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The World Bank

Report No: ICR00002909

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-56722 TF-56723)

ON

GLOBAL ENVIRONMENT FACILITY (GEF) GRANTS

IN THE AMOUNT OF

US$6.86 MILLION
TO THE
INTERNATIONAL MARITIME ORGANIZATION

AND

US$1.44 MILLION
TO THE
REPUBLIC OF INDONESIA

FOR A

MARINE ELECTRONIC HIGHWAY DEMONSTRATION PROJECT

January 15, 2014

Transport Sector
Sustainable Development Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective May 15, 2013)

Currency Unit = Indonesian Rupiah (IDR)
IDR 10,000 = US$1.03
US$1 = IDR9,748

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AIS	Automated Identification System
BoI	Bank of Indonesia
BPKP	Badan Pengawasan Keuangan dan Pembangunan
DGPS	Differential Global Positioning System
DGST	Directorate General of Sea Transportation
DP	Demonstration Phase
ECDIS	Electronic Chart Display and Information System
E-MIO	Electronic Marine Information Overlay
ENC	Electronic Navigation Chart
ERR	Economic Rate of Return
FM	Financial Management
GA	Grant Agreement
GEF	Global Environment Facility
GHG	Greenhouse Gases
GOI	Government of Indonesia
ICS	International Chamber of Shipping
IHO	International Hydrographic Organization
IMO	International Maritime Organization
Intertanko	International Association of Independent Tanker Owners
IT	Information Technology
LC	Letter of Credit
MEH	Marine Electronic Highway
MERR	Modified Economic Rate of Return
MIS	Maritime Information System
MOA	Memorandum of Agreement
MOE	Ministry of Environment
MOU	Memorandum of Understanding
MOF	Ministry of Finance
MOT	Ministry of Transport
NOL	No Objection Letter
NPV	Net Present Value
PIP	Project Implementation Plan

PMO	Project Management Office
PSC	Project Steering Committee
RFC	Revolving Fund Committee
SC	Special Commitment
SOMS	Straits of Malacca and Singapore
SOP	Standard Operating Procedures
STRAITREP	Straits Ships Reporting System
TC	Technical Committee
TSS	Traffic Separation Scheme
TTEG	Tripartite Technical Experts Group
UKC	Under Keel Clearance
UNCLOS	United Nations Convention on the Law of the Sea
WG	Working Group

Vice President:	Axel van Trotsenburg, EAP
Country Director:	Rodrigo A. Chaves, EACIF
Sector Manager:	Nathan M. Belete, EASIS
Project Team Leader:	Mustapha Benmaamar, EASIS
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INDONESIA
Marine Electronic Highway Demonstration Project

CONTENTS

A. Basic Information

Country:	Indonesia	Project Name:	MARINE ELECTRONIC HIGHWAY DEMONSTRATION PROJECT
Project ID:	P068133	L/C/TF Number(s):	TF-56722,TF-56723
ICR Date:	01/15/2014	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	REPUBLIC OF INDONESIA AND IMO
Original Total Commitment:	USD 8.30M	Disbursed Amount:	USD 5.56M
Revised Amount:	USD 5.56M		
Environmental Category: C		**Global Focal Area: I**	

Implementing Agencies:

International Maritime Organization

Ministry of Transport, Directorate General of Sea Transport

Cofinanciers and Other External Partners:

Government of Malaysia

Government of Singapore

B. Key Dates

Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	01/23/2003	Effectiveness:	12/05/2006	11/20/2006
Appraisal:	01/04/2006	Restructuring(s):		06/16/2011 06/13/2012 12/21/2012
Approval:	06/13/2006	Mid-term Review:	11/28/2010	11/28/2010
		Closing:	06/30/2011	05/15/2013

C. Ratings Summary

C.1 Performance Rating by ICR

Outcomes:	Moderately Unsatisfactory
Risk to Global Environment Outcome	Substantial
Bank Performance:	Moderately Unsatisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry:	Moderately Unsatisfactory	Government:	Satisfactory
Quality of Supervision:	Moderately Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Moderately Unsatisfactory	**Overall Borrower Performance:**	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	Yes	Quality of Supervision (QSA):	None
GEO rating before Closing/Inactive status	Moderately Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Central government administration	20	20
Ports, waterways and shipping	80	80
Theme Code (as % of total Bank financing)		
Pollution management and environmental health	50	50
Regional integration	50	50

E. Bank Staff		
Positions	**At ICR**	**At Approval**
Vice President:	Axel van Trotsenburg	Jeffrey S. Gutman
Country Director:	Rodrigo A. Chaves	Andrew D. Steer
Sector Manager:	Nathan M. Belete	Jitendra N. Bajpai
Project Team Leader:	Mustapha Benmaamar	Sally L. Burningham
ICR Team Leader:	Amilia Aldian	
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	Dewi Wandansari	

F. Results Framework Analysis

Global Environment Objectives (GEO) and Key Indicators(as approved)

The objectives of the project are:

(a) to assist the Republic of Indonesia, Malaysia, the Republic of Singapore, and representative of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore, and

(b) to improve maritime safety and reduce the risk of environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore.

Revised Global Environment Objectives (as approved by original approving authority) and Key Indicators and reasons/justifications

(a) GEO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	The littoral states and commercial shipping users jointly decide whether or not to develop a MEH for the entire Straits and an Environment Fund, based on evaluation of the demonstration project			
Value (quantitative or Qualitative)	Navigation largely based on paper charts, outdated ENCs, visual navigation aids, limited automatic monitoring, and ship-to-shore traffic control. Demonstration of integrated, electronic, shipboard MEH navigation system with real-time data planned	Decision taken on scaling up MEH for entire Straits		Littoral states agree to work toward a sustainable, full-scale MEH for the straits, with effort to be led by the intergovernmental TTEG using the Cooperative Mechanism as a forum for collaboration with other stakeholders
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partly achieved. Shipping users had weak role in demo and formal decision, but trial still allowed valid assessment to inform decision (Sep 2012) by littoral states. No formal decision on Environment Fund, but parallel mechanisms in development by TTEG			
Indicator 2 :	If the decision regarding the previous indicator is positive, a full-scale MEH for the entire Straits of Malacca and Singapore and an Environment Fund are designed and financing and institutional plan is prepared			
Value (quantitative or Qualitative)	No Straits MEH system design/plan	Design/plan of a full-scale MEH system,		Proposal for overall design, financing options, and

		environment fund, and financing and institutional of MEH		institutional arrangements (via TTEG and Cooperative Mechanism) agreed, and several specific activities planned to help to implement a full-scale MEH covering entire Traffic Separation Scheme area
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partially achieved. Key elements of design to scale up MEH agreed, but financing options and success of system dependent on adoption by ship owners, which is still uncertain. Note: Grant Agreement called for a "proposal" for design and financing			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Project Implementation Plans (PIPs) prepared and implemented on schedule and updated annually, financial management system effective, disbursement on schedule			
Value (quantitative or Qualitative)	No activity	Completed		PIPs were prepared, implemented, and updated, the financial management system was effective, but disbursements were not on schedule
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partially achieved. There was some unexpected delay during implementation caused by lengthy preparation processes, which delayed disbursements.			
Indicator 2 :	All partners report that the project management system is functioning effectively			
Value (quantitative or Qualitative)	No activity	Reports received from all partners during the annual Project Steering Committee (PSC) meetings		Progress reports received from all partners during the annual PSC meetings

Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Achieved. All partners had project management systems and the progress reports were shared during the annual PSC meetings.			
Indicator 3 :	Four MEH data centers established. Data production and management system functioning satisfactorily			
Value (quantitative or Qualitative)	No activity	Completed		MEH data centers established in Batam Indonesia (system hub), Malaysia, and Singapore. The second Indonesia MEH data center has not yet been completed, but its key functions can be backed up by the Batam hub.
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Largely achieved. Although the Indonesia MEH data center has not yet been completed, data production and management systems are functioning satisfactorily since they are covered by the Batam hub and the Malaysia and Singapore data centers.			
Indicator 4 :	MEH demonstration system for congested 300 km section of the Straits fully functional.			
Value (quantitative or Qualitative)	No activity	Completed		MEH demonstration system is fully functional, but with shortcomings
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partially Achieved. System operational for purpose of demonstrating the core feature of information exchange functionality (despite not all facilities completed, shortcomings in scale and scope of information, and low uptake of ship-based component).			
Indicator 5 :	Indonesian navigational data gathering system in the Straits upgraded and data provided to MEH Project Management Office (PMO)			
Value (quantitative or Qualitative)	No activity	Installation of tidal station, Automated ID System (AIS), Differential GPS, and ocean buoys in the appointed location, and provided data to MEH PMO		System upgraded with the installation of tidal stations and the AIS units and the equipment provided data to MEH PMO. Differential GPS and data buoys not completed
Date achieved	05/02/2006	05/15/2013		05/15/2013

Comments (incl. % achievement)	Partially achieved. Indonesia's national budget for 2014 includes funds for the delivery and installation of the remaining equipment namely DGPS and ocean data buoys in 2014.			
Indicator 6 :	Hydrographic survey of MEH area completed			
Value (quantitative or Qualitative)	No activity	Hydrographic survey completed		The survey covered only 14% of the originally targeted area (the TSS),but focused on complete and detailed floor coverage of the most critical area.
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partially achieved. Appraised cost was too low to survey the entire TSS, so it focused on only the most critical areas. Coverage was too narrow for use in the demonstration, but provided critical information for scale-up decision and design.			
Indicator 7 :	Well-functioning Electronic Navigation Charts (ENCs) for MEH demonstration section of the Straits available for use by appropriately-equipped ships in transit			
Value (quantitative or Qualitative)	No activity	Completed		High resolution ENCs were produced from the hydrographic survey but not used for the MEH system
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Not achieved. Area covered was not sufficient to fully update ENCs and lacked formal approval for navigation. ENCs actually used for the MEH system were produced by the littoral states under a joint project with Japan, rather than the MEH project.			
Indicator 8 :	At least 160 large oil tankers and container ships that regularly pass through the Straits are able and choose to navigate through the Straits using Electronic Navigation Charts and all other components of the demonstration MEH system			
Value (quantitative or Qualitative)	No activity	160		18
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Not achieved. Only 18 ships chose to use MEH system; sea trial 6 weeks rather than 1 year. Low uptake due to cost (internet) and utility (lack of dynamic info). Demo (incl 54 shore-based users) provided valid data but showed low interest by ship owners.			
Indicator 9 :	Sand wave model for the Straits produced, tested and integrated into the MEH system			
Value (quantitative or Qualitative)	No activity	Completed		Activity cancelled
Date achieved	05/02/2006	05/15/2013		05/15/2013

Comments (incl. % achievement)	Not achieved. Though MEH system functional without it, lack of sand wave modeling reduces predictive value of system for both navigation and environmental response. Hydrographic survey may be input for future sand wave study.			
Indicator 10 :	Environmentally sensitive areas within and near MEH demonstration area mapped and incorporated into MEH system's Electronic Navigation Charts			
Value (quantitative or Qualitative)	No activity	Completed		Environmental Marine Information Overlays (E-MIOs) from other sources incorporated into ENCs/MEH Database, but not yet in use.
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Not achieved. Project demonstrated production of ENC with E-MIOs, but did not conduct mapping itself. Materials cannot be used for navigation until officially verified by the hydrographic offices of the three littoral states.			
Indicator 11 :	Environment staff in the three littoral states successfully complete simulated marine environment emergency response exercises			
Value (quantitative or Qualitative)	No activity	Simulated marine environment emergency response exercises completed		Development of an emergency response system was cancelled. Exercise was done in different forums
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Not achieved. Littoral states still operate/develop their own systems, and have cooperative response agreement, but no improvement can be attributed to project activities, nor did it reassess efficiency or effectiveness of current arrangements.			
Indicator 12 :	Well-designed and functioning Web Page created for MEH; suite of informative publications issued			
Value (quantitative or Qualitative)	No activity	MEH web page is available on the internet		MEH website is operational and functional
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Achieved. www.mehsoms.com is established and provides data/information on navigation and marine environment, and information about the MEH system and project.			
Indicator 13 :	Workshop on demonstration system design and initial performance held			
Value (quantitative or Qualitative)	No activity	Workshop held		Workshop held and attended by all key stakeholders
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Achieved. In the conduct of the sea trial, a number of working group meetings and workshops were held to analyze the initial system performance.			
Indicator 14 :	Evaluation of potential economic, financial and environmental costs/benefits and legal feasibility of MEH system for entire Straits and Environment Fund co-			

	financed by it , based on the performance of the demonstration, approved by key stakeholders			
Value (quantitative or Qualitative)	No activity	Evaluation report completed and approved by key stakeholders		Evaluation report completed and approved by key stakeholders
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Achieved.			
Indicator 15 :	If, based on evaluation, key stakeholders decide to develop Full-Scale MEH for the entire Straits, proposal for its design, financing plan, and institutional arrangements prepared			
Value (quantitative or Qualitative)	No activity	Proposal prepared		The littoral states agreed to conduct several activities necessary to implement a full-scale MEH. Financial resources were provisionally identified
Date achieved	05/02/2006	05/15/2013		05/15/2013
Comments (incl. % achievement)	Partially achieved. This intermediate indicator mirrors GEO indicator #2, but specifies "proposal" for design and financial plan. GEF grant agreements included this indicator, but not the version of the indicator in the results framework of the PAD.			

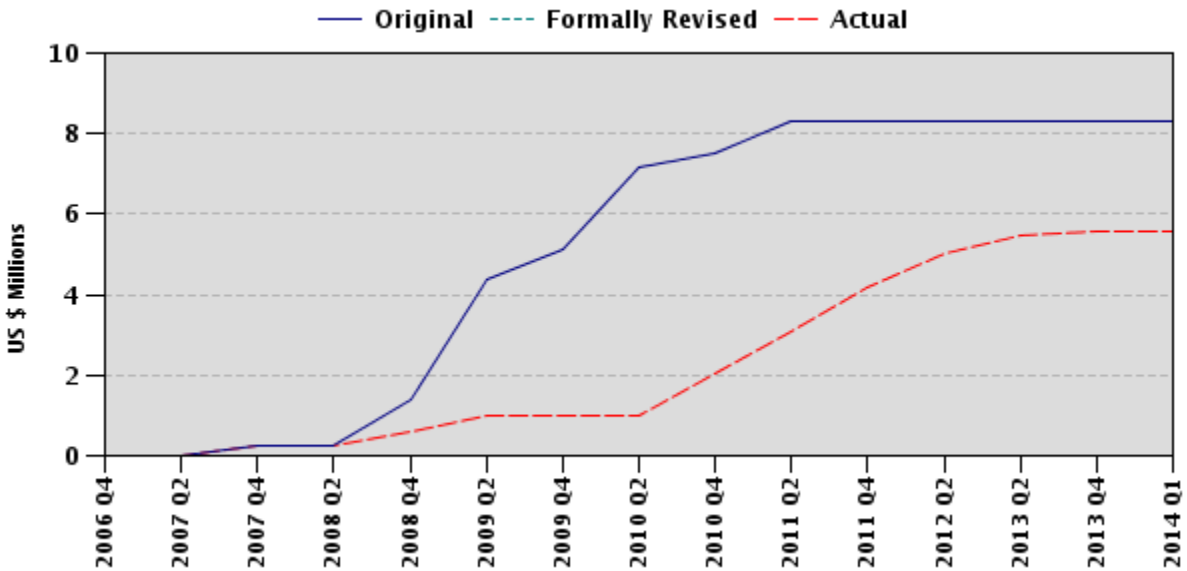
G. Ratings of Project Performance in ISRs

No.	Date ISR Archived	GEO	IP	Actual Disbursements (USD millions)
1	03/19/2007	Satisfactory	Satisfactory	0.25
2	06/26/2008	Satisfactory	Satisfactory	0.60
3	06/30/2009	Moderately Satisfactory	Moderately Unsatisfactory	1.01
4	06/24/2010	Moderately Satisfactory	Moderately Unsatisfactory	2.03
5	04/24/2011	Moderately Satisfactory	Moderately Satisfactory	4.05
6	04/06/2012	Moderately Satisfactory	Moderately Satisfactory	5.11
7	01/30/2013	Moderately Satisfactory	Moderately Satisfactory	5.50

H. Restructuring (if any)

Restructuring Date(s)	Board Approved GEO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		GEO	IP		
06/16/2011	N	MS	MS	4.05	Extended from June 30, 2011 to June 30, 2012 to allow completion of hydrographic survey and procurement of goods
06/13/2012	N	MS	MS	5.11	Extended from June 30, 2012 to December 31, 2012 to allow more time to import to Indonesia and install the delayed maritime safety equipment, including testing and commissioning, ensuring the equipment performed functionally prior to hand-over, and training of the DGST staff in operating and managing the MEH Data Center.
12/21/2012	N	MS	MS	5.47	Extended from December 31, 2012 to May 15, 2013 for DGST only to extend validity date of the Letter of Credit, complete installation and training of the navigation equipment, and to allow Indonesia to include MEH project in the 2013 budget. Bank of Indonesia and the World Bank will not authorize payment to contractor for completed works if the Letter of Credit is expired.

