Transitioning to Low Carbon Shipping Module

Sustainable Sea Transport Solutions for SIDS: Pacific Island Countries Case Studies

5. Barriers for Sea Transport for SIDS

http://unctadsftportal.org/sftftoolkit/transitioningtolowcarbonshippingmodule/chapter5/

Summary

This chapter looks at the barriers for low carbon sea transport solutions for SIDS.

Key Themes: Policy Barriers – Perception – Financing Barriers – Visibility

Sea transport is the lifeline of SIDS. With no land borders, island countries are arguably more dependent on sea transport than any other countries. A lack of adequate, reliable and affordable shipping is a major impediment to socio-economic development. Despite sea transport being an obvious and essential basic need for many oceanic communities, development of low carbon sea transport solutions for SIDS has not been considered a priority to date. If change is to be effected at a scale sufficient to make a measurable difference, it is essential that the barriers to transitioning to low carbon sea transport are understood.

5. Barriers for Sea Transport for SIDS

Sea transport is the lifeline of Small Island Developing States (SIDS). With no land borders, island countries are arguably more dependent on sea transport than any other countries. A lack of adequate, reliable and affordable shipping is a major impediment to socio-economic development and provision of essential government services, particularly to remote communities. Sea transport, especially at the domestic level, has always presented a difficult issue for SIDS to find long-term, sustainable, and cost-viable solutions for, even in periods of low fuel costs. They face a unique sea transport scenario: shipping for SIDS uses a higher proportion of imported fuels at a higher cost than continental countries and ships tend to be older, smaller and more poorly maintained than developed, larger countries.

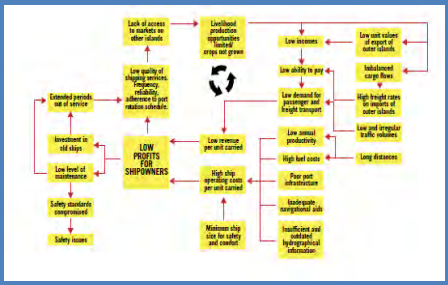
SIDS are also the front line communities facing increasing effects of accelerating climate change, a global phenomenon requiring global solutions. Shipping internationally is undergoing an unprecedented energy efficiency revolution. As a major and growing sector emitter shipping can be predicted to become ever more efficient in the near and medium future. If the shipping needs of SIDS are not included and provided for in this trend they will inevitably face a double penalty: continued dependency on increasingly out-dated technology with increasing costs of operation and increasing compliance costs for using cleaner versions of existing fossil fuels or pay increasing penalties for not doing so.

Collectively these drivers add up to a logical and compelling case for SIDS to prepare for a transition to low carbon sea transport futures now. But despite sea transport being an obvious and essential basic need for many oceanic communities and a potential range of solutions, development of low carbon sea transport solutions for SIDS has not been considered a priority to date. It has received little of the attention and funding that programmes using renewable energy for electricity generation have. Yet for Pacific SIDS electricity uses only 20% of imported fossil fuel. Examining the available evidence to support a case for SIDS transitioning to low carbon transport as an immediate priority it is obvious there are substantial barriers to be overcome. However, if they can be, it is also obvious there are substantial gains accruable measurable across environment, social and economic baselines.

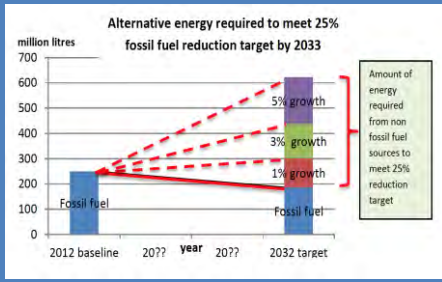
In this section we consider the barriers that SIDS face in transitioning to a low carbon shipping future. If change is to be effected at a scale sufficient to make a measurable difference, it is essential these barriers be understood. Overcoming these barriers is achievable but requires visibility in currently empty policy spaces at all levels, political leadership, a change in paradigm to financing and resourcing research and development for the sector, and coordinated implementation of structured

The following images are selected from "Appendix D: Chapter 5."

Please refer to this appendix for full size images and sources.



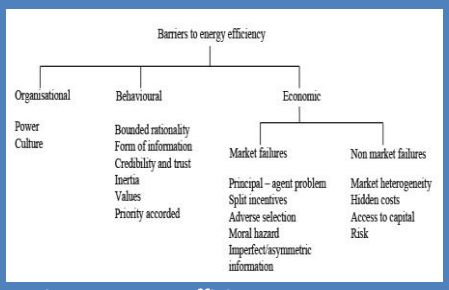
Barriers to SIDS sea transport.



Alternative energy required to meet 25% fossil fuel reduction target by 2033.

regional and sub-regional programmes.

The reasons are complex and previously poorly characterized. The low priority given to sea transport within current sustainability discourse is not restricted to the Pacific and recent research suggests it is a global phenomenon. International studies identify barriers to transformation in Norwegian and global shipping scenarios and find that institutional barriers, including access to financing, managerial practices and legal constraints, sit alongside technology issues constraining transition to low carbon shipping.



Barriers to energy efficiency.

If there are serious constraints to decarbonising global shipping these are only exacerbated at the small scale at which SIDS operate. Pacific research finds that policy and financing barriers are as great, if not greater, a challenge than access to the technology as is often assumed. Many of the barriers are perceptual as much as factual but appear deeply entrenched. We are not aware of parallel work focusing on other SIDS but assume similar constraints prevail.

The characteristics of SIDS mean the *options available to the global theatre are not necessarily the most accessible or appropriate.* This is due to the characteristics of local demand, including the merchant fleet profile (blue water but small and often old, many small village level boats powered by outboards, higher proportion of petrol to diesel, etc.); a lack of access to financing for new technologies; and the prohibitive cost and practicality of establishing extensive bunkering and support infrastructure for alternative fuels such as liquefied natural gas (LNG).

There is considerable scope for *operational efficiency* improvements for both existing vessels and related infrastructure (port design and management options, feeder transport networks, etc.). These same factors likely make renewable energy technologies, such as wind and solar, more appropriate for a range of SIDS applications than at a global scale. The greatest efficiency gains projected for renewable energy will come at the small ship scale and hybrid wind and solar along with biofuels, including bio-methanes, have strongest potential.

