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Strategic Innovation Tools Enabling Nautical Stakeholders To Shape A Next Level Port

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Abstract: The current study explores how strategic design can foster innovation within the nautical process. With a focus on creating and learning by doing, strategic design can generate value among the nautical stakeholders. The nautical (operational) process has been explored in detail and translated into boundary objects to facilitate and foster strategic innovation in the nautical innovation process. It can be concluded that these objects have unlocked different perspectives, and enabled the nautical stakeholders to make their implicit knowledge explicit, and to co-construct the nautical process together. The objects remove boundaries in transferring knowledge while recognising people's values, demands, and communication skills. Next to that, varying the use of the boundary objects in creating innovation in the nautical process seems to be valuable in structuring and collaboratively innovating. Besides, the application of the boundary objects into practice established an increasing level of attachment to both process and results.

Keywords: Co-creation, Innovation, Port Industry, Research through Design, Strategic Design.

1. Introduction

Many ports are facing new challenges in terms of (re)defining their processes and activities. The automation of processes, the digital world, and the environmental awareness are just a few exemplary factors that cause these challenges, stressing the need for continuous innovation. What's more, today's ports are an industry in itself; an eco-system of various stakeholders, each with their own interests. Consequently, ports processes are characterised by collaboration among these different people involved. The changing port industry, combined with this level of human complexity often goes hand in hand with a reluctance to innovate, while the success of innovation largely depends on stakeholders' collaboration. Strategic innovation in port industry thus asks for a substantial shift in both mind-set and activities. Understanding different interests and roles is crucial for an eco-system of stakeholders working towards a shared vision of developing a next level port. Even though, most stakeholders are open to innovate, they do not necessarily know how to do that, or are not taking the first step. Therefore, innovation in the nautical process needs to be seen as a

strategic issue which deals with the future of the port industry, and with the future of companies and people involved. Design thinking is oftentimes perceived as the answer to these major and complex challenges because it takes the user needs into account while creating possible solutions (Macdonald, 2014). Strategic design is mainly seen as the facilitator of creating this future direction from people's values and demands (Lockwood, 2010; Meroni, 2008). It is 'a way to re-examine, re-think, and re-design the systems that we have inherited from the past' (Boyer, Cook & Steinberg, 2011).

The current work elaborates upon the role of design thinking and strategic design in fostering innovation within the nautical process of ports. We refer to the nautical process as the process of coordinating, manoeuvring, and assisting the vessel into the port before it is ready to (un)load its cargo at the terminal. The nautical process in ports is characterised by a high level of operational activities. Innovation in the nautical process not only deals with the optimisation and automation of transporting vessels in and out of the port and changing the nautical routines to shape a next level port, but also with changing the reluctance towards innovation among the people involved in the operational process. In the remainder, the nautical process and its different stakeholders, roles, and activities are studied from a strategic design perspective using a research through design approach. The next section positions strategic design in the nautical process in ports. After that, the research through design approach has been applied into practice through conducting an ethnographic study, interviews, and workshops. The findings are translated into strategic innovation tools and evaluated as boundary objects that can be used to foster innovation and help build a next level port together. We conclude with a discussion on how the different boundary objects can strengthen each other in fostering innovation. Hereto, the objects are placed into a framework aiming to support the further debate on nautical innovation routines.

2. Strategic design in ports

In the current work, we refer to strategic design as an integrated organisational approach on how to (re)design your process(es) by thinking from a human perspective, the way they communicate, and their values and demands (Boyer et al., 2011; Lockwood, 2010; Meroni, 2008). More specifically, strategic design values a bottom-up approach and aims to make the unknown known (Meroni, 2008; Michlewski, 2008). Strategic design can be of value between and within different levels and disciplines within an organisation, and in ports; on strategic, tactical, and operational level (Borja de Mozota, 2003). It mainly functions as the glue between these levels to ensure that everyone is on the same page (Kootstra, 2009). It can be concluded that the social values of the nautical stakeholders, across and within organisations are important to consider in applying strategic design. In the current section, we explain the characteristics of strategic design and explore how strategic design can be applied in the nautical process in the ports. One of the important aspects in recognising each other's values and demands is the way how people learn and communicate (Manzin & Vezzoli, 2003). Especially in a multidisciplinary context as the nautical process, the interaction is a process of learning and transferring knowledge between each other (Buijs, 1984). The way how people learn is linked to their mental models. Smulders, de Caluwé, and Nieuwenhuizen (2003) state that if these mental models are different than the situation demands, the action would also be less effective. Figure 1 shows a schematic view of such a mental model.

