The Supply Chain Perspective on Slow Steaming

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Abstract

Slow steaming in container liner shipping has emerged since 2008 as a mean to reduce the operating costs and the CO_2 emissions of shipping companies. Slow steaming raised the interest of researchers who actively studied the concept in terms of speed reduction, fuel savings and CO_2 emissions, particularly from the shipping lines' side. However, there was a clear gap in research that investigated the impact of slow steaming on the shippers' supply chain performance. Therefore, the purpose of this paper is to investigate the impact of slow steaming on the supply chain performance metrics to determine whether its advantages are extended to benefit the supply chain or not. This study is exploratory using semi-structured interviews on a sample of 12 companies from 3 main sectors: manufacturing, imports/exports, and freight forwarders. Purposive sampling is applied as the companies chosen would be involved in imports/exports activities to/from Asia in which slow steam shipping is most likely to occur. The purpose of the semi-structured interviews would be to identify the impact of slow steaming on the supply chain performance metrics of the chosen companies and examine the extent to which the advantages of slow steaming are extended to their supply chains. The findings revealed that slow steaming did not have a radical impact either positive or negative on the supply chain performance metrics of the selected sample, with the exception of 'order lead time', 'total cycle time' and 'total cash flow'. The study recommends that shipping lines should take a more active role towards promoting sustainability that would support the positive engagement between them and their clients, thus creating a global sustainable culture.

Keywords: Slow steaming, sustainability, Egypt, supply chain, shippers,

1. Introduction

Supply chain management has traditionally been viewed as a process in which raw materials are converted into final products, and then delivered to the end-consumers (Beamon, 1999). The waste and emissions caused by the supply chain have become one of the main sources of serious environmental problems including global warming and acid rain (Kumar et al., 2012). The impact of business operations on the natural environment is one of the main areas in which societies and governments have become more sensitive. This consequently enforced companies to react to the challenges of green issues by implementing sustainable (or green) logistics and supply chain practices (Evangelista et al., 2010).

In the global supply chain, transportation is one of the most important logistics activities as well as one of the primary performance drivers of the supply chain (Chopra, 2007). Nevertheless, transportation is also one of the major sources of pollution in the form of greenhouse gases (GHG) emissions, which is a main contributor to global warming. Accordingly, the maritime transport sector which carries nearly 95% of global trade was forced to adopt new practices that would lower the negative impact of transport on the environment. One of these practices is slow steaming which emerged since 2008 in container liner shipping as a mean to reduce the operating costs and Carbon Dioxide (CO_2) emissions of shipping companies. But despite the financial and environmental benefits that slow steaming brings to the shipping market, supply chains have been impacted by such practice as lead time was lengthened, inventory increased, and production planning became more challenging.

Therefore, the purpose of this paper is to investigate the impact of slow steaming on the supply chain performance metrics to determine whether its advantages are truly extended to benefit the supply chain partners.

With a primary focus on shippers, this investigation would assist in determining the processes that are impacted by slow steaming and in proposing practices to maintain the required supply chain performance measures.

2. Literature Review

2.1 Sustainable supply chains and slow steaming

Environmental sustainability has been receiving growing interest over the years and many organizations have adopted the term in their vision and core values. According to Carter and Rogers (2008), the term sustainability refers to an integration of social, environmental and economic responsibilities. More precisely, green supply chain management (GSCM) is referred to as 'the achievement of economic, environmental, and social goals in the systemic coordination of key inter-organizational business processes to improve performance in the long-term for the organization and its partners in the supply chain' (Ageron, et al., 2012). Green supply chain (GSC) considers the environmental effect of the entire process of the supply chain (SC) from the extraction of raw material to the final disposal of goods (Emmett and Sood, 2010; Kumar and Chandrakar, 2012). Activities such as reducing packaging, using biodegradable materials and using more fuel efficient transportation are just very few examples of the different green activities being executed in a GSC (Emmett and Sood, 2010). From a GSC macro level, Evangelista et al. (2010), stated that logistics activities, especially transportation related activities, are the most important contributors to GHG emissions. The maritime transportation system was thus on the top list of the targeted sectors to be greened.

