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ORIGINALBEITRAG / ORIGINAL ARTICLE

Shipping and a "Great Transformation"—some remarks for a new sustainability paradigm

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Abstract
Shipping contributed significantly to facilitating global trade over the last decades. However, there is growing concern that the global economic model, in which shipping is integrated, or rather shipping contributes to, pushes the Earth towards its sustainable physical limits. There is also concern that it leads economics to dominate a majority of human interaction. Addressing global environmental and social sustainability requires shipping to discuss its underlying economic paradigm. Both, environmental and social consequences cannot be mitigated through ever more efficiencies in shipping. On the contrary, demands for higher efficiency as the domineering element of the prevailing economic paradigm create rebound effects and provide false reassurances of "carry-on-as-usual". Calls for increased ecological as well as social sustainability ensue. These culminate in a "great transformation" scenario in Polanyi's interpretation, which questions humankind's core economic values and mental models of growth and prosperity. These considerations result in a call to review the economic paradigm under which shipping also operates. Such attempt outlines four elements to effect eco-social transformations.

Keywords Shipping · Great Transformation · Global value chains · Sustainability · Planetary boundaries

1 Global trade, shipping and sustainability

Shipping contributed to expanding global trade significantly over the recent couple of decades. This was made possible by falling costs for shipping and information exchange (Baldwin 2006). Today, 50,000 merchant vessels[1] are deployed around the globe to provide logistics services for local, regional and global value chains (UNCTAD 2018, p. 28). As such, shipping is an indispensable element of global economic development.

However, there is growing evidence that this kind of global economic activity pushes the planet towards it "planetary boundaries" (Rockström et al. 2009). Further, spreading dominance of global markets, helped by shipping, embeds social relations in the economy, rather the other way round, (Polanyi 1944). This economisation leads disadvantaged social groups to call for the prosperity promise they got from political elites in return for allowing globalization to happen, but which now appears to fail.

Calls for increased ecological as well as social sustainability ensue, culminating in a "great transformation" scenario in Polanyi's interpretation (ibid.), which questions humankind's core economic values and mental models of growth and prosperity. Even the "Economist" suggests that decarbonizing an "economy (...) requires a near-complete overhaul. (...) This overhaul requires nothing less than (...) uprooting of capitalism." (The Economist 2019).

Despite being always at the forefront of global trade and interconnectedness, it is time for shipping to address its contributions to global economic development from an environmental and social perspective. In the Western world, plenty of voices call for a paradigm shift of our global socio-economic system (Dörre and Rosa 2019).

It is time for shipping to clarify its future role in such a debate. As maritime transport has played, and still plays a key role in creating prosperity, this paper cautiously applies Polanyi's notion of his "Great Transformation" towards shipping. It asks

- How does shipping might look like in a great-transformation scenario?
- How can shipping manage effectively its social and environmental capital dependencies?

[1] Propelled seagoing vessels of 1000 gross tons and above.

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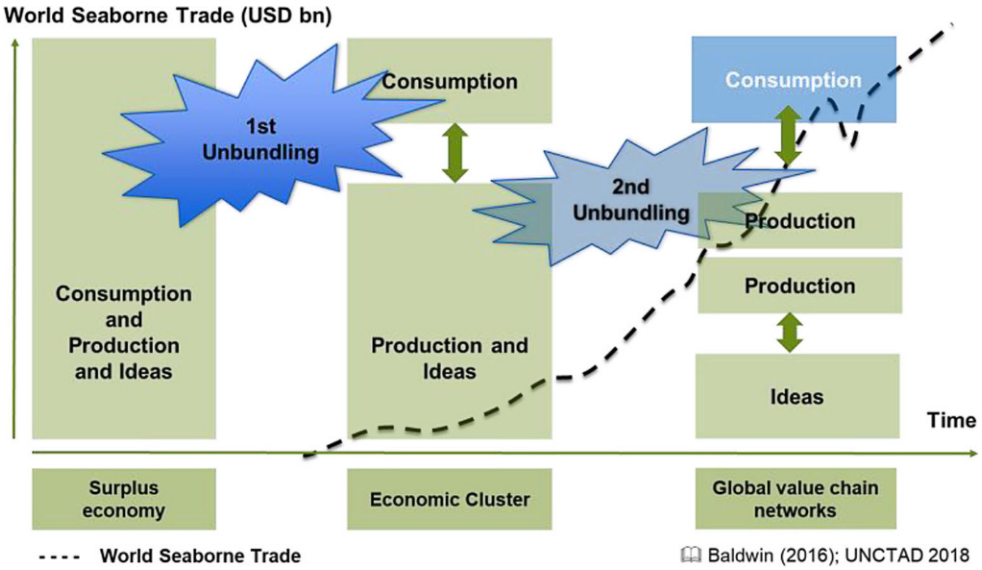

