wide and varied spread of mangrove forests and have three white sand beaches with low and straight reliefs. This potential is supported by good oceanographic parameters on the two islands. The suitability of marine ecotourism in each activity (snorkeling, diving, mangrove tracking and beach recreation) is in the appropriate category (72%) and very suitable (96.7%).

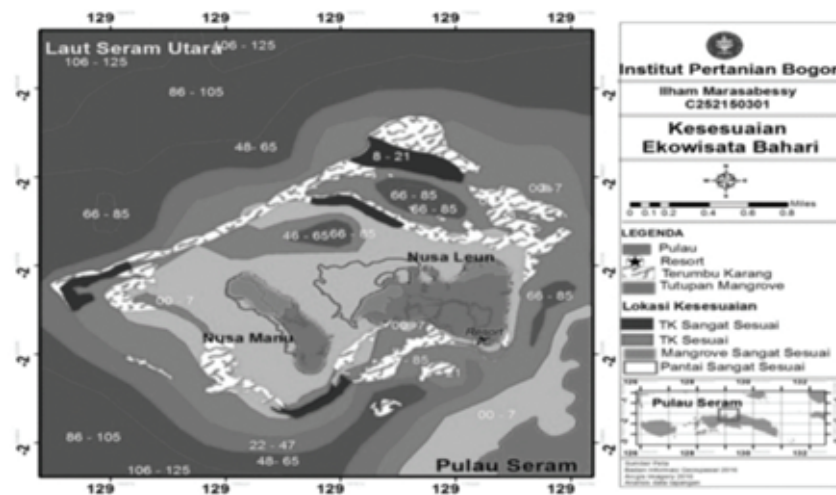


Figure 2

Theoretically, from an ecological resilience perspective, all ecosystems are vulnerable and easily disturbed. Carrying capacity as a concept based on an environmental approach is an important part of the study of natural resource management. (A.A, Syahputra & Yunasfi, Suryanti A. (2015). Analisis kesesuaian dan daya dukung ekowisata pantai, selam dan snorkeling di Pulau Berhala Kabupaten Serdang Bedagai Provinsi Sumatera Utara. *Jurnal Aquacostmarine*, 12(2), 016-031) Carrying capacity is defined as nature's ability to tolerate human activities. Marine tourism through an ecosystem approach can increase public awareness in protecting the marine environment, especially in unspoiled areas. (Abecasis, R.C., Longnecker, N., Schmidt, L., & Clifton, J. (2013). Marine conservation in remote small island settings: Factors influencing marine protected area establishment in the Azores. *Mar. Policy*, 40 (1), 1–9) The results of the analysis of the carrying capacity of the area on Nusa Manu Island and Nusa Leun Island in full can be seen in Table 1.

The tourist activities carried out by visitors to the *Negeri Sawai* are naturally integrated between land tourism and marine tourism (sea and small islands) in the vicinity. Tourists who visit not only do tourist activities on the two islands, but can do other tourist activities such as mountain nature tourism (Mount Manusela National Park) and cultural tourism, which geographically the tourist location is in mainland.

TABLE 1

No	Type of activity	Area/Length of Utilized Area	DDK
1	Diving	37. 293 m <sup>2</sup>	149 people/day
2	Snorkeling	11. 594 m <sup>2</sup>	46 people/day
3	Mangrove Tracking	1. 895 meters	152 people/day
4	Beach Recreation	2. 221 meters	69 people/day

Source: Analysis results, (2017)

The tourism sector in North Seram, especially in the *Negeri Sawai* on Nusa Manu Island and Nusa Leun Island, has experienced an increase in tourists in the last five years.

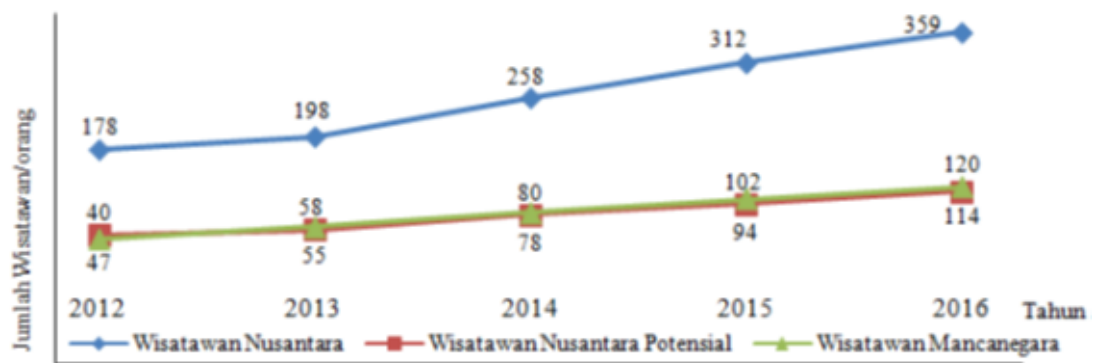


Figure 3: Number of tourist visits in *Negeri Sawai* from 2012–2016 (Source: Elaboration of data from the Central Maluku Regency Culture and Tourism Office and Resort Management)

