

MASTER THESIS

In

Universal Design of ICT

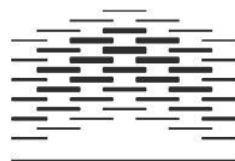
May 2017

Procedures for achieving universally designed
website for the Norwegian Broadcasting Cooperation
[NRK]

Vaskar Shrestha

Department of Computer Science

Faculty of Technology, Art and Design



OSLO AND AKERSHUS
UNIVERSITY COLLEGE
OF APPLIED SCIENCES

A. Preface

The objective of this thesis is to report 60p for my master course in Universal Design of ICT. The project was proposed by NRK through master thesis proposal. The fundamental goal of this project was to evaluate the front-end development process, the people involved in the process, and to provide suggestion how NRK can improve their website's accessibility. This thesis has provided me the experience of conducting real environment project and the profound understanding of the process involved during the research in the field of Human Computer Interaction (HCI). Furthermore, this thesis has helped me to expand my knowledge in accessibility, its importance, and how organization can achieve accessibility in their online web system.

Without the support of many people along the way, it was impossible for me to come up with this thesis. First and foremost, I would like to provide my sincere gratitude to my supervisor, Siri Fagernes, whom I am honored to work with and learned incredibly so much from. Through her invaluable help, it was possible to present this large project into something that is understandable to everyone. Secondly, I would like to thank all the remarkable participants and respondents from the development team in NRK for their time and for their valuable response.

Furthermore, I would also like to thank Helge Kassin, the representative from NRK for this Master Thesis, for his support and for the project itself.

Lastly, I would like to thank my parents and my wife for their unending support and encouragement in the completion of this thesis.



Vaskar Shrestha

Oslo, Norway / 16th May, 2017

B. Summary

In the one hand, the trend of online digital media is booming leaving behind the traditional media due to its various advantages over traditional. On the other hand, the number of disability and old users are increasing and they represent large numbers in the society. To ensure that everybody has access to the digital contents in the media and to ensure the human rights of everyone, the accessibility of the online digital media has become essential to achieve. The accessibility of the web is the ability of the website to be accessed, interact, and perceive the contents by the disabled or old users with or without mainstream technologies in certain context of use.

This research is follow-up research conducted by a group of researchers who found that the NRK's website hadn't fulfilled majority of the WCAG 2.0 criteria. NRK is a state owned Norwegian Broadcasting company that delivers media through various platforms. The purpose of this thesis is to evaluate the front-end development process of nrk.no/nyheter and to suggest what they should improve in their process to achieve web accessibility. In the evaluation process, the study of several factors like the process involved in the development, people involved in the process, and the strategy adopted by NRK to achieve accessibility was done.

For the evaluation process, two qualitative research method i.e. interview and survey was conducted with participants from the team of front-end development in NRK. The data from these research methods was collected and analyzed through thematic analysis under content analysis.

Through the data analysis, it was found out that there lie several barriers within process, people involved, and their strategy for the development of an accessible website.

C. Table of Contents

- MASTER THESIS..... 1
- A. Preface 2
- B. Summary..... 3
- C. Table of Contents - 1 -
- D. List of Figures..... 6
- E. List of Tables 6
- F. Abbreviations..... 8
- 1. Introduction 9
 - 1.1. Research Question 12
 - 1.2. Goals and Expected Outcome 12
 - 1.3. Outline of the Thesis..... 12
- 2. Literature Review..... 14
 - 2.1. Universal Design (UD) and Web Accessibility (WA)..... 14
 - 2.2. Disability..... 17
 - 2.2.1. Disability Gap Model 18
 - 2.2.2. Types of Disabilities 19
 - 2.3. Assistive Technologies 22
 - 2.4. The importance of web accessibility..... 22

2.5.	Web Accessibility Guidelines.....	27
2.5.1.	Web Content Accessibility Guidelines (WCAG 2.0).....	27
2.5.2.	Section 508 Guidelines.....	28
2.5.3.	BS8878.....	29
2.6.	International and National regulations	30
2.7.	Barriers in developing accessible websites.....	31
2.8.	Recommendations for developing an accessible website	35
2.8.1.	Raising awareness of accessibility and its importance.....	38
2.8.2.	High Prioritization of accessibility.....	38
2.8.3.	Integration of accessibility early into the process	39
2.8.4.	Accessibility Expert	42
2.8.5.	Guideline is not the only thing.	43
2.8.6.	Following and being up to date with the legislation.....	43
2.8.7.	Accessibility Training.....	44
2.8.8.	Accessibility Testing	45
2.8.9.	Inclusion of accessibility report in the web	49
2.9.	Disability and ICT in Norway	49
2.10.	Norwegian Broadcasting Corporation (NRK).....	51
2.10.1.	NRK Website System architecture.....	52
2.10.2.	Accessibility Issues with nrk.no/nyheter.....	54
3.	Methodology	56

3.1.	Data Collection Procedure	56
3.1.1.	Semi-Structured Interviews	57
3.1.2.	Questionnaire	62
3.2.	Ethical Considerations.....	67
	Vulnerable Participants	67
	Informed Consent	67
	Maintaining Trust, Privacy and Confidentiality	68
3.3.	Content Analysis.....	68
4.	Results.....	72
4.1.	Data analysis of Semi-Structured Interview	72
4.2.	Data Analysis of Survey	80
4.2.1.	Diversity of respondents	81
4.2.2.	Understanding/knowledge about accessibility	81
4.2.3.	Accessibility Training/workshop	83
4.2.4.	Prioritization of accessibility in NRK	83
4.2.5.	Knowledge of Automatic Accessibility Testing Tools	84
4.2.6.	Real-user involvement	84
4.2.7.	Accessibility Testing	85
4.2.8.	Attitude towards Accessibility	86
4.3.	Findings	87
4.3.1.	Lack of prioritization of accessibility in the development process.....	87

4.3.2.	Inadequate understanding/knowledge of accessibility.....	88
4.3.3.	Insufficient understanding/knowledge of accessibility guidelines	89
4.3.4.	No any Accessibility Guidelines Followed	90
4.3.5.	Lack of training/workshop.....	90
4.3.6.	Lack of User Testing	91
4.3.7.	Lack of accessibility testing.....	91
4.3.8.	Lack of Accessibility Experts	92
5.	Discussions and Recommendations	93
5.1.	Discussions	93
5.2.	Recommendations	99
5.2.1.	High Prioritization and implementation of Accessibility into process.....	99
5.2.2.	Following or customizing accessibility Guidelines.....	100
5.2.3.	Increasing awareness among stakeholders, product owners, and team members	100
5.2.4.	Provide training to team members.....	101
5.2.5.	Having accessibility expert in the team.....	101
5.2.6.	Accessibility testing at the major development phase	102
5.2.7.	Providing the knowledge about automatic evaluation tools	103
5.2.8.	User testing with real users.....	103
6.	Conclusion	105
7.	Limitations and Future Work.....	107

8. References	108
9. Appendix	113
9.1. Consent form for Interview.....	113
9.2. Semi-Structured Interview Question.....	116
9.3. Survey Questionnaire	119

D. List of Figures

Figure 2-1: The six major concepts that should be included in the definitions of the web accessibility..... 16

Figure 2-2: Disability Gap Model showing the relations between the requirements set by the environment and the human abilities 18

Figure 2-3: Integration of accessibility into the development cycle proposed by Microsoft..... 41

Figure 2-4: The general overview of the use of internet for various purpose by people in Norway between 16-79 ages 50

Figure 2-5: Architecture of different responsible system for creating and rendering content in the nrk.no 52

E. List of Tables

Table 1: *General information of each participant*..... 67

F. Abbreviations

ICT = Information and Communication Technology

WAI = Web Accessibility Initiative

W3C = World Wide Web Consortium

WWW = World Wide Web

WCAG = Web Content Accessibility Guideline

UD = Universal design

UNCRPD = United Nation Convention of Rights for People with Disabilities

WA = Web Accessibility

ADA = Discrimination and Accessibility Act

NRK = Norwegian Broadcasting Corporation (Norsk Rikskringkasting)

ADHD = Attention Deficit Hyperactivity Disorder

AT = Assistive Technology

WHO = World Health Organization

UNESCO = United Nations Educational, Scientific and Cultural Organization

HTML = Hypertext Markup Language

CSS = Cascading Stylesheet

ATAG = Authoring Tools Accessibility Guideline

HCI = Human Computer Interaction

1. Introduction

In present, due to the web's feature like adoptability into various platform and reaching broad audience in short period of time, it has become an important resource in accessing information and communication (S. L. Henry, Abou-Zahra, & Brewer, 2014). Accessing information in the web has not only become luxury but it has become necessities and human rights for the people with disabilities. Regardless of necessities and human rights, different evidence shows that the people with disabilities are encountering different types of barriers while accessing the information.

Despite the availability of accessibility guidelines, legislative requirement for the responsible parties to produce an accessible website in many countries, and irresistible advantages of accessible website (Miñón, Moreno, Martínez, & Abascal, 2014), many has failed to provide an accessible website. For instance, A. Olalere and J. Lazar (2011), studied the accessibility of governmental websites in the United States and they found out that majority of the website are inaccessible although they are enforced for the development of accessible website through US Section 508 law. In another report, J. M. Kuzma (2010), after studying the accessibility level of 130 parliament sites in UK with automated testing tools, found that only 5% of the website did not reported any accessibility issues. These and other different research shows that there are more factors than guidelines and legislation which can influences the accessibility degree of the website.

As more and more people are spending their time online, online digital media are booming leaving behind the traditional media (Mander, 2014; Statistisk Sentralbyrå, 2017). One of the advantage of online digital media is that it can reach wide range of people instantly with less effort than the traditional one. In addition, online media has become important field for sharing information, events, current news from around the world, and public arguments. With growing number of internet users and growth in the use of smart devices in emerging e-society, online media will indisputably lead the behavior of people accessing media. As a result, for ensuring freedom of rights and equal participation of everyone in the society, accessibility is indispensable in the field of digital media.

Web Accessibility (WA) is complex and represented by different components (Harper & Yesilada, 2008, p. 61). Understanding each component of WA is essential to develop accessible website. According to (Petrie, Savva, & Power, 2015) web accessibility can be defined as the design and development of a website with usability characteristics that is usable, perceivable, accessible, and intractable by everyone in specific situations of use, despite the users' disabilities or age and with or without assistive technologies.

Sanderson, Chen, and Kessel (2015) conducted an evaluation with multi-method approach of few selected webpages of a Norwegian public media website called NRK. NRK¹ stands as **Norsk Rikskringkasting AS** in Norwegian and **Norwegian Broadcasting Corporation** in English. The researchers used focus group interview with 16 diverse disabled users and heuristic evaluation for the accessibility evaluation process. Upon analyzing the result, the researchers found out that among 61 criteria of Web Content Accessibility Guidelines 2.0 (WCAG 2.0), the NRK's website had only fulfilled just nine. Other nine were not applicable to the website resulting that 41 criteria of the WCAG guidelines were not fulfilled.

The website of NRK is the second biggest website in Norway (Communication Department, 2007). As being media organization NRK provides attractive current contents from around the world, Norway and all the events of NRK online along with TV, radio and different other services in the website. In 2012, with the increase of 22% from the previous year, the average unique visitors were 4.8 million per week. In NRK, solely one third portion of traffic in the web applications come from mobile and tablet. Now, there are average of 70,000 unique visitors in mobile device per week (NRK, 2015). NRK daily generates around 250 articles with the help of 400 news journalists. The content in the online site is managed by the two inner systems Polopoly and Panorama (Kessel, Sanderson, & Chen, 2014a).

The rights of every Norwegian citizen to equally access Internet is stated in the section 14 of Discrimination and Accessibility Act (ADA) and in Universal design of information and Communication Technology (ICT) solutions (Sanderson et al., 2015). To increase the equal participation and digitalized number of citizens, the Norwegian

¹ <https://www.nrk.no/>

government has been putting forward effort on continuous basis and investing large quantity of funds to increase the quality of the broadband coverage. By far in 2013, the number of households who have chances to access the broadband internet services were 99.9% excluding just 2000 households (Kessel, Sanderson, & Chen, 2014b). However, in the other hand, little is done in regarding to accessibility in the emerging e-society.

From the research paper where researcher evaluated the few selected pages of nrk.no (Sanderson et al., 2015) and from another research paper (Kessel et al., 2014b), where the researcher evaluated the content management systems of NRK, it is clear that the web page of NRK is not fully accessible. As being the state-owned media website and majority number of people come in contact everyday with NRK implies that the accessibility of the NRK's website is fundamental. Thus, for NRK to develop an accessible website, first it is essential to understand the factors that has caused in the inaccessibility of the website and what factors can mitigates these factors to increase the accessibility (Jaeger, 2006).