Maritime transport plays a key role in connecting markets by moving more than 90% of cargo to all parts around the world at a relatively low cost when compared with the value of goods being shipped (IMO, 2013; Yang et al., 2013). Therefore, the maritime transport became 'the most preferred mode of transport among importers and exporters for doing business especially for international trade' (Abdulrahman, 2012). Additionally, as global supply chain activities continue to expand around the globe with more activities being outsourced offshore, maritime transport not only secured the relatively low cost of transport but also reliability and competitive supply chain performance. As a result, containerized ocean freight became the lifeline of nearly any global supply chain (Fransoo and Lee, 2011; Harrison and Fichtinger, 2013).

In terms of green performance, the container shipping sector is facing the challenge of balancing between cost competitiveness and sustainability, as it is more pressured to respond to the increasing level of pollution caused by vessels (Yang et al., 2013). As a result, many shipping companies proactively developed environmental management systems, to reduce the environmental impact, reduce cost and improve corporate social reputation (Carter and Rogers, 2008; Woo and Moon, 2013). 'Slow steaming' emerged as the ultimate solution for shipping companies that would achieve the reduction of GHG emissions as well as the reduction of fuel costs (Kontovas and Psaraftis, 2011; Lindstad et al., 2011).

Slow steaming according to Woo and Moon (2012) is reducing the vessel's speed than the deliberately designed voyage speed, which necessitates more vessels to transport the same volume of cargo while maintaining the announced weekly service schedule. Slow steaming simply refers to the reduction of the vessels' speed from 27 knots to 18 knots, whereby the vessel's engine power is reduced to 42%, resulting in fuel savings up to 75% (Wiesmann, 2010). It is worth noting that the factors that encouraged the adoption of slow steaming was not only limited to responding to the sustainability requirements of the global supply chains, but was also to respond to the following: (1) the global financing crisis that caused a downturn in global economy, (2) the high fuel costs, (3) the increasing operating costs, and (4) the falling freight rates (Wiesmann, 2010; Armstrong 2013; Yin et al., 2013). The reduction of speed and the lower consumption of fuel, resulted in the reduction of greenhouse gases emissions (Cameron et al., 2010; Faber et al., 2010). According to Wiesmann (2010), 'for every ton of fuel saved, the industry reduces its CO_2 emissions by three tons, and the cylinder lubricating oil consumption of the main engine is reduced at almost the same percentages as the fuel, which also reduces solid particle emissions'.

The introduction of slow steaming raised the interest of researchers who examined the topics from different perspectives. Some researchers focused on studying the relationship between speed reduction and fuel savings,

for instance, Alvarez et al. (2010) attempted to optimize fuel and ship costs with regard to vessel speed and berth availability. Wang and Meng (2012) used historical operating data of a global shipping line to study the relationship between bunker consumption and sailing speed. They formulated a mixed integer nonlinear programming model to investigate the optimal speed and provided an efficient approximation method to obtain a nearly optimal solution.

Other researchers focused on examining the relation between speed reduction, fuel savings and CO_2 emissions. Cariou (2011) measured the rate of reduction of CO_2 for different container trades and estimated the bunker break-even price to attain the long term sustainability of this strategy. He found that reductions can only be sustained under the condition that the bunker price is at least $350–$400 for the main container trades. Ronen (2011) developed a cost model to study the optimal speed and the number of vessels needed to maintain a service frequency while minimizing the total cost, including bunker cost, vessel fixed cost and other operating cost. Psaraftis and Kontovas (2012) provided a taxonomy and survey of speed models, recognizing that vessel's speed is a key determinant to both shipping economics and environmental sustainability. Tai and Lin (2013) examined the GHG emissions of international container shipping carriers on the Far East-Europe routes using the slow steaming strategy and the daily frequency strategies. They concluded that both strategies are effective in reducing emissions. Woo and Moon (2013) also analyzed the relationship between voyage speed, the amount of CO_2 emissions, and the operating costs and focused on finding the optimal voyage speed as a solution to reduce emissions at the lowest operating cost possible to satisfy the reduction target of the International Maritime Organization (IMO).

