Reverse Supply Chain of Ship Recycling: Marketization and Operationalization

Juliana Hsuan (jh.om@cbs.dk)
Copenhagen Business School, Dept. of Operations Management

Cristiana Parisi
Copenhagen Business School, Dept. of Operations Management

Abstract
Ship recycling refers to the process of tearing down vessels with the goal of reusing the components. This paper treats ship recycling as an economic activity, contextualizing it in accounting and operations management debates about the economization of markets and the assessment of value. Through qualitative research, a map of reverse supply chain of ship recycling and key activities of the stakeholders are portrayed. Preliminary findings show that there are conflicts of interest in the valuation of ship recycling by the stakeholders. Moreover, standards and regulations have not been able to fully embrace the social aspects in the developing countries.

Keywords: Reverse supply chain, Ship recycling, Marketization

Introduction
Ship recycling refers to the process of tearing down vessels with the goal of reusing the components, particularly the iron and steel. One particular process in ship recycling is ship breaking, the dismantling of obsolete vessel's structure for scrapping or disposal (Demaria, 2010). As a result, of the recent financial crisis, the world fleet has reached overcapacity due to a decrease in goods shipped across the world. This leads to more ships being decommissioned and scrapped (Ko et al., 2015), as evidenced by the surge of ship breaking activities (Saraff et al., 2010). Despite regulations and new conventions for ship breaking, the majority of ships are dismantled in South Asia (Devault et al., 2016), where ship breaking facilities often offer cheap and unsafe environments.

This paper treats ship recycling as an economic activity, contextualizing it in accounting and operations management debates about the economization of markets and the assessment of value. Evidence shows that for manufacturers the substitution of secondary for primary materials is not a straightforward process, as poor-quality materials from secondary material will threaten the tradability of the primary good and the reputation of that manufacturer (Desrochers, 2002). This leads to another consideration: that secondary resource reuse, while technically possible, is always dependent upon a socio-technical decision. Paying attention to secondary materials is not just important to the economization of recycling. When economic activities are concerned with the destruction of complex things and allied materials recovery, the definition of the values involved is necessarily complex. This is mainly calculative devices struggle to stabilize

the valuation process that presents a number of possible outcomes. In the economization of secondary materials recovery from discharged materials, the calculative task is the challenging one of how to transform estimated and animate multiples (end-of-life things) into stabilized goods (plural), that is, materials that can be traded in markets (Callon, 2016). Hence, our main research questions are: How can the economic activities be captured in value assessment of ship recycling? To what extend can regulations impact the shipbreaking industry?

We draw theoretical foundation from the following literatures: sustainability (e.g., Alexander, 2005; O'Neill, 1998), performance management and calculative devices (e.g. Callon et al., 2002; Callon and Muniesa, 2002), and reverse supply chain (e.g., Sarkis et al., 2010; Govidan et al., 2015). Our aim is to investigate the implementation of recycling, which rests on the re-qualification of end-of-life, or spent, things and their constituent materials. The question posed by the internalization of what was formerly externalized, then, is one of economization, namely how to make markets of and from spent things, or how to turn unwanted material into products and tradable goods (Callon, 2016).

The paper contributes to the literature on marketization and reverse supply chain. Recycling is a practice of governing waste with the relative behaviors and practices (Bulkeley et al., 2007). The sustainability literature lacks in-depth research about the economic side of secondary resource recovery. While the relevance of recycling is widely addressed in the industrial ecology literature, the focus is mostly on closing materials loops and on the principles and policies (Desrochers, 2002). This paper focuses on the 'economization' of recycling (Callon, 2016) and provides an innovative analysis of the implications of dealing with ship recycling different settings: the OECD countries and the emerging countries.

The paper is organized as follows. In the following section, literature review on sustainability, reverse supply chain, marketization and economization is provided. This is followed by the research methodology. Next, the preliminary findings of our analysis on ship recycling industry is described. The paper ends with discussion, limitations and future research.

