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A Process Design Towards the Yacht Environmental Transparency Index*

M.E. Letschert

Faculty of Technology, Policy and Management, Technical University Delft

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Abstract

In this paper a summary is presented of a research conducted to develop a process design towards a credible index that is capable to indicate the environmental impact of a yacht. The process design is developed for yacht builders and designers to execute. The process design is developed to ensure the credibility of the index. The most important considerations providing credibility is the development by stakeholders and transparency throughout the development process and governing this development process by the provided rules. Transparency is provided by installing a third party that controls the development process, developing standardisations for all procedures part of the index, and sharing all information on the development with interested parties.

Keywords; Yacht Environmental Transparency Index, Environmental Impact Assessment, Yachting Industry, Institutional Analysis and Development Framework

*This article is a presentation of a thesis written for the master's programme Complex Systems Engineering and Management. For more background information it is recommended to consult the thesis.

1. Introduction

In the Paris Agreement produced by the United Nations Framework Convention on Climate Change, goals are set out by participating nations to collectively combat global climate change (United Nations, 2015). Consumers are adapting their lifestyle and try to live more consciously because they feel responsible, which causes a rising demand for sustainable products (Confino & Muminova, 2011). An example case from which a trend towards more sustainable products can be derived, is the global market share of electric cars. The share of EV's almost doubled in 2018 to 4.6% compared to 2017 (Manthey, 2018). In the yachting industry a demand for more sustainable yachts is among others noticed at Feadship, a market leader in the construction of these privately-owned pleasure craft. The desire of clients for yachts with a lower environmental impact has presented itself during meetings with potential clients. Sustainability is becoming prestigious for this group of consumers and the feeling of environmental responsibility is valuable for the potential clientele of Feadship (Williams, 2019). This increasing demand for environmentally friendly yachts is noticed across the whole yachting market (Merl, 2015).

Besides a rising demand of consumers, the yachting industry wants to become more sustainable since regulations are being installed by the International Maritime Organisation (IMO) setting limits to the environmental impact ships can have (Ecorys, 2012). Currently the regulations of the IMO do not affect yachts. Yachts have less absolute impact on the environment in comparison to for example, cargo ships. However, since the goals of the Paris Agreement have to be reached, it is to be expected that such regulations affecting yachts will be installed in the future. An example is the regulation regarding 'Emission Control Areas' or ECAs in which ships are not allowed to sail if it has emission above a threshold value. This threshold value has been lowered during the past few years (IMO, n.d.-a) and it is expected that it will be lowered even more. This regulation already affects yachts in build and operation.

The demand of consumers and the impeding regulations made the producers of superyachts realise that a change is needed. However, it is hard for producers of yachts to identify how they can quantify more sustainable products. A solution for this problem is the development of an index representing the environmental impact of superyachts, enabling comparison of different yachts based on the impact they have on the environment. Bram Jongepier, senior specialist at De Voogt Naval Architects, a company within the Feadship group, developed the idea for an environmental impact index for yachts. One of the functions of an index is to clearly measure something so it can be improved, because something that cannot be measured cannot be improved (Böhringer & Jochem, 2007). For the yachting industry an index that provides information on the environmental impact of yachts is therefore desired by producers of superyachts. Bram Jongepier named the to be developed index the 'Yacht Environmental Transparency Index' or YETI. Essential of the idea is the 'Transparency' embedded in

the name. The procedural part of the index has to be clear for every stakeholder and the indication of the environmental impact has to be trusted by all. In essence, the index must be credible. If this is not the case the industry will not use the index and it will have no value. To ensure that the index is credible it is proposed to develop the YETI cooperatively by yacht builders and designers active in the industry. The research is focused on how yacht builders and designers can co-develop an environmental impact index for yachts. In this paper a summary is presented of the research in which a possible process design for the development of an environmental impact index for yachts by yacht builders and designers is developed. Important is that the developed process design leads towards a credible index that is accepted by those who design the index.

The development of the YETI by a variety of yacht builders and designers to strengthen the credibility of the index presents a more extensive complexity than when an individual would develop an environmental impact index for yachts. The inclusion of multiple stakeholders automatically means the inclusion of a variety of objectives and opinions on how to develop an index. It also makes it more difficult to ensure credibility. Therefore, it is researched how credibility can be ensured for all involved stakeholders. The process design has to govern yacht builders and designers during the cooperative development of the YETI in such a way that credibility is ensured for all. The following research question is answered:

How to develop a process design towards a credible environmental impact index for the operational lifetime of superyachts?