Fig. 1 Baldwin's Two Unbundlings: From a surplus economy towards global value chain networks. Source: Baldwin (2006); UNCTAD (2018)

Those questions shall encourage the reader to understand the global challenges put across shipping managers and to reflect critically about shipping's role in a sustainable economy trying to stabilize an industry as part of wider society by other means than economic growth.

2 Approach

The ideas of Baldwin's "Two Unbundlings" (Baldwin 2006), Rockström's et al. suggestions about "Planetary Boundaries" (Rockström et al. 2009) and Polanyi's reflections on a "Great Transformation" (Polanyi 1944) form the theoretical basis to outline and structure the interconnectivity of global trade and development, shipping and sustainability. These ideas establish a baseline for assumptions to identify shipping's current sustainability challenges, which suggest that established beliefs of economic collaboration no longer work reliably to satisfy all the requirements of maritime transport's stakeholders.

Defining sustainability in shipping along the questions of how to negotiate outcomes of economic activity and which commercial imperative shall govern economic activity helps to outline four elements of a reviewed paradigm to effect eco-social transformations addressing those challenges. Relating these elements to sustainable activities in shipping creates a framework for its future role of a global intermediary in economics as well as environmentalism.

3 Shipping: Indispensable ally for global trade

3.1 Shipping and two phases of globalization

Baldwin's "Two Unbundlings" (Baldwin 2006) describe global value chains in which shipping has played, and still plays, a major role. Today's globalization is a result of the divergence, first, of production and consumption on local and regional level, and, second, of the subsequent divergence of production itself into separate tasks performed along global supply chains (Fig. 1).

Although trade has been around since at least 3000 BC, nothing has had such a lasting impact on it as the introduction of hydrocarbons as fuel in shipping (and other industrial activities) at the beginning of the Industrial Revolution, and the dramatic fall in the costs for information exchange around the world (Bernstein 2008; Vries 2012, p. 7, 28). In times of sail transit times were unreliable, if the vessels arrived at all. Spreading information around by word-of-mouth, instead of postal services, or the telegraph, and not to mention today's email, was a slow process. These constraints let production and consumption bundle together geographically. In a village economy, everything that was consumed was produced locally. Only the surplus, if any, could be traded and exchanged for other goods (Vries 2012, p. 8, 20).

Literally, taking on full steam from the early 1700s onwards, with the commercial use of the first steam engine, and lasting until c. 1960, the first wave of globalisation unbundled production and consumption. The costs of moving information, and thus of moving ideas around, were still prohibitively expensive, leading to high coordination costs. Thus, production still used to be vertically integrated due

to high coordination costs. (Baldwin 2006, p. 7). The concentrations of the textile industry in England, agricultural activities in the tropics, or the coal and steel industry in the Rhine-Ruhr area are appropriate examples. In these clusters, national teams of ideas and workers battled for supremacy on global consumption markets (Vries 2012, p. 15).

Since the early 1990s globalisation has changed face again. The Internet has lowered the costs of moving ideas. A second unbundling has seen production falling apart itself. The decrease in coordination costs enabled firms to deploy production activities in different locations around the world and coordinate them centrally. As a result, goods travel the world no longer in raw or finished form, but as semi-finished items. Global value chains have emerged, and with them, supply chain trade (Baldwin 2006, p. 23) and unprecedented material well-being (Morris 2011, p. 166).