2.2 The Impact of Slow Steaming on the Shippers and Consignees' Supply Chain

Shipping lines, freight forwarders or logistics service providers, have to satisfy shippers at one end and the consignees on the other through the provision of efficient and effective services (Lai et al., 2002). Added to these two requirements is sustainability and green performance that would meet the shippers/consignees green standards. However, the shippers/consignees' demand of 'clean' services and a lower carbon footprint would come at a price. Slow steaming would increase the transit times as well as the pipeline inventory costs (Bonney and Leach, 2010; Page, 2011). This longer transit time would require shippers/consignees to extend their forecast range which would affect its accuracy and would require a higher level of safety stock (Bonney and Leach, 2010; Dupin, 2011). Hailey (2013) quoted that "If the time costs for shippers and consignees are compared to the benefits of carriers due to slow steaming, one can see that slow steaming is most of the times not viable on a supply chain level…the costs for shippers and consignees are most of the times higher than the possible benefits for carriers." It is also worth noting that despite the savings made in the shipping lines' fuel costs, nothing of these savings have been passed to the shippers, as shipping lines did not lower their freight rates (Gallagher, 2010). This in return made shippers feel that the benefits of slow steaming are one-sided (Gallagher, 2010).

The review of literature on slow steaming confirmed Maloni et al.'s (2013) claim that academic literature addressed the advantages of slow steaming and focused on the carriers or the shipping lines. The review of literature showed that the three main variables that were investigated by the majority of slow steaming research were speed reduction, fuel savings and CO_2 emissions. Therefore, the gap in literature was apparent in the following aspects: (1) investigating the shippers or cargo owners' perspective on slow steaming as they are the key customers of shipping lines (2) examining the impact of slow steaming on the shippers' supply chain performance which include important metrics other than the (speed reduction, fuel savings and CO_2 emissions) which are the primary concern of shipping lines (3) The majority of research that addressed slow steaming were conducted in Asia, and none addressed the topic within the African or Middle Eastern settings.

3. Research Methodology

As previously stated, academic research on slow steaming addressed the advantages of slow steaming and focused on the carriers or the shipping lines, particularly focusing on the relation between speed reduction, fuel savings and CO_2 emissions. However, there was an apparent lack of research that investigated the impact of slow steaming on shippers/consignees who play a very important role in the shipping lines' supply chain, which

is the 'customer'. Shippers are the shipping lines' customers at one end, and the consignees are also the shipping lines' customers at the other. Therefore it was necessary to examine the impact of slow steaming on the shippers/consignees' supply chain using the supply chain performance metrics as a tool in order to determine whether the advantages of slow steaming is extended to benefit the supply chain or not.

This study is exploratory using semi-structured interviews on a sample of 12 companies from three main sectors: manufacturing, exports/imports firms, and freight forwarders. Purposive sampling is applied as the companies chosen would be involved in imports/exports activities to/from Asia in which slow steam shipping is most likely to occur. The purpose of the semi-structured interviews would be to identify the impact of slow steaming on the supply chain performance metrics of the chosen companies. The interviews were conducted by phone with logistics managers and/or operations managers. Each interview lasted approximately 30 minutes, where the interviewees had to answer thirteen questions about the impact of slow steaming on their companies' performance. In these interviews the researchers used Gunasekaran et al.'s (2004) supply chain performance measures framework which outlines thirty two measures divided into three main categories i.e. strategic, operational and tactical, in order to ask the interviewees about the impact of slow steaming on each of these measures. The interviewees in return had to indicate whether there was a positive change, a negative change or no change on these measures.

4. Research Findings

4.1 Basic information on the companies

The first part the of the interview focused on understanding the companies' main business, the activities in which the companies' are most likely to use container shipping (imports or exports) and the shipping lines that the companies' mainly deal with. The interviews were conducted with 5 manufacturing companies, 2 exports/imports companies and 5 freight forwarders. These companies use container shipping for both importing and exporting activities, where the manufacturing firms are most likely to import raw materials and export finished products, and where freight forwarders and the other exports/imports companies are most likely to use container shipping for importing supplies, spare parts or finished products. Table 1 shows the description of the participating companies in this research. It is worth noting that according to the confidentiality agreement with the interviewees, the answers or opinions which will be discussed in the following sections will not be specifically associated with the mentioned interviewees.

