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Seaweed Cultivation and Coastal Communities in Malaysia: an Overview

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Abstract

The majority of research on Malaysian seaweed farming has focused on the biological and macroeconomic aspects, and has significantly disregarded the micro-level social, cultural and economic issues, especially the relationship between seaweed cultivation and coastal communities. Therefore, this paper focuses on the social and economic aspects that have been covered in studies in the seaweed sector, together with those aspects that have been ignored. Seaweed cultivation activities have not only resulted in a contest over marine spaces and resources, but has also led to changes in the values of communities, in that communities have compromised the social values of collective care in favour of individual economic benefits. Due to the increasing tension in seaweed areas, many families have stopped helping each other; however, this aspect has been ignored in academic research. The role of migrant workers in seaweed cultivation is another topic that remains untouched. Also lacking was empirical evidence concerning the role of seaweed cultivation initiatives in reducing the economic poverty of the communities and improving coastal people's level of income. Finally, this paper raises some questions about the absence of data related to seaweed cultivating communities.

Keywords: Coastal communities, gender, migrant workers, seaweed cultivation, socioeconomic and cultural, Sabah, Malaysia

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Introduction

Globally, studies that investigated the relationship between seaweed cultivation and coastal communities have been conducted. These studies covered a broad range of issues. Cai et al. (2013) reported on studies from the following six countries - Indonesia, the Philippines, India, Tanzania, Solomon Islands and Mexico and, among other aspects, they highlighted the associated economic, social, cultural, religious and political dimensions. In the six countries mentioned, research had shown that seaweed cultivation had improved the level of household income and living standards including children's access to school, and bringing improvements to houses/households, improvement in diets and the purchase of material goods (Krishnan and Narayanakumar 2013). These studies acknowledged the role of relatively simple cultivation techniques in improving the sources of livelihood of small-scale marginalised fishing communities. In addition, more evidence from India (Padi 2012) and Tanzania (Msuya 2011) explained how seaweed cultivation enhanced the income of fishing communities in coastal areas, and empowered women in decisions relating to management and the use of seaweed resources (WWF undated).

In Malaysia, studies on seaweed farming have substantially focused on the macro-level commercialisation of seaweed cultivation through the creation of the seaweed Mini Estate System. Attention has also been paid to biological questions pertaining to types of seaweed, the sizes of species and their industrial uses (Phang 2010; Yong et al. 2015). However, the welfare of seaweed-cultivating communities, as well as the social, cultural and economic issues have not received much attention from the Federal government (which is formed with the support of 13 states and 3 federal territories in Malaysia) or the State government of the main seaweed growing state Sabah, or by social scientists. Notwithstanding the flourishing seaweed industry in Malaysia, and the hundreds of families reported to be engaged in seaweed cultivation, studies on these communities with reference to seaweed activities are scattered, and cover other aspects of seaweed cultivation and their impact on the social and economic aspects of community life (Sade et al. 2006; Kaur and Ang 2009a; Wood et al. 2011; Safari 2015; Hussin et al. 2015; Kunjuraman et al. 2015).

In research on the social and economic benefits of seaweed farming as a livelihood, the relative dearth of social science studies has resulted in the positive dimensions (such as significant economic benefits) appearing more important. The studies of Frocklin et al. (2012) and Cai et al. (2013) in Zanzibar (Tanzania) provide concrete evidence from countries outside Malaysia of the potential adverse impact of seaweed cultivation activities on women. To date, no integrated and inclusive research in Malaysia is available that covers all the social, economic, religious and political aspects of seaweed cultivation and the associated communities. The primary tasks of the present overview, therefore, is to synthesise the major social and economic aspects of seaweed cultivation in Malaysia, based on studies in the literature and secondarily to highlight those dimensions that, hitherto, have not been addressed. In doing so, the paper will identify major knowledge gaps that seriously hamper the understanding of whether or not the industry is serving the local communities.

Thus, it will attempt to answer the following questions: What are the research areas related to the social and economic aspects of the seaweed cultivation sector, and which research areas have been ignored and require the attention of researchers? The paper asks why relationships between different people in the seaweed industry and the coastal communities in which cultivation is located have been transformed, often negatively, by the development of the industry.

