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Western Norway University of Applied Sciences

MASTER'S THESIS

Pilotage methods

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I confirm that the work is self-prepared and that references/source references to all sources used in the work are provided, cf. Regulation relating to academic studies and examinations at the Western Norway University of Applied Sciences (HVL), § 12-1.

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Abstract

Since the first regulations on pilotage there have been an evolution in shipping. New pilotage methods have been to obtain the regulations on pilotage. The classic pilotage method is seen as the original method, whilst pilot exemption certificates have been implemented in many nations and other methods such as remote pilotage is not widespread yet.

This research aims to investigate primary users` in the pilot service perception on the three pilotage methods. The informants that are involved in the research are navigators and pilots. A qualitative method consisting of open-format interviews, with an ISO-standard on quality in use, was used as a framework for the interview-guide.

The findings of the research are that the perception of the primary users for the three methods is as follows. The perception of classic pilotage has overweight in positive factors, the perception of PEC also has overweight in positive factors, while the perception of remote pilotage has overweight in negative factors.

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Abbreviations

Abbreviation	Description
ECDIS	Electronic Chart Display and Information System
IMO	International Maritime Organization
INF Code	International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on board Ships
ISO	International Organization for Standardization
LOA	Length Over All
NCA	The Norwegian Coastal Administration
OOW	Officer Of the Watch
PEC	Pilot Exemption Certificate
QMS	Quality Management System
SBP	Shore-based Pilotage
SOLAS	International Convention for the Safety of Life at Sea
SQuaRE	Systems and Software Quality Requirements end Evaluation
VTS	Vessel Traffic Service

1 Introduction

This research aims to investigate primary users' perception on three pilotage methods. The primary users that are included in this research are navigators and pilots. The three pilotage methods included in this research are classic pilotage, pilot exemption certificate and remote pilotage.

This chapter gives an introduction of the theme pilotage methods. Next up is the purpose of this research and a presentation of the research question. Finally, the structure of the research will be presented.

1.1 Background

In 2013 a national public inquiry was published in Norway. Part eight of this inquiry is named "On pilotage with maritime safety[1]", and its inquiry number is "NOU 2013:8". (2013:8, 2013). The inquiry on pilotage presented that it was more than ten years since a review was undertaken on the pilot service in Norway. The Norwegian government considered that there were several factors that made such a review necessary. Several factors were mentioned, as an example they stated that it was unclear to what extent that pilot exemption certificates (PEC) can replace a pilot on board the vessels. In addition, when conducted, there had been a technological and competence evolution on board vessels navigating in Norwegian waters, factors considered to reduce the need for pilots on board vessels. It was therefore concluded that the scope and organization of the compulsory pilotage was to be evaluated or reviewed, which this inquiry in fact did. (2013:8, 2013).

The selection that made up this inquiry had two premises for the report. The first one was that the pilot service shall be 100 precent users financed, and the second is that the level of maritime safety shall not be weakened in relation to the level when the inquiry was written.

Is this even possible with the two premises as a basis for the pilot service? The inquiry was looking to cheaper alternatives, with a satisfactory level of safety, seen in the light of the technological evolution which will change the need for pilots on board vessels.

With the presentation on the inquiry, it is my understanding that searching for alternatives for classic pilotage is important in the inquiry. I will now present the findings on the proposed alternatives for classic pilotage, from the selection that made up this inquiry.

The first alternative to classic pilotage from the inquiry that was evaluated was shore-based pilotage. The report stated that the evolution of monitoring systems and communication aids would make it possible for a pilot to follow a vessel`s motions from a shore station and based on this guidance could be provided to vessels. The conclusion of the evaluation on shore-based pilotage was that shore-based pilotage should not be implemented as an alternative to classic pilotage at that time. The justifications for this conclusion are listed below (2013:8, 2013, p. 87-88):

- Very strict requirements for involved users (vessels, navigators, shore-stations)
- Limitations in geographic coverage for the method
- Uncertainty in relation to the level of safety
- Uncertainty if the savings of the method will be greater than the investment- and operating costs
- Most vessels that would be suited for this method would probably qualify for PEC

The second result from the inquiry that was evaluated as an alternative to classic pilotage was broader services from VTS. The findings of the inquiry stated that VTS with the services in 2013 could not replace use of pilots. On the contrary, they stated that the VTS supplemented the pilot service rather than making it unnecessary (2013:8, 2013, p. 89). This method was therefore not stated as an alternative to classic pilotage in this inquiry.The national public inquiry shows that there is a political willingness in Norway to evaluate the need for a classic pilotage method. The inquiry shows that that the classic pilotage method is an expensive method, and therefore the inquiry looked for less expensive alternatives. Per date in May 2021 not much has been done in implementing new alternative methods to classic pilotage, other than the PEC, which is being adjusted regularly. In my opinion the political willingness to implement new pilotage methods will affect the navigators and pilots in their work. This group of professionals are using the methods on a fixed basis at work. The inquiry did not mention much about the assessment of the end users, the ones who would use the new methods. It mainly focused on the economic gain of implementing new methods. It is fully understandable that economic gain is a highly relevant factor for a user financed system. On the other hand, the level of safety that new methods, such as shore-based pilotage, can achieve were mentioned as an uncertain factor when evaluating new methods for pilotage. It is my belief that navigators and pilots can contribute to deeper understanding how the pilotage methods contribute to safe operation of vessels which is among their responsibilities at work.

1.2 Purpose and research question

Given the introduction above on alternatives to classic pilotage this research aims to examine the perception of the primary users in the pilot service on three pilotage methods. The informants consist of a selection of navigators and pilots, called primary users that interacts with the pilot service in their daily work. A model from the ISO standard 25010 "SQuaRE" – System and software quality models was used as a framework for the informants` perceived quality in use in this study. The quality in use model is built up by characteristics such as effectivity, efficiency, satisfaction, freedom from risk and context coverage.

Research question:

- What are the primary users´ perceived quality in use of the three pilotage methods?

Follow-up question:

- How do "ISO 25010 Quality in use" contribute to examine primary users´ perception in the pilot service?

1.3 Structure of the thesis

A brief presentation of the chapters in this thesis will follow

Chapter 1 - Introduction

Introduction to the theme of pilotage methods. Presentation of research question

Chapter 2 – Theory

Theoretical background on pilotage methods

Chapter 3 – Methodology

Presentation of background for chosen method, methodical critique, and the ISO standard which were used as framework for the interviews

Chapter 4 - Results and discussion

The results from the interviews are presented and discussed

Chapter 5 - Framework method discussion

A general discussion on how the ISO standard contributed to set a framework for the interviews

Chapter 6 – Conclusion

Concluding remarks for the research

Chapter 7 – Further work

Recommendations on further work based on findings in this research

2 Theory

This chapter includes the history of pilotage, regulatory framework for pilotage and a presentation of the three pilot methods that the thesis includes.

2.1 History of the pilot services

Stories about piloting of vessels can be found in ancient stories back to the 6th century BC. Back then pilots were expressed by the term "guide" of a vessel (Fédération Française des Pilotes Maritimes., 2021). The guides were used by explorers that sailed beyond their known waters, and therefore they acquired a local "guide" to get them safely in to ports, through challenging waters and through narrow passes. Marco Polo`s first voyage eastbound was executed by help of Arab Pilots (Fédération Française des Pilotes Maritimes., 2021).

The Rôles d'Oléron can be seen as the foundation of modern maritime law and was established around mid-12th century AD. This French collection of judgments had great influence on the European laws of the sea (Store Norske Leksikon, 2021). Some of the articles within these laws deal with piloting of vessels. The laws, or Rôles have the following wordings on the pilot's responsibilities on board a vessel, from Article XXIII[2]:

> "If a pilot undertakes the conduct of a vessel, to bring her to St. Malo, or any other port, and fail of his duty therein, so as the vessel miscarry by reason of his ignorance in what he undertook, and the merchants sustain damage thereby, he shall be obliged to make full satisfaction for the same, if he hath wherewithal; and if not, lose his head."

Following in the next article of the Rôles, Article XXIV it is written:

> "And if the master, or any of his mariners, or any one of the merchants, cut off his head, they shall not be bound to answer for it; but before they do it, they must be sure he had not herewith to make satisfaction."

This is most likely one of the oldest "regulations" on piloting within the maritime industry. They show that the duties of a pilot must have been recognized as highly important because of the severe consequences if the actions of a pilot mission caused damage to the vessel and crew.

[2] From the webpage http://www.admiraltylawguide.com/documents/oleron.html

National “Pilotage Acts” were developed in Europe in the 17th century (Fédération Française des Pilotes Maritimes., 2021). Today’s national pilotage acts are influenced by the regulations from these old pilotage acts.

All states with a coastal line developed their own national pilotage act which organizes the pilotage-system in their country. The pilot-service in Norway was established in 1720 after the special knowledge on inshore sailing was recognized to be important in war times (Kystverkmusea, 2021). At the time the pilot missions were based on a competition between the pilots in Norway. The competition-principle was organized saying the first pilot to embark the vessel from his rowing boat, got the pilotage assignment. This competition-principle was applicable until 1889 (Kystverkmusea, 2021). In the same period the safety for pilots was improved due to procurement of new and better pilot-boats to bring the pilot from ashore to the vessel that acquired a pilot. The investments in safer and newer pilot-boats as the Colin Archer type reduced the mortality at sea among pilots significantly (Kystverkmusea, 2021).

Nowadays the pilot-service is a well-organized system where pilots hired by a coastal-government or a firm that is authorized by the government and the pilots receives their pilot-missions from for example a pilot-dispatcher ashore. In Norway the pilots are trained and employed by the state-owned enterprise Norwegian Coastal Administration (NCA). The pilot-boats were operated by the NCA until 2015. From 2015 a private company got the mission of operating the pilot-boats.

The method of bringing a pilot from shore on board a pilot-boat and then on board a vessel acquiring a pilot is what I will define as Classic Pilotage. Classic pilotage is the first of a limited number of pilotage methods that are in service today. The second method that can be used to obtain the compulsory pilotage is the use of Pilot Exemption Certificates (PEC). This pilotage method was introduced around mid-1990 in Norway. The third method of sustaining the compulsory pilotage is remote pilotage. Remote pilotage is a pilotage method where the pilot, is not on board the vessel that acquires a pilot but executes the pilot-mission from another place than on board the vessel. Remote pilotage is often referred to as shore-based pilotage when the pilot is situated at a shore-station during pilot missions.

2.2 Regulatory framework for pilot-service

In this part the regulatory framework for the pilot-service will be explained

The regulatory framework for the pilot service in Norway is enshrined in “Regulations on compulsory pilotage and use of pilot exemption certificates (PEC)”. This regulation contains a description of which vessels are obligated to take on board a pilot or hold a PEC when operating inside the baseline of Norway, called compulsory pilotage. The baseline of a coastal state is formed by drawing lines between the outermost coast at low tide. In 2018 a proposition to amend this regulation was established to make it possible to fulfil the regulation with autonomous operation of vessels.

These following vessels are obligated to fulfil the compulsory pilotage in Norway. All items are for vessels operating/underway inside the baseline (Lospliktforskriften, 2014, §3)

- Vessels with length-over-all (LOA) 70 metres or more, or a width of 20 metres or more
- Vessels towing or pushing an object (one or more objects), and the towed or pushed objects have a length above 50 metres,
- Vessels carrying hazardous or pollutive cargo with double hull, with a length of 50 metres or more
- Vessels carrying hazardous or pollutive cargo with single hull, with a length of 35 metres or more
- Vessels carrying substances regulated by the INF code
- Vessels with a length of 50 metres or more carrying gas condensate in bulk
- Nuclear-powered vessels
- Passenger vessels (above 12 passengers) above 50 metres

There are exceptions from these rules in the regulation when it comes to which vessels that are subjects to the compulsory pilotage. An example of this is that passenger-vessels with a predetermined route like Hurtigruten which had an exception from the compulsory pilotage. These exceptions are based on the vessels frequent sailing along the Norwegian coast on its predetermined route. In addition, vessels towing aquaculture fish-cages are also excepted from the rules of the compulsory pilotage act with some predetermined requirements.