I. Disbursement Profile



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1. Project Context, Global Environment Objectives and Design

1.1 Context at Appraisal

1. The Straits of Malacca and Singapore, situated between Sumatra and the Malay Peninsula, are approximately 1,000 kilometers long, 300 kilometers wide at their north-west entrance, and just 12 kilometers wide at their south-east entrance, between Singapore and Indonesia's Riau Archipelago. The Straits are shallow, with narrow channels, irregular tides and shifting bottom topography, and hence are hazardous to navigation for large ships. Despite their difficult navigational features, the Straits are the shortest and hence the preferred shipping route between the Indian Ocean and the South China Sea, and for oil tankers trading between the Persian Gulf and the fast-growing countries of East Asia. Every year roughly 80,000 ships transit the strait every year, more than 60 percent of which are tankers or container ships.

2. In 1998, the three littoral states of Republic of Indonesia, Malaysia, and Republic of Singapore jointly commissioned a mandatory Straits Ships Reporting System (STRAITREP) for the most congested 300 kilometer section of the Straits from One Fathom Bank to the Singapore Strait, which combines radar and automatic ship identification and tracking. The maritime safety infrastructure and regulatory mechanisms in place at the time of appraisal in the Straits of Malacca and Singapore reduced the frequency of ship collisions, groundings and oil spills. However the threats of collisions, groundings and consequent environmental damage were still significant and, with rapid traffic growth, was increasing.

3. An innovative approach to improving the management of maritime traffic and marine environment protection in the Straits was expected to ameliorate these impacts and enhance the carrying capacity of the Straits for various uses and activities.

4. The best-proven of the new marine navigation technologies that could reduce this threat was the Marine Electronic Highway (MEH). It combines an Electronic Chart Display and Information System (ECDIS) using updated Electronic Navigation Charts (ENCs), an Automated Identification System (AIS), shore-based marine information databases and advanced ship-to-shore communications. Data to mariners is provided through an MIS (Maritime Information System). By providing mariners with accurate, real-time navigational information, the new technologies was expected to reduce shipping costs by permitting safe navigation in poor weather, optimize loading to take account of better information on minimum depths, and reduce fuel consumption by giving more accurate and timely information so that more advantage can be taken of favorable tides and currents.

5. The implementation of the MEH involved the three littoral states of Indonesia, Malaysia, and the Republic of Singapore, the International Maritime Organization (IMO), and the shipping industry. Only Indonesia and the IMO were grant recipients. Indonesia was the recipient of a US$1.44 million grant to procure navigation equipment and install it on the Indonesian territory. The IMO was the recipient of a US$6.86 million grant for the hydrological survey and the other components of the MEH as well as for project management.

Rationale for Bank assistance

6. The Bank had a unique combination of convening power and technical skills that were expected to help the littoral states to overcome the barriers that have prevented implementation of

the system. The Bank could facilitate collaboration between the International Maritime Organization (IMO), the international institution responsible for promoting environmentally-sound marine navigation, the International Hydrographic Organization (IHO), responsible for marine mapping, major international ship-owner representative organizations, and the government of the three littoral states. Financially, the Bank could help access the resources of the Global Environment Facility (GEF), which in its International Waters Focal Area, could help to provide grants or concessional funding to help countries address major environmental threats to shared water bodies, such as the Straits of Malacca and Singapore.

1.2 Original Global Environment Objectives (GEO) and Key Indicators (*as approved*)

Global Environment Objective

7. The statement of objectives presented the ICR Data Sheet is taken from the GEF grant agreements:

> *The objectives of the project are:*
>
> *(a) to assist the Republic of Indonesia, Malaysia, the Republic of Singapore, and representative of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore, and*
>
> *(b) to improve maritime safety and reduce the risk of environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore.*

8. The same objectives are stated in the PAD, except that the first objective (decision to establish a scaled-up MEH) was called the "PDO" and the second objective (improved safety and reduced risk of environmental damage) was called as the "GEO." However, as a stand-alone GEF project, technically the project should only have a GEO, and indeed the GEF grant agreements combine both objectives in a single statement that by definition serves as the GEO.

9. However, in assessing outcomes it is critical to note that the "GEO" in the PAD, while inextricably linked to the project rationale, justification of GEF financing, and longer-term impacts of the MEH, was not expected to be direct achieved or demonstrated by the project itself. This is reflected unambiguously in the PAD, which states (emphasis added) that:

> "The Project's global environment objective is to improve maritime safety and reduce environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore. *It will not be possible to determine with certainty if it has achieved this objective in its short life*. An evaluation of the Marine Electronic Highway demonstration system's technical performance and the project stakeholders' decision whether to maintain and/or expand it *will indicate if this objective is s likely to be achieved in the longer term*."

10. Therefore this element of the project objectives is linked to and advanced by achievement of the shorter term objective of demonstrating and facilitating a decision to scale up the MEH, but is not directly monitorable or attributable to the project. The activities and results framework are consistent with this distinction, as there is no attempt to measure actual environmental impacts or their mitigation, or even actual maritime safety.

Key Indicators

11. The two key outcome indicators in the PAD Results Framework are

- The littoral states and commercial shipping users of the Straits jointly decide whether or not to develop a Marine Electronic Highway (MEH) for the entire Straits and an Environment Fund, based on evaluation of this MEH Demonstration Project and a cost/benefit and financial/legal feasibility analysis o f a potential full-scale MEH system for the entire Straits.
- If their decision is positive, a full-scale MEH for the entire Straits of Malacca and Singapore and an Environment Fund are designed and a financing and institutional plan prepared.

12. The GEF grant agreement with IMO did not include these two outcome indicators, or indeed any outcome indicators distinct from the intermediate results and output indicators. It did include an end-of-project indicator (considered an intermediate indicator in the PAD) that essentially captures these two outcomes, but that only specifies preparation of a "proposal" for the design, financing, and institutional arrangements of the scale-up at project completion rather than an actual design.

13. The DGST grant agreement included only a single performance indicator: "Indonesian navigational data gathering system in Straits upgraded and data provided to MEH PMO," which is linked to Component 2 and considered and intermediate indicator in the PAD.

14. Since (a) the two outcome indicators are not included in the grant agreements, (b) there is some ambiguity about exactly what decision or design is expected, and (c) the MEH decision cannot be isolated from delivery of the demonstration, in assessing achievement of objectives (see Sections 3.2 and 3.4) it is reasonable to also consider the operation's full design features and planned outputs rather than only the narrow question of whether a decision for future development of the MEH was taken.

1.3 Revised GEO and Key Indicators, and reasons/justification

15. The GEO, and key indicators were not revised.

1.3 Main Beneficiaries

16. From a global environment perspective the primary intended benefits are protection and conservation of sensitive, globally significant natural and environmental resources shared by the countries bordering the Straits. A secondary benefit is reduced greenhouse gas (GHG) emissions resulting from more efficient cargo shipping operations.

17. However, the main direct benefits of the MEH actually accrue to the ship owners and other stakeholders(as summarized below and in Annex 3) in the form of reduced expenses due to more reliable and efficient shipping as well as fewer clean-ups of spills and contamination caused by groundings, collisions, and other discharges. GEF financing of the MEH demonstration was justified because these direct benefits did not provide sufficient incentive in themselves for creation of the MEH, particularly a system with the added environmental design features promoted by the project.

18. The three littoral states would benefit from the MEH through the reduced cost of clean-up of sea pollutants and a reduction in the loss in value of the marine and coastal resources of the Straits. In turn, the coastal inhabitants in the surrounding area were to benefit from the improved coastal environment and natural resources, which was expected to also enhance their quality of life.

19. The ship operators including their crews and customers would benefit through savings in operational and maintenance costs due to the reduced under-keel clearance requirement of the Straits as the result of more accurate hydrographic and navigation information. This was expected to enable them to load more on their ships. Better navigational information would also reduce transit times, particularly when low visibility or other constraints would otherwise limit speeds or even require delaying transit. Other benefit for the operators and the customers were reduction of accident and fatalities, and would also reduce the risk to pay the damages caused by oil spills to the marine and coastal environments.

1.5 Original Components

20. The project had five components:

1. MEH System Design, Coordination and Operation
2. MEH System Development
3. Ship-board Equipment and Communications
4. Marine Environment Protection
5. Information Dissemination, Evaluation and Scale-up Plan

21. *Component 1: MEH System Design, Coordination and Operation (US$2.88 million)*. This component was meant for project management by the International Maritime Organization (IMO) on behalf of the participating states, coordination of the design, development and operation of the MEH demonstration system and also provided for key technical inputs to the project. The major tasks to be undertaken within this component are:

(a) System Planning and International Maritime Organization Management, focusing on operational aspects of project implementation itself.
(b) Strengthening of the Project Management Office in Batam and establishment of the MEH Data Centers and training for their staff.
(c) Support to the Project Steering Committee and its technical committees and working groups.

22. *Component 2: MEH System Development (US$7.04 million).*This component provided for the production of the navigational information on which the MEH system is based, and its incorporation into real-time electronic charts that ship operators will be able to use to navigate with precision through the MEH demonstration section of the Straits. The specific subcomponents and outputs are:

(a) Tide and Current Facilities. Tidal and current monitoring on the Indonesian coast of the Strait of Malacca, including provision of relevant equipment.
(b) Hydrographic Survey. Carry out a hydrographic survey of the TSS area and provide training to surveyors in the hydrographic offices of the littoral states.
(c) Electronic Navigation Charts. Produce high-resolution ENCs for the project area, including provision of relevant computer software licenses.

(d) Information Exchange System. Establish the MEH information exchange system, including data servers, data exchange protocols and training of staff.

23. *Component 3: Ship-board Equipment and Communications (US$6.00 million).*This component was expected to be implemented in cooperation with the owners of large oil tankers and container ships that regularly transit the Straits, and facilitated by two major ship owner representative organizations, the International Association of Independent Tanker Owners (Intertanko) and The International Chamber of Shipping (ICS). By the end of year three, at least 160 ships would be fitted with internationally-approved Electronic Chart Display and Information Systems (ECDIS) and Automatic Identification Systems (AIS) and have internet connectivity so that they can demonstrate the MEH system and provide detailed feedback on its performance as an input for assessment of the costs, benefits and legal/financial feasibility of expanding the MEH

24. *Component 4: Marine Environment Protection (US$0.85 million).* This component was executed jointly by institutions in the littoral states that are responsible for marine navigation and environmental management and the IMO. It included:

(a) Oil Spill and Sand Wave Models. Modeling and analyses of the likely movement of oil spills and of sand wave formation and movement.
(b) Sensitive Area Mapping. Research and development of options for providing real-time, geo-referenced environmental protection information to mariners navigating in the Straits of Malacca and Singapore and for conservation and coastal resources management and mapping of sensitive areas.
(c) Emergency Response Systems. Carry out simulated oil and chemical spill emergency response exercises to determine the cost-effectiveness and efficiency of the MEH system in the event of chemical and oil spill incidents from ships.

25. *Component 5: Information Dissemination, Evaluation and Scale-up Plan (US$0.23 million).* This component was managed by the IMO through the Project Management Office (PMO). It included:

(a) Website and publicity for the MEH to both disseminate information about the system and its benefits and to seek feedback.
(b) Evaluation and assessment of the costs and benefits, technical functionality, performance, institutional and legal aspects of the MEH, and consolidation of findings for decision and management purposes.
(c) System development and marketing strategies to package the MEH system and its products and services.

1.6 Revised Components

26. The components were not revised.

1.7 Other significant changes

27. The project closing date was extended three times. The first extension to June 30, 2012, was necessary due to the delays in hydrographic survey and procurement of goods.

28. The second extension to December 31, 2012, was necessary to allow more time to import to Indonesia and install the delayed maritime safety equipment, including testing and

commissioning, ensuring the equipment performed functionally prior to hand-over, and training of the DGST staff in operating and managing the MEH Data Center.

29. The third extension to May 15, 2013, was necessary in order to extend the validity date of the Letter of Credit, complete installation and training of the navigation equipment, and to allow Indonesia to include MEH project in the 2013 budget. Bank of Indonesia and the World Bank will not authorize payment to contractor for completed works if the Letter of Credit is expired. Consequently the contractor will not be able to complete the remaining tasks if no payment was made.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

30. **Formal cooperation and coordination between the three littoral states and other stakeholders already existed before the project started and developed during project implementation.** The cooperation and coordination were facilitated by the Tripartite Technical Experts Group the (TTEG) set up in 1977.The TTEG is a group of experts from the maritime administration of the three littoral states. The TTEG meets annually to discuss and collaborate on issues to enhance navigational safety and protection of the marine environment, as well as other traffic management measures in the Straits.

31. For example, the TTEG was the instrument through which the littoral states developed, achieved consensus, and implemented the STRAITREP system in 1998 that created the Traffic Separation Scheme and require designated vessels transiting the Straits to report to authorities on their identity, cargo, and navigation capacity, and to use ship-to-shore communications for traffic control in the Straits.

32. **The main risks were identified adequately but their mitigation measures were inadequate.** In particular in term of political risks, there was an awareness that the project requiring cooperation among states that have not been consistent in maintaining such relations. Furthermore IMO also realized that they only have few powers of enforcement of conventions and agreements on using international waters. Despite this, the proposed mitigation measures only relied on the signed Memorandum of Understanding (MOU) and Memorandum of Arrangements (MOA) for this project. The MOU and MOA were important documents where commitments of the littoral states as well as all other participating organizations listed and agreed, but mitigation measures to anticipate unfulfilled commitments and/or change of commitments, and also delays in delivering the commitments were not prepared.

33. The performance of managerial, technical, and financial aspects of the project could be associated with inadequate mitigation measures of political risks. For instance mitigation measures on lack of commitment of INTERTANKO and ICS in supplying 160 adequately equipped vessels were not prepared. Participation of the vessels in the sea trial was an important part in producing a good evaluation report of MEH Demonstration Project. Another example was unfulfilled commitment of Indonesia to assign IT specialist during project implementation. It largely influenced managerial and technical aspect of the project in term of day to day operation of the center. The other managerial risks not anticipated were lack of capacity and/or experience of the implementing agencies with the Bank project that delays procurement and disbursement,

and delays in importing navigation equipment in Indonesia as it went to several procedures, especially custom clearance.

34. **The design of the project was complex, and it was ambitious to have the three littoral states collaboratively deciding to establish an income generating regional institution**. Even though the project was prepared carefully, taking into account the lessons learned and formal procedures from previously implemented project, some of the components were too ambitious to be implemented. In particular, in term of preparing design and plan to establish a formal institution collaboratively managed by the three littoral states. In addition, this institution supposed to generate income from users to maintain and operate the system as well as become main source of Environment Fund. Such institution to some extents would be a politically sensitive issue. It would involve legal discussion on the boundary of country, sharing detail data of seabed to other countries, share of power of each country in the institution, and distribution of income generated. Creating such institution also need a similar level of capacity of the three littoral states, especially in technical, financial, and human resources. Therefore a full design and plan of such institution would need a very long process. In fact, the three littoral states only manage to have two forums to facilitate discussion and collaboration in managing the Straits, namely TTEG (established in 1977) and the Cooperative Mechanism (created in 2007).

2.2 Implementation

35. **Cooperative Mechanism of the TTEG.** In 2007, shortly after project approval, the littoral states established the Cooperative Mechanism on Safety of the Navigation and Environmental Protection in the Straits of Malacca and Singapore. The Cooperative Mechanism enhanced the TTEG by creating a formal mechanism to facilitate dialogue and collaboration between the three littoral states and the international maritime community on issues of common interest in the Straits. This Mechanism also coordinates the implementation of projects in the Straits and receives direct financial contributions from the international maritime community to maintain marine navigational aids in the Straits (Aids to Navigation Fund). The TTEG and the cooperative mechanism played a significant role during project implementation, especially in facilitating decisions on some key issues (e.g. accepting/rejecting financial and/or technical support from user states and other stakeholders).

36. **Leveraging of co-financing.** The project leveraged a USD850,000 grant from the Republic of Korea for the establishment of the Batam MEH Data Center, which covered the hardware and software of the IT equipment, including capacity-building (training and workshops) on the management and operation of the MEH Data Center. The system was installed and running by December 2011 including the training of Project staff and officers from the three littoral States. The co-financing was necessary since there was no provision for an operating system that could integrate data streaming from the Indonesian facilities similar to an emulated ECDIS. The co-financing earmarked for Indonesia was utilized solely for the development of the MEH system.