To identify the factors causing in inaccessibility of website, the fundamental goal of this thesis is to study the process and people involved in the design and development process in nrk.no/nyheter. The study will focus on the people's attributes which can have influence in the web accessibility like their perception, attitude, knowledge about accessibility, guidelines, and evaluations tools. Furthermore, the study will focus on the process adopted during the development process and strategies adopted by NRK to achieve the development of an accessible website. After studying process and people involved in the development of NRK, the possible hindering factor in the development of an accessible website will be outlined.

Through study of other researches, practical and reasonable solutions will be recommended for NRK that could help the organization to alleviate the hindering factors in the development of an accessible media website. The finding of this thesis not only provide benefits to NRK, however, also to other organization who are finding difficulties on deciding where and how to begin and what could be the barriers in the development of an accessible website.

1.1. Research Question

As outline above, different research paper has provided the overview that there exit several accessibility issues both in the content management system and in the webpage of NRK. Being state-owned and largest media organization in Norway, accessibility is very essential in their website. Thus, for the development of accessible website, for the first, NRK should identify and understand the barriers that influences the accessibility of their website. Thus, this thesis, after the study of the process and the people involved in the process, will answered the following research questions. The research questions for this study are:

- A. What are the main factors behind the development of inaccessible website in NRK?
- B. What will be the best solutions to mitigate the hindering factors during the development of an accessible website for NRK?

1.2. Goals and Expected Outcome

As discussed earlier, the fundamental goal of this thesis is to study the process involved in the front-end development of NRK; the people involved in the development process; and to identify the barriers that hinders in the development of an accessible website for NRK.

The expected outcome of this thesis is the factors that hinders in the development of an accessible website for the organization like NRK and the solutions that organization can adopt to remove the barriers.

1.3. Outline of the Thesis

Section 1 Introduction: This section provides detail information about the problem background and the objectives of this research.

Section 2 Literature Review: This section provides information about web accessibility, guidelines and legislation, barriers in development of an accessible website, recommendations on making accessible website based on previous literature. Furthermore, later the section will give brief introduction to NRK, system

architecture of NRK, and accessibility issues in NRK's website nrk.no/nyheter according to previous research.

Section 3 Methodology: This section consists details about the methodologies chosen for the data collection procedure and the analysis procedure for analyzing the data. This section will also contain the details about the participants and responders who were involved in the data collection.

Section 4 Results: This section will consist the preliminary result from the semi-structured interview; will consist the result from the survey; and will consist the findings from both results analysis.

Section 5 Discussions and Recommendations: This section will consist the discussion of the findings and recommendations for mitigating the accessibility issues in the development process.

Section 6 Conclusion: This section will consist the summary of this thesis.

Section 7 Reflection and Future Work: This section will consist the reflection on the thesis and will provide the insights of the task that can be carried out in the future.

2. Literature Review

This section will consist the study of the previous literature and research. Through the literature review, brief discussion will be in various aspects like universal design, web accessibility, the needs for the web accessibility, the barriers disabled people experience with the inaccessible websites, and the steps that the web organizations need to take into considerations during the development of accessible website. Later in this section, the brief introduction of the NRK and its online structure will be provided. Further, the studies from the different research regarding the accessibility of NRK will also be covered.

2.1. Universal Design (UD) and Web Accessibility (WA)

Universal design (henceforth UD) is the ability of using the systems, services, environments, and products by everyone to utmost degree possible, exclusive of any adjustment or particular design (Horton & Leventhal, 2008; United Nations, 2007). The term UD focuses to include diverse range of users in terms of age, culture, physical limitations, economic situation, languages, and abilities. The seven principle of UD which clarifies its meaning are as following (Aslaksen, Bergh, Bringa, & Heggem, 1997):

- Equitable Use,
- Flexibility in Use,
- Simple and Intuitive Use
- Perceptible Information,
- Tolerance for Error,
- Low physical effort,
- Size and space for Approach and Use.

UD is also known with different other terms like inclusive design, universal usability, design for all. Implementation of UD can yield numerous advantages. Some of the benefits of UD are saving cost, design of better usability interface, and designing universally profits everybody (Horton & Leventhal, 2008). To achieve universal design, attention should be provided into different factors of technology like multimodality, internationalization, independent of device, and accessibility.

Web accessibility is one of the major aspect of UD and one of the principle among other 8 in “*United Nation Convention on the Right of Persons with Disabilities*” (Henceforth UNCRPD) (United Nations, 2007). Accessibility of web means anyone with special characteristics can use, interact, perceive, understand, navigate and make contribution to the web (W3C, 2005). In spite of factors like location, culture, software, hardware, language, physical, and mental ability of users, the content of the web must be designed in such a way that it can be easily accessible by the disabled users (W3C, 2015). Director of the W3C and the inventor of World Wide Web (WWW), Tim Berners-Lee have said that (W3C, 2015)

“The power of the web is in its universality. Access by everyone regardless of disability is essential aspect.”

Researchers (Petrie et al., 2015) collected around 50 definitions from 1996 to 2014 from various books, articles, standards, guidelines, and online sources to do analysis and identify the main aspects that should be in the definitions of accessibility. Through research, the researchers identified six major aspects. The six major aspects are (a) people, (b) especially disabled and old users, (c) design and development, (d) can be access, use, interact, navigate, understand, and perceive, (e) in specific context, and (f) with using mainstream or assistive technologies. After combining these six aspects, the definitions became as:

The design and development of the websites with usability characteristics that can be accessed, used, interacted, navigated, understand, and perceived in a specific context with using mainstream or assistive technologies by everyone especially with disabled and old users (Petrie et al., 2015).

With accessible website, diverse range of people having problems with vision, cognitive, physical, neurological, speech, and auditory can actively participate on the web. In addition, not only disabled users can get advantages of accessible website but the people with ageing disabilities can also use the website without any challenges. Although the fundamental goal of accessible website is to make ease of access for the people with disability and old users, the advantages of accessible website can be to diverse users. Along with disabled users, users with situational limitations (device and environment) can also take the advantage of accessible

website. Accessibility is not only for the specific groups of people; it is for everyone. However, accessibility is not one size fit all.



Figure 2-1: The six major concepts that should be included in the definitions of the web accessibility

(Image source: (Petrie et al., 2015))

Several factors have resulted in the growing need for the awareness and understanding of accessibility. Factors like increase in the use of portable and easily available device (mobile, laptop, television, tablet); easier to reach wide web audience in short period of time despite the user's low literacy or use of old technology; the use of online system by the old users to live their life independently

have circumstanced the responsible organization to research and develop accessible website (S. L. Henry et al., 2014).

The web meets its goal when the diverse range of users can use it without any interruptions. In a physical environment, where accessing information is difficult for disabled people, web has removed the barriers and made it easier enabling them to participate equally on the web. However, the main concern is that the researchers are focusing more on the research regarding accessibility while in practical, less is done in terms of providing accessible web to the users.

During the last 20 years, there has not been much progress in terms of accessibility. On an accessibility progress report done during 14 years, over 100 high traffic gaining websites from UK and USA, from 1999 to 2012, researchers (Hanson & Richards, 2013) were able to find out interesting result. On checking the conformant of WCAG 2.0 level A in those websites, the researcher figured out that during these 14 years the gaming website were able to cover several issues but not all. Moreover, government websites had fulfilled more criteria of WCAG 2.0 than the private ones. Some of the features overcome were alternative text for non-text content, using appropriate style of code, meaningful content with the title, proper layout of the site.

Many researchers (J. Kuzma, Yen, & Oestreicher, 2009; J. M. Kuzma, 2010; Abiodun Olalere & Jonathan Lazar, 2011; Sanderson et al., 2015) has evaluated various websites from different countries. The result from the research shows that many organizational and governmental websites does not fulfill the basic criteria of the web accessibility. These researches justify that there has been done little in terms of accessibility and still many disabled and older users are excluded from actively participating in the society through web.

2.2. Disability

Disability is not a human attribute. In any stage of life, almost all of us will experience difficulties in our body functioning for temporarily or permanently due to accident or of old age. According to (World Health Organization, 2011), disability occurs as a consequence of barriers they face in the environment or society which limits their

rights to equal participation in the social activities. There are around 600 million people disabled worldwide (Loiacono & Djamasbi, 2013).

In the recent years, the perception on viewing disability has changed dramatically. With the help of the organizations related to disability, research in the field of health science, and various movements, disability is no longer seen as an issue in the human body, however it has become a human rights issue. Lately, instead of separating them from the society, the policy regarding their human rights has changed towards social and educational inclusion so that they can live normal life without any feelings of discrimination.

Earlier, the concept of disability according to medical model was that disability is an issue resulted by the deficiency in the human bodies (Fuglerud, 2014). It was perceived as the loss or damage of the physical or biological abilities. Later, this medical model is transited to social model where disability is perceived as the barriers disabled persons face on the societies rather than the limitations of their bodies. The concept of social model is best described by the following figure.

2.2.1. Disability Gap Model

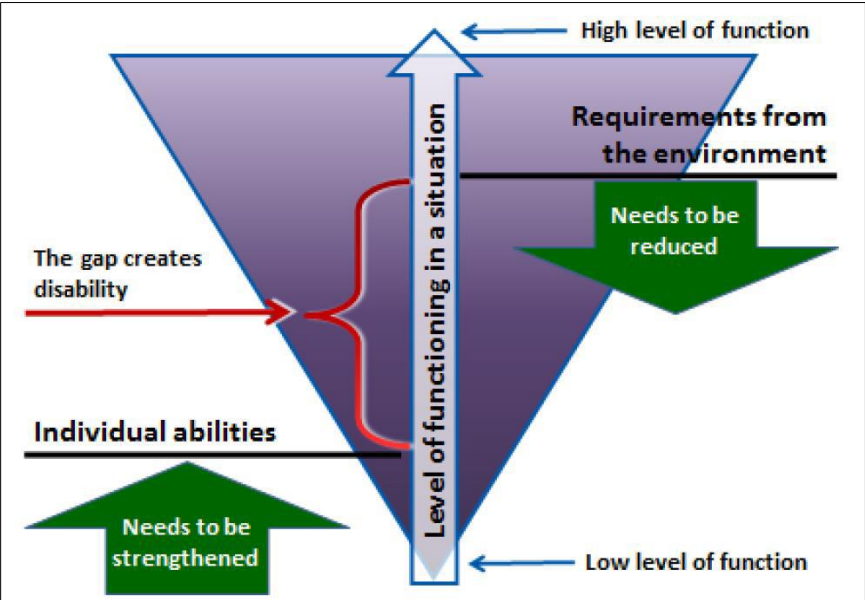


Figure 2-2: Disability Gap Model showing the relations between the requirements set by the environment and the human abilities

(Image source: (Fuglerud, 2014))

Proposed by Professor Ivar Lie (cited in (Fuglerud, 2014)), this disability gap model, as the term suggests, visualizes the concept of how the gap between abilities of human bodies and the strength require to accomplish the requirements sets by environment creates a disability. In simple, disability exists when the ability of the human bodies mismatches the demand set by the environment and society. In the above figure, the disability gap is shown with the red vertical line. Furthermore, the demand that sets a limitation line for the abilities of the human is known as the “barriers”.

2.2.2. Types of Disabilities

How people with disability interacts with the content in the web depends on the type of functional limitation they have. The following contains the information about the disorders in different categories of disability, how they interact with the web, accessibility barriers they experience, and the basic solution to mitigate the barriers.

2.2.2.1. Visual Disabilities

The range of visual disability can be from partial (low vision) to no sights at all (legally or completely blindness). Further, visual disability can be caused by lack of ability to distinguish certain colors (S. Abou-Zahra, 2012). For accessing the web pages efficiently, effectively and without any barriers, people with visual disabilities rely on different techniques. According to (S. Abou-Zahra, 2012; WebAIM, 2013c), some of the techniques are:

- Magnifying the contents in the web page
- Changing the color and fonts of the texts
- Converting the text into speech with Screen Reader software,
- Using refreshable braille to read the text of the web content,
- Reading or listening to text description of the multimedia content like (images, audio, video).

For the persons with visual disabilities to access the contents of the web site without any barriers, the developer must take several things into considerations. First, they

must understand that the visual disabled person does not rely on mouse and screen to access the contents. Moreover, the structure of the coding must be conducted properly so that the assistive software can outline the contents and can present it to the visually disabled users. The developer should confirm that the structure of the contents in the web and its presentation do not depend with each other.

2.2.2.2. Auditory Disabilities

The extent of auditory disability ranges from moderate loss of hearing (“hard of hearing”) to complete loss of hearing (“deafness”). Normally, many of the developers do not consider auditory disability as an issue when developing the website (WebAIM, 2013a). However, due to increase in use of multimedia in the web, people with auditory disabilities could also face problems when accessing the multimedia information.