3.2 An economic straightjacket?—The framework of "Planetary Boundaries"

Apparently, maritime transport's huge economic success over the last decades comes with severe environmental flip sides. Maritime transport accounts for approximately 2.5% of global greenhouse gas (GHG) emissions (IMO 2014; Sims et al. 2014, p. 608).

Whereas GHG and other emissions are relatively easy to determine, indirect consequences are more difficult to establish. Shipping interacts with coastal zones in terms of dredging of waterways and the need for port land, to name but a few. Shipping and ports interferes with local ecosystems but, depending on the port governance scheme, might also raise questions of external effects if the costs of those infrastructural measures are borne by the local public whereas benefits go towards privately run international corporations.

Rockström et al. (2009) suggest a perspective towards global sustainability proposing planetary boundaries. These set a framework within that humanity could operate safely (Fig. 2). These boundaries go far beyond GHG-emission only. They "cover the global biogeochemical cycles of nitrogen, phosphorus, carbon, and water; the major physical circulation systems of the planet (the climate, stratosphere, ocean systems); biophysical features of Earth that contribute to the underlying resilience of its self-regulatory capacity (marine and terrestrial biodiversity, land systems); and two critical features associated with anthro-

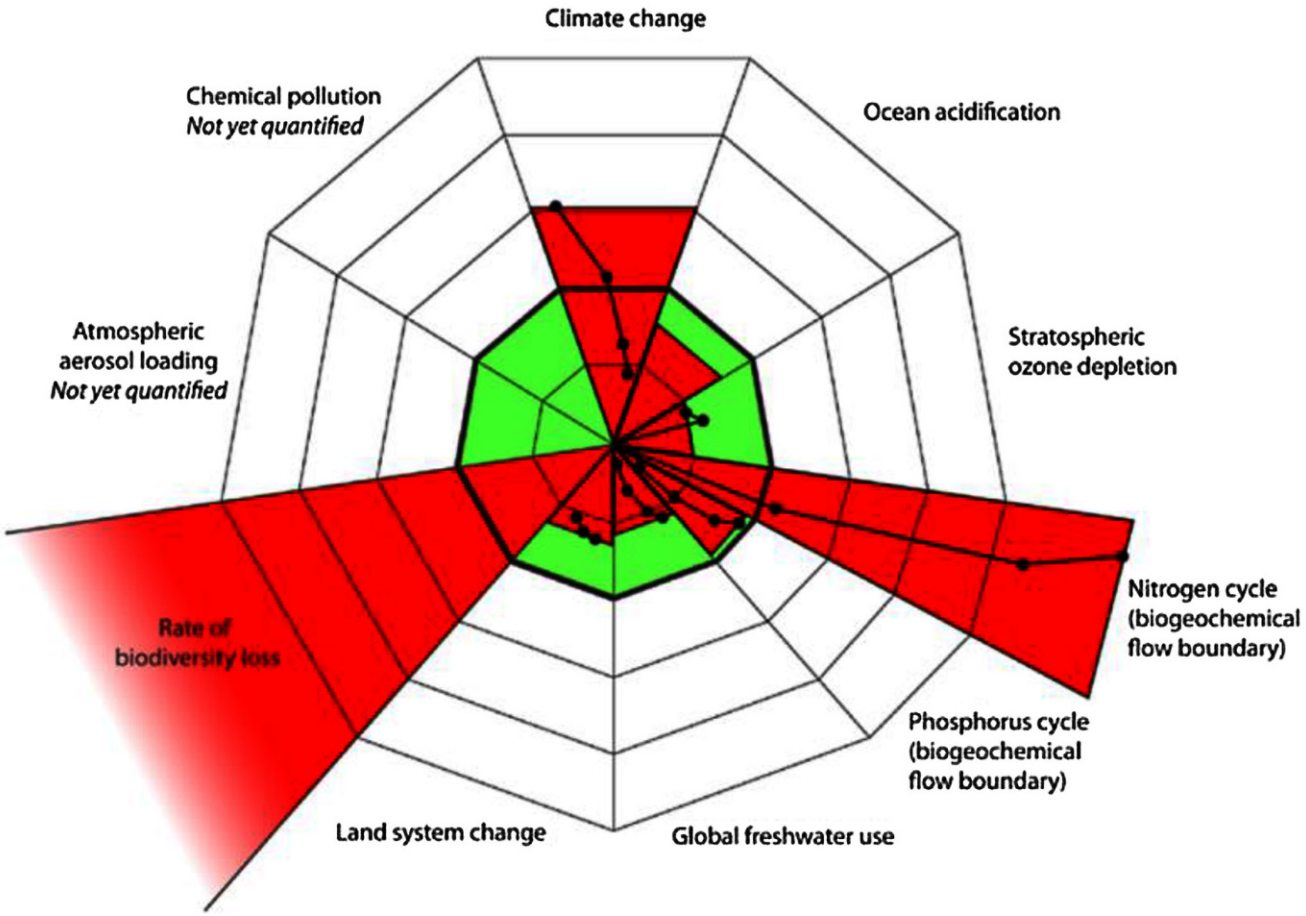

Fig. 2 Systematic of nine Planetary Boundaries. Source: Rockström et al. 2009

pogenic global change (aerosol loading and chemical pollution)" (ibid.).

"The evidence so far suggests that, as along as the [planetary boundary] thresholds are not crossed, humanity has the freedom to pursue long-term social and economic development" (ibid.). The authors estimate that humankind has already exceeded three planetary boundaries: for climate change, rate of biodiversity loss, and changes to the global nitrogen cycle.

Humankind experienced a period of relative climatic stability over the recent 10,000 years, the Holocene. This stability allowed humans for the first time to invest into their environment rather than just to exploit it. The scientific reference points for the level of planetary boundaries have been derived from the climatic conditions at the start of this period, which allowed agriculture and complex societies, including the present, to emerge. Crutzen pointedly termed this period the Anthropocene in which humans made a significant impact on global ecosystems (Crutzen 2002). In terms of human responsibility, it increasingly appears to become a burden.