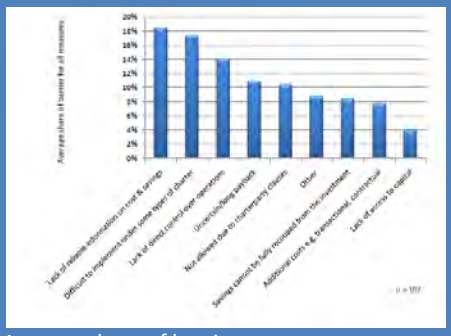
But the availability of these options to small island governments and commercial operators is heavily constrained. With a lack of capacity and resourcing to conduct vital research and development themselves, they are highly reliant on international trends and developments.

The transition to a clean energy shipping sector requires a significant *shift from fossil fuel-powered transport to energy-efficient designs and renewable energy technologies*, starting now. Unfortunately, the development of solutions for shipping has been hampered by a weak regulatory environment, over-supply of fossil fuel-powered shipping in recent years, the related depressed investment market and the recent falling oil price.

Efficiency gains will continue to favour new build, large-scale vessels servicing primary transport routes. While global interest in low carbon technologies for shipping is growing, solutions at the small-scale level appropriate to the domestic needs of SIDS have yet to be seriously explored. The 10,000 tonne and smaller vessel range carries only 4% of world cargo but emit 25% of its CO_2.

In the international sector the existence of split incentives between ship owners and operators is a primary barrier resulting in limited motivation for deployment of clean energy solutions. Ultimately market forces working within a tightening regulatory regime will govern the speed of uptake of energy efficiency technology for international shipping, though this will also be tempered by infrastructure lock-in and other non-market factors. Therefore, a set of organisational/structural, behavioural, market and non-market barriers need to be removed before low carbon developments can make meaningful contributions to the energy needs of the international shipping sector.

We have grouped the primary barriers for SIDS into four categories: Policy, Perception, Financing and Visibility.



Average share of barriers.

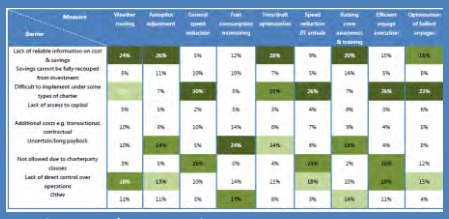
5.1 Policy Barriers

International policy for shipping efficiency is being driven by climate change, fuel costs and concerns over public and ecological health. The barriers in this sector are complex, in part reflecting the unique nature of the international shipping industry, with emissions control beyond the scope of most nation states, though larger entities such as the EU do exert influence.

The governance arrangements around CO_2 produced by international shipping (and aviation) are different from other sectors because their emissions are released in international waters and are not included in national targets. Instead, through the Kyoto Protocol, the International Maritime Organisation (IMO) was charged with developing policies towards mitigating shipping emissions. The new Paris Agreement is silent on this issue. Meaningful policy measures that address rising CO_2 emissions from international shipping are needed to achieve efficiency savings from the sector consistent with global targets of no more than 2°C warming, let alone the 1.5°C target favoured by many island states.

Slow progress to date, coupled with strong connections with rapidly growing economies, have led to the CO_2 emissions from international sea transport growing at a higher rate than the average rate of all other sectors. Overall growth of the sector will consistently outstrip gains being made in individual ship efficiency under all BAU scenarios modelled by the IMO. In May 2015, the Republic of the Marshall Islands unsuccessfully

petitioned the IMO to set a clear and ambitious sector target for shipping emissions. Despite a portfolio of opportunities for short to medium-term decarbonisation for shipping, the regulatory complexity at the international level is the greatest barrier to change. The solution remains controversial and unpopular – avoiding 2°C global warming requires demand management and all sectors must play their part.



Barriers and respective measures.

To date the disjunction between the "common but differentiated responsibility" (CBDR) approach of the United Nations Framework Convention on Climate Change (UNFCCC) and the "no more favourable treatment" (NMFT) principle of the IMO has seen extreme caution from emerging developing countries to any attempt to set direct enforceable policy. There is no urgency on behalf of the industry, traditionally resistant of external regulation and confident that self-regulation and innovation is the most effective route to efficiency. There remains no consensus on whether the responsibility and cost of change should fall to the ship-owner or the ship charterer. Following the collapse of the shipping boom in 2006, the investor market is highly conservative and risk averse. Until these barriers are overcome it is unlikely that global regulatory policy on shipping efficiency will tighten sufficiently in the near future to drive a comprehensive decarbonisation of the industry.

At the level of SIDS, policy for shipping efficiency is even more poorly populated. There has been almost no attempt to date to include low carbon transport transition in regional or national policies. Importantly, given the importance of aid to many SIDS, it is all but invisible in relevant donor policy or strategies. Transport, energy, development and climate change polices are often poorly integrated. These challenges were taken up at the UN SIDS conference in Samoa in 2014. The resultant SAMOA Pathway calls for gaining access to environmentally sound, safe, affordable and well-maintained transportation; advancing the safety of land, sea and air transportation; developing viable national, regional and international transportation; and increasing energy efficiency in the transport sector.

Again using the Pacific SIDS as an example, all Pacific Island Countries (PICs) have set national targets for reducing their dependency on fossil fuel use for electricity generation. In some cases, like Tuvalu's 100% by 2020 target or Samoa's 100% by 2017, these are highly ambitious. To date, only the Marshall Islands has set a target for reducing transport fuel reliance (20% by 2020) although 13 PICs are signatories to the SIDS DOCK initiative that pledged 25% transport fuel use reduction by 2033.

For transition to low carbon transport to occur policy intervention is required at:

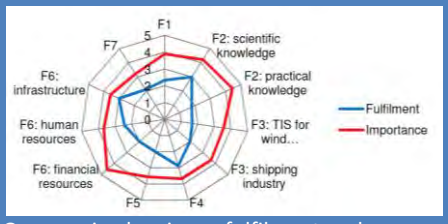
- National level. Inclusion of transport energy efficiency targets in SIDS energy, transport, climate change and development policies and strategies.