This research only focusses on a process design that governs the development process of an index capable of assessing the operational lifetime phase. This lifetime phase is chosen since in this phase approximately 90% of the total environmental impact is made (Fundació Mar, n.d.; Harren & De Voogt Naval Architects, 2009). The process design is not specifically applicable for the development of an index for the other lifetime phases.

2. Research Approach

The research has been conducted in 5 steps. First, a literature study has been executed on how to develop a credible index. This study provided 7 principles for the development of credible environmental impact indices. These principles are coupled to the Institutional Analysis and Development (IAD) Framework (Ostrom, 2005) in the second step. Thirdly, an analysis of the yachting industry is performed to identify considerations for the development of an index in that industry. The fourth step contained a workshop in which yacht builders and designers were asked how to develop a credible index. In the final step a process design is developed based on all the information obtained in the research.

3. Development of a Credible Environmental Impact Index

From the literature it was found that an environmental impact index supplies "a relative ranking of energy efficiency among alternative technological designs providing an energy-consuming service" (McMahon & Turiel, 1997). Furthermore, it was found that an environmental impact index is based on a 'Test Procedure'. The test procedure contains a formula in which the environmental impact inflicted is calculated (Meier & Hill, 1997). For an environmental impact index for yachts the focus lies on the development of a credible test procedure that calculates the environmental impact based on the energy used in the operational lifetime phase.

In order to make the test procedure credible 8 principles for sustainability assessment of Sala et al. (2015) are used. These principles are; 'Guiding Vision', 'Essential Considerations', 'Adequate Scope', 'Framework and Indicators', 'Transparency', 'Effective Communication', 'Continuity and Capacity' and 'Broad Participation'. It was studied how these principles are embodied in literature on the development of indices for three different industries.

For household appliances, environmental impact indices are common. Refrigerators, dishwashers and other appliances have energy labels to inform stakeholders on the energy efficiency of a specific appliance. The labels are mostly focussed on informing consumers when buying an appliance. Household appliances have in common with yachts that they are both utensils, the energy consumed is determined by how the appliance is used.

Literature was also studied on environmental impact indices of buildings which is relevant since buildings and yachts are both large constructions in which multiple systems and functions are embedded. Literature on environmental impact indices for buildings focus mostly on an index that is capable of informing stakeholders during the development of the building itself. This with the goal to develop a design for a building that is optimised in terms of environmental impact.

The last industry that was studied was environmental impact indices for cities and countries, which is mostly used to obtain additional information on how an index is constructed. An index for cities and countries is mostly concerning a much higher complexity, meaning that the indices are not only assessing environmental impact but also social welfare and/or economic performance and therefore sustainability. This is broader than the focus of this research but there is still relevant information found on the development of a credible index.

Based on the literature, the principles which have to be taken into account when developing an environmental index are determined. The 'Guiding Vision' of an environmental impact index should be to inform stakeholders on the environmental impact of a product in order to enable comparison and to stimulate them to buy or produce one.

- This ‘Guiding Vision’ can be achieved by including technical, economic, cultural and behavioural aspects as ‘Essential Considerations’.
- The principle of ‘Adequate Scope’ is not found to be relevant for this research since the indication of environmental impact is not focussed on the progress over time, it is an indication of the environmental impact at a certain moment in time.
- The ’Framework and Indicator’ principle demands that the development of the test procedure has to be executed in such a way, that a large variety of products within the same product type can be assessed. The test procedure also has to be based on the technical characteristics of the product, include reliable data and should be determined through standardised and scientific methods for measurements. A generalized framework should be applied for all assessments in order to obtain fair and repeatable results.
- The principle of ‘Transparency’ applies on the construction and execution of the test procedure. Both processes have to be made public so it can be verified by stakeholders how they are performed and if stakeholders try to influence the development or execution of the assessment. In order to monitor if this is the case a 3rd party could be installed to monitor the standardized processes.
- ‘Effective Communication’ is necessary to enable easy comparison between assessments and informing stakeholders is done clearly. During the development process effective communication is necessary to support the transparency.
- The ‘Continuity and Capacity’ principle presented itself through the demand that the test procedure has to be adaptable for future technologies.
- Finally, the development of the index and test procedure has to be done through the involvement of stakeholders in order to obtain a functioning and credible index according to the principle of ‘Broad Participation’.