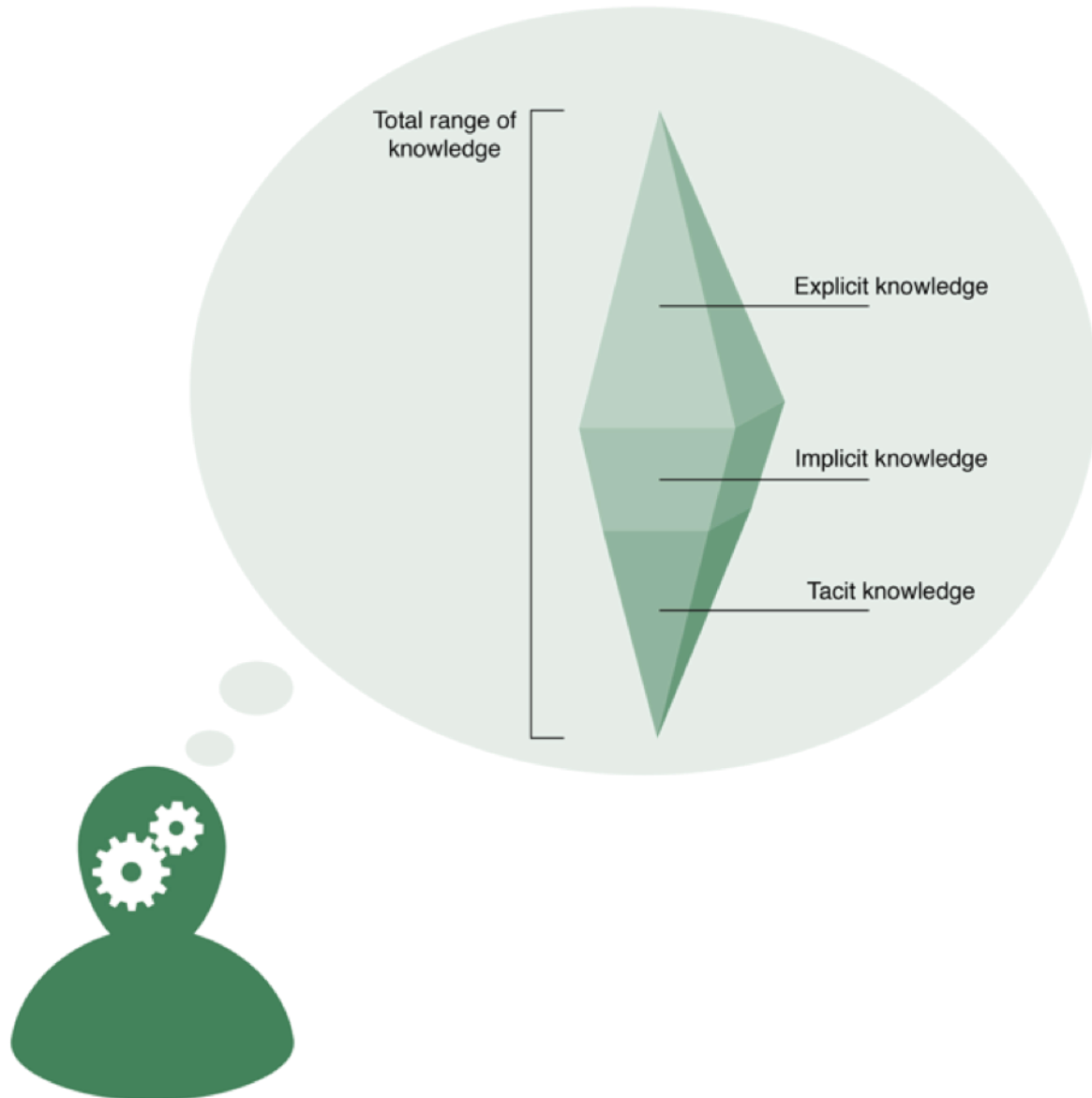


Figure 1. The schematic view of a person's mental model.

A mental model consists of explicit, implicit, and tacit knowledge. The size of these parts differs from person to person. Explicit knowledge can be easily explained in words, whereas implicit knowledge is often hard to recall. Tacit knowledge is embedded into the person's mental model itself and hardly explainable. Creating innovation in a context where people have different mental models frequently result in cognitive errors between these people. The need to avoid cognitive errors in understanding and transferring knowledge is important recognising each other's values and demands. These errors can be avoided using boundary objects to support the transfer of relevant knowledge that is required and remove knowledge boundaries (Smulders, Lousberg, & Dorst 2008). Exchanging knowledge is a critical source in creating successful innovation within an organisation and/or an industry (Carlile, 2000). Whereas the nautical process is emphasised by its operational activities, referring to the mental model of people it means that the knowledge of the operational nautical people is emphasised by its implicit and tacit part. In a nautical context, knowledge is often 'localised, embedded and invested into practice' (Carlile, 2000). It is, therefore, important to create efficient knowledge transfers using the right boundary objects to foster innovation. Especially in a rapidly changing port industry, knowledge can be both a boundary and a source for creating innovations.

The essence is to design boundary objects that recognises the different nautical roles, ways of learning, differences, and dependencies in transferring knowledge (Figure 2).