- Regional frameworks and strategies. Each ocean has its regional infrastructure, borne out of the necessity to collaborate with neighbours to gain scale. In the Pacific the need for sustainable sea transport is recognised as vital for plans for regional cooperation and integration. However, a structured policy framework to support this has yet to evolve. Economic integration depends critically on the development of seamless connectivity within and between countries. Air transport is likely to remain under-developed in the Pacific and, even if it improves, it is unlikely to provide an effective substitution for sea transport. The future of PIC economies and potential for trade will depend on effective and affordable sea transport for the foreseeable future.

- At the international level through UNFCCC, IMO and the International Civil Aviation Organisation (ICAO) processes. If globally agreed emissions targets are not to be exceeded, then SIDS require all sectors to decarbonise. An immediate paradigm shift is required. This is not a criticism of the effort being made by international shipping to increase efficiency of shipping per tonne/km. It is recognition of the likely increase in tonnage outstripping the individual ship efficiency gains being made.
  Most SIDS have narrow economies and limited opportunity to diversify. Many SIDS are hosts to independent registries which provide a hard to replace national income. These therefore require a stable profitable industry. So, if the triple gains of reduced global emissions, local decreased fuel dependency and a profit return on flag rental are to be met, a level playing field across the industry is required and this is likely only through a regulated global target.
  The parity of costs to SIDS for implementing agreed international action also needs to be addressed. Economic modelling done in 2010 when the IMO considered adopting market based mechanisms to control emissions, showed SIDS paying a greater proportional cost than other countries due to their size and remoteness.

5.2 Perception

Unlike most other energy user sectors, shipping is seldom visible to the average person. This is especially true for non-island dwellers. Shipping is literally over the horizon, unlike cars, trains, factories and power lines. Efficiency has not historically been a driver for the industry, impetus and research for shipping lags well behind all other energy sectors. And perception plays a large role – sails, for example, are often seen as part of a romantic but inefficient and slower past. As the findings from critical experiments in the last oil crisis have demonstrated, such perceptions often have no factual basis. Ship owners often take market risks, which in the past has resulted in ordering too many ships for example, yet find visible risk-taking such as embracing a novel solution, even on a trial basis, difficult to accept.



Overcoming barriers – fulfilment and importance.

5 common perceptual attitudes prevail:

5.2.1 Energy v Transport

Energy is used by a number of different sectors. But in discussion on climate change and renewable energy use in particular, energy is often equated most heavily with one sector, electricity generation, and this sector has become more heavily prioritised than any other.

The statistics speak for themselves in describing the extent of this revolution toward low carbon transition and the effectiveness of policy as a driver of change. By 2014 renewable energy targets and other support policies, now in place in 164 countries, powered the growth of solar, wind and other renewable technologies to a record-breaking energy generation capacity in 2014, up 8.5% from the year before. As of the end of 2014, renewables comprised an estimated 27.7% of the world's power generating capacity, enough to supply an estimated 22.8% of global electricity demand. In the Pacific over USD 1 billion is currently queued for renewable energy projects with funding and technical support pledged from all the large donors, development banks and UN agencies, targeting public and private partners.

Transport as a sector by comparison is seen as separate to energy, despite being a primary energy consumer and in the case of Pacific SIDS, the majority sector user. The focus on electricity is largely donor policy driven. It is not entirely clear how the current generic Pacific policy decision to prefer electricity was made but appears to be predicated on the assumptions that it is easier and more cost effective to generate meaningful savings at scale in the electricity sector. There is little detailed analysis of the results achieved by the investment in alternative electricity generation or whether this has provided the same benefits that a similar investment in the transport sector might have achieved.

Despite the stated driver for the current investment in renewable energies being reducing diesel dependency for the region, almost none of these funds are directed at transport, the majority user of such fuel. Where funds are dedicated to maritime transport it is for shore-side infrastructure or biofuel development in conjunction with other land-based transport and energy sectors. Again this is illogical when for island countries land transport is a minority sub-sector when compared with maritime and air.

The only solution to this barrier is to change the political directives from SIDS leaders to the international community about where aid and development funds should be invested to include transition to decarbonised sea transport. This in turn requires quality information and analysis being available to leaders.

5.2.2 There are No Solutions Available

This perceptual barrier is often framed as an assumption that:

- the technological barriers to reducing sea transport fuel use are high,
- the technology itself is unavailable or unproven, and
- therefore, is of much higher risk.

None of these are logical on available evidence. Most renewable energy technology retrofits or built into new designs suggests a 10-15% increase in overall construction costs with an economic investment rate of return (EIRR) ranging from 2 to 6 years. Much of it is mature and well characterised technology. Most of the advances in renewable energy technology for land based solutions and enormous advances in technologies such as those used in super yachts and high performance racing vessels are available for commercial application.

The real barrier is that data and information on the actual deployment costs of the various renewable energy solutions that have so far been adopted in the shipping sector are very scarce. There has not yet been sufficient demonstration of commercially viable solutions for the sector to drive deployment and thereby bring down costs. Ship owners and operators do not trust the return on investment (ROI) and savings that manufacturers claim their technologies can deliver. Moreover, reliable information on the effectiveness of technologies in improving energy efficiency also reduces the financial risk for investors.

There is paucity of targeted research in any of these fields currently within the Pacific, and an almost total lack of reliable and comprehensive data to support analysis. Unlike other transport sector operations, shipping movements and operations tend to be poorly documented and reported. There are a small number of operators, data is viewed as being commercially sensitive, and reporting to regulatory authorities is often poor. Ships at this level tend to be second-hand, old and often in poor condition. The hesitancy of finance companies and donors alike to invest in this field leads to a perpetuation of the cycle.

5.5.3 Within the Transport Sector, Urban and Land Subsectors are the Priorities

In 2012 UN Secretary-General Ban Ki-moon announced that USD 175 billion had been leveraged from the world's seven development banks to provide 'sustainable transport for all'. Unfortunately, this does not appear to include the unique maritime transport issues faced by SIDS. For Pacific SIDS, the ADB is the traditional funding source for transport and infrastructure. However, the long-term strategy of investment by the ADB is almost exclusively targeted at urban and land subsectors. The special transport needs of Pacific SIDS have to compete with the needs of vastly more populous Asian nations and simply fail to register.

