Marine Policy 83 (2017) 221–229

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Bridging islands and calming seas: A material flow management approach to sustainable sea transportation for Fiji's lower southern Lau islands

Taylor Searcy*,[1]

Trier University of Applied Sciences, Environmental Campus Birkenfeld, Germany

A B S T R A C T

The relatively remote and geographically isolated lower southern Lau islands of Fiji rely on maritime transportation for their economic success and social wellbeing. This paper explores the feasibility of implementing a Material Flow Management (MFM) framework to sustainable shipping and the possibilities for addressing the socio-economic development needs of the relevant island communities. The research question is: how can a regional MFM framework for hybrid powered maritime vessels be implemented effectively to promote ecological quality improvements and local added value for Fiji's lower southern Lau islands? The mixed methods research uses a quasi-experimental design, with most data collected on site during a March 2015 field study of the lower southern Lau route. The findings are applied to a tailor-made MFM framework that demonstrate the viability and effectiveness in achieving seven key aims: (1) activate regional potential; (2) increase system efficiency; (3) decrease operating costs; (4) create stakeholder network; (5) create and maintain jobs; (6) support innovative small and medium enterprises (SMEs); and (7) create sustainable economy/society. The results validate the MFM framework as a potential model of sustainable sea transport for this particular route that can be expanded upon for other domestic and regional shipping routes. The author concludes that further research and the development of pertinent socio-economic indicators based on these findings will support a more robust MFM model as it applies to sustainable sea transport.

1. Introduction

Sea trade is inextricably linked with the global economy. The association between economic growth, industrial activity and trade clearly indicates the expansive nature of maritime transport services, where shipping accounts for over 90% of global trade [1,2]. Thus, sea trade is paramount to the growth of the global economy; in simplified terms, the growing demand for an already colossal shipping industry in transporting goods around the world clearly requires a growing use of fossil fuels.

As global trade increases, the demand of shipping services increases, and ultimately the amount of finite fossil fuels that pollute the oceans and atmosphere likewise increases. Under the United Nations, the principle regulatory authority for all matters regarding shipping is the International Maritime Organization (IMO). In the most recent United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP) in Paris, key organizations (e.g., Sustainable Shipping Initiative – SSI) and leading individuals (e.g., Foreign Minister Tony de Brum of the Republic of the Marshall Islands) called for action on part of the IMO to set limits to greenhouse gas (GHG) emissions from shipping [3]. To date, the IMO has been reluctant to make any stringent limits or meaningful targets; in fact, the IMO along with its sister organization the International Civil Aviation Organization (ICAO) have remained outside the scope of UNFCCC GHG emissions targets established since the 1997 Kyoto Protocol [4–6].

With the visible trend of a global path towards sustainable development, sea transportation will play a significant role. As economic growth is becoming decoupled from environmental impacts such as GHG emissions, sustainable shipping options must be included. The shipping industry is considering various approaches to a sustainable shipping future, ranging from greater fuel efficiency and renewable energy technologies to improved operational and logistical coordination.

As part of the extensive geopolitical area known as Oceania, the Pacific Island region consists of over 7500 islands (of which only around 500 are inhabited) comprising 22 island countries covering a 30 million square kilometer area of the Pacific Ocean [7]. This region, containing just 0.1% of the world's population, sits on the periphery of

* Corresponding author.
E-mail addresses: s15d19@umwelt-campus.de, taylorpsearcy@gmail.com.
[1] Postal address: Trier University of Applied Sciences, Environmental Campus Birkenfeld, P.O. Box 1380, Birkenfeld 55761, Germany.

http://dx.doi.org/10.1016/j.marpol.2017.06.001
Received 16 November 2016; Received in revised form 1 June 2017; Accepted 2 June 2017
Available online 15 June 2017
0308-597X/

Nomenclature

ADO	automotive diesel oil
BAU	business as usual
COP	Conference of the Parties
FCC	Fiji Commerce Commission
FJD	Fiji dollars
GHG	greenhouse gas
GSFS	Government Shipping Franchise Scheme
HFO	heavy fuel oil
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
MDO	marine diesel oil
MEPC	Marine Environment Protection Committee
MFA	material flow analysis
MFM	material flow management
MoIT	Ministry of Infrastructure and Transport
MSAF	Maritime Safety Authority of Fiji
OCST	Oceania Center for Sustainable Transport
PIC	Pacific island country
PIFS	Pacific Islands Forum Secretariat
SME	small-to-medium sized enterprise
SPC	Secretariat of the Pacific Community
SSI	Sustainable Shipping Initiative
TPU	Transport Planning Unit
UNFCCC	United Nations Framework Convention on Climate Change
USP	The University of the South Pacific

global development initiatives. In fact, most geographers and cartographers conceptualize the world as a division of continents – remote Oceania as a "continent" in its own right became common only as late as the early 20th century [8]. In the context of a globalized, interconnected world, Oceania must be considered a region in its own right; indeed, it is a "sea of islands" full of diverse populations, natural resources, and the vast ocean that connects it all [9].

