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Evidence in the Air

Exploring the Implementation and Experiences with Evidence-Based Training in Scandinavia

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Table of contents

List of tables

Abbreviations

CBTA	Competency-based Training Assessment
EBT	Evidence-based Training
ICAO	International Civil Aviation Organization
IATA	International Air Transport Association
OPC	Operator Proficiency Check
PC	Proficiency Check

Abstract

Due to the voluntary nature of Evidence-based Training (EBT) under European Union Aviation Safety Agency (EASA) regulations, this thesis explores its implementation across the Scandinavian aviation sector. The study examines the perceptions and experiences of Scandinavian aviation operators regarding EBT, focusing on the factors that influence their decisions to either adopt or reject this innovative training framework. EBT represents a shift from traditional training methods to a competency-based approach, emphasising observable behaviours and essential competencies.

Utilizing qualitative research methods, this study involved semi-structured interviews with Nominated Person Crew Training from five different operators to explore the complexities and strategic considerations of EBT implementation. The findings indicate varied attitudes towards EBT among operators, ranging from strong endorsement of its potential to enhance pilot competencies to concerns about its complex legislation and bureaucratic and resource-intensive nature.

The study reveals that operators who have adopted Competency-based Training and Assessment (CBTA) acknowledge its significant impact on pilot training. However, the full transition to EBT is seen as a considerable commitment that many operators are hesitant to make. The study suggests a need for a common forum for operators to exchange experiences and knowledge.

The study presents a brief insight into the perceptions and experiences with EBT in Scandinavia. It contributes with new insights to the aviation industry, authorities, and lawmakers.

Foreword

This thesis represents the most comprehensive work of my academic career and marks the culmination of an interesting period as a student at UiT. The completion of this work was made possible only through the unwavering skills and support of my fantastic wife. Numerous individuals have contributed to this process, all of whom have shown immense patience and support. I am particularly grateful to my supervisor, Steen Sandal, a supportive and critical voice in my choices during the project.

Thank you!

Copenhagen, November 2024
Henrik Tams Madsen

1 Introduction

Since the first flight, aviation has transformed significantly. Aircraft design and reliability have improved, as has the complexity of both the aircraft and the environment in which they are operated (ICAO, 2013). This evolution contrasts sharply with the traditional approach to training and checking of pilots, which was originally designed for early-generation jet aircraft and has since only been modified by adding manoeuvres as new needs became apparent (IATA, 2014).

Today the backbone of the traditional checking is under the European Union Aviation Safety Agency (EASA) jurisdiction: the Operator Proficiency Check (OPC) and the Proficiency Check (PC). The OPC is conducted every 6 months and is intended to evaluate the proficiency in operating a specific type of aircraft within an operator's environment (ORO.FC.230). The PC for multi-pilot aircraft is conducted every 12 months to maintain the validaty of the relevant type rating. This check assesses a pilot's general flying skills and their ability to manage a range of flight operations (FCL.740). The topics that are covered during a PC are defined by Part-FCL Appendix 9 from EASA, which is generic to all aeroplanes within the multi-pilot high performance complex category (Appendix 9). When operating under traditional training and checking, it is stated that the operator should include feedback from the management system in the training programme (ORO.FC.230 AMC3, 2022). In addition, the requirements for the training programme are that all major failures of aircraft systems and their associated procedures should have been trained in the preceding 3-year period (ORO.FC.230 AMC1).

In addition to traditional training and checking, EASA allows the use of what they call the Alternative Training and Qualification Programme (ATQP). This allows the operators to implement a customised approach to training and checking that deviate from standard regulatory requirements under certain conditions (ORO.FC.A.245 AMC1, 2022). The key in ATQP is that the operator must document that they will improve training standards beyond those prescribed by traditional training and checking (ORO.FC.A.245 AMC1, 2022).This is done through a safety case, describing how they will conduct their training. It is stated by EASA that it allows the operators to align their training more with their operations to enhance the relevance and effectiveness of the training. In the later years, EASA has introduced a

focus on behavioural markers that are of the same definition as described later in the next chapter (ORO.FC.A.245 AMC1, 2022).

1.1 Evidence-based Training

The aviation industry did agree on the necessity to review the current training and checking of airline pilots to enhance safety (IATA, 2013). The International Air Transport Association (IATA) established the Training and Qualification Initiative (ITQI) in 2007 (IATA, 2023). This initiative brought together a diverse working group consisting of representatives from authorities, airlines, academic institutions, original equipment manufacturers, international organisations, pilot representative bodies, and training organisations (IATA, 2023). The group was tasked with conducting a strategic review of airline pilot training, focusing initially on recurrent training programmes (ICAO, 2013). This review highlighted the need for a shift in how training and checking are conducted. Traditionally, pilot checking involved scenario-based assessments where pilots were evaluated mainly on their ability to adhere to predefined limits during set scenarios. This method, while structured, often did not account for the varying competencies required across different generations of aircraft, nor did it address the broader scope of operational risks effectively (IATA, 2014).

In response, a significant shift was made from this traditional scenario-based checking to a competency-focused approach. This new approach evaluates pilots based on a range of competencies that are critical for safe and effective operation across different aircraft generations. These competencies are identified through an analysis of operational data, highlighting the specific risks associated with different types of aircraft (IATA, 2013). The result was the development of Evidence-Based Training (EBT), a programme that emphasises competencies over procedural adherence and restructures the whole training and checking programme as it had been. EBT is designed to be dynamic and evidence-based, ensuring that it remains relevant to the current operational risks for any particular aircraft type and generation (ICAO, 2013).

1.1.1 Publications on EBT

The foundational manual of EBT is published by ICAO (2013) as DOC 9995. It is referenced in the legislation and guidance material made by EASA that are laying down the foundation of EBT in Scandinavia. Furthermore, EASA (2024) has published an EBT Manual, that, during the course of this study, has been developed from a very basic manual to the more comprehensive manual it is today. In addition, EASA (2022a, 2022b) has published guidance material on implementation of both Mixed- and Baseline EBT. One distinction taken in this study is the interpretation of Guidance Material (GM) and Acceptable Means of Compliance (AMC) from EASA. They are interpreted and referred to as legislation to simplify the understanding.

1.1.2 EBT applicability

EBT primarily targets airline pilots operating large commercial aircraft, including both turbojet and turboprop aeroplanes, with a focus on those having significant passenger capacities and operational complexities. According to ICAO (2013), EBT is applicable to aircraft with a certified seating capacity of 50 or more passengers for turbojets and 30 or more for turboprops.

The scope of EBT spans various aircraft generations, each characterised by distinct operational features and associated risks. ICAO categorises aircraft into six generations, each reflecting technological advancements, design improvements, and enhanced safety features (ICAO, 2013). The development of an EBT programme for any specific aircraft type is guided by a detailed matrix of assessment and training topics, ensuring that the training is precisely tailored to the unique needs and challenges of each aircraft generation (ORO.FC.232(b)(3) AMC1, 2021). For instance, Generation 4 jets like the A320 and B787, which are equipped with fly-by-wire controls and advanced flight envelope protection systems, require training programmes that address the management of these sophisticated systems. Similarly, training for Generation 2 turboprops such as the Bombardier Dash 8-100/200/300 series focuses on their specific analogue/CRT instrument displays and basic flight envelope protection systems like stick shakers and pushers (ORO.FC.232(b)(3) AMC1, 2021).

EBT programmes are not only generation-specific but also adaptable to various operational contexts, whether pilots are engaged in short-haul domestic flights or long-haul international routes. This adaptability ensures that pilots are prepared for the specific challenges they encounter in their respective operational environments (ICAO, 2013). By focusing on the development of competencies that align with the technological and operational specifics of different aircraft types and generations, EBT effectively enhances pilot capabilities to manage both routine and unforeseen situations in flight (ICAO, 2013).

1.1.3 Competency-based Training and Assessment

CBTA is structured around a framework of competencies, which includes detailed sets of skills, knowledge, and attitudes necessary for successful job performance. In aviation, these competencies extend beyond mere aircraft handling to encompass critical non-technical skills such as decision-making, teamwork, communication, and situational awareness. Each competency is associated with specific observable behaviours that provide measurable criteria for assessment (ICAO, 2013).

Observable behaviours are a key component of CBTA, as they allow instructors to assess whether trainees can apply their skills and knowledge effectively in real-world scenarios. An example of a competence can be seen in Table 1-1 below. The competency of "Workload Management" can among other observable behaviours, be measured by observing the behaviour on the right side of the table.

Table 1-1: Section of the table on recommended EBT competencies from EASA (ORO.FC.231(b) AMC1, 2021).

Workload management (WLM)	
Description:	Maintains available workload capacity by prioritising and distributing tasks using appropriate resources
OB 8.1	Exercises self-control in all situations
OB 8.2	Plans, prioritises and schedules appropriate tasks effectively

These behaviours are actions or reactions that are visible and measurable during training or actual operations, making them critical for accurate assessment and feedback. This focus on observable behaviours helps to ensure that the competencies taught are not only understood theoretically but are also demonstrable in practical settings (ICAO, 2013).

1.1.4 Modules

In EBT, modules are structured to ensure coverage of the essential competencies for pilots. These modules are integral to the EBT framework and distinctly different from the traditional training and checking and ATQP. Each 3-year cycle consists of 6 modules (ORO.FC.231, 2020). Each module within this cycle should contain the specific assessment and training topics designed specifically to the relevant aircraft type and generation as described in the chapter on EBT applicability. The distribution of assessment and training topics across the EBT modules is governed by defined frequencies, ensuring that each pilot is exposed to all necessary topics within the three-year programme (ORO.FC.231, 2020).

An EBT module is composed of two phases: the Evaluation phase and the Training phase, which includes Manoeuvres Training and Scenario-Based Training. The Evaluation phase is conducted first to assess the current competencies of the pilots, identifying any areas that require further development. Following this, the training phase addresses these areas through targeted exercises in both the Manoeuvres Training and Scenario-Based Training sessions (ORO.FC.231, 2020).

ORO.FC.231 (2020) specifies that pilots must complete at least two EBT modules within the validity period of their type ratings, which means that every 12 months, a pilot must have completed two modules. A critical aspect of EBT is the ongoing assessment process throughout all training phases. If a pilot is found to be lacking in any competency, additional training is provided. Should the pilot still not meet the required standards after further training, they are temporarily removed from line flying duties. This continuous assessment and adjustment process places the responsibility of determining a pilot's competency on the instructor, rather than on an examiner as in traditional training systems (ICAO, 2013).