The pilotage act also determines which geographic areas inside the baseline where vessels navigating in these areas are subjects to compulsory pilotage. The act includes positions that are used as pilot boarding areas. In the charts these positions are marked with a pilot-mark. In addition, the act opens for exemption for compulsory pilotage for some specified vessels when relocating in a harbour.

The Norwegian compulsory pilotage regulations opens for using PECs. In addition to classic pilotage and remote pilotage, PEC is what I will define as a pilotage method in this thesis. A definition of pilotage method is therefore necessary. For the purpose of this thesis a pilotage method is a method used to fulfil the compulsory pilotage acts with its regulations.

The International Maritime Organization, a specialized agency of the United Nations, usually draws up conventions and codes for international shipping. The IMO states that "Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented." (IMO, 2021). The IMO does not have conventions and codes for organization of pilotage, only recommendations. For pilotage, the IMO recommendation on pilotage states that nations should organize pilotage services themselves. Therefore, nations that have rights to areas where pilot services can contribute to safer and more effective navigation have pilotage acts like the Norwegian one. IMO has regulations in the Safety Of Life At Sea (SOLAS) convention on how to design vessels for pilot transfer arrangements, and how a pilot ladder must be rigged.

With the regulations in mind as a basis for the aim, the aim of a pilot-service is in place for introduction. The aim of the Norwegian pilot-service is as follows: "The aim of the pilot service is to safeguard traffic at sea and protect the environment by ensuring that vessels operating in Norwegian waters have navigators with adequate qualifications for safe navigation" (Kystverket, 2021).

The distribution of which method that is used to fulfil the regulations on pilotage in Norway is shown in the table 1 (in Norwegian). This table will be referred to in the thesis to show the increasing number of pilot compulsory voyages in column two. Column three shows how many voyages that are conducted by use of pilot by the classic pilotage method. Column four shows how many dispensations that are given. Column five shows how many voyages that are done by using the PEC-method to comply with the regulations. The table shows that the PEC-method has dealt with the increasing numbers of pilot compulsory voyages on the Norwegian coast

Utvikling i aktivitet og kapasitet i lostjenesten, 1995-2019

År	Sum lospliktige seilas (1)	Los-oppdrag	Dispen-sasjoner	Seilas på farleds-bevis (2)	Antall loser (3)	Gj.sn losoppdrag pr los	Farleds-bevis (4)
1995	52 990	41 039		11 951	278	148	
1996	51 585	42 073	2 127	7 385	274	154	*1 730*
1997	54 075	44 423	1 885	7 767	273	163	*2 181*
1998	55 898	46 209	1 794	7 895	274	169	*2 496*
1999	60 857	47 675	2 492	10 690	289	165	*2 863*
2000	59 010	44 071	**2 787**	12 152	275	160	*3 150*
2001	57 787	44 021	1 162	12 604	260	169	*3 416*
2002	52 838	41 229	1 061	10 548	273	151	*4 287*
2003	57 022	43 801	939	12 282	261	168	2 582
2004	55 589	43 145	1 088	11 356	253	171	2 596
2005	57 556	44 983	1 773	10 800	253	178	2 722
2006	58 324	45 786	1 931	10 607	264	174	2 783
2007	60 920	**49 047**	1 952	9 921	265	**185**	2 904
2008	75 696	47 894	1 611	26 191	271	177	2 866
2009	84 732	42 168	1 350	41 214	284	149	2 800
2010	94 014	44 708	1 321	47 985	288	156	2 800
2011	95 096	44 980	2 251	47 865	286	157	2 800
2012	97 977	44 535	2 363	51 079	284	157	2 800
2013	104 675	43 773	2 265	58 637	**293**	149	2 873
2014	110 861	44 427	2 277	64 157	286	155	2 775
2015	111 035	41 946	1 442	67 647	286	147	2 855
2016	108 474	38 911	1 202	68 361	282	138	3 086
2017	110 982	40 403	1 045	69 534	276	146	3 218
2018	118 151	39 542	1 174	77 435	282	140	3 496
2019	**121 502**	40 820	1 523	**79 159**	290	141	**3 818**

(1) Sum lospliktige seilas var før juni 2008 kun enkeltseilas (ikke seilas på farledsbevis med årsavgift).

(2) Seilas på farledsbevis inkluderer i 2008-2011 seilas på dispensasjonsordning i Grenland.
Statistikken for seilas på farledsbevis er korrigert ned til lospliktige skip tilbake til 2011 (korrigert fra 2018-rapp

(3) Antall loser pr 31.12.2019 er 292, men er i tabellen uten loser med redusert stilling (2*0,5) eller i permisjon (1).

(4) Antall bevis i perioden 1996-2002 er totalt utstedte, mens tallene fra og med 2003 er antall gyldige bevis.

Table 1: Distribution of pilot compulsory voyages in Norway. Used with permission from the NCA.

2.3 Classic pilotage method

In this part the pilotage method classic pilotage will be explained.

Classic pilotage is what we can consider as the original and oldest method to fulfil the compulsory pilotage. There are several definitions of pilotage. The Danish Maritime Authority defines pilotage as "Advice given to ship´s master about navigation, the voyage and manoeuvring irrespective of whether the advice is provided on board the ship or by means of communication from another ship or from ashore." (Consolidated pilotage act[1], 2016, Part 2, Section 3) . The American Practical Navigator uses the following definition of pilotage "The services of especially qualified navigators having local knowledge who assist in the navigation of vessels in particular areas." (Bowditch, 1995, p. 826).

Most definitions of pilotage include a pilot who assists in navigation of vessels. Therefore, a definition of pilot is proposed. The Danish Maritime Authority uses this definition of a pilot "A person certified by the DMA to carry out pilotage activities" (Consolidated pilotage act[1], 2016, Part 2, Section 3). Another definition of the term pilot from The American Practical Navigator is "A person who directs the movement of vessel through pilot waters, usually a person who has demonstrated extensive knowledge of channels, aids to navigation, dangers to navigation etc., in a particular area and is licensed in that area." (Bowditch, 1995, p. 826).

Thus, we can conclude that pilotage is the task of assisting a vessel and performing or directing navigation using specialized knowledge, and a pilot is the person carrying out this act. The specialized knowledge of the pilot is gained by extensive training after getting accepted for service as a pilot. In Norway the NCA organizes training and employs the pilots.

The execution of a classic pilot assignment is as follows, with the Norwegian Pilotage act as a basis. Vessels sailing towards or leaving an area that are mentioned in the compulsory pilotage act must apply for a pilot no later than 24 hours before the pilot assignment starts. A pilot assignment starts at a pilot mark, and anchorage or from a quay. A pilot dispatcher receives the application from the vessel and allocates a pilot to the pilot assignment. The vessel must give a final confirmation two hours prior to the start of an assignment. Pilot boats or helicopters transfer the pilot to and from the pilot assignments. For assignments starting from a quay the pilots travel by car, taxi, or public transport. On board the vessel the pilot provides local knowledge and navigational skills to the bridge team during the assignment.

When vessels are navigating with a pilot on board it is clear in the regulations that the presence of a pilot do not exempt the duties and responsibilities of the captain or officer of the watch (OOW) (Forskr. om vakthold på passasjer- og lasteskip , 1994, Attachment A, Part 3, 49-50). The relationship between pilots and seafarers are often discussed based on these regulations. In an article the insurance company Gard states that even if these procedures and practices should be well known it is a fact a large portion of navigation-related accidents occur when a pilot is on board (Gard, 2006). They state that the reason for this is obvious; vessels sailing into areas with high risk are subjects to compulsory pilotage and therefore pilots are involved in accidents. Furthermore, Gard clarifies that it is their understanding that having a pilot on board prevents far more accidents than they cause (Gard, 2006). In the same article they look at several reasons for accidents for vessels using pilots to comply with the compulsory pilotage act. Communication between pilot and master can, due to several factors, be a problem. In addition, they state that in many situations the responsibility for navigation is given from one person to another.

There are indications that navigators leave the responsibility of navigation to pilots. This can be found in a report from the Transportation Safety Board of Canada. The study looked at the operational relationship between ship master/watchkeeping officers and marine pilots. In the report it is written “According to the pilots interviewed, an increasing number of foreign masters consider the arrival of a pilot on board as a relief, a way to discharge some of their responsibilities, a chance to get some rest.” (Transportation Safety Board of Canada, 1995, p. 9).

2.4 Pilot Exemption Certificate

In this part the pilotage method PEC will be explained.

The PEC arrangement or method was introduced in Norway in 1995 shown in figure 1. As the name of this pilotage method states, it makes it possible for vessels to comply with the compulsory pilotage regulations without having a pilot on board the vessel. To be able to use this method the navigator must hold an adequate PEC for the fairways the vessel is sailing into without a pilot on board. This is a commonly used method which has dealt with most of the increase in pilot compulsory voyages on the Norwegian coast since the method was introduced in 1995.

In 2011 adjustments were conducted to the old pilotage regulations to make it easier for navigational officers to find a suitable PEC for their vessel. Today's PEC arrangement in Norway contains three classes of PECs and one Cadet-PEC arrangement. PECs cannot, as a main rule, be issued for use on board vessels above 150 metres or more or nuclear-powered vessels. Nevertheless, vessels with a length above the main rule of 150 metres that calls a port twice a month can use PEC to comply with the compulsory pilotage regulations, when there are two deck officers on the bridge where one has a valid PEC for the area (Samferdselsdepartementet, 2014, §9)

The different classes of PECS in Norway are shown below (Samferdselsdepartementet, 2014, §9-12 and §20-22). All applicants for PEC need a valid navigator certificate for the vessel.

Class 1 PEC:

- Least restrictions in areas with local restrictions, restrictions beyond class 2 and 3
- Need extensive experience on coastal navigation prior to applying
- Can be used for vessels over 150
- Two years validity period, renewal by documenting minimum two voyages in the fairway
- Examination by pilot

Class 2 PEC:

- More restrictions than for class 1 PEC in areas with local restrictions

- Five years validity period, renewal by documenting that knowledge in the area is maintained
- Examination by pilot

Class 3 PEC:

- To be used for vessels shorter than 100 metres of length with an approved ECDIS
- Examination can be done with PEC assessor
- Cannot be used with vessels carrying heavy oil or dangerous cargo
- Five years validity period, renewal by documenting that knowledge in the area is maintained

Cadet PEC:

- Need a course that is approved by the NCA prior to application
- An in-writing agreement between the company, the captain and the applicant on systematic training must be present
- Can be used for fairways where the captain approves the holder of a cadet PEC. Not for fairways that requires class 1 PEC.
- Cannot be renewed. Three years validity period.

The PEC-assessor gets acknowledged by the NCA to execute examination with candidates applying for PEC class 3. A course organised by the NCA is necessary to become acknowledged as an assessor. Furthermore, the assessor is required to hold a PEC class 1 or 2 for the area that the candidate is applying PEC, and it is only applicable for similar vessels that the assessor holds a valid PEC for (Samferdselsdepartementet, 2014, §14).

In a study from PWC and Panteia published 2012 on PECs in European countries (plus Croatia and Norway) there are some comparisons between pilotage with pilot and pilotage with use of PEC. The main objective of the report was to provide a picture of the procedures and legal requirements for PECs and was ordered by the European Union. When it comes to incidents in pilotage assignments carried out with pilot on board compared with use of PEC, the report shows that there is not much variation in frequency of incidents between the pilotage methods (PWC and Panteia, 2012). The report shows that in a period between 2009 to 2011 vessels with only PEC holders on board have 0,18 accidents per 1000 missions, whilst vessels having a pilot on board have 0,13 accidents per 1000 missions (PWC and Panteia, 2012, p. 204).

2.5 Remote pilotage

In this part the pilotage method remote pilotage method will be explained. Remote pilotage consists of both the term shore-based pilotage and piloting from pilot boat.

