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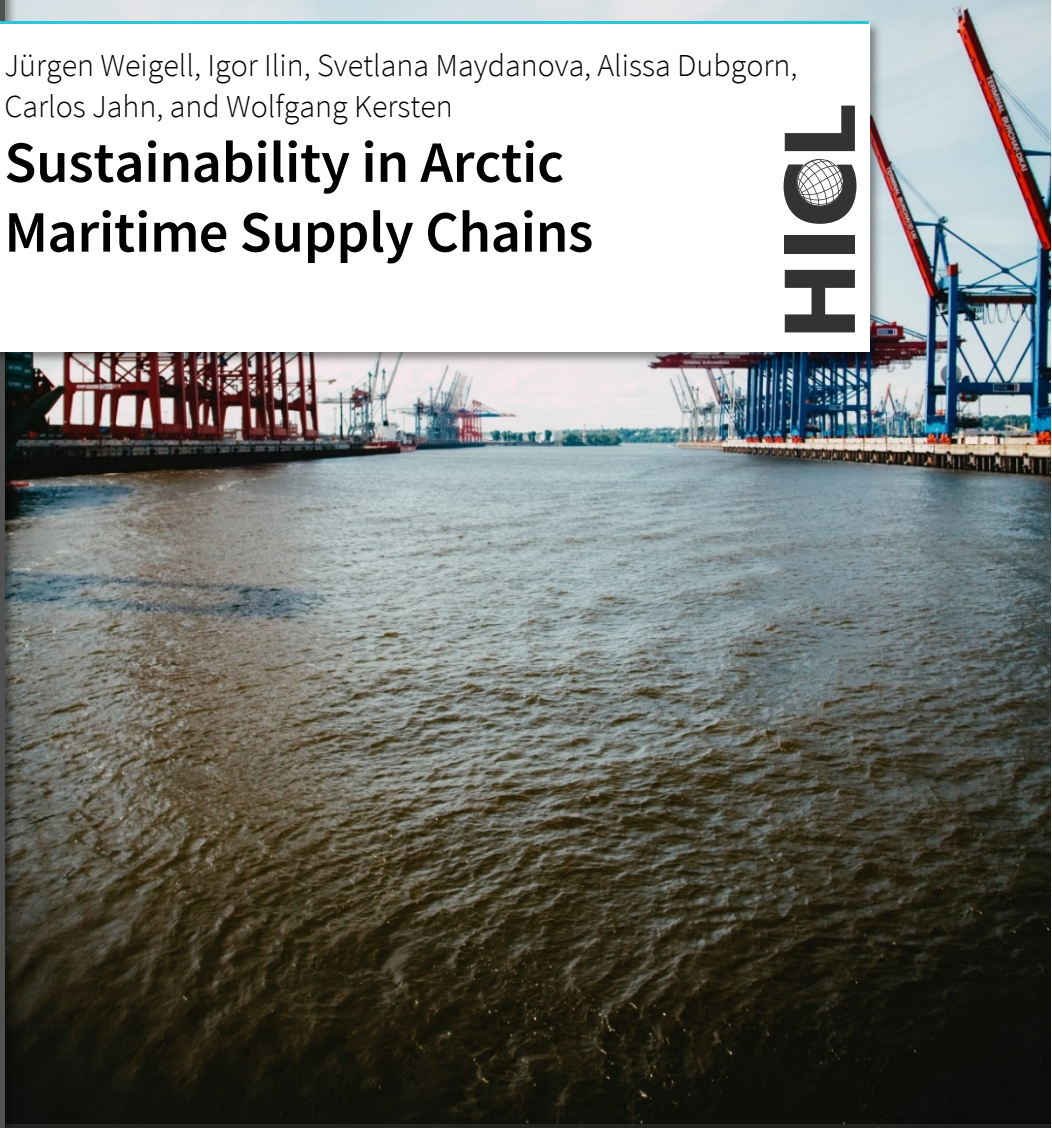

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Sustainability in Arctic Maritime Supply Chains