Literature Review

Sustainability and Reverse Supply Chain

Sustainability is a broad concept embracing general policy areas such as economic and social development as well as environmental protection. It highlights the importance of distribution of resources across time (Bansal and DesJardine, 2014). In the traditional forward supply chain charts the transformation of raw materials into goods and sold to the end consumers. In the reverse supply chain, the starting point is the end consumer with the end-of-life (EOL) products and waste, ending with the disposal management. The management of reverse supply chain includes five tasks (Guide and Wassenhove, 2002): product acquisition, reverse logistics, inspection and disposition, reconditioning, and distribution and sales.

Marketization and economization

A Triple Bottom Line (TBL) accounting which incorporates aspects related to environmental, social and economic aspect has been proposed as a mean to achieve the goal of evaluating sustainability (Garriga and Melé, 2004). The well-known expression of TBL was presented in 1994 by Elkington (1997), in an attempt to provide a way to expand the environmental agenda. The concept included social justice, in addition to economic prosperity and environmental quality, a pillar which previously had been neglected (Elkington, 1997). In this way the concept of "value" within sustainability has

broadened. The TBL concept recognizes that corporations need to focus on the combined total value they add (or reduce) within the economic, social and environmental dimension. In order to calculate the financial value of economic, environmental and social externalities, these have to be converted into monetary value. In the TBL concept the framework of sustainability accounting is used to account for these financial values (Richardson, 2004). Based on this view, we conceptualize the definition of value in the context of sustainability as the result of the creation of a market in which multiple dimensions of value are considered (Callon and Muniesa, 2002).

However, the practice of sustainability accounting cannot be seen as a panacea and the concept has received critics from various authors. Richardson (2004) emphasizes that the danger of sustainability accounting is that environmental and social issues that are not quantifiable may be overlooked by the measurement devices and that there will be a narrow focus on items that can be quantifiable. Monetary value may also not be appropriate for some environmental and social functions, as they are not able to capture the complexity of these systems (see Bebbington, 2001; Richardson, 2004). Moreover, the literature suggests that operational boundaries for the sustainability impacts are not easily established, meaning that the responsibilities of the externalities are not clear (Bebbington and Larrinaga, 2014). Another issue arises from the attempt to convert social and environmental impacts into financial impacts. Creating a shared currency implies that economic, social and environmental implications can be traded off, within the category and across the categories (Richardson, 2004). This implication is in the heart of the debate regarding weak versus strong sustainability (Schaltegger and Burritt, 2000). Weak sustainability sees natural resources and human/human-made capital as substitutes. Degradation of the natural environment is seen as acceptable if it can be compensated with human/human-made capital. Strong sustainability, on the other hand, takes a broader perspective and argues against the substitutability and that non-renewable resources should be preserved (Schaltegger and Burritt, 2000). A second concern is the inter-generational equity which has steamed debate regarding intra-generational equity (Schaltegger et al., 2003). In addition Henriques (2004) has criticized the concept of TBL for being too focused on the short-term, only measuring performance in specific periods rather than embracing long-term indicators. The literature suggests a more systematic, 'whole system' approach to sustainability accounting; "we need to take a step back and search for the 'qualitative' processes of a sustainable system, such as diversity, learning, adoption and self-organization" (Richardson, 2004, p. 44). Similarly, Henriques (2004) advocates that diversity is a significant qualitative characteristic of sustainability, and encourages corporations to focus on environmental diversity and social diversity among other concepts.

The win-win paradigm limits the scope of potential corporate responses to sustainable development, by constraining the corporations' initiatives and strategies to the sphere of profit maximization. Acknowledging the tradeoffs the authors argue, greater positive contribution to corporate sustainable development could be achieved. As few environmental and social assets can be quantifiable and monetized, together with the lack of distinct operational boundaries, other control mechanisms must be introduced in order to draw attention to these assets' value rather than only to companies' profit lines (Hahn and Figge, 2011; Hahn et al., 2010). Gabel and Sinclair-Desgagné (1993) argue that organizational failures exist alongside market failures, as environmental assets are allocated within the firm.