37. **Slow project implementation**. The project progressed slowly prior to the mid-term review on both implementing agencies, namely IMO and DGST. It was because of the resignation of the MEH Project Manager after only 10 months of service, delay of hydrographic survey, lack of capacity and/or experience of the implementing agencies with the World Bank procedures, and long process in issuing permit and clearance in Indonesia.

38. **The resignation of MEH Project Manager**. The resignation in October 2008 of the MEH Project Manager after only 10 months of service delayed some activities planned. IMO had to mobilize their MEH Project Coordinator as an interim Project Manager to handle the project

day-to-day operation remotely from London and from Jakarta from February to July 2010. This arrangement was also not too effective since the interim project manager was also IMO MEH Project Coordinator. A new Project Manager together with an Administrative Assistant was appointed in November 2010 and both were based in Batam until the end of the project. Since the recruitment of the new project manager, the progress of the project was then improved.

39. **Delay of hydrographic survey**. Since 2007, the project had initiated the hydrographic survey but the hydrographic survey preparation activity took nearly two years before the contract was awarded in May 2009 and another nine months before field operation commenced in April 2010.The delay in procurement was attributed to the cost estimate being far too low, and as a result all bids came in well above the budget for the activity. The PAD explicitly recognized that as a demonstration project, the cost estimate for some activities would be more uncertain than usual, particularly the hydrographic survey. This was indeed the case. The project explored the possibility that the hydrographic departments of Indonesia and Malaysia could carry out the survey themselves, but since this was not possible, the solution adopted was to contract a commercial survey of as much of the TSS as the budget would allow, focusing on the section with the most critical navigation challenges and risks.

40. The delay of the hydrographic survey was also due to a long process of getting permit and clearances to undertake the survey from Indonesia. The issuance of the permit and clearances in Indonesia required tedious coordination between at least six government agencies, namely MOE (as the national focal point), Ministry of Foreign Affairs, Dishidros (the Indonesian Navy Hydro-Oceanographic Service), Directorate General of Immigration, Directorate General of Customs, and Ministry of Defense. The clearances were finally obtained after the survey commenced in the Malaysian waters.

41. **Repercussions of the delay in the hydrographic survey on other activities**. The delay in hydrographic survey affected the sand wave study. The high resolution Electronic Navigation Charts (ENCs) resulting from the hydrographic survey were supposed to be used as the basis for the sand wave study. The bidding documents were prepared for this activity. However the remaining time until project closing did not allow for the sand wave study to be implemented, taking into account the bidding process and duration of the study.

42. **Lack of capacity and/or experience of the implementing agencies with the World Bank procedures and commitment**. On Indonesian side, it really delayed project implementation since procurement and disbursement could not be done timely. There was issue with the DGST readiness to conduct the procurement prior to the mid-term review. Even though the Bank already issued NOL to the bidding documents on February 2008, changes in DGST personnel took place and there was no staff assigned to follow up with the procurement process. When the Bank re-emphasized the importance of DGST commitment, only then DGST assumed stronger ownership and involved more actively in the project. The procurement activity was resumed in late-2009 although the actual procurement took place in mid-2010 after the activity was included in the DGST budget.

43. The lack of capacity and commitment also delayed the installation of some of navigation equipment. The navigation equipment could not enter Batam from Singapore due to lack of capacity of DGST in processing customs clearance and Letter of Credit from Bank of Indonesia. It took quite long time to get the clearance and reissue Letter of Credit. As the result, some equipment had exceeded the storage time and had to be sent back to the manufacturer for recalibration to prevent inappropriate equipment performance.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

44. **M & E Design**. Since the objective of improved maritime safety and reduced environmental damage was not intended to be directly measured or achieved by the project, the results framework did not include indicators related to collisions, groundings, and transit times for shipping, or to actual damage to environmental resources in the straits. Instead, the RF focused on the MEH system itself, outputs related to the MEH capabilities and its demonstration, evaluation of the system and scale-up options, and the resulting decision of the littoral states and ship owners. The demonstration would not directly improve safety and reduce impacts, but the scale up of the system which would be expected to result in such benefits in the future.

45. The design correctly tracked the progress of the inputs and activities as well as the outputs and analysis needed for a robust demonstration of the MEH. The M&E arrangements for tracking activities and outputs was very clear in terms of defining their contribution toward achieving the objectives, and very practical in terms of monitoring progress. The outcome indicators related to the decision and design of a scaled-up were dependent on the results of the demonstration and findings of the feasibility and options study, but were not clear as to what an actual design and plan were expected to comprise, or whether the intent was to produce a proposal as reflected in the grant agreement, or finished plan as suggested in the PAD results framework. The project itself did not include a subcomponent to finance and support preparation of an actual design, financing plan, and institutional arrangements for a full scale MEH, suggesting that this was to be left to the stakeholders themselves (and which they have indeed taken on without Bank or GEF assistance).

46. **M&E Implementation**. Activities and data were collected and monitored during supervisions, PSC and TTEG meetings, and communications with PMO and the three littoral states. M&E arrangements were carried out as designed and provided useful and timely information on progress and/or hurdles in carrying out the activities and producing the outputs needed to achieve the project's objectives. Some sites where navigation equipment was installed could not be visited easily for direct inspection because of their remoteness, but the installation and function of the equipment itself was confirmed, and the data feed functioned properly. Some data on indicators were not updated regularly after supervision missions, but this did not in itself affect or limit capacity to effectively manage the project. While indicators measuring percentage progress toward a particular output did not always give a clear picture of the progress in the activity, information was available that detail edits specific status.

47. **M&E Utilization**. While the M&E did a good job of tracking the technical aspects of setting up the MEH demonstration, some intangible dimensions of the process where not reflected as clearly, such as dialogue between the three littoral states and other stakeholders about issues related to the ultimate scale-up decision. Monitoring of specific aspects of the Project Implementation Plan helped identify where tasks were falling behind schedule or institutional performance was weak, so that greater attention and support could be targeted to those issue (though not always with convincing results). Close tracking of progress and problems in contracting the hydrological survey resulted in exploration or alternative means or carrying out the survey (through government agencies), and finally to the decision to narrow the target area to cover the most critical parts of the TSS.

2.4 Safeguard and Fiduciary Compliance

48. **Safeguard**. The Project was classified as an environmental category "C" project since no direct or indirect adverse impacts to the environment were associated with it. Although the

Project triggered OP/BP/GP 7.50 Projects on International Waterways, the requirement of notification of other riparian did not arise, due to the three littoral states of the Straits of Malacca, namely Republic of Indonesia, Malaysia and Republic of Singapore, were participants as well as beneficiaries of the projects and the three states have signed an MOU regarding their participation. There were no safeguards compliance problems or shortcomings.

49. **Financial Management**. The two implementing agencies made significant efforts to maintain adequate financial management (FM) arrangements. Although the IMO and the Directorate General of Sea Transportation (DGST) needed time to adopt the Bank's FM standards, appropriate actions were taken to address the FM findings and issues during implementation. There were no major FM issues. The two implementing agencies assigned project officers for carrying out the FM functions at all times. The interim financial reports submitted to and reviewed by the Bank during implementation were in a format acceptable to the Bank with only minor issues identified. In close coordination with the Bank, the MoF, the IMO, the Bank of Indonesia, and the DGST addressed all these FM issues. The Bank received the FY 2012 audit report for the IMO in which the auditors provided an unqualified opinion. The Bank also received the FY 2013 audit report for DGST in which the auditors provided an unqualified opinion. Therefore, throughout project implementation the ISRs rated financial management as Moderately Satisfactory.

50. **Procurement**. There were some procurement issues related to quality, procedural compliance, or processes encountered during implementation. Those procurement issues were caused by lack of capacity and experience of the staff of the implementing agencies with Bank procedures and also to a lesser extend to shortcomings in the commitment of the implementing agencies to speed up the process. Changes in procurement arrangements also had to be done to accommodate the dynamic of actual conditions in the field. Despite close coordination between the Bank and the implementing agencies, those issues led to significant delays in procurement.

2.5 Post-completion Operation/Next Phase

51. **Some activities were not completed, but the system was functional**. Although some activities were not completed, the project achieved significant success in enhancing stakeholder coordination and cooperation and in improving navigation equipment and system in the straits of Malacca and Singapore. The enhancement of coordination and cooperation was not only between Indonesia, Malaysia, Singapore, and users of the straits, but also between institutions within the littoral states, especially Indonesia. For Indonesia, this project had been a platform for coordination and cooperation in maritime safety and environment issues between Ministry of Transportation, Ministry of Environment, Ministry of Foreign Affairs, and Indonesian Hydro Oceanographic Offices. Hydrographic survey of the One Fathom Bank Traffic Separation Scheme Area in Malacca Strait was conducted, bathymetric charts were produced, and very good ENCs had been prepared, though they could not actually be used in the MEH demonstration because of their limited scope and lack of type-approval. Indonesian navigational data gathering system in Straits was upgraded with the installation of the tidal stations and the AIS units to provide data to MEH PMO in Batam. This has enhanced the safety of navigation in the pilot areas and to some extent in the straits of Malacca and Singapore. The project provided very valuable support to all participating countries in improving capacity of institutions and personnel responsible in maritime safety and environment through substantial training and equipment. Furthermore, the project has contributed to include information on environmentally sensitive areas to existing ENCs of the Straits of Malacca and Singapore.

52. As the result of better coordination and cooperation and improvement of navigation equipment, the MEH Demonstration Project was able to develop and establish a pilot MEH System for the 300 km congested part of SOMS. The main facility of MEH system in Batam (Indonesia) is managed and operated by Indonesia. Malaysia and Singapore had developed similar systems to back-up MEH system in Batam, which are accessible via the Internet. The littoral states are in a process to technically and legally improve the system to be able to use it for maritime traffic management in the whole SOMS. Apart from improving the utility of the MEH System, the three littoral States commits to have regular meetings to review the progress being made and to address problems that may arise.

53. **MEH becomes part of Cooperative Mechanism (CM) and TTEG**. The littoral states agreed to put MEH pilot project under the Cooperative Mechanism and TTEG, then MEH is not a stand-alone project, but become an integral part of projects under Cooperative Mechanism. There are some projects related to MEH managed by CM. Therefore, M&E of long term GEO could be done by the Cooperative Mechanism.

54. **Indonesia allocated in its own budget of USD70.000 in 2014 to continue to operate and maintain MEH Data Center in Batam, and of USD700.000 to install the two remaining navigation equipment**. In the 2013 Bali meeting, Indonesia committed to finance the operation and maintenance of MEH Data Center and procurement of two remaining navigation equipment namely DGPS and Ocean Data Buoy in 2014.

55. **DGST recruits IT specialists and some of them will be posted in MEH Data Center in Batam.** In September 2013, Ministry of Transport of Indonesia recruited new officers from different education backgrounds. DGST in particular recruited some IT specialist and some of them will be posted in Batam MEH Data Center to handle day to day operation of the MEH pilot system.

56. **Malaysia will lead multibeam hydrographic survey in critical areas of the Straits**. The main investment needed for expanding the MEH would be for a hydrographic survey of the area not covered during the Demonstration Phase. The hydrographic surveys that will be taken are an important step of the expansion.

57. **All three data centers will be synchronized.** Malaysia and Singapore technical personnel will visit the MEH Batam Data Centre to find solutions for the synchronization/replication of user data base and data streaming matters. When the data centers are synchronized, users do not necessarily need to register at all 3 littoral States in order to access the information provided under the MEH.

58. **Serial switch over for the backup of Batam MEH Data Center was agreed**. Serial switch over between Malaysia and Singapore for the backup of Batam MEH Data Center will be done on 6 monthly bases. From 1st January to 30 June, Malaysia will be the backup for MEH Batam Data Centre. While 1 July to 31 December Singapore will be the backup.

59. **Ship owners pointed out that they will use the MEH system if it is completely functional and approved by the littoral states.** The non-participation of the project's shipping partners in the sea trial was attributed to the lack of confidence on the utility/reliability of the MEH and its collected data in general. Furthermore, the participants of the sea trial stated that beyond merely tidal, currents, oceanographic and meteorological data, they would like to see real-time, dynamic data that will help ships avoid navigational hazards, enhance emergency responses and improve navigation. In addition to real time features, information/data generated from the

MEH must be accurate and precise, which would be useful to land-based participants, particularly those involved in the administration and management of coastal areas and resources. In order to incentivize ship owners to actively utilize the MEH system, it must meet the expectations of ship owners and other stakeholders. The littoral states then must technically and legally approve it, before using it for maritime traffic management in the SOMS.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

60. The GEO and the design and the implementation of this project are highly relevant for the three literal states and other stakeholders using the Straits of Malacca and Singapore. The GEO is in line with the long-term development plan (2005-2025) of the Government of Indonesia's Ministry of Transport (MOT). The MOT is in charge of ensuring the safe and orderly flow of vessel traffic, monitoring maritime safety, optimizing search and rescue operations in case of sea accidents, and improving the readiness of marine and coastal infrastructure and facilities, especially in the surrounding of the Strait of Malacca.

61. In line with the current Country Partnership Strategy (CPS), one of the Bank's core objectives is the *Pro-Green* development, including emphasize on the sustainability and protection of coral and marine resources. As the Straits of Malacca and Singapore is a zone of high marine biological diversity, the MEH demonstration project is highly relevant. The MEH integrate natural and marine resources data with navigational information. It increases the users' environmental awareness and helps in their navigating decision to protect the Straits natural resources.

62. The MEH Demonstration Projects is consistent with one of the major objectives of the GEF's International Waters Operational Program 10, as it overcomes the barriers to the adoption of the best-practice technology in marine navigation and pollution control in the Straits, and thereby reduces the risk of contamination of an international water body. As the project is a partnership between governments, the GEF, and the private sector, it is also consistent with one of the GEF's key strategic objectives, to promote public-private partnerships that benefit the global environment.

63. Although the objectives were highly relevant in the light of the objectives of all the project's stakeholders, the design and implementation of the project were not fully adequate to achieve all indicators and the project's objectives. Some important components of the project, e.g. hydrographic survey, simulated marine environment emergency response exercises, were not well designed and implemented.

3.2 Achievement of Global Environmental Objectives

64. The GEO defined two main objectives:

(a) to assist the Republic of Indonesia, Malaysia, the Republic of Singapore, and representative of some of the large commercial ship owners that use the Strait of Malacca and the Strait of Singapore, to collectively decide whether to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore, and

(b) to improve maritime safety and reduce the risk of environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore.

65. As discussed in Section 1.2, the PAD distinguished between a "PDO" (facilitating a decision regarding scale-up of the MEH) and a "GEO" (improved maritime safety and reduced environmental damage). But as a stand-alone GEF project, both objectives should be considered part of the GEO. Furthermore, while the second objective is inextricably linked to achievement of the first, it is explicitly defined in the PAD as a longer-term impact that is not directly monitorable or attributable to the project itself (within the scope or duration of the project). Therefore the assessment of achievement of objectives focuses mainly on the successful demonstration of the MEH system as way of arriving at a decision to scale-up, while maritime safety and environmental protection are largely assessed as a function of the future prospects for successful implementation of the system.

Objective 1– Assisting in decision to establish a marine electronic highway for the entire length of the Straits of Malacca and Singapore

66. While a decision was made based on the demonstration project (and its evaluation of MEH scale-up costs, benefits, and feasibility), the demonstration itself was not of the scope, scale, or duration originally planned, and a decision was not taken on whether to establish an Environmental Fund, as specified in the outcome indicator. Perhaps most importantly, the sea trial did not include participation by the large oil tankers and container ships that had committed to participate at the outset of the project, and whose adoption of the MEH is critical to its success and perhaps to its financing.

67. A very positive outcome is that the TTEG has now adopted development of the MEH as a key undertaking, and there is agreement on overall design, strategy, and perhaps most importantly institutional arrangements. But the financing plan is, if anything, less clear due to the lack of commitment by private ship owners.

68. If assessed solely on the question of whether the essential technological elements of the MEH were in place and the project helped facilitate a decision, the outcome could be considered to have been largely achieved. But if the assessment encompasses the delivery of planned outputs, and a system demonstration of the thoroughness, scale, and elements envisioned in the approved design, then the project fell well short of expectations.