4. Structuring a Process Design Towards a Credible Environmental Impact Index

The principles for the development of an environmental impact index do not indicate how they have to be considered when the index is developed by stakeholders of the industry. For that reason the IAD-framework is used. The IAD-framework is capable of analysing the behaviour of a group of stakeholders in a certain situation and gives insights in how to control this behaviour through institutions. Institutions are prescriptions that humans use for organizing all forms of structured and repetitive interactions which involve humans. Within those interactions, individuals will have to make choices and undertake actions that define their strategy and have consequences for themselves and their environment (Ostrom, 2005).

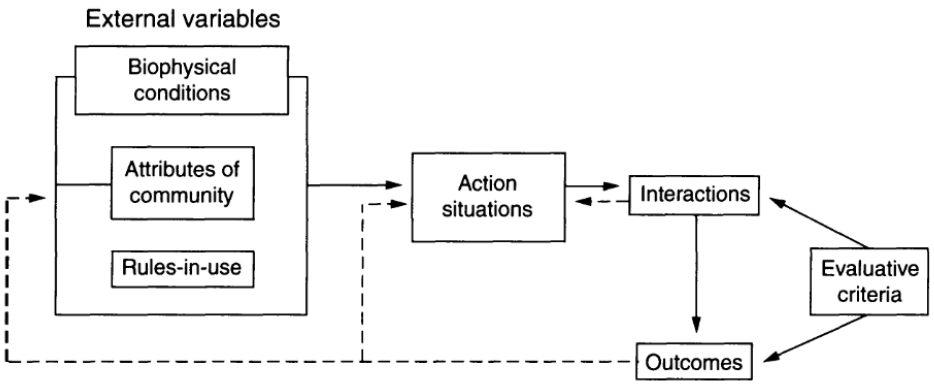

Figure 1 - The Institutional Analysis and Development Framework (Ostrom, 2010)

The IAD-framework consists of multiple categories. In Figure 1, the IAD-framework is shown with the 'Action Situation' in the middle and four categories; 'Outcome', 'Biophysical Conditions', 'Attributes of Community' and 'Rules in Use'. In this section the 'Action Situation' represents the development process of the YETI. The 'Biophysical Conditions' represent the technical characteristics of a yacht. The 'Attributes of Community' are regarding the characteristics of the stakeholders active within the yachting industry and developing the index. 'Rules in Use' are regarding the formal and informal rules structuring the development process. To embed the influence of these three categories on the development process an analysis of the industry is done. The 'Outcome' Category represents the product of the 'Action Situation'. In this research the 'Outcome' has to be a credible index, which is represented by the 'Evaluative Criteria'.

To develop a process design towards a credible index focus is laid on the 'Action Situation' and the rules governing the activities within it. In Figure 2, a schematic representation of the 'Action Situation' and the belonging rules is presented. The first three variables to be considered are the 'Positions' that can be taken by 'Actors' and what 'Actions' those actors can perform when holding different positions (Ostrom, 2010; Ostrom et al., 1994). For the development of a process design it is important to know who is participating in the development process and what the different positions in regard to each other they have. The positions determine the other variables since they are linked to the information and control actors have on the situation. The 'Information' and 'Control' can determine what actions they perform. The actions performed lead to 'Potential Outcomes' yielding 'Net Costs and Benefits' for the variety of actors identified (Ostrom, 2010; Ostrom et al., 1994). The 'Action Situation' is used to identify the perspective of the stakeholder group of yacht builders and designers on the development of an environmental impact index. The 'Action Situation' structures the development of the process design that has to govern the variety of 'Actors' and 'Positions' within the stakeholder group of yacht builders and designers. Therefore, the variables of the 'Action Situation'

give relevant insights when developing the process design, the variables are used to indicate what has to be regulated through the process design. Below the relevant rules and what they govern is elaborated on.