Jürgen Weigell [1], Igor Ilin [2], Svetlana Maydanova [3], Alissa Dubgorn [2], Carlos Jahn [1], and Wolfgang Kersten[1]

1 – Hamburg University of Technology, Institute of Logistics

2 – Peter the Great Saint- Petersburg Polytechnic University

3 – Unifeeder A/S

Purpose: The sustainable development of Arctic maritime supply chains requires an effective balance between economic growth, environmental protection and social relations. Existing Arctic development projects are often distinguished by single-criterion decision making - economic growth to the detriment of other components. The paper aims to analyze existing approaches and practices of Arctic supply chains development from a sustainable development viewpoint.

Methodology: Best practices of other industries are identified by a thoroughly literature research of relevant publications and developing a model for sustainability issues in Arctic maritime supply chains. The model compromises relevant indicators in regard to economic, social and environmental performance for the Arctic region.

Findings: The result of this paper will be a thoroughly overview over current sustainability issues in the Arctic framework (economic, social and environmental). Findings for example will be how companies adjust to the ban of using heavy Sulphur fuel in the Arctic or social and economic changes in remote areas due to more shipping in the Arctic.

Originality: The originality of the research is defined by the sustainability viewpoint on the problem: the combination of social, economic as well as environmental issues is the main focus of this paper especially with a focus on remote areas of the Arctic.

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1 Introduction

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (United Nations, 1987). Sustainable development is needed for long-term global development. This principle, announced in 1987, is being discussed by world leaders and international community representatives on a global level to ensure coherent, secure and sustained development of the world economy since then. In 1992 in Rio de Janeiro commitments of 172 states to reach a sustainable development were formulated in the “Agenda 21” declaration. (United Nations, 1992).

A sustainable development entails the unity of economic, environmental and social development. The economic approach to the sustainable development concept considers the economy as a waste less, environmentally friendly, energy-efficient and material-efficient system aimed at creating an environmentally acceptable product. Environmental development is the base sustainable development and must ensure the safety and viability of natural systems, with a view to ensure global stability of the planet's biosphere. The social dimension of sustainable development is aimed at achieving equal distribution of social benefits among all members of human society.

In 1995 the Sustainable Development Commission of the UN adopted indicators to be used by countries during the strategic decisions implementation on the national level for the work program of sustainable development (United Nations, 1995). These indicators are categorized into four dimensions: social indicators, economic indicators, ecological indicators, and institutional indicators.

The shipping industry nowadays is under pressure in regard to social, economic and ecological factors. It is an industry in a maturity stage, which is characterized by declining income growth, structural overcapacity, and changes in demand. At these stage, companies – need to develop new strategies, aimed at increases in efficiency, creating new markets and fulfillment of requirements.

The Arctic regional development as a transport corridor is defined in the Russian government set of strategic initiatives. There are a number of targets and documents developed at these regards, including the national container operator implementation on the Arctic Maritime Road to increase cargo turnover by 2024 to 80 million tons per year, mainly on the Northern Sea Route (NSR) and to 160 million tons per year by 2035, including at least 40 million tons per year of containerized cargoes (News Agency TASS, 2019).

The sustainable development of Arctic maritime supply chains requires an effective balance between economic growth, environmental protection and social relations. Existing Arctic development projects are often distinguished by single-criterion decision making - economic growth to the detriment of other components. This paper aims to analyze existing approaches and practices of Arctic supply chains development from a sustainable development viewpoint to allow alignment in accordance with international and local legislation, research and best practices.

2 Research Overview

The following section shall give an overview of existing literature of supply chain management in the Arctic in regard to sustainability issues. The overview will start with the general literature in regard to sustainability and then moves on to the literature regarding sustainable supply chain management. Then papers about sustainable supply chains in the Arctic and the used approaches in Arctic supply chains will be introduced.