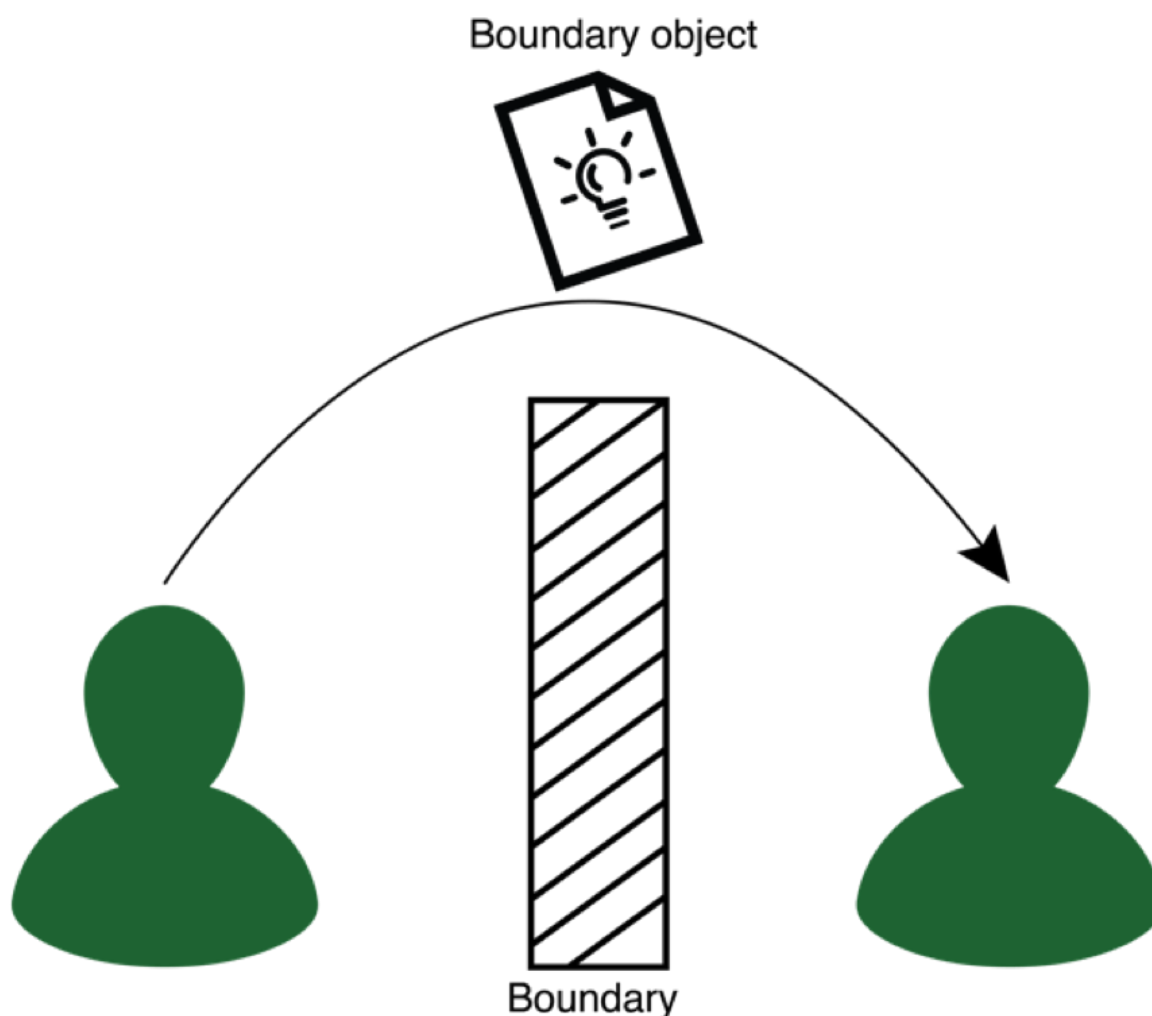


Figure 2. A schematic view of a boundary object.

As mentioned earlier, the nautical activities in ports are characterised by its operational performance which create a high level of organisational routines. The way how a routine is structured can be evaluated according to the ostensive and performative part of the routine (Feldman & Pentland, 2003). The ostensive part includes the agreements/goals people made to perform its actions in the performative part. These parts can be both a bottleneck and a source for innovation (Feldman et al., 2003). It is important that the ostensive part is less tacit and implicit within an organisation, meaning that everybody is on the same page. If the routines allow flexibility according to its efficiency, it fosters innovation. If the routines are too structured, there is little room for adjustments, which creates a boundary for innovations. Boundary objects allow a routine to be, on the one hand, flexible to generate new knowledge, and on the other hand, provide structure in efficient knowledge transfers on how to allow flexibility.

In the way, strategic design can be used to create efficient knowledge transfers between the different stakeholders involved in a nautical context. Figure 3 shows the strategic innovation framework, where the above discussed characteristics of strategic design are linked to each other. The framework illustrates which roles strategic design can play to foster innovation in the nautical

process. On the left, the different nautical stakeholders are listed. The middle part shows the nautical innovation routine; the ostensive part should allow exploration and flexibility, whereas the performative part should exploit this knowledge into concrete changes and adjustments regarding innovation. Throughout the entire process, boundary objects are essential to avoid cognitive errors in transferring knowledge between people. Finally, one can build a competitive advantage, create innovation, and enhance performance. Building a competitive advantage, fostering innovation, and enhancing the performance of the nautical process demands efficient knowledge transfers to change and/or adjust the nautical routine. As Junginger (2008) argued, stability is needed to function properly, but you need change to survive. The next section introduces the Research through Design approach used to foster innovation within the nautical process.