Materials and Methods

In this paper, the discussion and analysis are based on secondary literature, mainly research articles, government documents and media reports related to coastal communities engaged in seaweed cultivation in Sabah, Malaysia. As fishing communities usually perform seaweed cultivation activities, the paper will also discuss some details related to fishing as part of the communities' overall economic and farming activities. This paper begins with an overall discussion of the seaweed industry in Malaysia, and then, separately touches upon the macro-level successes and identifies the number of communities engaged in seaweed cultivation. Subsequently it looks at the promotion of the seaweed industry by the Malaysian government, the impacts on women and children, the changing social values towards help and care in the face of economic competition, and migrant workers engaged in seaweed cultivation.

Results

Seaweed Industry in Malaysia

Malaysia is located in the Coral Triangle, a term which generally refers to a geographic area covering the waters adjacent to six countries (i.e., Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands and Timor-Leste) in Southeast Asia and the Pacific, (WWF, undated). The tropical conditions in the coastal waters of Malaysia provide a favourable environment for the production and growth of diverse types of seaweed species. In Malaysia, the eastern coast of Sabah has a suitable environment for cultivating good value seaweed that includes the red seaweed *Kappaphycus alvarezii* ((Doty) Doty ex Silva 1996) and the green seaweed *Caulerpa lentillifera* (J. Agardh 1837) (Phang 2006). Sabah is geographically situated below the monsoon and typhoon belt, and, therefore, is known as 'the land below the wind.' Sabah is located on the Island of Borneo and is the only part of Malaysia where seaweed is grown commercially. To its south-west is Sarawak, Malaysia's largest state. Sabah shares its border with Indonesia to the south (Institute of Island Studies 2007).

In 1978, the State government of Sabah introduced the seaweed *Eucheuma cottonii* (Weber-van Bosse 1913) cultivation to the Semporna district of eastern Sabah (Hurtado et al. 2014; Kaur and Ang 2009a). In the 1980s, the Federal government initiated a seaweed project in Sabah. Initially, it failed because it received little support from local people, and the cultivation techniques and knowledge were not properly applied.

After 1988, seaweed production started to increase and continued to do so until 2001. However, in 2002, seaweed production decreased to its lowest level, but gradually improved from 2004 to 2014 (Safari 2015). In 2008, in Malaysia, 111,298 tonnes of seaweed were grown in four areas: Semporna (95 per cent), Lahad Datu (4.4 per cent), Banggi (0.3 percent), and Kunak (0.3 percent) (Fig. 1) (Kaur and Ang 2009b). In 2008, Malaysia was ranked ninth among the top ten seaweed-producing countries, and contributed 0.4 per cent of the world seaweed production (Kaur and Ang 2009b). In 2013, it was ranked eighth, with 1 percent (269,431 tonnes) of the total worldwide seaweed production (FAO 2015).

Fig. 1. Location of seaweed growing areas in Sabah; Banggi, Kudat, Lahad Datu, Kunak, Semporna, Selakan Island, Bum Bum Island and Tawau (adapted from **maps.google.com.my**).

The promotion and development of the seaweed industry gained importance in the 10th Malaysia Plan from 2010 to 2015. Although the 11th Malaysia Plan, 2015 to 2020, did not directly refer to the seaweed industry, the industry was included in various key areas related to coastal development, conservation of natural resources, and improvement of the livelihood of coastal area populations. However, in the Malaysian National Agro-Food Policy 2011-2020, seaweed was considered a high-value commodity (Safari 2015). By 2020, through the development of the seaweed industrial zone, the Ministry of Agriculture and Agro-Based Industries aims to provide a safe cultivation environment of 20,500 hectares. Under the Policy, by 2020, the Malaysian government aimed to "capitalise on Malaysia's competitive advantage" (Safari 2015) and increase dry seaweed production to 900,000 tonnes, which would be worth approximately MYR 1.4 billion (approximately USD 344.76 million).

Engagement of communities in seaweed cultivation in Sabah/Malaysia

For decades, seaweed cultivation has been one of the activities contributing to the livelihood of the communities in different areas of Sabah (Fig. 1). However, specific and accurate data on the number of individuals and families involved in seaweed cultivation are lacking because of the lack of focus on the communities engaged in seaweed cultivation by the respective departments (including the Department of Fisheries, Sabah) (Table 1). The following available data show that, in 1978, an estimated 500 families were involved in seaweed cultivation (Safari 2015) in Sabah in the following areas: Tawau, Kunak and Lahad Datu but it does not include details of other areas such Semporna and the Tun Sakaran Marine Park (TSMP) (Fig. 1).