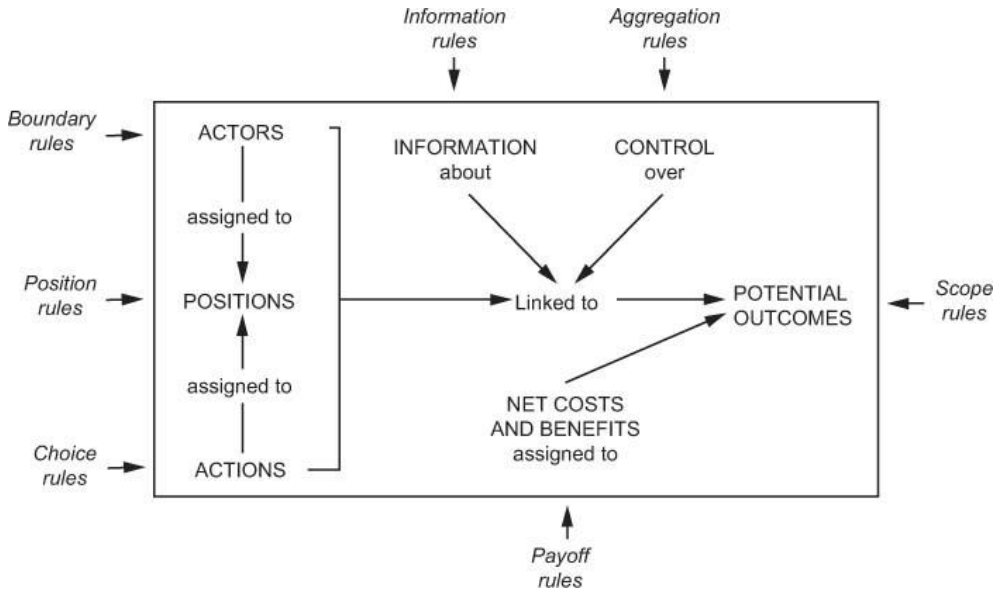

Figure 2 - The Action Situation and Rules ; image from Witting (2017) based on Ostrom (2005)

Position Rules

Position rules determine what roles actors can take within an action situation. Positions determine what actors can perform what kind of actions can be performed (Ostrom, 2005). Position rules can also restrict the variety of positions actors can take within an 'Action Situation' and how many actors can hold a certain position (Ostrom et al., 1994). For the development of the YETI the position rules have to determine what the different roles are within the development process and how many actors can take those roles.

Boundary Rules

The boundary rules define who can participate in the 'Action Situation', how this is determined and how an actor can leave a position. Boundary rules are also called entry and exit rules. (Ostrom, 2005) For the development of the YETI it has to be determined what yacht builders and designers can participate or how many are necessary. The boundary rules are also interesting because the exclusion of other stakeholder parties that yacht builders and designers might infringe the credibility of the index.

Choice Rules

Choice rules specify what actions actors in certain positions can, must, or must not perform and at what moment in the decision process. The actions are dependent on what positions the actors have and on what actions have been performed prior to this actions that is performed (Ostrom et al., 1994; Ostrom, 2005)

Aggregation Rules

Aggregation rules specify the power of a position held by actors to achieve a certain outcome of the 'Action Situation'. For example, one position has more votes than another in an election (Ostrom et al., 1994). For the development of the YETI it has to be defined what the power of the yacht builders and designers is and how this is distributed over the participants.

Scope Rules

Scope rules specify what outcomes can be achieved by the 'Action Situation'. These can be intermediate or final outcomes (Ostrom et al., 1994). Since the outcome of the 'Action Situation' in this research is a credible index the scope rules have to define what this index has to be composed of and how it is made credible. The principles found in the literature that provide insights on the characteristics of the index are affecting the scope rules.

Information Rules

Information rules state what information actors in certain positions receive regarding the proceedings of the 'Action Situation' (Ostrom et al., 1994). It has to be defined what information is available for whom when co-developing the YETI.

Payoff Rules

Payoff rules are installed to determine how benefits and costs are required, permitted or forbidden between actors in the 'Action Situation' based on the outcomes reached (Ostrom et al., 1994).