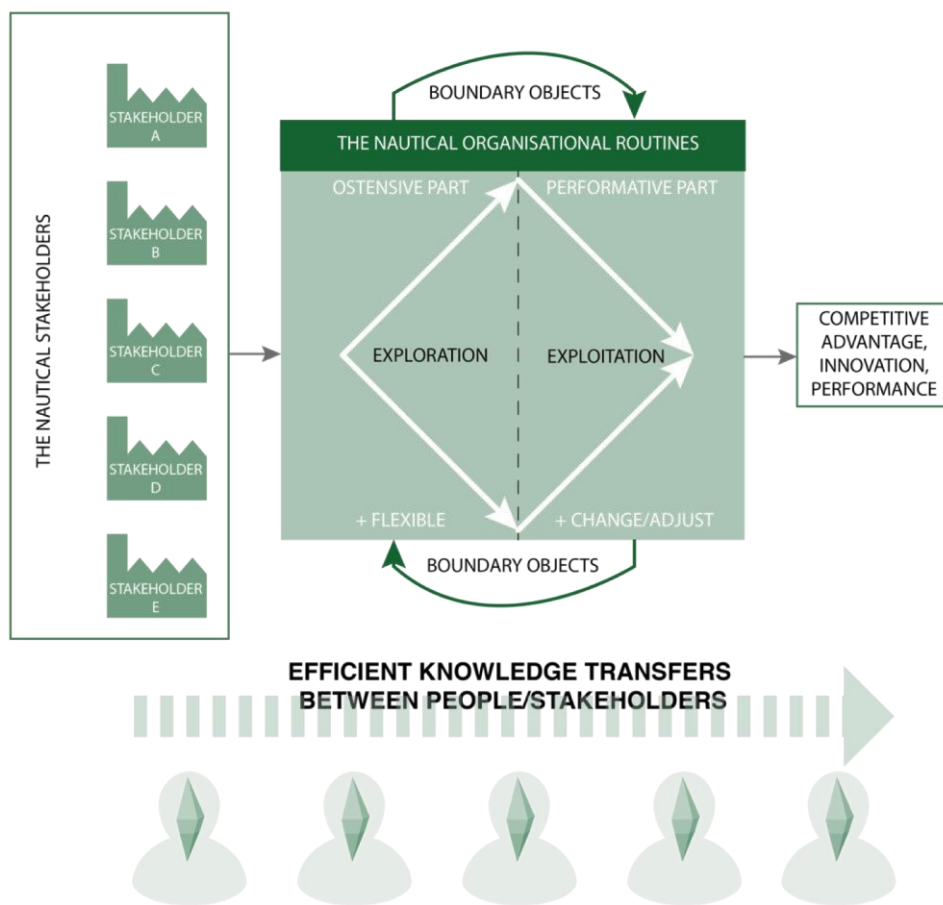


Figure 3. The proposed strategic innovation framework.

3. Approach

A research through design (RTD) approach has been used where different strategic innovation tools have been developed and used to understand the nautical process. The goal of the current approach was two-folded. First, a RTD method has been used to understand and define the nautical process. Second, these findings were translated into boundary objects that can be used among the stakeholders to discover new opportunities and foster innovation within the nautical process. Since innovation in the nautical process is an ill-defined issue, the RTD allowed us to discover the main obstacles and develop boundary objects to avoid these obstacles. Hereto, an iterative approach has been pursued where the insights were captured, discussed, and evaluated with the nautical

stakeholders to eventually create the right boundary objects that foster innovation. The following three phases were used: 1) Explore the nautical process and its stakeholders, 2) Iterate by translating the findings into artefacts, and 3) Define and test the use of the strategic innovation tools as boundary objects. Figure 4 visualises the research through design approach and the corresponding three main phases: explore, iterate, and define.