Research Methodology

The research design of this is paper is qualitative. The paper is exploratory research, and in order to arrive at the operationalization of value in ship recycling from reverse supply chain perspective, we carried out the research in the following steps: conduct a literature review on ship recycling, map the supply chain of ship recycling, identify the key stakeholders, identify key activities of the stakeholders, and investigate the operationalization of value.

We performed in-depth interviews with ship owners, ship recycling companies, and non-governmental organizations. We had two rounds of in-depth interviews (in April of 2017 and March of 2018, each lasting 3 hours) with an expert in International Hazardous Material Association, who is also a technical expert of IMO. We had two in-depth interviews with NGO Shipbreaking Platform, in March 2018, each lasting around 2 hours). All interviews were recorded and transcribed. The mapping of the supply chain was checked by the interviewed experts for validation and feedback.

Moreover, we also relied on secondary sources, such as company and industry reports, internal and official presentations of various stakeholders in the ship recycling industry both in Europe and in India and sustainability reports.

Mapping of Ship Recycling Supply Chain

More than 80% of international trade of goods by volume is transported by sea (Demaria, 2010). Ships are mostly owned and used by developed countries, but are often demolished in developing countries. On average, as much as 3.3 million tons of steel per year are scrapped globally (Jain et al., 2015), lead by Bangladesh, India and Pakistan, see Figure 1 (NGO Shipbreaking Platform, 2017).

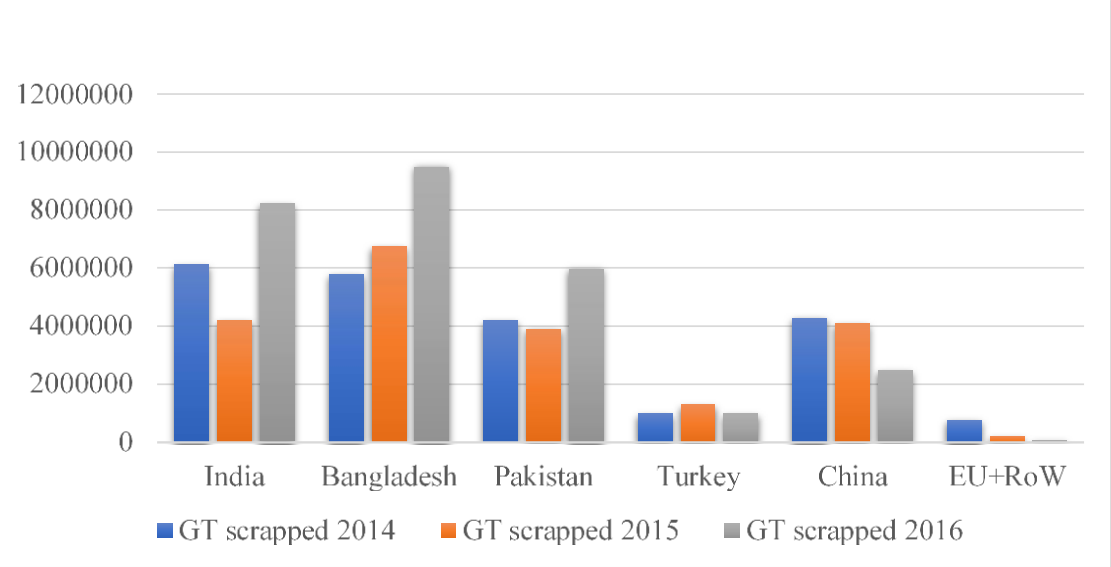

Figure 1. Ships scrapped in gross ton.