5.1.4 Efficient Ship Asset is the Preserve of the Private Sector

In general terms globally, ship asset is the preserve of the private sector and investment policy is accordingly geared. Major sea-transport infrastructure tends to be state owned and commercially managed or state/private partner or private sector owned.

For Pacific small island states, this scenario does not always apply. In most SIDS, the private sector is underdeveloped and enterprises are not competitive. Moreover, they are dependent on imports, especially basic imports such as fuel and food, and are thus exposed to high transport costs and uncertainty of supplies, due to their remoteness. They also lack the ability to influence international prices. SIDS are too small to be competitive in international markets and require support in enhancing their competitiveness. Their share of global trade is too small to have any significant impact on the global economic system. Due to their remoteness and small markets, many SIDS have great difficulties in attracting external financial resources, including those from international financial institutions.

The archipelagic nature of many means internal hub and spoke arrangements leave the most remote penalised, and governments are regularly required to provide shipping or subsidises commercial operators and, more often than not, both. The inadequacies of commercial services outside of high traffic routes means government shipping is required for delivery of essential services and as cover for disaster relief such as droughts (where water must be delivered by sea), tsunami and cyclones. For many small economies the concept of the private sector is not appropriate. There is simply insufficient internal trade in a country such as Tuvalu, with 10,000 people spread across nine islands, a 2013 GDP of less than USD 40 million and a 757,000 km^2 exclusive economic zone (EEZ), to sustain a commercially viable private shipping sector.

Further, outside the major centres and primary tourist hubs, even when economical, they are often only marginally so. Existing operators are unlikely to change from the common operational scenario of replacing old inefficient ships with old ships until new generation vessels or technologies have been practically and economically demonstrated to be viable.

Many governments and communities are reliant on donated vessels. One logical solution of course is for bilateral donors to invest in “proof of concept” efficiency measures for small scale shipping in government shipping services and to wrap a structured monitoring and development programme around these. This would achieve the objectives of demonstrating viability and ensuring government vessels are as energy efficient as possible.

5.2.5 Sails are Inefficient and Slow

Merchant shipping used wind as the main form of propulsion for centuries, until the arrival of steam and diesel engines. The increased speed and reliability that steam and diesel allowed, and the availability of cheap, high-density energy sources such as coal and oil, made wind propulsion redundant for much of the 20th century. It is now largely forgotten that the last of the famous clippers, such as the *Cutty Sark*, could reach peak average speeds of 15 knots under sail alone – faster than much of today's merchant fleet. Hybrid wind powered vessels employing motor sailing combinations achieve either overall faster passage speeds for the same fuel or similar passage speeds for reduced fuel.

5.3 Financing Barriers

In terms of market barriers at the international level, the fundamental problem is "split incentives" between ship owners and charters, limiting the motivation of owners to invest in clean energy solutions for their shipping stock. As the costs and benefits do not always accrue to the investing party and hence savings cannot be fully recouped, especially following the collapse of the shipping boom in 2006, investors (especially banks and hedge funds) in the sector are highly risk adverse. Regulatory pressure is as yet insufficient to drive a faster rate of change. The current depressed oil prices have relieved pressure on operational cost increases.

The sector's growth could be even greater if the more than USD 550 billion in annual subsidies for fossil fuel and nuclear energy were removed. Subsidies perpetuate artificially low energy prices from those sources, encouraging waste and impeding competition from renewable energies.

Recent work by Lloyd's Register into wind power use for shipping asked "why a technology offering double-digit savings with short payback is not being adopted." Lloyd's found the limited financing of research and development, particularly for initial "proof of concept" technologies is a major factor, together with the concern of ship owners over the risk of hidden and additional costs, as well as opportunity costs of any renewable energy solutions.

For all technologies, it is evident that further trials are needed to validate initial cost-benefit estimates, resolve teething problems and optimize designs. In the current environment of low freight rates and high costs, measures with short payback periods are important.

Financing barriers are only magnified for SIDS, although at the domestic level the issue of split incentives is not prevalent with most owners also operating their own vessels. The marginality of most maritime operations combined with the high-risk operating environment has always meant accessing investment capital is difficult and expensive.

Without substantially increased ROI, there is unlikely to be sustained private sector interest in leading an industry shift. While there is substantial work on trade and trade incentives for SIDS, to date this has not been integrated with serious economic analysis of trade logistics. Several sources consider that Public-Private Partnerships (PPPs) in ship finance are part of the solution. However, while these sound attractive on paper, there is little guidance to date on how they work in practice and it appears the development of these is a complex process. Development banks could also play an important role in providing financing options to sustainable shipping in SIDS.

5.4 Visibility and Silo-ing

The shipping sector is seldom visible to the general public, resulting in less societal pressure on the industry to transition to cleaner energy solutions.

The large suggested savings from across the range of technology providers are not yet accompanied by substantial reality. It requires more than one or two vessels using solutions to convince the industry that the large investment will deliver a large return.

Significant advancements in the offshore and super yacht sectors have not been transferred into commercial shipping, unlike advancements of Formula One racing cars, which have led to significant advances in ordinary family car designs. This technology transfer has not occurred in a similar magnitude in commercial shipping.

There is a lack of reliable information on costs and potential savings from specific operational measures, which could lead ship owners to investigate but not implement them. The ship owners' perceptions of these barriers are highlighted in a Norwegian survey focused on their attitudes to safety and reliability, technical uncertainty, behavioural, market, financial and economic constraints, and complexity. The survey showed that operational measures (reducing speed, voyage optimisation, main engine improvements, drag reduction technology) are those that understandably appear most easily implemented. Fuel cells, wind, LNG and solar are identified as those with the highest barriers, however in practical terms the presence of a single barrier can 'set an obstacle high enough for the company that the technology might not be implemented'.