One of the most critical aspect of effective socio-economic development in this region hinges upon a regionally integrated, sustainable maritime transportation sector. Maritime transportation is the lifeline of trade and economic development for Pacific island countries (PICs), and the recent advances in low-carbon technologies and sustainable shipping research in this region highlight the growing interest in this field of study [10–12]. The common features of maritime transportation in this region – geographic remoteness, limited volumes of trade, a heavy dependence on imports, and low volumes of a few key exports [13] – provide an opportunity to develop different renewable energy technologies for marine transportation.

This paper is a case study of the most uneconomical route for Fiji's government: the monthly trip to the lower southern Lau islands. By developing a Material Flow Management (MFM) framework for this localized shipping route, this paper presents a model that can be expanded upon for domestic and regional shipping routes in Oceania and beyond.

2. Island shipping: the case for sustainability

The highly mobilized, interconnected infrastructure that is the hallmark of 21st century economic activity is largely dependent on sea trade. The *2015 Review of Maritime Transport* estimates a 3.4% expansion of seaborne merchandise shipments in 2014; this is equivalent to an additional 300 million tons, bringing the total volume to 9.84 billion tons, or approximately 80% of the world total in merchandise trade [1]. An important aspect of this trend, however, is that the share of world merchandise trade from developed countries is declining and that of developing countries is on the rise (45.0% of world exports and 42.2% of world imports in 2014) [1]. Most PICs belong to this latter category.

Shipping is not only the lifeblood of the global economy, it is also considered to be a barometer of world trade; along with the growth of economic activity in recent decades, ton-miles of cargo have doubled from 1990 to 2008 [14]. Indeed, shipping has grown in importance over the past 5000 years to the point where it is now a critical element of globalization that is unfortunately "hooked on oil" [15]. The fact remains that shipping is central to our globalized economy, and as such, it shapes the modern society and lifestyle of mass consumption with intractable force.

As a vast geographical region characterized by innumerable small islands and archipelagos, Oceania relies on all aspects of the sea for the cultural and socio-economic livelihood of its people [16]. Sea-going vessels, being the pinnacle of social and cultural achievement, required the most time and resources from the indigenous communities [17]. This seafaring heritage has been in decline over the past century due to a variety of factors, such as developments in transportation, telecommunications and cultural influences [16,18–20]. However, a recent revival in this heritage is taking shape, evidenced by the growth in Pacific island voyaging societies, the 2011 *Te Mana o Te Moana* ('The spirit of the ocean'), and the 2012 Festival of Pacific Arts [21]. This forward momentum, together with significant effort from engaged and passionate individuals, led to the highly successful Sustainable Sea Transport Talanoa in November 2012 [22]. Now more than ever, this cultural and social resurgence in seafaring heritage together with the economic and environmental priorities of the times offer an exceptional opportunity to further the developments of sustainable sea transportation in Oceania.

2.1. Fiji's seafaring heritage

Considered the "hub of the Pacific", Fiji is an important center for international shipping services, telecommunication and regional business activity [23]. Fiji has a long and storied history with its seafaring prowess. Most notable is the "finest two-hulled sailing vessels built by Pacific islanders" – the magnificent *drua*, a shunting vessel over 100 feet long, capable of carrying over 200 passengers and travelling up to 15 knots [24]. While the *drua* is the most emblematic symbol of Fiji's sailing heritage, other noteworthy vessels such as the *camakau* were more prevalent throughout the islands.

As Nuttall, D'Arcy and Philps indicate, historical analyses and perspectives on Fijian sailing culture are dispersed among various sources [17]. One of the most detailed accounts of Lau culture comes from American Anthropologist Laura Thompson, where she notes that the Lau islands of Kabara, Fulaga and Ogea are unique in their limestone foundations and have traditionally been the source of hardwoods ideal for shipbuilding (*Intsia bijuga, Pittosprum brackenridgei, Dysoxylum richii*) [25,26]. Rich in resources and geographically closer to Tonga, the Lau islanders have strong historical and cultural ties with Tongan society. Due to this, the Lau island of Kabara became a strategic and influential island in the South Pacific [27,28]. In essence, the historical underpinnings and current predominance of Fiji as a regional actor strongly lend credence to its ability to initiate an effective and replicable methodology of sustainable shipping.

2.2. Shipping and climate change

Transporting goods across the world's oceans takes it's toll on the environment. From changing atmospheric composition to degraded marine ecosystems, the steady balance of nature is ever more