69. *Results Chain / Design.* The project design envisioned a results chain in which investments in specific equipment, facilities, software, and training would create the technological infrastructure to gather, transmit, aggregate, exchange, and share information with ship and shore-based users to improve navigation, maritime safety, and ultimately reduce environment impacts from accidents and other discharges from ships. In addition, hydrographic surveys would provide the data needed to create detailed and updated ENCs, which would be adopted by ships using ECDIS systems on their bridge to integrate information from the ENCs with data collected from buoys, automatic identification systems, tidal monitoring equipment, GPS systems, oil spill and sand wave models, environmental marine information overlays, and shore-to-ship transmissions from the MEH Data Centers.

70. All of these elements would constitute a fully functioning MEH demonstration system, which would undergo sea trials by at least 160 large tankers and container ships over a period of about a year, to test how the system worked and provide detailed feedback on its performance. The indicator related to the sea trial required not only that that ships be equipped to use the system, but would also "choose" to use the ENCs and "all other components" of the demonstration system to navigate the Straits. The ships would also finance the cost of required shipboard equipment and systems required (about $50,000 per ship) and pay the cost of internet

access. Participation by ship owners was considered central to the demonstration. In addition, both the longer term safety and environmental outcomes, as well as the most likely financing model for the full-scale system, required that a high percentage of all ships transiting the Straits use the MEH.

71. Based on the sea trial, the project would conduct a cost-benefit analysis and feasibility study of different scale-up options, which in turn would provide the littoral states and commercial shipping users the information needed to collectively make a decision on the scale-up, and prepare a design and financing plan for the MEH as well as the Environment Fund.

72. *Actual Demonstration.* The actual demonstration did not include all of the inputs and elements originally planned. The hydrographic survey covered only 14 percent of the original area, and though it was used to produce ENCs, they were not used as part of the sea trial. One of the four data centers was not established, some of the ocean data buoys and the DGPS were not installed, the sand wave model was not completed, and environmental information overlays were produced by another source rather than the project (and were not used in the demonstration). Rather than a long-term trial involving 160 large ships that regularly transit the Straits, the sea trial was conducted for six weeks and included only 18 smaller ships that engage in cross-straits traffic.

73. The loss of interest by ship owners who originally had indicated commitment to participating in the demonstration was mainly due to the cost of participation and the perception that the information and capabilities offered by the demonstration system did not serve their needs or substantially improve their ship-board information and navigational capacity. In particular, the ships were interested in having dynamic information on water depths to determine under-keel clearance in real time, which the current system could not provide. The extent to which lack of interest was due to inadequate promotion of the system's benefits was not evaluated, and more proactive promotion of the system is clearly needed, but is unlikely to have been a significant factor in the ships' choice not to participate in the demonstration sea trial.

74. Nevertheless, even without all intended inputs, the basic elements of the system were functional, and in particular the information exchange system that is at the core of the MEH. This allowed a successful though scaled-back test of the interconnectivity and data sharing of various data servers, exchange protocols, and staff capacity.

75. Technically the MEH pilot system worked well during the sea trial. All participants in the trial were able to access the information and data of the MEH through the Internet portal. The participants found the information and data useful and suggested improving the pilot system with more real time and dynamic data. The economic evaluation after the sea trial indicated that developing a full-scale MEH system was economically and financially viable.

76. *Decision to Scale Up (first GEO indicator).*Consequently, at the September 2012 meeting of Tripartite Technical Experts Group (TTEG), the three littoral states signed Letters of Acknowledgement to continue with the operation of the pilot MEH and to work closely together to further advance and scale-up the MEH under the Cooperative Mechanism on Safety of the Navigation and Environmental Protection in the Straits of Malacca and Singapore. Following the signing of the Letters of Acknowledgement, TTEG agreed to establish Technical Working Group on MEH under TTEG.

77. Setting up an Environmental Fund to support local marine environmental conservation activities was not specifically discussed by the littoral states and consequently no decision was

taken with respect to this topic. However, since the littoral states agreed to put MEH project under the Cooperative Mechanism and TTEG, the MEH is not a stand-alone project, but become an integral part of projects under Cooperative Mechanism. Consequently the objective of the Environment Fund could be fulfilled by one of the projects under the Cooperative Mechanism (e.g. Straits Project 2 – Cooperation and Capacity Building on Hazardous and Noxious Substance Incidents Preparedness and Response in the Straits of Malacca and Singapore) and/or using available funds (e.g. the Aids to Navigation Fund (ANF).

78. *Design of Full-Scale MEH and Environment Fund (second GEO indicator).* At the Tripartite Technical Experts Group (TTEG) meeting in September 2012, the littoral states decided to conduct hydrographic surveys covering critical areas in the Straits and to produce larger scale ENCs. At the TTEG meeting in October2013, the littoral states agreed to set up a technical committee led by Malaysia to conduct the joint hydrographic survey. India offered of in-kind contributions to the joint survey. This offer still needs to be evaluated by the technical committee.

79. In financing terms, the littoral states agreed to fund the maintenance and operation of the current MEH pilot system under the Straits Project 4, which aims at setting up a Tide, Current and Wind Measurement System for Straits of Malacca and Singapore, and also welcomed user States and stakeholders to contribute. They also agreed to use the Aids to Navigation Fund (ANF) to harmonize the data display between the Straits Project 4 and the MEH. Since MEH is now under the Cooperative Mechanism and TTEG, the expansion of MEH will be the responsibility of the three littoral states and international marine community.

80. In term of institutional aspects, the littoral states agreed to use the Cooperative Mechanism as a regional body to oversee the continued development and future operation of the MEH System. In the October 2013 TTEG meeting, the financial and institutional aspects of MEH were fine-tuned in the following way: (i) the three data centers will be synchronized to avoid having to register with all three littoral states in order to access the information provided under the MEH; (ii) Malaysia and Singapore will be the backup for the MEH Batam Data Center on a six-month rotating basis; and (iii) Indonesia will be responsible for the maintenance of the Batam MEH Data Center, for which funding of US$70,000 was set aside in the 2014 budget. The Batam MEH data center will be a joint center supported by the three littoral states.

81. *Inputs, outputs, and intermediate indicators.* Although the GEO-level indicators were, on the surface, largely achieved, most of the inputs and outputs reflected in the intermediate indicators were either not achieved, or only partially achieved. Some activities and outputs suffered from lengthy procurement processes and unexpected delays in shipping the navigation equipment from Singapore to Indonesia. Some were not sufficiently funded (hydrographic survey), were not carried out with project resources (environmental mapping), or couldn't be completed before closing (sand wave models). Although participation of commercial ship owners was outside the control of the project, their loss of interest was lack of participation was a major shortcoming. While all this had an impact on the scope of the pilot MEH system, it did not preclude testing and evaluating the system's functionality, nor the ability of the littoral states to take a decision on whether or not to expand it.

Objective 2 –Improving maritime safety and reducing the risk of environmental damage to the globally-significant shared natural resources of the Straits of Malacca and Singapore

82. Direct demonstration of this objective was not intended by project completion, and the results framework did not include indicators to measure it (such as the rate of collisions, groundings, and other accidents; chemical and oil spills including deliberate discharges; and impact on environmental resources and response and mitigation when such damage does occur).

83. However, some project activities and outputs were specifically targeted at the environmental damage reduction and mitigation aspects or the MEH as a ship traffic management system, as well as to provide non-shipping stakeholders with data to help predict and respond to the impacts of incidents when they do occur. Many of these activities were either not completed, or only partially completed. For example, planned sand wave models were not developed, environmental marine information overlays could not be created by the project and were instead undertaken by the government of Singapore (but not incorporated with the ENCs during the demonstration), and development of an emergency response system was cancelled and response exercises continued to be carried out by individual authorities rather than through the project. The Environment Fund was not established or financed (though other initiatives and sources of financing might help fulfill the intended purpose of the Funds).

84. In any case, the most important linkage of this objective to the project is the expectation that a full-scale MEH, with high participation rates by commercial shipping, will decrease accidents and the resulting environment impacts. The decision to scale-up the MEH and the strong indication of commitment by the TTEG to serve as the main institution responsible for seeing the scale-up through to fruition are highly encouraging signs that the longer-term maritime safety and damage reductions will be achieved, possibly sooner rather than later. Though not as large or comprehensive as originally planned, the demonstration still provided enough information to conduct the evaluation study used to inform the decision.

85. The primary reason to temper these expectations is that commercial shipping users, who had been interested and apparently committed to the demonstration at the outset, did not participate in the actual sea trial of the MEH as planned, and their future interest and participation is not assured. Without a high rate of adoption of the MEH, particularly by the largest and potentially most damaging ships, the benefits of the system for both safety and reduced environmental damage would be critically compromised. Although other financing strategies are under consideration, paid participation by commercial ships is also essential to the favored approach to financing the hydrographic surveys and system operation necessary for a fully functioning MEH.

3.3 Efficiency

Rating: Substantial

86. The economic evaluation in the PAD used NPV, ERR, and MERR as indicators to measure economic feasibility of the MEH. All of these indicators involve converting a stream of future costs and benefits into a single number, the NPV, the ERR or the MERR. The benefit included in the evaluation was reduction of clean-up costs of oil spills. The cost included investment, operation, and maintenance costs. The evaluation did not take into account other benefit, namely reduced under keel-clearance which increases efficiency of ships, and cost of collision or grounding.

87. In the evaluation, number of tanker voyages through the Straits was projected from 2002 to 2025, and the investment costs are taken to include operating and maintenance and resurveying every four years. The net present value was about U$26 million (using a discount rate of 12

percent), the economic rate of return was about 32 percent and the modified economic rate of return was about 21 percent. These values were robust to projections in the number of voyages, even with a continuation of the 2002 number of voyages the evaluation results were U$13 million for the NPV, 24 percent for the ERR and 18 percent for the MERR. At appraisal the analysis showed that the project was economically feasible.

88. During project implementation, a socio economic evaluation was also undertaken. The economic analysis evaluated three possible scenarios for extending the Demonstration Phase (DP) of the MEH. They were:

- Scenario 1: completing the DP and making it operationally and financially sustainable;
- Scenario 2: extending the DP (scenario 1) to cover the whole area of the Traffic Separation Scheme (TSS), and:
- Scenario 3: extending the scenario 2 to cover the whole of the Straits of Malacca and Singapore.

89. The NPV, ERR, and MERR were also calculated in this evaluation. The evaluation was for 20 years of investment from 2014 to 2033. There were at least four quantifiable benefits of maintaining and expanding the MEHSOMS: reduced cost of oil spills, reduced cost of groundings and collisions, reduction in ship operating costs (fuel), and reduction in loss of life and injuries. The investment cost includes among others hydrographic surveys, development of ENCs, etc.

90. Using a discount rate of 12%, the analysis showed that all three scenarios have a positive annual net benefit and cost benefit ratio greater than 1.0. It also indicated that all three scenarios are economically and financially feasible. Amongst the three scenarios, the analysis showed that scenario 2 was the most feasible one. The preferred path is to invest based on scenario 1, and then to proceed to invest based on scenario 2.The result of the socio-economic evaluation done during project implementation was consistent with the economic evaluation in the PAD.

3.4 Justification of Overall Outcome Rating

Rating: Moderately Unsatisfactory

91. The demonstration provided by the MEH project and the decision of the littoral states to complete the MEH demonstration system and to scale it up to a larger area are important outcomes of the project. On this basis alone the outcome might reasonably be considered moderately satisfactory. But viewed in its entirety, there were also substantial shortcomings relative to the outputs and outcomes envisioned in the appraised project design. These shortcomings (discussed in more detail in Section 3.2) involve the scope, scale, and quality of the demonstration, the participation of key stakeholders (ship owners) in both the demonstration and the scale-up decision, the lack of a clear decision on the Environment Fund, and in some of the small environmental activities intended to strengthen the local environmental response to any incidents that the MEH safety improvements are unable to prevent. Therefore and considering that (i) the project was and is highly relevant in terms of objectives, but was not fully adequate in terms of design and implementation, and (ii) the efficiency is considered substantial, the overall outcome rating is moderately unsatisfactory.

92. In a narrow sense the MEH demonstration system functioned well enough to provide the basis for a cost-benefit and feasibility assessment that helped the littoral states in the decision to move forward with a larger-scale MEH. The design of the system and plan for its financing are

not contained in a single, distinct design document (which in any case was not explicitly called for in the project results framework), rather comprise the littoral states' agreement on an overall strategy, definition of critical next steps, commitment to several specific MEH-related projects, and continued exploration of long-term financing options.

93. However, a reasonable interpretation of the project objective is not only that a decision was taken, but that the outputs and elements of the MEH demonstration that were to form the basis of the decision were also delivered, and that the decision included the key stakeholders needed for a full-scale MEH to be sustainable and deliver the promised benefits in shipping safety and reduced environmental damage. In this respect, there were a number of significant shortcomings.

94. The hydrographic survey covered a much smaller area than planned; limited ENCs were produced based on the survey but were not actually used in the sea trials; overlays of environmentally sensitive areas were not created by the project and those created by other sources were not used; some electronic monitoring and reporting equipment was not installed, sand wave models were not done, and an emergency response plan was not developed nor were exercises conducted. The result was a demonstration system that allowed key system functionality to be tested, including the information exchange system, but did not integrate "all the elements" that the commercial ships were originally expected to test in the sea trials.

95. If the key outcome of the project could have been achieved without these intermediate outputs and elements, it is reasonable to assume that it would have been designed without them. The reasons these activities were not achieved, despite almost two years' extension of the project, was because of delays, capacity constraints, costs, and other implementation issues, not because they were determined to be unnecessary.

96. Perhaps most importantly, owners of the (minimum) 160 large tankers and cargo ships that was to test the system lost interest as the project progressed, and ultimately chose not to participate in demonstration. The participation of these ships was highlighted repeatedly in the project design as a key element of the demonstration, both for testing and for generating feedback. They were replaced by 18 smaller, trans-straits ships recruited by the project implementing agency, which allowed the project to conduct a smaller, shorter sea trial that was still deemed sufficient for evaluative purposes. But even if that is the case, the significance of these ships goes beyond technical trials of the MEH, as their participation in the MEH is critical to the system's ability to deliver benefits and possibly to its financing and sustainability as well.

97. The second GEO objective (improved safety and reduced environmental damage) is mainly a long-term impact that is dependent on achievement of the first objective (scale-up of the MEH). To the extent that the MEH demonstration was not fully developed and all of its elements not yet installed or integrated, and the commitment of shipping users is uncertain, the prospect of achieving the intended safety and environmental benefits, while likely at some point, are not as strong as the original project design envisioned. The project envisioned a fully functioning, fully equipped and updated MEH demonstration system, with clear private-sector interest and strong stakeholder commitment to scale-up in scope and adoption. The project delivered a smaller demonstration that did not integrate all of the planned elements, and led to a scale-up decision, but without the involvement of a critical stakeholder.

98. Other environmental activities and outputs related to response rather than mitigation were not completed or fully achieved, such as the Environment Fund, sand wave modeling, mapping of sensitive areas, and emergency response planning and exercises. While the main environmental

benefits are likely to accrue from avoidance of incidents that damage natural resources (because of improved navigation and maritime safety), it does not change the fact that these relatively small elements of the project were not achieved.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

99. The project did not have any poverty-specific emphasis, gender aspect, nor any social development aspect to it.

(b) Institutional Change/Strengthening

100. The project contributed to institutional strengthening/changes in the following way:

- Capacity building through trainings of hydrographic survey, ENC software suite, and MEH Data Center IT equipment software and hardware to the participants from the three littoral states.
- Upgrading the Government of Indonesia's navigation safety equipment and DGST officers' capability with regard to monitoring the maritime safety.
- Improving capacity of the IMO staff and DGST officers in regard to the financial management and procurement procedures of the Bank's project.
- Better coordination in marine safety and marine environment issues for Indonesia.

(c) Other Unintended Outcomes and Impacts

101. **Integration of MEH to Cooperative Mechanism integrated marine safety and marine environment development**. Under Cooperative mechanism, there are separate projects on marine safety and marine environment. The MEH integrated these two different focuses into a single integrated focus in CM.

102. **Enhanced environmental awareness**. This project introduced the environmental awareness by integrating physical data and marine environment data into the MEH database. All stakeholders who are involved with the Project and the users who have access to the data will be presented with sufficient natural and marine resources information in order to support in their decision making related to the Straits of Malacca and Singapore.