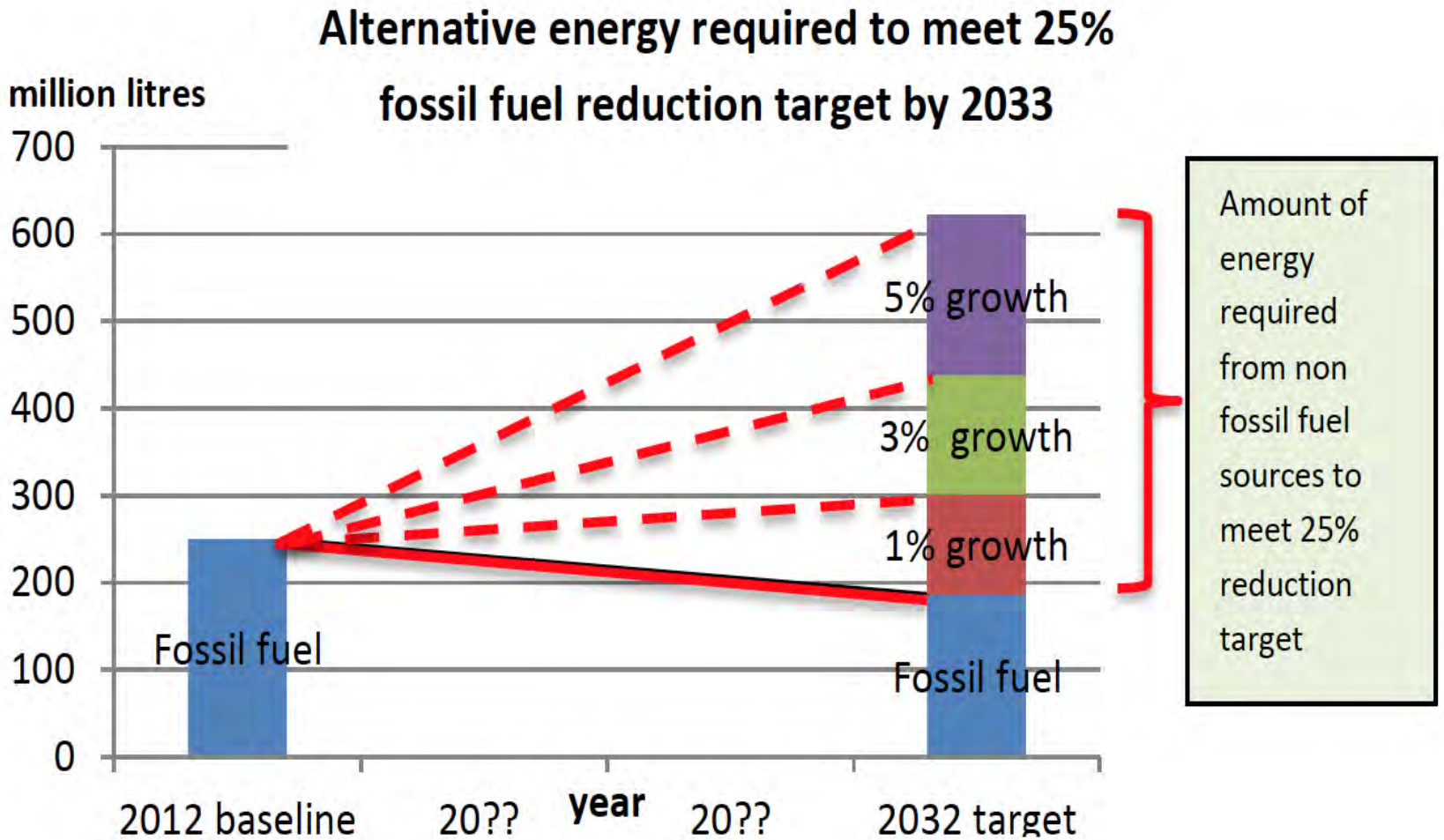
5.5 Conclusion

These barriers all need to be recognised before they can be overcome. For SIDS this requires capacity building in all aspects of domestic and international shipping levels, from transport planning, ship operations, and financing. Lessons can also be learned from the experiences of decarbonising the electricity sector, of which there are many examples across the SIDS. Action is needed at all levels, local, national, regional, and international,

if the required paradigm shift is to be achieved in time to ensure targets for global warming are met. SIDS are well placed to be a 'proving ground' for renewable energy technologies for shipping, but the barriers need to be addressed.

Chapter 5

Barriers for Sea Transport for SIDS


Alternative energy required to meet 25% fossil fuel reduction target by 2033
million litres
700
600
500
400
300
200
100
0
5% growth
3% growth
1% growth
Fossil fuel
Fossil fuel
2012 baseline
20??
year
20??
2032 target
Amount of energy required from non fossil fuel sources to meet 25% reduction target

Barriers to Uptake

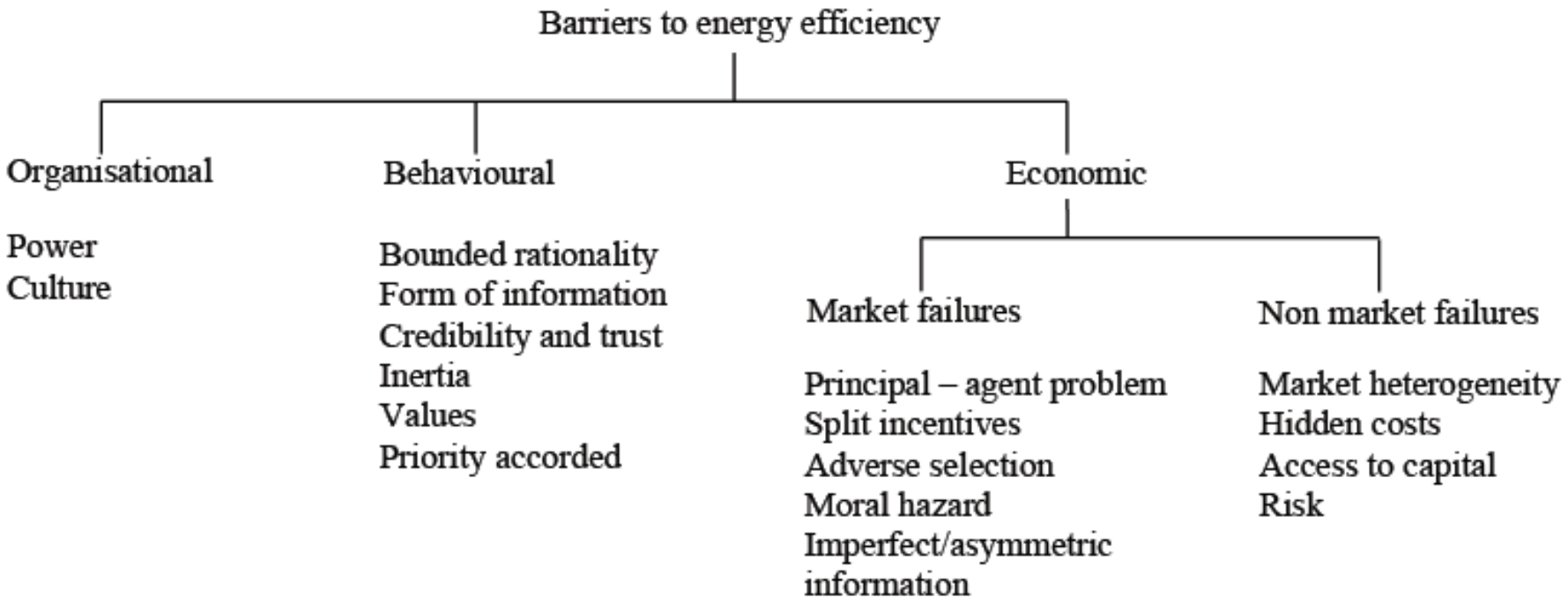
Pacific and International research identifies 4 critical barriers:

- Policy
- Perception
- Financing
- Visibility and silo-ing

Overcoming these requires:

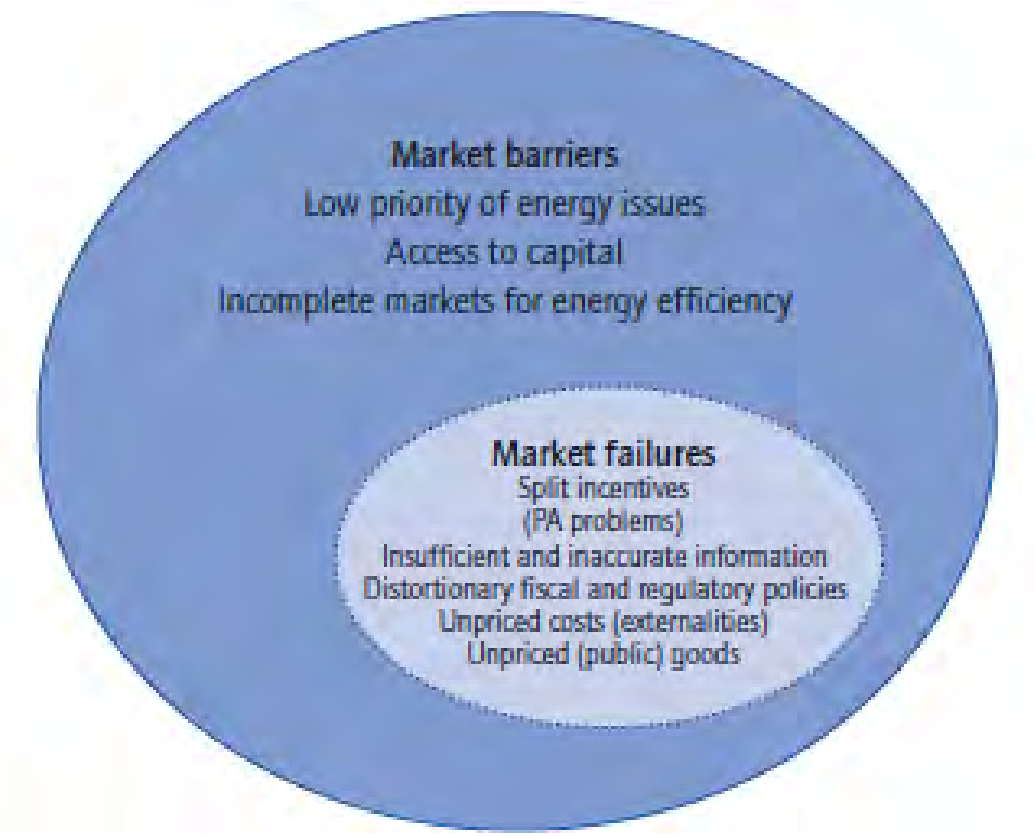
- visibility in currently empty policy spaces at all levels
- political leadership
- paradigm shift in financing mechanisms and resourcing research & development and proof of concept/practical trials
- coordinated implementation of structured regional and sub-regional programmes

Classification of Barriers



Source: Rehmatulla, Smith & Wrobel, 2013, Implementation Barriers to Low Carbon Shipping