3.3 Sustainability and a "Great Transformation"

It was 1944 when Karl Polanyi published his book on "The Great Transformation". Reflecting on the two devastating world wars and the recessionist inter-war period, he observed a dominating economization of major parts of human life (Polanyi 1944, p. 57). In his view, the market as instrument of economic decision-making and allocator of wealth took precedence over reciprocity and commons as earlier (and different) forms of resource allocation. As such, markets took over aspects of society that had been outside of the economy (Victor 2008, p. 37). Schneidewind surely polarizes saying that "our economic system is the cast-iron of market-driven mechanisms and institutions believing in unlimited material growth" (Schneidewind 2018).

Polanyi interpreted the development of industrialized societies as a double movement, which he called "disembedment" (Dörre and Rosa 2019). Once considered without alternatives, globalization has become repulsive, triggering opposing trends of "defensive" movements to protect society and environment (Forster 2019), but also political populism in the Western world. The "Fridays-for-future" movement initiated by Greta Thunberg, the New Green Deal proposed by US-left-leaning politics or the proposed "Green Deal" by the European Commission are prominent examples.

Polanyi subsumed such considerations under the broad theme of a "great transformation"; a transformation in a sense of understanding the interconnectivity of technological, social-cultural, economic and political dynamics in order to operate Earth on its "planetary playing field" (Rockström et al. 2009; Schneidewind 2018).

What are now the consequences of those socio-physical developments, if any, for shipping? Answering this question is vital, shall climate change not become the "death knell for economic freedom" (The Economist 2019).

4 The future of shipping—shipping of the future?

4.1 Why shipping fell into a "sustainability trap"

Although shipping contributed towards unprecedented economic expansion, it is increasingly the villain for various adverse environmental and, indirectly at least, for social phenomena. Before discussing consequences it appears appropriate to elaborate how today's situation has come about. Provokingly, shipping fell into a kind of "sustainability trap", contributing towards economic development but at the same time delivering, but not considering, any bads.

