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Assessing Current Information Delivery for the Visually Impaired

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Assessing Current Information Delivery for the Visually Impaired

Danish Association of the Blind

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Assessing Current Information Delivery for the Visually Impaired

An Interactive Qualifying Project submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE in partial fulfillment of the requirements for the degree of Bachelor of Science

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27th April, 2017

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Abstract

In Denmark, digitization has led to the decline of the "talking newspaper" compact disc (CD) mailing system, resulting in an information gap for the visually impaired. Sponsored by the Danish Association of the Blind (DAB), this report aims to recommend approaches for the timely distribution of DAISY formatted current information to the visually impaired. By communicating with various organizations and conducting a device evaluation with the visually impaired themselves, we recommended a multi-system approach with calling, assistive technology (AT), and smartphone compatibility, an active teaching and awareness program, and a collaboration between organizations for distributing current information effectively to the visually impaired.

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1. Introduction

Historically, many visually impaired individuals in Denmark relied on a compact disc (CD) system delivered through the postal service for current information updates. The Nota library for the print-disabled (visually impaired and dyslexic population) creates audio files of books, magazines and newspapers for the visually impaired onto CDs for distribution through the postal service[1]. Cost cutting measures and efforts to become more environmentally friendly, while generally beneficial, have indirectly affected the postal service in Denmark. PostNord is the organization that handles the mailing, communication, other mailing logistics and e-commerce services to people and businesses in Denmark and Sweden. In order to reduce paper waste, digitization of government forms and public sector mail have taken place in Denmark creating an eGovernment and a Digital Post service[2]. Due to the physical mail volume decreasing, PostNord has been incurring a net loss since 2010, resulting in a deficit of $179 million (1.239 billion DKK) during 2016[3]. To counter these large losses, an economic reform was initiated in 2013 to streamline mailing processes. All newspaper CDs from Monday to Thursday are received in bulk the next Tuesday, while CDs with news from Thursday to Sunday are received the next Wednesday[4]. This change in circulation and delay in delivery has led to an information gap for the visually impaired[5]. The recent budget and service cuts in the postal system have left many people without timely access to current information, including local and national news, events and advertisements. There are many potential solutions to fill this information gap: radio systems, phone services, and assistive technologies. For more detailed information on the following sections, refer to Chapter 1.0 "Background" in the Supplemental Materials Document.

1.1 Radio Systems

One of the ways to deliver current information is over the radio. Radio reading services for the visually impaired require a narrator to broadcast local and national news updates as well as magazines and other print material. An example of this type of service is Gatewave, based in New York City in the United States. The user can access this service on the Internet, through applications on smartphones, on a Gatewave radio device, or by calling the radio station itself[6]. The news is broadcasted throughout the day, with six new hours of content each day[7]. This

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[1] Nota, 2017.

[2] European Commission, 2014.

[3] Postnord, 2017.

[4] Peter Seyfarth, personal communications, 21 April, 2017.

[5] J. Heilbrunn, personal communication, February 13, 2017.

[6] Gatewave, 2017.

[7] Rainbow Broadband, 2015.

news content is on a set time schedule with different publications broadcasted every hour[8]. This audio service relies on volunteers willing to help the visually impaired community by reading the content from the Internet, newspapers or magazines to the listeners. Overall access to the audio service itself is limited to the people who are legally blind or partially sighted. The radio station is free of charge, but Gatewave relies on donations to financially support the organization and to continue its service. Information distribution through radio can be an efficient method to deliver current information. However, the information is not customizable aside from listening to the station during the broadcasting of preferred content.

1.2 Iceland Assistive Technology System

In Iceland, an at-home device called Orion Webbox, made by Solutions Radio, is used as a method to modernize the information distribution to the visually impaired. Blindraelagid, the Icelandic Organization of the Visually Impaired, is partnered with Solutions Radio to distribute information using text to speech (TTS) software to create a format accessible for the visually impaired[9]. The Webbox is a device that can output audio files of newspapers, magazines, radio and/or television voice-subtitles, and books[10]. The user can customize the content that they receive through free subscriptions. The service works by extracting information from a provider, converting the information to a Digital Accessible Information System (DAISY) formatted file through a computer program, and then uploading the file to Webbox servers[11]. The DAISY standard universalizes audio formats and is further discussed below in Section 1.4.1 of the Report. The content is pushed to the Webbox device from this server. A push notification is when publication content from the Internet is automatically downloaded to a device connected to Wi-Fi, notifying the user that the download is complete. This process prevents users from missing information due to a lack of technology experience[12]. This information distribution method is timely and effective but, the system is not portable or available on a variety of devices at this time.

1.3 NFB-Newsline

An example of a system that utilizes multiple platforms, both portable and stationary, was created by the National Federation of the Blind (NFB) in the United States. NFB has created a news service for visually impaired individuals called "NFB-Newsline". Individuals can access this

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[8] Gatewave, 2017.
[9] Einarsson, 2014.
[10] Solutions Radio, 2017.
[11] Engelen, & Paepen, 2015.
[12] Ibid.

service over the phone, on a mobile app, through an online portal, or by downloading content to talking-book players (see Section 1.4.1 of the Report)[13]. Excluding the calling service, each method allows the user to save publications. The interfaces are designed to accommodate varying levels of experience with accessibility software or accessibility technology[14]. NFB Newsline promotes customization by allowing users to browse articles. The Newsline program is used nationally in the United States and is funded by individual state governments. Though this method is free of charge for the visually impaired, it is expensive for the individual states governments to provide. State budget cuts have led to the decline in reliability of this service. For example, during 2010 in Michigan, a budget cut in NFB-Newsline drastically limited access to information on international affairs for the visually impaired[15]. However, positive aspects of NFB-Newsline are portability and wide range of coverage, assuming that the individuals at least have and can use a telephone. The NFB-Newsline is an innovative example of combining multiple technologies in order to distribute current information to the visually impaired.

1.4 Assistive Technologies Currently Available to the Visually Impaired

Overall, the use of assistive technology (AT) is a promising direction for information distribution considering the strong push for digitization of information in Denmark. According to the Assistive Technology Industry Association (ATIA), assistive technology is any device, piece of equipment, or software that is used to maintain or improve the motor or bodily capabilities of people with disabilities[16]. An important application of AT in the modern world is within the progression of computer and communication technologies for the visually impaired[17]. These technologies give the visually impaired the opportunity to communicate and obtain information effectively. The present AT solutions include braille, screen readers, screen magnifiers, Optical Character Recognition (OCR), voice-over technology, and talking books, described in Figure 1 below. In addition, the iPhone can be considered an assistive technology through the use of it's built in accessibility software[18]. Utilizing a combination of these devices, along with online capabilities, yields a potential solution for distributing timely information to the visually impaired.

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[13] National Federation for the Blind, 2017.

[14] Ibid.

[15] PR-Newswire, 2010.

[16] Assistive Technology Industry Association, 2017.

[17] Williamson, Wright, Schauder, & Bow, 2001.

[18] Apple Inc. 2017a.

Figure 1. Assistive Technology Currently Available

The figure above highlights some of the assistive technology currently available to the visually impaired, which includes braille, screen readers, Optical Character Recognition (OCR), screen magnifiers, VoiceOver technology, and eBooks or "talking books".

Braille is a form of written language for the visually impaired in which characters are represented by patterns of raised dots[19].

Screen reading software is available for individuals with complete vision loss. This software uses text-to-speech (TTS) technology to turn text into audio on computers and on mobile devices.

Optical Character Recognition (OCR) converts printed material through camera scanning and is coupled with text-to-speech to play back the information as an audio file.

Screen magnifiers allows the user to zoom in to see content that has a limited proportion on

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[19] Braille Works, 2017.

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the page and can be disorientating to the partially sighted user.

VoiceOver, in iPhones and iPads, allows the user to navigate and interact with items on the touchscreen using audio descriptions provided by the software[20]

eBooks or "talking books" are handheld devices that have the ability to download documents over Wi-Fi that are used to read electronic versions of publications.

1.4.1 DAISY Players: The Technology and Devices

Talking books and audio feedback technology have emerged as one of the leading AT resources for the visually impaired. These devices were developed as a way to store audio-books and magazines in order for the visually impaired to have access to the same print material available to sighted people[21]. Talking book handheld devices that follow the DAISY standard are collectively known as "DAISY players". The Digital Accessible Information System (DAISY) is a technical standard for reading devices, digital books, periodicals, and other media types for the blind, partially sighted, and otherwise print-disabled individuals, such as those affected by dyslexia[22]. Features such as FM/AM radio, Wi-Fi capability, support for multiple document formats (.txt, .html, and .doc), voice recording, OCR technology, Bluetooth, alarm clock, timer, and barcode scanners are now available on DAISY players[23]. DAISY players range from small and portable to larger desktop versions. Desktop devices are defined as objects that may be moved from room to room but too big to be taken outside of the home and usually remain on a table. Examples of DAISY players and their respective features are listed in Table 1 below. The variety of features included within these devices gives DAISY players the potential to be used as a fully functioning solution for obtaining information.