Market Barriers and Market Failures Inhibiting Energy Efficiency Improvements

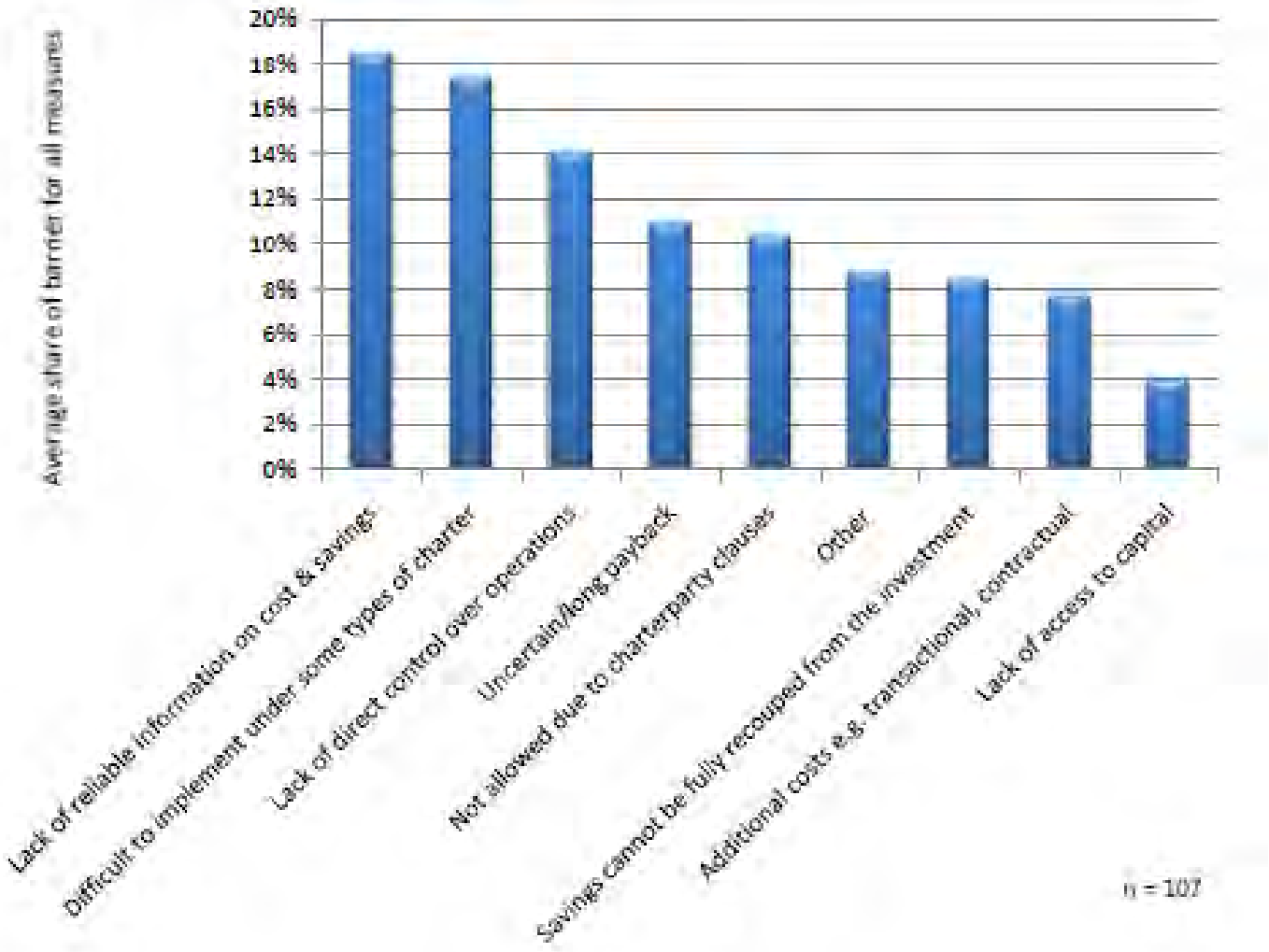


Source: International Energy Agency, 2007, Mind the Gap

Policy Barriers

- International
  - Disjunct between IMO/ICAO and UNFCCC processes
  - Self-regulation versus external regulation
- Regional
  - Lack of structured regional and donor/development partner frameworks and strategies
- National
  - Lack of visibility
  - Lack of capacity
  - Lack of co-ordination between transport, energy and climate change policies

Most Important Barriers Identified by Industry



Source: Rehmatulla, 2012, Barriers to Uptake of Energy Efficient Operational Measures

Perceptual Barriers

- Energy versus transport
- There are no solutions available
- Within the transport sector, land and urban are priorities
- Ships are the preserve of the Private Sector
- Sails are inefficient and slow

Most Cited Barriers per Energy Efficiency Operational Measure

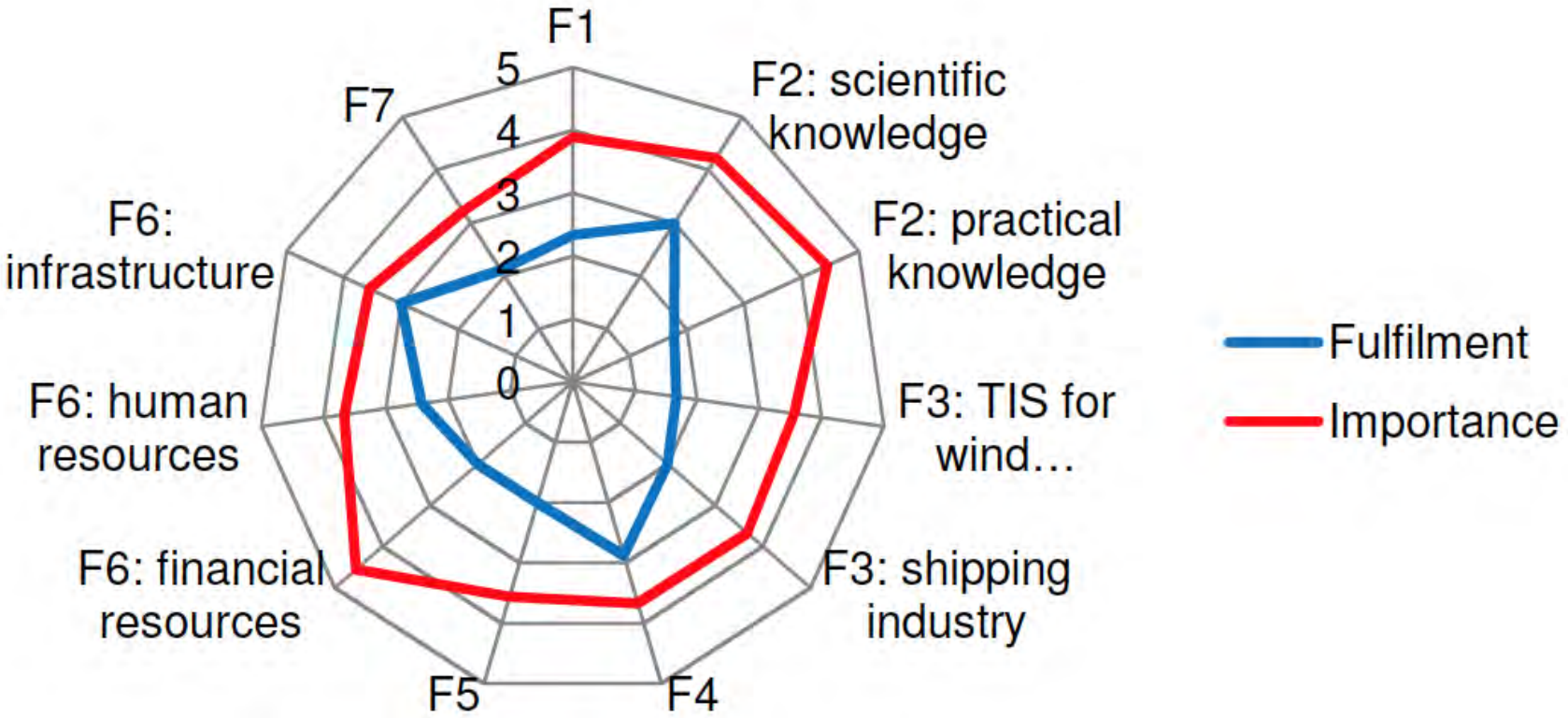
Barrier \ Measure	Weather routing	Autopilot adjustment	General speed reduction	Fuel consumption monitoring	Trim/draft optimisation	Speed reduction JIT arrivals	Raising crew awareness & training	Efficient voyage execution	Optimisation of ballast voyages
Lack of reliable information on cost & savings	24%	26%	5%	12%	28%	9%	20%	15%	16%
Savings cannot be fully recouped from investment	5%	11%	10%	10%	7%	5%	14%	5%	8%
Difficult to implement under some types of charter	15%	7%	30%	5%	19%	26%	7%	26%	23%
Lack of access to capital	5%	5%	2%	5%	3%	4%	6%	0%	6%
Additional costs e.g. transactional, contractual	10%	8%	10%	14%	6%	7%	9%	4%	8%
Uncertain/long payback	10%	14%	5%	24%	14%	6%	18%	4%	8%
Not allowed due to charterparty clauses	3%	5%	26%	0%	4%	24%	2%	18%	12%
Lack of direct control over operations	18%	13%	10%	14%	11%	18%	10%	18%	15%
Other	11%	11%	3%	17%	8%	3%	14%	11%	4%