One of the unknown factor in ship recycling is to be able to determine the quality of inputs of the ships and potential for contamination beforehand (Gregson et al., 2013). It has been estimated that the number of ships that will be dismantled in India, Pakistan and Bangladesh will continue to grow. Shipbreaking in these countries is attractive for many reasons, such as low labor costs, loose enforcement of laws, etc. There has been a handful of cases where shipbreaking is 'not green' for not following IHM regulations. In order to

mitigate sustainable ship breaking, or to promote 'green shipbreaking', maritime organizations and the EU are devising guidelines for ship owners to be more aware of the shipbreaking process and its serious shortcomings.

There are different methods applied in ship recycling including: beaching, landing, alongside, and dry dock. According to John et al. (2014), around 60-70% of vessel components can be recovered, with 1%-10% being toxic or contaminated. There is a huge secondhand market for equipment such as air compressors, generators, pumps, engine, incinerator, etc. There is still the problem associated with the fact that most of the scrapped components have marginal market value as well as on how and where the scrap can be supplied to extract maximum benefit while protecting the environment and ensuring human safety. The value chain of ship breaking and recycling is illustrated in Figure 2.

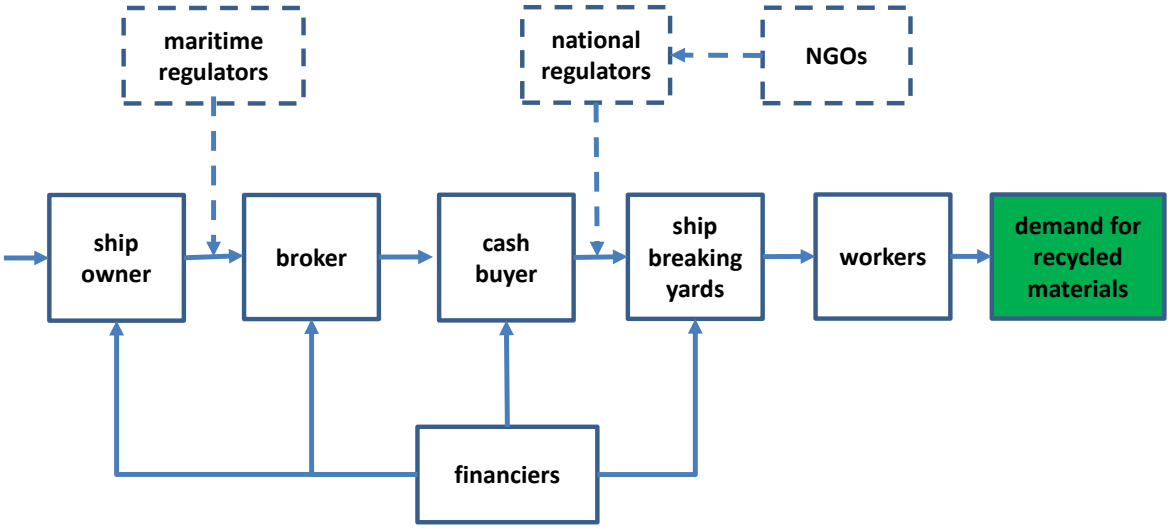

Figure 2. The supply chain of ship recycling.

Ship owners

Ships can have a lifecycle of 25 years and when it reaches its EOL, it is sold to a third party (often a broker or cash buyer) for recycling. Ships will always have a positive market value, even at its EOL, since about 95% of a ship can be reused, scrapped, or recycled. Consequently, ship owners are incentivized to sell the EOL ships to the highest bidder.