Remote pilotage is not as common as classic pilotage and PECs. This is illustrated by the data from the NCA in figure 1, where one third of the pilotage assignments is by classic pilotage and the two thirds is by use of PEC.

A definition on this method is “Shore Based Pilotage (SBP) means an act of pilotage carried out in a designated area by a maritime pilot for that area, from a position other than on board the vessel concerned to conduct the safe navigation of that vessel” (ISPO International User Group, 2015, p. 5). From somewhere else than on board the vessel can be for example from a shore station or from a pilot boat. The term shore-based pilotage is often seen as the same as remote pilotage because the definition does not clarify where the pilot is situated during the mission. Remote pilotage will be used in this thesis as a definition because it will involve both shore-based pilotage and pilotage from pilot boat.

Remote pilotage is as mentioned not a widespread method for fulfilling compulsory pilotage for vessels. According to PWC and Panteia (PWC and Panteia, 2012) it mainly occurs in exceptional circumstances such as bad weather or other situations where the pilot is unable to embark the vessel safely. There was a test project in Norway on shore-based pilotage from the VTS-station at Kvitsøy. After this project several reports were written on the safety and economical effects of shore-based pilotage from VTS-stations. Det Norske Veritas (DNV) wrote a report on behalf of the Coastal Directorate (todays NCA) in 2001 which suggests several prerequisites that must be available prior to implementing shore-based pilotage. Some of the prerequisites are legal basis for this method; new regulations and procedures, two officers on the bridge of the vessel, ECDIS on bridge with a preapproved route from pilot, functioning AIS, and prequalification of vessel to be piloted (DNV, 2001, p. 23).

The benefits of SBP that the report from DNV (2001) suggest from implementing this method is better utilization of ECDIS and AIS, increased efficiency for pilots due to less travel time and that the method can be used in bad weather conditions which increases safety for pilot and vessel. Further on the report suggests that shore-based pilotage should be implemented in the easiest fairways along the coast. The risk of collision and grounding is estimated by DNV to be reduced by 13% for vessels using this method instead of classic pilotage (DNV, 2001, p. 3). The test project on shore-based pilotage from Kvitsøy was ended in 2004.

Newer reports on shore-based pilotage can be found in for example Denmark. The Danish Maritime Authority ordered a report from COWI on the subject. The report is called Technological Assessment On The Possibility Of Shore Based Pilotage in Danish Waters. This report defines SBP as "piloting with the assistance of, and guidance from, qualified pilots on land" (Danish Maritime Authority, 2014, p. 3). The report has findings that shows that SBP is technologically possible to implement in Denmark. Further on it also states that implementing SBP can have a negative effect on safety. It also has findings that calculates a reduction on costs of 50% of implementing SBP (Danish Maritime Authority, 2014, p. 8). I assume that this reduction of costs was compared to classic pilotage and not PEC. The overall conclusion of the report is that SBP is recommended to be implemented in the outlying waters with little effect on safety.

Extensive use of SBP today is mainly found in Italy as an alternative to classic pilotage. The vessels receive piloting from VHF from the same corporation that provides classic pilotage. The vessels receiving SBP must obtain a certificate prior to using this service, and it is mainly used for ferries and other vessels that frequently visits the port. The report from PWC states that this method is safe due to no registered incidents, cost saving because it costs one third of a regular mission and is an efficient method (PWC and Panteia, 2012).

In 1999 Mike Hadley wrote a paper in The Journal of Navigation on Issues in Remote Pilotage. The paper consists of several problems to overcome concept with remote pilotage before it can be taken further (Hadley, 1999). Some issues Hadley's paper presented are difficulties with language, lack of "feel" for the ship and its crew, and lack of ship motion data (Hadley, 1999, p. 1). The presented issues shows that there are more problems than technological issues to remote pilotage.

In Finland they have a goal to fully implement remote pilotage as an alternative for classic pilotage, and this is planned to be SBP. The Finnpilot Pilotage company is operating the pilot service in Finland. They have entered a cooperation with Wärtstila, a technology company, with the intention to add remote pilotage as a solution in some predetermined areas (Wärtsila, 2019). According to the schedule of Finnpilot will have a trial on remote pilotage ready in 2022, and they have a goal of start with remote pilotage in 2025 (Ahonen, 2021).

Pilotage from pilot boat is also considered as remote pilotage in this thesis. Piloting form pilot boat is according to the report from PWC common in several countries in Europe (PWC and Panteia, 2012, p. 16). The main reason for using this method with pilotage from pilot boat is again that circumstances like bad weather makes it difficult to embark or disembark a vessel safely. The NCA has a procedure for this which is called "Piloting Over Distance[3]". The procedure is for example used to guide vessels from the pilot mark into sheltered waters where the pilot can embark vessels safely. During the covid-19 pandemic this procedure has been commonly used by the Norwegian pilot service to minimize the risk of infection during pilotage missions. It is clear that this procedure is meant for missions where embarking or disembarking of vessels are considered to be too dangerous at the pilot mark.

[3] Translated from Norwegian. Original wording «Veiledning av los over distanse fra losbåt»

3 Methodology

The following chapter contains a presentation of the research method used in this thesis. First the background for the chosen method is presented, then the procedure of the chosen method is presented, afterwards an evaluation of the method is displayed. Finally chosen method for analysis of gathered data is presented.

3.1 Background for chosen method

With a research question that aims to investigate the perception among stakeholders in the pilot-system on the three pilotage methods, I early decided that a qualitative method was most suitable. The definition of perception that I chose to use is from Oxford Languages; "the way in which something is regarded, understood or interpreted." All these three characteristics are seen as relevant for the investigating the impressions that the primary users have on the pilotage methods. A definition of qualitative data from Walliman is "Qualitative data cannot be accurately measured and counted, and are generally expressed in words rather than numbers" (Walliman, 2011, p. 72). With the definition from Oxford on perception as a basis a qualitative method was decided to be best suited to examine the research question.

It would probably be possible to investigate some kind of level of for example satisfaction among a great number of primary users in the pilot system, by using a quantitative method. My aim was not to measure the level of satisfaction, but the aim was to dive deeper into thoughts and experiences that the informants possess on the characteristic. Especially, experiences from the field can be relevant for a deeper understanding of the informant's perception on the pilotage methods. One of the major characteristics of a qualitative research is that the data can be collected by "interviews that capture direct quotations about people`s personal perspectives and experiences" (B. Christensen, Johnson, & Turner, 2015, page 365).

Early in the project it was discussed between me and my supervisor that it would be exciting and relevant to use a field study in a simulator for testing the different methods. A field study on board vessels using a pilot was also discussed as an opportunity. Mainly due to limited time and the limitations of the covid-19 pandemic both the simulator test and the field study was shelved. “Real-life” vignettes was considered as a method that could replace the simulator test but was put to side because I considered it to be more suited for more specific operations. Therefore, the research question was decided to be examined by use of interviews alone. In a book from SAGE on Qualitative Data Collection it is written: “Many researchers use interviews as a sole method of data generation. This approach works well if the research purpose is to learn about people`s beliefs, perspectives, and meaning-making” (Roulston & Choi, Qualitative Interviews, 2018, p. 247). This reference acknowledges that interviews alone as the one and only method of generating data for my research question is appropriate.

3.2 Methodical critique

The first critique of the method that I will discuss is biasing of gathered data. Bias is in Walliman`s book Research Methods explained as unwanted distortions that can be constructed because a part of a population is more present than another part of a population (Walliman, 2011, p. 95). An example of such a biasing that could be distorting the data in this research is if I only included navigators that favoured the PEC method and left out the navigators the other pilotage methods. This could result in that the findings in my thesis showed that “all” navigators favour the PEC method, and no navigators favoured the other methods. To deal with this issue I tried to involve a variety of navigators from different types of vessels and with varying ages.

In addition to biasing the use of telephone interviews has some restrictions. Establishing a good dialogue with people may be more challenging by phone than in person. Most of the informants were people that I have never met before, and therefore some time was be used to introduce the project and myself. The interview guide started with some easy opening questions that were supposed to get me to know the informant. This were also done to get the conversation flow before asking the questions that I mainly was interested in.

Generalisation of the findings in the research is often an issue that qualitative methods are facing. This is because the number of informants in qualitative research usually are small in relation to number of informants in quantitative work. The question that I then want to ask is why my research should be generalised? The research only will present the perspectives that a very small part of the population that it represents. This is known and clearly shown in the research procedure. I will say that the goal of this research is not to generalise the perception that all users in the pilot service have. The aim is to explore if there are factors that indicates the perception of a representative population in the industry. Presumably, results would be easier to generalize if the number of informants were considerably higher. This was not possible because of limited time for conducting the research.

For all research projects, reliability and validity are of great importance. Reliability has, according to Christensen, to do with the consistency or stability of scores (B. Christensen, Johnson, & Turner, 2015, p. 155). Since it has to do with scores, which also is not relevant for the research question in this thesis, I find this as more of a way of evaluating quantitative research. One issue that may have impact on reliability for my type of research is that the data can get incorrect if the researcher has a personal agenda. Validity of a qualitative research is on the other hand more important. Validity can be separated into internal and external validity. Internal validity is how well the chosen method answers the research question, whilst external validity is to which extent the results from a research can be generalized to a greater population. The aim of the research question is to investigate a small populations perception on a system that is used by a large population. Therefore, validity is considered as very important for this research, and I will explain in the procedure what I did to ensure as best validity as possible.

3.3 Secondary data

Secondary data from former research and projects within the theme was mostly gathered through the internet. Search engines such as Google Scholar and ScienceDirect was used to examine the theme of interest. Search words for finding relevant literature on the world wide web that was used for this thesis:

- Maritime pilot
- Nautical pilot
- Maritime Pilotage
- Sea pilot
- Navigational pilot

- Pilotage
- Los
- Lots
- Pilot exemption certificate
- PEC
- Farledsbevis
- Remote pilotage
- Shore-based pilotage
- Losing over distanse
- Fjernlosing
- Efficiency
- Effectiveness
- Effektivitet

3.4 Procedure

Since the ISO-standard was used as a framework for examining the research question, a presentation of the standard is necessary. After the presentation of the standard, the procedure of the research will be presented and explained.

3.4.1 ISO standard 25010 Quality in Use

The International Organization for Standardization (ISO) was founded in 1947. As the name indicates the main goal of this organization is to establish and maintain international standards. The organization has members from 165 countries which is represented by their national standard bodies. Today`s most common standard is the ISO 9001:2015 on Quality Management Systems (QMS).

The standard from ISO that will be used in this thesis is the ISO 25010. This standard is a part of the Systems and software quality requirements and evaluation (SQuaRE) from ISO 25000. The ISO 25010 is called System and software quality models. As the name of the ISO 25010 states, it provides a framework of models to evaluate systems and software. The main objective of the standard is to evaluate quality of software products and software-intensive computers systems. In the notes of the standard, it states "Although the scope of the product quality model is intended to be software and computer systems, many of the characteristics are also relevant to wider systems and services" (ISO, 2011, p. 1). It seems like the ISO 25010 most likely is used for evaluating quality in use of software and computers systems, as it is intended.

Quality in use is composed of five characteristics (with sub-characteristics) that relate to the outcome of interaction when a product is used in a particular context of use. **Quality in use** is defined by ISO as "degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use" (ISO, 2011, p. 17).

Within the pilot-system there are **stakeholders** on several levels. Primary users are defined as "individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations" (ISO, 2011, p. 18). In the notes of the standard there are several suggestions on which users that can be defined as primary users. Primary users within the pilot system involved in this research are the navigators on board vessels that are subjects to compulsory pilotage and pilots in the pilot service.

Definition of a **system** in the ISO standard "combination of interacting elements organized to achieve one or more stated purposes" (ISO, 2011, p. 19). In the notes of this standard, it is stated that a system may be considered as a product or as the services it provides. The pilot service is seen as a system suitable for this definition from the ISO standard.

I will present the definition of the characteristics and describe why I find it relevant to use this standard for examining my theme of interest in pilotage methods.