2.1 Sustainable Supply Chain Management

The UN defines sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987). In 1994 the term “triple bottom line” was invented as a more holistic concept. In “Cannibals with Forks: The Triple Bottom Line of 21st Century Business” Elkington stated that "companies should account not only for the traditional financial profit and loss bottom line, but also for both the social and the environmental bottom lines" (Elkington, 1997). "The first - people's bottom line - measures the level of social responsibility of the company, whereas the second - planet's bottom line - records the environmental impact of its operations. This three-pillar perspective became synonymous of a more comprehensive approach to business sustainability". (Martins and Pato, 2019).

Sustainable supply chain management (SSCM) became one of the most prolific research areas over the last years, but the concept of sustainable supply chains must be preceded by a thorough understanding from both theoretical and practical standpoints. In "World class sustainable supply

chain management: critical review and further research directions" the authors mentioned: "There is a growing body of literature related to sustainable supply chain management but on the other hand, there are overlaps between green supply chain management or environmental supply chain management literature and sustainable supply chain management literature, as well as other areas that have attracted significant contributions, such as environmental supply chains, ethical supply chains and responsible supply chains" (Dubey et al., 2017). A number of SSCM definitions were defined, thus in (Dubey et al., 2017) a list of definitions of sustainability in supply chain literature was developed, which contain sixteen definitions of SSCM. Dubey also states that "the majority of the SSCM literature focuses mostly on the environmental and economic dimensions and there is a lack of research that identifies and tests the impact of factors such as culture, geography, and company size on SSCM practices. To eliminate this gap, the new term – World Class Sustainable Supply Chain Management (WCSSCM) was introduced as a continuous development of the appropriate organizational culture, use of innovative technologies, and awareness and involvement of the top management, employees, and society to consider and translate external pressure into strategic and operational performance as well as economic stability while considering the impact of these practices on social equity, ethical values and welfare, and the environment." (Dubey et al., 2017). WCSSCM consists of six constructs and eighteen items, which are conceptualized as follows: (Dubey et al., 2017)

1) "Environmental: Green Design, Packaging, Distribution and Warehousing; Conservation; Life cycle concept"

2) "Social Values and Ethics: Code of Conduct; Employee welfare; Equity; Public awareness and Ethics"

3) "Economic Stability: Profitability; Strategic collaboration and Information sharing; Logistics optimization"

4) "Operational Performance Assessment: Audit and Assessment; Standardization"

5) "Internal Factors: Organizational culture; Technology; Corporate Strategy and Commitment"

6) "External Factors: Government Rules and Regulations; Customer Pressure; Competition"

Hansen and Schaltegger propose an extended scorecard architecture under the name of Sustainable Balanced Scorecard (SBSC) as an approach (Hansen and Schaltegger, 2012). In (Epstein and Wisner, 2001) the differentiation of the SBSC from the balanced scorecard (BSC) is explained by "recognizing sustainability-related objectives and performance measures and it is an appropriate tool for integrating strategically relevant environmental, social, and ethical goals. The SBSC measures an organization's performance in four to five perspectives, which are: financial, customer, internal business process, learning and growth, as well as environmental perspectives. Integrating social and environmental metrics into the scorecard outcomes group of benefits improves decision-making and corporate responsibility" (Epstein and Wisner, 2001).

2.2 Sustainable Development in the Arctic

The following paragraphs will give a brief overview over the literature in regard to Arctic supply chains with a focus on sustainability. (Gunnarsson, 2013) gives an outlook of marine operations in the Arctic in the future. (Trump, Kadenic and Linkov, 2018) use a multicriteria decision analysis to help identify policies that minimize the potential for adverse environmental impacts and at the same time maximize economic and industrial objectives. (Franklin, 1983) showed in a paper the adverse obstacles Arctic supply chains face in Canada. During the last years a decline in Arctic sea ice lead to the possibility of new routes in the Arctic. (Pizzolato et al., 2014) conducted a study of vessel voyages by using a large dataset based on the level of sea ice. Between 1992 and 2012 increased traffic was observed in connection with declining levels of sea ice (Pizzolato et al., 2014).