The customisation of the EBT programme syllabus is a process that ensures the training is relevant and tailored to the specific operational needs of an airline. According to the EASA (2024), this customization must be systematically described by the operator and is based on evidence collected from multiple sources. This evidence includes individual data from training reports and grading metrics, operator-specific insights from safety management processes, and external information from regulatory authorities and original equipment manufacturers. By integrating this diverse set of data, airlines can adapt their EBT programmes to address the unique challenges faced by different groups of pilots or specific aircraft types (EASA, 2024).

1.1.5 Instructors

Under EBT, instructors ability to accurately analyse and assess pilot performance according to their competences is important, which is why instructor concordance and standardisation are regulated by EASA legislation and guided by the EBT Manual from EASA (2024). The instructor training should emphasise the development of competencies, particularly in measuring observed behaviours in relation to the operator's grading system. It also focuses on correlating these observed behaviours with potential outcomes in training situations, ensuring instructors can effectively identify and enhance pilot performance (EASA, 2024).

Moreover, instructors are trained to recognise and commend good performance and to determine the root causes of substandard performance. This dual focus helps in reinforcing positive behaviours and addressing areas needing improvement (EASA, 2024).

A critical component of the EBT framework is the implementation of a concordance programme. This programme is essential for ensuring the reliability of data from the EBT programme and the validity of the training outcomes. Concordance, as defined in statistics, refers to the degree of agreement among raters (ICAO, 2013). EBT programmes require the use of sophisticated statistical methods to evaluate instructor metrics at both individual and group levels. To aid in the assessment of concordance, reference materials such as scripted videos and case studies focusing on selected competencies can be utilised. These materials should cover all competencies over a three-year cycle and shall be supplemented with correct gradings to allow comparisons of instructor assessments against established standards. These

standards should be set by a group of EBT instructors that should be rotated to prevent bias (EASA, 2024).

1.1.6 Mixed EBT

Mixed EBT serves as an intermediary step towards the full implementation of EBT. It is designed to facilitate both organisations and regulatory authorities in gaining practical experience with EBT methodologies before committing to a full-scale implementation (EASA, 2024). The primary differences between Mixed EBT and full EBT lie in the scope and regulatory compliance. Mixed EBT programmes operate within the constraints of traditional checking regulations, requiring a careful balance between new EBT methodologies and existing checking practises.

The Mixed EBT programme still retains the Evaluation Phase but modifies the Manoeuvres Training Phase to the Manoeuvres Validation Phase, aligning it more closely with traditional proficiency checks (EASA, 2024). Those two phases are designed to meet the requirements of a traditional proficiency check. The final Scenario-based Training phase remains consistent with full EBT, focusing on training rather than assessment. This structure ensures that pilots, instructors, and the operator's gain experience with the first parts of EBT but are still complying with the regulatory requirements of traditional training systems (EASA, 2022b).

As in full EBT, instructors and examiners play critical roles in the successful implementation of Mixed EBT. Examiners, in particular, are pivotal during the Evaluation Phase and the Manoeuvres Validation Phase as they are assessing the pilots as in traditional checking but also as required under EBT, assessing pilot competencies, in order to establish the basis for the training requirements later in the Scenario-based Training phase. Their assessments must align with the standards set forth in Part-FCL Appendix 9, which outlines specific manoeuvres and procedures required for pilot proficiency, akin to a traditional proficiency check. Integrating Appendix 9 into the Mixed EBT framework ensures that the checks meet traditional regulatory requirements for licencing and proficiency while simultaneously providing exposure to the EBT framework (EASA, 2022b).

It is outlined that, among other things, 3 years' experience with a Mixed EBT programme and 2 years' experience with an instructor concordance programme are required as a prerequisite

to the transition into a full EBT implementation. It is also an option to introduce Mixed EBT on the basis of an ATQP programme (ORO.FC.A.245 GM2, 2015).

1.1.7 Evidence-based Training under EASA

As shown on the timeline in Table 1-2, the EBT programme has in different steps been adjusted and implemented by EASA. EASA has chosen to design the regulatory framework to make it voluntary for the operators to implement EBT (Explanatory Note to Decision 2021/002/R, 2021). It will, according to them, maintain a high level of safety in a cost-efficient way (NPA 2018-07(A), 2018).

Table 1-2: Timeline of EBT.

2007	• IATA established the ITQI (IATA, 2023).
2013	• ICAO introduces EBT in PANS-TRG (ICAO, 2013).
2015 sep.	• EASA starts work towards implementation of EBT with RMT.0696 (RMT.0696, 2015).
2015 dec.	• The use of Mixed EBT is introduced under current regulatory framework in EASA, with ED Decision 2015/027/R (ED 2015/027/R, 2015).
2016 feb.	• With RMT.0599 EASA starts work towards a more complete implementation of EBT (RMT.0599, 2016).
2020 dec.	• With Comission Implementing Regulation (EU) 2020/2036, 2020/2193 Air OPS and Air Crew regulation, was amended to allow for a more complete EBT implementation (Regulation (EU) 2020/2036, 2020).
2021 mar.	• With ED Decision 2021/002/R the relevant AMC's and GM's was adjusted for the use of EBT (ED 2021/002/R, 2021).

1.2 Literature overview

To identify the need for further knowledge and to establish my research question I investigated the existing literature on the implementation of EBT in aviation; a search was

conducted. The literature review was conducted primarily on Google Scholar, with a range of different search words related to the subject, hereunder “evidence-based training”, “aviation” and “implementation”. It showed a range of articles on the subject, but articles were focused on how-to implement and studying the workings of EBT. These were not relevant for this study. The articles with a heading that sounded relevant was the one by Han (2020) named “Study on EBT Implementation and Approval Process in Korea” which was about the process of forming the legislation to accommodate for EBT in the Korean legislation. The article was not relevant, as the legislation is already in place under EASA. The other article is the one by Hwang and Kim (2023) investigating the performance of an EBT training programme on pilots. Which again is not relevant for this study as it investigates effects of an already complete implementation of EBT.

1.3 Reflexivity

To understand the study, it is relevant to understand the background of the researcher. Today, I work as a pilot for an operator based in Scandinavia. Combined with a background as a flight instructor, I have a sincere interest in training in aviation. Curiosity on EBT emerged from an impression that not many operators in Scandinavia were using the new training programme that was sold as being transformative and better.

According to (King, 2004) reflexivity is about the acknowledgement that the researcher's involvement shapes the research process and knowledge produced through it. That means that I, as the researcher in this thesis, am an integral part and a tool in the production of knowledge (Alvesson & Sandberg, 2022). Through the whole process, I have been aware that I have pre-understandings of the subject. These have been a part of the process; as I have gained more and more knowledge on the subject, the area of interest and therefore the research questions have evolved.

1.4 Research questions

Given the voluntary nature of EBT implementation under EASA regulations, the aim of this study is to **explore the implementation of EBT in Scandinavia**. The study seeks to answer the following questions:

What factors of EBT are experienced as significant for Scandinavian operators in relation to their decision to implement EBT or not?

What have been the significant experiences with EBT implementation among Scandinavian operators?

2 Theoretical framework

To broaden the understanding of the research questions as outlined above, a theoretical framework will be employed. As the implementation of EBT under the jurisdiction of EASA is voluntary, it is deemed appropriate to use a theory from the field of social science to broaden the understanding of the operators' perceptions and experiences with EBT.

For this thesis I will use Rogers' (2003) social science theory of Diffusion of Innovations as the theoretical framework. The model is comprehensive, but in the context of this study it will be used as a tool to broaden the understanding of the findings; therefore, only parts of the theory that are relevant for the findings will be used. The model is mainly chosen due to its ability to identify and describe the effects of different perceptions on the operator's willingness to implement EBT. It can also help to understand the implementation of EBT and why it is done as it is.

In the context of the diffusion theory, "diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003). It involves the spread of new ideas, practises, or technologies from their originators to the wider community or organisations (Rogers, 2003). It means the diffusion of an innovation can be split into the following four elements. The innovation is something new or significantly improved, which can be a product, a service, or a practice. The communication channels by which information about the innovation is transmitted, such as media, interpersonal communication, or professional networks. Time is the duration over which the innovation spreads and is adopted by the members of the social system. The social system is the community or network of individuals and organisations that must adopt the innovation for it to be considered diffused (Rogers, 2003).

Diffusion is therefore a way to broaden the understanding of how an innovation, are diffused or implemented across a social system. The theory focuses on the decision to implement or reject the innovation and what influences that decision, the time the decision takes, and how the implementation is done. As seen in Figure 2.1 it can be split into five stages. The model is called the innovation-decision process (Rogers, 2003).

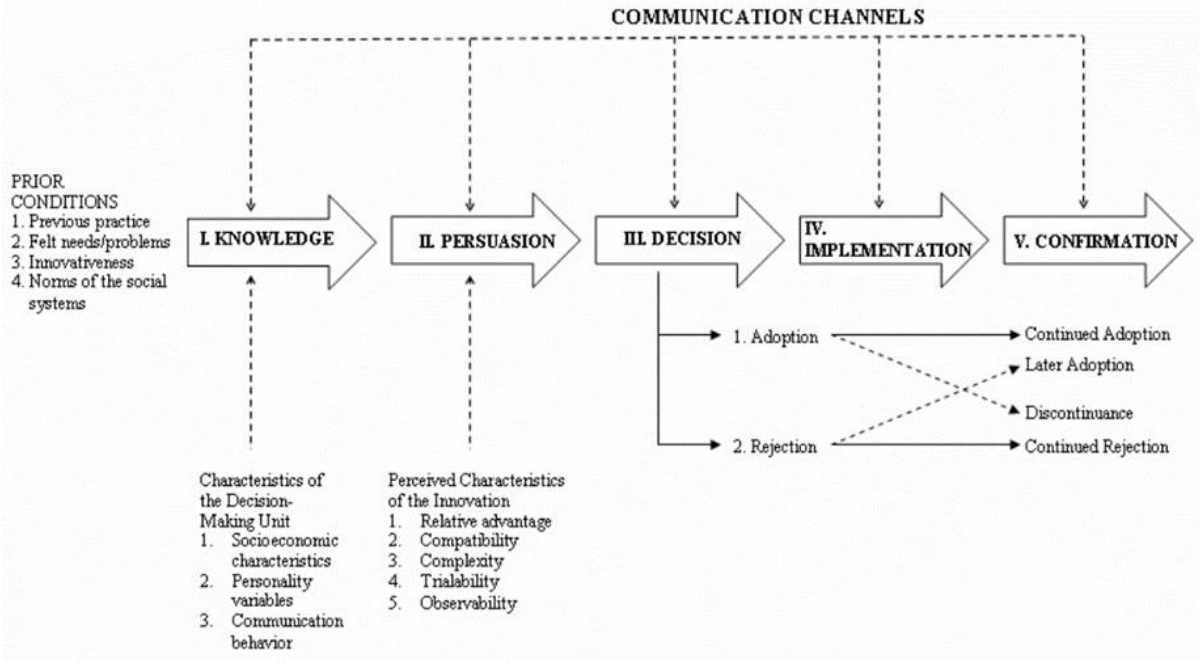

Figure 2.1: A model of Five Stages in the Innovation-Decision Process. (Source: From DIFFUSION OF INNOVATIONS, 5E by Everett M. Rogers. Copyright © 1995, 2003 by Everett M. Rogers. Copyright © 1962, 1971, 1983 by The Free Press. Reprinted with the permission of The Free Press, an Imprint of Simon & Schuster, LLC. All rights reserved.) (Rogers, 2003, p. 168)

The first stage is the knowledge stage. The awareness-knowledge starts when an individual or organisation is becoming aware of the existence of a particular innovation; ideally, it motivates them to seek more knowledge on the innovation, leading them into the how-to knowledge. In this stage, they seek knowledge of how an innovation works. The more complex an innovation is, the more knowledge is needed. If a sufficient level of how-to knowledge is not obtained, a rejection of the innovation is likely to occur (Rogers, 2003).