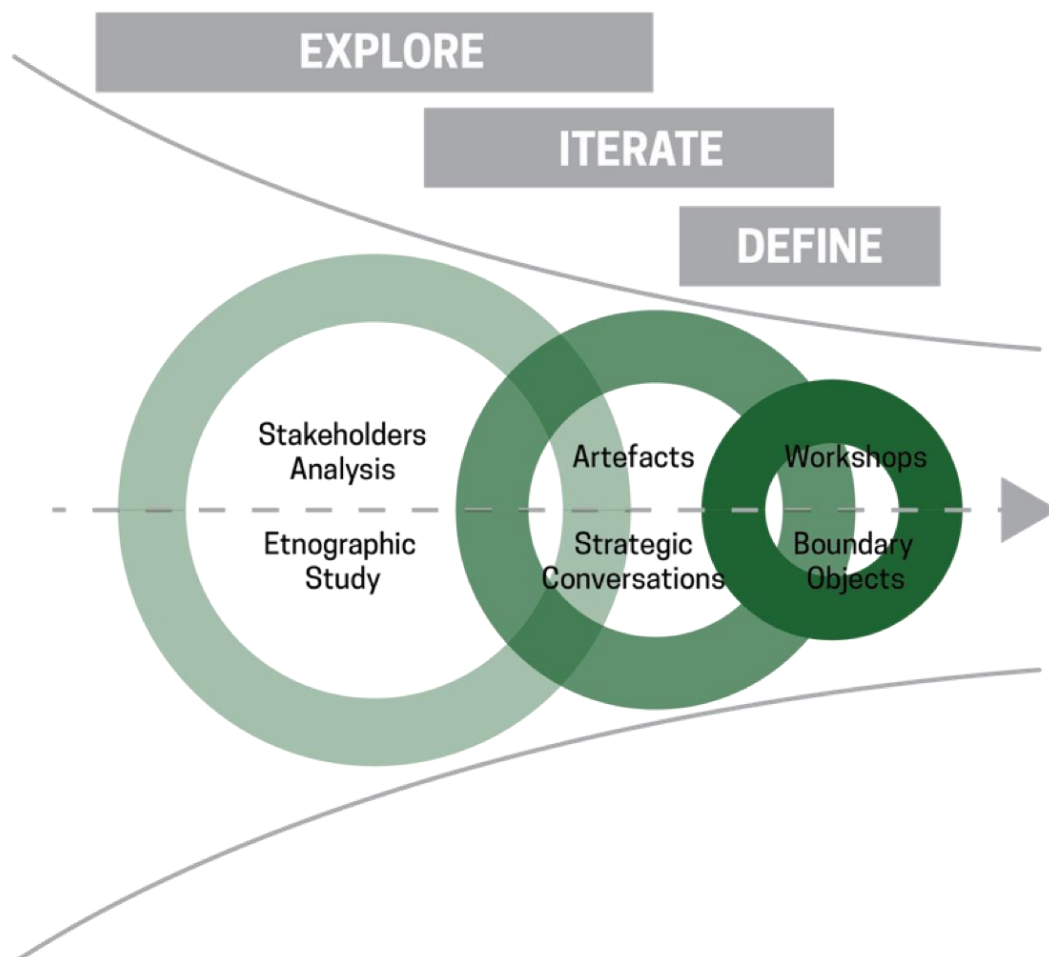


Figure 4. Visualisation of the Research through Design process.

3.1 Explore

In the exploration phase the characteristics of the nautical stakeholders have been explored. In the first part of each interviews, the Research through Design approach has been explained. During the second part of the interview, a stakeholder analysis has been performed to explore the nautical activities and interests from each stakeholders' point of view. After that, job-shadowing days followed to experience the nautical process from each stakeholder's perspective. Several stakeholders from the harbour coordination centre (HCC), boatmen association, pilot association, towage company, agents and terminal have been interviewed. These were largely people on strategic or tactical level of the organisation (board members, managers, planners). The ethnographic study has been done in the operational field of the different organisations. Participants were not always the same people as those that participated in the interviews. Job shadowing days have been conducted with the HCC, boatmen, pilots, agent, and tugs.

The goal of this first phase was to explore and learn about the activities happen in the nautical process from each stakeholders' point of view. At the same time, the goal was to identify spots how and where the strategic innovation tools could be translated into boundary objects to foster innovation.

3.2 Iterate

In the second phase, insights and findings from the exploration phase have been translated into artefacts to capture and share the findings. The artefacts were constantly updated and discussed through several strategic conversations with the nautical stakeholders. We refer to strategic conversations as a dialogue with people involved in the process to create a shared level of knowledge between them (Meroni, 2008). As the research progressed, the artefacts functioned not only as a visualisation of the process, but also as boundary objects to explain the nautical process and facilitate the strategic conversations on the development of the future of the port, and the stakeholders' role in that. The strategic conversations, where we constantly evaluated the artefacts, were done with design experts, the nautical stakeholders, and fellow researchers. Both the content and the visualisation itself have been discussed.

The goal of this second phase was to create the fundament for designing useful boundary objects for the nautical stakeholders to foster innovation. Second, the goal was to research how the artefacts function while using it to explain the bottlenecks within the nautical process.

3.3 Define

In the last phase of the research, the four resulting artefacts have been evaluated in two workshops to investigate whether they could function as boundary objects to foster innovation within the nautical process. In the first workshop the nautical roles, value web, and the vessel's journey were presented and discussed. In the second workshop, the nautical stakeholders were invited to join PortPlay. Eventually, the findings of these workshops were evaluated using the conceptual framework as displayed earlier in Figure 3. In both workshops the nautical stakeholders were invited to join. However, in the first workshop not every stakeholder was present, so the roles, web and journey were presented individually to them in a separate session. In the second workshop, all the nautical stakeholders were present. During this research, several artefacts were designed which function as strategic innovation tools. However, not every strategic innovation tool function as a boundary object among the nautical stakeholders. The goal of this phase is to define which of the strategic innovation tools can be used as boundary objects to foster innovation within and by the nautical stakeholders.

In the next section the final versions of the artefacts are introduced as strategic innovation tools. Section 5 presents the results of the tools in practice. The current work ends with a discussion and conclusion on how strategic design could be used in fostering innovation in the nautical process.

4. Strategic Innovation Tools

Each strategic innovation tool has its own purpose and contribution to the quest of co-creating innovation. The four resulting tools (nautical roles, value web, vessel's journey, and portplay) are introduced below.

4.1 Nautical Roles

The nautical roles describe each stakeholder according to its function, interest, strength and weakness (Figure 5). The overview of the different roles aims to create a shared understanding of the different nautical activities related to the different stakeholders. Adding a nuance in the description of the different roles helps to understand each other and creates a common picture.

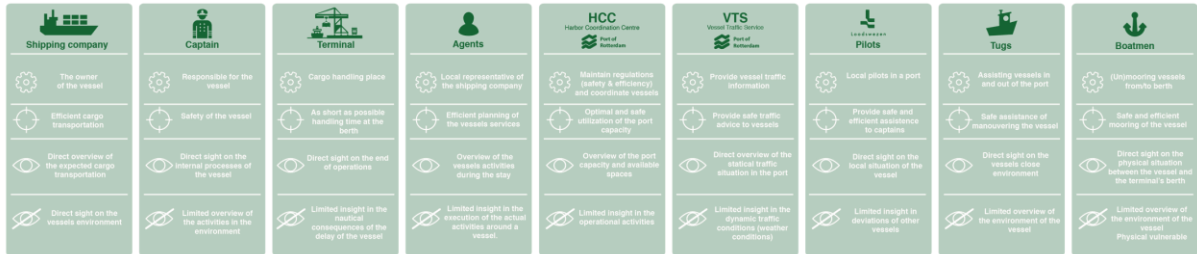


Figure 5. The nautical roles (function/interest/strength/weakness).