103. **Open dialogue between the three littoral states.** The MEH demonstration project has provided a platform for the three littoral states to strengthen their coordination with regard to the maritime safety and marine environmental issues over the Straits of Malacca and Singapore.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

N/A

4. Assessment of Risk to Development Outcome

Rating: Substantial

104. The main factor contributing to the *substantial* risk rating to outcomes is the uncertainty about the interest of private ships in using the MEH. The importance of convincing ship owners

of the benefits and utility of the system was recognized at appraisal, but was not considered a major hurdle. In fact, there was a strong expectation that more ships would participate in the sea trial than the minimum of 160 that was planned. In the end, no ships of the type targeted as the most critical users chose to participate, and they were not directly involved in the decision to scale up. There is high confidence that once the full system capabilities are in place (particularly the data required to provide dynamic under-keel clearance information) and greater efforts are made to disseminate and market the MEH, their interest will be rekindled. But while the likelihood of ship owners declining to use the system in the long-term is low, the impact if they did not would be critical, essentially preventing the system from delivering the intended benefits.

105. **Reliability of MEH Data Center.** If the MEH is to provide a fully functional, 24/7 system with no allowance for downtime, there must be permanent and capable operating staff at the Data Center. The newly recruited IT specialists of the DGST that will be allocated to the Batam Data Center must be highly qualified to manage the Data Center; otherwise there is a risk that the Center will not perform as expected. The IT specialists need to attend to the data systems, ensure that the electrical system is functioning and that any back-up facilities are operational, in order to ensure that both input and output data transmissions are functioning. The specialists also need to maintain records of performance and the use of the systems. While these will be mostly automatic, these records need to be analyzed, and performance and monitoring reports need to be prepared and disseminated. Feedback from users also need to be collected and analyzed, in order to gauge how system performance can be improved to better meet users' needs.

106. **Availability of sufficient budget for operation and maintenance of the MEH Data Centers.** There will be maintenance and operation cost to be carried by the three littoral states for the running of MEH Data Centers and for the equipment installed in various location, i.e. the cost of staff, the internet bandwidth service, maintenance of the servers and the equipment. MEH Data Centers relies for their absolute reliability to continuously provide data. There is risk associated with the littoral states future budget availability to meet the minimum cost of operation and maintenance. The cost of operating the MEH is estimated to a little less than US$ 1.5 million per year, which could be shared equally or based on GDP of the three littoral States. Nevertheless, the operating cost can be offset by the revenue that will be accrued from the operation of the MEH.

107. **Users' interest to utilize the data provided by the MEH.** The MEH Data Center will perform its function when there are the user of data, in this case the ships that are passing the Strait. There is cost associated with communication service to the user. The users need to use satellite service to connect to the internet and obtain the data from MEH Data Center. The risks are related to the willingness of the user to use the data provided by MEH Data Center and pay for the associated fees. Although the representatives of the ship operators (ICS and Intertanko) were supporting the MEH when it started, that interest had significantly lessened by the time it was drawing to a close. This lack of interest was demonstrated by their reluctance to encourage their members to take part in the sea trials of the systems. Unless that interest can be rekindled there is no purpose in further developing the MEH. There needs to be more convincing benefits from the MEH, which can be achieved if the MEH is more reliable, operated 24/7, and provides more coverage area. A public relation campaign directed towards the ship operators can attract the potential user of MEH. This campaign can be done through promotion of MEH in the website, in articles in maritime journals and presentation in conferences.

108. **GEO is not achieved if the system's performance is not satisfactory and/or ship operators do not willing to use MEH**. The main strength of MEH is that marine navigation information/data is integrated with marine environment sensitive areas in a real time situation.

The system is also capable to estimate the likely areas impacted by oil spills. If the system fails to perform satisfactorily, it will reduce attractiveness of MEH and will increase the risk of collision as well as environmental damage.

5. Assessment of Bank and Borrower Performance

5.1 Bank

(a) Bank Performance in Ensuring Quality at Entry

Rating: Moderately Unsatisfactory

109. Project preparation took a long time and involved several very seasoned sector specialists. Some initial preparatory studies for the project were carried out in 1997. Formal project preparation started in 2000. The project was approved by the Board in June 2006. The long preparation time was mainly due to the need to reach an agreement among the three littoral states to work together in jointly managing their sea space in the Straits through the implementation of the MEH. The joint management of the sea space in the Straits had not always been without controversy and conflicts in the past. The Bank team was instrumental in reaching this agreement. The Bank team also carried out due diligence in fiduciary and safeguard terms. The need to comply with GEF requirements added to the length of project preparation.

110. The Bank team underestimated the complexity of this project, which required the active involvement of three different countries and several agencies in each country, the IMO and the shipping industry. Only the GOI and the IMO were formal project implementation agencies and signed the respective legal agreements. The involvement of Singapore, Malaysia and the two shipping associations were assured through MOUs.

111. The Bank team did not realize the existence of the TTEG, a group of experts from the maritime administrations of the three littoral states, which meet annually to discuss and collaborate in the areas of maritime safety and environment protection. Had the Bank involved the TTEG, it would have benefited from the beginning in project preparation, design and implementation.

112. The project was also overly ambitious in the design of its component. It envisaged a large amount of different activities, which diluted the efforts of the implementation agencies. A focus on the key elements of the MEH, including the hydrologic survey and the preparation of the ENC could have helped to speed up project implementation and maintain the interest of the shipping sector. Additionally, the Bank team underestimated the project costs, especially the cost to implement the hydrologic survey.

113. Finally, although most of the project risks were adequately identified, the project had shortcomings in the design of the risk mitigation measures. For instance, the limited participation of the shipping sector in the field trial could have been mitigated through adequate incentives, including monitory incentive to cover the cost of their participation.

(b) Quality of Supervision

Rating: Moderately Satisfactory

114. Overall, the Bank team was strongly involved in project implementation and had an instrumental role in solving implementation bottlenecks and maintaining the support of all parties. However, during the initial phase of project implementation, supervision missions were conducted irregularly and the project implementation support was not as intense. After the mid-term review and towards project closing, supervision missions became regular and the project implementation support magnified. Many initiatives to proceed came from the Bank team. This in turn assisted both IMO and DGST in performing their parts. In addition to this, the Bank team maintained continuous communications and held discussions throughout the project with all stakeholders to ensure that any issue could be resolved as soon as possible.

115. The Bank kept reminding the clients to stick to the agreements in the PAD and the legal agreements, especially in terms of timing, use of resources and the scope of work of each activity. The Bank provided a considerable amount of implementation support, especially in reviewing the economic evaluation of the MEH carried out under the project. The Bank team had a crucial role in trying to maintain the support of all project parties. The Bank team also spent a lot of efforts in facilitating the institutional coordination in Indonesia. Most time during supervision was used to deal with these issues.

116. However, the facts that the project involved many stakeholders in different countries, the project sites were scattered in remote areas, especially those were the navigation equipment was installed, and the supervision budget was limited created some supervision challenges.

(c) Justification of Rating for Overall Bank Performance

Rating: Moderately Unsatisfactory

117. The Bank performance in ensuring quality at entry was rated moderately unsatisfactory and the quality of supervision was rated moderately satisfactory. Therefore, the Bank's overall performance was rated moderately unsatisfactory.

5.2 Borrower

(a) Government Performance

Rating: Satisfactory

118. The GOI had a proactive role during project preparation. It called for several meetings among stakeholder to make progress on project implementation bottlenecks. The GOI also showed strong commitment and played an important role in facilitating project implementation. Issues with inter-agency bureaucracy were addressed appropriately, e.g. through the frequent calling of inter-agency meetings by the Ministry of Finance, cooperative dialogue to resolve differences between agencies, and the resolution of technical problems in the data center using their own budgets. The Ministries of Finance and Environment, as well as the Bank of Indonesia, responded in a timely manner to any issue raised by the Bank during project implementation. Despite this proactive approach, it often took longer to reach solution than desirable. This is not due to a lack of commitment of the GOI. It stems from the multi-stakeholder nature of the project

and the local bureaucracy, which often require lengthy exchanges of formal letters between agencies. It is also due to complicated and lengthy clearance procedures in Indonesia.

119. The commitment of the GOI in post project completion is demonstrated through the allocation of funds and human capital to provide continuity the project, as elucidated below.

(b) Implementing Agency or Agencies Performance

Rating: Moderately Satisfactory

120. The IMO maintained a strong commitment throughout the project. Its convening power was effective in bringing stakeholders to the table for multilateral discussions. The IMO responded quickly to resolve problems, such as in financial reporting. When the project coordinator resigned, the IMO quickly assigned one of their officials to temporarily lead project implementation.

121. In terms of fiduciary performance, the IMO made significant efforts to maintain adequate FM arrangements and comply with the Bank's procurement rules. However, the IMO struggled with the Bank's procurement and FM rules and procedures. As a consequence, minor FM issues arose, which were resolved in close collaboration with the Bank. Shortcomings also took place in terms of procurement and caused significant delays. These shortcomings were due to a lack of capacity and experience of IMO staff. However, in the later years of project implementation, along with close coordination with the Bank, IMO managed to resolve these issues and implemented their part of the project.

122. On the side of the GOI, project implementation relied heavily on the Ministry of Transport, through the DGST as the implementing agency. Due to the unfamiliarity with the project and a lack of experience with Bank rules and procedures, the progress in the implementation of the components under the DGST was slow, especially in terms of procurement. Some shortcomings in terms of quality and procedural compliance were encountered. Starting in 2010, the capacity of the DGST's project management team markedly improved. With a better understanding of the importance of this regional project and a greater familiarity with Bank rules and procedures, the DGST assumed a stronger ownership for its parts of the project. In the post-completion phase, the DGST assumed the O&M expenditures of the data center and the cost of the building, navigational equipment, and the newly-recruited IT staff.

(c) Justification of Rating for Overall Borrower Performance

Rating: Moderately Satisfactory

123. Since the performance of the Government was satisfactory and the implementation agencies' performance was moderately satisfactory, the overall performance is rated moderately satisfactory.

6. Lessons Learned

124. **The need to comply with GEF requirements may lengthen the project preparation time.** As mentioned, some preparatory activities for this project took place already in 1997, formal project preparation started in 2000 and the project was approved by the board only in May

2006. The long preparation period cannot only be attributed to the involvement of multiple stakeholders in the project, but is also caused by the need to comply with GEF requirement. This not only refers to the additional approval process within GEF. In the case of Indonesia, it required the involvement of the Ministry of Environment as the main focal point, which complicated communication and coordination. In addition, it took the three littoral states and the IMO a long time to agree on the project objectives in line with GEF requirements. Therefore, when deciding embarking on a GEF project, time and budget constraints should be careful considered.

125. **Appropriate risk mitigation is crucial.** This project adequately identified the risks that emerged during project implementation, but failed to propose adequate mitigation measures. Most of the delays in the implementation of the project components and the shortfalls in the achievement of the project outcomes could have been avoided if adequate mitigation measures were in place. For instance, the project could have engaged with additional ship owner associations and shipping lines from the outset in order to make sure that a sufficient amount of ships participated in the sea trial.

126. **Projects involving multiple countries and stakeholders should be kept simple.** Regional projects are difficult to manage and need a very close attention: the success of this type of projects depend on the performance of the weakest country/stakeholder. The complexity of this project negatively affected both project implementation and its outcomes. A simpler project scope focusing only on the hydrographic survey, the development of models, and the preparation of ENCs might have permitted to finalize these activities before the sea trial. This in turn might have ensured the participation of the ship owners in this trial.

127. **Proper cost estimation and the allocation of sufficient budget to the project components are essential.** The main activity of the project was the development of new ENCs based on new and better hydrographic data and models. These ENCs were expected to be used for the navigation of ships in SOMS to increase safety and the efficiency of shipping. Nevertheless, the budget allocated to implement this component was too small; hence it was not properly implemented and did not fully achieve the overall project outcome.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

128. The Bank appreciates the comments from the Government of Indonesia, who was represented by the Directorate General of Sea Transportation, who finds the MEH Demonstration Project as positive support in upgrading the navigational equipment and providing capacity building for the DGST officers in the new technologies of sea navigation.

(b) Co-financiers

N/A

(c) Other partners and stakeholders

129. The Bank gratefully acknowledges the comments from the MEH Working Group under the Tripartite Technical Expert Group (TTEG) for Straits of Malacca and Singapore (SOMS) as one of the stakeholders, who finds that the main benefit of the MEH project is the deliverance of

integrated information such as tides and meteorological information in a common format, which can be accessed through the internet.

ANNEXES

Annex 1. Project Costs and Financing

(a) Project Cost by Component (in USD Million equivalent)

Components	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
1. MEH System Design, Coordination and Operation	2.64	2.13	81
2. MEH System Development	6.45	6.36	99
3. Shipboard Equipment and Communications	6.00	0.68	11
4. Marine Environment Protection	0.77	0.31	40
5. Dissemination, Evaluation and Scale-up Plan	0.21	0.08	38
Total Baseline Cost	16.07	9.56	59
Price and Physical Contingencies	0.93	0.23	25
Total Project Costs	17.00	9.79	58

(b) Financing

Source of Funds	Type of Cofinancing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Global Env Facility (GEF):		*8.30*	*5.56*	*67*
Grant for IMO		6.86	5.07	74
Grant for Indonesia		1.44	0.49	34
Littoral States:		*2.70*	*2.70*	*100*
Indonesia		1.50	1.50	100
Malaysia		0.90	0.90	100
Singapore		0.30	0.30	100
Private (ship operators)	Parallel	6.00	0.68	11
Republic of Korea	Parallel	0	0.85	--
Total Financing		**17.00**	**9.79**	**58**

Annex 2. Outputs by Component

Component 1: MEH System Design, Coordination and Operation	
1.1. System Planning and International Maritime Organization Management	
For this particular sub-component of system planning and IMO management, the following outcomes were originally envisaged: (a) Management of the operational aspects of the Project by the IMO (b) Development of a system for the management, on-line access and storage of data, including links to the MEH Data Centers, as well as financial and economic assessments. (c) Development of criteria and measurable indicators for Project performance assessment, including the execution of a baseline survey to compile and analyze data, as well as information covering a period of roughly thirty years up to the inception of the Project, as a basis for evaluation of the impact of the MEH system.	Outputs: Recruitment of project personnel was completed. Management of project was conducted properly. The development of the MEH system covered the hiring of an IT consultant to prepare the technical specifications of the MEH system for bidding purpose, preparation of the bid document, bidding and contract arrangement and the construction of the MEH system in Batam. Baseline survey could not be conducted. It was decided that baseline information required by the Project was as data feed to the MEH and the development of E-MIOs rather than to include time series data that assessed trends or changes. In this case, data would be currents, tides and meteorological information as well as coastal sites (coral reefs, mangroves, fishing areas). The data feed on tides and currents were provided by Malaysia and Singapore from their remote island stations and can be accessed from the MEH website by registered users.
1.2. Project Management Office (PMO)	
In terms of the PMO sub-component, the following outcomes were originally envisaged: (a) Strengthening the capacity of the PMO staff, including relevant training (b) Establishment of MEH Data Centers in the Republics of Indonesia, Malaysia and Singapore, including provision of the relevant training to the staff of the MEH Data Centers in operation and management of the MEH system, as well as in data-management and exchange.	Outputs: In connection with Activity 1.1a, the PMO staff had been trained to operate the MEH system in Batam before it was handed over to Indonesia. The Batam MEH Data Center was operational since December 2011 and formally handed over to DGST by IMO's Secretary-General on 3 August 2012. The establishment was partially completed as the maritime safety equipment under the Indonesian grant was not completed yet when the Project closed. Hence, the regional MEH system where Malaysia and Singapore are to be connected to the Batam Data Center was not achieved. However, both Malaysia (www.mehsoms.marine.gov.my) and Singapore (www.mehsoms-sg.com) established their respective Internet-based back-up systems of the Batam Data Center after 2012 to ensure that data being transmitted to the Batam Data Center are captured in case of downtime and power outage.
1.3. Project Steering Committee Support	
For the support of the steering committee sub-component, the following outcomes were originally	Outputs: Since its inception in 2006 until the closure in 2012, the Project held 6 PSC Meetings and one