The five characteristics that the quality in use model includes is as follows (ISO, 2011)**:**

Effectiveness is defined as "accuracy and completeness with which users achieve specified goals" (ISO, 2011, p. 8)

Why is effectiveness relevant in a study on pilotage methods?

As the definition from the standard states effectiveness mainly deals with how accurate and complete a system is to achieve the users' goals. From the theory about the pilot methods, it can be seen as the main goal of the users to apply a method that makes it possible to successfully navigate and maneuver a vessel safely. Therefore, the perceived effectiveness among the navigators and pilots that deals with this system is seen as relevant for examining this thesis´ research question.

Efficiency is defined as "resources expended in relation to the accuracy and completeness with which users achieve goals" (ISO, 2011, p. 8)

Why is efficiency relevant in a study on pilotage methods?

The definition of efficiency includes the expended resources to achieve accuracy and completeness for the method. Given the fact that the pilot service are user-financed (in Norway), the efficiency of a pilotage method is important to keep the costs of shipping as low as possible. Examples of resources involved in the piloting are personnel time, materials such as pilot boats and financial costs. Even though the navigators and pilots rarely are directly in charge of the resources, they might have impressions and understandings relevant for efficiency.

Satisfaction is defined as "degree to which user needs are satisfied when a product or system is used in specified context of use" (ISO, 2011, p. 8)

Why is satisfaction relevant in a study on pilotage methods?

Satisfaction includes several sub-characteristics that deals with the users' personal feelings and impressions when a system is used. Especially relevant sub-characteristics are trust and comfort. In my point of view especially these two characteristics are essential for users to be satisfied with a pilotage method. In chapter 2.5 on remote pilotage, I referred to a paper from Hadley (Hadley, 1999) which suggest issues in remote pilotage. That a pilotage method may involve difficulties with communication and lack of "feel" from the ship from for the primary users I see as factors that may affect the satisfaction for involved personnel.

Freedom from risk is defined as "degree to which a product or system mitigates the potential risk to economic status, human life, health, or the environment" (ISO, 2011, p. 9)

Why is freedom from risk relevant in a study on pilot methods?

Freedom from risk deals with to which degree a system can mitigate potential for risk. With the main aim of the pilot service from NCA (Kystverket, 2021) in mind it is obvious that this characteristic is of great relevance for pilotage methods. Safeguarding traffic and protect the environment is exactly what the pilotage methods are there for, and in my point of view the primary users will have insights on aspects that are relevant for this characteristic.

Context coverage is defined as "degree to which a product or system can be used with effectiveness, efficiency, freedom from risk in both specified contexts of use and in contexts beyond those initially specified in the requirements" (ISO, 2011, p. 9)

Why is context coverage relevant in a study on pilot methods?

This characteristic is mainly a summary of all the four characteristics above. One thing that is of great importance is the sub-characteristic on flexibility. Flexibility of a pilot method is seen as relevant because it is somehow the foundation of why there are new pilot methods available in addition to classic pilotage. Both PEC and remote pilotage provides flexibility to users of the pilot system to obtain the compulsory pilotage without adding a pilot to the bridge. The primary users' thoughts on the flexibility of new pilotage methods are relevant, but also if the classic pilotage method is needed in the future.

3.4.2 Research procedure

After reading through and reflecting on the ISO standard with the research question in mind an interview guide was constructed. The guide is shown in appendix 1.

The interview guide that I wrote was set up for all three pilot methods with relevant questions in accordance with the ISO standard as a basis. Open format questions were decided as most appropriate for my research, again because I do not find it easy to put a number on perception. In open format questions, the respondent is free to answer in their own content and style (Walliman, 2011). On the other hand, open format is more demanding and time consuming, in addition to being more complex to code than closed format questions. The interview guide was an unstructured guide with open format questions. Some follow-up questions and notes were included in the guide. In addition to the written follow-up question some additional questions was asked to cover the characteristics as good as possible.

A pilot-interview or pilot study was conducted on a voluntary person within my network of contacts. This person had maritime experience as a navigator and had used all three pilot methods. According to Christensen a pilot study is strongly recommended. A pilot study can add a great deal of information and give the researcher experience with the procedure (B. Christensen, Johnson, & Turner, 2015, p. 356). Input from the test-person and from my own notes and impressions during this pilot-interview made it easier to observe what needed correction before putting the interview-guide at work on my population of interest. After the pilot-interview the information was transcribed from audio to a large written document.

From the beginning I had a clear goal of interviewing ten participants. This was achieved, five pilots and five navigators were interviewed during the data gathering. I decided to conduct the interview in the Norwegian language as all the informants were Norwegian speaking, and I considered that this would give the best quality of information.

To get in contact with relevant personnel with experience from the pilot methods I used both my personal contacts that I worked with before, contacted shipping companies asking for contact information and contacted the NCA to get a hold of pilots to be included in the study. I planned for telephone interviews mainly due to the covid-19 restrictions and the limited time. The interviews were to be recorded and afterwards transcribed to text. After getting a hold of all ten participants, I scheduled a time to execute the interview to fit the informants´ time schedule.

Informants that participated in this study:

Position	Age	Work experience in today's position	Miscellaneous information	Code
Captain	45-55	15-25	Offshore vessel	N1
First mate	25-35	5-10	Shuttle tanker	N2
First mate	25-35	0-5	Shuttle tanker	N3
Captain	35-45	5-15	Coastal cargo vessel	N4
Second mate	25-35	5-15	Offshore vessel	N5
Pilot	35-45	0-5		P1
Pilot	55-65	25-35	PEC-censor	P2
Pilot	35-45	5-15	PEC-censor	P3
Pilot	55-65	15-25	PEC-censor	P4
Pilot	55-65	25-35	PEC-censor	P5

An informed consent was written, and all participants were informed on their rights as participants in the research. Furthermore, all participants gave feedback that they agreed to the informed consent. The informed consent form is attached in appendix 2. The project was reported to the Norwegian centre for research data, NSD. The acceptance on data gathering from the NSD was granted the 18th of march in 2021. The transcription from the interviews was sent to all participants for read-through. Some modifications and deleting were done after this. Not all participants replied to the mail with their transcribed interview.

The large, transcribed document from each participant was summarized into a more manageable document of interest for the research question. The summaries were written in English from the Norwegian transcription from the interviews.

3.5 How the procedure worked out

The interview guide, which is attached in appendix 1, was proven as suitable during the interviews. A factor that I reflected on was that not all informants had the same level of experience with the three pilotage methods. As an example, the two navigators from shuttle-tankers had very limited experience with PEC, because their vessels cannot comply with the regulations by using PEC. Even with this of lack of experience within the informants, they had still had personal understandings and views.

Reaching out to informants willing to participate in the research was not a very big problem, easier than I had anticipated. Through former colleagues, the pilot masters from NCA, local shipping companies and other personal contacts the goal of holding ten interviews was reached.

Prior to holding interviews with the informants, a pilot-interview was held. The duration of this interview was just over one hour, which I had imagined prior to the interview. Based on this the informants were informed that the duration of their interviews would be between one and one and a half hour. When doing the actual interviews this was not held, at all. Some informants talked a lot about themes that did not fit into my area of interest, and I was not strict enough to tell them that their themes of interest did not fit into my research. This could have been avoided if I had been stricter on holding to the scheme. On the other hand, I did not want to be strict to the informants which used time to participate in my research.

3.6 Analysis of data

The chosen method of analysing data will be explained in this part.

There are several ways of analysing data from qualitative method such as interviews. There are some steps that are common. In SAGEs Handbook of Qualitative Data Analysis there are three practical steps that are suggested to use for analysing interviews (Roulston, 2013, p. 308-309):

- The first step is to reduce data. This is done to make it easier to dig into the gathered data that are relevant for the research question.
- The second step is reorganizing, classification and categorizing of data.
- The third step is to interpret the data and write up findings.

With this approach on analysing gathered data I went through with the following:

- At first all transcribed interviews were shortened into reduced interview schemes. The interview-guide were written according to the categories from the ISO-standard from the start. Shortened or reduced interview schemes that were more specific to the research question was written. Irrelevant data was sorted out in these schemes. Most interviews were reduced from about twenty pages to three pages of summaries. The summaries were categorized according to the characteristics from the ISO standard.

- The second step was to draw up tables for all the five characteristics in the ISO-standard. In these tables, I listed short notes on positive and negative factors for each standard from each of the ten participants. While writing up results and discussion these tables were used as the basis to display how many that were positive and negative for each characteristic of each pilotage method. Examples that could be used in the results and discussion chapter got a star in these tables. A picture of the written table with positive and negative factors for efficiency is shown in figure 2.

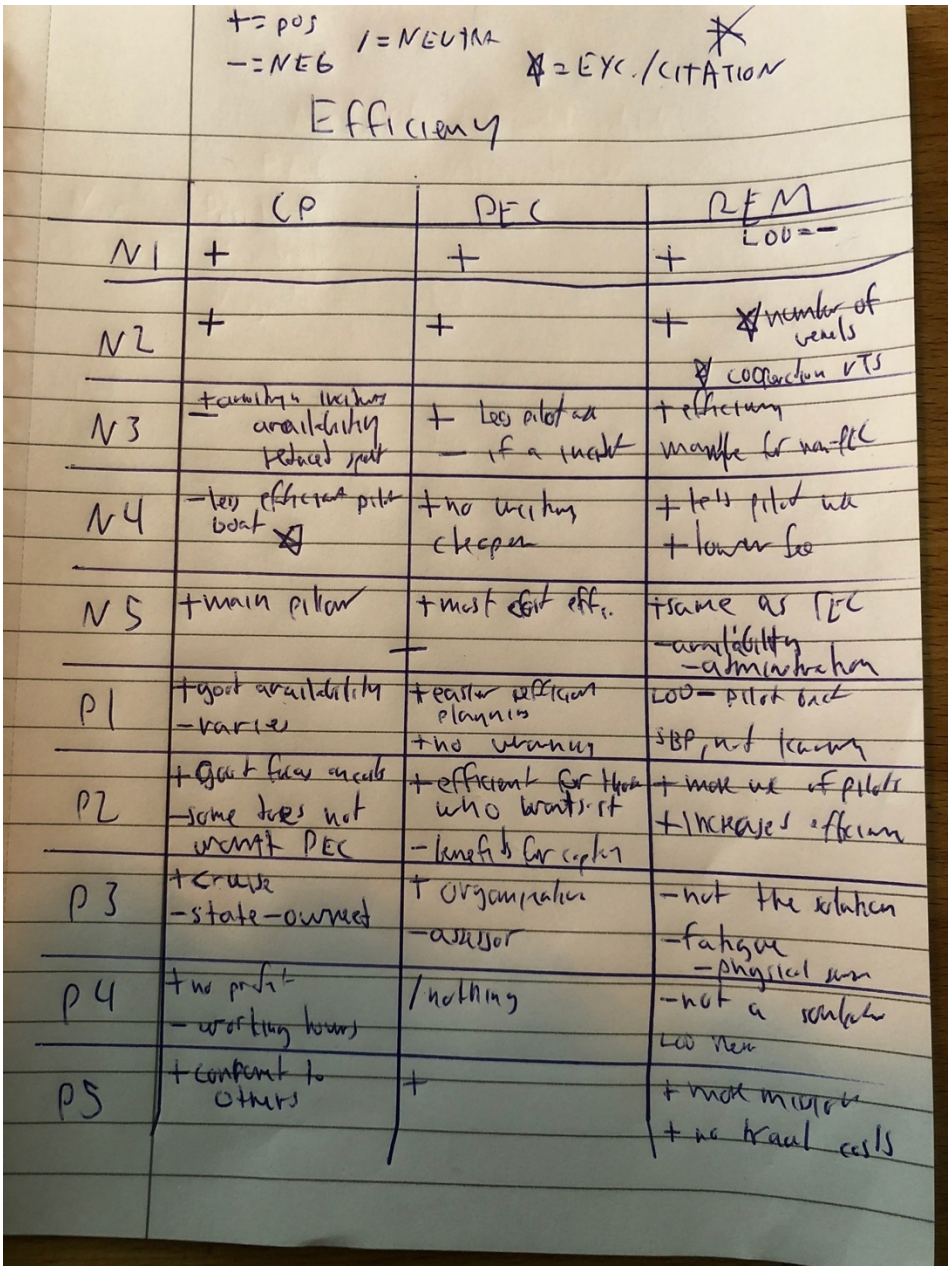

Figure 2: Picture of tables for positive and negative factors for efficiency.