For the development of the process design towards an environmental impact index these rules have to be developed. To identify what these rules have to entail for the development of an environmental impact index the principles are coupled to the rules. How the rules are coupled is presented in Figure 3. The green principles are regarding the development process and the blue principles are regarding the characteristics of the index. What rules have to be installed specifically for an index in the yachting industry is determined through workshop in which yacht builders and designers specified the rules coupled with the principles. Based on the specified rules the process design is developed.

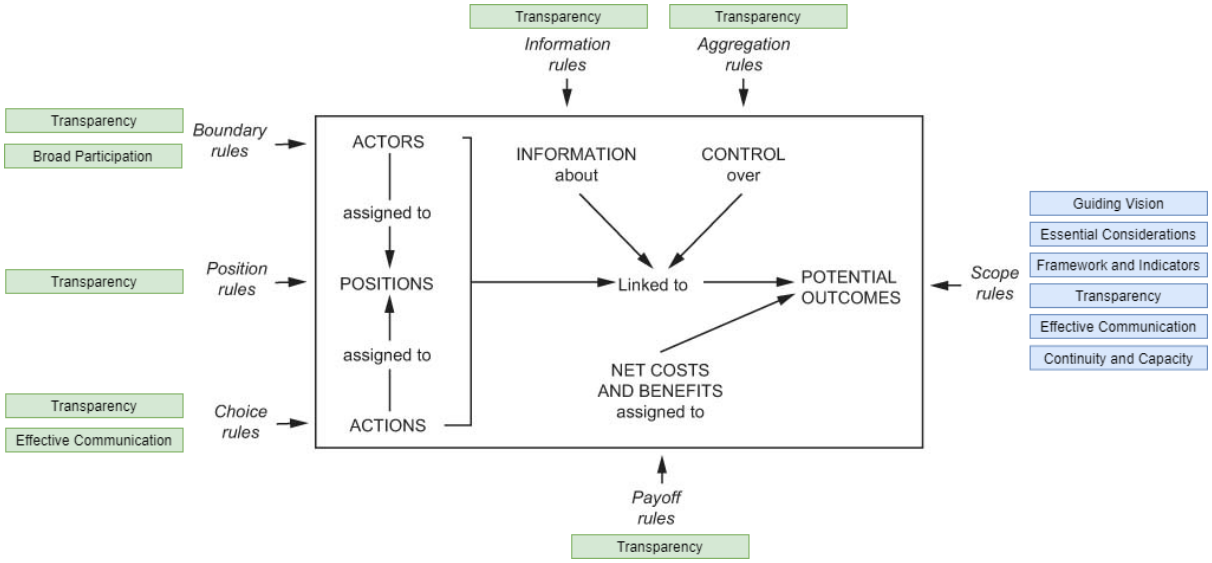

Figure 3 - Principles Assigned to the Rules Governing the Action Situation

5. Credible Index Development According to Yacht Builders and Designers

Based on statements made by yacht builders and designers during the workshop the rules governing the IAD-framework were specified. Below an explanation of how every rule should be formed to develop a credible index in the yachting industry is presented.

Position Rules have to be developed that state that two sorts of positions take part in the development process of the YETI. One is yacht builders and designers. The other is a 3rd party that controls if the development process is executed according to the rules developed. The 3rd party is therefore giving the task to control if the index, as it is being developed, is still credible.

The boundary rules have to state how many yacht builders and designers can take part in the development of the YETI and who they are. Also, the appointment of the 3rd party has to be determined through boundary rules. The proposition of developing the YETI through a Joint Industry Project (JIP) could be a structured way to develop the index.

Authority rules have to be developed that state what the possible actions of yacht builders and designers or the 3rd party can be. From the workshop it was found that the YETI should be developed based on scientifically proven methods. This could be a restriction of how certain aspects of the index can be developed. Authority rules also have to be installed to state what the 3rd party can do to correct the development.

The determination of actions is closely related to the aggregation rules. It has to be determined what the power of the two groups of participants are. Ideally the yacht builders and designers all have equal power and they have to co-develop everything. The 3rd party has to have to power to correct what is developed if it is not according to the rules set.