The important aspect of the accessibility to consider for the auditory disabled people is making the contents perceivable (WebAIM, 2013a). To make the multimedia contents accessible, they should provide the captions and transcription for the video contents and transcriptions for the audio contents. Accessible operation controls to the multimedia like play, pause, forward, volume, etc. should be available. The foreground sound should be distinguishable from the noise if there are any. The first language for communication to some of the people with auditory disability could be sign language. Thus, it is also essential to include sign language in the multimedia content as possible, however, it is also important to take into considerations that not everyone with auditory disability understands the sign language. (S. Abou-Zahra, 2012; WebAIM, 2013a)

2.2.2.3. Motor Disabilities

Sometimes also known as Physical disabilities, motor disabilities can be caused by traumatic injuries or diseases and congenital disorders (WebAIM, 2012). Disabilities caused by damages in spinal cord, and lack of limb(s) falls under traumatic injuries. While, disabilities caused by cerebral palsy, muscular dystrophy, multiple sclerosis, arthritis, Parkinson’s disease, and essential tremor falls under congenital disorders.

The important aspects of web accessibility to consider for the people with motor disabilities is to make the web content operable (WebAIM, 2012). Besides, the developer also need to understand that physically impaired person finds hard to use the mouse. People with physical disabilities rely on various tools to access the web. Some of the assistive tools, they depend on are:

- Keyboard with specialized stroke design (ergonomic keyboard)
- Speech to text software,
- Mouth stick, head wand, oversized trackball, adaptive keyboard,
- Eye-tracking, voice recognition,
- Single-switch access.

2.2.2.4. Cognitive and neurological Disabilities

Cognitive disability is broad and it is the disorders caused by damages in the nervous systems of human body. Some of the disorders that falls under cognitive disability are autism, dementia, intellectual disabilities, learning disabilities, mental health disabilities, attention deficit hyperactivity disorder (ADHD), seizures, etc. (WebAIM, 2013b)

The people with cognitive disabilities finds difficult on attention, reading and understanding, solving problems, memory, intellectual capacity regarding visual, verbal, and mathematics. Some of the accessibility barriers people with cognitive disabilities find in the web are:

- Navigation structure too difficult to understand,
- Available of unusual words, and complex sentence
- Forms and functions without proper labels,
- Unclear links, blinking texts, pop-up windows, animation, etc.,
- Long paragraphs without any multimedia contents like image, graphs, etc.

Ensuring the effective communication with the people with cognitive disabilities is the straightforward measure to make accessible website for them. They use different tools to interact the web likes text-to-speech, zooming, color customization, and grammar tools. For the cognitively impaired people to get a better experience in

interaction of the web and its contents, the developer should, according to (WebAIM, 2013b),

- Provide the consistent, predictable, and clear links,
- Make the structure of the content clear and understandable,
- Provide labels to form, and other interactive elements in the web,
- Provide multiple ways for the navigation of the web (site map, search),
- Avoiding distracting contents like contents that blinks or flickers,
- Provide text and paragraph that are easy to understand and simple.

2.3. Assistive Technologies

According to the (The Assistive Technology Act of 1998 cited in (Cook & Polgar, 2014, pp. 1-3)), assistive technologies are the tools, product, system, or piece of equipment which is specifically designed and customized to increase, improve or maintain the abilities of disabled and older users. Assistive technologies bridges between the requirements demanded from the website to use it and the abilities of the disabled users. However, assistive technologies alone cannot do anything. For the users to use the web with assistive technologies, the website should be accessible (Harper & Yesilada, 2008).

For example, the blind users can interact the website with the use of screen reader software, which is an assistive technology. Through screen readers, the user can read the text in the website and can know the position and functions of the elements in the website. In addition, they can know the alternative text of the image, know the menu elements, headings, and read table information. However, if the website is not accessible, the screen readers will not properly function resulting dissatisfaction among the screen reader users.

2.4. The importance of Web Accessibility

Disable people represents large numbers. Until now, it is estimated that there are around 1 billion disabled people in the world, which is around 15% of the total population (UNESCO, 2014). This numbers represents significantly large number of people. Disability users includes diverse range of users from visual, hearing, learning, cognitive, intellectual, physical to impairments due to ageing. They represent large

number of work force and do also have billions of dollars in their disability funds (Loiacono & Djamasbi, 2013). Furthermore, the number of disabled people are increasing at a slow speed due to several factors like poor health conditions, lack of awareness, poverty, rapid spreading diseases, lack of medical treatments, and environment pollution. As a result, to address the needs of these people and to help them to live independently for longer period, and for the organization to increase the number of their customers, accessibility is an important factor to consider.

Accessibility is to ensure and respect the human rights of disabled people:

According to Article 9 of the UNCRPD (United Nations, 2007):

- The government authorities have the responsibility to take necessary approaches to ensure that the disabled people gets equal access and opportunities into the public services like physical environment, school, emergency service, information and communication technologies, transportation in everyplace whether they are rural or remote area. The reason is to encourage and let them participate actively in every aspect of life and to live their life independently. Besides, not to let the disabled people feel discriminated.
- The major areas some need to be accessible to disable people are the public areas, public services, emergency and electronic services, internet and contents in the internet, workplaces, hospitals, schools etc.

The organizations should actively take participation in ensuring that the service they provide to the users are accessible to the disabled people also. They can do so by:

- Following some standards or guidelines so that the states parties can provide the service accessible to the disabled persons,
- Monitoring, developing, and implementing the guidelines organizations follow,
- Providing enough training to the stakeholders, the webmaster, and the product owner about the importance of accessibility and the issues faced by the disabled people, and

- One should plan the accessibility of information and communication technologies from the early stage in the process of development life cycle to develop these technologies at minimum cost as possible.

Accessibility is required by national and international legal. Not only ethically, the development of accessible website is becoming legal requirements in many countries. Countries like USA, Norway, UK, Australia, and many other countries in Europe has adopted the legal requirements for the services to be accessible to every kind of users (Loiacono & Djamasbi, 2013). In addition, developing countries are also implementing the legal requirements for accessibility. The legal requirements enforce everybody in the country to make their service accessible to disabled people so that everybody can participate in the society and live their life independently.

However, lack of effective governing by the government regarding accessibility policies has resulted in many concerned organizations not implementing the accessibility in their service they provide. On the other hand, in some countries there has been case filed by the disabled persons against the organizations for not providing accessible service although they are bound by the legal requirements to make their service accessible (Web Accessibility Initiative, 2005). As a result, some of the organizations has ended paying compensation for not obeying the legal requirements. In addition to the compensation cost, the organization might also loose the reputation.

If the disabled user felt discriminated or excluded from the service, they can complain the case in the court resulting the organization in paying the compensation. One of the example of such case is that in July 1999, a blind by-birth web user cased a file against Sydney Olympic Committee because the page they developed to provide information about the Olympic in Sydney was inaccessible ((WAI), 2009). Besides spending almost \$2.2 million ASD in fixing the accessibility issues over 368 working days, the committee were required to pay compensation around \$20000 ASD to the case winners.

Accessible web system provides equal opportunity and participation in the society. The web has become important assets in our daily lives because of its unlimited access to information and interaction in the sector like education,

employment, commerce, health sector, science etc. (W3C, 2005). Likewise, Public Media has played vital role in providing general education and public debate and internet has become the easiest and popular way for accessing it. It has been and is important sector as it provides freedom of expression and foundation of democracy (Kessel et al., 2014a). Hence, to provide everyone equal access and equal participation, public media along with the above-mentioned sectors on the web should be easily accessible fulfilling the special needs of disabled person. In addition, providing accessible content to the special needy people will also motivate them to do something on their own.

On the other hand, the numbers of elderly people are accelerating. In 2010, the number of people aged 65+ overall in the world were 524 million and report from “*Global Health and Aging*” predicts that one in every five people will be 65+ by 2050 ((WHO), 2011). As the people grow older, they starts to have impairments on vision, hearing, physical disability, and cognitive ability ((WAI), 2010). The number of older people represents large number thus it is not a good idea to avoid them. So, accessibility of web page not only helps disabled people, but also the older users can get benefits from the accessible web leading them to leave independent life.

Accessible system helps to increase the number of customers and furthermore the revenue. To accomplish simple task, people are becoming dependent in the technology media. Moreover, due to competence, people choose over good designed technologies because it provides comfort and to use it efficiently. According to (Grantham, Grantham, & Powers, 2012), non-accessible system or program has chances of 10 to 20% of declination of customer and in today’s world accessibility can significantly affect the loss and profit factor of the business. The accessible website could reach to wider range of user giving good experience to the disabled people, increasing the revenue of the organizations. Therefore, accessibility is an important issue to re-consider from organization or business entrepreneur view to build accessible society in the future.

The biggest online and physical retailers of UK, Tesco, in 2001 implemented simple accessibility changes in their website (McGee, 2009). First, they tested their website with 20 varied vision impaired users and they designed new prototype according to the issues identified. Later, Tesco tested the new prototype with 70 diverse vision

impaired users. In the new prototype, Tesco implemented several key changes, which they found as a lacking factor in the old design. As a result, the total revenue from 2001 increased to £13 million Pound annually.

To save planets: Nevermore, accessible website can help to save the planets with decreasing the quantity of release of CO₂ in the environment (Olivier Nourry, 2014). When a user wants to visit a site, the data of the website transfers from the server to the user's display device. This results in the engagement of various energy consuming devices like different type of servers, wired networks, modem, routers, and user's terminal. The time needed to transfer the total data from the server to the users display device is directly proportional to the size of the data. More the size of the bytes of the website, more time it takes to reach the users, resulting in the release of more CO₂ in the environment.

The accessibility of the webpage can help to reduce the amount of release of CO₂ in multiple ways. Web accessibility encourages the webmasters to master in HTML and CSS for the display and presentation of the contents in the website. With the use of HTML tags and CSS features to present the content, the weights of the websites are lighter. Furthermore, mastering in HTML and CSS would enable the webmaster in reducing the excessive use of the codes resulting in the lesser user of the repeating tags. Lesser the size of the page, shorter the time to reach the user. Shorter time to reach the destination of users means that the heavy energy-consuming device in between the way runs for shorter period. As a result, less slip of CO₂ in the environment then the website with heavier data-size used to do.

In addition, the main goal of the web accessibility is to include all the users in the society with the customization of the website according to their requirements and abilities. Currently, the websites overflow with lots of multimedia contents. With accessible website, the vision and hearing impaired users can ignore the multimedia contents resulting in the transfer of website with less data size (bytes).

Never the less, the accessible website are well tested and evaluated by the experts minimizing the possible errors and making the code robust, which helps the browser to interpret the website in short time. In addition, the CSS style of the visited websites are stored in the user's terminal by the browser, so when the users visit the page

again, the CSS are loaded from the users' device. Thus, resulting in the transfer of lighter website.

Accessible websites have other advantages too. Accessible websites benefits people without disability as well (Sánchez-Gordón & Moreno, 2014). Focusing in accessibility has resulted in innovation (evolution of technology) (S. L. Henry et al., 2014). The people without disabilities can have negative perception over the organization if the organization do not provide any accommodations to the people with disabilities in their services (Loiacono & Djamasbi, 2013).

2.5. Web Accessibility Guidelines

Developing an accessible website is not an easy task. For to help the webmaster and organization, few organization has created a standard or guidelines where the techniques for developing an accessible website is explained (Harper & Chen, 2012; Harper & Yesilada, 2008). The following are some of the popular accessibility guidelines.

2.5.1. Web Content Accessibility Guidelines (WCAG 2.0)

Web Accessibility Initiative (WAI), a sub-initiative of World Wide Web Consortium (W3C), in collaboration with different organization and individuals, has produced an accessibility guideline, which is known as Web Content Accessibility Guideline. In 1998, WAI introduced the first version of the guideline (WCAG 1.0) (Harper & Yesilada, 2008). WAI updated and introduced the second version of guideline (WCAG 2.0) in 2008 (Consortium, 2008). This guideline entails recommendations and explanation on how the web master can create an accessible content. The accessible content on the web refers to the text, multimedia, the presentation, and the structure of the code ((WAI), 2005).

The main objective of the guideline is to become a standard to help the webmaster, organizations, and government in creating accessible website internationally. In particularly, the focus of this guideline is for,

- The webmaster,
- Developers of web authoring tools,

- Developers of accessibility evaluation tools, and
- To the people who wants to have accessibility standard. (Consortium, 2008)

The structure of this guideline is divided into four principles and these four principles contains altogether 12 guidelines. Each 12 guidelines, furthermore, contains set of success criteria. The following are the four principle of WCAG 2.0. (Consortium, 2008)

- **Perceivable:** The information presented on the website must be aware or perceivable to the users by any means of sense as they can. In simple, it must be detectable by any one of the senses.
- **Operable:** The interface and navigations of the web must be in such a way that it is easily operable by the users.
- **Understandable:** The presented information in the interface should be clear enough not to create any difficulties in understanding them.
- **Robust:** The system must be durable, long lasting, and well made enough that the evolving technologies and wide user agents can interpret it.

Guidelines: Under each principle, there are few guidelines. In total, 12 guidelines provide a baseline or structure for the designers or developers to understand the techniques to implement the guidelines.

Success Criteria: For each guideline, WCAG 2.0 has provided success criteria to confront the fulfillments of requirements in the system. Each criterion is divided either into A, AA, and AAA.