An individual or organisation may know about an innovation but may not regard it as relevant to their situation or see it as useful and needed. Therefore, are the attitudes towards an innovation relevant for the understanding of the outcome of the innovation-decision process. The attitudes are in the process covered by the persuasion stage (Rogers, 2003).

As seen in Figure 2.1, the persuasion stage is influenced by the five attributes of the innovation: relative advantage, compatibility, complexity, trialability, and observability. The key to understanding their influence is that it purely is the perception of the attributes of the

innovation, as perceived by the organisation, that influences the time- and decision to implement or not (Rogers, 2003).

The next stage in the model is the decision stage, where a decision whether to implement or not is made. To implement an innovation is said to occur when an individual or organisation puts the innovation to use. It is at this stage that the challenges of putting the innovation to use arise (Rogers, 2003). During the implementation stage, re-invention often occurs. Re-invention is when an innovation is modified by a user in the process of implementation. It is said that innovations can be designed to encourage re-invention. The logic behind it is that innovations that are more flexible and easily re-invented can be fit to a wider range of adopter's conditions (Rogers, 2003).

More complex innovations will be more likely to be re-invented. An innovation that has a general nature, with many possible applications is more likely to be re-invented. If it consists of different elements that are loosely bundled and not necessarily dependent on each other, it is easier to re-invent the innovation to suit an adopter's need. The opposite is the case if the elements of the innovation are highly dependent on each other (Rogers, 2003).

Communication channels are relevant at all stages of the model, as the model is a means of reducing uncertainty, which is done through communication. Communication channels are split into two types: mass media channels like the internet and TV, and interpersonal channels, which are between persons who are similar in terms of socioeconomic status or other important ways (Rogers, 2003). Of relevance to this study is to know that on the persuasion stage of the innovation-decision process, information from interpersonal channels is having a greater weight when accessing attributes of an innovation (Rogers, 2003).

3 Method

This chapter outlines the research methodology applied in this study to investigate the experiences and perceptions of EBT among Scandinavian operators. The methodology is crucial for understanding how and why data was collected, analysed, and interpreted.

3.1 Study design

As the area of EBT under EASA is relatively new, it is an area where the operator's perceptions and experiences have not been studied before. Therefore, the study applied a qualitative research design to explore the subjective perceptions and experiences of EBT (Brinkmann & Kvale, 2015).

The study is explorative as "we do not head for a complete description of all aspects of the phenomenon we study" (Malterud, 2012, p. 802). The qualitative approach was chosen due to its strength in obtaining a deeper understanding of the research subjects and their insights into their organisation's perceptions and experiences related to EBT (Brinkmann & Kvale, 2015). The qualitative interview can be used in exploring what the operator's mindset is towards EBT. It can be used to gain a nuanced understanding of their concerns and perceived good things with EBT. According to Creswell and Creswell (2022) the qualitative study design is suitable if a phenomenon needs to be explored and no research has been done in the field, which applies to the perceptions and experiences of EBT in Scandinavia.

Data collected through a qualitative method has in its origin a smaller sample size and is not universally generalisable. However, the data found through this method is profound, which is the strength of this method (Brinkmann & Kvale, 2015.). In a qualitative approach, it is not feasible to calculate data saturation. Data saturation is met when adding data from new informants does not create new empirical knowledge. Therefore, data saturation varies (Brinkmann & Kvale, 2015). As this study has an exploratory design, it does not seek to find final answers and complete explanations to the phenomenon. The goal is to open the door to a previously unexplored phenomenon. Thus, data saturation was not intended as an outcome. To meet the criteria of data saturation, I would have had to include bigger numbers of informants (Malterud, 2012).

To understand the phenomenon, an inductive approach was taken to the analysis of the findings. It explored the individual operator's perceptions and experiences and identified themes in the transcripts, which lead to general themes and impressions on EBT (Brinkmann & Kvale, 2015).

3.2 Sampling

To identify participants for the interviews, the criteria for relevant operators were set. The first inclusion criteria were the operator's geographical connection. It was set by which jurisdiction of national civil aviation authority they were under. The relevant jurisdictions were set to be Denmark, Norway, and Sweden. The Civil Aviation Authorities in Norway, Sweden, and Denmark publish lists of Air Operator Certificates under their jurisdiction. These lists were merged into one list. The list was thereafter supplemented with open-source data and personal knowledge about the aircraft types each operator operates. Thereafter, an exclusion criterion was introduced. The operators should not operate helicopters. The final inclusion criterion involved selecting operators with aircraft types suitable for EBT, as previously defined, and inviting them to participate in the interviews.

At the time of invitation, the 8th of February 2024, there were 19 applicable operators. Invitations were sent through personal contacts where possible and through official email addresses otherwise. Follow-up invitations and communication were sent to those where an interview appointment was not set initially, which resulted in one additional interview, ending up with a sample size of 5 operators.

As it is presented in Table 3-1 the participating operators in this study have different prerequisites for EBT. As some operators have not implemented EBT, some are in the decision process, and one has implemented Mixed EBT. For anonymity, all other details on the participating operators are removed, but it can be said that the participating operators represent both small and large operators in terms of the number of aircraft they operate, and they do also present different geographical areas of Scandinavia. All interviews were collected with one participant from each operator, except from one operator, where there were two participants. To establish a reference for their perceptions and reflections, the status of their current training and checking methodology and plans is as follows in .

Table 3-1: Operators participating in the study.

Operator 1 Are not using either CBTA or EBT and have no current plans for implementation.
Operator 2 Are using CBTA in an informal way, are about to formally implement it. Have no current plans for EBT implementation.
Operator 3 Are using CBTA in combination with ATQP and have no current plans for EBT implementation.
Operator 4 Are using CBTA and are strongly considering EBT implementation.
Operator 5 Have implemented Mixed EBT including CBTA and are on the way to Baseline EBT.

3.3 Interviews

Data was collected through semi-structured interviews with Nominated Person Crew Training, representing each of their operators. Semi-structured interviews are designed to get elaborated answers, which was the aim of these interviews (Brinkmann & Kvale, 2015). The interviews were centred around an interview guide, which set the main themes for the interview, with room for follow-up questions. It was designed with some open-ended questions to encourage the participant to share what they felt was relevant in relation to EBT. The intention was to get the participants to reflect upon their experience and perspectives, providing a foundation of rich and detailed information relating to EBT.

The interview guide can be seen in Appendix 2: Interview guide. It was, as stated, developed to guide the interview, with room for the participant to tell stories and to open areas of EBT

that were of importance to them. Brinkmann and Kvale (2015) suggest a guideline for how the quality of an interview can be determined. Their definition should be viewed as a guideline, as the quality of an interview, according to them, depends to a certain extent on the researcher's craftsmanship, life experience, and prejudice against the field of subject. Brinkmann and Kvale (2015) guidelines as presented below were kept in mind when designing the interview guide and performing the interviews:

- The shortest interviewer's questions and longest subjects' answers possible
- The extent spontaneous, rich, specific, and relevant answers from the interviewee
- The degree to which the interviewer follows up and clarifies the meanings of the relevant aspects of the answers
- To a large extent, the interview being interpreted throughout the interview
- The interviewer attempting to verify his or her interpretations of the subjects' answers over the course of the interview
- The interviewer being "self-reported," a self-reliant story that hardly requires additional explanations (Brinkmann & Kvale, 2015, p. 192)

The questions and themes in the interview guide were split in two due to the different nature of the operators. Some had implemented EBT, and some had not. The area of focus had overlapping elements but was in general different for the two.

To ensure the quality of the interviews, a pilot or test interview was conducted with a colleague. It was to ensure that the questions were understood as expected and to get an estimate of the timeframe for the interviews (Brinkmann & Kvale, 2015).

Each interview was conducted by me and lasted approximately one hour. Interviews were conducted online via Microsoft Teams, and the audio was recorded with the consent of the participants. The recording was done to ensure that detailed information could be accurately captured and later transcribed for analysis. The literature suggests that interviews conducted online are a feasible method compared to face-to-face interviews (Archibald et al., 2019; Lobe et al., 2020).

Follow-up questions were primarily used to get the participants to elaborate their answers; therefore, a frequent follow-up question was *why*. Furthermore, I used control questions to

verify my interpretation during the interview to improve the quality of my interview (Brinkmann & Kvale, 2015).

3.4 Ethical considerations

The study adheres to the ethical guidelines as specified by UiT The Arctic University of Norway. Prior to all interviews, the participants were informed of the purpose of the interview and gave their written informed consent on the consent form, as seen in Appendix 1: Consent form. They were informed about their right to withdraw without reason at any time and what the purpose of the interview was. The transcription, translation, and analysis of the interviews have been done to stay as loyal to the oral statement as possible.

3.5 Data analysis

To understand the data collected in the interviews, an inductive approach was used. It was used because of its ability to say something general about a given class of instances (Brinkmann & Kvale, 2015). To analyse the data, Malterud (2012) concept for systematic text condensation was used. The transcription was done leaving out any specific data that could relate the transcription back to the operator. It could be the mention of names, aircraft types, or times for the implementation of specific programmes.