The number of domestic tourist visits increased from 2012 to 2016 from 178 people to 359 people, potential domestic tourists were 40 to 120 people and foreign tourists were 47 to 114 people. However, the number of tourists visiting is still within ideal limits (not exceeding carrying capacity). The analysis of KJA cultivation suitability shows that at locations in the northern part of the two islands have a different suitability index value and fall into two categories, namely very suitable, having an IKW of 96.00% and conditional compliance with an IKW of 56.00%. Likewise, for locations in the southern part of the two islands, there were two classes of suitability, namely very suitable at 96.00% and 86.00%, while conditional compliance with the IKW was 48.00%.

The influence of water characteristics and seabed topography of the two islands tends to vary, where depth is the limiting factor. There are several contours of the seabed such as; flate, crest, slope and lagoon at that location.

In the first location, namely in the northern part of Nusa Manu Island and Nusa Leun Island, it is divided into two depth classes, namely 7 to 20 meters and depth classes > 25 meters. Location two, in the southern part of Nusa Manu Island and Nusa Leun Island,

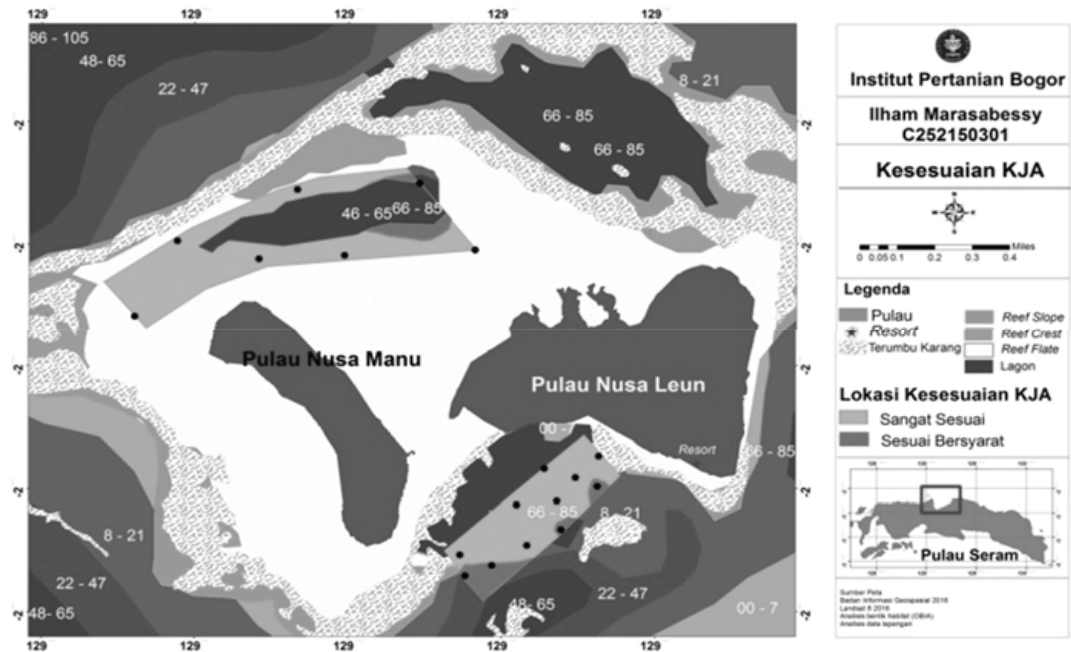


Figure 4: Suitability of KJA cultivation locations in the waters of Nusa Manu Island and Nusa Leun Island.

is divided into three depth classes, namely 7 to 20 meters, > 20 to <25 meters and > 25 meters.

The area suitability of the area for KJA cultivation can be seen in Table 2.