envisaged: This sub-component financed the travel and accommodation costs of the three littoral states in attending meetings of the PSC and its TCs and WGs, which were held in rotation among the countries.	intersessional PSC Meeting. All the PSC meetings were co-chaired by Indonesia and Malaysia. 1st PSC: Batam, Indonesia, 29-31 May 2007 2ndPSC: Kuala Lumpur, Malaysia, 3-5 Jun 2008 3rd PSC: Singapore, 13-15 Jul 2010 4th PSC: Kuala Lumpur, Malaysia, 5-7 Oct 2011 5th PSC: Jakarta, Indonesia, 6-8 Jun 2012 6th PSC: Singapore, 14-15 Nov 2012 Intersessional PSC: Singapore, 6 Sept 2007
Component 2: MEH System Development	
2.1. Tide and Current Facilities	
Regarding the tide and current facilities sub-component, the following procurement outcomes were originally envisaged: 1. One Differential Global Positioning System (DGPS) to be installed in Dumai, 2. One ocean sensor to be installed along Phillip Channel, 3. Three tidal equipment installed in Tanjung Medang, Iyu Kecil and Nongsapura; and 4. Two AIS units installed in Tanjung Medang and Batam, respectively.	Outputs: Only the tidal and the AIS units were procured and delivered to the Batam MEH Center, and are installed in their planned location. Testing and commissioning of the equipment is included. The DGPS and ocean sensor are expected to be delivered in 2014 but all expenditures to be incurred on delivery and installation will be borne by Indonesia. DGST has ensured that government funds have been allocated for the purpose
2.2. Hydrographic Survey	
The following outcomes were originally envisaged for the hydographic survey sub-component: This activity expected to comprise a bathymetry survey of the sea-lanes of the TSS within the project area of the Malacca Straits using multi-beam echo sounder and DGPS to provide complete bottom coverage.	Outputs: The survey was conducted from Feb 10 to Apr 4, 2010. Deliverables were as follows: bathymetric charts, tide data, multi-beam sonar data and side-scan sonar data; S-57 digital files, paper charts and descriptive reports. Indonesia and Malaysia each received a set of the deliverables, respectively. The quality and standards of the deliverables were in accord with the specifications of the contract, in particular, the scope of services. Although the area covered by the survey was 14.38% (621.28 km^2) of the Traffic Separation Scheme (total area is 13,461.1 km^2), the results were significant. A large percentage of the survey area is dominated by sand waves, and two shoals are present in the northern and south parts of the site.
2.3. Electronic Navigation Charts	
, the following outcomes were originally envisaged: Production of high resolution electronic navigation charts for the Project Area, including provision of relevant computer software licenses to the Republic of Indonesia and to Malaysia.	Outputs: One set of software was delivered to each of the respective hydrographic offices of Indonesia and Malaysia, which took place after the training on the use of the software held in Malacca, Malaysia from 8 to 12 November 2010. All three littoral States now have the same software for ENC production, enabling data exchange and integration across boundaries. Although very good ENCs have been prepared from the hydrographic survey, the area covered is not significant enough to warrant any updating of the ENCs of the TSS. Furthermore, the hydrographic offices of the littoral States must agree to such

	updating, in order to ensure that the charts meet the technical specifications required for navigation.
2.4. Information Exchange System	
Regarding the information exchange system, the following outcomes were originally envisaged: This sub-component would provide the hardware (data servers), software (data exchange protocols) and human resources (training of staff), in order to permit these exchanges to take place.	Outputs: The MEH Data Center hardware and software were developed with the grant from the Republic of Korea. The MEH system established in Batam has Internet connectivity (www.mehsoms.com), and was used for online data exchange with Malaysia and Singapore. Capacity-building and training of Data Centre IT personnel (Database Administrator, System Manager and System Operator) was conducted. Sixteen participants from the three littoral States were trained at the level of competence to operate and manage the MEH Data Centre IT System.
Component 3: Ship-board Equipment and Communications	
In terms of the ship-board equipment and communication sub-component, the following outcomes were originally envisaged: The MEH system would be tested by about 160 large oil tankers and container ships that regularly transit the Straits, fitted with type-approved electronic charts display and information systems, including Internet connectivity, and were facilitated by two major ship owner representative organizations (Intertanko and ICS)	Outputs: Towards the last two years of the Project, both organizations did not participate in any activity of the Project, including the sea trial of the MEH System held in March/April 2012. The non-participation of the Project's shipping partners in the sea trial was attributed to information that could be obtained from the MEH Demonstration project was perceived to be limited where some data were not available, the need to pay for Internet cost to access the data, and a lack of confidence in using the MEH as it is demonstration project only.
Component 4: Marine Environment Protection	
4.1. Oil Spill and Sand Wave Models	
The following outcomes were originally envisaged for the oil spill wave models component: Executing a modeling and analyses of: (i) the likely movement of oil spills originating in the Project Area, and (ii) the sand wave formation and movement in the Project Area.	Outputs: The sub-activity on hydrodynamic-coupled oil spill model software was procured and installed in the Batam MEH Data Centre on 10 – 14 September 2012. This was followed by a training of 6 staff from the 3 littoral States. The installation of the hydrodynamic-coupled oil spill model included calibration and testing. This model was integrated into the MEH system and was turned over to Indonesia (DGST) in December 2012. The sub-activity on sand wave models was cancelled, due to lack of time, as the Project was winding down. Although the bid document was prepared, there was insufficient time to implement the sub-activity, taking into account the procurement process (i.e., bidding, bid assessment, approval of the winning bid, awarding and contract signing).
4.2. Sensitive Area Mapping	
The following outcomes were originally envisaged	Outputs: This activity was referred to as

for the sensitive area mapping sub-component: Research and development of options for providing real-time, geo-referenced environmental protection information to mariners navigating in the Straits of Malacca and Singapore, as well as for conservation and coastal resources management and mapping of sensitive areas.	development of environmental marine information overlays (E-MIOs). The initial approach was to carry out a research project to develop E-MIOs as special spatial layers to electronic navigational charts (ENCs). Two bid proposal attempts were unsuccessful, due to problematic E-MIOs and no bidder submissions, respectively. After subsequent meetings and workshops (including that of the PSC), it was decided that Singapore would initiate the development of static E-MIOs using IHO S-100 standard, and that the East Asian Hydrographic Commission would produce E-MIOs for the South China in S-100 ENCs by early 2014. Hence, the Project was able to demonstrate the production of ENC with E-MIOs, however, such materials were not officially verified by the hydrographic offices of the three littoral States. Moreover, MIOs have been used mostly for non-shipping purposes.
4.3. Emergency Response Systems	
The following outcomes were originally envisaged as the emergency response systems sub-component: Execution of simulated oil and chemical spill emergency response exercises, in order to determine the cost-effectiveness and efficiency of the MEH System in the event of chemical and oil spill incidents from ships.	Outputs: A draft ToR for a bid proposal to develop emergency response systems for SOMS linked to the MEH was submitted by the PMO for review. However it was decided that the PMO should not proceed with the bid proposal, as there are several agencies in-charge of various aspects of maritime emergency response, which meet at various forums. In addition, at the Environmental Data Feed Workshops in mid-2011, it was concluded that National Contingency Plans for oil spill response should not be displayed in the open domain of the MEH website. In light of the above, the PSC requested Malaysia to take the lead in providing the requisite information on emergency response to the Project. Thus, open provisions of such information will be subject to request.
Component 5: Information Dissemination, Evaluation and Scale-up Plan	
5.1. Website and Publicity	
the following outcomes were originally envisaged: Production and dissemination of information through the internet on the MEH system, including technical reports, progress reports and a newsletter, and carrying out of national and regional workshops and seminars to provide information and seek feedback on the benefits and applicability of the MEH system.	Outputs: Training of the Interim Project Manager on the uploading and editing of the website (www.meh-project.com) was carried out in early January 2010 prior to its launching on 10 January 2010. The website was maintained by IMO until it was replaced by the Batam MEH website (www.mehsoms.com) in July 2012. The Batam MEH website was in operation in late 2011 when the IT contractor handed over the source codes of the MEH system to the PMO following contract completion. Information from the IMO-based website was subsequently transferred to the Batam

	MEH website during the first and second quarters of 2012.
5.2. Evaluation	
The following outcomes were originally envisaged for the evaluation sub-component: (a) Assessment of the cost and benefits of the establishment and use of the MEH system in terms of maritime safety and marine environment protection, including: (i) the development of criteria and measurable indicators for the socio-economic assessment of the MEH system, and (ii) the execution of a survey to evaluate the socio-economic benefits of the MEH system; (b) Execution of an assessment of the technical functionalities of the MEH system, including: system performance, (ii) the delivery of a continuous monitoring of new and potential technologies that could be linked to the MEH system or enhance its performance, (c) Delivery of an assessment of the MEH system, including institutional and legal aspects, and (d) Consolidation of the technical, institutional, legal, financial and economic assessments of the MEH system, including the implementation of the Project, and the development of a managing tool blueprint.	Outputs: The economic assessment was deemed economically and financially viable using three possible scenarios for extending the Demonstration Phase of the MEH: 1. Scenario 1:Completing the demonstration phase and making it operationally and financially sustainable; 2. Scenario 2:Building on the first scenario, extending the coverage to the whole of the TSS; and 3. Scenario 3:Extending the second scenario to cover the entire Straits of Malacca and Singapore Using cost benefit analysis, five sources of benefits were identified and measured: 1. A reduction in the costs of clean-up of oil spills; 2. A reduction in the loss in value of the marine and coastal resources of the Straits; 3. A reduction in the costs of groundings and collisions of vessels; 4. Savings in the cost of bunker fuel used by vessels using the Straits and an assessment of the reduction in GHGs that would come from the reduced fuel consumption; and 5. A reduction in fatalities and injuries to ships crews, through the reduction in the number of collisions. The result of the evaluations indicate that the second Scenario, completing the MEH of the Demonstration Phase and making it sustainable, and extending its geographical coverage to the entire TSS would bring the largest net benefits of all three Scenarios, and is therefore the preferred scope of scaling-up of the MEH. The sea trial was carried out from 28 March 2012 to 4 May 2012, covered the whole of the TSS., and involved 72 registered participants. Overall, all the participants were able to access the MEH through the Internet portal although with varying degrees of success. In terms of availability of information/data, most of the respondents would like to see real time and dynamic information/data that will help ships avoid navigational hazards, enhance emergency response and improve navigation. Most of the respondents indicated that the MEH should have expanded information/data types and not just tides,

	currents, oceanographic and meteorological data so that it could be a useful decision support tools for relevant stakeholders of the SOMS.
5.3. System Development	
Regarding the system development sub-component, the following outcome was originally envisaged: Execution of marketing strategies to package and market the MEH system and its proposed marine data, products, and services.	Outputs: In promoting the Project and in particular, the MEH concept, the progress of the MEH Demonstration Project was regularly reported at various sessions of IMO's Marine Environment Protection Committee (MEPC), Sub-Committee of Safety of Navigation (NAV), Council and Technical Cooperation Committee, as well as in several international conferences organized by international and regional bodies (e.g. APEC, HelCom, PEMSEA, IMAREST). Project reports, such as the PSC Meeting reports, can be accessed from the MEH website. The Project also published brochures, which were circulated during Rio+20 Conference, the handover ceremony of the MEH system to Indonesia, and various IMO meetings.

Annex 3. Economic and Financial Analysis

Excerpt from the Executive Summary of Socio Economic Evaluation and Assessment of Scaling Up the Marine Electronic Highway (MEH) System for the Straits of Malacca and Singapore

Costs and Benefits of extending the Demonstration Phase

Three possible scenarios for extending the Demonstration Phase of the MEH were evaluated:

Scenario 1 Completing the DP and making it operationally and financially sustainable;

Scenario 2 Building on the first Scenario, extending the sustainable DP to cover the entire area of the Traffic Separation Scheme (TSS), and:

Scenario 3 Extending the second Scenario, to cover the entire Straits of Malacca and Singapore.

The evaluation was undertaken in the form of a cost benefit analysis. Five sources of benefit were identified and measured:

- a reduction of the costs of oil spill clean-ups;
- a reduction of the loss in Straits marine and coastal resources value;
- a reduction of the costs of groundings and collisions of vessels;
- savings in the cost of bunker fuel used by vessels using the Straits, and an assessment of the reduction of GHGs that would result from reduced fuel consumption, and;
- a reduction of fatalities and injuries to ship crews, through the reduction of the number of collisions.

The value of these benefits for each of the Scenarios was compared to the cost of scaling-up and maintaining the MEH as it is now. The major cost for the second and third Scenarios would be for undertaking new hydrographic surveys and the production of high resolution ENCs based on those surveys. Other costs for these two scenarios would be for additional equipment to obtain and transmit data to feed into the MEH. All Scenarios would include operating costs for the MEH and its MIS, as well as maintenance costs for the equipment used to generate and transmit the data for the MIS.

Results of the evaluation

The cost-benefit analysis was undertaken in two Parts. The first was relatively straightforward and used the largest annual average net benefit and Benefit/Cost ratio as the decision criteria, while the second required many more assumptions and projections, and used the Net Present Value (NPV), Economic Rate of Return (ERR) and Modified Economic Rate of Return (MERR) as the decision criteria. Both parts of the evaluation demonstrated that it would be most worthwhile to scale-up the MEH to Scenario 2, although all three Scenarios would have positive outcomes.

For the first Scenario, the decision criteria that are relative to the size of the project yields relatively small results, with an average annual net benefit at just over U$1 M per year and an NPV of U$5M. However, the criteria that are not dependent on the scale of the project yields more positive results, with a Benefit/Cost ratio of 2.0, an ERR of39.2% and an MERR of 19.3%.

The second Scenario has larger absolute benefits, its average annual benefit being more than U$12 M per year and its NPV being more than U$50 M. The Benefit/Cost ratio is 2.7, the ERR is 33.9% and the MERR is 16.1%.
Scenario 3 has an average annual net benefit less than Scenario 2, of just less than U$12M, as well as a slightly smaller NPV (U$40.2m) and Benefit/Cost ratio (2.0), and ERR and MERRs that are less than Scenario 1 and 2 (29.8% and 15.5% respectively).

The results for the third Scenario require careful interpretation than the straightforward results for Scenarios 1 and 2, since the definition of the Scenarios makes them cumulative (each includes the actions of the preceding Scenario/s). The less positive outcomes for Scenario 3 indicate that the additional costs of scaling-up Scenario 2 to Scenario 3 would be less than the additional benefits it would bring. This implies that scaling-up from Scenario 2 to Scenario 3 would not be worthwhile.

Given the limited geographic scope of Scenario1,it would not be able to realize many of the potential benefits of the other Scenarios. Scenario 2 would overcome these limitations, yielding much higher benefits, but at the cost of having to undertake a new hydrographic survey. The third Scenario would involve costs of a more extensive hydrographic survey and investment in more data equipment, but would bring only limited additional benefits since there is little congestion and are no shallow depth points that hinder navigation in the expanded area.

The robustness of these results was tested using switching values - values of the main parameters in the evaluation needed to change its outcome. The probability of occurrence of the switching values was considered to be so low as to make them improbable, hence the results of the evaluations were deemed to be robust.

Distribution of benefits and costs

The distribution of the benefits and costs of scaling-up the MEH to Scenario 2 will depend on whether and how the investment and operating costs of the scaling -up are charged to its users. If no charges were to be made, the people and governments of the littoral states would have a negative net benefit, since the social and environmental benefits would be less than the investment and operating costs of the MEH. Ship operators would accrue most of the net benefits (all the benefits of fuel savings and most of those of reduced groundings and collisions) and ships' crews (through reduced fatalities and injuries) would accrue the remainder.

If a user charge were implemented to recover all the investment costs of the MEH, the governments' net benefit share would become 4% (they would still incur the operating costs of the MEH) and ship operators' share would be reduced to 67% (viz. they would now incur the investment cost of the hydrographic survey) while the savings in lives and accidents to ship's crew would remain at 29% of the net benefit.

Conclusion of the Evaluation

The results of the evaluations indicate that the second Scenario, completing the MEH of the Demonstration Phase and rendering it sustainable, and extending its geographic coverage to the whole of the TSS, would bring the largest net benefits of all three Scenarios, and is therefore the preferred scope of scaling-up of the MEH. The major beneficiaries of the scaling-up would be ship operators.

Role of users of the MEH

For Scenario 2 to be successfully implemented, it will need the active and willing support of its users: the operators of ships using the TSS. Although the main objectives of scaling-up the MEH are to reduce the risk of damage to the marine and coastal environment of the Straits and to improve the safety of navigation, in monetary terms the largest benefits will accrue to ship owners and operators. Their savings in fuel costs and other benefits make up about 70% of the total benefits of each Scenario.

This is significant, because the high cost of the new hydrographic survey that would be needed for the expansion is beyond the resources of the institutions that would be responsible for its undertaking. A consideration of three ways of financing the expansion of the MEH to the whole of the TSS found that the most viable option would require some form of user charging. The amount of the charge, however it was levied, would need to be less than the benefits to the ship operators, so that the scheme could be of interest to them. But this can only occur if the cost is shared between a high proportion of ships using the Straits – if the survey costs were to be recovered over a period of ten years, the user charge would have to be paid by about 70% of transiting vessels to make the charge low enough to leave the ship operators with a residual benefit large enough to make participation in the MEH worthwhile to them.

If the charge were to be paid only by the VLCCs and deep-draught container ships (about 21% of the projected transits), it would be nearlyUS$800 per transit (more than the benefits per transit). But if about 50% of the transiting vessels were also to pay the charge, it would reduce the average charge to about U$200 per transit, low enough to make it worthwhile for them to pay.