Melting Arctic sea ice make new shipping routes feasible, for example the Northwest Passage (NWP) and the Arctic Bridge. The former can be used as an substitute route for the Panama Canal and the latter can be used to connect e.g. the port of Murmansk with Canada (Pizzolato et al., 2014). This will lead to a need in investments in a better port infrastructure, the use of natural resources and higher tourism without leading to adverse effects for environment, people, and wildlife (Rompkey and Cochcrane, 2008). (Buixadé Farré et al., 2014) state that research on Arctic shipping routes was focused on the Northeast Passage (NEP) along the Arctic coasts of Norway and Russia and the Northwest Passage (NWP) around the Arctic coasts of the US and Canada. The Northern Sea Route (NSR) is another name for the NEP. However according to (Solski, 2012) the NSR is in Russia defined "as extending from the Novaya Zhelaniya straits (at the Novaya Zemlya archipelago,

connecting the Barents Sea to the West and the Kara Sea to the East), to Cape Dezhnev by the Bering Strait".

(Wang and Overland, 2012) predict summers with no ice in the Arctic by 2030. (Hinzman et al., 2005) write about the climate changes in the Alaskan part of the Arctic. (Prowse et al., 2009) did a study on the influence of climate change for the Canadian Arctic. They took a look into additional business and the establishment of new routes for mining and oil companies. The following routes were identified in the Arctic area of Canada: "to the port of Churchill and via Hudson Strait, to the Beaufort Sea via Bering Strait or the Mackenzie River, and through the Arctic Archipelago via the Northwest Passage (NWP). The NWP extends from Baffin Bay through Lancaster Sound to the Beaufort Sea via a number of different waterways". Whereas (Walsh, 2008) shows different scenarios till 2050 for the Arctic climate. (Buixadé Farré et al., 2014) are describing the chances the Northeast Passage can bring as a maritime route for the connection of the Atlantic and the Pacific but they also state the limitations of the NEP in comparison to the Suez Canal, e.g. "jurisdictional disputes create political uncertainties; shallow waters limit ship size; lack of modern deepwater ports and search and rescue (SAR) capabilities requires ships to have higher standards of autonomy and safety; harsh weather conditions and free-floating ice make navigation more difficult". The Northeast Passage has a big economical potential for transports between Europe and China, South Korea and Japan. The distance using the NWP instead of the Suez Canal can shorten the distance between Yokohama and Rotterdam by 37% or between Busan and Rotterdam by 29% (Buixadé Farré et al., 2014). (Ng et al., 2018) did a paper on the opportunities of new routes in the Arctic.

The Arctic is also a place where large natural resources are. Crude Oil and liquefied natural gas (LNG) projects are realized for example in the Pechora, Kara, White and Barents Sea (Bambulyak, Rautio and Grigoriev, 2012).

3 Method

Sustainable supply chain development in the Arctic is primarily connected with maritime transportations. “The Review of Maritime Transport 2019” defines maritime transport as "a complex area of activity, owing to the inherently international nature of shipping and its multi-stakeholder dimension. These characteristics create an analytical challenge that is compounded by the role of the sector as an input production factor supporting other economic sectors and areas of activity, such as trade, fishing, tourism and energy". (UNCTAD, 2019)

For this paper performance indicators developed by the United Nations Conference on Trade and Development (UNCTAD) were used. Indicators for maritime transport support monitoring, measuring, reporting and evaluation and thus could provide a guidance in sustainable development goals achievement. One of the tools, the UNCTAD Framework for sustainable freight transport, supports the development of sustainable freight transport strategies with the help of set of 250 indicators, 152 of them can be applied to maritime transport. (United Nations, 2015). Another tool is “The Review of Maritime Transport 2019” (UNCTAD, 2019) which considers different performance indicators related to the maritime transport sector. There are also goals and performance indicators of Russian legislation and public institutions, related to Arctic region development.

As result, there were the reference models of the Northern Sea Route Sustainable Chain Management Framework and the Northern Sea Route Sustainable Balanced Scorecard were elaborated, which are able to bring together and systematize goals and dimensions of sustainable development of the Arctic Maritime Supply Chains.