TABLE 2

No.	Area Suitability	Area (ha)	Location
1	Perfectly Fit (S1)	39.40 and 19.31	North of both islands Southern part of both islands
2	Conditional Compliant (S2)	11.48 2.89 0.42 1.48	ST2. The northern part of the island of Nusa Leun ST10 and 11. Southern part of Nusa Manu Island ST6. Southern part of Nusa Leun Island ST2. Southern part of Nusa Leun Island

Determination of the carrying capacity of the area KJA cultivation on Nusa Manu Island and Nusa Leun Island, namely, refers to the very suitable area suitability value (S1) in each research location. From the results of this calculation, it is obtained the physical carrying capacity (Adibrata, S., Kamal, M.M., & Yulianda, F. (2013). Daya Dukung Lingkungan untuk Budidaya Kerapu (Famili Serranidae) di Perairan Pulau Pongok Kabupaten Bangka Selatan. *Jurnal Pesisir dan Pulau-pulau Kecil*, 2 (1), 43-58), KJA cultivation activities that can be accommodated in the area of the two islands are presented in Table 3 and Table 4 as follows.

TABLE 3: Physical carrying capacity for marine cage cultivation in the northern part of Nusa Manu Island and Nusa Leun Island

No	Carrying capacity	Amount	Unit
1	KJA	24	KJA
2	KJA Raft	145	Unit
3	Hole KJA	583	Box
4	Number of Fish	140,088	Tail
5	Cultivated Fishermen	24	Group
6	Labor	145	Person

TABLE 4: Physical carrying capacity for marine cage cultivation in the southern part of Nusa Manu Island and Nusa Leun Island

No.	Carrying capacity	amount	Unit
1	KJA	12	KJA
2	KJA Raft	71	Unit
3	Hole KJA	286	Box
4	Number of Fish	68,657	Tail
5	Cultivated Fishermen	12	Group
6	Labor	71	Person

The unique topography of Sawai Bay and high biodiversity provide different characteristics as in the bay area in general. The diversity of ecosystems around this area affects the activities that take place in an effort to extract human resources, including fishing activities (Coll, M., Piroddi, C., Steenbeek, J., Kaschner, K., Lasram, F.B.R., Aguzzi, J., Vafidis, D., Villanueva, R., & Voultsiadou, E. (2010). The Biodiversity of the Mediterranean Sea: Forecasts, Patterns, and Threats. *Journal PLoS One*, 5 (8), e11842). Based on the tracking fishing ground process with fishermen who carry out fishing activities, it can be seen that the fishing locations are around the islands of Nusa Manu and Nusa Leun Island to the north of the spooky sea about 3 km or equivalent to 1.61987 nautical miles (1 km = 0.53995 nautical miles). (Marasabessy, I., Fahrudin, A., Imran, Z., & Syamsul, B.A. (2018). *Pengelolaan Berkelanjutan Perikanan Demersal di Kawasan Pulau Nusa Manu dan Nusa Leun Maluku Tengah. Jurnal Albacore*, 2(1), 13-27)

It is generally known that fishermen’s fishing ground is located around the two islands, only a few fishermen are fishing to the north and partly to the western part of Sawai Bay. This condition is due to the relatively simple and relatively small fishing fleet of fishermen, so it is not optimal to use when carrying out fishing activities with distant fishing grounds. (Ibid.)

Another thing that causes the concentration of fishing activities on Nusa Manu Island and Nusa Leun Island is the existence of a large fringing reef with a shape that circles the two islands, making it a preferred habitat for various types of reef fish such as;

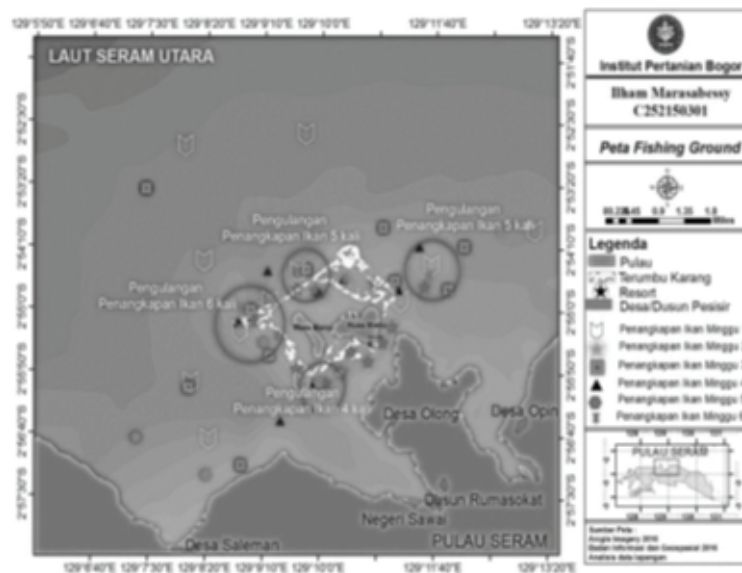


Figure 5

grouper, snapper, bubara and others (Lokcit) the primary productivity of a water is closely related to the good and bad of the surrounding ecosystem, where most reef fish make coral reefs as a place to find food (feeding ground), a breeding ground), a shelter (protection ground) and a care area (nursery ground). Management of Nusa Manu Island and Nusa Leun Island The preparation of AHP is made based on the division of roles of each stakeholder, such as; key actors, establish criteria and establish appropriate management alternatives.

