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TECHNO-ECONOMICS OF SEAWEED FARMING ALONG THE COASTS OF KELANTAN, EAST COAST PENINSULAR MALAYSIA

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Abstract A Grand Challenge programme was initiated at the University of Malaya under the Equitable Society Research Cluster, to introduce seaweed farming to the coastal communities at Bachok district, Kelantan. Cultivation trials of selected commercial seaweeds like *Kappaphycus* (source of carrageenan), *Gracilaria* (source of agar), *Gelidium* (source of agar and pulp) and *Ulva* (salad) will be conducted using on-shore and off-shore systems, and the data collected is used for the techno-economics analysis. This paper discusses the techno-economics of various cultivation systems, as well as the importance of community empowerment, as a guide to the formulation of a roadmap for the integration of seaweed farming into the Bachok coastal communities.

Abstrak Satu Program Grand Challenge telah dimulakan dibawah Kluster Penyelidikan Equitable Society di Universiti Malaya bagi memperkenalkan pengkulturan rumpair laut kepada komuniti persisiran pantai di daerah Bachok, Kelantan. Percubaan pengkulturan rumpair laut terpilih seperti *Kappaphycus* (sumber carrageenan), *Gracilaria* (sumber agar), *Gelidium* (sumber agar dan pulpa) dan *Ulva* (salad) akan dilaksanakan dengan menggunakan sistem tepi pantai (on-shore) dan luar pantai (off-shore), dan data-data yang dikumpulkan ini digunakan dalam analisis tekno-ekonomi. Makalah ini membincangkan tekno-ekonomi bagi pelbagai sistem pengkulturan serta kepentingan pemberdayaan komuniti, sebagai panduan kepada perumusan pelan hala tuju untuk mengintegrasikan pengkulturan rumpair laut ke komuniti pesisiran pantai Bachok.

Keywords: seaweed farming, off-shore system, on-shore system, techno-economic analysis, community participation, Kelantan

INTRODUCTION

The seaweed industry in Malaysia is focussed mainly around the Semporna area of Sabah, East Malaysia. Farming of the carrageenophytes *Eucheuma* J. Agardh and *Kappaphycus* Doty by both indigenous and migrant coastal communities at Semporna, was initiated in the 1970s (Sade et al., 2006; Hurtado et al., 2014). The global increase in demand for carrageenan and the seaweed feedstocks, led to the expansion of farming activities and areas in the Brunei-Indonesia-Malaysia-Philippines (BIMP) region, which is located within the Coral Triangle. *Kappaphycus*, which is one of the few

trials conducted with the villagers will contribute to generation of data for the techno-economic analysis as well as the socio-economic study. The villagers will also be taught the simple processing methods (viz. harvesting, drying, storage) and ways to transform the seaweeds into value-added products like soap, cosmeceuticals, food, desserts, etc. (Phang, 2010; Phang et al., 2010). Another project within the same programme is the development of a high-end product, namely a seaweed battery, and agarose, which is in high demand due to use in molecular and genetic research.

Sondak et al. (2017) reported that in 2014, the seaweeds farms in the Asia-Pacific region amounted to 2.61×10^6 tonnes DW. Assuming that 30 % of the DW of seaweeds is carbon, then in 2014, the amount of carbon accumulated in the biomass was 0.78 × 106 tonnes y^{-1}, equivalent to > 2.87×10^6 tonnes CO_2 y^{-1}. Increase in seaweed farming areas can increase CO_2 removal, and if the biomass is converted to biofuel, then further contribution to climate change may be achieved. Climate related studies will also be conducted during the GC project. Carbon fixation rates and halocarbon emissions (Keng et al., 2013; Mithoo Singh et al., 2017) will be monitored using the seaweeds that are cultivated using the off-shore and on-shore cultivation systems at the IOES Bachok Marine Research Station. Marine biogenic sources of halocarbons emitted from phytoplankton and seaweeds contribute to ozone destruction leading to warming of the earth's surface. This aspect will be studied simultaneously with the positive aspects derived from CO_2 drawdown by the photosynthetically efficient seaweeds.

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