4.2 Value web

The value web is a useful tool for creating an overview of the stakeholders involved, each with their interest and values. The nautical value web provides an overview of the nautical services (public) and the commercials (private). Furthermore, the value web shows the separate values of each stakeholders in relation to the bigger picture (Figure 6).

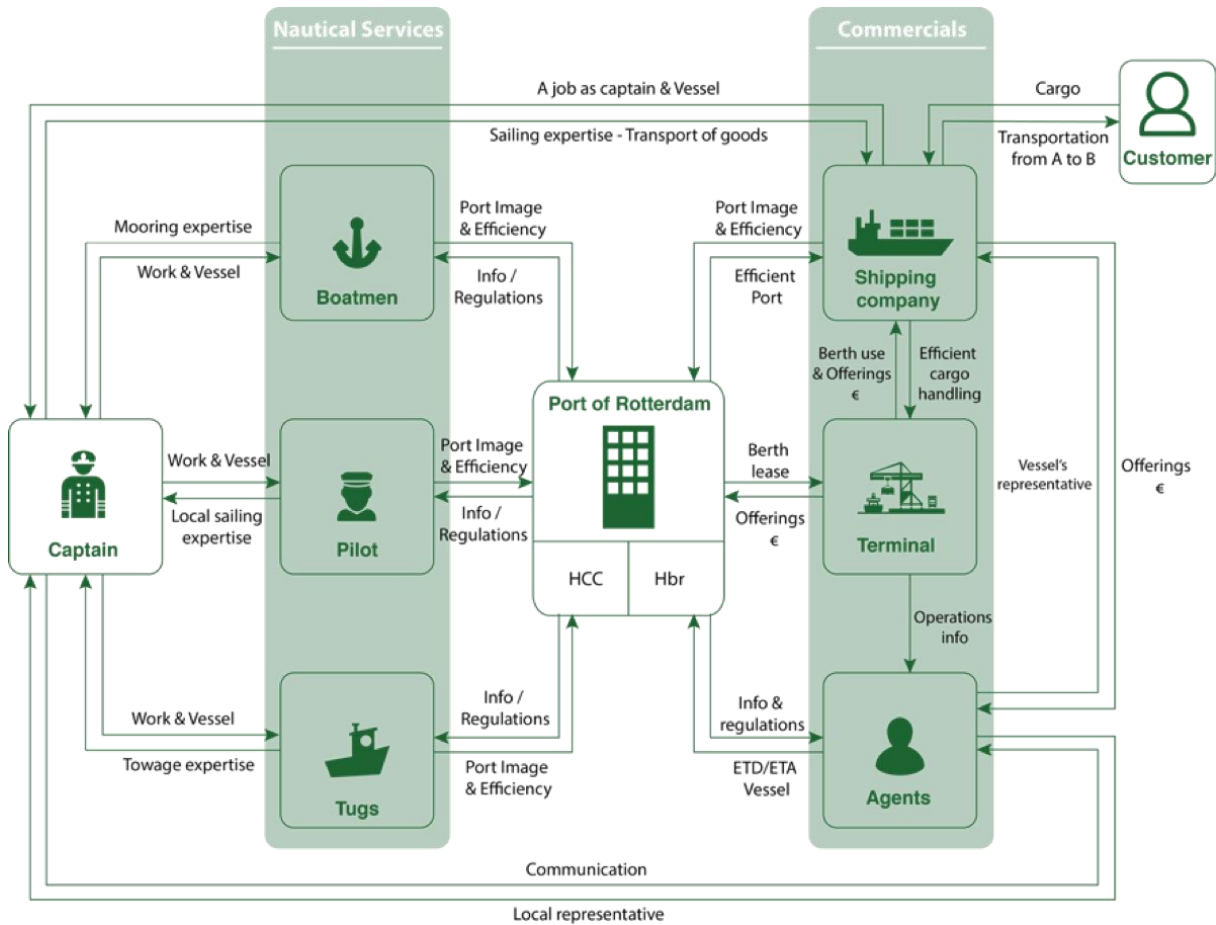


Figure 6. The value web with nautical services and commercial values.

4.3 Vessel's Journey

The vessel's journey is a tool that visualises the nautical process from a vessel's port call according to specific actors, and can be used to understand the nautical activities. The tool functions as an overview of the interactions and actions happened during the operational activities (Figure 7). The journey is based on qualitative design research and is a relatively fast way to map and understand the process.