Markets have been around since humans entered into the age of Holocene around 10,000 years ago. Humanity changed from hunter-gatherers to settlers taking up agriculture and livestock breeding. Expendable surplus of human activity due the different natural endowments of the individual settlements could be exchanged with neighbouring settlements, thus establishing simple, regional markets, however based on reciprocity and on a barter basis. It was a kind of forced subsistence with high transport costs and unreliable means of exchange. Shipping provides a good example, with vessels under sail unreliable and prone to loss and damage, limiting the geographical reach of the exchange.

There were two milestones in the development of shipping that had changed this. First, the discovery of the Americas, and, second, the invention of steel ships driven by steam engines. The discovery of the Americas saw the introduction of a farming system across the West-Indies aimed not at achieving subsistence, but a surplus (Adelmann 2013). In their colonies, the Spanish planted sugar cane for the sole purpose to export these crops against cash, so-called "cash-crops". Later, the Dutch and the British perfected this system across their empires. Later on, seeking to generate efficiencies in these early global value chains through the application of steam power seems only natural. Any adverse environmental impact of steam, on a relatively small scale, and later oil-driven engines appeared negligible, and, looking at it from the working conditions on and reliability of early sailing vessels, also appeared justifiable.

But, markets were no longer local platforms of mutual exchange. If different communities, or social groups, or geographical areas benefit from profits of an economic ac-

tivity, but other groups or areas must bear any related external costs from this activity, respectively, markets lose their element of reciprocity. For example multi-national corporations: Profits appear in a low-tax environment, but local communities need to pay for social infrastructure in a high-tax European state.

This "sustainability trap" was set during centuries of human development in austere times enshrining a concept of "gain-and-growth" into the human cultural DNA, however unaware and at that time justifiable. The trap was cocked by the use of fossil fuels to seek productivity gains of the environmental consequences of doing so. Ultimately, the trap snapped close by turning those efficiencies into ever larger vessels, and increased global trade volumes.

4.2 Future as a linear scale-up of the present?

Current approaches to increased sustainability in shipping concentrate around efficiencies in ship operation and on alternative fuels. The International Maritime Organisation (IMO) supports and promotes internationally agreed energy efficiency rules and standards.[2] A further step is the introduction of sulphur-free fuel to prevent ship engines from emitting SOX from 2020 onwards. However, this does not limit the addiction to fossil fuels. Many regard the use of liquid natural gas (LNG) as a panacea. LNG can be seen it as a transition technology to be replaced in time by hydrogen or derivatives of it. Moreover, is still a fossil fuel, emitting CO2 and, speaking provocatively, it is only to safeguard the survival of the internal combustion engine. Others see the inclusion of shipping in a global emissions trading scheme as a way out.

However, a "Third Unbundling" may provide for a regionalization of trade, hence shorter distances, less volume to be shipped, and thus fewer emissions. This "Third Unbundling" (Stemmler 2018) is an expected upcoming third wave of falling costs of information manipulation and storage following the first and second unbundlings. This, what we might call digitization, enables organizations to introduce digital tools to support their activities. Thereby, regionalization of supply chains might become possible, whereby shippers gain the benefits of using less fuel, saving costs and reducing emissions of fewer long-haul transports and more short-haul carriage (Millar 2017).

Efficiency gains risk becoming over-compensated for by increased usage, resulting in so-called rebound effects. Increases in ship size are promoted as achievements to reduce CO2-emission per ton-mile, but they overlook resulting pressure on public waterways and port infrastructure.

Rather, pleasing stories are told to sustain inconvenient truths and to avoid awkward contradictions, as Brunnhuber (Brunnhuber 2017) puts it. Schneidewind (Schneidewind 2018) urges to accept those realities instead. "Maybe it is going to be ok at the end", or "the scientists got the stats wrong", or "let's wait and see what the others are doing" are fine examples of those stories. They serve to confirm convenient individual behaviour along established measures of prosperity, growth and consumption. Accepting reality starts with endorsing that there are finite physical boundaries of the Earth, that there are more resources than we like, and that efficiency gain evaporate through rebound-effect (Schneidewind 2018). As such, the future is not a linear scale-up of the present (Welzer 2019).