The transcribed interviews were then taken through the four steps of the systematic text condensation from Malterud (2012). Even though the interview guide was split in two due to the different nature of the operators with and without EBT, it was chosen to analyse the interviews together, as there were common themes and relevant viewpoints on the research questions. The first phase of the model from Malterud (2012) was to get a total impression of what was said in the interviews. It was done during the transcription process, and again, after the transcription was complete, the complete transcripts were read and preliminary themes related to the research questions were identified. The process was completed for the first two interviews, right after they were conducted to identify new relevant themes for the operators. An example of a theme was the indicators the operators monitor to adjust their training programmes. The theme led to new questions in the interview guide.

The second step in the process by Malterud (2012) was to search for meaning units in the text. The step is called decontextualization and refers to the practice where bits of text are put into groups of the same relevant thematic codes. The step required much work back and forth and

to decide on the meaning units of text while identifying the correct thematic codes and sub-groups. Meaning units and thematic codes changed dynamically during the process, evolving as new knowledge was acquired. The thematic codes ended up being split into two main groups and a range of sub-groups, as illustrated in .

Table 3-2: Thematic codes and sub-groups

Thematic code	**Sub-groups**
Opinions on EBT	General opinions Training over checking Training adjustments Training structure Competency-based Training and Assessment
Experiences with EBT	Evidence-based Training Competency based Training and Assessment Standardisation of instructors

The third step in the process is to systematically construct meaning units by looking at each group. The meaning units should then form the basis for a condensate written for each of the groups, where the essence of the group is captured. They sought to resemble the original meaning and words. In the fourth step and last, the text was recontextualized. Here the condensates were synthesised into descriptions to provide credible stories relevant for the research questions (Malterud, 2012). That text is what is presented in chapter 0 under each thematic code group.

3.6 AI declaration

In the work with this study, I have utilized OpenAI's language model, ChatGPT, provided by UiT The Arctic University of Tromsø (UiT), as a tool to assist with aspects of information gathering. ChatGPT has been used to support refining and proofreading parts of the text for grammatical accuracy, punctuation, and coherence. It is important to note that the entire thesis was written by me.

Throughout the thesis preparation, ChatGPT has been used to respond to specific queries related to the subject matter, providing references to explanations, definitions, and clarifications to deepen understanding of the topics discussed.

This acknowledgement is intended to transparently declare the use of AI in the research and writing process, in line with academic integrity principles and the guidelines provided by UiT.

4 Findings

This chapter outlines the findings derived from interviews and subsequent analysis as detailed in Chapter 3. It is structured around the thematic codes identified during the analysis, each corresponding to key characteristics of EBT. Each section begins with a metatext that provides an overview of the findings within, offering a concise summary of the insights related to each thematic code. To understand the remainder of the thesis, it is important to note that the operators are referred to as companies, and therefore the pronouns 'they' and 'their' will be used throughout the text.

4.1 EBT & CBTA opinions

All participating operators have developed opinions on the aspects of EBT that they have understood. Additionally, those operators who have a comprehensive understanding of EBT, as well as those who have already implemented CBTA and/or EBT, hold distinct perspectives on the subject. This chapter presents the findings related to their opinions.

4.1.1 General opinions on Evidence-based Training

This chapter presents the general opinions from the operators regarding the transition to EBT. It captures different opinions, ranging from scepticism about the bureaucratic load and perceived minimal benefits over existing methods like ATQP to a more optimistic view where the integration of CBTA within EBT is seen as a significant advantage. The chapter highlights the complexity of EBT legislation as a barrier to full understanding and implementation, with some operators expressing a preference to delay their own implementation until they can learn from the experiences of others. Moreover, the chapter explores the motivations behind operators' interest in participating in this study, including a desire to gain more knowledge and share insights. The narrative also touches on the strategic approaches of operators who are considering EBT, including the use of external assistance in the implementation of EBT. This chapter provides a comprehensive overview of the operators' attitudes towards EBT, reflecting a blend of apprehension and proactive engagement.

During the interview, one of the operators expresses that they view the transition to EBT as a process burdened with excessive bureaucracy, and they expect minimal improvement in training outcomes. That is compared to just continuing with their already established ATQP,

which they compare to EBT and see as similar to EBT to be data driven. It is important to note that this operator currently employs CBTA, which they favour.

Another operator articulates that the core advantage of EBT is emphasised by its integration of CBTA, which they have implemented and are using. As the citation below shows, they argue that without CBTA, EBT is viewed merely as a reorganisation of existing structures with an added focus on evidence collection.

> *"CBTA is the invention, it is the core! EBT is just a rearrangement of things and an organized collection of evidence" (Operator 4)*

The operator in the citation above has also implemented CBTA but is using it combined with traditional training and checking. The perspective can be interpreted as they put less weight on the significance of EBT compared to CBTA.

Three of the participating operators found the legislation complex, with one elaborating that transitioning from their current ATQP to EBT was anticipated to entail considerable bureaucratic effort. The perception of a complicated legislative environment gave the impression that it makes it challenging for operators to grasp the full scope of EBT, its functionality, and its impacts. This complexity is highlighted by a statement from one of the operators, indicating that the difficulty in understanding the legislative framework has led to a delay in putting in effort to understanding and subsequently deciding whether to implement EBT.

> *"I must admit that I have only scratched the surface, when I have been looking through the legislation for Evidence-based Training… *sighs* this is something we look at later" (Operator 1)*

To better understand EBT and its effects, two operators mentioned that they have engaged in both formal and informal discussions with other operators who are already using EBT. One of the operators who explicitly stated that they had been engaged in discussions about EBT mentioned that part of their motivation to participate in the study was to share insights about EBT. They expressed a self profound, good understanding of what EBT entails and gave the impression that they wanted to share with others what they had learnt on EBT.

Other operators expressed that a part of their motivation for participating in this study was to gain more knowledge and engage in discussions about EBT. They gave the impression that they had a genuine curiosity on the subject and hoped to gain insight into EBT through their participation in this study.

Furthermore, three of the participating operators expressed an expectation not to be "frontrunners" in EBT implementation. They indicated a desire to let others be the first to implement EBT and to learn from their experiences before starting their own implementation. Two of these operators specifically noted that if they decided to implement EBT, they would seek external assistance to streamline the process and potentially reduce resource expenditure. This approach is encapsulated in the following quote from one of the operators:

> *"I think there should come someone with experience of EBT from somewhere else, that can show us a way to do it" (Operator 1)*

An operator who had decided to implement Mixed EBT elaborated during the interview that they were influenced by having an internal employee with prior experience in EBT from previous employment. Despite having internal expertise, the same operator opted to also engage external help in the implementation of EBT. It underlines the expectations from the two operators above that they would engage external help if they were to implement EBT.

4.1.2 Training over checking

This chapter discusses the preference among operators for prioritising training over checking in pilot development. Operators focus on creating a comfortable learning environment to enhance performance, occasionally using checking sessions for training. However, the necessity of checks as corrective measures for less motivated pilots is also recognised. Concerns are raised about EBT potentially lowering failure rates without genuinely improving pilot skills.

Throughout the interviews, it is a significant trend among all the operators in this study that they expressed a preference for training over checking. Two of the operators specifically emphasised their efforts to create an optimal learning environment by making pilots comfortable and reducing their nervousness. One operator with a traditional training and checking programme even implied that they utilised simulator sessions designated for

checking to focus on training instead. It was understood that their objective was to foster an optimal and comfortable training environment to elicit the pilots' everyday performance.

Despite the general preference for training, two operators also highlighted the importance of checks, particularly for certain pilots who might require a corrective "wake-up call". It is illustrated through the citation below. This perspective suggests that while training is crucial for continuous improvement and skill enhancement, checking is viewed by some operators as necessary interventions to ensure pilots maintain the motivation to meet required standards.

> *"Checking can be good, as some people just do not care about training, for those checking can be a wake-up call." (Operator 2)*

One operator, not utilising EBT but with a self-professed understanding of it, expressed concerns that EBT introduced different criteria for failing a pilot compared to traditional checking scenarios. The operator had noted that instructors on the second day of EBT might have a different threshold for failing a pilot in a training session, potentially leading to a lower failure rate. However, this lower failure rate might not necessarily indicate better pilot performance. The operator speculated that if a pilot trained under EBT were subjected to a traditional proficiency check on the third day, the outcomes might not always be satisfactory. This suggests that EBT may alleviate the pressure and stress associated with checks. However, the operators were of the impression that it might not fully prepare pilots for traditional checking processes. This viewpoint presents a slight contradiction to the same operator's preference for training over checking and underscores the concerns of two participating operators. They question the effectiveness of a shift towards more training-focused approaches, particularly concerning pilots who, in their view, require a "wake-up call."

4.1.3 Training adjustments

This chapter examines how operators dynamically adjust their training programmes to enhance realism and prepare pilots for real-world scenarios. Operators use various sources like flight data monitoring, safety report systems, and grading systems to identify training needs. One operator plans to implement a new grading system alongside CBTA to better understand pilot competencies and refine training focus. The chapter also discusses the strategic use of low grades as crucial indicators for training adjustments, emphasizing the risk

associated with "just competent" pilots and the potential operational hazards of pairing such pilots in challenging conditions

All the operators in this study articulated that they, in various degrees, were dynamically adjusting their training programmes. Two of the operators explicitly stated that they strive to make their simulator scenarios as realistic as possible. One operator mentioned that new destinations are often introduced in the simulator, but the sessions might also include elements with smaller elements, such as problems with baggage handling, to enhance the realism of the simulator scenarios. It was understood that the operators' intention behind this approach was to prepare the pilots for real-world situations and to give them tools to handle those scenarios effectively.

When it comes to deciding on which elements to train, the operators in the study did vary on which sources of information they used for determining training needs. All of them were using flight data monitoring and their safety report system. Four of them also utilised their grading system to gather information. One operator lacked a good overview of the trends in their current gradings, and as a result, they were considering implementation of a new grading system, combined with an anticipated implementation of CBTA. In conjunction with CBTA, they expected to gain a better overview of trends in the competencies within the pilot corps, which could provide more data on what to train and, as they said, what not to train. It should be noted that this operator, compared to others, reported that they had many mandatory training items due to the nature of their operations, which gave the impression that it limits their flexibility to adjust the training.

As shown in the citation below, one operator believed that many operators already know their pilots very well, thus they are collecting evidence in an informal way and are aware of the weak points. This operator, who is using CBTA but not EBT, stated that they, among other things, adjust their training according to trends in the gradings.

> *"In many companies, they know their pilots so well, that they are collecting evidence already" (Operator 4)*

The statement is supporting the findings earlier in this chapter that all the operators are in varying degree monitoring the needs to adjust their training programme. Another perspective

from the operator above was their concerns on what they view as one of the most important factors to monitor. They regard the low grades as the most crucial. They argue that if the percentage of just competent pilots increases, they are increasing the risks in their operation. If a pilot fails, that pilot will receive training to become competent, and such a pilot does not increase the operational risk. In contrast, if a pilot barely passes a check with grades that are just good enough, that pilot can be seen as competent enough. If the number of just competent pilots rises, they argue that the risk of two such pilots flying together in challenging conditions increases, thereby elevating the operational risk, compared to an operation with two pilots who are above the required competence level.