According to (United Nations, 2019), the most valuable sustainability parameters of the Maritime Transport are "efficiency, access to markets, infrastructure endowment, supply-side capacity, trade facilitation" and their available proxy measures are shipping connectivity and port turnaround times. A country's shipping connectivity depend on geography, trade volumes and port efficiency. Based on the Trade Port Management Program results there has been a port performance scorecard developed, "26 indicators were identified, collected and classified into six main categories: finance, human resources, gender, vessel operations, cargo operations and environment". Another factor of the shipping connectivity is the shipping fleet, characterized by vessel operations efficiency.

It also has a substantial impact on the environment, which could be measured by three vessel indicators: fitted with a ballast water treatment system, scrubber to reduce Sulphur emissions, and to adhere to regulations to reduce nitrogen-oxide pollution. (United Nations, 2019).

The Decree on the Foundations of State Policy of the RF in the Arctic up to the year 2035 established 15 performance indicators which characterize the efficiency of the provided policy in the Arctic including the life expectancy of people born in the Arctic, migrant population rate, unemployment rate, average salary, share of regional gross product, value-added share of high-technology production, NSR cargo shipping volume including transit cargo and environmental spending (Russian Federation, 2020).

In addition, there are a number of institutions which activity is connected to the sustainable development of the Arctic and who contribute substantial inputs in this field. There is the Centre of Expertise "Project office of the Arctic development" (PORA). Among their initiatives, they have developed

the Polar Index, which is assigned to the Arctic sub region or companies operating in the Arctic (Bobylev et al., 2018). Methodological basis of the Polar Index (PORA, 2020) is a concept of the sustainable development. The Polar Index includes sets of performance indicators, including socio-economic, socio-ecological, environmental-economic for regions and economic, social, environmental – for companies.

Socio-economic indicators for regions are average salary and living wage ratio; migration rate; regional gross product per capita; transport infrastructure availability; respect for the rights of indigenous peoples; housing provision per inhabitant; proportion of population using the Internet to total population; employment and unemployment as a percentage of the total population. Socio-ecological indicators for regions are the number of people with access to quality fresh water; the increase of life expectancy of indigenous peoples; existence of regional and municipal programs to adapt people and management systems to climate change. Environmental-economic indicators for regions are share of environmental spending in the regional budget; growth rate ratio of stocks and production of critical mineral resources; percentage of recultivated land area; percentage of GDP per emission fees; percentage of hazardous waste.

Economic indicators of the Polar Index for companies, working in the Arctic zone, settled as asset profitability, income trends, and capital expenditure. Social indicators are working conditions of the company employees, level of their skills, charity activities, infrastructure development, policies for indigenous populations. Environmental indicators are pollution rates, accidents, investments in environmental protection activities, resource-saving technologies availability, recycling of raw materials (Bobylev et al., 2018).

Another public institution, which realizes sustainable development principles in the Arctic Zone is project "Arctic 18-24-35: view of youth". Developed by this institution is the strategic document "Strategy of the Arctic 18-24-35" which represents the vision of a young Arctic Zone future across a range of priorities(Dolgova, Ruzakova and Siluanova, 2018):

1) ensure comprehensive human development as a key engine and object of regional development;

2) increase the multiplier effect of large Arctic projects on the basis of integrated innovations;

3) create conditions to improve the quality of life and social standards in the Arctic Zone;

4) develop regional entrepreneurship, with a focus on youth projects, small and medium-sized businesses;

5) improve the competitiveness of Arctic transport systems on the basis of multimodal transport and logistics infrastructure;

6) ensure a balance in the society and nature development;

7) promote the discovery of the innovative potential of the Arctic through related targeted high-tech projects development.

Public institutions in the Arctic Zone are important to reach the sustainable development goals proposed by the performance indicators, but they almost have no influence on the decision making by the government, regional or federal. The role of public institutions will probably increase after the new project digital platform "Arctic 2035" will be launched. This project was initiated as the opportunity to generate interest of experts and the pub-

lic to a government strategy development and has different types of participant's relationship, including expert round-tables discussions, mobile discussion clubs, online offers submitting and feedback. This project is supposed to increase the influence on government policy in the Arctic Zone and the involvement of citizens into decision making.