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[20] Apple Inc. 2017b.
[21] American Foundation for the Blind 2017b.
[22] DAISY Consortium, 2017.
[23] Library of Congress, 2014.

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Table 1. DAISY Players

DAISY Player	Main Method of Use	Manufacturer	General Features
Blaze ET Multi Player[24]	Portable	Human Interaction Motivation Study	OCR, FM radio, Bluetooth, voice recording, advanced file system, Wi-Fi, bookmarks, color system, alarm, calculator, SD Card, and web radio.
Milestone 312 Ace[25]	Portable	Bones	SD card, voice recording, alarm, FM transmitter, FM radio, calendar, and bookmarks.
Victor Reader Stream II[26]	Portable	Victor Reader	Wi-Fi, FM/AM radio, bookmarks, voice recording, SD card, and web radio
Orion Webbox[27]	Desktop	Solutions Radio	Wi-Fi, bookmarks, web radio, FM radio, and TV subtitles
Victor Reader Stratus[28]	Desktop	Victor Reader	CD player, SD Card, and Bookmarks

1.4.2 Financial Barriers of Assistive Technology Devices

In order to obtain an assistive device, visually impaired individuals must first complete an application and submit it to their local municipality. Their municipality then provides devices from which the person may choose and are generally provided at free of charge. In total there are ninety-eight municipalities in Denmark. Although, each runs under the general national laws, each individual municipality has a different protocol and is not properly supervised by the national government to ensure that it is in compliance with the Social Services Act[29]. For example, one municipality may provide devices based on popularity, while another municipality may only offer the least expensive devices[30]. If a given municipality has a rigid device list, the individual may be limited in choice and not have access to the device with features that best suit their lifestyle. If the individual prefers a device not provided by their municipality, they may

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[24] Human Interaction Motivation Study (2017.) OCR and book players: Blaze ET Mulit Player. Retrieved April 4, 2017, from https://hims-inc.com/products/blaze-et.

[25] Bones (2017). Products: Milestone 312 Ace. Retrieved April 4, 2017, from http://www.bones.ch/milestone312.php.

[26] Humanware (2017). Blindness: Victor reader talking book players stream. Retrieved April 4, 2017, from http://store.humanware.com/hus/victor-reader-stream-new-generation.html.

[27] SeniorenWebshop [Seniors Webshop] (2017). Audio: Orion Webbox 2. Retrieved April 4, 2017, from http://www.seniorenwebshop.com/orion-webbox-2.html.

[28] Humanware (2017). Blindness: Victor reader talking book players stratus Retrieved April 4, 2017, from and http://store.humanware.com/hus/victor-reader-stratus12-m-daisy-mp3-player.html.

[29] Bue Vester-Andersen, personal communications, March 27, 2017.

[30] Ibid.

have to purchase the device on their own. Many visually impaired individuals also choose to purchase their devices directly from a retailer because there is potential for a delay of around six months when requesting a device through their municipality[31]. Having the responsibility to purchase their own device may cause them financial strain. In general, there are not many companies currently producing assistive devices for the visually impaired as the market itself is considered a "niche market"[32]. This small market makes it difficult for companies to produce inexpensive products as there is high potential for only two to three hundred of one item to be sold within a small country such as Denmark[33]. Because of the lack of uniformity in device distribution among the municipalities, it can be difficult for all visually impaired individuals to have access to the same information delivery system.

1.5 Project Goal

Throughout our research we investigated three system solutions for communicating information through radio systems, calling systems, and assistive technology (AT) systems. The goal of this project was to assist the Danish Association of the Blind to recommend approaches for the timely distribution of current information to the visually impaired citizens in Denmark. We investigated the technological and economic barriers to accessing and distributing current information. In addition, we evaluated AT device features to understand the most relevant features for an information distribution system. Based on our research and evaluations we look to recommend a system to improve information distribution to the visually impaired as well as the best method for helping people integrate this system into their everyday lives.

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[31] Anders, Personal communications, 2017.
[32] Johnson & Moxon, 1998.
[33] Bue Vester-Andersen, personal communications, March 27, 2017.

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2.0 Methodology

This project aimed to assist the Danish Association of the Blind to recommend approaches for the timely distribution of current information to the visually impaired in Denmark. Our objectives were to:

1. Investigate the technological and economic barriers of distribution and access of current information to the visually impaired.
2. Evaluate assistive technology features for accessing current information for the visually impaired.

In order to fulfill our project's goal, we carried out several methods to address our research objectives, which included semi-structured interviews and a device evaluation. Please refer to Chapter 2.0 "Methodology" in the Supplemental Materials Document for further details of each method.

2.1 Investigate the Barriers Surrounding Current Information Access and Delivery to the Visually Impaired

Our first objective was to investigate the barriers that the visually impaired encounter when accessing current information in Denmark as well as gain a greater understanding of the technological and economic factors that limit such access. These factors can be defined as the limitations surrounding assistive technology (AT) practicality and cost as well as limitations in distributing accessible documents to all. In order to accomplish this goal, we conducted several semi-structured interviews with various stakeholders. These stakeholders included organizations for the visually impaired, the Danish organization for digitization, private retailers of assistive technologies, and current information distribution organizations. Table 2 below outlines the representatives we interviewed as well as their affiliation, position within the organization, and date the interview was conducted. Further description of the interviews follows the table.

Table 2. Outline of Semi-Structured Interview Participants

Name	Organization	Position	Date of Interview	Description
John Heilbrunn	The Danish Association of the Blind	Vice-president	March 28th, 2017	Section 2.1.1
Ask Abildgaard	The Danish Association of the Blind	Executive Committee Chair	April 3rd, 2017	Section 2.1.1
Daniel Gartman	The Institute for the Blind and Partially Sighted	Information and Communication Technology Consultant	March 29th, 2017	Section 2.1.1
Hans Rasmussen	The Institute for the Blind and Partially Sighted	Former Information Technology Consultant from DAB and IBOS	April 6th, 2017	Section 2.1.1
Peter Houmann	Digitaliseringsstyrelsen	Digital Communications Accessibility Officer	March 24th, 2017	Section 2.1.2
Henriette Eskelund-Hansen	Digitaliseringsstyrelsen	Communications Consultant	March 24th, 2017	Section 2.1.2
Bue Vester Anderson	Low Vision International	Technical Consultant	March 27th, 2017	Section 2.1.3
Johannes Nørgaard	Instrulog A/S	Sales and Support Associate	March 20th, 2017	Section 2.1.3
Michael Nilsson	Instrulog A/S	Service and Support of Computer Solutions	March 20th, 2017	Section 2.1.3
Tammy Albee	The National Federation of the Blind	Assistant to the Director of Sponsored Technology Programs	March 30th, 2017	Section 2.1.4
Stine Duus Svendsen	Nota	Team Leader of Audio Production	April 21st, 2017	Section 2.1.4
Peter Seyfarth	Nota	Team Leader of the Technical Support Team	April 21st, 2017	Section 2.1.4

2.1.1 Semi-Structured Interviews with Organizations for the Visually Impaired

We conducted interviews with the advocacy organization, the Danish Association of the Blind (DAB), and the resource center for visually impaired individuals, the Institute for the Blind and Partially Sighted (IBOS). DAB helps its 8,000 members in a number of ways including providing support and resources. IBOS is a national institution that focuses on helping and teaching the visually impaired. We conducted these interviews to learn the current methods of acquiring current information, the preferences of the visually impaired for obtaining current information, limiting factors or barriers with the present methods, and the important features that should be included in the future systems. Overall we aimed to gain insight on the limitations of information distribution to for the visually impaired in Denmark.

2.1.2 Semi-Structured Interview with the Danish Agency for Digitization

To gain a better understanding of possible digitized services for the visually impaired in Denmark, we held an interview with representatives of the Agency for Digitization of Denmark, Digitaliseringsstyrelsen. This government agency is in charge of changing most government communication media into a computerized system. Digitization has indirectly led to the decline of the mailing system, drastically reducing the use of print communication. We arranged this interview in order to identify the most effective methods for the distribution of digital information, the advantages and the challenges faced during digitized communication, and the government's role in information distribution for the visually impaired in Denmark.

2.1.3 Semi-Structured Interviews with Private Assistive Technology Retailers

We conducted interviews with representatives of Low Vision International (LVI) and Instrulog A/S to have a better overall perspective on AT devices. LVI and Instrulog A/S are the main suppliers of AT to local municipalities that, in turn, are distributed to the visually impaired. We decided to interview these companies in order to gain information on the success of different DAISY players in the market. Furthermore, we wanted obtain insight on the distribution process of AT devices by the municipalities to the visually impaired.