5 A "great transformation"-scenario: outlines of a new sustainability paradigm of shipping

5.1 Sustainability efforts between economic decision making and limitations of nature

If the global community succeeds in setting a reduction of the "eco-footprint" of human activity as a common goal, there are numerous ways to achieve. Better use of market-forces, for example the introduction of tradable pollution permits, or a limitation of such forces and more regulation; technological improvement to reap efficiencies or more sufficiency in consumption: there are plenty of alternatives to choose from.

According to Koepp (Koepp et al. 2015) the drivers for pushing the Earth towards the planetary boundaries are threefold, namely market-driven economic activity, missing efficiencies in production and transportation, as well as inappropriate interpretation of mental models of "gain and growth". Market-driven economic activity refers to the implicit growth imperative of markets, setting exchange values rather than use values (Jackson 2009, p. 40) that lead to the over-exploitation of perceptively free natural resources, such as carbon sources and sinks. To shipping, this is very relevant, in terms of increases in ship sizes in order to outgrowth competitors, and in terms of almost exclusive reliance on fossil fuels. Missing efficiencies in production and transportation stress the need to delink economic activity from necessary resource inputs. Inappropriate interpre-

[2] http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Technical-and-Operational-Measures.aspx. With 2008 as baseline, IMO aims to reduce total GHG emissions from shipping by at least 50% by 2050, and to phase out GHG emissions beyond 2050. Measures include for example the Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP). The EEDI is a design index indicating the energy efficiency of a ship in terms of CO2 per tonne-mile at a specific draft and speed. The EEDI for new ships aims at promoting the use of more energy-efficient and less polluting equipment and engines. EEDI requirements were adopted as amendments to MARPOL Annex VI in 2011 and entered into force in 2013.

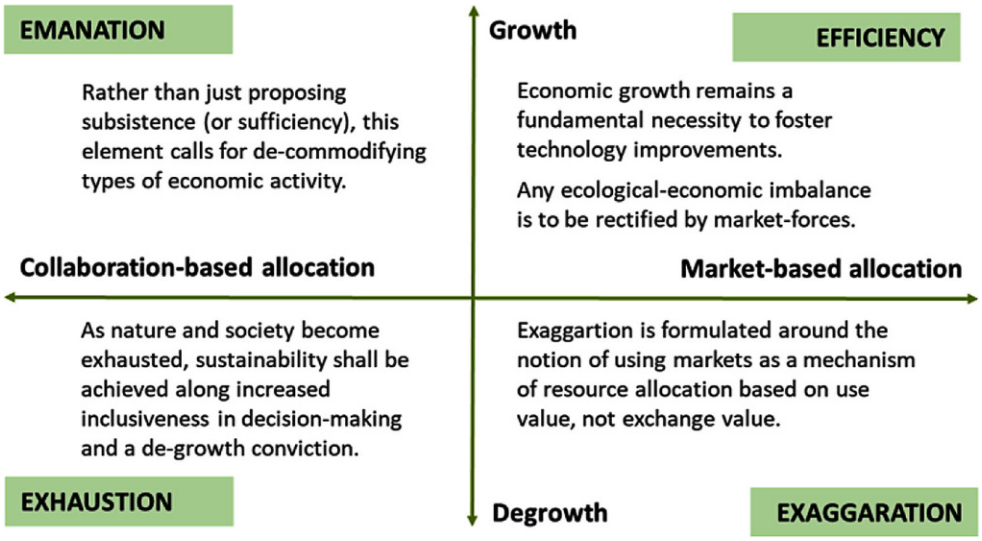

Fig. 3 Areas of opportunities dominating the sustainability-discourse. Adapted and expanded from Koepp et al. (2015)

tation of mental models of "gain and growth" sustain the assumption that only growth can deliver quality of life. What might have been appropriate in earlier centuries, might no longer apply to developed societies.