- The third and final step was to make interpret and write up the findings from the interviews. The tables above were the basis for the result and discussion chapter. It was necessary to go all the way back to the transcription-files of interviews in some cases, especially for the examples to be used in the results and discussion chapter. (Roulston, Analysing Interviews, 2013)

4 Results and discussion

- What was the perception among the primary users within the pilotage systems on the pilot methods?

In this chapter the results from the interviews will be presented and discussed. I will NOT attempt to define which method that is best in any of the characteristics. That remote pilotage is, as explained in chapter 2.5, not a widespread pilotage method. This must be taken into consideration when reading this result chapter.

4.1 Effectiveness

Positive, negative, and neutral factors on effectiveness of each method for navigators and pilots will be presented and discussed.

4.1.1 Effectiveness of Classic Pilotage

There were some positive aspects related to classic pilotage from the navigators in the research. At first N1 answered that communication between pilot and navigators are experienced to be easy when the pilot is on board and that pilots contribute to painless sailing inshore. Another positive factor from N1 is that he stated was that if compulsory pilotage cannot be fulfilled by PEC, classic pilotage is his preferred method. In addition to this N3 is convinced that this method is as effective as it can be today.

However, some navigators have experienced negative aspects relative to the effectiveness of classic pilotage. At first N2, N3 and N4 all mentioned that availability sometimes is a problem that they experience with this method. N2 stated the reduced availability of pilots can cause delays in operations, which again lead to stressful situations for the navigators. In addition, N3 claimed that the navigators put most of the control or command of inshore sailing in the hands of the pilot alone. This was done because the navigators then could do administrative tasks. This phenomenon was experienced on board a shuttle tanker. In my opinion this phenomenon also can be seen as a positive factor as well because the need of a pilot on the bridge is clearly there. The negative part of the phenomena is that the navigators do not gain experience from inshore sailing when doing administrative tasks instead of participating in the navigational tasks.

Indications on the phenomena of navigators handing the control of the bridge over to the pilots were also mentioned in the theory chapter (chapter 2.4). The report from Canada has similar findings as my research for this phenomenon. In addition, the insurance company Gard stated that responsibility could be handed over from one person to another, and this example within my findings strengthens this statement from Gard.

The pilots´ perception on effectiveness for classic pilotage consists of mainly positive factors. At first punctuality of the Norwegian pilot-service is mentioned by all the pilots as positive factor on effectiveness. They claim that most vessels are serviced when they need. P2 and P4 refer to user surveys where the Norwegian pilot-service scores well, some states that it is best in its class, relative to other pilot-services. P5 stated that classic pilotage is a well-tested method that has worked fine for a long time.

On the other hand, two pilots also mentioned a negative factor on effectiveness for classic pilotage. P3 and P5 brought up that the availability of pilots sometimes can be an issue. P3 stated that this mainly was a concern during summertime, a period with normally a lot of cruise vessels along the coast. The cruise vessels are usually subject to compulsory pilotage and often take up two pilots at a time. Therefore, they take up much of the capacity of pilots.

This negative factor on availability was also mentioned by three navigators. It may be possible that the experienced lack of availability of pilots was during summertime when there are many cruise vessels along the coast. On the other hand, how big of a problem availability is not generalizable on this basis.

4.1.2 Effectiveness of Pilot Exemption Certificate

The perceived effectiveness of PEC is good among the navigators. Positive factors are statements that indicates that N1 prefers to not use pilot in familiar simple fairways with good chart coverage. In addition to this N5 sees this method as the one with the best effectivity, but states that quality must be ensured prior to using this method. N3 answered that voyages can be done safely by using PEC with skilled navigators. N4 clarified that this method is very effective for coastal vessels.

There are also negative factors on effectiveness of PEC from the navigators. N4 with long experience with PEC`s has experienced that it is more comprehensive to get a PEC now than it was before. This may have a footing in the fact that when PECs were introduced candidates received certificates based on experience, no tests were required at that time. One could argue that making it more comprehensive to get a PEC ensures the quality of the PEC-holder, which again increases the effectiveness of the method. Both N3 and N4 with experience from shuttle-tankers answered that PEC`s could be used by their vessels into easy fairways. This experienced unused potential for the method may be seen as a negative factor on effectiveness.

The pilots' perception on effectiveness of PEC also consists of positive factors. First of all, four out five state that it is a good and very effective method. The method is recognized of the pilots as an important method for many ship operators that operates frequently along the Norwegian coast. P2 specifies that it especially is a good method for vessels with two navigators on the bridge.

On the contrary, there are negative aspects of the effectiveness with PEC among the pilots. P4 pilot state that it actually works too well in in various cases. An example of a case that P3 are not happy with is that some "company-pilots" are operating on board vessels to save money on less use of pilots. This phenomena or arrangement means that some PEC-holders, one who is not a part of the permanent crew, goes on board vessels to fulfil the compulsory pilotage act. This arrangement with "company-pilots" is not seen as good because the external PEC holder is not familiar with the vessel, which they see as an important factor of the PEC method.

4.1.3 Effectiveness of Remote Pilotage

The navigators have statements that can be seen as positive for effectiveness of remote pilotage (RP). N1, N2 and N4 saw remote pilotage as a possible alternative to be used with some prerequisites. Mentioned prerequisites are that it is used in simple fairways with limited traffic, a planned route should be approved and that vessels to use RP should be piloted by a pilot prior to using RP. N5 stated that it could be an effective method if it was used right. N3 answered that piloting from pilot boat was seen as an effective method to be able to get in to harbour instead of waiting for better weather conditions. These findings indicates that the navigators in this research does not assume that this method could be implemented without taking prerequisites. The prerequisites mentioned by the informants have parallels to the prerequisites from the DNV report (DNV, 2001) presented in chapter 2.5.

In addition to the positive factors, the navigators had negative aspects on effectiveness of remote pilotage. N2 reflected that in ports with much traffic, Rotterdam was mentioned, RP would contribute to more dangerous conditions. I think that this must be seen in relation to classic pilotage in the same port. In addition, N5 answered that the accuracy of communication between a pilot on land a vessel could be low because it had to be done by use of radio. In addition, that one of the prerequisites of the method was that it should be used in simple fairways, may be seen as a negative factor. One could ask if RP would increase effectivity if it only could be used in simple fairways.

Incidentally, N4 stated that a need for harbour pilots may be introduced if RP was to be operational. I assume that this was mentioned because he thought that need for assistance during manoeuvring to quays was necessary for some navigators. This factor I see as neither negative nor positive, maybe more of a neutral reflection.

For the pilots there are not many positive aspects on effectiveness of RP, especially not on shore-based pilotage. The one positive aspect that was stated from P2 was that during a test-period it worked apparently well to pilot from shore. This must be seen in the context that RP from land was only used into shallower water during this test project. The informant that stated this participated as a pilot during the test-period on Kvitsøy mentioned in chapter 2.5. One positive factor on remote pilotage is that piloting from pilot boat is recognized as an acceptable method to use, it is better than piloting from shore P3 answered. This because it is possible for pilots to detect irregularities immediately, for example if a vessels course changes, the pilot instantly can discover this and react to the irregularity.

Negative effectiveness factors of RP were more common from pilots. One thing that all the pilots stated was that it will always be best to be on board the vessel. Another factor is that they do not see it as possible to assist in manoeuvring a vessel to a quay from other places than on board. Furthermore, P5 said that knowledge on how to receive RP must be implemented to the navigator's education. As an illustration of a pilot`s attitude to RP I find this quotation from P4 as suitable: "I would only trust remote pilotage to the pilot mark, no further. Easy as that!". To make it clear that this quotation is on shore-based pilotage.

The negative factors from the pilots can be associated with the findings in Hadley's paper on issues with Remote pilotage. The loss of "feel" with ship motion seems to be critical factor for the pilots whilst manoeuvring vessels. With the answers from the pilots in this research it seems

like the loss of feel, or ship handling, is something that experts manoeuvring a vessel would strongly dislike missing.

4.2 Efficiency

Positive, negative, and neutral factors on efficiency for each pilotage method for navigators and pilots will be presented and discussed.

4.2.1 Efficiency for Classic Pilotage

Positive factors on efficiency for classic pilotage were found in the navigators' answers. N1 answered that it was a cost-effective method when the navigator is unfamiliar in the fairways. N2 mentioned that mostly just one pilot is used for both navigation and manoeuvring to the quay as an efficient factor. Simultaneously N2 also answered that he did see if there was more effectivization to be done for this method. N5 answered that the classic pilotage method is the main pillar of the pilot-service. N4 answered that use of pilots by using the classic pilotage method was also seen as a good efficiency increasing factor by a navigator who sees the pilot lowers the risk of incidents. Avoiding incidents is clearly a good cost-reducing measure.

On the contrary N3 and N4 had negative factors concerning efficiency of the classic pilotage method. Again, N3 mentioned that availability of pilots resulted in lower efficiency when using this method. This was especially experienced on board the shuttle-tanker that N3 worked on; he went as far as calling this availability issue more of the normal situation rather than the abnormal situation in some areas of the Norwegian coast. N4 has experienced another negative efficiency factor with the pilot-boats. After the pilot-boat contract was privatized his cargo-vessel had to sail towards the pilot station. Before the privatisation of the pilot-boats it was normal that the pilot-boat sailed towards his vessel. The result of this was that his vessels had to sail about two hours extra to pick up the pilot, which again result in additional use of fuels and time. At first sight privatizing the pilot-boats may have reduced the costs for the NCA, but increased sailing time for their customers which this example show, may reduce the total efficiency.

All the pilots had positive efficiency factors about the classic pilotage method. P1 stated that sufficient availability of pilots in most of the country as a positive efficiency factor. P2 answered that the focus on costs in later years have increased for the pilot-service. In addition, P5 mentioned that the Norwegian pilot-service had been recognized as efficient compared to other pilot-services. As an example, P3 stated that a very efficient part of classic piloting is the use of pilots on board cruise vessels that visits the coast. On board such vessels two pilots are added to be able to sail more than twelve hours per day. Twelve hours is the maximum hours that one pilot can work per day.

There were some negative factors among the pilots on the efficiency of classic pilotage. P3 stated that privatization of the pilot-service would increase efficiency of the service. P4 pointed out that what he called a new organisation or routines of working hours made it hard for pilots do to mission effectively. The maximum twelve hours working time was mentioned as a negative factor on efficiency of the pilot service. Included in the working hours of a pilot is preparation prior to a mission, travel to a mission, execution of the pilotage mission and traveling from the mission. P4 that stated new routines for working hours results in lower efficiency for the pilot-service. It can the case that there was more flexibility in the working hours in the old routines or contracts for the pilots. One could ask that if the experienced efficiency after privatizing the pilot-boat was lower for a navigator, that privatizing of the pilot-service would make thing even worse.

4.2.2 Efficiency for Pilot Exemption Certificate

Positive aspects on efficiency of PEC method from the navigators were present. Four of the five navigators acknowledged this method as the most cost-effective pilotage method. Examples of good cost-effective factors are no waiting time for pilot mentioned by N4, no administrational work on ordering of pilot stated by N4 and N5 and reduced need for pilot assisted voyages answered by N2, N3 and N4.

There were also some negative factors affiliated to efficiency of the PEC method in the answers from the navigators. N3 answered that all the cost-reducing factors present in this method is instantly spoiled if a large incident happens. In addition to this is N5 mentioned that there was significantly administrative work to be done prior to applying for a PEC. An example of the administrational work was to keep track on prior voyages needed to qualify for a PEC.