4.1.4 Training structure

This chapter explores operators' perspectives on the structuring and requirements of simulator sessions under EBT. It highlights differing opinions on the adequacy of session durations, with one operator advocating for four 4-hour sessions annually to fully realize EBT's benefits, contrasting with another who finds efficiency in four 3-hour sessions without mid-session breaks. The discussion extends to the motivations behind adopting EBT, such as economic benefits from reduced proficiency checks and operational cost savings. Additionally, the chapter touches on the positive impact of EBT on reducing pilot nervousness by creating a more relaxed training atmosphere, enhancing overall pilot performance during simulator sessions.

As the structuring and requirements for simulator sessions is changed under EBT, it is pertinent to explore various operators' opinions on this new structure. One operator, who has not yet implemented EBT but indicates they have a good understanding of it, expressed concerns that 3-hour simulator sessions are insufficient. One of the variables in their decision to implement EBT or not was whether they were granted an additional simulator session per year. As the citation below shows, they deemed it necessary to get 4 sessions of 4 hours per year (4x4), to get the proper effect of EBT.

> *"If EBT is to truly be effective and deliver what the theory promises, then opting for a 4x3 solution with 12 hours of simulator time per year is not good enough. To properly implement EBT, it should be done with a 4x4 solution and 16 hours of*

simulator time per year; otherwise, it is not being executed correctly." (Operator 4)

They elaborated that, in their view, implementing EBT with 4 sessions of only 3-hours would likely be motivated by economic reasons rather than a genuine intent to enhance pilot competencies. This operator had engaged in discussions with various other operators and came away with the impression that many had adopted EBT primarily to circumvent traditional proficiency check requirements, allowing for the distribution of these requirements throughout the year. Additionally, they understood that the removal of the OPC and the extension of line checks under EBT had led to cost savings for some operators.

This gave the impression that the operator had a genuine interest in getting what they viewed as the correct version of EBT, if they were to implement it. They might not get it if they were unable to get an extra 4 hours of simulator time annually per pilot.

The perspective is in contrast to that of another operator who has already implemented Mixed EBT. They reported using 3-hour simulator sessions and noted that, unlike 4-hour sessions, which require a mid-session break, the 3-hour sessions do not, effectively providing 15% more training time. This operator highlighted that their traditional schedule before EBT consisted of three 4-hour sessions annually. They believed that their upper management would not have approved an increase in annual training hours. It is relevant to note that two of the four operators who have not implemented EBT are already conducting four simulator sessions of 4 hours each year.

Regarding the training environment, one operator explained that the benefits of EBT, particularly in terms of reducing pilot nervousness during simulator sessions, could be quickly realised post-implementation. They attributed this improvement to the EBT structure, which evaluates pilots on the first day and allows for targeted training to proficiency on the second day. This operator speculated that the reduction in nervousness is likely due to the more relaxed atmosphere during training sessions as compared to traditional checking environments.

4.1.5 Competency-based Training and Assessment

This chapter delves into the significant role of CBTA within the framework of EBT, as perceived by the operators in this study. Most operators view CBTA as a transformative element in pilot training, integrating both technical and non-technical skills for a holistic training approach. The chapter highlights enthusiastic endorsements of CBTA, with one operator emphasising its logical and comprehensive nature compared to traditional training methods. Even operators not currently using CBTA recognise the importance of enhancing individual competencies, particularly in decision-making. The chapter also illustrates the universal applicability of CBTA, where training focuses on processes rather than outcomes, aiming to improve efficiency and effectiveness in operations. Additionally, it touches on the necessity of robust data and feedback mechanisms to fully leverage CBTA's potential, and critiques the traditional training focus on perfection, advocating instead for resilience and understanding in pilot training.

As earlier established, CBTA is by most of the operators participating in this study seen as the most significant part of EBT. Only one operator was not familiar with it and had no current intention on implementation of it; the other four operators either had it implemented or had plans to do so. As stated earlier in this analysis and aligning with the citation below, three of the participating operators were very enthusiastic about CBTA. They gave the impression that it has revolutionised their training approaches and philosophies.

> *"CBTA is the jewel of EBT!" (Operator 3)*

This strong endorsement stems according to the operator, among other things from CBTA's ability to integrate both technical and non-technical skills, which is by the operators understood to provide a holistic approach to pilot training that was not as emphasized in the previous different systems used. The operator highlighted that this combination seemed very logical and appropriate for them, marking a significant improvement over traditional methods that often focused narrowly on technical proficiency and crew resource management (CRM) as two separate things.

The two operators that are not currently using CBTA, hereunder one who was not well acquainted with it, acknowledge the importance of individual competencies. The operators

have adapted their training to include scenarios specifically designed to strengthen the pilots decision-making tools.

Three of the participating operators highlight the expected benefits of implementation of CBTA as the enhancement of the correct or relevant competencies as a means to improve general problem-solving abilities. One of the operators mentioned specifically that they see the strengthening of competencies as a great benefit for the operator and for the company in general. Strengthening of competencies can improve decision-making in critical situations where cost is always a factor. A specific example provided illustrates how enhanced problem-solving skills could influence decision-making during in-flight challenges, such as opting to continue a little longer to a home base rather than diverting to the nearest airport when a medical issue arises onboard. It is understood that this approach not only addresses the immediate problem but also facilitates easier management of the remaining passengers.

Two of the operators noted the universality of CBTA, highlighted by the following citation, which states that pilots solve different problems through the same process. Therefore, it can be understood that the training of different problems or failures should be based on what process is used and not the handling of the single event. They stated that their experience is what drives the process is the 5 soft competencies. The focus on the process is understood to be in contradiction to traditional training and checking, where event-based training focused on the result of handling a problem and not on the process to get it handled.

> *"When pilots handle a technical problem, it is universal the way they do it, whether it is electrical, hydraulically or other systems, therefore the focus should not be on the result, it should be on the process of handling the problem" (Operator 5)*

The operators believed in the universality of enhancing these competencies, asserting that it would significantly benefit the company. They elaborated that focusing on developing the right competencies would lead to more efficient and effective operations to benefit profitability. For instance, they highlighted the importance of enhancing decision-making skills in complex situations as a key competence they aimed to strengthen through EBT.

Moreover, one operator highlights that the effectiveness of CBTA is closely tied to the quality of the data and feedback mechanisms in place. They stress the importance of having robust systems to collect, analyse, and act upon training data. Data that is not utilised correctly does not have much value; therefore, tools to analyse and highlight problematic areas are paramount in getting the full use of CBTA.

In the citation below, an operator presents a critique regarding the focus of training institutions and instructors on perfection. The operator argues that soft skills are paramount in the journey towards excellence and that the shift should be towards developing pilots who are not just reliable but also resilient.

> *"Traditionally the focus from training organizations and instructors has been on perfection. I think it is a wrong focus, you must focus on the soft values to get excellence." (Operator 5)*

The operator discusses the concepts of excellence and resilience while critiquing the emphasis on perfection. They argue that being precisely "on the mark" during a manoeuvre (within certain limits) is not as crucial. Instead, the important aspect is understanding why you were "on the mark" or why you were not, and how to get there.

4.2 EBT & CBTA experiences

This chapter explores the practical experiences of operators who have implemented either CBTA, EBT, or both, highlighting the nuanced experiences and challenges faced during the integration of these training frameworks into their operations.

4.2.1 Evidence-based training

This chapter presents an operator's experience with implementing Mixed EBT, emphasizing the importance of a gradual implementation period and effective communication strategies to ensure understanding and engagement among pilots and instructors, ultimately enhancing pilot training outcomes. The decision-making process leading to the implementation of EBT has been detailed in chapter 4.1 and will not be reiterated here.

Following the operator's decision to adopt EBT, they allocated a six-month period before the initial deployment of the first EBT module. They advised against this compressed timeframe, recommending a more feasible period of 12 months for implementation.

The operator reported that the rapid implementation timeline imposed considerable strain on their organisation, pushing it to its limits and proving to be unsustainable. In managing their expectations, they acknowledged that the initial EBT modules were not perfect and resembled traditional simulator sessions too closely. The operator emphasised that the current modules, in their opinion, have reached a level that is appropriate for Baseline EBT and are reflecting significant progress from the initial phases.

During the implementation, the operator explained that they maintained good collaboration with the authorities, involving them in various relevant meetings. The operator understood that this approach aimed for a transparent implementation process to facilitate a better understanding by the authorities of the operator's methods and objectives.

As highlighted in the following citation, the operator recognised the critical importance of ensuring that both pilots and instructors understood what EBT and CBTA entail. Believing this understanding to be crucial for the success of the implementation, they launched an informational campaign using emphatic language such as "revolution." This campaign included meetings and informational flyers and commenced before the introduction of the first EBT modules. The aim was to engage pilots in the transition to EBT by making it intriguing and fun.

> *"One of the most important things we have done, was to get the pilots corps on board" (Operator 5)*

The feedback from pilots suggests that the majority view EBT as a beneficial training approach that better focuses on development. Only a small fraction remains sceptical. The operator noted that their training approach has shifted to emphasise the existing strengths of the candidates, treating them as experts in their fields.

For this particular operator, the level of sub-standard grades after the first day of training stands at 1,32%. After the second day, where training focuses on strengthening identified areas of concern, the percentage of pilots requiring additional training drops to 0,1%.

4.2.2 Competency-based Training and Assessment

This chapter explores the implementation of CBTA by three operators, focusing on the critical role and challenges of instructors as primary deliverers. It highlights the necessity for

instructors to fully grasp and effectively apply CBTA principles, a process complicated by the need for a substantial cultural shift within training departments. The chapter also discusses the development of self-study tools for pilots, illustrating the complexities of integrating CBTA into existing training frameworks.

Two of the operators encapsulated the essence of the challenges and advantages of CBTA with a focus on the pivotal role of instructors, as they are seen as the primary deliverers of CBTA. Thus, a significant challenge in implementing CBTA is ensuring that instructors fully understand and can effectively apply it. This necessity is underscored by the following citation.

> *"The instructors are the end-users and those who have to deliver CBTA" (Operator 5)*

Another operator highlighted their experiences with CBTA implementation with the following statement, emphasising the substantial challenge in altering how instructors work and utilise simulator sessions. This leads to a critical aspect of CBTA implementation: instructor standardisation.