4 Results

The authors propose the model of the Northern Sea Route Sustainable Supply Chain Framework (Fig. 1). This model reflects factors influencing maritime supply chain sustainability under six dimensions of WCSSCM: environmental, social value and ethics, economic stability, operational performance assessment, internal and external factors.

The environmental dimension of maritime supply chains depends on pollution rates, accidents, resource-saving technology availability, and investments in environmental projects. Social value and ethics dimension need to be supported with a code of conduct, which ensures comprehensive human development, creates conditions for improving the quality of life and social standards in the Arctic Zone; grants employee welfare and equity, and guarantees public awareness and ethics. The economic stability dimension needs to ensure profitability of NSR operations, logistic optimization and strategic collaboration and information sharing within all stakeholders. The operational performance needs to ensure shipping connectivity, port waiting times, as well as vessel and cargo operations optimization. The internal factors dimension are corporate strategy and commitment, organizational culture and technology. As along the NSR different companies will operate, this dimension needs to enable their interoperability and communications based on mutual principles of collaboration, by a support business ecosystem activity. The external factor dimension requires alignment with local and international rules and regulations, public institution assessment, customer pressure and competition realities.

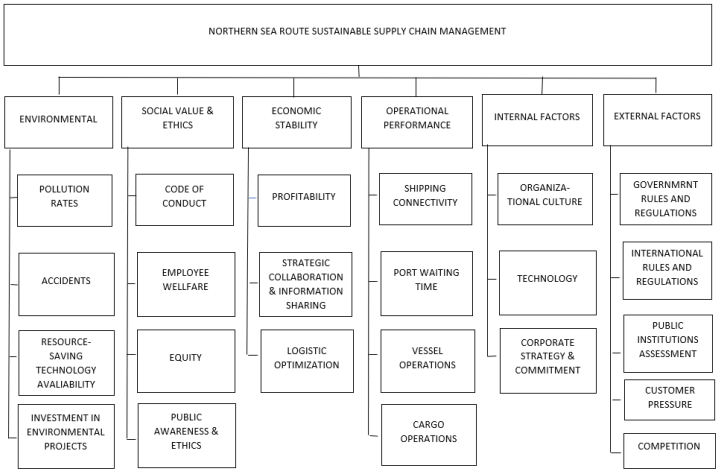

Figure 1: Northern Sea Route Sustainable Chain Management Framework

Furthermore, there is the Northern Sea Route Sustainable Balanced Scorecard model developed which as logical extension of the NSR SCM Framework represents goals which should be accomplished for a sustainable supply chain development (Fig. 2). The NSR SBSC model contains six perspectives: economic performance, external stakeholders, environmental performance, social performance, operational performance, and skills and capabilities and evaluate the NSR as business ecosystem, which contains of a number of different agents.