The AHP approach, shows that the alternative management of Nusa Manu Island and Nusa Leun Island as a small, uninhabited island is carried out based on the priority of activity space allocation on the two islands. Although these two islands are included in the area of Central Maluku Regency, their management is in accordance with regional autonomy by referring to Act No. 23 of 2014 concerning Regional Government and National issues regarding Indonesia as the world's maritime axis, making this inseparable from support (good political will) from the Central Government with management authority granted to the Maluku Provincial Government to empower Nusa Manu Island and Nusa Leun Island as small, uninhabited islands.

Furthermore, analysis is carried out based on the level of the role of each actor and on the appropriate criteria to obtain alternative management of Nusa Manu Island and Nusa Leun with the AHP approach, through several levels namely, actor level, criteria and alternatives.



### 3.1. Actor Level

The basis for setting priorities at the activity level is adjusted to the influence of each actor on the sustainable management of Nusa Manu Island and Nusa Leun Island. Based on the assessment at the actor level, the priority order of actors is the government, as the organizer of state policies in the perspective of managing and developing small islands to ensure the lives of all communities around the area, then the second level is the local community, while the private sector (marine tourism entrepreneurs and local fishery business plasma) and non-bureaucratic institutions (academics, non-governmental organizations/NGOs and environmentalists) have the same values.

In the process of managing small island clusters, especially on Nusa Manu Island and Nusa Leun Island, the role of the government is more important than the other three actors because:

The government is a state institution that is obliged to safeguard, manage and protect all natural resources, formulate and implement maritime policies both nationally and regionally in Maluku. Providing influence on the policy of managing small islands and being able to create appropriate use of marine and coastal space so as to provide a conducive investment climate for the business world;

1. Implementing the mandate of Act No.27 of 2007 jo. Act No. 1 of 2014 concerning Management of Coastal Areas and Small Islands and Act No. 23 of 2014 concerning Regional Government; and
2. The existence of the Ministry of Marine Affairs and Fisheries, which within its organizational structure is the Directorate General of Marine Spatial Management of the Ministry of Marine Affairs and Fisheries, is the most competent institution to manage, utilize, develop and develop small islands throughout Indonesia, including Nusa Manu Island and Nusa Leun Island in a sustainable manner. According to Samudra (2010), national macroeconomic policies are the main principles in the formulation of policies for the use of small islands concerning policies on planning and utilization of natural resources, legalization per region and defense, economic development.

### 3.2. Criteria Level

The management criteria for Nusa Manu Island and Nusa Leun Island are determined based on the level of importance of each of the criteria that have been formulated in

the context of sustainable management of the two islands. Based on this assessment, the priority order of the criteria is environmental, social, economic and political. This priority determination is in accordance with the results of interviews and in-depth discussions with *Negeri Sawai* stakeholders, namely Saniri Negeri (State Officials, traditional and religious leaders, community leaders), youth leaders, fishermen (fish catchers and cultivation), local entrepreneurs (fishing and tourism platforms /private). The results obtained are that environmental (ecological) factors in the two islands have the highest priority compared to economic, social and political factors.

### 3.3. Alternative Level

Prioritization at this level is based on the best alternative that is to be achieved in the sustainable management of Nusa Manu Island and Nusa Leun Island. Based on the assessment, the priority order of marine tourism activities on Nusa Manu Island and Nusa Leun Island is developed based on conservation; second priority, marine tourism activities are developed together with marine cultivation fisheries (KJA) and capture fisheries (fishing ground); the third priority is, marine tourism activities are developed together with marine cultivation activities (KJA); and the last priority, namely, marine tourism activities to be developed together with fishing activities (fishing ground). Determination of alternative ranking is done by determining the eigenvalue (eigenvector) of each alternative.

## 4. Conclusion

In general, the management of coastal and marine areas on Nusa Manu Island and Nusa Leun Island can be carried out for various activities. The management strategy through an ecosystem approach with management priority is marine ecotourism based on conservation. The distribution of utilization activities is determined based on the suitability of the waters and the carrying capacity of the area which is appropriate, so as not to cause conflicts in spatial use and guarantee the preservation of natural resources. As a recommendation in this study, there is a need for management synergy between local wisdom "*Petuanan Negeri*" and the suitability of management zoning in the perspective of developing the two islands as conservation areas.

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