> *"The principles of CBTA are well understood by training managers, etc. who work extensively with it during implementation, but it is much harder to establish that understanding in the instructors using it" (Operator 4)*

This statement suggests that while training managers may have a deep understanding of CBTA principles due to their involvement in its implementation, instructors might only receive limited exposure through a few standardisation meetings before they are expected to apply these principles in a significantly altered training context. Highlighting this discrepancy underscores the operators experienced need for a substantial cultural shift within the corps of instructors during the implementation of CBTA. The operator mentioned above, who has not implemented EBT, opined that the biggest change for the organisation in an EBT implementation seemed to be the shift towards CBTA rather than the implementation of EBT itself.

Additionally, one operator shared their initiative on developing self-study tools for pilots to enhance their competencies by themselves. However, they noted challenges in creating these

tools, as they are concurrently working on enhancing the instructors' competencies during the transition phase. This dual focus underscores the complexities involved in fully integrating CBTA into existing training frameworks.

4.2.3 Standardisation of instructors

As established in the former chapter, instructors are by two of the operators identified as the primary end-users, and their standardisation is highlighted to present one of the most significant challenges in the implementation of CBTA. This chapter delves into the challenges and strategies associated with standardising instructors in the implementation of CBTA. It highlights the significant time and cultural shifts required to fully integrate CBTA, particularly emphasising the difficulty in altering the mindset of experienced instructors. The chapter discusses various methods used by operators to ensure consistent training experiences and effective instructor standardisation, such as regular standardisation meetings, monitoring grading practises, and engaging external assistance for benchmarking. Additionally, it explores innovative approaches like mentor programmes and facilitated debriefing to enhance training outcomes and reduce performance anxiety, ultimately fostering a more constructive learning environment.

One operator reported that they have been using CBTA for approximately three years, during which they have facilitated instructor standardisation meetings every six months to promote and clarify CBTA practises. It was only after three years that instructors began to challenge the application of CBTA, indicating a deeper engagement and understanding. It can be understood that this timeline suggests that it takes considerable time for instructors to internalise and critically engage with new training methodologies. The operator, therefore, estimates that the full implementation period for CBTA is around three years. This duration underscores the depth of the cultural and operational shift required in adopting CBTA.

The challenge of altering the mindset of experienced instructors is particularly pronounced. As highlighted by the following citation, changing the established practises of seasoned instructors is more difficult than influencing those newer to the profession:

> *"The challenge is to change the mindset of instructors with 25 years of experience, not the young ones" (Operator 4)*

It is then suggested by the operator that, due to this difficulty, special attention needs to be given to experienced instructors who might rely on traditional methods and techniques.

Moreover, ensuring consistency in the training experience across different instructors is crucial for maintaining the credibility and effectiveness of CBTA, according to one operator. The operator emphasised the importance of all pilots receiving the same experience in training regardless of the instructor. It is understood that this uniformity is vital for pilots to trust the objectivity and fairness of their evaluations. For the operator challenges arose with a few instructors who misunderstood CBTA principles and reverted to traditional checking methods and made more demanding simulator sessions than described by their syllabus. To address this, the operator believes that achieving a critical mass of instructors who understand and support CBTA will naturally influence the remaining instructors. The operator underlines that currently, all instructors view CBTA and EBT positively.

For two of the operators, monitoring instructor standardisation and concordance involves analysing the gradings given by instructors. One operator presents individual grading statistics during standardisation meetings, using these statistics as a basis for discussions about grading decisions. Another operator is noting that technical competencies are often overemphasised, leading to frequent low gradings in technical areas when a soft competency might be more appropriate. It is said that it might suggest that some instructors may still lack a full understanding of identifying the root causes of performance issues.

The operator with EBT implemented engages external assistance in their concordance programme. They film a training scenario focusing on selected competencies, which is then graded by both their senior instructors and external CBTA specialists. This serves as a benchmark for grade standards. During standardisation meetings, instructors are asked to grade the scenario on the selected competencies anonymously. The results are then compared to the benchmark, serving both as a compliance measure with regulatory requirements and as a foundation for discussions about grading practises. The operator gave the impression that they are proud of this programme.

This same operator is developing a mentor program where a “standardization captain” is responsible for a group of instructors. This programme is designed to provide personalised feedback on grading practises through one-on-one meetings, where specific grading examples

are discussed in detail. As highlighted in the following citation, this intensive individual feedback process is resource-demanding, but it is understood that it is deemed crucial for effective instructor standardisation and seen as a natural step in their concordance programme.

> *"To transition from general feedback to instructors at standardization meetings to individual feedback demands a lot of resources but is very important for making the instructors reflect on their grading." (Operator 5)*

Additionally, this operator says that they are using facilitated debriefing to enhance training outcomes. It is stated that this approach aims to help pilots self-identify their strengths and then guide them to recognise their primary challenges during simulator sessions, focusing on competencies that need improvement and how the improvement can help them. By fostering a positive training environment, they believe that pilots approach training sessions with a more constructive and less anxious mindset. For the operator, this positive perception of training is considered a critical success factor for EBT, as it shifts the focus from performance anxiety to learning and development.

The operator said that instructors are instructed to select only one or, if absolutely necessary, two competencies to focus on during the next training. They then use a catalogue of different modules to tailor the programme for the second day of training, ensuring that each session is specifically designed to address the identified areas for improvement.

5 Discussion

5.1 Discussion of findings

The findings above are presenting the operator's opinions and experiences with EBT. To broaden the understanding of the findings and answer the research questions, the findings will hereunder be discussed in relation to the diffusion of innovations theory and innovation-decision process as outlined in chapter 0 (Rogers, 2003). Summed up, the innovation-decision process is a process of reducing uncertainty for the potential adopters of an innovation (Rogers, 2003). The different stages present different factors that affect the innovation decision process, eventually leading to a rejection or adoption of the innovation. From the findings of this study, some of the factors affecting the innovation-decision process are identified; these factors are the relative advantage, complexity, and compatibility. The factors will be discussed below. In addition to the implementation stage, the general communication in relation to Rogers (2003) theory will be discussed. To understand the diffusion of innovations theory, it is relevant to define that the social system regarding this study is seen as the Scandinavian operators.

5.1.1 Relative advantage

The findings start by getting the perspective from the operator utilising ATQP with CBTA. When looking at the perceived attributes for them, they assess that the work an implementation of EBT will require of them might not be worth it. They see EBT to be data-driven, as the system they have now, but with a higher level of required bureaucracy. In the light of the innovation-decision process, the perceived degree of relative advantage for them might decrease. "Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2003, p. 216). For this particular operator, it gave the impression that it could lead to a rejection of EBT. According to Rogers (2003), it will lead to a slower rate of adoption if this is a general perception among other operators. Another perspective is the operator utilising traditional training and checking combined with CBTA, who have still not decided on whether to implement or not. Their perception of EBT is that the relative advantage is less significant when CBTA is already implemented. It could indicate that they somehow are of the same impression as the first operator; they see the relative advantage of EBT to be of a lesser degree, leading to a slower general adoption rate in the social system (Rogers, 2003).

A factor to include for the operators when considering the implementation of EBT is the profitability of an implementation. According to Rogers (2003) the perceived profitability will affect to what degree an innovation is perceived as a relative advantage. For this last operator, utilising traditional training and checking combined with CBTA, one of the variables was if they were granted an extra annual simulator session per pilot from their upper management, as they believed it was essential to get the full use of EBT. That extra simulator session will be a factor in the perceived profitability of EBT.

It can be discussed what the definition of the innovation should be, and further, is an adoption complete when CBTA is implemented without EBT? Rogers (2003) has no clear definition of it, but a property of an innovation is the degree to which it can be re-invented, which will be discussed later. For the purpose of this discussion, the following assumption is made: an implementation of CBTA alone is not seen as a full implementation or adoption of EBT, as many of the new and relevant co-related components are not introduced to the operators training and checking. CBTA, combined with either the traditional training and checking system or ATQP, might be lacking important components from EBT, hereunder instructor standardisation and concordance and the feedback structure required under EBT (ORO.FC.231, 2020). As one operator highlights, the correct utilisation of data is paramount to getting the full use of CBTA. It could indicate that the systems around CBTA, including the validity-, generation-, and utilisation of data through the instructor concordance programme, are viewed as important for the quality of CBTA. The perspective is interestingly not highlighted or recognised by other operators than the one with Mixed EBT and could be an overlooked factor when the perceived relative advantage of EBT as a whole is assessed by the operators.

Another perspective on the operators using CBTA with ATQP and traditional training and checking who might not see the relative advantage of a full EBT implementation is the perceived relative advantage of CBTA. All the operators using CBTA are very impressed with it and see it having a high degree of relative advantage (Rogers, 2003). It can be a contributing factor to CBTA being that widely adopted as it is in this study, where only one operator had not decided to implement it.

What the operator's see as the high degree of relative advantage is the universality of CBTA. It is highlighted by one of the operators, as they are seeing it as both a benefit to the problem-solving of the pilots regarding flight safety and also as a general benefit for the profitability of the operator. It can be understood that the pilots have an influence on the profitability when they are making decisions, so to enhance their decision-making skills is seen as important for the profitability for the operator, and therefore it gives a higher degree of perceived relative advantage (Rogers, 2003).

5.1.2 Complexity

Another attribute in Rogers (2003) innovation-decision process is the perceived complexity of an innovation. Three of the participating operators perceived the legislation on EBT as complex. The consequences of that for at least one of the operators were a delayed effort in comprehending what EBT entails.

When the process is seen as an uncertainty reduction process, where potential adopters are encouraged to search for knowledge, the perceived complexity of an innovation is important in order to understand and reduce the uncertainty. It is stated by Rogers (2003) that the higher the degree of perceived complexity, the slower the adoption rate. Even though the effect on the adoption rate, of an innovation's perceived complexity is not as significant as the perceived relative advantage (Rogers, 2003). Rogers gives an example that when innovations are perceived as being complex, it can in some cases be mitigated through forums, where experiences are exchanged between peers (Rogers, 2003).

According to Rogers (2003) the perceived complexity of an innovation is evaluated at the persuasion stage, where the potential adopter already has established a level of awareness- and how-to knowledge on the previous knowledge stage. The knowledge stage is, among other things, said to provide knowledge on how to use the innovation (Rogers, 2003). Without placing the different operators on the stages, due to insufficient findings, the brief impression was that two of the operators were on a stage of getting how-to knowledge on EBT. The findings illustrate how some of the operator's motivation for participating in the study was to get more knowledge on EBT. It was the same operators that found the legislation on EBT complex. Rogers (2003) do argue that with some innovations the order of the stages might be different than in his general innovation-decision process, which somehow aligns well with the

indications of this study. It indicates that the perceived complexity of EBT might be a barrier for some of the operators already on the knowledge stage.