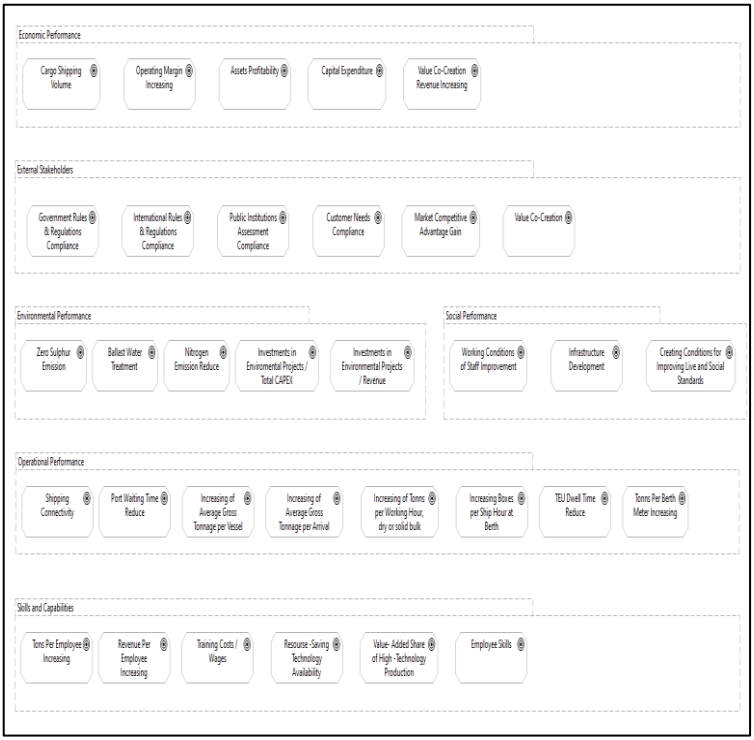

Figure 2: Northern Sea Route Sustainable Balanced Scorecard

The Economic Performance perspective set a number of goals such as cargo shipping volume and operating margin increasing, assets profitability, capital expenditure, increasing of value co-creation revenue.

The External Stakeholders perspective controls government and international rules and regulations compliance, relationship with public institutions, customer needs compliance, market competitive advantage gain and value co-creation.

The Environmental Performance perspective set such goals as zero Sulphur emission, ballast water treatment, nitrogen emission reduction, correlation between investments in environmental projects and total Capital Expenditure (CAPEX) and revenue.

The Social Performance perspective consists of such goals as improvement of staff working conditions, infrastructure development, creating conditions for live and social standards improvement.

The Operational Performance perspective has goals of shipping connectivity, port waiting time reduce, increasing of average gross tonnage per vessel / arrival, increasing quantity of tons per working hours for dry or solid bulk cargoes, increasing quantity of containers per ship hour at berth as well as quantity of tons per berth meter, reducing of Twenty-foot Equivalent Unit (TEU) dwell time.

The Skills and Capabilities perspective evaluate succeeding such goals as tons or revenue per employee increasing, resource-saving technology availability, value-added share of high-technology production, correlation between training costs and wages and employee skills improvement.

The Models of the Northern Sea Route Sustainable Supply Chain Framework and the Northern Sea Route Sustainable Balanced Scorecard are useful to provide substantial support for a sustainable development assessment of the NSR as international transport corridor and modern transport communication of the RF.

5 Discussion of Results

The Russian Arctic is an extremely complex facility for public administration. Its complexity consists not only in climate, environmental or logistic features that provide an impact on development but the main difficulty is the critically high cost of human error. The price of development mistakes in the Arctic does not lend itself to neither economic nor social calculation. The Arctic is deservedly considered the most dangerous region on the planet. The Arctic is the northern belt of Russia, a special regional dimension of the country, in which huge territories extending from the extreme points of the Russian borders in Europe to the limits of Russia in Asia, are merged by the unity of harsh natural and climate conditions, the wealth of natural resources, and a huge potential for the development of maritime transport (Dolgova, Ruzakova and Siluanova, 2018).

In December 2019, the Russian Security Council has approved "The Foundations of State Policy in the Arctic zone until 2035". This document shall combine the activities of national projects and state programs, investment plans of infrastructure companies, and development programs of Arctic regions and cities. The State policy of the RF in the Arctic is based on national priorities of the RF. The national interests of the Russian Federation in regard to the Arctic are (Decree of the President of the RF N164, 2020):

a) "to ensure the territorial integrity and sovereignty of the RF";

b) "preservation of the Arctic as a territory of a peaceful, stable and mutually beneficial partnership";

c) "ensuring high quality of life and good living conditions of people in the Arctic area of the RF";

d) "development of the Arctic areas of the RF as a resource base and its rational use to accelerate the economic growth of the RF";

e) "development of the NSR as competitive in the world market";

f) "protection of the Arctic environment, to protect the traditional way of life of indigenous peoples living in the Arctic zone of the RF".