Schneidewind puts those drivers into a more neutral proposition formulating the need to decouple growth from resource consumption, and further, decoupling quality of life from growth (Schneidewind 2018). This addresses both the planetary boundaries and the "Great Transformation", in other words the avoidance of reaching planetary boundaries and the avoidance of disembedment scenarios. However, from whatever perspective those ambitions are looked at, growth, resource consumption and the social issues discussed in great-transformation debates boil down to two important questions:

- How to negotiate outcomes of economic activities? Or, which mechanism shall allocate resources?, and
- Which commercial imperative shall govern economic activity?

Answering those questions leads to four elements of a new paradigm for more sustainability from which we can derive a leitmotif for the future of shipping, or the shipping of the future.

5.2 Efficiency—Exaggeration—Exhaustion—Emanation: Building blocks of a new paradigm

The questions relating to economic activity, first how to negotiate outcomes of economic activity and, second, which commercial imperative shall govern it, can be answered along two dimensions each. Referring to the first question, the market constitutes a form to bargain and allocate resources. Another represents a wider form of collective decision-making. Referring to the second one, a widely used commercial imperative is the concept of economic growth. The alternative draft is de-growth. Each of these answers can be put on a continuum along two axis traversing each other (Fig. 3). The resulting four quadrants help to formulate areas of opportunities for an expanded paradigm.

In an economic world, which relies on growth-seeking markets for allocation of resources, the underlying element is "**efficiency**". Here, economic growth remains a fundamental necessity to foster technology improvements. Any ecological-economic imbalance is to be rectified by market-forces, such as carbon pricing. As such, improvements come in the form of incremental efficiencies, which are mere adjustments to existing models that no longer work reliably, and which are only generated if markets set the right incentives. This paradigm entails a scale-up of the present into the future. It tries to avoid major disruptions, as these would render existing productive assets as commercially worthless. Disruptions would trigger an immediate need to write them off with devastating results to balance sheets.

In a world of rebound effects, disruptive effects of digitization, approaching planetary boundaries and disembedment it is to be expected that neither a linear scale-up of the present will have the desired effect, nor that the true sustainability dilemmas will be addressed (McManners 2019). Further, the achieved incremental improvements in GHG-reductions by means of efficiency gains fall woefully short to what is required to achieve either the SDGs or the commitments of the Paris Agreement (Edgerton 2019). "The view remains widespread that a combination of new technologies, a shift from goods to services, and more reuse and recycling, will decouple economic growth from throughput, especially critical components such as fossil fuels, allowing growth to continue while resource inputs and wastes decline" (Victor 2011). As Welzer puts it humorously, but distinctly frank, when he highlights that disruption would

be required: "the electric car is the methadone of a fossil-addicted society" (Welzer 2019).

The majority of attempts to increase sustainability in shipping is concentrated here, such as alternative fuels (eg LNG), larger vessel to reduce the CO2-footprint per ton-mile or tradable pollution permits. The apparent danger is that any attempt for more sustainability remains in this category.

An element of an adjusted paradigm emerges around a market-based economy, but under a degrowth encouragement. This element is formulated around the notion of using markets as a mechanism of resource allocation based on use value (supply chain perspective), not exchange value (monetary perspective) (Suwandi et al. 2019). On most markets, natural resources do not carry the exchange values to reflect their true use values, ie not factoring in free carbon sources and sinks. It accepts the perceived, and increasingly apparent, limits of established mental models of economic activity in an anthropogenic setting. Victor (Victor 2008, p. 5) argues that "since ancient times we have been programmed to accept growth as a vehicle to improve the human condition", whatever the costs. He puts it succinctly by proposing "de-growth by design, not disaster" (ibid.), the latter referring to the decline of global GDP during the global financial crisis in 2007/2008. Accordingly, this paradigm is termed "**exaggeration**", as de-growth leads to subsistence on localized markets.