2.5.2. Section 508 Guidelines

Particularly in USA, the state agencies are required to produce accessible information and technologies to the disabled people (Loiacono & Djamasi, 2013). The US government passed the law in 1998 under the Rehabilitation Act Amendments of 1998. The guideline contains the technical criteria the government wants the federal agencies to follow when developing, procuring, maintaining, or using technologies. The section 508 wants that the disabled people, public or working in the federal agencies, has access to information like normal people.

2.5.3. BS8878

BS8878 – is the first UK based accessibility standard to tackle the accessibility issues for equal participation in the society (Ambrose, 2011). First launched in 2010, BS8878 is a standard, which is mainly focused over the process. This standard includes a sixteen steps process which provides and helps the different responsible person about the requirements for accessibility and what they can do to make contents accessible. Furthermore, the objective of this process is to provide a clear overview to the organization the key ideas regarding accessibility and what they need to consider into practice for the development of an accessibility website. A comprehensive summary of the sixteen steps are as follows (8878, n.d.; Ambrose, 2011):

- I. Identifying the scope of the products,
- II. identifying the target audience,
- III. Identifying the target audience's needs,
- IV. Identifying the target audience's preferences and restrictions on the technology,
- V. Outlining the association, the product will have on the targeted audiences,
- VI. Identifying the functions and goals the products will provide,
- VII. Identifying the degree of web-experience the product aims to provide,
- VIII. Designing of the website with the objective of inclusive design and personalized approach,
- IX. Identifying the delivery platform (hardware for e.g. Mobile, desktop, etc.),
- X. Identifying and choosing the platforms (software for e.g. OS, browsers),
- XI. Deciding whether to develop the product in house or should out-source,
- XII. Identification of the technology in the development process and its support to the accessibility,
- XIII. adapting and following any accessibility guidelines,
- XIV. integrating accessibility throughout the development plan by making test plans and allocating the timeframes to mitigate the known accessibility issues,

- XV. providing the overview of the accessibility plan at the implementation of product, and
- XVI. Identifying the plan to maintain the degree of accessibility into the product in the future.

2.6. International and National regulations

Regulations that enforces the organization to follow certain accessibility guidelines and to develop accessible website is also an important aspect that can improve the accessibility level of the website. Loiacono and Djasmasbi (2013) conducted a research where they study the aspects that can influence the accessibility level of an organization's website and found that the regulations enforcing the organizations to follow and develop accessibility guidelines can also influence significantly the organizations in developing an accessible website.

There are various international and national regulations which enforces the organizations to follow the accessibility guidelines and to develop accessible website. These regulations demand the private and public organizations to develop and implement accessible website. Besides, there are several cases where the organization is lawfully charged because they were not enable to provide an accessible website to their customer.

In present, many countries have enacted the law as well. Countries like Australia, Canada, Italia, China, USA, Germany, Hong Kong, Japan, India, Spain, Switzerland, and UK already have enacted the law and has enforced the international and national organization in its countries to follow the specific accessibility guidelines and to develop the accessible website to its end-users (J. B. S. L. Henry, 2006; Loiacono & Djasmasbi, 2013). The majority of this regulations has redirected the WCAG 2.0 guidelines as to follow (Sánchez-Gordón & Moreno, 2014).

Americans with Disabilities Act (ADA): Commended in 1990 by the US Department of Justice, this requires the business and government sector whenever necessary to provide aids to the people with disabilities unless it does not provide any burden to the organization (Lazar et al., 2013).

Section 508 of the U.S. Rehabilitation act – commended in 1998 – was introduced with the primary object of addressing the discrimination inaccessible websites provides to the disabled users (Mankoff, Fait, & Tran, 2005). Every federal organization in the US should adhere the list of requirements that are presented in the section 508 to produce accessible electronic information (Lazar et al., 2013). The act is based on the international accessibility guidelines WCAG 2.0.

In Norway, the Norwegian Government has passed a regulation in 2013 which enforces the public and private stakeholders to ensure accessibility in their ICT services aiming towards the end users (Rand-Hendriksen, 2014). The regulations states that within 2021 all the existing web solutions should meet the criteria asserted by WCAG 2.0 level AA. The regulations came in affect from July 1st 2014. This regulation is extension of Norwegian Anti-Discrimination and Accessibility Act.

2.7. Barriers in developing accessible websites

There is a growing need for the responsible parties to enhance the extent of accessibility in their online system. However, enhancing the accessibility level is not an easy as “piece of cake” and one should adopt multiple components strategies to adhere it. According to Cooper, Sloan, Kelly, and Lewthwaite (2012), accessibility of a website is determined by several factors like political (legislation), social (public awareness), and technical (accessibility guidelines), and other contextual related factors (age, ethnicity, gender, etc.). Hence, it is wise for the responsible parties to first identify the accessibility requirements and possible accessibility barriers in the development process so that, later, it will be easier for them to identify the solutions and fulfill the accessibility requirements. Some of the identified issues in the previous research are discussed below.

With the focus group of 30 professional web developers, the authors (Hong, Trimi, Kim, & Hyun, 2015) studied the influences that hinders in the process of designing and developing accessible web system. The result from the study showed that there were several influences which could affect in the accessibility website development. The identified influences were lack of publicity and awareness, lack of management’s interest in accessibility, lack of accessibility experts in the team, lack of

understanding and knowledge of accessibility, lack of accessibility evaluation, and lack of fund and support from the government.

Similarly, in another report, the author (Lazar et al., 2013) has outlined some of the reasons for inaccessible e-government websites. According to the paper, some of the major reasons for the inaccessible websites are,

- Lack of compliance activities to ensure the accessibility in the organizations from the governmental perspective,
- Providing only technical specification over a clear process,
- No clear policies on how the public and private organizations should follow the approach for designing and developing an accessible website,
- Often the responsibility of accessibility is added to the person who already has another full-time responsibility (for example, developer or designer), and
- The unfamiliarity of the developers and designer about the accessibility guidelines.

Different international organization and research has insisted using the accessibility guidelines during the development of website as it helps to address the needs of broad range of users (Jaeger, 2006; Lazar et al., 2013). However, some other research has also criticized that the guidelines are not complete and ambiguous (Hong et al., 2015; Loiacono, Romano Jr, & McCoy, 2009). Furthermore, various research has pointed that following every criterion of the web accessibility guidelines will not create accessible website (Power et al., 2012) and the guidelines are only a part of multiple components that needs to get adopted in the policy and process (Cooper et al., 2012).

In another report by (Loiacono et al., 2009) the authors has discussed various factors that could be barriers in an organization for the development of accessible website. According to the report, some of the barriers for the development of inaccessible websites are:

- The managerial person in the organization lacks the knowledge regarding web accessibility and the available guidelines to create accessible website.

They did also lack awareness that inaccessible webpages are due to lack of strong accessibility policies and lack of awareness within the management.

- The webmaster does not have adequate training for the development of an accessible website.
- The corporation did not allocate enough time for the development of an accessible website.
- Almost 67% of the participants think that the available WAI guidelines to create accessible website are difficult to apply. Furthermore, almost half of the participant thinks that the accessibility of a website is completely the technical thing.
- The webmaster lacks experience of developing an accessible website.
- Some of the webmaster even criticized that the standards are not updated regularly to catch the pace of the updates in the technologies.
- Lack of adequate budget allocated to develop an accessible website.
- The lack of legal requirements enforcing the organizations in producing an accessible website. In some of the developed countries, the legal case has motivated many corporate organizations to develop an accessible website.

Authors Lazar, Dudley-Sponaugle, and Greenidge (2004) conducted a questionnaire survey with 175 webmasters to identify the factors leading to inaccessible websites. From the survey, the author summarized that – although the webmasters were supportive to accessibility – they lacked enough knowledge regarding accessibility, lacked adequate training, unavailable of adequate tools to develop the accessible sites, lack of support from the managerial and client, and not enough time. Furthermore, some of the webmaster even responded that they do support the term accessibility, however, they will not be implementing it in the website until and unless they are required to do so by government or by the managerial level.

Likewise, in another research paper, authors (Loiacono & Djamasbi, 2013) studied the factors like size of the organization, company allocation, company revenue, IT budget, numbers of manpower in IT, accessibility testing, and legislative requirement. The objective of the research was to identify whether the above-mentioned factors has influence in the development of accessible website or not. With 96 response from

managerial level from an IT company, the survey outlined that the three major factors that has direct influence in the development of accessible website are legislative requirement, accessibility testing, and number of manpower available in the IT department. While, the studied shows that the other factors, mentioned above, have indirect influence. According to the author, legislation influences the development of an accessible website in two ways. For the first, the legislation act as a requirement for the responsible one to develop accessible website, and for the second, legislation indirectly leads to accessibility testing to ensure in the development of an accessible website.

Through user testing with blind user and expert evaluation, the author (Abu-Doush, Bany-Mohammed, Ali, & Al-Betar, 2013) studied the accessibility level of e-government web sites in Jordan. The author selected the web site which were most visited by the blind people. Analyzing the data obtained from the study, the author found out that the maximum number of evaluated sites were inaccessible. At the same time, the author has pointed out some areas where there is necessity for the improvement. The first area for the improvement was the governmental policies for the progress of accessibility. In Jordan, there were no any specific policies in the governmental legislation enforcing the government sector and private corporation to make the website accessible. Secondly, the universities in Jordan lacked the curriculum related to accessibility and universal design, which could help raising awareness among youth. Lastly, the author has pointed out the inadequate training to the webmaster as the factor influencing the level of accessibility.

As many countries has introduced legal requirement for the organization to take into consideration of the disabled users while developing accessible website, accessibility has been the major topic of discussion. Many have misconception that the webmasters are solely responsible for the accessible website, however, for the successful development and implementation of the accessible website, stakeholders are almost equally responsible as the webmaster (Lopes, Van Isacker, & Carriço, 2010).

Developers are unfamiliar with the accessibility guidelines; the on-job training does not contains the contents that exposure the developers towards the accessible guidelines and to develop accessible interface. (Lazar et al., 2013) User testing in the

accessibility is not very common practice (Aizpurua, Arrue, Harper, & Vigo, 2014). This could be due to availability of diverse range of disabilities in the society, difficulty in testing many web pages with the users, lack of knowledge in the procedure, and lack of accessibility expertise during the testing.

Summarizing the above findings from the different research, the different factors that hinders in the development of an accessible website are listed below.

- Lack of publicity and awareness regarding accessibility,
- Lack of accessibility compliance from the government,
- Lack of managerial interest in implementing accessibility,
- Lack of prioritization of accessibility,
- Lack of integration of accessibility from the beginning phase,
- Lack of understanding of accessibility guidelines and its implementation in the real scenario,
- Lack of idea regarding the responsibilities among each other in the organization,
- Lack of accessibility expert,
- Lack of accessibility testing (automated testing, manual testing, and user testing), and
- Lack of budget and time allocation for the development of an accessible website.

2.8. Recommendations for developing an accessible website

In the preface section of a book “Web Accessibility, A foundation for research” by (Harper & Yesilada, 2008), the author has mentioned that there is no one big solution to develop an accessible website. To develop heterogeneous, flexible, device independent is extremely challenging but exceptionally important. This simply sketches that accessibility is complex. To develop accessible website, one should utilize and adopt the various components that directly or indirectly affects the accessibility of a website. The following sections provide different strategy one can adopt which can help the organizations to create accessible web system.

Accessibility is not “one size fits all”. Focusing on distinct design of the website and considering it usable to every user is a misconception that needs to be avoided. For the website to be accessible, one needs to adapt various customizable techniques in their website so that diversity of the users can customize the website according to their requirements and abilities. However, understanding the requirements of various users are challenging but not impossible.

With multi-method approach, researcher (Jaeger, 2006) studied the problems related to accessibility and the causes for the inaccessibility of the websites. After analysis, the researcher has provided the following suggestions to adopt for the development of an accessible websites.

- The accessibility should be planned and integrated from the beginning of the project. If the accessibility is integrated from the beginning, it will take less effort to comply with the standards and will save the cost by avoiding retrofitting at the last stage.
- For the testing of the web system, it is essential to conduct user testing with disabled people. Since the end-product is aimed towards the disabled and old users, they are best representatives in assessing the accessibility of the web system. Accessibility evaluation with disabled users can provide specific and comprehensive result which other evaluation methodology lacks.
- For the evaluation process of large chunk of web pages, one can use evaluation tools which are freely available on the market. However, complete relying over the automated tools should be avoided as it can never replace the result other testing methods provides.
- Have accessibility expert specifically designated for the accessibility field in the development team. The expert can help the team members to evaluate the page, and to identify the techniques on developing accessible website.
- Organization and web development team members should keep in touch with the disabled users. Since their quality of assessment and feedback can help the development team members in the process of developing an accessible website, it is important to be in touch with them as often as possible.

- Accessibility testing should be the key practice in the major stages of the development cycle. The process should be iterative. The organization should keep in mind that “there is always room for improvement”.
- The team members in the development and the organization should always focus on the advantages of accessible website, its importance, and the issues the disabled users face while interacting with an inaccessible website.