2.1.4 Semi-Structured Interviews with Information Distribution Organizations

We conducted an interview with an associate from the National Federation of the Blind (NFB) to understand the main factors of importance for an information distribution system. NFB organizes the electronic newspaper system described in Section 1.3 of the Report. Our questions entailed the logistics of the Newsline system itself as well as considerations to take when setting up and managing an information system for the visually impaired. The NFB-Newsline utilizes many platforms and we interviewed them to guide us in finding a possible system solution for distributing current information.
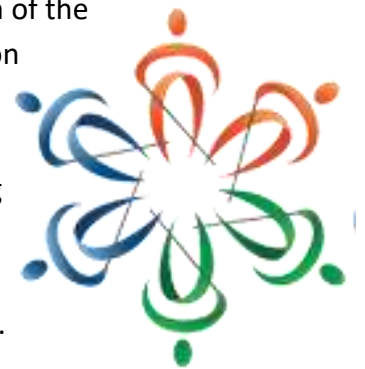
We also held an interview with Nota, the Danish library for the visually impaired, to learn about their information dissemination methods. We hoped to learn about information delivery services that Nota provides to the visually impaired, the measures they have taken to transition to a more digitized information, and the challenges they have faced during this transition. Moreover, because Nota is in charge of producing, recording, and distributing current information on compact discs (CD), we also inquired about the effects on the system due to the decline in the postal service. Lastly, we inquired about the use of AT as a solution to the current information issue.

2.2 Evaluate Assistive Technologies as an Approach for Current Information Delivery to the Visually Impaired

Our second objective was to evaluate the use of assistive technology (AT) as a potential system for current information distribution. We chose to investigate AT based on our research on the variety of functions for the user and the similarity of important features in AT devices compared to features in radio and calling systems. In addition, we did not have the resources to evaluate a radio or calling system. These technologies are also relatively straightforward and generally familiar the entire population. The aim of this objective was to identify if AT is a feasible medium for distributing information to the visually impaired based on user-friendliness and if so, which features are preferred by the participants. A device and its associated features are considered "user-friendly" if they are easy to learn, to understand, and to interact with[34]. This objective was accomplished through a device evaluation using current assistive technologies with members of the Danish Association of the Blind.

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[34] User-friendly, 2017.

2.2.1 Assistive Technology Device Evaluation

Our AT device evaluation included a three step process consisting of a semi-structured pre-interview, product trial, and a semi-structured post-interview. A more detailed procedure is outlined within Section 2.2.1 of the Supplemental Materials Document. In total, we conducted this evaluation with six members from the Danish Association of the Blind. The pre-interview included questions about the personal experience of the participants with the current information distribution in Denmark as well as their opinions on different information distribution methods. Through this interview we also surveyed their knowledge of the specific devices

Image 1: Device Evaluation with DAB Members. From left to right: Hans, the translator, Nelson, the interviewer, and Henrik, the interviewee.

used in our product trial; the Blaze ET Multi Player, the Milestone 312 Ace, and the Victor Reader Stream II, which are shown in the image below. These devices were provided by Instrulog A/S and LVI, and are described in Table 1. We used these devices because they each have unique characteristics and represent the overall market of AT devices available to the visually impaired.

Image 2: AT devices used in the Product Trial

The devices shown in the image, from left to right are: the Victor Reader Stream II, the Milestone 312 Ace, and the Blaze ET Multiplayer.

For the product trial itself, we first conducted a brief tutorial based on how familiar the participant was with the device according to the pre-interview. We then asked the individual to

perform a series of tasks. The tasks include turning the device on, making/retrieving a voice recording, controlling the volume, and finding a DAISY book. We selected these tasks because they are the most frequently used functions according to our research and interviews with stakeholders and therefore we were looking for confirmation of user-friendliness of the device especially in basic modes. We proceeded in this manner for all three of the devices. In addition, we tested the use of optical character recognition (OCR) by the participant when interacting with the Blaze ET, as it was the only player with this function. In order to record and organize the results of our evaluation we completed an "Assessing "User-Friendliness" of Devices" table for each participant's interaction with each device. The user-friendliness was evaluated through noting the individual's level of success upon completing each task and noting how familiar the individual was with the device. Within our evaluation we considered a function pathway "user-friendly" if the individual was able to complete the task with few or no mistakes following the short tutorial. Overall, this device trial was implemented to gain first-hand interaction with visually impaired individuals, observe how easy the devices were to learn and use, as well as understand the needs and preferences of these individuals in regards to accessing current information.

Following the evaluation with all three devices, we conducted a post-interview. These questions gauged the viability of the use of DAISY players as a method for delivering current information. We also asked the participants to rank, on a number scale, the importance of certain features of the devices to yield their preferences on features of the devices. We asked about features such as vertical and horizontal navigation, OCR, recording, menu buttons, radio, DAISY books, sleep timer, number of overall buttons, and multi-function buttons and completed an "Importance of Features to Participant" table. Vertical navigation is the navigation in a menu for genre of content while horizontal navigation is the navigation through an article itself. Figure 1 and Figure 2 below give additional information on these terms. The results of the rankings were not analyzed for statistical significance due to the small pool of participants. However, a table of the averages can be found in Section 3.2.1 of the Supplemental Materials Document. Through the combination of our pre-interview, product trial, and post-interviews we were able to investigate how easy to use AT was in general for the visually impaired in order to determine if it would be an effective platform for delivering current information.

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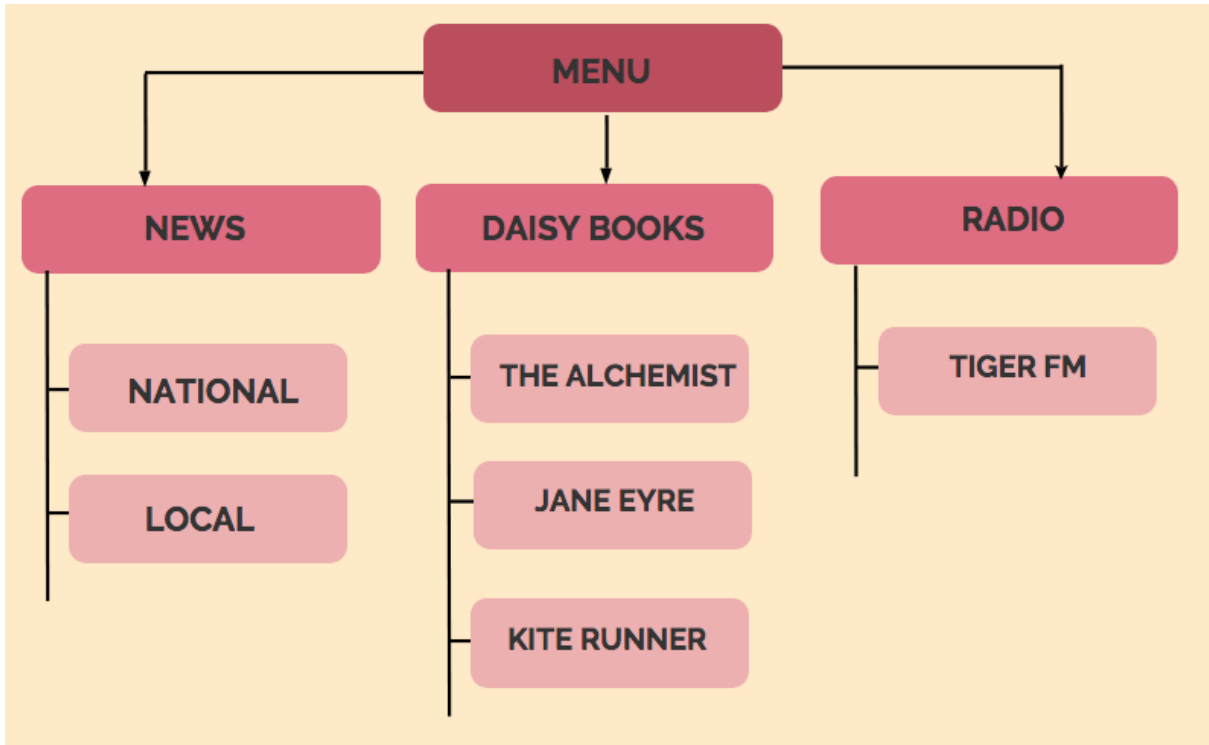
Figure 1. An example of Vertical Navigation

The figure above shows a representation of vertical navigation. In the figure there are three menu options stemming from the main menu and under each menu option there is a list of categories or genres.
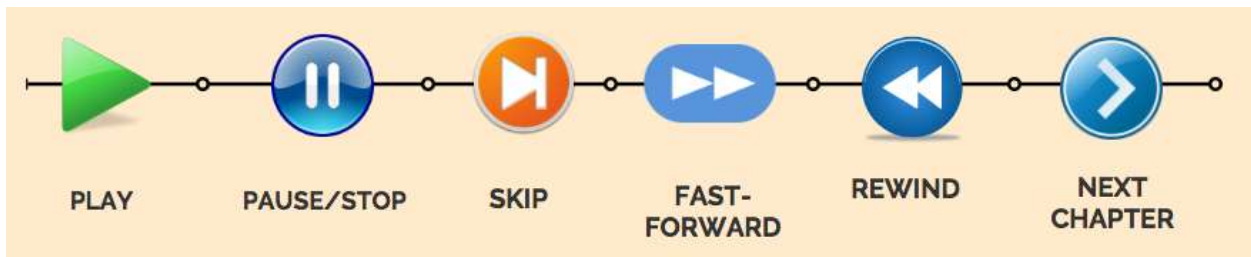
Figure 2. An example of Horizontal Navigation