The pilots also had positive factors affiliated to efficiency of the PEC method. P1 and P5 stated that without this method many vessels cannot operate and therefore it is important for many ship operators. A typical vessel where the PEC method is of great importance are coasters or freighters that have several ports of call, many ship operators design their routes to fit into the regulations of the PEC method. Another positive factor mentioned from P5 is that the planning for the vessels using this method is more efficient, I assume that this is compared to vessels using the classic pilotage method.

Negative factors on efficiency of the PEC method were also present in the pilots' feedback to the efficiency question in the interviews. P4 stated that he had experienced that a "pirate-pilot" went on board to educate new PEC-candidates prior to tests, which he considered as a bad development. According to him the education that these candidates got was not adequate to be recognized as suited for PEC. The negative factor may be as much of a satisfaction factor, but it was mentioned in context with the efficiency question of this method. I assume that the reason for this is that the pilots are used as censors for candidates applying for PEC, and therefore this development may be seen as inefficient. This can be an outcome of the knowledge gained by training from this "pirate-pilot", is inadequate for passing the candidates. The pilot that mentioned this was certain that if this "pirate-pilot" would apply for a PEC-test today, he would fail the examination.

4.2.3 Efficiency for Remote Pilotage

Positive factors affiliated with efficiency for remote pilotage were present in the feedback from the navigators. All answers in this paragraph deals with shore-based pilotage, not piloting from pilot boat. N1, N2 and N4 mentioned that this method could increase the efficiency of operations in for example fairways with limited traffic. It was mentioned by N4 that this could be a suitable method for those who can't use PEC. N5 answered that considered that efficiency of remote pilotage would be similar to the efficiency of PEC. As for effectivity, the method is recognized as efficient with prerequisites.

Negative factors of remote pilotage on efficiency from the navigators were also present. Piloting from pilot boat was not recognized as an efficient method from N1, it was just use in special circumstances and a pilot on the bridge is preferred over piloting from pilot boat. N5 reflected on that availability of pilots and examination of navigators prior to use are factors that affect efficiency of this method.

From the pilots there were some positive aspects on efficiency of remote pilotage. P2 stated that it is cost-reducing method if a station can be manned by a pilot who is already on duty. The answer on this was mentioned by a pilot who was in service during the test project in Kvitsøy. P5 answered that it was possible to get more “bridge-hours” (active hours on the bridge) for the pilots if time for travel to and from missions was removed. He stated that pilots today have around five hundred “bridge-hours” per year, and this would probably be doubled with remote pilotage. These statements are much alike the ones mentioned in chapter 2.5 where reduction in travel time for pilots on mission is stated as an efficiency increasing factor from DNV. P4 states that piloting from pilot boat is recognized as somehow efficient in contexts where embarking or disembarking is not feasible, and the nearest you can come to being on board without being on the bridge.

Negative factors affiliated with efficiency of remote pilotage from pilots are present. P1 does not see extensive use of RP as possible; it is just waste of resources he states. P4 answered that he does not see use of RP as possible solution at all. That it would be hard to implement were also stated by P5, it was seen especially challenging to use RP in difficult fairways. This can be connected to all the prerequisites that are needed for operational RP as suggested by the DNV report (DNV, 2001) in chapter 2.5. In addition, the test-project from 2004 that the DNV report evaluated, did not result in operative remote pilotage from shore-stations in Norway. So, the statement that it is just waste of resources can be seen by the outcome of the project at Kvitsøy, that he may have had in mind when answering this. On the other hand, there is operational RP in Italy where they report no incidents with use of RP so far. If this area in Italy where they use RP can be classified as a difficult fairway, the report does not tell anything about it. It is mentioned that RP is used by vessels who frequently visits the port.

4.3 Satisfaction

Positive, negative, and neutral factors on satisfaction for each pilotage method for navigators and pilots will be presented and discussed.

4.3.1 Satisfaction for classic pilotage

There are several positive factors of satisfaction from navigators on the classic pilotage method. At first all the navigators stated that they had trust in the pilots' skills and knowledge, which again results in a high level of comfort when using pilots. Pilots are recognized as professionals in their subject of piloting by the navigators. N1 said that he felt that a pilot strengthens the bridge team. Usefulness is also experienced as good by N1 when entering unfamiliar areas. Especially knowledge on local current conditions is of high importance for N1. N3 and N4 are positive to pilots that share their local knowledge when they are on board. N5 states that his comfort level is very high when using this method, it is in most situations higher than using PEC. The reason for this statement from N5 is discussed in the negative factors from the navigators on PECs.

However, there were also negative factors of satisfaction from the navigators on classic pilotage method. N3 stated that his comfort is low during embarking and disembarking of pilot from pilot-boat. This was much due to the pilot that must go from the pilot-boat to the ladder, but also the rigging of a pilot ladder on board vessels with great freeboard was considered as a dangerous operation. N1 stated that the confirmation notice two hours prior to departing could be a stressful factor on board the offshore vessels where he works.

Positive factors of satisfaction are also present in the pilots' interviews. As with the navigators, all the pilots have trust in that this method will contribute to successful sailing. The pilots experience that they have good trust from the navigators when they are executing pilot-missions. P3 and P4 answered that their comfort the first years of individual piloting varied a lot. Both P3 and P4 answered that after three to five years of piloting, most missions could be executed with a decent level of comfort.

Similarly, there are some factors that can be seen as negative on satisfaction from the pilots for the classic pilotage method. It is experienced by P3 that navigators think of them as controlling authorities. This may result in uncomfortable situations for the pilots during their missions. P4 says that due to digitalisation, the NCA removed a computer with electronic charts and replaced it with a tablet. According to this pilot the chart program on the tablet is not satisfactory relative

to the old one on the computer. P5 mentioned that the embarking and disembarking from pilot-boat is always something that can be experienced as stressful.

A neutral factor or sign on the high level of trust that pilots experience on missions was illustrated especially by P3. He stated that because of a high level of trust from navigators to pilots, navigators sometimes leave the bridge and leaves the inshore navigation to the pilot alone. This phenomenon is after my opinion not a very good thing. If this occurs one could ask if the pilot do what the pilot is on board for, which is to strengthen the bridge team. Of course, the pilot is most likely more skilled in inshore sailing, but the navigators does not gain much experience if they leave the bridge. This answer from P3 also corresponds well with the statements from the insurance company Gard in chapter 2.2, where the responsibility is given from one person to another.

4.3.2 Satisfaction for Pilot Exemption Certificate

Starting with positive factors on satisfaction from the navigators. To start with two of the navigators have never used PEC because they worked on board shuttle-tankers that are obligated to classic pilotage. First out is N4 is satisfied that navigators are given trust to sail independently without a pilot. In addition, N4 states that the usefulness of the method is very high, whilst N1 states that this varies a lot on the different types of vessels.

There are more negative factors on satisfaction of PEC among the navigators. N1 had experienced it as hard to acquire a PEC. I assume that it was the number of voyages required to apply for PEC that was the issue. N3 which has never used PEC, states that he would be comfortable to sail with a shuttle-tanker in pilot compulsory areas with PEC, which can be seen as a negative factor for his experienced usefulness for this method. In addition, N4 has experienced some issues when he was alone on board with valid PEC, there were some difficulties to fulfil the regulations on hours of rest in such situations. N5 mentioned that he had experienced limited trust to a colleague which had a valid PEC for an area he was not very familiar in, and therefore stated that he had better trust in classic pilotage for such circumstances. It is possible that the PEC-holder in this situation received a PEC for a greater area than he was censored for.

For the pilots there are also positive satisfaction factors for the PEC method. To start with P5 stated that this method is of great importance because todays navigators have limited training on inshore navigation. Training on inshore sailing is normal in Norwegian navigational schools,

but not in so many other countries P5 mentioned. This is a great example on the usefulness of this method and suits well to the main aim of the pilot-service. P2, P4 and P5 answered that they had trust in the PEC system, and they trusted the navigators that holds PECs today. The pilots are mostly involved in the PEC system when they are on board as censors for PEC-candidates. With this is mind, most of the pilots said that they felt comfortable after approving PEC-candidates for applying. P3 stated that he asked himself if he wished to meet the candidate in a narrow passage before approving the candidate. This was for him a good way of evaluating the performance of the candidate. P4 approved the assessor-scheme as good because nothing else was proven yet.

Negative factors from the pilots on satisfaction for the PEC method were also present. P1 and P3 questioned the assessor-scheme where a company-assessor approves candidates for PEC. Their reaction to the assessor-scheme involved that they could not see how a censor who also is a colleague with the candidate can provide a credible or unbiased assessment of the candidate.

4.3.3 Satisfaction for Remote Pilotage

Positive factors from navigators on satisfaction for remote pilotage were detected. To start with P1 and P3 have used piloting from pilot boat due to special circumstances. This procedure was by both seen as usable during such special circumstances, but it was stated that it is an emergency method from their point of view. P4 reflected that remote pilotage could be useful in simple fairways where a navigator without valid PEC for that area could receive instructions by remote pilotage. This would make it easier for him as a captain to fulfil the regulations on hours of rest.

There are several negative factors from the navigators on satisfaction in relation to remote pilotage. Communication by radio with a pilot on land is by N2 and N5 seen as a negative factor. Misunderstandings and restraint in asking more than necessary are mentioned as negative outcomes of communication by radio instead of face-to-face. In addition, much time and attention to the radio when using this method. This may draw attention away from navigation of the vessel. Simultaneously N1 stated that he would prefer to have the pilot on board in new areas, rather than over radio. Likewise, N1 stated that it would be negative if the pilot lost the ability to feel physical movements of the vessel.

There are a few positive factors on satisfaction in remote pilotage from the pilot. P2 who participated in the test project with remote pilotage from Kvitsøy, stated that the trust increased

during the test period. He could also remember that the reported trust from the navigators on board the vessels were good. P5 recently executed a piloting from pilot boat with a DP-rig due to special circumstances. He stated that his trust and comfort during this mission were satisfactory but pointed out that this was because of several meetings prior to the mission and that the crew were recognized as experienced.

Negative factors on satisfaction in remote pilotage are more common among the pilots. First, all the pilots clarified that their comfort always will be highest when they are piloting from the bridge. One pilot mentioned a situation where he was on a piloting over distance mission and the vessel did not respond to his instruction. The instruction was mainly that they had to alter course after passing a point, this to avoid crashing into land. After several confirming responses on the radio from the vessel on the instruction they still sailed towards land. Finally, not far from land the vessel changed its course. This was a very uncomfortable situation for the pilot who could not step in and change the course by himself. Another pilot states that he does not see any usability of extensive use of remote pilotage.

4.4 Freedom from risk

Positive, negative, and neutral factors on freedom from risk for each pilotage method from navigators and pilots will be presented and discussed.

4.4.1 Freedom from risk for Classic Pilotage

There are several positive risk mitigating factors for the classic pilotage method from the navigators. Four out of five navigator's states that adding a pilot to the bridge team is a risk reducing measure. The navigators recognize this method as mitigating measure to avoid grounding and collision that are good for reducing both economical, health related and environmental risks. Both N2 and N3 from shuttle-tankers stated that this method is good for such vessels with high risk for environmental risks if incidents occur. Similarly, N1 stated that adding a pilot to the bridge team with communication skills in the local language is an important factor to reduce risks. In addition, N4 mentioned that adding a pilot to the bridge could reduce mental problems for nervous navigators visiting new areas.

On the contrary there are also negative risk mitigating factors with the classic pilotage method from the navigators. N1 answered that availability of pilots can be seen as an economical risk. Limited availability of pilots can result in delays for operation which this navigator has

experienced outside of Norway. All navigators stated that the operation of embarking and disembarkation of pilots are seen as a high-risk operation.