Relevant for shipping here is an expected third wave of falling costs of information manipulation and storage. It might enable organizations to introduce digital tools to support their activities, thereby driving a renewed regionalization of their supply chains (Stemmler 2018). Shippers gain the benefits of using less fuel, saving costs and reducing emissions of fewer long-haul transports and more short-haul carriage (Millar 2017).

The pressures of increasing vessel sizes on ports pose another example in this category. Larger vessels exhaust the hydrological limits of river basins and estuaries. Wind-assisted ships might also qualify for this quadrant. Any additional travel time from favouring wind over fossil fuels represents an internalisation of external effects from burning fuel, and thus, showing a more transparent use value of the transported goods.

The third element can be called "**exhaustion**". It takes up the inkling that market-driven economic activity on an industrial scale coincides with pushing the Earth towards its planetary boundaries. Further, market-driven economic activity also led to worn out social systems and unequal societies. As such, nature and society become exhausted. Sustainability shall be achieved along increased inclusiveness in decision-making and a de-growth conviction similar to that in the "exaggeration"-paradigm.

The exhaustion-element takes us along the indirect consequences of shipping via Polanyi's disembedment-hypothesis. A good example relating to shipping is the use of crews from low-cost countries and the emergence of flags of convenience in the 1970ies. Today's example is surely automation, thereby trying to eliminate the human on board, ie the societal factor completely from the assets of the industry limiting it to participate in value-creating activity at all.

The forth element, which we want to call "**emanation**", is more challenging as it underpins the notion of collectivity and growth. If individual mental models about collectivism were in the past calibrated along the lines of Soviet-style variant, and in this wake, having observed that it had been bound to fail by design, i.e. it had not been able to generate prosperity; this element is difficult to comprehend. As in the "exhaustion"-paradigm, the ecological crisis is assumed to correlate with economic crises. Rather than just proposing subsistence (or sufficiency), this element calls for de-commodifying types of economic activity, thereby directly re-embedding markets into their surrounding social fabric and focusing on use values of (natural) goods. Cooperative forms of allocation emanate into the economic system.

The emanation-element, by contrast, is not yet very well trodden. Good examples are the initiatives around the cargo sailing vessels "Avontuur" and "Tres Hombres"[3]. Both provide a unifying common vision of emission-free cargo shipping under sail hauling high-value goods such as coffee, cocoa and wine from the Caribbean to Europe. Both projects are supported by numerous volunteers convinced of the viability this vision. Enthusiasts have even addressed the hinterland transport chain of the produce by tackling them by cargo bike-using swarm logistics.[4] Although it can't compete on cost, volume and reliability-terms it shows twofold: First, the freight charge differential of sailing cargo vs. moving it by motor-vessel reflects the free carbon sources and sinks, fossil-fuel driven ships use (missing internalization of external costs). Second, that we can succeed in bringing elements of inclusiveness into economic activities.

6 Conclusion

Four elements of efficiency, exaggeration, exhaustion and emanation describe a potential paradigm of shipping in a great-transformation scenario. These might provide guidance for shipping to manage effectively its social and environmental capital dependencies in today's complex world bearing in mind, on the one hand, shipping's contributions to economic development, and, on the other hand, the ap-

[3] https://www.timbercoast.de, https://www.treshombres.at/.

[4] https://schokofahrt.de.

proach of the planetary boundaries and a reflection of the benefits of globalization by local communities.

Assuming a common goal not to endanger shipping's future role as facilitator of global trade, a "business-as-usual" relying solely on efficiency gains limits inadvisably the industry's economic driver. As a result, implications of rebound effects, fossil fuel-reliance and digitization on maritime transport services can only be addressed by introducing three additional elements to shipping's future: A *Triple-E class* of new economic thinking to take hold in the industry to ensure future sustainability.

The analysis provides for an option to recapture, or widen, economic room for manoeuvre, which might have been lost. The proposed analytical framework must be seen as a stepstone only. It is by far from being concluded. Also, it does not deal with attempts of how to foster any kind of transformation. Both issues certainly warrant further research.

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