An effect of the perceived complexity seemed to be a resistance to be “frontrunners” in the implementation of EBT (Rogers, 2003). They would let others be first to get their experiences with the implementation. It was also said by two of the operators that they expected that if they were to implement EBT, it would be with external support. Those statements could be further supported by the operator who had already implemented EBT. Even though they had an internal stakeholder with experience on EBT from earlier, they still opted to get external help with the implementation. Thus, the reasons for the use of external support were not determined in the findings and could be due to a range of different reasons, such as resources or time, not only the perceived complexity of EBT.

Regarding the perceived complexity of EBT, the operator with an internal stakeholder with previous experience on EBT might have been a way of alleviating the perceived complexity of EBT by having knowledge on it beforehand. It could have been a factor in the quicker adoption of EBT than the rest of the operators in the study.

5.1.3 Compatibility

As Rogers (2003) define “Compatibility it is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 2003, p. 225). When an innovation aligns with previously known values or beliefs, it is said by Rogers (2003) that it is perceived as more familiar and less uncertain. As the innovation-decision process earlier was described as an uncertainty reduction process, it can be viewed as important for the potential adopter if an innovation had a high degree of compatibility.

In EBT, the feedback system is of important value and a core part of how new areas for training needs are uncovered (EASA, 2024). One operator argued that many operators already are collecting feedback on their pilots, so they know them very well. That is in contrast to another operator who did not monitor their gradings; they indicated that they lacked a system to do that but wanted to get it in conjunction with the implementation of CBTA. They wanted to get a better overview of their pilots. The two views can add to the perceived degree of compatibility with EBT, as the first one is arguing that many already do it so it would not be a

new thing with EBT, and the second one wants to do it and sees the value of it. Said in the terms of Rogers (2003) theory, they have a perceived need to do it.

Another finding is the way the operators adjust their training programmes. When using traditional training and checking, it is a requirement from EASA to include feedback from the management system, hereunder occurrence reports and flight data monitoring programmes, to adjust their training programmes (ORO.FC.230 AMC3, 2022). It could be the reason behind the operators being relatively uniform in their answers to what they use to adjust their training programmes. That could be seen as the operators could have a familiar reference to understand a part of EBT, which in turn adds to the degree of perceived compatibility.

The operator, pointing out their view on which grades to monitor in their CBTA grading system, sees pilots that are graded just competent enough as being the ones that might be the biggest risk to the operation due to them just being competent enough to pass the checks. The operator utilises traditional training and checking, where a check mainly is focused on technical requirements (Appendix 9, 2021). Through a full implementation of EBT, the operator would have the option to assess the candidates on the competences and not mainly on technical requirements, which one could speculate would allow the operator to enhance the competences further on the pilots that are viewed as just competent enough (ORO.FC.231, 2020). It is not totally clear, but the operator seems to have compatibility with their beliefs and experiences with EBT, in terms of pilots that are just competent enough that needs their competences to be enhanced, but they do not seem to be aware of it; at least they do not mention it.

A point where there was disagreement was the structuring of the simulator programme in EBT. One operator, not utilising EBT, argued that 4 sessions of 3-hour would not be good enough to get what EBT was designed for. On the other hand, the operator already utilizing Mixed EBT argued that they are having 3-hour sessions and effectively have more training time due to the lack of a mid-session break. The operator against 3-hour sessions was met by a barrier in implementing EBT, as it would require an extra annual simulator session for all their pilots, which would require approval from their upper management. In the light of diffusion, it could then be seen as a lover degree of compatibility with EBT from the operator if the management, who is also the operator, rejects the extra simulator session (Rogers,

2003). To generalise the above discussion on all the operators in the study, it can be said that two of the four operators who had not implemented EBT already had 4 sessions of 4-hours annually, so the reference point for the discussion is different from operator to operator.

The traditional philosophy of checking is changed with EBT as checking sessions are removed (EASA, 2024). Therefore, the operators were asked, based on their views on training vs. checking, what is most important for them. All the operators said that training was the most important, but two of them still saw a need to check some pilots, who "needed a wake-up call". Those two opinions are conflicting. In that case, it can be interpreted that their previous beliefs are not well aligned with EBT on that philosophy, which according to Rogers (2003) leads to a lower perceived compatibility with EBT. One can speculate why they are having these conflicting views, but a guess could be the lack of understanding of the instructor's role in EBT. The idea is that all training is done to proficiency, and if proficiency is not reached, extra training is required. Thereby, the integrity of the instructor in assessing proficiency is the key to ensuring that pilots are trained to proficiency. The same can be said of the required concordance programme, which is there to monitor and ensure that the instructors are delivering the desired quality of training and assessment (EASA, 2024).

In terms of perceived compatibility, CBTA is recognised as having a high degree of perceived compatibility with the operator's views. Only one operator did not know much about it; all the others had already implemented some form of it. One of the operators noted one of the reasons they liked CBTA. They had previously been using two different systems to assess crew resource management (CRM) and technical skills but believed it was inappropriate to their needs. When they found CBTA, they felt it aligned very well with their needs, which according to Rogers (2003) will lead to a faster adoption rate. That statement by Rogers (2003) is very well supported by this study, where the use of CBTA is that well established between the operators.

5.1.4 Implementation

The implementation stage is where the innovation is being put to use. The findings of this study mainly focus on how the innovation, EBT, has been used and, more importantly, to what degree it is re-invented by the operators. According to Rogers (2003), re-invention is "the degree to which an innovation is changed or modified by a user in the process of its

adoption and implementation" (Rogers, 2003, p. 177). The option to re-invent is generally seen as a desirable thing for the adopters of an innovation. According to Rogers (2003) flexibility when implementing an innovation is important for many adopters, especially with complex innovations, where the adjustments make it fit more appropriately to the adopter (Rogers, 2003). In the case of EBT, a core function of the programme is that it must be re-invented or modified to the operator's needs. It is a core argument from ICAO that the programme is made to be adjusted to the individual operator's needs; for example, the competencies required to operate one aircraft type might not be the same for another (ICAO, 2013). It is also a part of the legislation from EASA, where different levels of customisation of the syllabus are defined (ORO.FC.231(a) GM3, 2022).

The findings are listing a range of re-inventions done by the operators when implementing EBT and CBTA. It is all examples that highlight the theory from Rogers (2003). One particular to discuss is the concordance programme, which is a programme introduced under EBT. The concordance programme should identify areas of weak concordance to ensure the validity and quality of the grading system (ORO.FC.231(a) GM3, 2022). In other words, it is the system that ensures the quality of the gradings delivered by the instructors. It is re-invented by the operator utilising Mixed EBT, who have fitted it to their needs. They presented a structure on how to monitor and align concordance through pre-recorded scenarios in a simulator, where instructors grade competences, and those grades are then compared to a benchmark. The benchmark is set by a combination of their own senior instructors and external experts. Understanding the process of concordance seems to be important to understand the role of the instructors in EBT. It might be what is lacking for some of the operators not utilising EBT; how can they know what they don't know?

5.1.5 Communication

A central part of the diffusion of an innovation is the communication. An innovation will need to be communicated to the potential adopters (Rogers, 2003). The findings in this study do not reveal much about the communication the operators are experiencing, but it gives a peek into it. A part of the motivation to participate in the study was for two of the operators to gain insight and knowledge on EBT. According to Rogers (2003) interpersonal communication has a greater weight than mass communication for the potential adopter when evaluating the perceived attributes of an innovation (Rogers, 2003). In the case of this study,

the highlighted attributes are compatibility, complexity, and relative advantage. It can be speculated that the operators, mentioning their motivation to participate, could have been searching for peers to exchange interpersonal communication with to get information on EBT. The same can be speculated about the operator who had a self-professed good understanding of EBT, though without having it implemented yet, and who noted that they participated due to their interest in sharing their personal acquired insights on EBT. It could indicate a lack of a forum where EBT or training in general could be discussed.

5.2 Discussion of the theory

The theory on diffusion of innovation seemed to fit the purpose of this study appropriately. It did elaborate on the findings, found through interviews with stakeholders from the operators, with only a minor dissonance. The theory by Rogers (2003) might in relation to this discussion have a shortcoming in describing the effects of the perceived complexity of an innovation. It was found that the perceived complexity of EBT could slow the adoption rate for some potential adopters, already on the knowledge stage, instead of the persuasion stage as described by Rogers (2003). It could suggest that a complex innovation, like EBT, may get a slower adoption rate due to the slow or complicated understanding of how-to knowledge.

Rogers (2003) clearly sees a build in bias in much of the research that has laid the foundation for the diffusion theory. The bias is that most research is on successful innovation, which has already diffused successfully to much of the social system. He calls it the pro-innovation bias. The problem is that the angle of the theory is that an innovation should be adopted by all the members of the social system and that it should be adopted at a rapid rate. That might not be appropriate or the case for all innovations (Rogers, 2003). One can speculate that an innovation with a transforming effect on training and checking, in an industry where training and checking is so essential as it is in the aviation industry, might be somehow carefully adopted by members of the social system. It must also be acknowledged that all members of the social system might not or should not adopt the innovation.

5.3 Strengths and limitations

A problem with online-conducted interviews is the limited control over the environment for the interview. The participants were interrupted during some of the interviews by phones or relatives leaving or entering the rooms they were in. Another limitation is the interpretation of

the body language, which is limited to what can be seen on the screen, often just the shoulders and face. The strength of conducting the interviews online was the flexibility in getting an appointment with the stakeholders. As the geographical area for the study was Scandinavia, physical meetings would have been costly and challenging to arrange. Therefore, the practicality of conducting the interview online might have made the decision to participate in the study easier.

The guidelines by Brinkmann and Kvale (2015) as introduced in Chapter 3.3 were kept in mind during the interviews and have been followed to the best of my ability. It is reasonable to acknowledge that I am a novice in the craft of interviewing; a seasoned researcher might have gotten different results. The same can be said about the analysis, which also might have had a different outcome from a more seasoned researcher.

The interviews were conducted in Danish, while the study is written in English, with the potential of introducing linguistic errors in the translation of quotes. As stated earlier, all translation and analysis of the interviews has been done to stay as loyal to the oral statement as possible. Another factor in conducting the interviews in Danish was the participants being from different countries in Scandinavia with other native languages. To accommodate misinterpretations due to language barriers, I was aware of the importance of clarifying interpretations throughout the interviews. Moreover, I made sure to ask for clarification in English when there was the slightest feeling of misinterpretations, but in general this was on a very low level due to the big exposure to each other's languages in the Scandinavian aviation industry.