The figure above shows a representation of horizontal navigation. In the figure, features used in media content are images connected horizontally including: play, pause/stop, skip, fast-forward, and rewind, and next chapter.
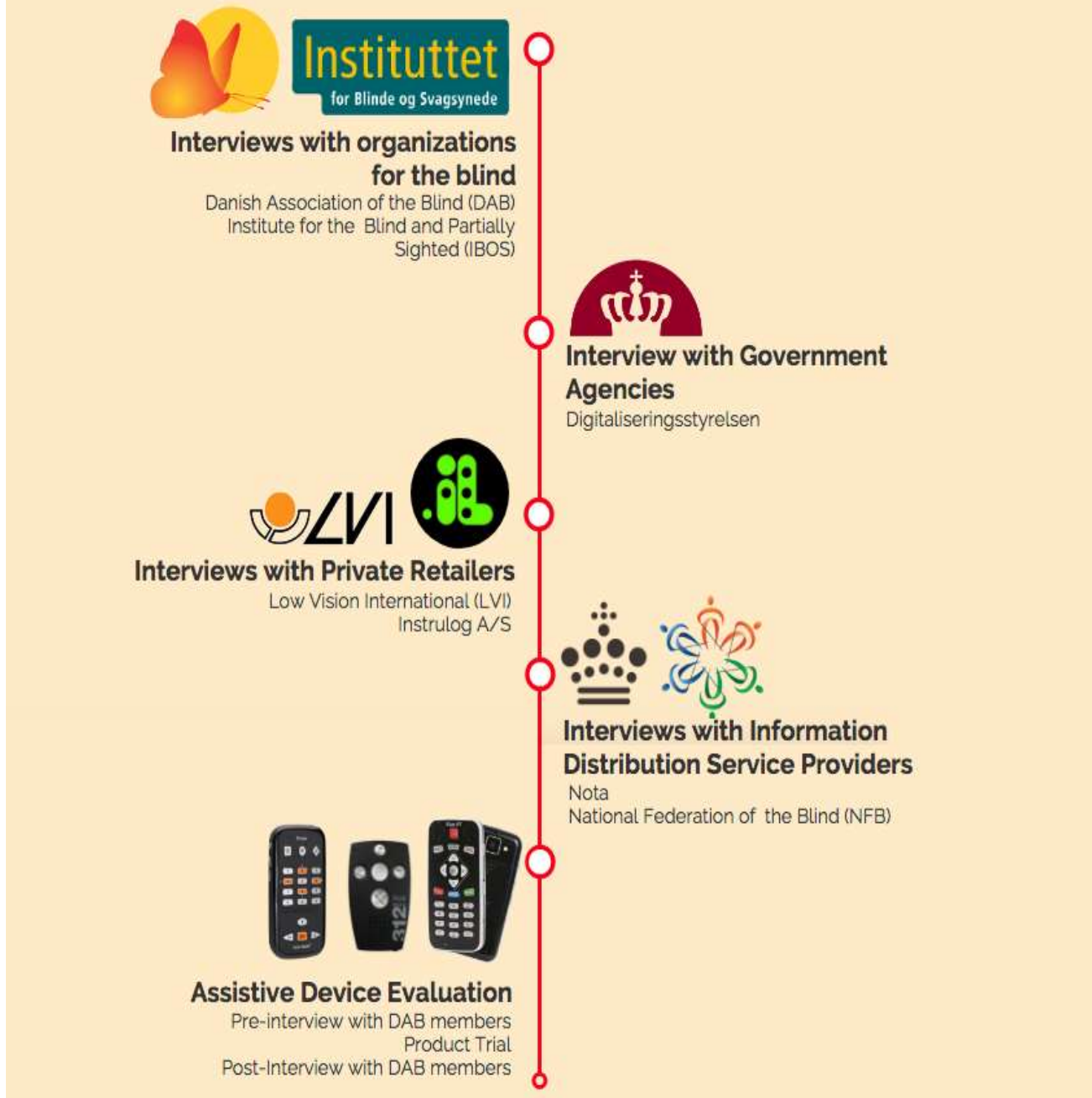
Figure 3. Methodology Overview

The above figure summarizes our project's methodology to address our research objectives, and to recommend approaches for the timely distribution of current information to the visually impaired. We interviewed two organizations for the blind: Danish Association of the Blind (DAB) and Institute for the Blind and Partially Sighted (IBOS), the digitizing agency of Denmark: Digitaliseringsstyrelsen, two private retailers of the DAISY players: Low Vision International (LVI)

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and Instrulog A/S, and two information distribution service providers: National Federation of the Blind (NFB) in the United States and Nota in Denmark. We also carried out an Assistive Technology device evaluation with the visually impaired members of DAB, which consisted of a pre-interview, a product trial of the DAISY players, and a post-interview.

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3.0 Results

This section discusses the results of our semi-structured interviews with various stakeholders and the results of our assistive technology (AT) device evaluation. Please refer to Chapter 3.0 "Results" within the Supplemental Materials Document for further details and specific responses to interview questions.

3.1 Investigate Barriers Surrounding Current Information Access and Delivery to the Visually Impaired

Through these semi-structured interviews conducted with organizations for the visually impaired, private retailers, government agencies, and information distribution service providers we found a greater understanding of the issues of current information distribution to the visually impaired. Overall, we discovered that delivery system limitations can arise as a result from the distributor or the visually impaired individuals themselves as well as from a lack of uniformity in distributing content and assistive technology devices.

3.1.1 Semi-Structured Interviews with Organizations for the Visually Impaired

In our interviews with the Danish Association of the Blind (DAB) and the Institute for the Blind and Partially Sighted (IBOS) we obtained information on many different influential factors surrounding the distribution and access of current information for the visually impaired. Through these interviews we also gained personal perspectives on these ideas, as all of the interviewees were visually impaired themselves.

3.1.1.1 Danish Association of the Blind (DAB)

Through our interview with John Heilbrunn, we learned that visually impaired individuals utilize radio, Internet, and applications on smartphones, Internet radio, CD mailing system, and television to gain information. Often times, the individuals use a combination of devices in order to meet the needs of their specific lifestyle. We also gathered that easy navigation through articles is a critical feature within AT and information documents being distributed. As far as limiting factors of current information delivery, complications arise from a combination of both the distributor and the side of the individual trying to access current information. Distributors, such as newspaper or magazine publishers, do not always convert their information into accessible formats. On the other hand, in regards to access, oftentimes a user may not be aware of the means they have at their disposal or may not know how to use them. For example, an individual may not be aware of the search term options or even the categories of information available.

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We also interviewed Ask L. Abildgaard, one of the members of the executive committee in DAB. He discussed that radio and television are the main methods of accessing current information after the decline of the CD mailing system. The problem with these methods is the lack of freedom while navigating from one section to another. Ask emphasized that easy navigation while accessing current information is one of the most important factors while choosing a method for getting information. For example, a radio listener cannot fast forward, rewind, or pause the audio playback. When asked about AT devices as one of the potential methods for delivering current information, he said that DAISY players are very widespread in Denmark, but they are mainly used for listening books. He supported his argument by discussing how the factor of habit comes into consideration. Individuals who have been visually impaired for a long time can be habituated to using radio and TV as the main method for getting current information.

3.1.1.2 The Institute for the Blind and Partially Sighted (IBOS)
In our interview with Daniel Gartmann we discussed that the visually impaired are more inclined towards an audio-based method for getting current information, which includes radio or television. Moreover, they prefer a method where they can easily navigate and jump back and forth from one section to another. When asked about the use of a phone line service to distribute information and he was not in favor because it may lack in navigation and he would be unable to save articles for later use. He also mentioned that the visually impaired are either granted AT devices for free, or for half-price, depending on their respective municipality, as rules differ from one municipality to another in Denmark.

We also interviewed Hans Rasmussen, who used to work at IBOS and DAB as an IT (information technology) expert. He stated that people who have lost sight over the course of their lives tend to be less open to learning AT devices and other methods to access information. This is because they have become habitual in their lives to using radio and television sources for acquiring current information. Visually impaired individuals ten to lack incentive to learn other methods to obtain current information. Hans stated that whatever technology the visually impaired learn must be "logical and easy-to-use"[35] to be accepted by the visually impaired.

3.1.2 Semi-Structured Interview with the Danish Agency for Digitization
Upon interviewing representatives from Digitaliseringsstyrelsen we found that it is more efficient to distribute information over the Internet because it is less expensive and faster than sending information through physical mail. However, problems arise when the information

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[35] Hans Resmussen, personal communications, 2017.

distributed is not accessible to people with print disabilities. We were informed that it is difficult to make digital post universally accessible due to the large number of different agencies, officials, and other contributors that send documents into their system. There are many different public sectors within the Danish government as well as 98 municipalities. This makes it troublesome to streamline the processing of every document, especially if it comes from an older system. It is important to note that in the case that an individual is unable to use a computer for any reason, they can apply for exemption from the Digital Post system. This results in receiving documents through the physical mail service.