The majority of the statements made during the workshop were regarding the scope rules. The scope rules have to determine what is developed and what the index has to look like in order to be credible. Important is that the test procedure includes indicators for the energy use of the yacht during its operational lifetime phase. Only indicators that can be calculated during the design phase and verified during sea trials can be included. The indicators that have to be included are the sort of energy carrier that is used by the yacht, the efficiency of conversion systems installed that convert the energy carriers to useable energy, and how much energy is used by the yacht under influence of a generalised operational profile with climate conditions and the hydrodynamic properties of the yacht. Important is that the test procedure is understandable for all stakeholders, it has to remain relatively simple to achieve this. Part of the development has to be done by institutions that govern the execution of the YETI. Most importantly is that all procedures of the index are standardised. Standardisation secures equal execution of assessments and therefore enables fair comparison. It also creates the possibility to verify if the assessment is executed in the right manner.

The information rules are less discussed in the workshop but are rather important. All stakeholders have to understand what has been developed and how this is done. Credibility of the index is highly dependent on the perception stakeholders have of the index. If they do not understand the index or how it has been developed the index will not be credible.

No statements were made regarding the payoff rules. However, it is important that all stakeholders are treated equally in the development process and no actor can have an additional gain by the development of the index itself. Therefore, payoff rules have to be installed so it is transparent what the costs and benefits are and that all should be divided equally.

6. Process Design Based on the IAD-Framework

The process design is constructed based on the rules governing the seven variables of the action situation as presented in Chapter 4 of this paper. In this first it is presented what each rule has to contain to make the index credible. Afterwards the process design is presented.

Position Rules

Important is that all yacht builders and designers involved with the development of the YETI have equal **positions**. The development of the YETI has to be based on a consensus among stakeholders and there cannot be a party that has a higher influence on the development process than another. This would be conflicting with the fact that every yacht should be fairly assessed so a fair comparison can be made. The only exception of this is the 3rd party that has to be appointed. However, it this party should be serving the other stakeholders by reviewing if the test procedure developed through a consensus can be standardised and verified.

Boundary Rules

In the development process of the YETI multiple **actors** are involved. From the analysis of the industry it was found that yacht builders and designers have to be included in the development, along with a 3rd party controlling the process. Consumers also have a stake in the project, but they do not need to be included in the development process. They desire an index that informs them on the environmental impact of the yacht they want to buy but no reason is found to include them in the development process. Furthermore, it is explicitly mentioned by both literature and in the workshop that governmental bodies should not interfere with the development of the YETI. Although, the inclusion of the 3rd party responsible for control on the execution of the test procedure and other standardisations is necessary. It is proposed that a Classification Society fulfils this role since they are independent, accredited by stakeholders and familiar with the yachting industry.

Choice Rules

The limitations of positions reflect on the **actions** stakeholders can perform. Since all positions are equal the actions actors can perform are also all equal. The actions that are performed are all involved with reaching the consensus on the development of the index. The main aspect on which a consensus has to be reached is the construction of the test procedure. To give a starting point for this development a concept test procedure is part of the recommendations of this research. The 3rd party has to control if what is developed as demanded by the scope rules is done credible. Indicators included in the developed test procedure have to be calculated in the design phase and verified during sea trials for example. If this is not possible the indicator cannot be included in the test procedure. This task is assigned to the 3rd party since they are an independent party that is common with the

measurements and quality control of yachts. They have the expertise that is necessary to decide if an indicator can be include.

Aggregation Rules

All stakeholders have to have equal **control** over the situation. The opinions of the involved stakeholders all have to weigh equally in order to reach a consensus. It has to be impossible for stakeholders to force their opinion on other stakeholders or to veto a decision. The only party that can overrule a decision made for the development of the test procedure is the 3rd party and this can only occur when the decisions are made that damage the credibility of the index. For example, an indicator cannot be included in the test procedure due to the inability to calculate or verify the value in both design phase and during sea trials.

Scope Rules

The scope rules have to determine what the **outcome** of the 'Action Situation' is, and therefore what has to be developed. Most importantly is to develop a test procedure that is credible. Part of the test procedure have to be the energy carriers used by a yacht, the energy conversion systems and a dimensional measure has to be included. An operational profile has to be created and a method to convert energy use to environmental impact has to be designed. It is important that every indicator part of the test procedure can be predicted and verified in a credible way.