If, on further consideration and consultation with ship owners, it appears that less than half the transiting vessels would be prepared to pay the fee, a potentially viable alternative for funding expansion of the MEH would be for the hydrographic departments of the littoral states themselves to undertake the survey. If this proves to be feasible (and it was not feasible for the Demonstration Phase), then the cost would be reduced sufficiently to be easily recoverable from a user charge.

The dependence of funding the MEH on implementing a user charge underscores the importance of ship operators being fully aware of the benefits an MEH in the TSS could offer them. The benefits can best be demonstrated by making the current MEH system fully operational and able to transmit its data ships in a form that they can receive, without undue difficulties or additional cost. This demonstration would need to be complemented by a deliberate campaign to disseminate information on the successful operation of the MEH and the usefulness of its outputs to ships using the Straits. This campaign would include presentations of the MEH at conferences and exhibitions attended by operators of ships using the Straits, publicity of the MEH website and scope of services it provides, publication of articles in professional and trade journals and magazines, as well as frequent and direct contact with the ship owners and their representative chambers, trade associations and industry groups.

Operation of the MEH

The need to maintain the MIS of the current MEH so as to provide a demonstrably reliable and useful data service to mariners highlights the necessity of establishing a full-time MEH management capacity. The recent transfer of decision-making responsibility of the MEH to the Tri-partite Technical Experts Group is a positive step forward, but it does not fully address how the day–to-day operations of the MEH will be managed. Among the few precedents of the full-

time management of a maritime agreement is that of the Helsinki Commission and its permanent Secretariat. While the context in which the Helsinki Commission[1] operates for the Baltic Sea is not directly comparable to that of the SOMS, the way that its Secretariat is structured and funded provides many useful exemplars for how the day–to-day functioning of the MEH can best be managed.

Recommendations

- The MEH should be scaled-up to cover the entire TSS. As the first stage, the Demonstration Phase should be completed by making its MIS more reliable and fully populated with the expected data;
- Once agreement on scaling-up the MEH has been reached, in order to start implementation of the agreement, the TTEG should further investigate the options for undertaking and funding a hydrographic survey that will cover the TSS and permit the creation of ENCs of a comparable standard to those available for the Strait of Singapore;
- To ensure that the Demonstration Phase of the MEH is completed and its MIS remains operational and available, the TTEG should quickly hire a full-time and fully-staffed Operations Unit to ensure that the MIS can be kept operating. The Secretariat to HELCOM (the Helsinki Commission) offers a useful precedent and, with necessary adaptations to the local context, could be an exemplary model for the MEH Operations Unit;
- To encourage the necessary participation by and commitment of the operators of ships using the TSS in the scaling-up process, the TTEG should also design and implement a public relations operation. This will make the advantages of the fully functioning Demonstration Phase MIS more visible to the ship operators (who will need to make a commitment to participating in the scaled-up MEH in order to justify investment in the new hydrographic survey), while at the same time, bringing knowledge about the MEH to a wider audience.

[1] Baltic Marine Environmental Commission http://www.helcom.fi/

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Marc H. Juhel	Sector Manager, Transport	TWITR	Task Team Leader
Robin C. Carruthers	Consultant	PRMTR	Task Team Leader
Bernadine G. D'Souza	Program Assistant	EASER	Program Assistant
Hatim M. Hajj	Consultant	EASTR	Task Team Leader
Arthur Robin Broadfield	Consultant	EASES	Transport
Saraswathi Sundaram	Program Assistant	EASTR	Program Assistant
Firman Dharmawan	Procurement Specialist	EASR1	Procurement
Mesra Eza	ET Consultant	EASTR	Transport
Migara Jayawardena	Senior Energy Specialist	LCSEG	Energy
Peng Wang	Junior Professional Associate		
Supervision/ICR			
Milen Dyoulgerov Vollen	Operations Officer	GFDRR	Transport
HanggarIrawan	Financial Management Analyst	EASID	Financial Management
Sally Burningham	Sector Manager	LCSDE	Task Team Leader
Imogene B. Jensen	Consultant	EASNS	Task Team Leader
Maria Luisa G. Juico	Program Assistant	EASIN	Program Assistant
Zhentu Liu	Senior Procurement Specialist	EASR2	Procurement
James Orehmie Monday	Senior Environmental Engineer	SASDI	Environment
Sri Oktorini	Program Assistant	EACIF	Program Assistant
YoganaPrasta	Operations Adviser	EACIF	Operations
Jean-Jacques Raoul	Consultant	MNAPC	Transport
Mustapha Benmaamar	Sr Transport Specialist	ECSTR	Task Team Leader
Imad Saleh	Operations Adviser	LCSDE	Procurement
Andry Utama Thamrin	Finance Analyst	CTRLN	Disbursement
Dewi Wandansari	Consultant	EASIS	Transport
Novira Kusdiart Asra	Sr Financial Management Spec	EASFM	Financial Management
AmiliaAldian	Tranport Engineer	EASIS	Task Team Leader
Enggar Prasetyaningsih	Procurement Analyst	EASR1	Procurement

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY00	9.55	37.78
FY01	2.43	13.80
FY02	0.5	6.49
FY03	9.02	52.03
FY04	12.04	106.13

FY05	12.55	59.58
FY06	11.45	74.65
Total:		350.47
Supervision/ICR		
FY02	6.63	34.06
FY03		0.00
FY04		0.00
FY05		0.00
FY06		0.00
FY07	17.13	86.45
FY08	14.19	73.65
FY09	10.72	48.02
FY10	12.21	69.81
FY11	12.87	61.15
FY12	13.95	54.39
FY13	16.06	57.12
FY14	0.11	8.67
Total:		493.33

Annex 5. Beneficiary Survey Results
(if any)

N/A

Annex 6. Stakeholder Workshop Report and Results
(if any)

N/A

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Comments from the Directorate General of Sea Transportation

Dear Pak Aldian,

Please find our comments on the ICR for MEH Project as follows:

1. We think that the ICR is comprehensive and covers all of the issues encountered during implementation.
2. Regarding the need for IT Specialist to be appointed at the Batam MEH Data Center, please be informed that the Ministry of Transportation is recruiting new officers including IT specialist. Hopefully there will be new officers qualified for the position in Batam.
3. We found that the Bank payment procedures were complicated and thus has caused delays to equipment delivery. Despite the complicated procedures experienced during project implementation involving payment process, the Bank team provided solid assistance in the form of continuous communication and discussion to find good solution.
4. We suggest that all aspects of project management were prepared and discussed thoroughly between the Bank and the Ministry of Finance prior to project implementation.

Thank you for the opportunity to provide our comments.

Summary of Directorate General of Sea Transport (DGST) Project Final Report

1. Project Description

1.1. Project Purpose

The Navigation network to assist for ships passing in Malacca and Singapore straits, in order to all ship sailing on there for improve safety and collision danger and grounded. So that MEH user for ship owner and tanker operator and voluntary services.

To achieve the above, the Project is to be executed in line with following points:

- Environments Protection;
- Safety Navigation;
- Sustainable Financing Mechanism.

1.2. Project Scope

1.2.1 Comparison of Project Scope between Original and Actual

Original Scope (as stated in Contract)	Actual
1. 1. Lot. 1 - Quantity 1 (one) MSK DGPS Navigation System including data link relaying data on a real-time or near real-time basis from the equipment installation site to the MEH Data Center in Batam, Indonesia.	1. Lot 1. Not Supply
2. Lot 2 - Quantity 3 (Three) Automatic Tide Gauges (including meteorological sensors) including data link	2. Lot 2. - Quantity 3 (three) Automatic Tide Gauges (including meteorological sensors) including data link

relaying data on a real-time or near real-time basis from the equipment installation sites to the MEH Data Center in Batam, Indonesia.	relaying data on a real-time or near real-time basis from the equipment installation sites to the MEH Data Center in Batam, Indonesia
3. Lot 3. - Quantity 1 (one) Ocean Data Buoy (including meteorological sensors and current meter) including data link relaying data on a real-time or near real-time basis from the equipment installation site to the MEH Data Center in Batam,	3. Lot. 3 - Quantity 1 (one) Not Supply
4. Lot 4. - Quantity 2 (two) AIS Base Stations (and control station)including data link relaying data on a real-time or near real-time basis from the equipment installation site to the MEH Data Center in Batam, Indonesia	4. Lot 4. - Quantity 2 (two) AIS Base Stations (and control station)including data link relaying data on a real-time or near real-time basis from the equipment installation site to the MEH Data Center in Batam, Indonesia

1.2.2 Reason(s) for Difference(s) in Project Scope between Original and Actual

The Contractor, until the end of contract date – 15 May 2013, was not able to provide the equipment mentioned in MEH Project contract no.: 01/PP/PKP/III-11, dated 4 March 2011: DGPS and Ocean Data Buoy (ODB), by reasons of:

"Several equipment, had been in the warehouse located in Singapore, had to be taken back to each fabricant, as the storage time had expired. This was done to prevent inappropriate equipment performance that may have resulted due to forced usage of the equipment".

Receipt of the equipment return to original fabricant is attached,

However, the Contractor agrees to finish the work for DGPS and Ocean Data Buoy (ODB) as mentioned in Contractor's Statement Letter

1.3. Necessity of the Project

1.3.1 Necessity/Background of the Project

Implementation of the Marine Electronic Highway (MEH) Demonstration Project in the Straits of Malacca and Singapore (SoMS) was given the go ahead in June2006 following the signing of a grant agreement between the Global Environment Facility (GEF)/World Bank and the International Maritime Organization (IMO).

1). The MEH is being built upon a network of Electronic Navigational Charts (ENCs) using Electronic Chart Display and Information Systems (ECDIS) and environmental management tools. Positioning systems, real-time navigational information like tidal and current data providing meteorological and oceanographic information is designed to assist in the overall traffic management of the Straits and provide the basis for sound marine environmental protection and management.

2). The overall objectives of MEH are to enhance maritime services, improve navigational safety and [security], promote marine environment protection and the sustainable development, and use of the coastal and marine resources of the littoral States.

3). The regional demonstration project involves littoral States aims to link shore based marine information and communication infrastructure with the corresponding navigational and communication facilities aboard transiting ships.

2. Project Implementation

2.1. Organization for Implementation

2.1.1. Executing Agency

Items	Original Plan	Actual Implementation
Name of organization	Directorate General of Sea Communication (DGSC), the Ministry of Communications	No change in the executing agency. The former DGSC is currently named as follows: Directorate General of Sea Transportation (DGST), the Ministry of Transportation)

2.1.2 Contractor(s)/Supplier(s)

ICB without P/Q

A	B		C	D
Contract Package	Selection Method		Name and Nationality of Contractor(s)/Supplier(s)	Remarks
	B-1 Original Plan	B-2 Actual Implementation		
One Package	ICB without P.Q	ICB without P.Q	PT. Pandu Bahtera Bhakti, Indonesia.	None(*)

Bidding has been conducted through the International Competitive Bidding (ICB) procedures specified in the World Bank's *Guidelines: Procurement under IBRD Loans and IDA Credits (2004)* and Indonesia's Presidential Decree No. 80 Year2003 concerning Procurement of Goods / Services for The Government of Indonesia, and is open to all bidders from Eligible Source Countries as defined in the Guidelines.

2.1.3 Amendment of Contract has been done for 5 (five) times by reasons of:

1. Amendment Contract 1 – for 1 (one) month; on account of the work could not be commenced as the advance payment had not been initiated acting as the effective date.
2. Amendment Contract 2 – for 3(three) months; on account of the information regarding the issuance of the Special Commitment (SC) from The World Bank had not reached any confirmation even until the middle of August 2011. Only after 5 December 2011, the information was received from Bank of Indonesia, stating that the SC proposal to The World Bank was rejected as the L/C signer official was considered unqualified because the Ministry of Finance did not release the power of attorney
3. Amendment Contract 3 – for 6 (six) months, on account of waiting the finalization process of SC release from The World Bank
4. Amendment Contract 4 – for 6 (six) months; on account of anticipating the completion of The World Bank's SC release. On 4 July 2013, the SC was released by the World Bank,

validating until 30 November 2013.Yet, the work could not be commenced as the Contractor had to wait for DIPA revision proposal from Satker Pengembangan Kenavigasian Pusat, for 2012 fiscal year. The revision was just completed on the end October2012, resulting in a delay of the import activities by the Contractor due to the short period for the commencement.

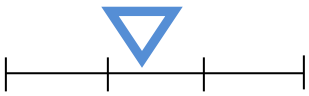
5. Amendment Contract 5 – for 6 months; on account of awaiting The World Bank's grant agreement extension as well as the DIPA 2013 fiscal year, as the work was not included in.

2.2. Actual Expenditure (by Item)

- Name of contractor/supplier:
  PT. PanduBahtera Bhakti, principal place of business at Kantor Independent Blok B No.6 Super blok Mega Glodok Kemayoran Jl. Angkasa Kav. B-6 Kota Bandar Baru Kemayoran, Indonesia.
- Amount of payment:
  Total amount :
  (Contract Amount) : USD 940.202,00 (LC=722,341.80 + PL=217.860.20)
  : IDR 1.423.241.316,00
  All contract amounts were paid to Contractor.
  : USD 355.826,00 (LC =288,426.00 + PL 67.400,00)
  : IDR 1.253.030.321,00 (PL)
- Overall Project Disbursement : 45 %

2.3. Performance of Contractor(s), Supplier(s) and Consultant(s)

Performance of Contractor has evaluated regarding administration, technical sufficiency/expertise, schedule control, procurement, staffs, and coordination between other organizations concerning the project, compliance with contracts

Name of Organization	Overall Performance	Comment
Contractor: PT. PanduBahteraBhakti	Good Poor 	All service provided by Contractor (administrative, expertise, coordination, design) were moderate satisfactory.

3. Facilities, Operation and Maintenance

3.1. Facilities

3.1.1 Present Condition

There is any problem in physical condition of each facility developed/supplied by the project.

3.1.2 Facilities with problem(s)

Facilities	Description of Problems	Remedial Action Plan
Battery	Battery for power support Equipment	Replaced with new battery.
Engine-Generator (E/G):	E/G does not start.	Replaced with new battery and key starter

3.2. Operation

3.2.1 Initial Operation

There is any problem in terms of initial operation.

■ No
□ Yes
Normal Operation

3.2.2 Operational problem(s)
There is no problem for first operation.

3.3. Operation and Maintenance (O/M) and its Management.

3.3.1 Organization in charge of O/M

Item	Original Plan	Actual Operation
Name of organization	Coast Radio Station, Directorate of Navigation, Ministry of Transportation	Same as the original
Name and title of the person who is responsible to O/M	Chief of Coast Station at Batam Radio	Same as the original

3.3.2 Section(s)/Department(s) in charge of O/M
District Navigation of Tanjung Pinang, Directorate Navigation of Sea Transportation of Ministry of Transportation.

3.3.3 O/M Staff

A	B	C
Occupation*	B-1 Number	Qualification/Skill
Chief of Coast Station. Maintenance Operators	1 2 1	Radio officers Electrical engineer GOC
Total Number/ Overall evaluation	4 (people)	■Sufficient

3.4. Annual O/M Planning Budget

Annual O/M budget actually appointed IDR 350.000.000, 00 at the year of 2014
This budget is include Airtime for internet, Commercial power, spare parts, fuel, maintenance for AC and equipment, mobile to site and room services.

Summary of International Maritime Organization (IMO) Project Terminal Report

Project Implementation - Summary

Implementation of the MEH Demonstration Project was initiated following the signing of the Grant Agreement between IMO and the World Bank and initiated the recruitment of a Project Launching Consultant (J. Kramer, Project Manager) and a Procurement Specialist (E. Hanselman) in early 2006. In March 2007, the Project established its headquarters, the Project Management Office (PMO), in Batam following the appointment in December 2006 of the Project Manager and the Procurement Specialist by IMO's Secretary-General as field staff of the Project based at PMO.

The period from 2007 to June 2010 can be construed as planning phase due to the limited implementation of activities in the field as the focus was on the preparation of procurement documents, including bidding, bid assessment and selection as well as securing agreements or arrangements on various aspects of Project activities, in particular, the work permits or visas of Project staff, development of work plan and establishment of financial arrangements. During this period, three Project Steering Committee (PSC) meetings were held, the awarding of the bid on the hydrographic survey of a part of the Traffic Separation Scheme (TSS) of the Straits of Malacca and Singapore to a private firm (GEMS Survey Limited), the hiring of an IT consultant to develop the blueprint of the MEH and the recruitment of a new Project Manager (A. Tcheng) who subsequently resigned in October 2008. The contract on the hydrographic survey in the TSS was signed in May 2009 but it took more than 6 months to mobilize resources for survey, including the survey vessel. On 10 February 2010, the survey vessel set sailed from Singapore to begin its survey.