3.1.3 Semi-Structured Interviews with Private Assistive Technology Retailers

Through our interviews with representatives from Low Vision International (LVI) and Instrulog were able to understand current information delivery from the perspective of assistive technology (AT) distributors. We gathered the features that are important to the visually impaired as well as the lack of uniformity in distributing AT devices to the visually impaired.

3.1.3.1 Low Vision International (LVI)

LVI noted that the AT market in Denmark is controlled individually by the 98 municipalities in terms of distributing AT devices to their specific visually impaired population. After the devices are purchased, they are then offered free of charge to the visually impaired in that municipality. The municipalities provide the training on how to use the AT device that they procure. However, every municipality has unique criteria when deciding what AT devices to buy in bulk from retailers such as LVI. Two municipalities may have completely different sets of AT devices. Individuals do sometimes purchase devices on their own. They are usually devices that are not offered by their municipality, but they often come at a high cost because of how small the AT market is.

3.1.3.2 Instrulog A/S

Instrulog is in favor of information distribution moving toward Wi-Fi push notifications over sending physical compact discs (CD). The representative we interviewed indicated Nota as the main controller of this information distribution. The most popular device is the desktop player Victor Reader Stratus followed by the portable player Victor Reader Stream II shown in Table 1 of the Report. The company has found that simplicity, and ease of navigation in devices is what makes AT devices popular and the most helpful. Other smaller factors were, battery life, the tactile feel of the buttons, and the button positions. The features that interact with the senses of touch and hearing are the most important to the visually impaired. During the interview, the representatives did not feel that age is significant factor limiting technology understanding, but more as a trend present in all age groups. We also learned that the distribution of AT in

Denmark can be disorganized. The 98 different municipalities have their own criteria for deciding what AT to buy in bulk for its residents, be it price, or a specific feature. Because of this, not all the needs of the visually impaired are met in terms of AT devices and this can discourage them to pursue a new technology.

3.1.4 Semi-Structured Interviews with Information Distribution Organizations

Interviewing the National Federation of the Blind, an American information provider, as well as Nota, a Danish provider, allowed us to understand the specific processes of current information distribution to the visually impaired. We also learned that it is possible to create an information delivery system that utilizes multiple technologies, and on a large scale.

3.1.4.1 The National Federation of the Blind (NFB)

From this interview we were able to inquire more about the logistics regarding a national news-line calling service. The way the service is set up makes navigation and finding specific publications easy. The service is also available on multiple platforms including a calling service, smartphone applications, and assistive technology devices. The service uses a computer to translate over 400 publications into accessible documents. However, when retrieving the information from a vast number of sources, the documents may not always be in a format that can be converted to an accessible one. A member of NFB then manually has to copy over the faulty documents. In addition, the service relies on funding from individual state governments that vary from state to state. It can be difficult to keep the service running when funds end, are lowered or removed from the state.

3.1.4.2 Nota

This interview highlighted that it is easier, faster and cheaper for Nota to produce online material, rather than distributing audio information through the compact disc (CD) mailing system. Most visually impaired people are elderly and the CD mailing system is easy for them for to use. Small changes in their methods of acquiring current information will be a huge change for them and therefore they tend not to shift to new methods. Experience with technology can also act as a barrier. Computers and mobile phones have been in market for over 30 years, yet the current visually impaired population scarcely uses or possesses them. This supports the claim that many individuals may be reluctant to try new methods. In this interview, the DAISY Online Delivery Protocol (DODP) was also discussed. DODP is a web service application-programming interface (API) that facilitates the delivery of digital content from service providers to end-users. However, running a DODP can be costly. In addition, few DAISY players, like the Victor Reader Stream II and PlexTalk Linio, support the DODP system. Local municipalities have been providing their members with various DAISY players over the years and many of them do not support the DODP system. However, they generally are not in a favor

of replacing these devices with new DAISY players that support the DOPD system due to price. Lastly, Nota is also working on an upcoming smartphone application, which will have audio books available to stream and download via Wi-Fi. One of the positive things about smartphones is that many visually impaired individuals are familiar with phones, unlike DAISY players.

3.2 Evaluate Assistive Technology as an Approach for Current Information Delivery to the Visually Impaired

Our second objective was to evaluate the approaches to current information delivery. We accomplished this through an assistive technology device evaluation to understand the most important features for accessing information for the visually impaired.

3.2.1 Assistive Technology Device Evaluation

Our AT device evaluation was a three step process consisting of a pre-interview, product trial, and the post interview. In the pre-interview we learned that AT devices were common among the visually impaired we interviewed in Copenhagen. Five out of the six volunteers had a DAISY player and indicated that they mainly used the device to read audiobooks. All of the volunteers said that they used television and radio as sources of current information while some used computers and others did not. In the group of participants, five out of six volunteers used the CD mailing system and expressed their issues with how slow this method can be. Yet, five out of six of our volunteers mentioned that learning a new method of getting information was a hassle and can be intimidating. This creates an interesting situation because the individuals feel the need for change but some are unwilling to learn new technology.

During the product trial, we observed how the individuals interacted with the three devices. When using the milestone, the individuals had the most difficulty accessing a recording as well as adjusting the volume. When retrieving a recording, two of the six were unable to do the task at all. To adjust the volume, they needed to utilize a button combination. Three of the six members either made a few mistakes before completing the task or were unable to complete it at all. When utilizing the Victor Reader Stream, all but one of the individuals were familiar with the device. They were all able to accomplish the five tasks. The one exception was that the one participant unfamiliar with the device had trouble retrieving her recording but was able to accomplish it after a few mistakes. Lastly, all participants were unfamiliar with the Blaze ET and all five members who interacted with the device were able to complete four of the six tasks asked (including OCR). In terms of making a recording, only one person made a mistake before completing the task. However, it was difficult for the individuals to retrieve the recording and only one person successfully completed this task. One participant did not interact with the

device due to a dead battery. Overall, the Blaze ET was the device with the highest number of completed tasks by participants who were unfamiliar with the device. All individuals interviewed were hesitant to change from their current method because they feel the methods they use are good enough for their lifestyle and accessing information. However, after speaking and working with them, they were more receptive to the devices and able to learn and complete the tasks.

The post-trial interview revealed to us that the visually impaired ranked DAISY compatibility and easy navigation of menus and content as their preferred features. Wi-Fi compatibility was also expressed as important but was not a feature that could be tested in our product trial because not all locations utilized in the trial had access to wireless Internet. Overall, the participants disliked the use of fewer buttons because it was difficult to learn and remember the combinations needed to accomplish the tasks. Because of this the Milestone 312 Ace, which has the fewest buttons, was the least user-friendly device. The navigation of the Blaze ET Multi Player and the Victor Reader Stream II which was deemed to be easy to use by the visually impaired made them more favorable for the visually impaired. However it is important to note that five of the six participants were familiar with the Victor Reader Stream.

4.0 Discussion and Considerations

This section outlines inferences made from the information recorded in the results chapter. We compare the three main information distribution systems and discuss the social aspect of implementing technological solutions. The combination of our findings and resulting inferences are the basis on which we developed our recommendations for the Danish Association of the Blind in regards to current information distribution to the visually impaired in Denmark.

4.1 Important Features for Information Distribution Systems

Overall, we identified DAISY compatibility, Wi-Fi capability/push notifications, and horizontal/vertical navigation of content as the most important features in an information distribution system. The visually impaired individuals we interviewed preferred DAISY format because it is easy to use and there is a wide content variety that uses this format. Push notifications and Wi-Fi support was considered important because it can provide access to a large variety of current information than the compact disc (CD) mailing system. Horizontal and vertical navigation are defined respectively as selection within menus and navigation within the article itself. Navigation is vital for the user to be able to easily interact with the device and access the information they need. An individual may not want to listen to an entire article and wish to skip around. Overall, these important features can be applied to the other information distribution systems at the conceptual level. The important features and considerations discussed should be the minimum requirements when creating a new information system.

4.2 Comparing Information Distribution Systems

When evaluating approaches to current information distribution, it is important to consider both the similarities and differences between the three systems, radio, assistive technology (AT), and calling. In regards to the features described in the above section, radio systems tend to be lacking in comparison to calling systems and AT systems. A radio system would have minimal control in terms of content navigation by the user. The system, in general, is built on the idea of the users tuning into a pre-scheduled program rather than having the ability to customize the information they receive. A radio system would also have less variety in terms of content in comparison to AT devices and calling systems. This is because only the article broadcasted at a given time is available. Overall, though a radio system would be easy for the individual to access, it is not practical because of the lack of features.