Information Rules

The **information** that stakeholders have over the development process also has to be equally distributed. All stakeholders have to be aware of what is developed and how this is achieved. Transparency is necessary in order to distribute the information to all stakeholders. The openness of what is going on during the development enables stakeholders to intervene and discuss design decisions. All procedures and products of the development process have to be understood by all actors in order to let the index be credible.

Payoff Rules

The **net costs and benefits** the stakeholders receive from the development process also have to be divided equally. Again, the only exception is the 3rd party. The yacht builders and designers would have to contribute equally to the development of the index. The motivation for participation has to be to obtain an index that informs them on the environmental impact of their yachts. If costs arise all stakeholders should carry those equally as well. It is not ruled out that the appointed 3rd party has to receive benefits from their involvement in the project. This because for example, a Classification

Society its core business is to assess ships or yachts. For taking the role of controller in the project they can receive benefits.

Developed Process Design

The process design consists of steps that have to be executed in cooperation between the yacht builders and designers. These steps state what has to be designed and are proposed as scope rules. It is highly important that a consensus has to be reached for every step in, together all steps are part of a larger consensus that has to be reached in order to develop the YETI. The consensus is what makes the development process credible. In order to achieve a consensus all stakeholders have to be aware of what the steps have resulted in. They have to thoroughly understand what has been developed and agree with the result. Below the five steps are presented. Afterwards, it is elaborated on why those steps are part of the process design.

1. Appoint 3rd party
2. Determine Goal and Purpose
3. Determine Scope
4. Determine Variable Indicators of Test Procedure
5. Develop Constant Indicators of Test Procedure
    a. Develop Operational Profile
    b. Determine Scientific Method for Environmental Impact Calculation
    c. Determine Size Comparison Variable

1. Appoint 3rd party

The 3rd party's role in the development process is to review the if the design choices made by stakeholders on the inclusion of indicators are justified. The 3rd party has to review if the indicators can be calculated during the design phase of the yacht in the 'design-tool'. It also has to be possible to verify those calculations by measurements during sea trials. During the execution of the test procedure, when the index is developed, the third party can control the assessments executed. The involvement of a 3rd party in the index is based on the 'Transparency' principle assigned to the positions rules.

2. Determine Goal and Purpose

The YETI has to be developed through a consensus of all stakeholders, therefore the goal and purpose of the index have to be clearly defined. If this is not defined clearly stakeholders might have other ideas of what the function of the index is and therefore have a different opinion on how to develop the YETI. The goal of the index has to be to provide producers and consumers on the environmental

impact of a yacht inflicted during the operational lifetime phase during the design of the yacht. The purpose is to stimulate them to choose a design of a yacht with a low environmental impact. This step has to make sure that all yacht builders and designers agree on why the index is developed. Only when everybody has the same goal in mind a credible index can be developed.

3. Determine Scope

When the goal and purpose of the YETI is clear, the stakeholders have to decide how those goals are met and the purpose is served. When determining the scope, it has to be considered what has to be assessed in order to achieve the goal. This step is included in the process design based on presence of the 'Guiding Vision' and 'Essential Considerations' principles both influencing the scope rules. The scope of the assessment of environmental impact of a yacht during the operational lifetime phase has to be the use of energy during the operation of the yacht.

4. Determine Variable Indicators of Test Procedure

After the scope is determined the test procedure can be developed. The first step of developing the test procedure is determining the indicators that are variable. With variable indicators, the indicators that are dependent on the specific yacht that is assessed are meant. The variable indicators have to be determined first because they influence the constant indicators of the test procedure. An important for this step is that the test procedure remains as simple as possible and understandable as stated by the 'Effective Communication' principle assigned to the scope.

In the test procedure variable indicators have to be included that give information on the performance regarding the determined scope. Only indicators that are determined by the technical characteristics of the yacht have to be included according to the principle of 'Essential Considerations'. For the YETI indicators that influence the energy used during the operational lifetime phase have to be included. From the workshop it was found that the energy carriers that supply useable energy for the yacht (fuels) have to be identified. How energy carriers are converted in useable energy has to be known (main engines, generators). The efficiency of the systems that perform this conversion is needed to know how much energy carrier is needed to obtain the needed amount of useable energy (range, endurance). Also the hydrodynamic properties of a yacht need to be known, these have a high influence on how much energy is needed for the propulsion of the yacht (propulsion & hotel load). How these indicators are exactly included in the test procedure has to be agreed upon through the JIP.