Likewise, in another report, after identifying the issues that hinder in the development of accessible website, the author (Abu-Doush et al., 2013) has suggested the government to introduce legal requirement for the development of accessible website, to introduce accessibility and universal design curriculum in the universities, and to provide adequate training to the responsible person. In the accessibility training, the author has suggested to include factors like accessibility, its components, its advantages, techniques for achieving accessible website, choosing the right authoring tools, user testing techniques, and practical guidelines on using the web accessibility guidelines.

In the research (Loiacono & Djasasbi, 2013) has suggested corporation organization to go further from automatic testing to user testing and to integrate testing into the major stages of the development life cycle. To gain the proper picture of the issues regarding accessibility in their website, author has suggested using multi-approach testing. The multi-approach testing should include testing through the combination of automatic testing tools, review of the website with the expert testing, proper monitoring of the accessibility at the key stages, controlled and planned accessibility tasks, and the user testing by different disabled users. The multi-approach tools not only identify the issues but also helps corporation to solve them. However, the author has highlighted that doing multi-approach testing could increase the cost and time for the development process, but the revenue from the benefits of the website could easily overcome it.

The author has also suggested encouraging the designer and developer to think broadly, to conduct study of the latest assistive tools, available guidelines, authoring tools, and available techniques to develop an accessible website. In addition, designers are required to test the prototype of design of the website before it goes to another lifecycle. Testing the prototype at major stages can identify the accessibility

issues earlier in the process. The big steps in accessibility is to think it as a value rather than hindrance and having a positive attitude towards can help the designers and developers in achieving the accessibility (Rand-Hendriksen, 2014).

2.8.1. Raising awareness of accessibility and its importance

First and foremost, increasing awareness and understanding about accessibility in the organization is the major aspects in successfully integration of accessibility in the development process (S. L. Henry et al., 2014). When project manager, product developers, and stakeholders understands the importance of accessibility, they can allocate the required resources necessary for the development. Further, the developers and designers can efficiently achieve the goal when they are well aware with the accessibility.

Few researchers (Elcessor, 2014; Sierkowski, 2002) in their paper has claimed that the understanding and knowledge about accessibility within the developer and designer is directly proportional to the development of an accessible website. The more webmaster has the idea about accessibility, the more accessible website they will develop. For instance, understanding the complete meaning of the accessibility is very important. Accessibility is complex and it consists of several components like the type of users, technologies, context of use, and platform and deliveries (Petrie et al., 2015). Having a clear picture of what accessibility is, will provide a foundation for judging the enhancement and identifying any gaps in the development process. While lack of clear picture of any of the component of accessibility can affect the way disabled and old people uses the web.

2.8.2. High Prioritization of accessibility

From the above section “barriers in developing accessible web system”, it is clear that lack of awareness among managerial people and theirs support, lack of allocation of enough budget, and lack of time can also result in the inaccessible website. This can be overcome by highly prioritizing accessibility in the organization.

2.8.3. Integration of accessibility early into the process

To achieve development of an accessible website successfully, organization should integrate accessibility from early at the key stages in the development cycle (Jaeger, 2006; Sánchez-Gordón & Moreno, 2014). Considering the accessibility from the early stage, will help the organization to plan, to identify the requirements, and to test the prototype (S. Abou-Zahra, 2008). If the requirements for the accessible pages are identified earlier in the process, it will be easier for the designer and developer to address it earlier in the process.

Further, the issues related to accessibility can arise at any moment in the process (Loiacono & Djamasbi, 2013). Thus, accessibility testing is must in every key stage in the development process and should conduct it often. Accessibility testing early on the development process could help the designers and developers to deal with the errors as soon as possible. For instance, accessibility at IBM is integrated in the process through managerial signoff, testing against standards, and progress review. This process is moreover enhanced by the availability of the accessibility expert team (Trewin, Cragun, Swart, Brezin, & Richards, 2010).

Accessibility Integration and testing earlier in the process can help the organization to avoid the process of retrofitting in the last stage of development process. Retrofitting, the process of fixing the issues in the later stage of the development phase is extremely costly and requires in the change of the design delaying in the total duration of the development process. Furthermore, retrofitting sometimes can be impossible as some aspects of accessibility should be conducted early in the process e.g. requirement gathering and identifying the targeted audience (Sánchez-Gordón & Moreno, 2014). Research (cited in (Hong et al., 2015)) claims that, although the integration of accessibility from the beginning is costly, retrofitting the requirement of accessibility into the end of the process is 10% most costlier than the total cost of the website with accessibility integration.

Without any debate, integrating accessibility and accessibility testing from the beginning can result to higher cost, more allocation of time, budget, and resources, however, these aspects can be much higher when accessibility is considered at the last minute before implementation (Sánchez-Gordón & Moreno, 2014).

The 16 steps (8878, n.d.; Ambrose, 2011), available in the BS8878 standard, contains the procedure an organization could follow in the development of the accessible website. The standard advises to address accessibility from the beginning of the 16 steps to the end. The standard outlines that accessibility is not something that could be achieved at the end of the development process, however, it could be achieved by requirement gathering and integrating accessibility testing at the major stages of the development process. The 16 steps in the BS8878 includes the advice as defining the accessibility plan, targeted audience, collection of accessibility requirements, accessibility testing plan, and strategies after implementation to continuously test the accessibility level of the system.

Microsoft Corporation in their book *“Engineering Software for Accessibility”* (cited in (Sánchez-Gordón & Moreno, 2014)) has defined a model where they have explained about how we can integrate accessibility from the earlier stage of the development cycle. The accessibility integration model incorporates the accessibility strategy at the major stages in the traditional Microsoft Software Product Development Cycle. According to the figure, the accessibility should be included from the requirements phase where the major tasks in this stage are to plan for accessibility, providing adequate training to the webmaster, evaluating the risk, designing the business plan for accessibility, and planning the required resources.

According to the model, the furthermore tasks includes addressing UX, defining accessibility specification, in the design stage; developing the prototype with best authoring tools in the implementation stage; accessibility testing of the prototypes in the verification stage; and providing support to the people in need or getting feedbacks and supporting to them in the support and servicing stage.

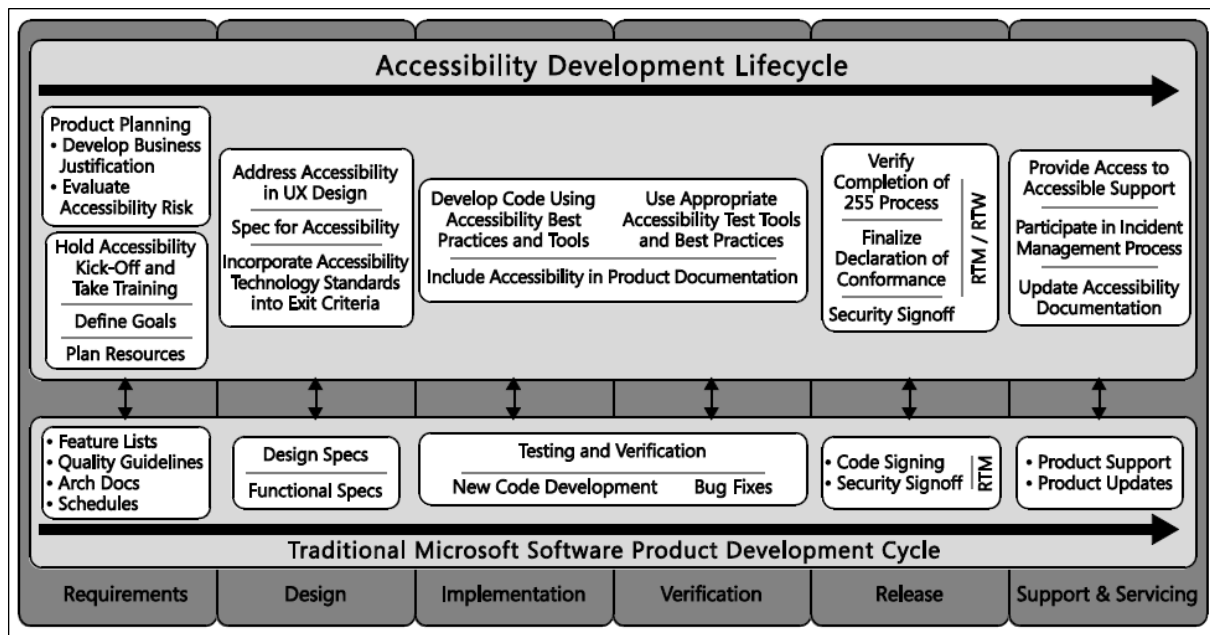


Figure 2-3: Integration of accessibility into the development cycle proposed by Microsoft

(cited in (Sánchez-Gordón & Moreno, 2014))

In the research paper (Lazar et al., 2004), the author has proposed “*web accessibility integration model*”. The model highlights the various aspects through which the level of accessibility could be influenced. The model is divided into three categories, societal foundations, stakeholder’s perceptions, and web development. According to the integration model, the accessibility level can be influenced from the society through introducing curriculum regarding accessibility from the school level, providing training to the webmaster, introducing the strong policies in the client’s side and through government, and doing research regarding accessibility and publishing its results and advantages of accessible website.

The webmaster and clients are the real person who has decision regarding the development of an accessible website. If they are not aware of the accessibility, then it can lead to inconsideration of accessibility into the website. Finally, in the third stage of the model, the authors suggest clearly explained guidelines and the right authoring tools can help the webmaster in developing the accessible website.

2.8.4. Accessibility Expert

In general, accessibility experts are the persons with profound knowledge in accessibility, its importance, and techniques to develop accessible websites. They can help the organization in several ways during the development of accessible websites. Experts can conduct and actively participate in the accessibility evaluation process, can help to find suitable techniques and standards, and provide training to team members and other responsible people in the organization.

Normally, upon availability of the accessibility expert, the responsibility of other team members will be to focus only on their specific work (Lazar et al., 2013). The accessibility expert can help team members by researching over new technologies and finding techniques on developing accessible content for new technologies. The accessibility expert can keep up to date with existing standards, regulations, and laws. Furthermore, the expert can conduct evaluations with a better accessibility evaluation plan than designers and developers. Furthermore, having an expert in-house can help providing training to web authors and to responsible persons.

The author (G. Brajnik, Y. Yesilada, & S. Harper, 2011) studied the effects of having accessibility expertise with the breakthrough method where 19 accessibility evaluation experts and 57 novice accessibility experts were required to manually evaluate the given website. The results from the study concluded that having experts on the team matters and they are important factors to have in the development team members. From the survey, the author concluded that three experts were enough to identify all the accessibility problems in the given website but to stabilize and validate the results 5 experts were required. While on the other hand, 14 novice accessibility evaluators were required just to identify all the accessibility issues. Moreover, the validity and reliability of the result produced by the novice users did not match the level of quality to that of experts. Furthermore, the experts were more confident on finding issues and took less time identifying the issues than the novice experts.

2.8.5. Guideline is not the only thing.

Implementation of guidelines is not the only thing to consider in developing accessible web system (Power et al., 2012; Sierkowski, 2002). However, being familiar with the components like situational barriers, user's agents, mainstream/assistive technologies are also crucial as accessibility guideline. Guidelines are only a part of the wide strategy that organization need to adopt to develop accessible website (Cooper et al., 2012).

For the better implementation of guideline into the system, individual countries or organization should customize and create their own version of guideline according to their needs. Furthermore, guidelines are technical documents and they are not comprehensively understood by the designer and developer (Lazar et al., 2013). In such case, the accessibility expert in the team members can provide the clear outline of the guidelines through training and how to achieve the criteria of the guidelines in the process.

To begin with the development of an accessible website, accessibility guidelines are important resources for the web masters. However, fulfilling every accessibility provisions does not guarantee fully accessible website (Jay, Lunn, & Michailidou, 2008). The web pages that are align to the accessibility standards becoming not accessible, are not uncommon. Thus, the best way to identify that the pages are accessible and user-friendly to the end-user is by conducting user testing (Jay et al., 2008; Pascual, Ribera, Granollers, & Coiduras, 2014).

2.8.6. Following and being up to date with the legislation.

The international standards, that are available in presence, are rather voluntary while the internal standards like legislation and rules can force the organization to consider the disabled users and to develop accessible website (J. M. Kuzma, 2010).

Furthermore, there are few handful cases of organized becoming sued by the disabled organization and people (Loiacono & Djamasbi, 2013). As a consequence, the organizations have ended paying large amount of sum to the people or organization who became affected by the system for the settlement purpose.

As discussed above, the legislation can help the organization in the development of an accessible website by enforcing them to do so and by indirectly leading into accessibility testing. In addition, currently, many countries have introduced the accessibility legislation into practice.

2.8.7. Accessibility Training

Undisputedly and as discussed above in the barriers for accessible website, one of the reason for the inaccessible websites are due to the lack of understanding and knowledge of web masters/authors. This is due to lack of accessibility training to the developers, designers, and to other responsible person in the organization (Lazar et al., 2004). Testing not only helps to increase the knowledge about accessibility, it also helps to perceive accessibility from the positive perspective (Jaeger, 2006). The following overview of the research outlines how accessibility training helps to raise the knowledge of developers and designer in developing the accessible website.