A system modeled after the National Federation of the Blind's calling system and AT systems in general offer more in terms of versatility and customization for the user. Calling and AT systems are similar because they contain horizontal as well as vertical navigation of articles. This

navigation gives the user independence to choose the information that is most relevant to them. Both systems are also compliant with the preferred DAISY standard to make documents accessible. One feature that AT devices have that calling and radio systems do not is the ability to store content. Storing content allows the user to quickly access previous information.

The ultimate factor that has to be considered is the lifespan of the technology. Radio and calling systems are older technologies that may have the potential to be made obsolete by iPhones or future technology in the coming years. This makes these technologies less favorable overall for developing an information system at this time. AT uses similar push notifications and access to content that computers and smartphones use making the lifespan of these devices significantly more promising.

After analyzing these main differences between the three systems we have concluded that calling based systems or AT based systems are the best systems to use for information distribution in Denmark with an emphasis on AT devices being the most promising system with the current trend in technology and given the current systems for AT already in place in Denmark. In addition, during our interviews and evaluations, another system to access current information emerged as a viable solution. The use of iPhones as a means for current information was higher than we expected with five out of six individuals using them as a part of their daily news access routine. With this in mind, we have considered smartphone use as part of our potential solution because this technology offers many of the same features of an AT device, including access to multiple publications, DAISY, and push notification compatibility. These devices will have a long life in the current trend of technology where the use of smartphones in Denmark has been projected to keep growing past 2019[36]. The culmination of our evaluation and interviews has yielded AT systems, calling systems, and smartphone systems for accessing current information as the most relevant solutions for Denmark to move towards.

4.3 Social Considerations

A major consideration when planning a new information distribution system is the social aspect of implementing technology to replace the former compact disc (CD) mailing system. Through our interviews, we uncovered deeper social aspects such as individual experience with technology and the learning curve associated with adopting new technological skills. One of the biggest barriers of implementing a new system or technology is the variance of users' experience with technology in general. Technology is a constantly changing field of products and it can be difficult at times for people to keep up. Every individual has different skills and level of comfort with technology and adapting it into their everyday life. Within our interviews

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[36] Statistica, 2017.

with the six Danish Association of the Blind, we found participants with different opinions on new technology: one participant was reluctant to try new technologies, two participant were initially intimidated but willing to learn, and three of the participants were comfortable with technology. It is important that information delivery systems include options for people with different technological backgrounds. Two of our interviewees mentioned the discomfort or lack of interest involved in learning new technologies because they considered it difficult to learn new technology. However, it is important to note that if the individual is assisted in adopting a new device into their life and is willing to learn, they will have more options when it comes to accessing information. Our success in the product trial emphasizes this trend of interactive teaching as a positive way to change individual's perspective on technology. For example, at the start of our trial all of the participants were unfamiliar with the Blaze ET device. However, following our tutorial all of the participants completed over half of the tasks without help. This demonstrated that even a short one-on-one teaching session can be sufficient and beneficial to an individual. An individual can increase their ability to live a more independent life by learning a new device.

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5.0 Recommendations

From our interviews with stakeholders we uncovered how big a role awareness and technological skill play in distribution of current information. A multiple-system approach with calling, assistive technology (AT), and smartphone compatibility should be the most effective approach to delivering current information to the visually impaired in Denmark. Through this method, different levels of technological skill and lifestyles are met by the array of options. People who prefer a more straightforward method would be able to call a centralized hotline and browse through publications with voice. On the contrary, more technologically savvy individuals would have the ability to receive constant updates to their AT device or smartphone through push notifications. In addition, raising awareness to the visually impaired themselves about technology and helping them to adapt it into their life is equally as important. Based on our findings, we recommend combining a multi-system approach, active teaching and awareness program, as well as collaboration between organizations as the most effective solution for distributing information.

5.1 Creation of a Streamlined Database

Through collaboration with the Danish Association of the Blind (DAB), an online database such as an Internet "cloud" based system should be put into place. This way audiobooks can be combined with narrated newspapers, magazines, and important news alerts in one cumulative collection. This system could be managed by organizations such as Nota or the DAB themselves. Nota presently has a system in place for organizing and converting newspapers into audio files. The system is still in its preliminary stages in the aspects of establishing an online data base and having full compatibility to push content to AT devices. However, with proper funding and procedure, DAB could set up a system specific for the visually impaired population. A cloud system should be modeled after the National Federation for the Blind (NFB) Newsline system in the United States and the information distribution system in Iceland created by Ivona. NFB has established a cloud system for many years dating back to 1995 by the Nebraska NFB section[37]. The age and success of this program makes it a great source to build a system from. The organization has experience in developing a system from the ground up and has knowledge in the important considerations to keep in mind in the systems development. This system can accommodate many different devices which will be described in more detail in Section 5.2 in the Report. Another system to model after would be the cloud system build by Ivona for the Orion Webbox AT device in Iceland. This would assist in learning about considerations for AT device interactions specifically, but many of the same principles can be used. The same access

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[37] National Federation of the Blind Nebraska 2017.

and push notification process can be used to send information to many types of devices.

A cloud system based online database would need funding either by one of the organization themselves or from the Danish national government. On the national level, the sponsoring organization would have to lobby for an increased budget in order to support the development and management of a current information database. If the local governments were to be used instead, collaboration between the municipalities and the organization handling this distribution interface would be imperative. With future research into these field as well as collaboration, relevant documents and information should be available in one place for download or sent out through push-notifications.

5.2 Implementation of a Multi-System Approach

In order to address a wide range of platforms and technical abilities of individuals, we recommend that a multi-system approach be used to address current information delivery. The main technologies used would be assistive technology (AT) DAISY players and the iPhone (currently the only accessible smartphone). Such a multi-system approach should be modeled similar to the NFB-Newsline system by allowing members to access current information from the sources they prefer. In Figure 4 below the multi-system approach is outlined. The multi-system approach should allow the individual to pull the information from the online database or have the documents automatically pushed to their AT device or iPhone. The NFB system uses online services, iPhone applications, AT access, and a calling service for individuals to access information[38]. As explained in Section 5.1, the NFB system has been in place for a number of years and they have established a working system that can accommodate these for devices at once from one cloud database. The concept of a multi-system approach is feasible and the service in the United States can be collaborated with to develop a similar system in Denmark.

The system should be first established with an AT system which utilizes the online database. The system has a strong starting point with the Digital Online Delivery Protocol (DODP) system at Nota, described in Section 3.1.4.2. of the Report. The DODP system could be the start of the multi-system because it is currently being used for audiobooks and under preliminary production in terms of newspapers. According to Nota, the updated versions of future AT devices will be compatible with DODP making this system easy to continue in the future. It is important to note that uniform policy would need to be enforced across all municipalities for the AT device distribution process (further described in Section 5.2.1. of the Report. In terms of the iPhone, there is an application being developed by Nota that works with DODP. Through this application or one similar, the user would be able to receive news that is directly pushed to

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[38] American Foundation for the Blind 2017b.

their cell phone. Though assistive devices are more accessible for the visually impaired, iPhones have an array of accessibility settings. Lastly, a calling service could be implemented for use by individuals who prefer not to learn a new technology. However, this type of program does not already exist within Denmark. A calling service would have to be set up by DAB or Nota and pull from the information database described above. Overall, a multi-system approach modeled after NFB and using the DODP system is the best solution to address the gap in current information delivery to the visually impaired.
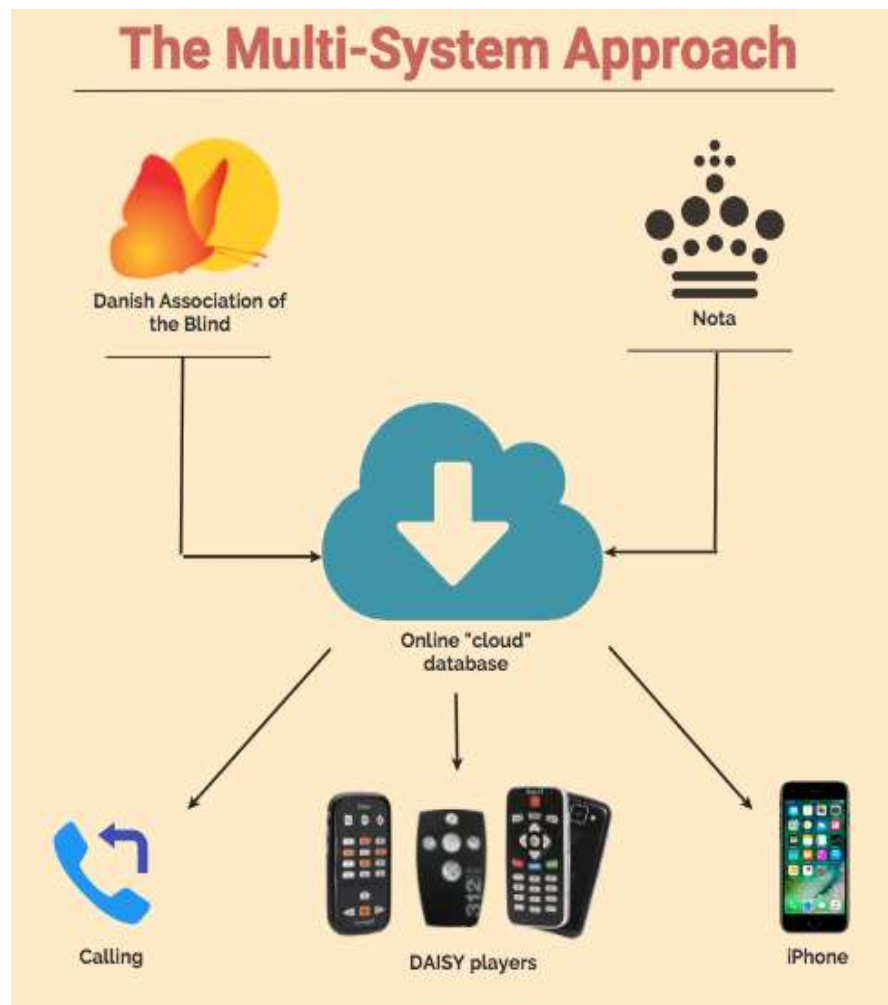
Figure 4. Multi-System Approach Overview