The principles of 'Framework and Indicators' and 'Transparency' assigned to the scope rules, state that the test procedure has to be standardised in order to equally assess all yachts. The development of the test procedure is determined by the possibility of standardising the indicators. The 3rd party is important to judge if the indicators can be included in the test procedure.

5. Develop Constant Indicators of Test Procedure

After the variable indicators are determined the constant indicators of the test procedure can be developed. The constant indicators can only be developed after the variable indicators are determined since the constant indicators have to enable comparison between the different value of the variable indicators. The constant indicators make sure a comparison of different yachts can be made as stated by the 'Guiding Vision' principle. These constant indicators are the operational profile, the calculation method and the size variable (functional unit).

5a. Develop Operational Profile

The first constant indicator that has to be developed is the operational profile. A generalised operational profile is needed to assess the environmental impact over time and in different conditions as was stated through the 'Framework and Indicators'. The operational profile has to contain activities that influence the energy use of a yacht during operation. Sailing at different speeds and in different climate conditions determine the energy needed for the propulsion of the yacht and the needed hotel energy. How much energy a yacht uses is dependent on how efficient a yacht utilises the available energy, activities in the operational profile dictate how much energy is needed.

5b. Determine Scientific Method for Environmental Impact Calculation

A scientific method has to be included in the test procedure to convert the energy used by the yacht to perform the operational profile into impact made on the environment. A scientific method has to be included as presented by the 'Transparency' and 'Framework and Indicators' principles. Also during the workshop it was stated that a scientific method has to be included. A scientific method is necessary to determine the environmental impact made. The environmental impact made is dependent on the energy carrier that is used to deliver the energy used during the different activities of the operational profile.

5c. Determine Size Comparison Variable

In order to enable comparison of yacht of different sizes as stated by the 'Guiding Vision' principle, a variable has to be included in the test procedure that enables this. In the workshop was proposed to base this comparison on the interior volume of the yacht that is destined for the user of the yacht. The 'Size Variable' has the function to supply a metric of environmental impact of the yacht per a dimensional characteristic of the yacht representing the value to the user.

7. Conclusions

From the research it became apparent that the most important feature of a credible environmental impact index is that it is being developed by the stakeholders of the industry that will use the index. In this research a process design has been developed that has to govern yacht builders and designers during the development of the YETI. To develop a credible index by stakeholders, transparency is highly important. Credibility is most ensured by making public what is being developed, and how it is developed. All stakeholders involved with the development have to agree on both aspects. A consensus has to be reached on all procedures part of the index. Credibility is ensured when all stakeholders agree on the executed development process and the end product of that process. Furthermore, a credible index is created by standardisations of all procedures part of the index as agreed through the consensus made. Standardisations provide the ability to verify if the procedures are executed correctly. This is also related to transparency. During the development process it is important that it is made sure that everything that is developed can be standardised. An independent 3rd party should be appointed during the development process to monitor if what is developed can be standardised. The development of a credible environmental impact index is the first step towards creating a more sustainable yachting industry. Providing information to all stakeholders of the industry on the environmental impact of a yacht has to raise awareness and stimulate them to decrease the impact of the industry on the environment.

It can be concluded that a process design towards a credible environmental impact index for the operational lifetime of superyacht does not solely consists of steps leading toward a ‘test procedure’. The development of the YETI is dependent on the environment in which the development steps have to be executed and is dependent on the actors developing the index. In order to let the index be credible the principles have to be honoured that state how a credible environmental impact index is developed and shaped the rules of the IAD-framework guiding the development process. Furthermore, it is important to understand that the concept of credibility is subjective. If the YETI is credible is dependent on how each stakeholder perceives the index. What one individual might see as credible could not apply for the other. That is why the development of the YETI with yacht builders and designers has to be based on a consensus. All actors in the development process have to agree with the development decisions made. In order to agree with them they have to possess all the required information to make the judgement if what is developed is credible for them. To make this judgement easier it is important that for every indicator part of the ‘test procedure’ standardised proceedings are developed in which it is documented how an indicator should be calculated or measured. This enables stakeholders to clearly see what is developed and how the assessment will be executed. The process design developed guides the yacht builders and designers towards a credible YETI.

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