Regulations

Regulations such as Basel Convention, Hong Kong Convention, and IMO Guidelines promote and enforce sustainable ship recycling. Basel Convention is one of the first agreements that lead to stricter regulations in ship recycling. It dictates that hazardous material cannot be moved to outside the OECD countries, but its full enforcement has been difficult to control. For instance, within the Basel Convention, EOL ships are both ships and hazardous waste, which means that when defined as ships, they can legitimately sail to non-OECD countries (Gregson et al., 2013). Hong Kong Convention (HKC),

adopted in 2009, focuses on safe and environmentally sound ship recycling practices, covering the entire life span of a vessel from design, construction, operations, to dismantling, hence termed 'craddle to grave' approach. EU Regulation follows the HKC with respect to periodical survey, reporting obligations, and certification processes (Moncayo, 2016). Although HKC and EU legislation's efforts, there are no examples or cases on how to prepare the ship-specific recycling plan (Hiremath et al., 2016). Current practices including re-flagging before scrapping, making monitoring difficult (Moncayo, 2016).

Brokers

Ships are sold through brokers and cash buyers, renamed and reflagged in open registers, where there are poor jurisdictional control over vessels flying their flags (Moncayo, 2016). Brokers and cash buyers are intermediaries between ship owners and ship breaking yards. Brokers are cash agents. Tasks carried out by the brokers include, for instance: registration documents, evaluation of vessels, and process the regulatory, linguistic, technical and shipping trends (Crang et al., 2013).

Cash buyers

Cash buyers are often regarded as service providers for the owner (or even owners), as they take care of the entire ship demolishing on behalf of the ship owner. Cash buyers pay cash for the ships, hence the name. They are able to articulate between multiple regimes of valuation based on the different stakeholders involved such as ship breakers, shipping operators, vessel owners, and banking institutions (Crang et al., 2013). The two largest cash buyers (from India) offer green recycling.

Financers

The financers provide credit and loans to brokers, cash buyers, and shipbreaking yards. There is risk that brand and financial value of the financers are hurt if they give loans to a questionable loaner.

Shipbreaking yards

According to NGO Shipbreaking Platform (2017), over three quarters of the EOL ships are demolished in shipbreaking yards in Indian subcontinent, under unsafe environment and poor conditions. After the ship is sold, ship owners often are not aware of (or don't care) about how the ships are being demolished and under what environmental and labor conditions, especially if it takes place in Indian subcontinent. The shipbreaking and recycling methods differ in countries. In India, for instance, beaching is the preferred method. India has the largest ship recycling industry in the world, responsible for nearly 47% of all EOL vessels recycled annually (Hiremath et al., 2016). Alang has approximately 160 active recycling yards engaged in recycling more than 350 ships annually, equivalent of approximately 2.7 million tons of recycled steel (Hiremath et al., 2016). The different methods affect the prices offered to the EOL ships. Green ship yards tend to be more expensive. There are service providers that helps the shipyards to improve their processes with the goal to get Hong Kong Convention ratified, particularly at Indian shipyards.

National Regulators

National regulators are responsible for implementing national and international regulations, such as enforcing taxes on ship owners and other relevant companies as well as to enforce better and more responsible recycling methods. Government has certain

responsibility towards communities and society, and as such, national regulators are keen on interfering and finding a balance between the freedom of ship owners and other stakeholders and the risks imposed on the society.

Non-Governmental Organizations (NGOs)

NGOs are coalition of environmental, human rights and labor rights organizations working to promote safe and environmental sound ship recycling globally. The goal of NGO Shipbreaking Platform, for instance, to prevent toxic end-of-life ships from being beached in developing countries. Its coalition includes NGOs based in largest shipbreaking countries and advocates on a national, European and international level for a safe and environmentally sound ship recycling policy.

Workers

The actual labor process of dismantling ships is shaped by a host of factors, including the physical geography of the coastal zone and the availability of labor and machinery. Alang in India, for example, is located on what is considered to be the best continental shelf in all of Asia available for shipbreaking, as the 10-m tide makes it possible to accommodate big ships while the coast's vast intertidal zone makes it well situated for shipbreaking activities—ships can be run aground high up the beach and so remain exposed to workers for longer periods of time. In China, on the other hand, ships are typically broken up in docks using large-scale machinery, largely because Chinese workers will not tolerate the poor conditions and low wages found in places such as India and Bangladesh, and so breakers have sought to modernize their operations with labor-saving technologies (Minter, 2011). Chinese shipbreakers are also seen to employ greener technologies, which can give them an edge with some consumers who demand this (Puthucherril, 2010). Finally, profit rates can vary quite considerably—about 16% per ship in Bangladesh in 2009 compared with only about 3% in Pakistan (Sarraf et al., 2010), for instance.