The figure above is an overview of our multi-system approach recommendation for the Danish Association of the Blind. It outlines that the Danish Association of the Blind or Nota would organize the creation of an online database for information and this database would be use to push current information to the three devices systems: the calling system, the AT system, and the smartphone system through an iPhone application.

5.2.1 Recommendations Assistive Technology Policy Change in Denmark

A limiting factor to the development of an AT system in Denmark is the separate policies for the bulk-purchasing and provision of AT devices to their visually impaired citizens in each of the 98 municipalities[39]. Due to this, citizens of the different municipalities have varying AT devices including some that are incompatible with Nota's DODP system. Because of this, we recommend a uniform policy to be enforced across all municipalities for the AT device distribution process. This would take time and effort to create, but overall it could be a worthwhile solution with long lasting benefits. Visually impaired members of Denmark would receive devices that fit their needs and the process for acquiring these devices would be simpler with one unifying standard. Working on policy change would be an area that needs to be further researched and could be beneficial to developing an AT systems approach in the future. This is a lofty goal and therefore it is a subsection of this recommendation because a great amount of government research and intervention would be needed.

5.3 Recommendations for Future Technology and System Development

Based on our interviews with the private retailers and our assistive technology device evaluation, we concluded the important features a current information system must have. If a device is to be developed for use by the visually impaired, it should be user-friendly with an easy hierarchical self-navigation. In addition, the inclusion of tactile buttons can be very beneficial as opposed to touch-screen buttons. This is because distinguishing among different buttons is difficult on an open touch-screen, unless there's an auditory description for each element on the screen. Overall, it is not possible to create a system that is ultimately future-proof because technology is constantly advancing. In order to minimize this, we recommend the future systems to be made modular and include a technology from the previous system in order to accommodate the individuals who do not wish to learn a new technology.

5.4 Creation of an Active Teaching Program and Troubleshooting Materials

We observed first hand through our device trials that even if the individuals had little experience with the DAISY players, it only took a few minutes for them to learn basic functions and tasks. Because of this, we recommend that an active education program be implemented. This program would assist the visually impaired members in learning how to use technologies such as computers, assistive technologies, and accessible smartphones like the iPhone. A teaching or help program could be set up to accompany the individuals within their homes, or wherever they are the most comfortable. We believe this program would reach the largest

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[39] Michael Nilsson and Johannes Nørgaard, personal communications April 4, 2017.

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range of visually impaired individuals if the Danish Association of the Blind (DAB) oversaw the program. Additional cooperation with the Institute for the Blind and Partially Sighted (IBOS) would be beneficial because they focus on training and education for the visually impaired. Presently, they provide services within their offices but we recommend a widespread program among all municipalities.

First, a protocol would be put into place where the representatives would be required to learn all of the devices available to their municipality. If the representatives do not know how to use a device they would be required to learn through IBOS. DAB would then make sure that their representatives are actively reaching out to the members of their municipality. They would be asked to contact all of the present people in their municipality as well as when new individuals register. The representatives could then check in and offer guidance to the individuals in their area. In addition, a protocol could be implemented in which the DAB municipality representatives are required to schedule a house visit and give a tutorial of the device, unless otherwise stated, when a visually impaired individual applies for an assistive technology device.

Second, it is important to note that information sessions with the visually impaired may not be enough for an individual to learn a new technology right away. It would be very difficult for the tutorial to include every function of the device or all of the troubleshooting procedures or for an individual to learn an entire device from a manual. Because of this, we recommend a system be put into place to create audio help files available for the individuals for their specific new device. This can be made and distributed by Nota or DAB. For the present situation, sending audio help files on DAISY format compact discs (CD) through PostNord would be the best distribution method. This way, individuals relying on CD-playing devices could use the device they are already familiar with, such as a Victor Reader Stratus, in order to learn the new technology. This way the individual is able to learn their device more in depth and at their own pace, as well as have on demand assistance when something goes wrong. In addition, audio files could be made on CD's to help individuals learn to use computers as they oftentimes accompany AT devices. It is also important for individuals to learn to use computers, as they are also platforms for potential strides in accessible technology for the visually impaired. In addition, braille guidebooks could be produced to help the population that prefers a physical copy of instructions.

Lastly, the creation of an online resource for use by the visually impaired would be very beneficial. This way, individuals who are proficient with the computer and wish to learn more about an AT device or smartphone could utilize this website. Figure 5 below shows an overview example of how an active teaching program could be set up and the accompanying troubleshooting materials recommendations. A similar program exists in the United States through the American Foundation for the Blind. On their website, there are a series of videos under their "LearnTech" tab. These are videos with detailed audio instruction that explain AT

devices for the individual[40]. In addition, this would be increasingly beneficial for the individual because family or the other people close to the visually impaired individuals could learn the devices themselves with the online resource. The visually impaired individual would then be able to receive help from their family members as well. Through the help of the people close to the visually impaired individuals, the audio help files, and the online resources, the individuals would learn to use their preferred device or smartphone.

Overall, this program will have a lasting positive impact because technology is constantly advancing and there will always be a number of individuals who need help transitioning. This program includes many different platforms and methods for individuals to learn to use these devices based on their lifestyle. Furthermore, the advancement in technology has led the population to try out new methods that provide current information faster and older methods may eventually "rust out"[41]. The system would need to be updated as major technologies are released. To accommodate for this, audio instructions and help books could be made for the device they are transferring from. No matter the information system implemented in the coming years, there will always be a population that is intimidated by new technology or unsure of how to switch over from their old system. Through this teaching and help program, individuals will be able to transition easier.

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[40] American Foundation of the Blind, 2017a.

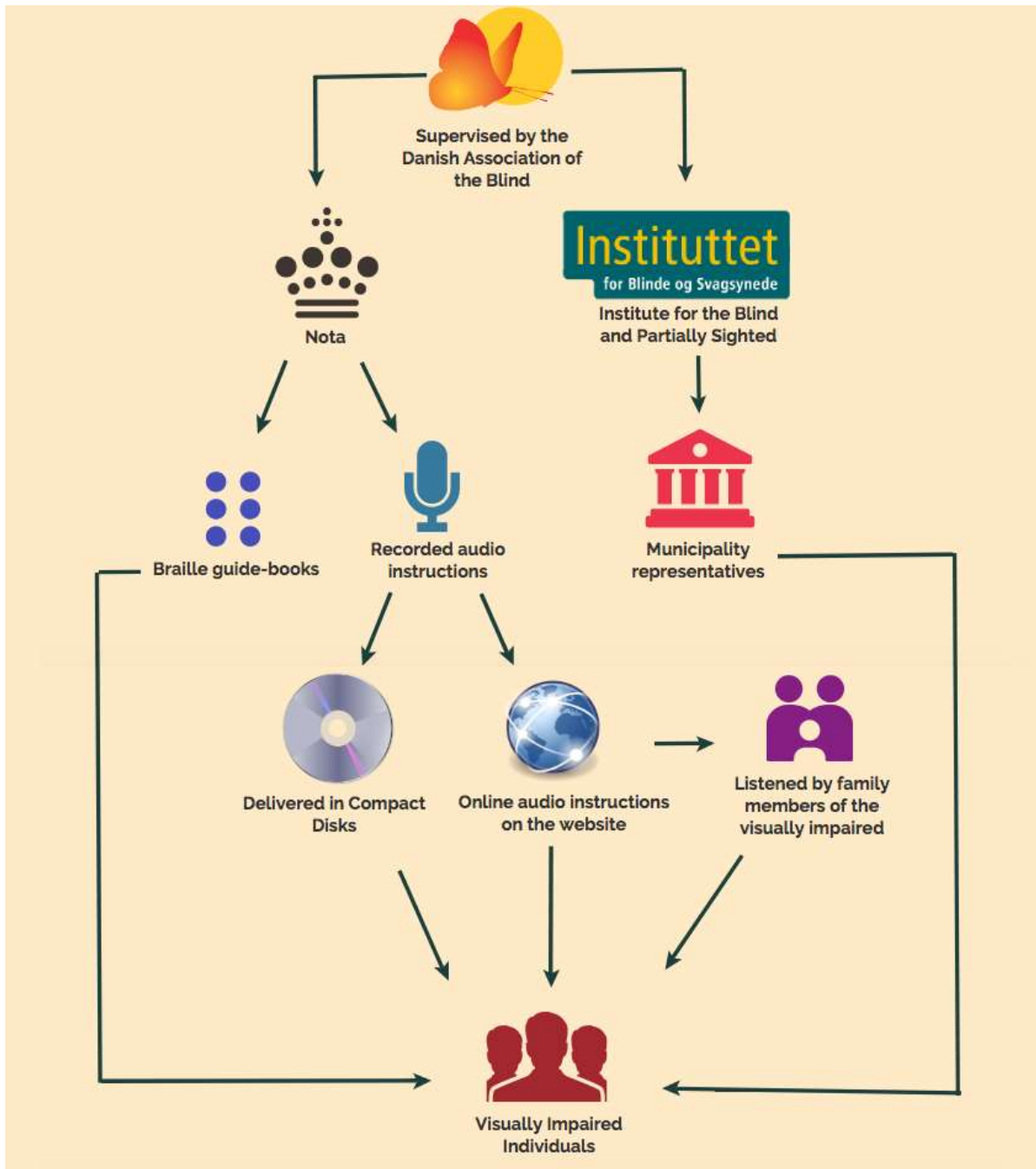[41] Ask Abildgaard, personal communications, April 3, 2017.