Kaur and Ang (2009a) revealed that in 2005, 583 families, and in 2008, 950 fishing families were reported to be involved in aquaculture including seaweed cultivation in Sabah (Kaur and Ang 2009a). However, Kaur and Ang (2009a) did not show how many of these families were inside and outside of the TSMP and how many of these were in other parts of Sabah. In 2006, a census was conducted in the TSMP (The TSMP contains eight islands, as well as over one hundred kilometres of the reef) in which interviews were conducted with 387 households, covering 99 per cent of houses present in the TSMP. The census showed that the major occupation of 59 per cent of the households was seaweed cultivation (Wood et al. 2011).

In 2012, the Department of Fisheries Sabah reported that, in Sabah, 2,720 and 1,200 fishing families were engaged in seaweed cultivation in 2000 and 2010, respectively (details provided in Ali et al. 2015). Table 1 shows population (families) engaged in seaweed cultivation in Sabah and different areas within Sabah. It also indicates poor management of data on cultivators engaged in the sector.

Table 1. Year and area wise population/families engaged in seaweed cultivation in Sabah.

Year	Total population engaged in seaweed cultivation	Reference of migrant workers	Location in Sabah	References
2016	4000 farmers (planters)	The *Bajau* and *Suluk*	Semporna, Kunak and Tawau	Daily Express (2016)
2010	1200 fishing families	Not mentioned	Sabah	Ali et al. (2015)
2008	950 fishing families	Not mentioned	Sabah	Kaur and Ang (2009a)
2006	Out of 378 households, 59 percent of households major occupation	Not mentioned	Tun Sakaran Marine Park	Wood et al. (2011)
2005	583 families	Not mentioned	Sabah	Kaur and Ang (2009a)
1971	Estimated 500 families	Not mentioned	Tawau, Kunak, and Lahad Datu	Safari (2015)

Kaur and Ang (2009a), Wood et al. (2011) and Ali et al. (2015) specifically did not mention if the seaweed workers were migrants from neighbouring countries; however, a large number of migrant workers had been reported contributing in the sector. Since the 1970s, in search of better livelihood opportunities, thousands of fishermen and cultivators have migrated from the Philippines and Indonesia to Sabah. These migrant workers included documented and undocumented (or regular and irregular) workers (Lasimbang et al. 2015). More than 90 percent of the workers in the seaweed industry were migrant workers (Hurtado et al. 2014), but the existing social science research did not offer categories (local or migrants) of the workers currently engaged in the sector.

A community census in 2006 in the TSMP was followed by a survey in 2008, which offered information about the status and the issues surrounding seaweed cultivation. The survey highlighted specific management issues that were the result of a hurry to start seaweed cultivation and the issue of lease agreements of plots (areas to cultivate seaweed). The survey identified six management issues: a) 'importation' of labour, b) people with no documents working in new operations, contrary to the provisions of the lease agreements, c) buildings and signs erected without permission, d) boundaries of leased areas not being adhered to, e) displacement of existing seaweed farmers, and f) Native Customary Rights or claims of 'heirs' over areas of sea (Wood et al. 2008).

It also gave eight main recommendations to the authorities for resolving the issues and problems faced by seaweed cultivating communities. However, there has been no talk of a resurvey to look at the steps taken by the authorities (Fisheries Department Sabah and TSMP Management) in light of the findings and recommendations of the survey, or to assess whether the community issues have been resolved or have become more serious.

Promotion of seaweed cultivation through homestay programme

As an instrument to support and promote tourism, in 1995, the Malaysian Federal Government, through the Ministry of Culture, Arts and Tourism, initiated a homestay programme, based on seaweed cultivating households in Sabah (Kunjuraman et al. 2015). In return for a fee, tourists were offered a stay in a community house to observe the seaweed cultivation activities conducted by the members of the household. Hussin et al. (2014) claimed that the homestay had captured the attention of tourists and resulted in more income for seaweed cultivating families (Kunjuraman et al. 2015). A study on three islands, i.e., Selakan, Omadal, and Sebangkat, in Sabah suggested that, at the micro-level, communities had perceived homestay tourism as a positive tool for their economic development due to the additional money received from the tourists.