Source: Rehmatulla, 2012, Barriers to Uptake of Energy Efficient Operational Measures

Financing Barriers

- Split incentives (ship owner & ship charterer)
- Lack of financial mechanisms for governments (e.g. tax & fiscal incentives)
- Limited financing for research and development
- Lack of donor/development partner policy

Overview of System Function Fulfilment based on Expert Survey

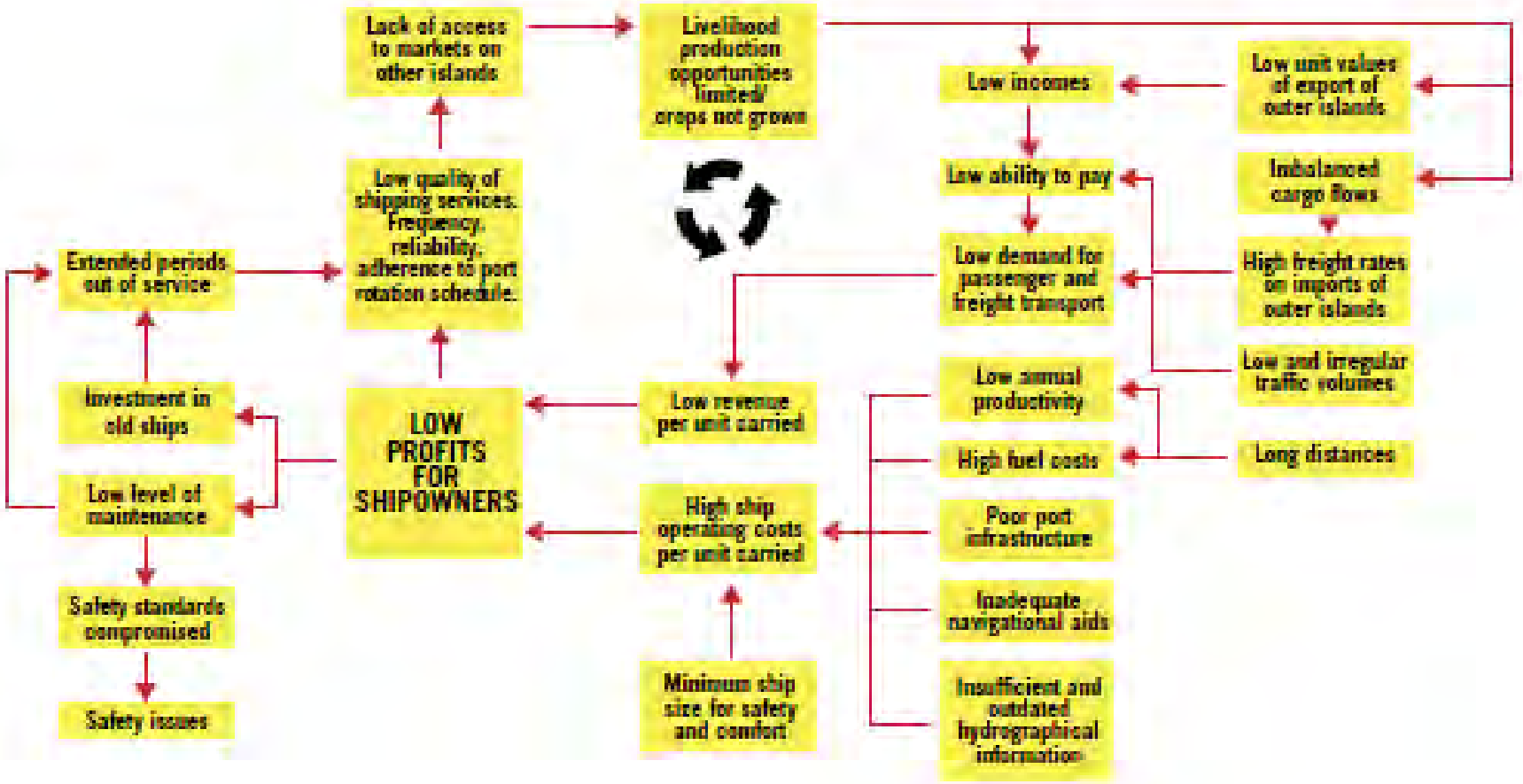


Source: Rojon, 2013, Blowin' in the Wind?

Visibility Barriers

- Shipping ‘out of sight out of mind’
- Lack of technology transfer to commercial sector
- Lack of information and proven commercial viability
- Need for ‘proof of concept’ and practical demonstration models

Links between Constraints and Consequences for Shipping in Pacific SIDS



Source: UNESCAP, 2013, Review of Developments in Transport in Asia and the Pacific

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