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Figure 5. Active Teaching Program and Troubleshooting Materials Overview

The above figure demonstrates the organization of the active teaching program and troubleshooting materials for the visually impaired individuals. The image contains DAB at the top of the chain as the chief organizer with arrows indicating the procedure of resources toward the visually impaired individuals. Information would first move from DAB to Nota regarding information distribution and IBOS regarding education. On the IBOS side, information continues to the municipalities and then teaching by the municipalities directly to the

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individual. On the Nota side, a set of arrows indicates the steps of converting information directly to a braille file or to audio based systems. The audio based system starts with audio recording and the recording is either made into a CD format for the individual or posted as an online resource for individuals. Lastly, the education of the individuals close to the visually impaired is taken into consideration by being included in the information distributed as an online resource which can then be given to the visually impaired.

5.5 Collaboration among Organizations

In our interviews with the stakeholders the Danish Association of the Blind (DAB), the Institute for the Blind and Partially Sighted (IBOS), Nota, and assistive technology retailers, we observed a lack of communication. There appeared to be miscommunication between the stakeholders regarding procuring timely current information for the visually impaired. We found through our interviews that organizations often times were unaware what other groups were doing. For example, when we interviewed Instrulog A/S the representatives were unaware of the work on information distribution currently done by Nota. Collaboration between these organizations would create a structure to share knowledge, experience and resources that can be used to alleviate the current information distribution problem. Group collaborations have been proven to be helpful in local governments in the UK for political, social, economic, social care, education, and environmental policy areas[42]. In order to bridge the information gap between these organizations we recommend for there to be an online forum created to connect the stakeholder organizations DAB, IBOS, Nota, and the municipalities of Denmark. We recommend an online forum over an in person meeting because it will increase the frequency of information exchanged and be convenient for the representatives. An example of an online forum in Europe is the European Disability Forum (EDF). This forum is a non-profit governmental organization and their goal is advocating and creating equal rights for everyone with disabilities[43]. Within their website there is an online "newsroom" for posting updates and accomplishments by the different organizations. They also include an online newsletter which is a summary of major accomplishments by the organizations. Our recommended forum would take this further and allow for online discussion through topic threads. It would also consist of each organization and sending updates on their current state and noting any changes to their respective areas, similar to EDF. This forum is not meant to be a place to expose future project plans, but to serve as a network of organizations "based on informality, trust and a sense of common purpose"[44]. More specifically, IBOS and DAB would report the status of the teaching program as well as any important opinions on the current information systems received from

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[42] Ibid.

[43] European Disability Forum, 2017.

[44] Ibid.

the visually impaired themselves. Then, Nota would update the other organizations on the status of their information distribution to the visually impaired. Lastly, the municipalities would post updates on the current state of the information systems and legislation surrounding them. Because all of their progress will be published for the public to see, like EDF, organizations such as Instrulog and LVI will be able to see the progress done within the field. Figure 6 below shows an overview of this forum. In addition to the online forum, a bi-annual or quarterly meeting of the stakeholder organizations would be used to discuss matters pertaining to all organizations and to reflect on progress made in the time period.

The communication of ideas is an important part of governing and organizing in general. The development of a forum to promote communication between IBOS, DAB, AT retailers in Denmark, and the municipalities would greatly assist the development of a solution for current information distribution. This collaboration would also set a future precedence on the communication for the multi-system information distribution systems in the future.
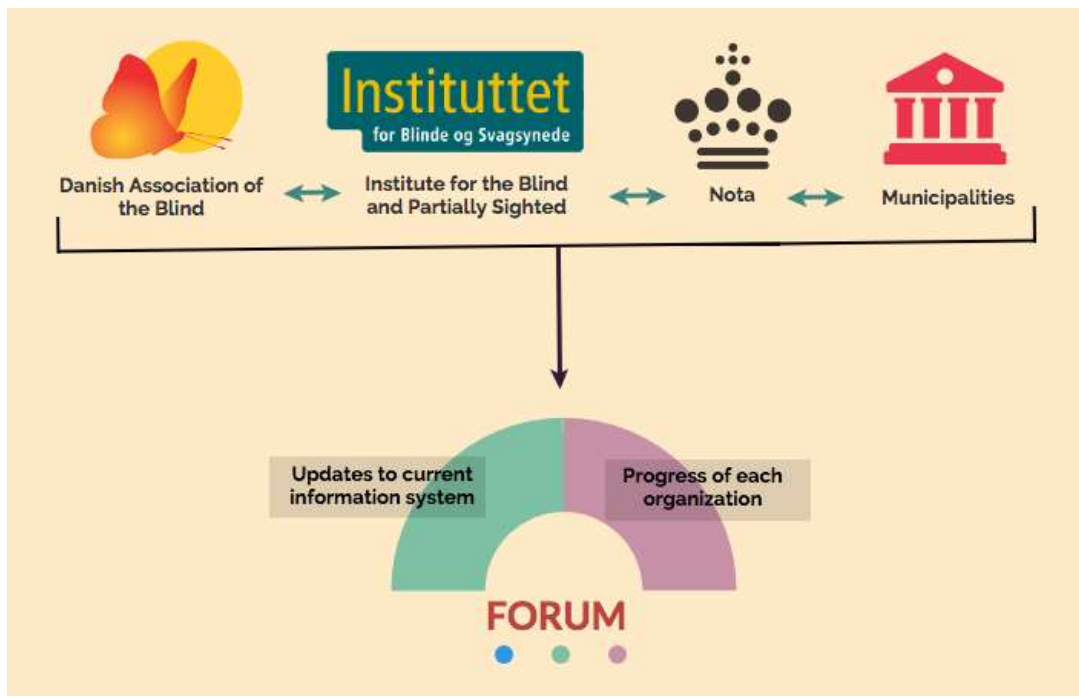

Figure 6. Group Forum Overview

The figure above demonstrates our plan for a group forum to increase the collaboration among organizations in Denmark. The visual shows images of DAB, IBOS, Nota, and the Danish municipalities with arrows connecting the organizations to indicate communication among them. A single arrow from the group of organizations to the forum represents the sharing of the organizations current status at the forum. At the forum the information can be discussed and future plans can be established.

5.6 Oversight of All Programs by the Danish Association of the Blind

Our last recommendation is for the Danish Association of the Blind (DAB) to reside as the head organizer of the information distribution to the visually impaired in Denmark as well as the teaching program for the visually impaired. DAB has experience working with visually impaired individuals giving them a strong understanding of the considerations to make everything accessible to the visually impaired and the most effective method to implement accessibility. As the oversight for the information distribution conducted by Nota or by the DAB themselves they can ensure the best practices of distributing information are in place and that the needs of the visually impaired population are being met. In regards to the teaching of devices and the information system, DAB and the Institute for the Blind and Partially Sighted (IBOS) can collaborate to develop the best teaching strategies possible for the visually impaired. IBOS has great experience teaching technology to the visually impaired and having DAB and IBOS work together will improve the process. The experience DAB has in managing large programs across Denmark is significant and can be applied to the management of a teaching program across Denmark. In addition, with DAB as the liaison between the municipalities, communication with the Danish government will be more efficient. DAB would be responsible for updating the municipalities on the information system and eliminating miscommunication from multiple parties solely working on one aspect of the information distribution process. In addition, no matter the service or options put into place, they will be ultimately unsuccessful if the population is unaware of it or the capabilities. Because of this it is important that the DAB and all organizations involved make people aware of their options and what the programs have to offer.

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