As the workers dismantle the ships to extract all useful material, salaries varies depending on the country's labor rights and supply of ships, and relatively low in India and Bangladesh. Approximately 70% of the labor force employed at a single yard in Alang, India, is engaged in cutting of plates (Hiremath et al., 2016). It has been estimated that on average 1.8 man days would be required to dismantle one light displacement tonnage (LDT) of a given ship, equivalent to one ton of the ship, excluding general cargo, fuel, water, ballast, stores, passengers, crew, but with water in boilers to steaming level (Hiremath et al., 2016). In subcontinent India, it is also a common practice that workers and their families buy furniture and recycled materials after disassembly. It has been reported that ship owners and ship breakers have obtained large profits by dumping the environmental costs on workers, local farmers ad fishery. In Bangladesh, despite labor exploitation, environmental and human right violations, the ship breaking industry is a vital source of income and livelihood for a significant portion of the population (Alam and Faruque, 2014).

Demand for recycled materials

The demand for recycled materials is highly dependent on the scrap prices paid for the vessels. India, Pakistan and Bangladesh have highest scrap prices for containers and tankers, followed by Turkey and China.

In addition to how location and the availability of labor can affect how a ship is broken up, what the metal from the ships is used for is a reflection of the end-users it supplies and can shape how the operation is organized and spatially tied to its customers. Hence, in the case of Bangladesh, the fact that the country does not have any iron mining to meet

its national needs for steel means that the shipbreaking industry is crucial to supplying metal to the local market in a way that is not the case in some other countries with shipbreaking industries. Thus, although in the mid-2000s breaking yards supplied about 80–90% of Bangladesh's steel, in India they accounted for only about 15% of that country's total steel consumption (Hossain and Islam, 2006). However, the fact that Indian shipbreakers were selling metal recycled from ships at about half the cost of regular blast furnace-produced steel (Rousmaniere and Raj, 2007) meant that the yards supply were constantly pressuring them to generate ever larger amounts—an specific example of how the demands of a downstream supply chain can shape the activities of an upstream one. End users in China have likewise been reshaping how shipbreaking operations are structured geographically in quite dramatic ways in recent years. In particular, the country's dramatic need for steel for construction and manufacturing led Chinese customers to pay higher prices for recycled metal which, in turn, encouraged Chinese breakers to offer higher prices for ships, with the result that fewer have been going to India. Furthermore, Indian government reductions in import tariffs for steel in the early 2000s, combined with the higher costs associated with the rather anachronistic demolition methods employed by Indian shipbreakers, meant that many Indian steelmakers began to import scrap metal rather than using steel coming from the shipbreaking yards of Alang (Basu, 2004).

Preliminary Findings

The initiatives to regulate ship recycling might induce negative effects on the ship breaking and recycling industry (SBRI). Hong Kong Convention, for instance, restricts the beaching method for shipbreaking; a method widely applied in many South East Asian countries. There are a great number of small family business in SBRI. Standards and regulations have not been able to embrace the social aspects in the developing countries, especially when various industries and hence jobs are depended on the SBRI. However, regulations are vital in influencing how SBRI can sustained, especially in reducing the number of loopholes and minimizing the opportunistic practices. Ratification of the Hong Kong Convention is the closest activity in making SBRI more sustainable.

By internalizing wastes or objects previously considered externalities, we investigated the relevance of calculative devices. Within the ship industry, materials recovery is quite critical due to the heavy pollutants and the difficulties related to the attribution of a certain value to recycled materials. Hence, assessment of the values involved and measurement issues become critical activities, as it critically influences in creating a business case for the activity, and the considerable economic impact of the activity for companies due to the increasingly high societal pressure on sustainable ship recycling.