This income increased their monthly earnings and taught them entrepreneurship skills. However, the study showed that the communities were not provided financial support under the programme to set up their own businesses on the islands (Hussin et al. 2014). Research showing the impact of the homestay programme on the social and economic lives of the communities and families was lacking. There was also a lack of research concerning the interaction among the government officials, seaweed operators, non-governmental organisations and the heads of villages (Hussin et al. 2014). Kaur and Ang (2009b) claimed that, besides contributing to the country's revenue, seaweed aquaculture in Malaysia had also helped to improve the livelihood of fishing communities living in coastal areas. Sade et al. (2006) also claimed that seaweed cultivation alone had the potential to overcome the poverty of communities that were solely dependent on seaweed.

Seaweed cultivation not only increased incomes but also helped the farmers to escape the poverty trap. However, after the claim by Sade et al. (2006), the poverty dimension had not been explained and explored further to clarify whether seaweed cultivation activities had alleviated poverty among the communities or not.

Hurdles to seaweed cultivation

Although seaweed cultivation was an important source of livelihood for the communities, their financial and technical incapacity was a major hurdle to obtaining any benefit from seaweed farming. Most of these communities were economically poor, and their livelihoods largely depended on fishing or other activities related to the sea (Hussin et al. 2015).

The government intended to address the issue of capacity building through its National Seaweed Nucleus (NSN) programme (Sabah Economic Development and Investment Authority, undated). However, whether the NSN programme has increased the technical and financial capacity of all small-scale seaweed cultivators is not known. The programme also raised other questions, such as, has it protected the interests of the local people or is it merely an effort to increase seaweed production or both?

During 2011 and 2013, Hussin et al. (2015) conducted a qualitative study with fishermen from Selakan and Bum Bum Islands (Fig. 1) in Semporna, Sabah. This study was based on participant observations and 10 interviews with the local community members and government officials. The study provided insights into the impacts of capacity building programmes on the knowledge of local fishermen about seaweed cultivation techniques and technologies, and their ability to cultivate a good quality of seaweed. The research found that fishermen were grouped under clusters within the Mini Estate System, and that they used modern techniques to meet the needs of national and international markets (Santos 2012). The Sabah Department of Fisheries ran the Mini Estate System together with Universiti Sains Malaysia and private firms that conducted training to build the capacity of the cultivators.

The idea for the Mini Estate System in the seaweed sector had come from Universiti Sains Malaysia to the Performance Management and Delivery Unit under the Prime Minister. The Mini Estate System Project emphasised community participation (Hussin et al. 2015). Hussin et al. (2015) reported that fishermen were exposed to new methods and practices that included the use of a variety of seaweed seeds, management of nurseries, use of fertilisers, methods of drying seaweed, and the use of the casino table technique to dry seaweed, and protect it from dirt and pollution. The study also claimed that these capacity-building activities by the government were useful for the lifelong learning of participants and that, through such activities, the knowledge and survival skills of the fishermen had improved. In turn, the knowledge and skills would help the fishermen to adapt to the changes in seaweed cultivation tools and techniques. However, the study did not show whether these skills had any socioeconomic impact on the lives of the communities in 2011 and 2013 when the research was conducted.

Women and children

Not only men but also women and children take part in seaweed cultivation activities (Msuya 2011). Usually, the activities are considered a small-scale family enterprise (Sade et al. 2006). In Tamil Nadu, India, Krishnan and Narayanakumar (2013) reported that seaweed cultivation had had a very positive impact on the socio-economic status of women cultivators. Women were leading the seaweed cultivation activities and also performing routine household chores. However, in the Malaysian context, only a little evidence is found about the changing roles and responsibilities of women (inside and outside the household) engaged in this sector. No data were available on the total number of women and children involved in seaweed cultivation. There was a generic emphasis on the participation of women in seaweed cultivation without the provision of exact numbers and their total contribution. In 2003, Cooke (2004) offered insights into the involvement and role of the *Bajau Laut* women in terms of their livelihood activities, which included seaweed cultivation in the *Banggi* and *Kudat* islands (Fig. 1) in Sabah. In this account, one can witness the clear role and participation of women in seaweed activities, and also their contribution to the household income.