The Project Coordinator (J. Paw) took over the Project as interim Project Manager following the resignation of Mr Tcheng and was based in Jakarta from February to July 2010. The Project Coordinator oversaw the implementation of the hydrographic survey, the training of hydrographers from the littoral States on the use of ENC production software, the finalization of the bid document for the development of the MEH, holding of the Third PSC Meeting and workshop on data feed as well as the restructuring of Project activities.

The period from July 2010 to 31 December 2012 saw the operational phase of the Project where planned activities were implemented and completed as well as the closure of the Project. A new Project Manager (Raja Malik Saripulazan, Malaysia) together with an Administrative Assistant were appointed in November 2010 and both were based in Batam. Prior to the closure of the PMO, all Project assets were turned over to the Directorate General of Sea Transportation (DGST), which was the lead implementing agency of the Project. Earlier on 3 August 2013, IMO's Secretary-General handed over the MEH System in Batam to the Director General of DGST in a formal ceremony held at the PMO.

During the development of the PAD and the negotiation period on the grant agreement in 2005 and throughout the implementation period of the Project, the World Bank carried out several missions to provide assistance on the Bank's procurement and financial procedures as well as to monitor, review and assess the progress of the Project. A grace period of 4 months ending on 30 April 2013 was granted to IMO for the financial closure of the Project following its technical closure on 31 December 2012.

Disbursement of Grant and Project Assets

IMO was given a grace period of four months from the technical closure of the MEH Demonstration Project (January to 30 April 2013) for the purpose of administrative closure (financial). For the last two quarters of the Project from October 2012 to April 2013, the disbursed fund by World Bank to IMO totaled US$334,510.15 and the final expenditure of the Project was US$153,496.35. The balance of US$181,013.80 was refunded to the World Bank on 11 June 2013 (duly acknowledged by World Bank Manila Office on 19 June 2013.

With respect to the GEF Trust Fund Grant allocation, the final disbursement status by Category was as follow:

	CATEGORY	AMOUNT (US$)
1	Goods	87,799.33
2	Consultants' Services	3,736,866.77
3	Incremental Operating Costs	571,393.31
4	Management Fee	672,194.61
	Total Disbursed	5,068,254.02
	Cancelled amount as of 11 June 2013	1,791,745.98
	Total Grant Amount	6,860,000.00

The total amount disbursed was 73.88% of the total grant. Of the cancelled amount, US$560,000 was unallocated cost as indicated in the Grant Agreement. If this is excluded from the total grant amount, the disbursement to the Project was 80.45%.

Achievements and Impacts

With the completion of the MEH Demonstration Project in December 2012, it bequeathed the following:

1. An operational MEH Data Center in Batam, Indonesia, which was handed over to DGST on 3 August 2012 by IMO's Secretary-General;
2. all Project assets installed at the Project Management Office in Batam transferred to DGST as the beneficiary, including a hydrodynamic-coupled oil spill modelling software (DGST) and a suite of ENC Production tools to both Indonesia (DISHIDROS) and Malaysia (National Hydrographic Centre); and
3. Trained IT staff to operate the MEH Data Center in Batam and hydrographers on hydrographic survey techniques (all three littoral States).

As the executing agency of the MEH Demonstration Project, IMO has successfully transferred the responsibility on the continued development and operation of the Batam MEH Data Center directly to DGST under the guidance of TTEG and the Cooperative Mechanism. As mentioned previously in this report, an MEH Working Group has been established within the TTEG, which met intersessionally in July 2013 and organized by IMO and MPA of Singapore.

The impacts of the Project are less visible and this will be so until TTEG and the Cooperative Mechanism will address relevant issues that the MEH Working Group and the littoral States will present at its forthcoming meeting in Bali, Indonesia in October 2013. In the case of the MEH Data Center, Malaysia and Singapore have established backup systems which will operate during downtime of the Batam MEH Data Center ensuring transmitted data are not lost. For Malaysia, the backup system is also linked to the Marine Department's database system and is being accessed by various agencies in Malaysia including the MEH Data.

The Project has successfully produced E-MIOs for the SOMS' ENCs, mainly static entities like mangroves and coral reefs using IHO S-100 standards. As a result of this milestone development by the Project, the East Asian Hydrographic Commission will produced E-MIOs for the South China in S-100 ENCs as its initial project by early 2014 to be followed by the second project in the SOMS.

Sustainability

The MEH Demonstration Project was able to develop and establish a pilot MEH System for the SOMS and the main facility is located in Batam, Indonesia under the management and operation by the DGST. Back-up systems have been established by Marine Department, Peninsular Malaysia and the Maritime and Port Authority of Singapore, respectively and accessible via the Internet. However, the pilot MEH System, although operational, cannot be used for maritime traffic management in the SOMS until the littoral States technically and legally approve it. The approval process will depend on several factors, including availability of funds. Firstly, the Batam MEH must be reconfigured in order to remove all Project-related aspects either as archived materials or background information. This will require some level of programming with the endpoint that the system can be mainstreamed into the existing maritime mechanisms in the SOMS. Apart from reprogramming the Batam MEH, DGST should also endeavor to apply the system to its maritime activities on an experimental basis to add to its utility as a decision support system paving the way to its mainstreaming. The hardware and operating modules must be regularly maintained and upgraded, including Internet connectivity. Apart from developing and improving the utility of the MEH System, the three littoral States should have regular meetings to review the progress being made and to address problems that may arise and justify funding requirements.

Recognizing that further work beyond the Project will be required in order to make the MEH operational in the three littoral States, the PSC at its fourth meeting and subsequent informal meetings suggested two options for a regional body to oversee the continued development of the MEH System. The first option would be under the governance of the TTEG but because TTEG is more an advisory body, activities geared toward enhancing the capability of the MEH System, including capacity building cannot be properly addressed. In this case, these activities could be realized under the second option, which is the Cooperative Mechanism and is also the operational arm of the TTEG as several of its projects were related to the activities of the MEH Demonstration Project. At the 5th PSC Meeting in June 2012, the littoral States reported that an MEH Working Group has been established in TTEG meetings. On the other hand, activities leading to the regional MEH development and operation will be programmed under the Cooperative Mechanism for funding and implementation.

In terms of sustainability, there are two aspects that concern the pilot MEH system. At the level of physical sustainability, DGST must continue to operate even though at pilot scale and interact closely with Malaysia and Singapore on data feed and exchange. As part of capacity building, the Project trained selected IT staff from the three littoral States on the operation of the MEH,

including advance training for DGST staff assigned to operate and maintain the system. Technical support was also provided well up to the closure of the Project on 31 December 2012. DGST has assigned staff to operate and maintain the Batam MEH Data Center and this should be a continuous commitment on the part of DGST, in particular, the allocation of national budget for the Data Center and the staff. During the transition period following Project closure, IMO extended the Internet subscription for 12 months (up to December 2013) to ensure continuous operation of the website as well as organized a meeting on 1-2 August 2013 in Singapore to evaluate the progress of the MEH under the TTEG/CM.

The second aspect on sustainability is institutional and some progress has already been made during the transition period. This included the backup systems of Malaysia and Singapore as well as the transfer of responsibility to Indonesia (DGST) and for the continued development of the MEH System under TTEG/CM. With those arrangements, the potential for funding is significant (TTEG/CM have at their disposal the following funding sources – Aid to Navigation Trust and the IMO Malacca and Singapore Straits Trust Fund), particularly to mainstream the system.

The baseline sustainability mechanisms are already in place. It is now up to the relevant agencies of the three littoral States to work closely together to develop and mainstream the MEH System so that it will become a decision support system for SOMS maritime traffic management and other activities.

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

Comments from the MEH Working Group under Tripartite Technical Expert Group

The following comments were given by Dr. Parry Oei (Director of Port Services Division, Maritime and Port Authority of Singapore).

Can you give a good example of a benefit to the region by the pilot MEH in Batam and the back-ups in Singapore and Malaysia?
Besides the better and continuous cooperation among the 3 littoral States, the main benefit of the MEH project is the deliverance of integrated information such as tides, meteorological information in a common format. And the information can be accessed via the internet by any user who registers with the MEH project. The common format and feel goes beyond the main MEH Batam Data Centre and will be similar for the back-ups in Singapore and Malaysia. The information is freely available for use by anyone who can value add to it, for example, use for passage planning or under-keel-clearance monitoring.

What are the key results (3 to 4 results)?
1. It is one of the largest scale data integration of shore base station information stations at one of the world's busiest waterways.
2. Real time observation and display of weather data along the entire Straits.
3. Production of the first Environmental Marine Information Overlay in the Straits for use by mariners and other stakeholders.
4. Strong demonstration of the Littoral States i.e. Indonesia, Malaysia and Singapore's Commitment and collaboration to further ensuring navigational safety and protection of the marine environment in the Straits of Malacca and Singapore (SOMS).
5. The commitment of the 3 Littoral States to the MEH project is further demonstrated by the permanent absorption of the project into Tripartite Technical Expert Group for SOMS

What are the key lessons learned (3 to 4 answers)?
1. A better understanding of the technologies by more importantly establishment of relationship between stakeholders and the 3 Littoral States.
2. The potential of new technologies which could make the MEH project more useful e.g. development of the IHO S-100 data standards which is being developed has lots of potential.
3. THE ECDIS is the key to users and Littoral States sharing information as it provides a common platform for display.

Quotes (2 to 3): what do you think about the MEH system? What about the MEH Project? (Note: this will be in the context of your participation in the MEH Project and in the development of the MEH and its backups).
The MEH Infrastructure is the beginning of a next phase of actualizing the e-Navigation strategy of IMO. The MEH project is proof that it works and is beneficial to not only Navigational for Mariners but also the Environmental aspect of the whole shipping ecosystem. There are still many gaps to fill for the realization of the e-Navigation. The MEH provides the platform for new technologies to be developed and tested for the safety of navigation in SOMS and around the world. We belief it is the future and the future is now a reality with MEH.

Annex 9. List of Supporting Documents

- *Socio Economic Evaluation And Assessment of Scaling Up the Marine Electronic Highway (MEH) System for the Straits of Malacca and Singapore*, Final Report, Robin Carruthers, September 2013

- *GEF/IBRD/IMO Marine Electronic Highway (MEH) Demonstration Project,* Project Terminal Report, October 2013

- *Project Final Report on Maritime Safety Equipment and Data Links for the Marine Electronic Highway Demonstration Project*, Directorate General of Sea Transportation, Ministry of Transportation, The Republic of Indonesia, May 2013

- *Reports of Tripartite Technical Experts Group (TTEG) Meetings, http://www.cooperativemechanism.org.my/index.php?option=com_phocadownload&view=category&id=28:2012-37th-tteg-meeting&Itemid=44*

- *Project Appraisal Document*

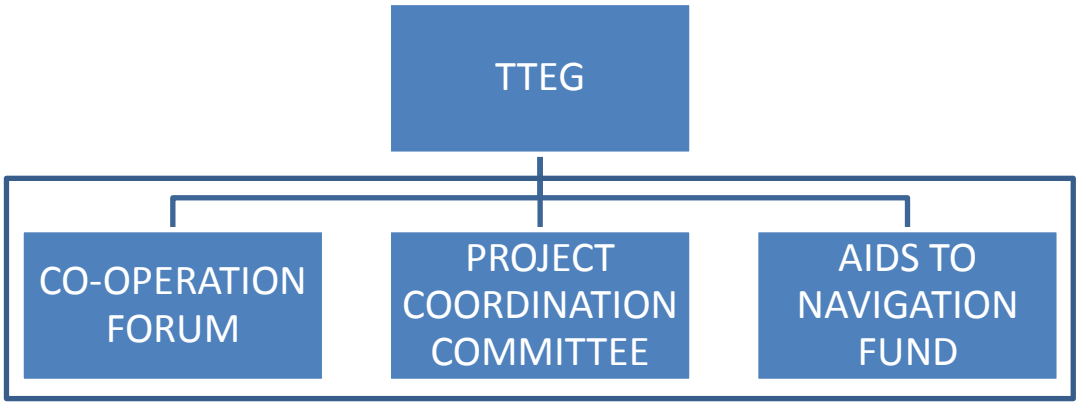
- *IMO and DGST Grant Agreements (GEF)*

- *Aide Memoires of preparation and supervision missions (archived in WBDocs)*

- *IBRD, IFC, and MIGA Country Partnership Strategy for the Republic of Indonesia for the Period FY2013-2015, December 13, 2012*

- *Project Implementation Status Reports (ISRs),* various dates.

Annex 10. Cooperative Mechanism for Safety of Navigation and Environment Protection in the Straits of Malacca and Singapore



1. The Co-operative Mechanism is the key platform in the Straits of Malacca and Singapore for the littoral States, user states, stakeholders and the industry to dialogue, exchange information and share their valuable perspectives on important Straits issues. It was launched at the IMO-Singapore Meeting in September 2007 as a result of a series of IMO-sponsored meetings on the Straits of Malacca and Singapore under the IMO's "Protection of Vital Shipping Lanes" initiative. This was a significant event for the international maritime community as it realized, for the first time, the spirit and intent of Article 431 of the United Nations Law of the Sea Convention (UNCLOS).

2. The Co-operative Mechanism consists of three components, namely, the **Cooperation Forum**, the **Project Co-ordination Committee** and the **Aids to Navigation Fund**. The components of the Co-operative Mechanism are interconnected and complementary. The Co-operative Mechanism has been structured to be flexible so as to provide a range of modalities or menu of options to users and stakeholders through which they can work with the littoral States. Contributions and participation can be in-kind, such as the provision of technical expertise and consultancy, or financial in the form of direct monetary contributions. This is intended to accommodate the varied interests and circumstances of the contributing parties.

Co-operation Forum

3. The Co-operation Forum is the main avenue for user States, the shipping industry and other stakeholders to meet and engage in dialogue with the littoral States of the Straits of Malacca and Singapore. The 5th Co-operation Forum will continue constructive discussions on possible measures to enhance navigational safety in the Straits, as well as address the issue of corporate social responsibility in promoting green and clean shipping. The meeting will also examine the synergies between the Marine Electronic Highway (MEH) project and E-Navigation, and discuss how to further develop the MEH project beyond its demonstration phase.

Project Coordination Committee

4. The Project Co-ordination Committee is the body that implements the various projects under the Co-operative Mechanism to promote safety of navigation and environmental protection. It is a concrete demonstration of co-operation and burden sharing between the littoral States and user States, the shipping industry and other stakeholders. Through the Project Co-ordination Committee, user States, the shipping industry and other stakeholders can contribute either by financing a project that has been identified and agreed upon, or a component therein, or by providing in kind resources such as technical assistance and equipment to specific aspects of a project.

5. The ongoing Straits Projects are:
   - Straits Project 1: Removal of Wrecks in the Traffic Separation Scheme in the Straits of Malacca and Singapore (led by Malaysia and supported by India and Germany)
   - Straits Project 2: Co-operation and Capacity Building on Hazardous and Noxious Substance (HNS) Preparedness and Response in the Straits of Malacca and Singapore (led by Malaysia and supported by Australia, China, US, European Commission and the Round Table of International Shipping Associations)
   - Straits Project 4: Setting up a Tide, Current and Wind Measurement System for the Traffic Separation Scheme in the Straits of Malacca and Singapore to Enhance Navigation Safety and Marine Environmental Protection (led by Singapore and supported by China and India)
   - Straits Project 5: Replacement and Maintenance of Aids to Navigation in the Straits of Malacca and Singapore (led by Indonesia and supported by members of the Aids to Navigation Fund Committee)
   - Straits Project 6: Replacement of Aids to Navigation Damaged by the Tsunami Incident of 2004 (led by Indonesia and supported by China)
   - Straits Project 7: Feasibility Study on Emergency Towing Vessel Service in the Straits of Malacca and Singapore (led by Singapore and supported by the IMO)

6. Straits Project 3 on "Demonstration trial of Automatic Identification System Class-B Transponders on Small Ships to Enhance Navigational Safety", led by Singapore and supported by Australia, Japan and the IMO, was successfully completed in 2010.

Aids to Navigation Fund

7. The Aids to Navigation Fund receives financial contributions for renewal and maintenance of aids to navigation in the Straits. The Committee members include the three littoral States, China, India, Japan, the Republic of Korea, Saudi Arabia, the United Arab Emirates, International Foundation of Aids to Navigation, International Maritime Organization, Malacca Strait Council and Nippon Foundation. To date, the Aids to Navigation Fund has received about US$15.2 million in both pledged and actual contributions.