Value

The notion of value is subjective and degree of effort in providing value in the supply chain differs, as it is influenced by the tradeoffs and combinations of financial value and sustainable value of individual stakeholder. As the market demand changes, so does the price(s) related to transactions fostering the sustainable practices. There are conflicts of interest in the valuation of ship recycling by the stakeholders. In India, for instance, the economic value of ship breaking on a national level is of higher importance than environmental and social impact on a local level (Demaria, 2010).

According to Moncayo (2016, p.308), "Despite the polluter pays principle, the obligation to ensure the environmentally sound management of ships has been shifted from the "State Of Export" and the shipowner (polluter) to shipbreaking states." The process of capturing value contains a great deal of tacit knowledge (e.g., every vessel is

unique), making generalization and the evaluation of potential profits difficult (Gregson et al., 2013). Potential areas for making a change in the value of the recycling process can be, for instance: 1) To include ship recycling requirements already in the ship design stage, where all materials, quality of steel, cables, IMH are in conformance with Hong Kong Convention, and 2) Lobby value-based compromises that are economically and financially attractive to all the stakeholders. This process implies a closer operationalization of monetization of value and its implication for OPEX and CAPEX.

Conclusions and future research

This exploratory and qualitative research we provided a map of the ship recycling supply chain with its stakeholders and key activities. We found that standards and regulations, such as HKC and intervention by NGOs, have not been able to embrace the social aspects in the developing countries, especially when various industries and hence jobs are depended on the SBRI. We also found that the notion of value is influenced by the tradeoffs and combinations of financial value and sustainable value of individual the stakeholder. Our future research will seek to evaluate and measure value with respect to marketization and operation activities.

Acknowledgments

This research is funded by the project "Green Shipping – Governance and Innovation for a Sustainable Maritime Supply Chain", partnership between UBC Sauder School of Business and Copenhagen Business School.

References

Alam, S. and Faruque, A. (2014), "Legal regulation on the shipbreaking industry in Bangladesh: The international regulatory framework and domestic implementation challenges", *Marine Policy*, 47: 46-56.

Alexander, C. (2005), "Economic valuations and environmental policy", in J. Carrier (Ed.), *Handbook of Economic Anthropology*, Cheltenham: Edward Elgar, pp. 455–471.

Bebbington, J. (2001), "Sustainable development: A review of the international development, business and accounting literature", *Accounting Forum*, 25(2): 128-157.

Bansal, P., and DesJardine, M.R. (2014), "Business sustainability: It is about time", *Strategic Organization*, 12(1): 70–78.

Callon, M., (2016), "Revisiting marketization: from interface-markets to market enhancements", *Consumption Markets and Culture*, 19(1): 17-37.

Callon, M., and Muniesa, F. (2005), "Peripheral vision: Economic markets as calculative collective devices", *Organisation Studies*, 26(8): 1229–1250.

Callon, M., Mèadel, C., and Raberharisoa, V., (2002), "The economy of qualities", *Economy and Society*, 31(2): 194–217.

Crang, M., Hughes, A., Gregson, N., Norris, L. and Ahamed, F. (2013), "Rethinking governance and value in commodity chains through global recycling networks", *Transactions of the Institute of British Geographers*, 38: 12-24.

Demaria, F. (2010), "Shipbreaking at Alang-Sosiya (India): An ecological distribution conflict", *Ecological Economics*, 70: 250-260.

Desrochers, P. (2002), "Industrial ecology and the rediscovery of inter-firm recycling linkages", *Industrial and Corporate Change*, 11(5): 1031–1057.

Devault, D.A., Beilvert, B. and Winterton, P. (2016), "Ship breaking or scuttling? A review of environmental, economic and forensic issues for decision support", *Environmental Science and Pollution Research*, 24: 25741-25774.