5.4 The researchers own position

I, the author of this study, am employed at an operator in Scandinavia, which can have influenced the interviews and the interpretation of the findings. As stated earlier, I had pre-understandings of EBT. It can have implications for what the participants of competing operators want to share, and it can lead to them assuming that I have implicit knowledge. The first part was not something I felt was the case. All participants seemed genuinely engaged in sharing their viewpoints and experiences. To limit the risk of them thinking I had implicit knowledge, follow-up questions were used to assure my understanding of their answers being

correct. By being an insider in the industry, made it easier to gain access to the relevant participants through personal contacts.

5.5 Trustworthiness

To ensure the trustworthiness Ahmed (2024) describes the criteria formulated by Lincoln and Guba (1985) to reflect upon when conducting qualitative research. The criteria are credibility, transferability, dependability, and confirmability. Credibility reflects whether the results are true and reflects the experienced reality of the participants. Dependability refers to the results being stable over time. Transferability refers to whether the results are transferable to another context or situation. Confirmability refers to the degree of the results being objectively formed and that they are not formed by the researcher (Ahmed, 2024). The four criteria will be discussed to be transparent about the trustworthiness of this study.

The first criterion is credibility. It is said by Ahmed (2024) that being aware of one's own biases may help in evaluating credibility. My reflexivity chapter in the introduction is meant to show that I am aware of the presence of biases when I am an integral part of the study. Furthermore, to enhance the credibility of the study, I have used citations in the findings to show the origin of the data presented. What I was not able to do was triangulate the data sources. By utilising more than one method or data source, credibility can be enhanced (Ahmed, 2024). The same can be said about the analysis. It could have enhanced this study's credibility if there had been a second researcher to verify the analysis.

To enhance the transferability of a study, one can provide detailed descriptions of the research content and methods to ease the transferability of the study to other settings. In the case of this study, the aim with the method chapter is to provide those exact descriptions to enable others to transfer the study to their setting. That could be the same kind of study in another geographical region (Ahmed, 2024).

When reflecting upon dependability, choices in the methodology have been documented in order to provide transparency and to help others replicate the study (Ahmed, 2024). The degree of dependability of this study can be discussed, as the findings are dependable on time. If the study was conducted again, some of the findings might be the same, but many might have changed, as the perceptions and opinions on EBT will change over time as more knowledge is gained by the operators.

By using peer debriefing, the confirmability of the study could have been enhanced. It was done to a low degree by using my supervisor, but a total review of the interpretations was not completed. There is a possibility that it could have introduced more alternative perspectives (Ahmed, 2024). Findings could have been returned to the participants for verification, but that was estimated to be a very time-consuming process, to be done by stakeholders with very little time available. To enhance the confirmability, my own position in the study was reflected on. It was kept in mind through the whole process that I might have pre-understandings of the subject that could affect the results I got. An example of a pre-understanding was my initial assumptions relating to why not all operators just immediately were implementing EBT when it got available; those assumptions have dynamically changed through the process and have been a part of the formation of my interview guide, with the objective of being critical to my own assumptions, leaving no other unexpected reasons out. The bias could not be removed but has been reflected upon in this study to be transparent on my position.

5.6 Perspectives

The findings of this study provide a brief insight into the Scandinavian operator's views on EBT. The findings can contribute to sharing knowledge within the industry to develop training and checking. It adds perspectives on EBT to the aviation industry, authorities, and lawmakers. Further studies on the subject could focus on clarifying further contributing aspects to the innovation-decision process to better understand the diffusion of EBT into the industry. Several informants in this study mention the cost and resources an implementation will require. This thesis has not delved into the exact cost and resources required for implementation of EBT. Therefore, an aspect for further investigation could focus on the actual implementation costs or resources required; are the burdens of implementation equal and unaffected by how big the operator is? Another angle could be to examine what kind of forums are available for the operators today when it comes to training; are there open forums where knowledge on training can be exchanged, and if so, who uses them? Finally, this study could form the basis for a quantitative study, with a greater number of participants, to investigate whether the findings have a broader applicability, for example under the whole jurisdiction of EASA.

6 Conclusion

The aim of this study has been to explore the implementation of EBT in Scandinavia. Which has been completed through a qualitative study. Furthermore, it aimed to answer the research questions. The first question was: What factors of EBT are experienced as significant for Scandinavian operators in relation to their decision to implement EBT or not?

CBTA is seen as the most transforming thing from EBT. It is highlighted by all the operators using it as the most significant thing of EBT. They see the universality of it as an advantage, as the pilots are getting better at decision-making, which in turn can lead to safer decisions but also potentially can lead to more profitable decisions. Conversely, the operators already employing CBTA without EBT might have a lesser degree of perceived relative advantage of EBT as a whole, due to their perception of already using what is the best part of EBT. As highlighted by the operator using Mixed EBT, these operators might be missing the importance of the related systems incorporated in EBT to ensure the validity and quality of CBTA.

By most of the operators, the legislation on EBT was found to be complex. The study could indicate a lack of a common forum for the operators to discuss subjects like EBT to alleviate the perceived complexity. An effect of the perceived complexity might be that EBT will be implemented at a slower rate or, for some, not at all. It also led to some operators expecting not to be first with implementation of EBT, and if they were to implement, it was said to be with help from external resources.

The study did find that the operators were already aligned with some of the practises EBT introduces. It includes the dynamic adjustment of their training programmes and the monitoring of their grading systems. It did also show some degree of disagreement with the philosophy of EBT, as some operators were of the opinion that some pilots do need checking. An operator expressed their scepticism towards pilots not getting the proper checking under EBT. It is speculated that this operator might lack knowledge of the significance of the role of the instructors and the concordance programme in EBT.

The study does also aim to answer the second research question: What have been the significant experiences with EBT implementation among Scandinavian operators?

The study examines the experiences of the operators who had already implemented CBTA and/or EBT. It was found that instructor standardisation in relation to the change to CBTA is found challenging. It was found that changing the way the experienced instructors work requires time and effort. The study presents a range of examples on how to implement different parts of EBT. One particular example is how to design a concordance programme with pre-recorded simulator sessions, where instructors grade a benchmarked scenario, to establish a standard in the instructors. It was also found that a suitable timeframe of CBTA implementation for one operator was 3 years before an appropriate level of understanding of CBTA was reached for their instructors, while another operator states that a timeframe of 6 months to implement Mixed EBT is not feasible and recommends 12 months for the task.

The study presents a brief insight into the implementation of EBT in Scandinavia and contributes with knowledge to the aviation industry, authorities, and lawmakers. It suggests a range of further studies, hereunder studies that could examine the economic burden of an implementation, is it equal, unaffected by the size of the operator. It does also suggest studies on the forums available for the operators to discuss training and checking.

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Appendix 1: Consent form

Interviewee form

The upcoming interview is part of a study of the implementation of Evidence-based Training (EBT) in the aviation industry in Scandinavia. The objective of the study is to clarify how the industry sees EBT, which benefits and barriers they see in connection with the current legislation. It will highlight weaknesses and strengths in EBT, and will be relevant to both the industry itself, and to authorities forming the legislation.

Please fill in the tables below and return this form:

Name	
Contact details (email or phone)	
Company	
Identifier code	*(to be set by interviewer)*

In relation to the interview, some numbers will be requested. If you can allow insight into them, please fill out the table below or prepare the numbers for the interview.

	Before EBT implementation	**After EBT implementation**
Average hours in simulator pr. year pr. pilot:		
Average extra training hours in simulator pr. year pr. pilot:		

Below are the themes and example question you will be asked. If there is anything else you want to discuss regarding EBT, we will make time for that by the end of the interview, your views and inputs are highly appreciated.

Themes for AOC with EBT

- EBT considerations and decisions
  - What was the most important reason for a change to EBT?
- EBT implementation experiences
  - What challenges did you face during implementation?
- Simulator sessions
  - What is the ratio between training and checking?
- EBT results
  - How have the pilot corps competencies changed after EBT implementation?

Themes for AOC without EBT

- EBT considerations and decisions
  - What should be different for you before implementation?
- Current training and checking
  - How do you tailor training and checking to your operation?
- Simulator sessions
  - Do you evaluate on reasons for extra training?

By participating in the study, you consent to the use of the data given during the interview, for my master thesis.

Participation will be anonymous.

The audio from the interview will be recorded. All data will be treated according to the General Data Protection Regulation (GDPR). At any time, for any reason a participant, can withdraw their consent and all data from the interview will be deleted and not included in the study. When the thesis has been completed and the grade confirmed, the interview data will be deleted.

Guidelines for Research Ethics in Science and Technology as found here will be followed.

Appendix 2: Interview guide

Questionnaire

Identifier code:	

What kind of checking and training structure do you follow now?

Have you considered EBT implementation?

If EBT	If not EBT
What was the most important reasons for a change to EBT? Where in your organisation was the decision regarding EBT implementation placed? What was the timeline for your EBT implementation? (where are you today?) What challenges did you face during implementation? (what about authorities?)(ask why!) Can you share any data that breaks down or give insight into the implementation cost of EBT? How many hours is a normal sim session? How many hours do a pilot train pr. year in simulator? (scheduled/actual, now/before EBT) (how much extra training do you have?) What is the ratio between training and checking during sim sessions? What do you monitor in order to adjust the training programs? How is EBT received by pilots? How is EBT received by instructors and examiners? What positive effects do you get from EBT? What negative effects do you get from EBT?	How well would you say you know EBT? What are the barriers for EBT implementation? (ask why, to the barriers!) What should be different, for EBT to be attractive? (3 most important things?)(question can be omitted depending on earlier answers)(ask why!). Can you show data that supports your decision about EBT? Were in your organisation is the decision regarding EBT implementation placed? (do you have an organisational diagram I can get?) Which parts of EBT do you see as attractive to implement, if any? Then we move over to how your training is today. How do you measure pilot proficiency today? (ask why!) How do you tailor training and checking to make pilots proficient in your operation? What tools do you use, if any? (ask why!) How many hours is a normal sim session? How many hours do a pilot train pr. year in simulator? (scheduled/actual) (how much extra training do you have?)

Page 1 of 2

How has the pilot corps competencies changed after implementation of EBT? What are the most important learning points from EBT implementation? What are your plans regarding training and checking? Finally, is there anything you want to add regarding EBT?	Do you evaluate on cost for extra training? (can you share the average number pr. pilot?)(do you mitigate extra training? What do you do?) Do you see a value in training in favour of checking? Why, why not? What do you monitor in order to adjust you training programs? What are your plans regarding training and checking? (ask why!) Finally, is there anything you want to add regarding EBT?