Cooke (2004) revealed that although seaweed required more time, care, and vigilance, it was less rewarding than fishing and mud crab harvesting, which were the quickest and easiest sources of women's income. The engagement of women in seaweed cultivation provided space for men to continue fishing and assist women in the cultivation of seaweed when time permitted. Cooke's article on the engagement of *Bajau Laut* women in seaweed cultivation does not apply to the current situation in Sabah, which follows the seaweed production boom in 2008 and the creation of the Mini Estate System and neither did it completely discuss the negative dimensions of seaweed cultivation, especially those activities that have impact on the routine life of women, such as health impacts, and overburdening of women with responsibilities for household chores.

Hussin et al. (2015) pointed out that, a decade ago, seaweed cultivation was a male domain. The Mini Estate System created under the National Seaweed Nucleus (NSN) programme provided opportunities for women to participate in seaweed cultivation and enhance their skills, knowledge, and income. Earlier, the need for long hours of sitting under the sun had discouraged young men and women from continuing with its cultivation. However, it appears (Ali et al. 2015) that the Mini Estate System brought more young women to the sector, and a gradual increase in the interest in the Mini Estate System was noticed. However, Hussin et al. (2015), and Ali et al. (2015) did not provide qualitative or quantitative evidence concerning the improvement in the total participation of women in seaweed cultivation, or improvement in their income, or their personal and family lives. Their papers lack any details pertaining to the difference in the monthly earnings before and after the Mini Estate System.

Hossin et al. (2014) claimed that, in the *Suluk* community (on Sebangkat Island in TSMP), women were kept away from the seaweed cultivation activities because of their monthly menstruation, which was said to have a negative supernatural effect on seaweed production, and because their domain of work was only in the home. However, the research finds no clarity on whether such restriction on women was for all times or only during the menstruation period. Hossin et al. (2014) also highlighted that it caused shame for men to engage their women in seaweed cultivation. In other research from Banggi Island in the Kudat district (Fig. 1), Ismail (2004) found that 25 percent of women were not encouraged by their men (whether husbands, fathers or brothers was not reported) to take part in seaweed cultivation because their role in seaweed cultivation (tying propagules on lines, providing vigilance over the farms and harvesting) prevented them from giving adequate time to their responsibilities for looking after children and attending to household chores.

Women in Banggi Island did not have enough time to contribute to seaweed cultivation. Usually, their engagement in cultivation was only with the consent of their male relatives, mainly husbands. Overall, a dearth of evidence concerning the participation of women in seaweed cultivation, and how and why communities were still making barriers to stop women from taking part in seaweed cultivation and fishing are the main research concerns and queries.

Changing values from care to competition

Hossin et al. (2014) claimed that seaweed cultivation has gradually changed the life and culture of the seaweed cultivating communities on Sebangkat Island (in the TSMP). In 1999, once the planned intervention of seaweed cultivation by private companies started, rigid social stratification appeared and damaged the communities' social value of caring for others. Hossin et al. (2014) asserted that heirs (locally known as *Pewaris* or owners of areas in the Sebangkat Island) had never used their power or authority in such a severe way as they did after the arrival of the seaweed farming companies in Sebangkat. With the advent of companies and growing competition, it had become mandatory for everyone to obtain prior permission from the heirs in order to be able to cultivate seaweed in the Sebangkat area. The heirs had two sources of income; they rented out space for seaweed farming companies and they owned small-scale seaweed cultivation companies. With more income, the heirs became well off and gained more power in the community.

The influential status of the heirs attracted many members of the community who also started capturing or demarcating areas in the sea for seaweed cultivation, and provided these for rent to seaweed cultivators from outside. Hossin et al. (2014) found that, with such competition, community members and households had quit helping and assisting each other in times of trouble. The communities no longer took care of each other; the values of mutual care and protection had been reduced to the household level, and the focus was on increasing seaweed productivity, earning more money, and competition with each other. However, Hossin et al. (2014) did not provide a detailed explanation of the complex situation that affected the values of the communities. Rather, their study gave a superficial view, lacking detail concerning the role of many other factors including that of the government agencies.