Table 1 – Description of Participating Companies

Company	Main Business	Activities used in container shipping	Shipping Lines
BMW	Car assembly	Importing	Maersk, Hapag-Lloyd, CMA-CGM
Mars	Confectionaries producer	Importing and exporting	Maersk, CMA-CGM, Seago line
Toshiba El Araby	Producer of home appliances and electronics	Importing and exporting	Maersk, CMA-CGM, APL
Samsung	Producer of televisions: LCDs, Plasma screens	Importing	CMA-CGM, Cosco
Alexandria Fiber Company	Producer of acrylic fibers	Importing and exporting	MSC, Yang-Ming
Sakr Globe	Importer and exporter of supplies	Importing and exporting	Maersk, Hapag-Lloyd
Egytronic	Importer of electronics	Importing	MSC, CMA-CGM
Egytrans	Freight forwarder and logistics services	Importing and exporting	MSC, CMA-CGM, Maersk
Tabadol Logistics	Freight forwarder	Importing and exporting	CMA-CGM, MSC, Maersk, Hamburg Sud
Transmisr	Freight forwarder and logistics services	Importing and exporting	MSC, Evergreen, Maersk, Arkas

Gulf Agency	Freight forwarder	Importing and exporting	MSC, Maersk, Seago
Integrated Solutions	Freight forwarder	Importing and exporting	CMA-CGM, Cosco, Seago

It was necessary to also ask the interviewees about whether their companies adopt a green or sustainable strategy before discussing the slow steaming issue. For the manufacturing companies, four out of the five companies have a sustainable strategy and are ISO 14001 certified. Most of them started the green strategy nearly 8 or 10 years ago due to their belief of the benefits that green practices would bring to their business and to their corporate image. One of the manufacturers even stated that his company is very strict on green practices especially with suppliers to whom the company plans weekly visits to inspect their operations and ensure that they are implementing the green regulations on which they have agreed. As for the exports/imports firms, they both do not have a green strategy but one of them indicated that it is a vision for the company to achieve within the coming years. All the freight forwarders stated that they have a green strategy which is mainly centralized on recycling activities and outsourcing gas operated trucks.

4.2 Slow Steaming in Action

In this part of the interviews, the questions focused on examining in more details how the shipping lines communicated the slow steaming initiative with the interviewed companies. More precisely, the questions focused on the following points: whether or not the shipping lines have notified them about slow steaming and how they described it, identifying any benefits of slow steaming on their supply chains, whether the shipping lines are providing them with information concerning emissions' savings, and their view on whether slow steaming would be sustainable over the long run or not.

All the interviewees stated that none of the shipping lines have notified them about slow steaming and none have explained or described the concept to them. One of the interviewees even stated that they just noticed that the regular duration of the shipping journey increased approximately 5 additional days without any justification from the shipping line. Another interviewee stated that he learned about slow steaming from reading an international shipping magazine and was surprised that none of the shipping lines they work with have taken the effort to explain to them as clients the concept of slow steaming.

The interviewees were then asked on whether their companies benefited from the fuel cost savings that slow steaming makes possible for the shipping lines by obtaining for example lower freight rates. All the interviewees stated that the freight rates did not change despite the implementation of slow steaming by the shipping lines. One of the interviewees explained that the shipping lines might have not been capable of passing these savings to them as clients because the shipping lines must operate more vessels on the same routes to compensate for the lower speed. Another interviewee claimed that some shipping lines like Maersk have made very high investments in the Triple E class of fuel efficient container ships which could be another reason for not passing the fuel cost savings to clients.

It was then important at this point to ask the interviewees on whether the shipping lines provide them with information on emissions savings that can allow them as clients to calculate their carbon footprint, since sustainability is one of the core reasons for the practice of slow steaming. Again, all the interviewees stated that the shipping lines do not provide the percentage of emissions saved although, according to one of the interviewees, it would be a great tool for all the parties involved to track their emissions' performance. One of the interviewees stated that due to the interest of his company in tracking its carbon footprint, he would check the shipping line's website for any published information on emissions savings. And according to his claim, the information provided is not always up to date, or specific to certain routes.

At the end of this part, the interviewees were asked about their opinion on the sustainability of slow steaming over the long run and three opinions prevailed. The first opinion was cynical, claiming that slow steaming will not be sustainable over the long run because the shipping lines are the only beneficiaries and none of the slow steaming benefits is truly extended to any of the other parties. This opinion was further supported by the claim that shippers are more concerned about lead time than about the savings made in the transport journey, whether

in costs or emissions. Thus, shippers would reach for regular or even faster mode of transport in order to decrease their lead time, consequently supporting their competitiveness. The second opinion was neutral, stating that the market is quickly changing and today's trend might not be suitable for tomorrow's market conditions. And the third opinion was positive, stating that with the rising concern of international organizations and governments around the world in setting international regulations for protecting the environment, would of course promote the sustainability of slow steaming in maritime transport.