The Australian Government introduced the National Transition Strategy (NTS) in June 2010 proposing every e-government website aimed towards end-users to confront double AA criteria of WCAG 2.0 within 2014 (Wood & Hollier, 2013). However, the research outlined that it was difficult to achieve the outlined goal within the period provided due to the lack of skills among the web masters working for the government's website and lack of resources and funding to achieve the accessibility. As a result, the government introduced a non-award training program with partnership to one of the university in Australia. The training was for six weeks and included the topics like the importance of accessibility, accessibility policy and legislation, essential techniques to achieve the success criteria of WCAG 2.0, authoring tools, and evaluation process.

After the training, the authors Wood and Hollier (2013) conducted a survey with the participants from the training from three intakes. In the survey, the participants were allowed to self-report their skills before and after; they were asked their opinion whether the training was helpful and will they recommend to others; and to what extent the training helped them to enhance their knowledge. From the analysis of the response, the author summarized that every participant marked their increment in their skills and awareness than before, the training was helpful for the participants to

enhance their knowledge, and the participants would obviously recommend it to others.

2.8.8. Accessibility Testing

Accessibility evaluation is the process of assessing whether the web page can be usable by the people with disabilities or not (S. Abou-Zahra, 2008). Similarly, as quality insurance, to improve the degree of accessibility, the accessibility techniques should be carried out at each key stage in the development process.

For instance, in the requirement phase, the requirements that features the accessibility of the system that will fulfill the needs of the disabled users should be identified (S. Abou-Zahra, 2008). To identify the requirements, one can use techniques like personas, storyboard, and scenario cases. In this stage, it is essential to know and understand how disabled people normally interacts with the web and its content. International guidelines like WCAG can also help to outline some of the requirements that are essential to the disabled users.

In the design phase, the prototypes and mockups addressing the above identified requirements should be created. Similarly, as above, some international guidelines provide clear guidelines on designing accessible content and layout. In this stage, the evaluations of the design attributes like presentation, color schemes, navigational feature, and the document structure should be carried out.

After finalizing the design mockup, in the implementation phase, the transformation of the mockup into actual web contents begins. In this stage, a comprehensive evaluation needs to be conducted to ensure that the developed contents meet the accessibility requirements. Here evaluation can be conducted on a single page to multiple sets of combined pages. Later, in the operation phase, if the web accessibility has been focused and integrated from the beginning, the evaluation conducted in this stage are just for monitoring the quality or just for identifying the additional requirements that can achieve more accessibility level.

The process of testing and identifying the workable accessible solutions is difficult and time consuming aspects in the accessibility development. Thus, accessibility evaluation is the fundamental and important practice one should consider during the

development process. In the accessibility development process, the earlier the problems in the page are identified, the easier it will be to fix it (Trewin et al., 2010).

Although the web authors are well aware of the usability and quality problems in the system, only handful of people have knowledge and conduct the accessibility testing (Loiacono & Djamasbi, 2013). The major reason for this is due to lack of concern and awareness. The other reasons are that the accessibility testing is time consuming, and tiresome. Often the tools that are available for automatic testing do not support what developers want from them. That means the tools are unable to list out all the issues, and unclear explanation of the issues identified.

Basically, there are three kinds of accessibility evaluations. They are automated testing, manual testing, and user testing. Sometimes, combination of these different techniques is necessary according to their advantages to achieve optimal result.

Automated Testing: One of the accessibility evaluation method is through using the automatic testing tools. There are abound numbers of automatic tools which webmasters can use to test the webpage early at the process. Further, WAI has provided the list of tools the webmaster can use to test the webpage in their [automated evaluation tools](#) page. According to the page (E. E. S. Abou-Zahra, 2006), these evaluation tools are the software or online service, web authors can use to assess whether the web page meets the guideline or not. Some of the evaluation tools are freely available whereas some of them are commercial.

Basically, the automated testing is done with software tools and no any human intervention is needed (S. Abou-Zahra, 2008). The major advantages of automated testing are that it is cost effective and can evaluate multiple sets of pages in short period of time. However, the disadvantages of this testing are that it can only address a subset of accessibility guidance and it is not recommended to rely only on this method to evaluate the accessibility of a website.

These tools can help the designers and developers to check the accessibility standards and flag the issues early in the process. However, relying too much to the tools can eliminate the need of the user testing and expert evaluation, which many researchers do not recommend. Research shows that the automatic tools can only

help to identify half of the standards available on the guidelines, and human evaluations are required to test the other half. (Vigo, Brown, & Conway, 2013)

During the process of automated testing and selecting the automated testing tools, one needs to take several things into considerations. First and foremost, the available tools are obsolete meaning that they are often not updated according to the new guidelines or techniques (Schiavone & Paternò, 2015). Furthermore, relying solely in the automatic testing tools would not contribute the accessibility barriers and do not completely helps in developing an accessible website (Vigo et al., 2013).

Only using the automated testing tools for saving the cost and time is unessential for the corporation. The automated testing tools can identify some of the accessibility issues and can help the webmaster in identifying the issues early in the lifecycle but they are not capable of providing the depth issues of inaccessible website as the user testing with the real users can do. For example, the automatic testing tool can check whether there is alternative text to the images in the website but they are not capable of testing whether the available alternative text is relevant to the picture or not. To test whether the alternative text gives actual meaning to the picture or not, one should test it with the users or accessibility experts.

Testing with software tools are not enough and evaluation from human is required. As a result, the organization should not rely completely on the accessibility testing software tools but should use multimethod approach. (J. M. Kuzma, 2010) From the research, the researcher has pointed out that the evaluation tools only can identify half the issues if the chosen tools are right tools with good quality and effectiveness (Vigo et al., 2013).

Manual Testing: In manual testing, the majority of the evaluation process is conducted by the human evaluator even if they use the support software tools for accessibility evaluation. Even though the evaluator gets support from the software tools, the final decision is made by the evaluators.

The varying skills and knowledge within the evaluators can affect the reliability and validity of the result. As a result, the human evaluations are required to have expert knowledge on the matter of accessibility. Furthermore, the research shows that the

expert evaluators can judge the page more efficiently and with confidence than the novice evaluators can (Brajnik, Yesilada, & Harper, 2010; Giorgio Brajnik, Yeliz Yesilada, & Simon Harper, 2011). In addition, the analysis result produced by the expert are more reliable and valid.

Training the evaluators can help in producing the evaluation result efficiently and effectively. Research shows that (cited in (S. Abou-Zahra, 2008)) providing just brief training to the novice evaluators can improve their performance nearly by ~31% than evaluators without training. To cover the broader aspect and to validate the result, more than one evaluators are recommended in the evaluation process (S. Abou-Zahra, 2008).

Different kinds of training are required to the web masters depending on their knowledge and skills. For the novice, at first, the training should include the clear overview of accessibility, its importance, and the barriers disabled people experience during the interaction of the site. As the number of training increases, the training should be more technical and should include complex topics like user-centered design, human computer interaction, best practices, etc. (S. Abou-Zahra, 2008).

End-user Testing: In the user testing, real users are involved. Since the focus of user testing is gathering the experience from the end-users on how they interact with the system, this technique overwhelms the other two techniques discussed above. The difference between the user testing and expert testing is that expert testing provides the insight of the accessibility barriers while user testing provides the accessibility barriers in much more detail (Aizpurua et al., 2014; Jaeger, 2006). In addition to the clear picture of the accessibility barriers, involving disabled users as the end-users in the testing process can also help to identify the possible solution.

At first, involvement of users can help the web authors in identifying the requirements and accessibility barriers; during the process, user evaluation will help in evaluating the components present in the web page; and later at the end, the involvement of users can help to ensure whether the final product has meet the previous goal (Jay et al., 2008). Some of the types of user testing one can practice are interviews, observations, questionnaires, performance measures, etc.

Researchers Abu-Doush et al. (2013) evaluated the set of e-government websites in Jordan with accessibility evaluation expertise and blind users against few international guidelines (WCAG 2.0, section 508). They found that many of the websites were inaccessible. The main reasons for the inaccessible websites were that the organization and web authors find difficult adopting and implementing the guidelines in practical. Among few recommendations, the authors have mentioned that raising awareness, providing training, and customizing formal accessibility guidelines can help to enhance the degree of accessibility into the websites.

The optimal solution in accessibility testing is through multi-method. Though, each of the accessibility testing methods has their own strengths and weakness, combination of these three different methods can give a clear outline of the accessibility issues.

2.8.9. Inclusion of accessibility report in the web

(Lazar et al., 2013) in their research has outlined that the organization are required to provide, in their website, the details of their accessibility plan and the steps the organization have adopted in the conformance of accessibility. The author has outline that the report should include the accessibility feature in the website, the accessibility testing strategy and plan, the link to the result of the user testing, contact person for reporting accessibility issues, and the time period of how often the website is tested against accessibility barriers.

2.9. Disability and ICT in Norway

In Norway, according to the Norwegian Statistic Central Bureau (Statistisk sentralbyrå, 2016a), around 18 percent (~ 636,000) of people from age between 15-66 has long term disability. Among 636,000, around 44.3 percent are employed either full time or part time. Besides, the statistics outlines that the number of disabled people with part time job is higher than people with full time.

Another statistic (Statistisk sentralbyrå, 2016b) shows the details of what people, aged between 16-79, do on the internet. The numbers from the statistics shows that around 90 percent of the people between 16 and 79 years old uses the internet for sending and receiving email, for reading and accessing news, and getting online

banking service. The following figure provides a clear overview of the purpose of using the internet.

ICT usage in the population				
	2010	2012	2014	2016
Share of population aged 16-79 - Internet use				
Use of PC last 3 months	92	93	94	..
Use of Internet last 3 months	91	93	95	96
Used the internet for e-mail	83	87	89	90
Used the internet for reading or downloading online news	76	83	88	90
Used the internet for banking	82	85	88	90
Used the internet for selling goods or services	14	27	25	29
Bought/ordered films/music	25	30	33	33
Bought/ordered clothes/sports goods	32	33	39	40
Bought/ordered travel or holiday accomodation	48	53	52	54

Figure 2-4: The general overview of the use of internet for various purpose by people in Norway between 16-79 ages

(Image Source (Statistisk sentralbyrå, 2016b))

The statistics (Statistisk sentralbyrå, 2016b) has also provided the information about the types of technology device the people use to connect to the internet. From the statistics, the two most used devices by the Norwegian people to access the internet were laptop and mobile with 80 and 85 percent respectively. People with the tablet to connect to internet were in the third place with 60 percent.

Similarly, in Norway, household with higher income has moved to fiber broadband for connecting to the internet with the increment of 44 percent in 2016 from 28 percent in the year 2015 (Statistisk sentralbyrå, 2016b). In total, in 2016, around 96 percent of households had access to broadband connection increased from 91 in 2015. Only 2 percent of household connected to the internet with mobile broadband.

Statistics (Statistisk sentralbyrå, 2016b) further shows that, in 2016, 83 percent of people aged between 16 to 79 used some kind of online service provided by the public authorities. The number of old users (75-79 years old) getting some kind of service from online public authorities increased from 27 percent in 2015 to 38 percent in 2016.

The report from the statistics (Statistisk sentralbyrå, 2016b) also shows that the number of people getting governmental service from online is increasing. Around 76 percent of people who used the internet, obtained information from the online service provided by governmental or public organizations. Around 60 percent of the total online users downloaded and submitted some kind of forms available online that were provided by the Norwegian government.

The statistics discussed above provides few important message to the government and private organizations providing their service online. From these figures, organization like NRK should understand why accessibility is important in their website. Different factors like rapid increase of old age users accessing the Norwegian government e-service, large number of disability people, and blooming of people transferring from traditional newspaper to online news, indisputably represents how important website accessibility is for NRK in their website.

2.10. Norwegian Broadcasting Corporation (NRK)

With providing services through three TV-Channels, fourteen national Radio-Channels, and four website (NRK, NRK super², NRK P3³, YR⁴), NRK is the Norway's biggest and second largest media house (NRK, 2015). This public service broadcaster is state-owned, commercial-free, and politically independent. With 56 departments and 3,500 employees overall in Norway, NRK provides wide range of contents to the Norwegian people and aims uniting them (Communication Department, 2007). NRK is completely financed by the fee collected through license.

According to NRK, in 2012, around 88% of total population used at least one of the service provided by NRK (NRK, 2012). Moreover, by annual customer survey, out of 10 people who uses NRK services, nine are happy with the content provided in the services thus fulfilling the mandate of public broadcasting. The fundamental objectives of NRK are (NRK, 2015; C. D. NRK, 2007)

- ❖ To be solely independent,

² <http://nrksuper.no/>

³ <http://p3.no/>

⁴ <https://www.yr.no/>

- ❖ To provide the viewers with the current unbiased content from around the world and Norway,
- ❖ To promote the culture and language of Norwegian and Sami,
- ❖ To unite and bring every citizen of Norway together,
- ❖ To publish the world class contents, and
- ❖ To become source of experience and understanding to everyone.