From the pilots several positive risk mitigating factors for classic pilotage are present. At first P1 and P3 answered that they are not unfamiliar with coming on board vessels where navigators have planned to sail into unsafe waters with for example too shallow depth. If the pilots correct the sailing plan for such vessels it is clearly a risk reducing method. In addition to this a P1 mentioned that they also increase efficiency because they know the fastest routes into the harbours, which can reduce economical risk. All pilots are clear on that this method decrease especially the environmental risk in a good manner. P2 stated that the reduction of risk for the environment is what the pilot-service is there for.

One example of situation where the strength of this method was proven during an incident in Norway in 2017, the example came from P4. A vessel on its way to scrapping almost grounded on a beach due to stop in the engines. A pilot was placed on board to ease communication between the vessel and resources on land. This pilot had to take over the operation because the captain was not able to do this himself. Communication with tugs was also done by the pilot. The outcome of this incident was limited, and I am sure that the skills of the pilot were a giant factor of the limited harm in this incident. One can imagine what it would look like with a giant vessel on the beach during summertime...

Negative risk reducing factors of the classic pilotage method are also present with the pilots. P1, P2, P4 and P5 stated that the embarking and disembarking with pilot boat is a dangerous operation that they have in mind. P3 stated that this operation is a part of the job that they are obligated to manage and deal with.

4.4.2 Freedom from risk for Pilot Exemption Certificate

Starting with positive risk reducing factors on PEC from the navigators. Positive factors that are mentioned by N1, N3 and N4 to reduce economical risk is related to the time that are saved by using PEC instead of the classic pilotage method. N4 states that the sailing route for his vessel is designed to fit the PEC regulations and therefore it is a good solution for effective operations. In addition, N1 considers the necessary local knowledge as satisfactory when a PEC is held by a navigator. In addition, the fact that there is no embarking and disembarking from pilot boat, which clearly reduces risk for personnel.

Negative risk reducing factors for PEC are present in the answers from the navigators. N3 and N5 answered that having a pilot on board is better for reducing risk in relation to PEC. N5 said that if irregularities occur, having a pilot on board would be better than using PEC. N4 stated that having a pilot on board reduces the risk for collision and grounding more than having a PEC does. This can be seen in relation that a pilot is an additional barrier to such incidents, whilst having a PEC removes this additional barrier. On the other hand, the skills of the navigator obtaining a PEC is somehow proved by the procedure for acquire a PEC according to the navigators themselves.

There are positive risk reducing factors from the pilots as well on the PEC method. First out, all the pilots state that economical risk mitigation is sufficiently reduced by this method. P4 stated that if nothing else is proven in relation to the frequency of incidents with PEC, this method also reduced risk in a satisfactory manner. A positive factor that P2 stated with this method is that there are no embarking and disembarking from pilot boat when using PEC.

Negative risk reducing factors on PEC from the pilots are also present. P3 stated that communication issues due to linguistic barriers can occur. This is essential in the case of incidents with potential risk. In accordance, P5 stated that there is limited focus on available oil recovery resources when applying for PEC.

Another negative factor or example from P1 was that losing a pilot`s input on weather conditions that vessels plan to sail into, with a special focus on sailing into bad weather, is somehow a negative outcome of the PEC-method. P1 stated that independent input from a pilot on the weather conditions, can reduce the risk of vessels sailing into too rough weather. From his point of view pilots had good opportunities to reduce the possibility of this to happen. He reasoned that this was mainly due to the high trust that shipowners have on pilots.

4.4.3 Freedom from risk for Remote Pilotage

Positive risk reducing factors on remote pilotage from the navigators are present. N2 and N5 stated that RP could be good for risk reduction if it was well organized. The removal of the operation of embarking and disembarking from pilot is seen by N1, N2 and N5 as a risk reducing measure connected to this method.

On the contrary, the navigators mentioned more negative factors in relation to risk reduction with remote pilotage. At first N2 was uncertain if a pilot could provide the same service from land than the pilot can from on board the vessel. N2 and N3 mentioned that losing the pilots

ability to help with communication and external resources if incidents occur as a negative outcome of remote pilotage. N1 summed that this method takes away the main reason for using the pilot-service. N1 asked that if a pilot is not on board, what would the pilot then contribute with?

There are a few positive risk reducing factors for remote pilotage in the answers from the pilots to. Without many details on how, P5 said that this method mainly had strengths in reducing economical and health related risk. For the reduction in economic risk, this can be related to reduction in travel time for pilots and use in extensive weather conditions, suggested by DNV as positive economic outcome of using RP from shore (DNV, 2001). This is strengthened by P2 answer on remote pilotage from shore. P2 answered that remote pilotage can reduce waiting due to for example bad weather, which can result in better flow in the operations. Piloting from pilot boat is recognized by P1 and P4 as a good method of decreasing risk for personnel, but only as an emergency procedure.

On the other hand, there are several negative risk reducing factors on remote pilotage from the pilots. P5 stated that this method demands much better understanding than today's users possesses before it can be implemented safely. P3 stated that piloting from land would increase the danger for incidents. In addition, one P2 said that a pilot placed on land is not able to give orders, only advice. Even though the pilot only is an advisor to the crew when the pilot is on board as well, it is understandable that getting orders from a person standing next to you rather than from the radio can be seen as clearer. In addition, Hadley wrote that language problems, which can I considers as a part of communication errors, is one issue with remote pilotage (Hadley, 1999). Importance of good communication was mentioned in chapter 4.1. on effectiveness of classic pilotage by N1, he stated that. communication between pilot and navigator is easy with a pilot on the bridge.

4.5 Context coverage

Positive, negative, and neutral factors on context coverage for each pilotage method from navigators and pilots will be presented and discussed.

4.5.1 Context coverage for Classic Pilotage

Positive factors of context coverage for the classic pilotage method among the navigators are present in the gathered information. At first N5 stated that the classic pilotage method is the most complete method of them all. N1 answered that a pilot's local knowledge and communication with mooring personnel as good for operations. In addition, N1 stated that classic pilotage is a service which is nice to have. Especially for large vessels such as shuttle-tankers the expertise that the pilots possess for mooring with tugs are appreciated by N2 and N3. Flexibility of the pilot-service is experienced as good by N3. For example, when the need for alternative route arises while sailing inshore, which can be demanding for navigators visiting new areas, it is experienced by N3 that pilots handle such changes easily. In addition, a N4 acknowledges that the pilot service adapts to changes in the industry, but it occasionally is a bit slow on adapting to new needs.

There are negative factors of context coverage for the classic pilotage method among the navigators as well. To start with, N1, N3 and N5 have experienced flexibility issues with the service. These issues are connected to availability, limited flexibility in dispensations and delays because of weather conditions. N4 who works on board a coastal vessel stated that the classic pilotage method is not very suited for his type of vessel, but the needs of this types of vessels are covered by the PEC.

The pilots have positive factors on context coverage for the classic pilotage method. All the pilots state that the pilot service works well for all contexts` that they might be involved in. Different contexts are types of vessels, quays and the method can be used for special missions like piloting oil rigs. P4 stated that they are trained in using anchors for mooring operations which increases the flexibility and therefore increases the boundaries of when a vessel can be able to dock. P1, P2, P3 and P5 mentioned that the flexibility of the classic pilotage method as the biggest strength of the method. P5 answered that they rarely say that missions cannot be executed, they are good at finding solutions to get the mission done. At the same time P1 stated that not all navigators are willing to use PEC which he takes a declaration of confidence.

There are not many negative factors on context coverage for the classic pilotage method from the pilots. P4 stated that he felt somehow behind the development on bridge technology that new vessels are integrated with, but this was not a giant problem. At the same time P4 the pilot said that this was not a very big problem, because pilots are trained on navigation and manoeuvring without input from technological equipment.

4.5.2 Context coverage for Pilot Exemption Certificate

There are positive factors on context coverage for PEC from the navigators in the research. First out N4 stated that it is a very good method for his type of vessel that visits several ports when sailing along the coast. N3 stated that there are no limitations on availability and weather conditions involved in this method. These two factors can be seen as flexibility increasing factors for the PEC-method. In addition, N3 answered that this method makes it possible to arrive and depart ports without thinking about ordering a pilot to assist for such operations. This is a positive flexibility factor for the PEC-method.

There are negative factors on context coverage for PEC from the navigators as well. To start with N3 stated that this method has unused potential, he mentioned that it could be used by more navigators than it is used of today. In addition, N3, with experience from a shuttle-tanker, answered that he would be comfortable with using PEC on board his vessel earlier in the interview. N5 answered that there are needs for more quality assurance in this method. He added that standardization for examination was needed to make this method more complete. This must be seen in a context where this navigator has been four years on shore without sailing time. In addition, N4 reflected on that it is negative that Norwegians do not have any advantages in Norwegian waters. This he stated that was normal in other nations.

Positive factors on context coverage for PEC from the pilots were present in the answers from the pilots. P2, P3 and P5 stated that this method is appropriate with today's regulations. The flexibility that this method gives the navigators and shipowners is acknowledged as an important factor by P1. P2 and P4 stated that flexibility has increased the prior years for this method.

Negative factors on context coverage for PEC are also present in the answers from the pilots. P1 answered that the method is too loose, or flexible for other nationalities. This was answered in combination with a discussion on whether communication skills should be evaluated on the same basis as navigational skills when searching for PEC. P3 stated that the flexibility with assessor examination for PEC candidates have issues. These issues are based on that he sees it as hard to evaluate colleagues on PEC-exams. He compared this to asking for example your mother or neighbour to be your censor when getting a driver's licence.

4.5.3 Context coverage for Remote Pilotage

First out are the positive factors on context coverage for remote pilotage in the answers from the navigators. To start with a N3 stated that this method also removes the issue of availability of pilots and limitations due to weather conditions. N4 states that extensive use of remote pilotage from land could be used into simple fairways. There are not a great number of positive statements on context coverage for this method from the navigators, I thought that there would be more positive factors on this method.

On the contrary, there are many negative factors on context coverage for remote pilotage from the navigators. N1 reflects that is not so useful at all because this method only gives the pilot possibilities to report on traffic and give instructions on where to sail. In addition, N1 stated that loosing direct input from the pilot as negative. N2 thought that mooring operations with big vessels, in this example a shuttle-tanker, would be slower without a pilot on board during mooring operations. N2 also thought that the speed of the vessels using remote pilotage would be lower than for vessels using pilots. Meanwhile, N5 stated that this method would not be good enough to remove the need for pilots. He saw this this method as a supplemental method for today's pilotage method.

There are some positive factors on context coverage for remote pilotage from the pilots. The piloting from pilot boat procedure is recognized as useful to increase context completeness by P5. That the procedure on piloting from pilot boat increases flexibility is acknowledged by P3. P2 answered that he experienced that RP from the shore station as flexible during the test-period at Kvitsøy, not so much on why this was experienced.

There are several negative factors on context coverage for remote pilotage from the pilots. P4 clarified that he never would pilot and manoeuvre a vessel to quay from a pilot boat, and that it is not useful for those who need assistance in manoeuvring operations to a quay. Extensive use of remote pilotage from land would according to P2 just be usable for fairways with limited turns, which may affect the benefit of this method. In addition, P3 stated that when piloting from pilot boat is used, it is mainly used in bad weather. In bad weather the need for a pilot on the bridge is extra needed for some navigators according to P3.

5 Framework method discussion

This chapter contains a discussion on how the ISO-standard contributed to examine the primary users' perception on the pilotage methods.

The ISO standard, with its five characteristics that makes up the quality in use of a system, clearly had a great value when conducting the interviews. I have reflected that without the characteristics from the standard, questions on the methods could have been like this:

- What do you see as positive with the PEC method?
- What do you see as negative with the PEC method?

Question like the two above I think would have been hard to categorize afterwards when writing up the result and discussion chapter.

In my opinion the characteristics within the standard contributed to good answers to suitable themes for the pilot methods. All the characteristics with their questions encouraged the informants to say something relevant about their perception on the pilotage methods.

The interview guide had some follow-up question after the questions based on the characteristics. These were added to give the informants a possibility to speak freely if they felt that something about the theme was missing. There was not much input from the informants after the interviews. It was mentioned by some informants after the interviews that most of the relevant factors on the theme were discussed. This is seen by me as a supporting statement that the perception of the pilotage methods, was examined with thoroughness.