Discussion

The above findings show that limited research is available concerning the relationship between seaweed cultivation and coastal communities in Sabah, Malaysia. Although several studies have been conducted (Wood et al. 2011; Safari 2015; Hussin et al. 2015; Kunjuraman et al. 2015), these cover only certain social and economic aspects of the communities in the sector. Specifically, the research lacks details on the role of seaweed cultivation with respect to household income levels, living standards, including details about access to education and other improvements in housing and living standards, diet or purchase of material goods.

Over the last three decades, although many families have been directly or indirectly engaged in seaweed cultivation, the exact number of these families (or individuals) remains unknown. The absence of accurate and precise data concerning seaweed cultivators may contribute to ill-informed policies and initiatives concerning the welfare and development of coastal communities and the seaweed sector as a whole. This aspect requires a detailed analysis for a deeper understanding of the impact of any such ill-informed policies on coastal communities engaged in seaweed.

The NSN programme (including the Mini Estate System and the homestay programme) indicates the government's commitment and willingness to invest in seaweed cultivation for macro- and micro-level benefits for the country and local seaweed farming communities. No detailed assessments were undertaken to show any direct impact of the NSN programme on the local coastal communities, even though the homestay programme and seaweed cultivation in Sabah were considered very instrumental in supporting and promoting tourism (Kunjuraman et al. 2015). It was claimed (Hussin et al. 2014: 8; Kunjuraman et al. 2015) that the programme has resulted in more income for seaweed cultivating families. There may be a possibility of increasing the incomes of those families working in the Mini Estate System (Hussin et al. 2015; Ali et al. 2015). However, others who did not work in the Mini Estate System, or those who worked under the influence of the heads of the communities (such as heirs in the Sebangkat Island), or those who did not have the resources to cultivate good quality seaweed have not been specifically considered in the research to date. Such areas require urgent attention from academia. In a similar fashion, generic claims were being made about the role of seaweed in helping the communities to exit from poverty (Sade et al. 2006). This area lacks facts about the role of seaweed cultivation activities in alleviating the poverty of poor seaweed cultivators.

The private companies and heads of the communities appeared certainly to benefit from seaweed farming (Hossin et al. 2014). In one sense, seaweed is considered to be a small-scale family enterprise (Sade et al. 2006), but the contribution of women in the sector has not been clearly assessed or calculated, particularly as the negative impacts of seaweed cultivation activities are ignored in the studies. The total number of women directly or indirectly engaged in seaweed activities is not known. These figures as well as additional information on gendered power relations are necessary to determine the scale of the contribution of women to the economy. More information is also needed to identify the magnitude of the contribution of children in seaweed cultivation. The role of migrant workers, including workers without valid Malaysian documents, in the cultivation of seaweed, has not been investigated thoroughly. On one hand, migrant workers produced more than 90 per cent of seaweed in some areas, such as the TSMP in Sabah, while, on the other, their contribution was not recognised. In addition, little access to livelihood rights (the right to work inside or outside the TSMP and the right to own the water territories for seaweed cultivation purpose) may have an effect on their other fundamental rights, such as health and education. Without livelihood sources, the migrant workers may not have sufficient income to support their children's education and health rights. Unfortunately, these factors have not attracted the attention of researchers.

Conclusion

This paper attempted to synthesise the social, economic, and cultural aspects concerning the seaweed sector that have been covered or, more usually, ignored in the literature on the Malaysia seaweed cultivation sector.

It offered some insights into existing social and economic dimensions of the Malaysian seaweed industry, however, in the absence of data pertaining to the social and economic dimensions, many issues cannot be discussed in detail such as the role of seaweed in alleviating the poverty of the communities, the challenges and barriers in the homestay and seaweed programmes, the role of women in seaweed production, and the impact of seaweed cultivation activities on the roles and responsibilities of women. What roles are the various purveyors of information, such as the development agencies of the national and state governments, private corporations, non-governmental organisations and researchers who are witnessing the first-hand field conditions of producers and tourism managers playing? In this large seaweed sector, one can imagine a possibility of economic exploitation of poor seaweed cultivators by others in the sector. Studies are needed to look into the role of government agencies in protecting the rights of seaweed cultivators. More investigations and a deeper probe into the human dimension of seaweed cultivation in Sabah are required, especially in areas that are important for the social and economic welfare of communities.

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