In the field of accessibility of nrk.no, NRK is working hard to ensure that the contents in the website are accessible to all the users. In the accessibility report in the website, the author (Kaasin, 2014) has mentioned that they will follow the WCAG 2.0 guidelines criteria AA because it is recommended by the law. Furthermore, this thesis was proposed by the NRK with the goal of what they can do to improve the accessibility of the nrk.no.

2.10.1. NRK Website System architecture

The following figure provides a detail overview of the architecture of the nrk.no system.

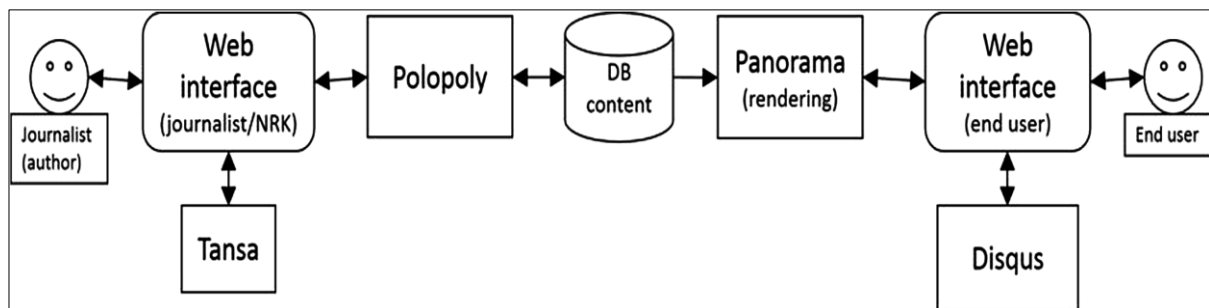


Figure 2-5: Architecture of different responsible system for creating and rendering content in the nrk.no

Image source: (Sanderson et al., 2015)

The main architecture consists of two main sub-systems Polopoly and Panorama. Polopoly is Content Management system used by NRK journalists. The journalists use the Polopoly to create, edit and manage the contents for nrk.no. Around 400 Journalist works in NRK to create articles (Kessel et al., 2014b).

The Polopoly system is also responsible for storing articles into the main database. Panorama is system developed by IT members of NRK, which is responsible for rendering the content stored in the database in the nrk.no website. The Panorama is responsible for the appearances and presentation of the articles in the different page of the website (Sanderson et al., 2015).

As shown in the figure, there are two more system Tansa and Disqus, which are third-party system. For checking the spelling of the words, journalists use Tansa. It is only available for the journalists as a plug-in in their web browsers and works with the Polopoly system. Disqus is a comments handling system and runs on the Panorama system. This free and widely used tool lets the users to post feedbacks and comments in the nrk.no website. (Sanderson et al., 2015)

On the process of creating and publishing article, journalists are first required to log in to the Polopoly system, which is a web-based interface to input the news. After login, they can type their article with selecting the correct category and correct multimedia section. They can also add different article elements like Video, audio, image, citation, maps, or links. However, during the process of uploading images, the Polopoly uses the texts of image descriptions as the text for alternative text. Afterwards, the journalists can save it to the metadata with the level of priority. In the level of priority, they can choose how important the new is and whether to upload it in the front page or not.

After storing the contents into the metadata, the Panorama will render the contents from the metadata and display it in the website according to the selected priority by the journalists. However, specialists are involved in making the decision of applying number of columns for each article, correct font size, colors, layout of the page, and overall design.

Through review of the previous research (Kessel et al., 2014b; Sanderson et al., 2015) and various other sources, this section provides the issues within the website of NRK, and the depth analysis of the barriers leading to inaccessible website. Furthermore, this section includes the comprehensive study of the procedures to follow during the development of an accessible website.

2.10.2. Accessibility Issues with nrk.no/nyheter

Four researchers from Oslo and Akershus University College of Applied Science, (Sanderson et al., 2015), conducted an evaluation testing of nrk.no with multi-method approach. In the multi-method approach, they used heuristic evaluation, focus groups, and user testing as the evaluation techniques. In the evaluation process, they tested the content of the pages against WCAG 2.0 to find out whether the contents are accessible to wide range of people or not.

The author evaluated few pages of the nrk.no/nyheter. The author did not evaluate the front page of nrk.no due to two reasons. First, the home page of the NRK is developed by the third party. Secondly, there is involvement of different tools to arrange the content in the home page of nrk.no. Similarly, in the focus group interviews, 19 participations from different user diversity took part for the process and later the researcher did interview with them. The 19 users were different in age, their abilities, sex, religion, and language. The focus group experiment focused moreover on the use of nrk.no website on factors like text, language, multimedia, structure, layout, design, and multimedia.

Findings from the focus group interviews shows that almost every user faced challenges while using the provided page for evaluation. The challenges faced by the users were in the area of navigation, color, contrast, layout, and multimedia.

However, the presence of issues in the tested pages did not completely stopped the users in using the system. Nevertheless, the issues created confusion, obstruction, frustration among the users. Thus, showing that the issues found were simple.

In the heuristic evaluation, the researcher evaluated the same pages, which the focus group users tested. The researcher tested the page with 61 criteria from the WCAG 2.0. The finding shows that among 61 success criteria, nine success criteria were not applicable to the pages. Among remaining 52 success criteria, the pages met only nine. To sum up, the pages did not meet 43 success criteria from WCAG 2.0.

From the two report, it is clear that their lies several issues within the website of nrk.no. As being the state owned and the biggest media in Norway, it is essential for

NRK to make their website accessible. In addition, the development of the accessible website has become ethical and legal requirement. Furthermore, if the users felt difficulties on using the NRK system, NRK might lose their user to the rival's organization.

3. Methodology

In this chapter of this thesis, the techniques that are involved in the collection of the data and how data were analyzed will be discussed. The first section includes the details about the data collection procedure, information about the participants, tools and environment used for the data collection, and the requirements for the selection of the participants. In addition, this section also includes the ethical considerations that were followed during the data collection.

Later, in another section, the details regarding the data analysis will be provided. The section will contain the techniques that were followed in the analysis procedure of the data. Each steps of the analysis procedure will be discussed in details.

3.1. Data Collection Procedure

In the field of Human Computer Interaction (HCI), there are several research methods from where researcher can select according to the objectives of the study. Some of the most common research methodology one can use are controlled experiment, surveys, interviews, focus groups, observations, field studies, and usability studies (Lazar, Feng, & Hochheiser, 2010, p. 20). Each research methodologies have its own advantages and disadvantages.

This thesis is about understanding and studying the process involved in the front-end development of NRK, the understanding of accessibility among the team members, and identifying the issues that are present in the development process. In this chapter, the overview of the different approaches that has been applied in this research to collect the data are discussed. Different methodologies within the qualitative research methodology are selected and carried out. According to (Adams, Lunt, & Cairns, 2008) a qualitative research emphasizes on understanding the problems areas rather than producing numerical results or measuring, which fits on to this project.

Two different qualitative data collection methodologies were chosen to collect the response from the participants. Firstly, open structure interview was chosen to get depth understanding of the development process and the strategies of accessibility

adopted by NRK into the process. The number of possible participants in the semi-structured interview were four. Secondly, based on the result from the interview, survey questionnaire was designed and conducted. The purpose of questionnaire was to reach the larger number of participants working in the front-end section of nrk.no/nyheter. The questions in the questionnaire were mainly focused on the issues identified from the semi-structured interview.

3.1.1. Semi-Structured Interviews

For this master thesis, to meet the assigned goals with better quality, combination of semi-structured interviews and questionnaire were conducted.

The semi-structured interview was chosen for several reasons. First, the interview helps researcher to understand and reach the insight of the problems in depth. Secondly, the interview provides the participants freedom to explain the answer/response in details. Furthermore, the participants feel relax and at ease giving them the opportunity to give more detail answers. Thirdly, with the semi-structured interviews, the investigator has the freedom to add further questions in between the interview (Cairns & Cox, 2008; Lazar et al., 2010).

However, there are also cons of choosing interview as the research method. Interview is normally conducted in one-to-one basis, which, in results, takes much of the time of both participants and investigators. Similarly, doing analysis after the collection of data is really time consuming and difficult. The process of transforming the recorded or collected raw data and coding it appropriately for the analyzing process is time consuming (Cairns & Cox, 2008).

When designing the interview questionnaire, several things were taken into considerations. The questions were revised multiple times to avoid the ambiguity of the questions and to make the question as simple as possible for the participants to understand. The interview was designed in a specific way where the information regarding the participants and their experience, response regarding the problems, and responses from other added questions were obtained in respective order.

Participants selection and their details

Before the selection of the participants for the interview, certain criteria were set for the participants to meet. First, the participants should have been working in the front-end section of nrk.no/nyheter in NRK, especially in design and development department. Secondly, the participants should have worked more than 2 years in NRK.

Primarily, a request was sent to the contact person for this master thesis for providing the contact list of possible participants that fulfills the above criteria. After receiving the contact list of possible participants, a mail informing the objectives of this thesis and the request for their participation was sent. Later, three participants responded to the email. However, for the interview, only two became available, a designer and a developer. The following information provides the brief information of the participants:

Participant 1: The participant has been working in nrk.no for 4 years as a designer in the front-end section of nrk.no/nyheter. The participant started working as a designer, in other section of NRK, since 2008.

The participant works as the head of designer in the “*media utvikling*” department (which means media development for TV in the internet) and even for nrk.no/nyheter in the news section. The participant also supervises the other team in digital design. The major responsibilities of the participant are to enhance process around the design, to make everything constant in the way they look.

Participant 2: The participant has been working in nrk.no for more than 4 years as a developer. The participant works as developer in the front-end development team of nrk.no.

Interview Procedure

During the process of Interview, at first, interviewee and the participant greeted each other. Then, the interviewee explained the objectives of the thesis and the interview. Furthermore, the interviewee also explained about the consent form. Later the consent form was provided to the participants. They were requested to go through the consent form once. The interviewee requested them to ask any questions related

to consent form if they didn't understand any aspects in the consent form. Later, they were asked to sign under the consent form. Participants were requested to sign two copies of consent form. One of the consent form was provided to the participants and the interviewee kept another.

After receiving the consent from the participants, general information related with the participants, their works, and the work experience was collected. Then, questions related to the main issues were asked. In between the questions, some additional questions were also asked for making the response clearer and understandable from the participants. At the end, debriefing of the response was done to round off that the participants have answered all the information they have or want to. The whole conversation was recorded in the audio device after the approval of the participant.

For the quality of the response from the participants, most of the talking was allowed to the participants, no any explanation of any questions was given, and no any leading questions were asked.

Apparatus Used and Environment

The setting environment for the interview is important and has direct influence over the quality of the interview. Keeping mind that the reliability and validity of the response is higher when the participants knows the environment better, the interview took place in the premises of NRK inside a meeting room.

There was no presence of any third member nor any disturbances during the interview. The duration of both interview was around 45-50 minutes. For the purpose of privacy and security of the collection of data, an audio recorder device without internet connection was used. Whole conversation in the interview was recorded with the audio device. Later, the audio file was transferred to the PC for the transcription and analysis process.

Objectives of semi-structured interview

The fundamental goal of the semi-structured interview is to explore the development process involved in the front-end development of nrk.no/nyheter. Research shows that retrofitting at the later stage of the development cycle to achieve accessibility is

costly and sometimes impossible (Loiacono & Djamasbi, 2013). Thus, various research has suggested accessibility to be implemented from the beginning (Loiacono & Djamasbi, 2013; Sánchez-Gordón & Moreno, 2014). Implementation of accessibility from the beginning means defining the accessibility requirement and implementing accessibility testing from the early stage. In the other hand, to ensure that the pre-defined accessibility requirement is met, accessibility testing also needs to be implemented from the beginning (Sánchez-Gordón & Moreno, 2014). Hence, to understand whether there has been involvement of accessibility and accessibility testing from the early stage or not in the development process in NRK, it is essential to study the process.

Within the study of the development process, the objective of the interview is to also study the other few factors that are involved in the process like, tools the designer and developer they use, communication between the team members, and critical factors during the process. Some of these factors have indirect influence over the accessibility of the website. For instance, communication is required between the team members to share the knowledge they have about accessibility back and forth. Furthermore, this information will also support the validity and reliability of the study of the process.

Various research has claimed that the lack of awareness, the lack of web authors understanding of web accessibility, and lack of knowledge about accessibility guideline is one among many reasons in the development of inaccessible websites (Hong et al., 2015; Lazar et al., 2013; Loiacono et al., 2009). Understanding of accessibility and its importance have positive perception during the development. Furthermore, accessibility training can help to overcome the misunderstanding of accessibility and to be prolific in the technical aspects of accessibility guidelines (Jaeger, 2006). So, the objectives of this semi-structured interview will be to identify to what extent the web authors in NRK have knowledge regarding accessibility, and accessibility guidelines. Furthermore, the interview will also explore whether NRK conduct accessibility training or not.