Elkington, J. (1997), *Cannibals with Forks - The Triple Bottom Line of the 21st Century Business*, Oxford: Capstone Publishing Limited.

Gabel, H.L. and Sinclair-Desgagné, B. (1993), "Managerial incentive and environmental compliance", *Journal of Environmental Economics and Management*, 24: 229-240.

Garriga, E. and Melé, D. (2004), "Corporate social responsibility theories: Mapping the territory*", Journal of Business Ethics*, 53: 51-71.

Govindan, K., Soleimani, H. and Kannan, D. (2015),"Reverse logistics and closed-loop supply chain: A comprehensive review to explore the future", *European Journal of Operational Research*, 240(3): 603–626.
Gregson, N., Watkins, H. and Calestani, M. (2013), "Political markets: recycling, economization and marketinzation", *Economy and Society*, 42(1): 1-25.
Guide, V.D.R. and Wassenhove, L.N.V. (2002), "The reverse supply chain", Harvard Business Review, 80(2): 25-26.
Hahn, T. and Figge, F. (2011), "Beyond the Bounded Instrumentality in Current Corporate Sustainability Research: Toward an Inclusive Notion of Profitability", *Journal of Business Ethics*, 104: 325-345.
Hahn, T., Figge, F., Pinkse, J. and Preuss, L. (2010), "Trade-offs in corporate sustainability: You can't have your cake and eat it", *Business Strategy and the Environment*, 19: 217-229.
Henriques, A. (2004), "CSR, sustainability and the triple bottom line", in: A. Henriques and J. Richardson (Ed.), *The Triple Bottom Line - Does It All Add Up?*. London: Earthscan, pp. 26-33.
Hiremath, A.M., Pandey, S.K. and Asolekar, S.R. (2016), "Development of ship-specific recycling plan to improve health safety and environment in ship recycling yards", *Journal of Cleaner Production*, 116: 279-298.
John, J., Kumar, S., Singh, K.N. and Srivastava, R.K. (2014), "Reverse supply chain of a large built to order product industries: A case of ship breaking", *Materials Management Review*, April: 23-28.
Ko, N., Gantner, J. and Wehner, D. (2015), "Life cycle assessment of ships with special consideration of ship scrapping", *Matériaux & Techniques*, 103(1): 101.
Moncayo, G.A. (2016), "International law on ship recycling and its interface with EU law", *Marine Pollution Bulletin*, 109: 301-309.
NGO Shipbreaking Platform. (2017) "2016 List of all ships scrapped worldwide - facts and figures", Retrieved from http://www.shipbreakingplatform.org/shipbrea_wp2011/wpcontent/uploads/2017/02/Stats-Graphs_2016-List_FINAL1.pdf
O'Neill, K. (1998), "Out of the backyard: The problems of hazardous waste management at a global level", *Journal of Environment and Development*, 7(2): 138–163.
Richardson, J., 2004. Accounting for Sustainability: Measuring Quantities or Enhancing Qualities. In: A. Henriques and J. Richardson, eds. *The Triple Bottom Line - Does It All Add Up?*. London: Earthscan, pp. 34-43.
Sarraf, M., Stuer-Lauridsen, F., Dyoulgerov, M., Bloch, R., Wingfield, S. and Watkinson, R. (2010), "Ship Breaking and Recycling Industry in Bangladesh and Pakistan", The World Bank, Report no. 58275-SAS.
Sarkis, J., Helms, M.M. and Hervani, A.A. (2010), "Reverse logistics and social sustainability", *Corporate Social Responsibility and Environmental Management*, 17(6): 337–354.
Schaltegger, S. and Burritt, R. (2000), *Contemporary Environmental Accounting: Issues, Concept and Practices*, Sheffield: Greenleaf Publishing.
Schaltegger, S., Burritt, R. and Petersen, H. (2003), *An Introduction to Corporate Environmental Management - Striving for Sustainability*. Sheffield: Greenleaf Publishing Limited.