4.3 The Impact of Slow Steaming on Supply Chain Performance

In order to get more precise details about the impact of slow steaming on the interviewees' supply chains, the researchers used the supply chain performance metrics framework by Gunasekaran et al. (2004) to indicate the change on performance whether positive, negative or no change. The performance metrics are divided into three main categories: strategic, tactical and operational. Table 2 shows the impact of slow steaming on the supply chain performance metrics of the selected sample of companies.

Table 2- The Supply Chain Performance Metrics Framework

Level	Performance Metric	Impact		
		Positive	Negative	No Change
Strategic	Level of customer perceived value of product			12
	Variances against budget			12
	Order lead time		9	3
	Information processing cost		1	11
	Net profit Vs productivity ratio			12
	Total cycle time		6	6
	Total cash flow time		6	6
	Product development cycle time		3	9
	Range of products and services		3	9
	Flexibility of service system to meet customer needs		3	9
	Effectiveness of enterprise distribution planning		1	11
Tactical	Customer query time			12
	Accuracy of forecasting techniques		2	10
	Planning process cycle time		2	10
	Order entry methods			12
	Human resource productivity		1	11
	Supplier delivery performance		1	11
	Supplier lead time against industry norm		2	10
	Supplier pricing against market			12
	Efficiency of purchase order cycle time		1	11
	Efficiency of cash flow method		1	11
	Percentage of defects		1	11
	Cost per operation hour		1	11
	Capacity utilization		1	11
	Utilization of economic order quantity		1	11
	Effectiveness of delivery invoice methods			12
	Percentage of finished goods in transit		5	7
Operational	Quality of delivered goods			12
	On time delivery of goods	1	5	6
	Percentage of urgent deliveries		1	11
	Information richness in carrying out delivery		1	11
	Delivery reliability performance	1	1	10

Source: Adapted from Gunasekaran et al. (2004)

The previous table clearly shows that the impact of slow steaming on the sample of the companies chosen is either negative or no change. The majority of the supply chain performance measures in the strategic level were almost not impacted by slow steaming with the exception of 'order lead time', 'total cycle time' and 'total cash flow time' which were negatively impacted. This negative impact is caused by the slower speed that resulted in the longer duration of the shipping journey that increased the lead time, consequently impacting the total cycle time and the total cash flow time. On the tactical level, the majority of the supply chain performance measures were also not significantly impacted by slow steaming.

Slow steaming had a positive impact on only two supply chain measurement indicators in the operational level for only one company: 'on time delivery of goods' and 'delivery reliability performance'. The interviewee stated that the service schedule of some shipping lines actually became more reliable after implementing slow steaming, and this is the reason for the positive impact it had on these two measures.

Therefore, it can be concluded that slow steaming does not have a radical impact whether positive or negative on the supply chain performance measures of shippers/consignees.

5. Conclusions and Recommendations for Further Studies

This research examined the much discussed topic of slow steaming from the shipping lines' customers' perspectives. Academic literature was found to have a notable gap in research that addressed slow steaming from the shippers' perspective – particularly within the African and Middle Eastern regions - and its impact on their supply chain performance and this research was an attempt to fill this gap. Through the semi-structured interviews, it was found that shipping lines did not engage their clients in the process of implementing slow steaming. This negligence of engagement could only be justified by their fears of facing resistance from clients especially that the regular shipping journey increased from 5 to 10 additional days which of course directly impact the clients' lead time as it was shown in the result of the study. However, since the main trigger for slow steaming is environmental sustainability, shipping lines must think of methods and strategies to convince their clients and partners about the importance of slow steaming and the benefits that everyone would gain, in order not appear that slow steaming's benefits are one-sided which could result in customers' dissatisfaction. In terms of supply chain performance, the study showed that it cannot be claimed that slow steaming negatively impacted the shippers' supply chain performance as many metrics were not affected either positively or negatively. A larger sample and quantitative measures of supply chain performance would give more insights into the impact of slow steaming on the shippers' supply chain performance.

Further research would be recommended to further investigate the impact of slow steaming on the quantifiable measures of green supply chain performance and its different processes. More research is also encouraged within the African and Middle Eastern regions as it involves a significant amount of imports/exports activities to/from Asia in which slow steam shipping is most likely to occur.

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