Above mentioned policy has established a very high level economic, social and environmental dimensions of the Arctic region development as well as internal and external state policy at this region, but more precise goals were conducted by another document. The Government of the RF has approved the development plan of the NSR infrastructure until the year 2035, the first policy document defining the development of the largest maritime transport highway of the Russian north. The plan is intended to specify the activities of the Northern Sea Route federal project, it includes construction of nuclear ice breakers, emergency and hydrographic vessels, a dredging fleet, using ice-class container ships powered by nuclear fuel or liquefied natural gas, construction of container hub terminals, port infrastructure development, global maritime disaster communication and safety facilities construction, objects automatic identification system and remote sensing system in NSR areas development, continuity of satellite communications securing for NSR users, centralized operational and tactical management system development, creation of a Russian container operator for international transportation on the NSR, analysis the need for a national maritime dredging company, establishment of a single control center for navigation control and the year-round navigation with organization of transportation on a regular basis (Russian Federation, 2019).

The development plan of the NSR infrastructure has determined a number of measures for shipping connectivity and other operational aspects improvement, but the document hardly identifies social issues in the Arctic regions dependent on the NSR work. Without this it will be difficult to attract staff to the Arctic. Another risk was announced by the Accounting Chamber of the Russian Federation. According to auditors, the shortage of transport vessels may call into question the expected growth of cargo traffic to 80 million tons (RG.RU, 2020). Economic, environmental dimensions as well as internal and external environment are not revealed at the document.

Despite the fact that today exploration and development is one of the domestic policy priorities of the RF, the Arctic still does not have a centralized system of management and a single vector of development. At present, the Arctic zone of the RF is a conglomerate of separate administrative entities with different status, including entire regions, as well as individual municipal districts and cities. The Arctic territory does not have a single management administration and thus no tool for centralized planning and control over the implementation of the taken decisions. Although possible models exist for integrating the Arctic into a single administrative framework, it is necessary to create a common basis for further development and a single vector of further growth by using the principles of sustainable development (Bobylev et al., 2018). The NSR Sustainable Chain Management Framework and External Stakeholders Perspective of the NSR Sustainable Balanced Scorecard can serve as a foundation for such process of developing.

Moreover, the Northern Sea Route development is regulated by different government authorities. Thus, the infrastructure development is under

control of the state corporation "Rosatom", and for cargo turnover are responsibility lies with the Ministry of Nature of the RF, the Ministry of Transport of RF, the Ministry of Far East Development and "Rosatom" as well. These authorities have different forecasts for the NSR cargo turnover development and even try to accomplish the goal of cargo turnover increase by 2024 with the extension of the NSR borders. Such aspects of the NSR Sustainable Chain Management Framework as technology, organizational culture, strategy and commitment are intendent to contribute to coordination and efforts concentration of all stakeholders.

The ecological dimension of the NSR development is still under great pressure as the dominant part of the planned cargo turnover increase represents crude oil from greenfield site mining. Setting of clear goals and dimensions for the control as they mentioned in this paper reference models will play a role in ensuring sustainable environment.

The Northern Sea Route could become a driver of the Arctic zone progress, but it needs to satisfy sustainable supply chain management requirements, and with this regard key performance indicators elaboration based on the international and Russian institutions experience can provide considerable support.

6 Conclusion

The issues of Arctic Zone sustainable development as well as Arctic maritime supply chains are in themselves extremely relevant and therefore actively discussed by different stakeholders. The Arctic is deservedly considered the most dangerous region on the planet as the price of development mistakes in the Arctic does not lend itself to neither economic nor social calculation. Melting Arctic sea ice make new shipping routes feasible; this will lead to a need in investments in a better port infrastructure, the use of natural resources and higher tourism without leading to adverse effects for environment, people, and wildlife.

Considering Arctic maritime supply chains from its sustainability point of view may lead to both productive and balanced development of shipping in the region. Sustainable supply chain management (SSCM) became one of the most prolific research areas over the last years. Taking into account such goals of sustainable development, as environmental issues, good working conditions and economic growth, fair actions and production when designing maritime supply chains is very important for its overall success and effectiveness. In this point the interaction of business, society and government involved in Arctic supply chain management is strongly needed and developed in this paper the NSR Sustainable Chain Management Framework and the NSR Sustainable Balanced Scorecard might contribute to Arctic maritime supply chain sustainability.

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