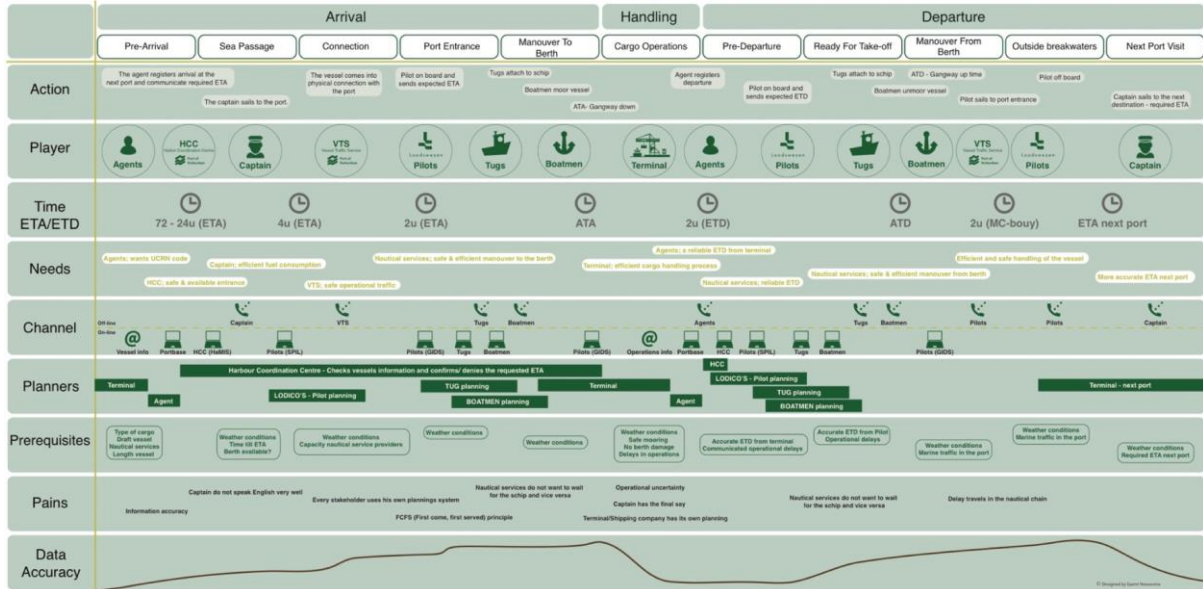


Figure 7. The vessel's journey.

4.4 PortPlay

PortPlay enables the nautical stakeholders to innovate together. PortPlay is an interactive table with nautical components laser-cutted from wood, designed to support the participants in explaining future ideas and thoughts. The table has been painted with chalkboard enabling the participant to sketch a future port. Figure 8 illustrates PortPlay in use, in a setup on a table where stakeholders stand around.



Figure 8. PortPlay innovation tool in use.

It seems that the tools can be classified into two types of boundary objects; boundary objects where the knowledge is already constructed upfront (the nautical roles/value web/vessel's journey), and boundary objects where the knowledge is co-constructed during use (PortPlay). In the next section, the tools are elaborated and evaluated regarding the strategic innovation framework.

5. Results

During the first workshop, the artefacts were sufficient enough to explain the nautical process and its characteristics. At the same time, the artefacts provoked a lot of discussion about the details of the nautical process. It has been noticed that these discussions work not very innovative. Some stakeholders started to defend their own process related to the bigger picture, instead of thinking how to change and/or adjust them. Whereas the vessel's journey has been used to improve the current characteristics of the nautical process, PortPlay enhanced the nautical stakeholders to think apart from their routines and habits, and made their ideas explicit. At the same time, PortPlay helped to avoid cognitive errors between the different levels of nautical expertise due to its ability to envision future ideas and supported the strategic dialogue. During the workshops, participants used the wooden components of PortPlay to explain ideas and thoughts for building a next level port. PortPlay enabled new perspectives within the nautical process, which is nicely illustrated by the following quote from one of the participants: "PortPlay enables imaging new ways of thinking". Moreover, PortPlay established alignment of the different roles, interactions, and expertise in the creation of a next level port. It integrates the different perspectives of the nautical roles. While building the next level port, all the roles and processes have been discussed and evaluated how it fits in this next level port. It can be concluded that PortPlay is a tool that fosters the collective intelligence of the nautical stakeholders.

Both the nautical roles and the value web function, within a nautical context, as an overview of the nautical characteristics rather than of a boundary object. Instead, the vessel's journey and PortPlay have been used to explain ideas, exchange thoughts, and to define possible improvements within the process and aim to function as boundary objects.

Besides the creation of the boundary objects itself, the findings showed the often-hidden innovation power of the nautical stakeholders. For example, after the workshops, several emails were received from participants detailing their personal learnings and feedback on the process. Second, when presenting the initial artefacts to the different stakeholders, several people within the company were already asked to join the presentations on a last notice. This illustrates confidence of the value of the current study as well as enthusiasm to share the findings among other colleagues. Third, even though, some nautical stakeholders were resistant at start, in the end all nautical stakeholders participated in the research, which is on itself already contributed to an innovative climate. And last but not least, some stakeholders have even printed the artefacts and use them as 'talking objects'.

6. Discussion

Innovation deals with changing current behaviours of stakeholders and developing new things together. In a complex eco-system, such as the nautical process in a port, with multiple stakeholders involved of which each has their own interests, this is a challenging task. During the current study, several strategic innovation tools have been designed and evaluated in co-creation with the nautical stakeholders. The boundary objects foster innovation and create efficient knowledge transfers across, and within the different disciplines. Applying the boundary objects likely generates 'product innovations' and 'strategic innovations'. Product innovations are the interesting ideas on how the stakeholders envisioned and discussed future innovations, for example a flexible quay that adjusts automatically towards the wind direction. Whereas, strategic innovations deal with how the tools are used and how they are recognising people's values and demands. For example, the alignment and integration of the different mental models within the nautical operations while using the boundary objects. It seems that the boundary objects can be discussed and evaluated according to the level of knowledge that has been (co)constructed and the type of knowledge boundary removed; eventually, illustrating a nautical innovation routine.