5.1 Examining perceived effectiveness

With a primary goal to examine perceived effectiveness from my informants, it is my understanding that the standard from ISO contributed to gathering relevant data. The most important contribution from the standard was the definition of effectiveness that clearly separates effectiveness from efficiency. The clear separation of these two characteristics were absolutely needed during the interviews. Without a clear separation on effectiveness and efficiency from the standard, I would not be surprised if struggles with separating these two occurred during the interviews. On the other hand, I could have found definitions from other sources than the standard. Meanwhile I found it reasonable and most neat to use definitions on relevant characteristics for the theme from the same source.

Effectiveness was experienced as a relevant characteristic to discuss with the informants in the research. They clearly have professional goals while using the pilotage methods, and their goals when using the methods mostly included getting a vessel safely in or out of a harbour.

5.2 Examining perceived efficiency

As for effectiveness the ISO standard contributed to a good definition of this characteristic. In addition, the standard had examples on which factors affect the efficiency of a system which was useful when drawing up the interview guide. When it comes to perception of efficiency for the pilotage methods it must be clarified that the primary users in this research do not interact closely with the economy of piloting. The economical part of the pilotage service can be more relevant for ship owners, cargo owners, ports, and end-customers of the cargo that the vessels ship. Similarly, the primary users involved in this research showed that they had factors that are connected to the efficiency of the system. Examples of such an efficiency factor mentioned are availability of pilots that some navigators experienced as a negative efficiency factor.

5.3 Examining perceived satisfaction

The satisfaction characteristic in the research is where the personal feeling from the primary users is examined. Sub-characteristics such as experienced usefulness, trust, pleasure, and comfort are seen as personal “feelings” that the users of the methods experience. During the interview it was experienced as fine to ask about the sub-characteristic’s usefulness and trust. On the other hand, pleasure and comfort did not work out so fine. These two sub-characteristics were experienced as too similar by the primary users, which I understand. Therefore, most informants only answered on the question on either the pleasure or comfort sub-characteristic.

The answers were in my opinion much the same for all sub-characteristics. How much this affected the answers for the satisfaction as a main characteristic is unclear.

5.4 Examining perceived freedom from risk

Talking about freedom from risk for pilotage methods led to a lot of engagement from the informants. Especially the pilots had a lot of input on the pilotage methods risk reducing measures. Several examples on real-life experiences were given as examples on how some methods are especially good at reducing risk. All things considered; this was the characteristic that was easiest to talk about with the informants. Furthermore, several of the informants stated that economical, health-related, and environmental risks are closely coupled in shipping.

5.5 Examining perceived context coverage

When examining the perceived characteristic context coverage as it is defined in the ISO standard, I experienced that flexibility was more of interest and therefore was given more interest from the informants. This may have driven the answers in this characteristic to be more about flexibility of the method, and not so much on how it fulfils the needs that the pilotage method is supposed to fill. By the same token, the perceived context coverage is partly examined in the other characteristics that the informants have answered for.

6 Conclusion

The main goal of this project was to get a deeper understanding of primary users` perception on three pilotage methods. The main research question was asked:

1. **What are the primary users´ perceived quality in use of the three pilotage methods?**

In addition to the main research question there was a follow-up question on the ISO-standard as chosen framework for the method:

2. **How do "ISO 25010 Quality in use" contribute to examine primary users` perception in the pilot service?**

6.1 Conclusion for the main research question

Classic pilotage

The primary users` perceived quality in use for this method has overweight in positive factors. Positive experiences and impressions are especially present in the characteristic on satisfaction and freedom from risk. Especially the navigators trust for pilots are considered as a positive factor. Negative factors for the method are also present. One repetitive feedback is the experienced issue with availability of pilots, which is mentioned by both navigators and pilots when talking about effectiveness and efficiency. How large the lack of availability is, is not covered in this research.

Pilot exemption certificate

The primary users` perceived quality in use for this method also has overweight in positive factors. Positive experiences are highly present in the answers in the characteristic effectiveness and efficiency of using PEC to obtain the compulsory pilotage. The freedom, based on the flexibility that this method provides vessel, is a repetitive answer when talking about primary users about PECs. Still there were negative factors as well for this method. One example is that some primary users have doubt in the objectivity of the assessor arrangement for examination of PEC-candidates.

Remote pilotage

The primary users` perceived quality in use for this method consists of overweight in negative factors. The negative feedback is especially present in the characteristic satisfaction and context coverage. For satisfaction, the loose of "ship-feel" or ship handling when manoeuvring a vessel, is considered as a very negative outcome of this method. This was answered by all the pilots and some of the navigators. The positive factors related to RP are mainly found in the characteristic effectiveness and efficiency.

The overall conclusion of the primary users' perception on the pilotage methods, is that it corresponds well with the development on pilotage today. The navigators and pilots are generally more positive to classic pilotage and PEC than they are for remote pilotage. In chapter 2.5. it is presented a report by PWC and Panteia (PWC and Panteia, 2012), which shows that remote pilotage is not a widespread method for obtaining compulsory pilotage. Several of the issues in remote pilotage presented by Hadley (Hadley, 1999) are also found again in my research. The findings in this study are from a rather limited population of the primary users in this system, and therefore it is not very generalizable. It must be seen as more as an indication on general impressions and understandings of the pilotage methods.

6.2 The contribution of the ISO-standard

The ISO-standard contributed to examine the perception from the primary users in an appropriate manner. Given that the standard was made for software and computer systems, it was especially interesting to test it on more physical systems. My findings in this research, shows that the ISO-standard is well suited to examine perception for alternative systems other than software and computer systems. The findings in my research show that the ISO-standard is adaptable for wider systems and services, than software and computer systems.

7 Further work

Based on the findings in this research, I have some suggestions to further work on the same theme:

- A quantitative research on the same theme, using the ISO-standard as a framework.
- A research aiming to examine technologies that are present and future to support implementing of new pilotage methods such as remote pilotage.

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Appendices

Appendix 1: Interview guide

Appendix 2: Informed Consent Form

Appendix 1 – *Interview Guide*

Åpningsspørsmål:

- Hvor gammel er du?
- Hvor mye arbeidserfaring har du som styrmann/los?
- Har du anvendt denne losmetoden før?
- Har du noen innledende tanker om metoden? Spesielt for case 3.
- Hva ville ditt hovedmål vært under anvendelse av losmetoden?

Karakteristikk	Hovedspørsmål Q1	Oppfølgingsspørsmål Q2	Notater
Åpningsspørsmål			
Innledende tanker om metode og hovedmål for en slik seilas i informantens stilling			
Klassisk losing			
Farledsbevis			
Fjernlosing	Hvordan ville en fjernlosing-operasjon foregått?		
Effektivitet Nøyaktighet Helhet	Hva er dine tanker om nøyaktigheten og helheten til denne losmetoden?	Hvor godt dekker den behovet den er tiltenkt å oppfylle?	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Effektivitet Ressursbruk	Hva tenker du om effektiviteten til losmetoden i form av ressursbruk?	personell, materiell, tid og finansiell kost.	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Tilfredshet, *velbehag*, *velbefinnende*	Dekkes/sum av de neste tre.	Personlig opplevelse	

Anvendelighet, nytte, brukervennlighet	Hva tenker du om anvendeligheten til losmetoden?	Eventuelt brukervennligheten	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Tillit	Hvordan er tilliten din til losmetoden?	Tror du den vil fungere som tiltenkt? Om den fungere som tiltenkt, ville du hatt tillitt da?	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Behag, glede	Hvordan ville din tilfredshet vært ved bruk av denne losmetoden?		
Klassisk losing			
Farledsbevis			
Fjernlosing			
Komfort	Ville du vært komfortabel ved bruk av losmetoden?		
Klassisk losing			

Farledsbevis			
Fjernlosing			
Evne til å minimere risiko	Dekkes/sum av de neste tre		
Økonomisk risiko	Hva tenker du om losmetodens evne til å begrense økonomisk risiko?	Finansiell status, effektive operasjoner, rykte eller andre ressurser	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Helse og sikkerhet	Hva tenker du om losmetodens evne til å begrense risiko for personell?		
Klassisk losing			
Farledsbevis			
Fjernlosing			
Miljørettet risiko	Hva tenker du om losmetodens evne til å begrense miljøforurensning?	Og eventuelt begrense om noe skulle oppstå?	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Hensiktsmessighet og fleksibilitet	Dekkes/sum av de neste to		

Hensiktsmessighet	Har du tanker om losmetodens evne til å anvendes i den konteksten den er tiltenkt å brukes i.	***Kontekst*** *er begrepet for omstendighetene omkring en hendelse eller en tilstand. Konteksten virker inn på hvordan vi tolker denne hendelsen eller tilstanden, og den kan også virke inn på hvordan hendelsen forløper.* *Kontekst = spesifiserte forhold.* *Spesifiserte forhold for losmetoden: Alle tenkelige skip, leder, værforhold, kaier med mer.*	
Klassisk losing			
Farledsbevis			
Fjernlosing			
Fleksibilitet	Har du tanker om losmetodens fleksibilitet og evne til å tilpasses til alle relevante sammenhenger?		
Klassisk losing			
Farledsbevis			
Fjernlosing			

Tanker og innspill fra informant:

Mine tanker etter intervjuet:

Har jeg spurt alle spørsmål du trodde jeg skulle spørre om?

Appendix 2 – *Informed Consent form*

Would you like to participate in the project

Pilotage methods?

This is a question for you to participate in a research project where the purpose is to investigate navigators and pilot's perception on three different pilotage methods. In this letter, I give you information about the goals of the project and what participation will mean for you.

Aim

The goal of this master thesis is to investigate the primary users` perception on three pilotage methods. The methods that will be involved is classic pilotage, pilot exemption certificate and remote pilotage. Characteristics that will be discussed is for example effectiveness, efficiency, satisfaction, freedom from risk and context coverage. Informants involved in this thesis are navigators and pilots which are defined as primary users.

Who is responsible for the research project?

The Institute for Maritime Studies at HVL is responsible for the project.

Why are we asking you to participate?

We are asking you to participate because you have experience as a navigator or a pilot.

What does participation mean to you?

If you choose to participate, I will interview you for about 60 minutes. The interview will be carried out by phone and will be recorded. After transcription of interview the record will be deleted.

It is voluntary to participate

It is voluntary to participate in the project. If you choose to participate, you can withdraw your consent at any time without giving any reason. All your personal information will then be deleted. It will not have any negative consequences for you if you do not want to participate or later choose to withdraw.

Your privacy - how I store and use your information

I will only use the information about you for the purposes I have described in this article. I treat the information confidentially and in accordance with the privacy regulations. The information will only be seen by me and my supervisor. No person or company will be identifiable in any publications from the project.

What happens to your information when I end the research project?

The information is destroyed when the project ends, which according to the plan is June 2021. At that time, all personal data will be destroyed.

Your rights

For as long as you can be identified in the data material, you have the right to:

-access to which personal information is registered about you, and to receive a copy of the information,

-to have personal information about you corrected,

-to have personal information about you deleted, and

-to send a complaint to the Data Inspectorate about the processing of your personal data.

What entitles me to process personal information about you?

I process information about you based on your consent.

On behalf of IMS, NSD - Norwegian Center for Research Data AS has assessed that the processing of personal data in this project is in accordance with the privacy regulations.

Where can I find out more?

If you have questions about the study, or want to exercise your rights, please contact:

Knut Hovda. E-mail: 214258@stud.hvl.no or phone 00 47 40607573

If you have questions related to NSD's assessment of the project, you can contact: NSD - Norwegian Center for Research Data AS by email (personverntjenester@nsd.no) or by phone: 55 58 21 17.

With kind regards,

Knut Hovda

(researcher)

I have received and understood information about the project Pilotage methods and have had the opportunity to ask questions. I agree to:

To participate in an interview

I agree that my information will be processed until the project is completed

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(signed by participant, date)