6.1 Classification of the boundary objects

PortPlay and the vessel's journey are boundary objects that varies on the level of knowledge that is co-constructed. The vessel's journey has already been designed and constructed upfront, whereas PortPlay asks the participants to construct and envision the next level port themselves (Figure 9-left). PortPlay helps to envision a next level port together. The vessel's journey starts from the current nautical process where the port is already envisioned and constructed using the customer journey tool. It seems that varying with the boundary conditions defines how, where, and when to use which boundary object. For example, if the focus is on the implementation of ideas, but how and where in the process is still uncertain, co-constructing an empty vessel's journey with the people involved seems to be the right boundary object. If discussions about the improvement of the current nautical process is preferred with stakeholders not involved in the process itself, the vessel's journey is most appropriate to use. However, further research needs to be done in varying with these boundary conditions related to the goal of using the objects.

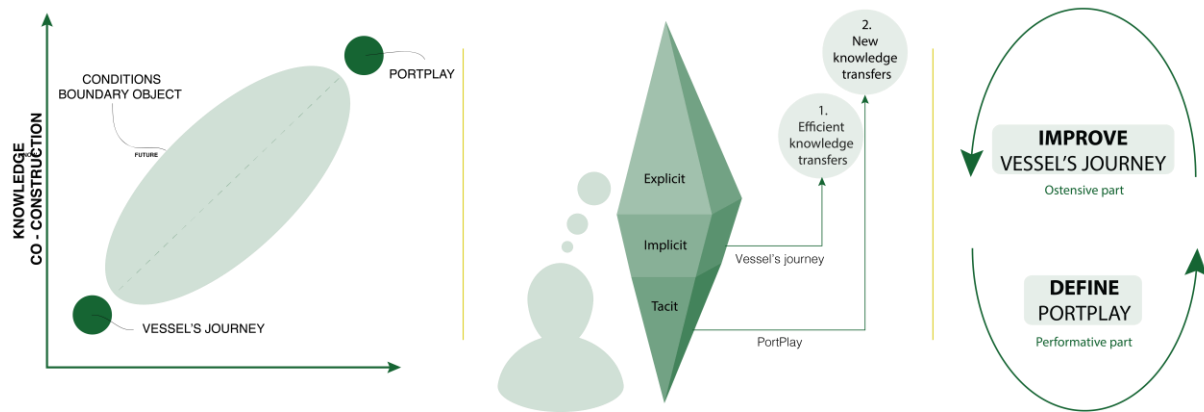


Figure 9. Classification of the boundary objects regarding the level of knowledge (left), mental models (middle) and the nautical innovation routine (right)

6.2 Efficient knowledge transfers

The strategic innovation tools remove knowledge boundaries between the tacit, implicit, and explicit knowledge boundaries of people. When the tacit and implicit knowledge becomes easier explicit, it helps in transferring knowledge within and across the different expertise and/or stakeholders in the nautical context. This research has shown that a distinction can be made between the type of boundary object and knowledge boundary removed (Figure 9-middle).

The vessel's journey is a representation of the nautical process and aims to display the differences and dependencies in this process. This object can be used for efficient knowledge transfers between people by removing the boundary between implicit and explicit knowledge. Whereas PortPlay is a boundary object that asks the nautical people to build a next level port by combining the different perspectives. In doing so, it aims to result in removing the boundary between tacit, implicit and explicit knowledge. In generating ideas together, PortPlay tries to find the knowledge that is hard to recall and embedded in the mental models of the nautical people.

6.3 Nautical innovation routine

Figure 9-right illustrates an innovation routine where the vessel's journey and PortPlay are positioned. The vessel's journey displays the arrival and departure of a sea-going vessel evaluated on several actors, such as the stakeholders involved, the action performed, time till moored, and so on. The physical boundary object PortPlay aims to 'co-construct' a future port together in a workshop where each nautical stakeholder is represented. The visualised vessel's journey refers to the current process, and makes people's implicit knowledge easier explicit. PortPlay enables the nautical stakeholders to envision a next level port together, by 'co-constructing' the port by transferring innovative knowledge. In doing so, PortPlay aims to make stakeholders' tacit knowledge easier explicit. The vessel's journey has an emphasis on improving the current nautical routines, whereas PortPlay focuses on (re)defining these nautical routines for strategic planning regarding the port's future.

7. Conclusion: talk of the port

In the current work a research through design approach in combination with strategic design has been used to structure the nautical process and co-create innovation. The nautical process has been explored in detail and translated into two types of boundary objects, which facilitate and foster strategic innovation in the nautical innovation process; an object that concentrates on understanding

and alignment of the nautical process itself (the vessel's journey) and an object that focuses on collectively transferring and creating knowledge while innovating together (PortPlay).

Our conceptual framework refers to two types of boundary objects, which we distinct in the level of knowledge that is (co)constructed. The vessel's journey has an emphasis on improving the current nautical routines, whereas PortPlay focuses on (re)defining these nautical routines. It can be concluded that these objects enable the nautical stakeholders to make their implicit knowledge easier explicit and to co-construct the nautical process together. The objects remove boundaries in transferring knowledge while recognising people's values, demands, and communication skills. Next to that, varying the use of the boundary objects in creating innovation in the nautical process seems to be valuable in structuring and collaboratively innovating.

Lastly, the application of the boundary objects into practice established an increasing level of attachment to both process and results. Results have shown an innovation routine where the boundary objects are allocated. By varying the use of the strategic innovation tools in innovating the nautical process seems to be the answer in how strategic design can facilitate and structure the innovation process within the nautical process. PortPlay became the talk of the port. All stakeholders participated in at least one of the workshops and continued talk about it.

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Garnt Nieuwsma holds a master degree in strategic product design. His main interest is to add value by applying design, in its broadest sense, into everyday business activities. Design is the fuel for innovation where technology, people and business are connected.

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