It is clear that for the development of an accessible website, one needs to adopt multiple strategy. One of the strategy is adopting accessibility guidelines. Although few research has outlined in their research (Jay et al., 2008; Power et al., 2012) that

only guidelines are not enough to develop accessible website, however, guidelines are a good place to start (Rømen & Svanæs, 2012). Thus, one of the objective of this semi-structured interview is to know whether NRK has adopted and followed any accessibility guidelines or not.

Similarly, another research by (Loiacono & Djamasbi, 2013) identified three major factors i.e. lack of ICT manpower, lack of accessibility testing, and lack of legislation, which affects vastly in the development of accessible website. Having accessibility expert helps organization immensely by helping to integrate accessibility early in the process, identifying the accessibility requirement, and conducting accessibility evaluation (Loiacono et al., 2009).

On the other hand, accessibility evaluation of the web system is vital to ensure that the website developed is accessible and according to the pre-defined accessibility requirement. The main types of accessibility testing are automated testing, expert evaluation, and user testing. Thus, the objective of this semi-structured interview is to find whether NRK has done any kind of accessibility testing or not. Furthermore, this interview will also identify whether there is available of accessibility expert in the NRK's development team members or not.

Design of the semi-structured interview questions

The questions were designed carefully and with the aim of “speaking the participant’s language”. Various questions were created to explore on the objectives that are listed above. The following paragraph will discuss the questions that were asked in each of the major categories.

To study the process involved in the design and development, the participant was asked to briefly explain the procedures in designing/developing nrk.no/nyheter. This was an open-ended question followed by other more specific questions like “kind of software tools they use”, “strengths and weakness of the tools”, “how they finalize the page during design/development”, “the critical factors during the process”.

Furthermore, questions on the factors like allocation of time for the designing, use of any (accessibility) guidelines, factors influencing the design of the page, testing of the design, and involvement of specific end users were asked. The response from the

participation was expected to provide information of the procedure during design and development, the tools they use, integration of training in the design, use of any guidelines, and the critical factors during the process.

To be acquainted with the opinions and attitude of participants on the subject of accessibility, their opinion regarding accessibility was asked.” The responses from the participation on this question was expected to provide information on what the participants think about accessibility and whether the participants are positive towards building accessible website or not.

To study the extent of knowledge the participants concerning accessibility and accessibility guidelines, the participants was asked about “the issues of inaccessible web page”, “familiarity with the accessibility guidelines/WCAG”, “explanation of automatic evaluation tools”, “factors that can include the accessibility of the webpage”, and “progress about accessibility in the world”. From this part, it was expected to get information regarding how well participants have knowledge regarding the accessibility, guidelines, and automatic testing tools.

Furthermore, to study the initiation from NRK to improve the accessibility of their website, the participants were asked about “reasons NRK not being able to produce accessible website” the future plans from NRK on regarding the implementation of accessibility” were asked. Besides, to know whether NRK has provided any accessibility training to the team members, the participants were asked about accessibility training organized or sponsored by NRK.

3.1.2. Questionnaire

A questionnaire is a research methodology which consists sets of questions and is delivered to the respondents through paper based survey or online (Cairns & Cox, 2008). One of the advantage of the questionnaire is that it can reach to large number of respondents in less effort. Secondly, no any special tools are required to conduct the questionnaire. However, some of the drawbacks of questionnaire are, the questionnaire could lead to biased data and the responses provided by the respondents are not in-depth (Lazar et al., 2010).

Objectives of the questionnaire

The questionnaire together with interview was chosen for this thesis as research methodology to increase the quality, reliability, and validity of the data collection. Literally, the questionnaire is based on the preliminary result of the semi-structured interview. However, the objectives of the questionnaires, to a moderate extent, are similar to the objectives of the semi-structured interview. In addition, the goal of the questionnaire was to reach large number of team members in NRK.

In brief, the objectives of the questionnaire were to

- Know the designation and responsibilities of the respondents,
- Know the level of knowledge and their perception regarding web accessibility,
- Know the knowledge about the accessibility guidelines
- Know whether they have used web accessibility automatic evaluation tools or not,
- Know whether they have done user testing with the real impaired users or not, and
- To know their views on the role of different persons in the organizations.

Design of the questions

The length of the questionnaire was kept as short as possible to let user not to feel rush to fill all the questionnaires and not to get uninterested. More attention was provided in structuring the questionnaire. The ambiguity of each word is checked for the participants to understand the questions easily. In some of the questions, the technical words with difficult meaning were defined just under the questions. Biased or leading questions and multiple questions at once was ignored. The questionnaire contained both open-ended and close-ended questions.

The related questions were kept in a common section, which could help the participants to contextualize the sub questions. The major headings (section) in the questionnaire were General Information, Accessibility Understanding, Accessibility Guidelines, Automatic Accessibility Testing Tools, Accessibility Perception, User Involvement, User Involvement Perception, and, Accessibility Testing. These

headings were identified according to the preliminary result from the semi-structured interview and background research. Some of the sections were further divided into sub-sections. The respondents were directed to sub-sections depending on the type of the response they provide.

For the General information of the respondents, they were asked their gender, designation, number of years working in NRK, and their responsibilities in NRK in their respective department. Three by fourth of the questions were multiple-choice questions. The response from the respondents is expected to provide the diversity of the respondents and their responsibilities.

Concerning the level of knowledge about accessibility and its understanding, it was difficult to assess to what extent the respondents has the knowledge regarding accessibility. Thus, few open-ended and close-ended questions were asked. The respondents were asked to “associate the term “accessibility””, “mention whether they have participated in accessibility training” “mention the resources needed to improve the accessibility of nrk.no/nyheter”. Furthermore, with the multiple choice, they were allowed to rate their level of expertise in context to accessibility and how familiar they are with any accessibility guidelines.

The choices provided in both of the objective questions were “Expert”, “Some Knowledge”, and “Very Little or No Knowledge”. These three choices were provided to narrow the range of answers the respondents provide.

Further, in the categorized sub-section under accessibility understanding, few more questions were asked related to accessibility guidelines. The respondents were asked to name the accessibility guidelines they know, and whether the guidelines they know are easy to implement or not. Besides, the respondents with no familiarity with the accessibility guidelines were asked the reasons behind it.

The aim of this section was to gather information regarding how the respondents define the accessibility, and where in the level of no knowledge to expert, they put themselves. In addition, the aim was to know whether they are familiar with accessibility guidelines or not and the measures NRK has put into effort for prioritizing accessibility into the development process.

The respondents were requested to scale (expert, some knowledge, very little or no knowledge) their familiarity with automatic accessibility testing tools. Based on the response they provide in this question, they were further forwarded to additional questions related to automatic testing tools. The other question was about naming the tools that they have used. They were also asked whether they have used the testing tools to test the nrk.no/nyheter.

To study the perception of respondents towards accessibility, respondents were asked to provide “importance regarding web accessibility”, “the biggest challenge in developing an accessible website”. In addition, they were provided the multiple options to select for the responsible person for the development of an accessible website, among the different designation in an organization. Later, the reason was asked. Through these questions, it was expected to get information about what they think about accessibility, and who they think are responsible in the organization for accessibility.

To know whether NRK has conducted user testing with specific user, and to know what the respondent think about the user testing, few open and close-ended questions were asked to the respondents. First, the respondents were asked whether there has been any real user involvement in the development of nrk.no/nyheter. Further, the respondents were forwarded based on the answer above. If they know there has been involvement of the user, they were further asked the questions like in which development phase, and how often. They were also asked about the involvement of special users and if yes, types of users too. Lastly, in this section, they were asked about the result of the user involvement and how it helped them to develop an accessible website. To the respondents who answered that there has been no any involvement of real users in NRK, were further asked about the reasons for lack of involvement of real-users in user testing.

User testing and involvement of users in the development process play an important role in ensuring accessibility of the website. From this section of the questionnaire, it is expected to get information regarding whether, in NRK, there has been involvement of real users in the development process or not. It is also expected to get information about the involvement of specific group of users and how the result was helpful if there has been any real-user involvement.

Lastly, the respondents were asked about accessibility testing to study whether NRK has implemented any accessibility testing strategy in the development process. A simple “yes” or “No” question stating “Have you or NRK performed any manual or automatic accessibility testing?” and the reason for not doing it, was asked. This gives the perception and ensures how accessibility testing integrates in the development process of NRK.

Questionnaire Procedure

During the questionnaire, first the consent form for participating in the research and explanation of the objectives of this research was presented to the respondents. The participants were given the options in the consent form to either agree with the consent form and to participate in the research or disagree with the research and not to participate. The participants who are not interested and selects “disagree” button was forwarded to the “Thank you” step. While, the participants who agreed to take part in this questionnaire were asked first about their general background information about their designation, and their work experience. Later, they were forwarded to the other section of the questionnaire.

Apparatus Used

The online [Google Form](#) was used as the tool for preparing the questionnaire. The Google Form was chosen, as it is free and simple. Furthermore, when the participation responses the questionnaire, the response is stored in the Google Form itself. In addition, Google Form sorts out the responses in the best way as a result helping the researcher for the data analysis process.

Details of Respondents

First, the contact person from the NRK for this thesis was contacted requesting for the contact details of designer and developer. The contact person provided 13 contact details. The questionnaire was sent through the email to the developer and designer. During 2 months (Apr – May 16) of time duration, only eight respondents responded to the questionnaire. The following table provides brief details of each respondents.

Table 3-1: General information of each participant

Participants	Gender	Designation	No. of years worked in NRK	Major Responsibilities
Participant 1	Male	Developer	<1 year	Front End Development
Participant 2	Female	Designer	>1 year < 2year	Designing Apps
Participant 3	Female	Designer	>2 year < 5year	Concept Developing
Participant 4	Female	Designer	<1 year	Interaction Design, user experience design (UX), and accessibility
Participant 5	Female	Designer	>2 year < 5 Year	Design, UX, accessibility
Participant 6	Male	Developer	<1 year	Front End Development
Participant 7	Male	Product Owner	>2 year <5 year	Collaborating on concept in macro level
Participant 8	Male	Developer	>1 year < 2 year	Full stack developer

3.2. Ethical Considerations

The ethical dimensions of this research will be three following major elements (Blandford, Cox, & Cairns, 2008).

Vulnerable Participants

There might be vulnerable participant in the research who can refuse to participate for any kind of reason like they are afraid or the possible participants are responsible in the process of developing the website. Or some can refuse to participate so as to get along with the critics and solutions of issues. So, this will be addressed by clarifying the advantages of universally designed website; explaining the procedure for developing accessible website and also by making clear the aims of this research.

Informed Consent

The participants will be provided the details about the purpose of this research and about the use of data. Moreover, they will be ensured that the information will be

made anonymous or will use code for the common name as possible. Also, short consent will be taken from the participants, which will mention that the participants are aware of the research goals and they will give answers as much as they know. Subsequently, they will be informed that they can withdraw from being participants in the research without giving any reasons.

Maintaining Trust, Privacy and Confidentiality

Every data will be gathered, sampled, processed, and stored according to the Norwegian data law. Later, with building trust among the participants they will be provided the opportunity to give feedbacks about this research or can add something if they want to.

3.3. Content Analysis

In the Human Computer Interaction (HCI) research field, there are numbers of complex phenomena that cannot be measured or are difficult to quantify in numbers. For instance, the complex phenomena meaning that it requires understanding the behavior of the human beings, their perspectives, emotions, norms, social values, identity, expectations, trust, etc. (Adams et al., 2008). Thus, in such kind of HCI research, researcher is using qualitative method to come up with the result that HCI wants. As, for this thesis, the fundamental objective of the research is to understand the perspective of front end designer and developer of NRK about accessibility, their attitude towards accessibility; knowledge about the accessibility guidelines, automatic testing tools; and NRK's initiation on improving and implementing accessibility on their website. Consequently, qualitative method was chosen as the research method for this research. Under qualitative methodology, semi-structured interview and survey is used to gather the required data and content analysis was used to analyze the collected data.

Content analysis is widely used process in the HCI domain where the textual information collected from the participants are analyzed with a specific pattern and break down into required inferences. Defining it broadly, content analysis is in-depth and systematic approach in compressing the large text into meaningful results based on a defined pattern (Lazar et al., 2010). Here, content is defined as the textual

information that are either collected through journals or book or through audience by conducting interview, observation, surveys, focus groups, etc. Both types of content, media and audience, was collected in this research.

Before diving into the major analysis process, few considerations were made. First of all, the numbers of data set were defined. In this research, there were two semi-structured interview (a designer and a developer) and eight responses (designer, developer, product owner) from the online survey. Secondly, after going through the data sets numerous time, unnecessary information collected through both data collection procedures were eliminated to avoid any pollution of the data and to produce result without any bias or misleading.

The data sets, then, were analyzed with the actual technical process called “coding” (Lazar et al., 2010). This is the process where the paraphrasing of the textual information in the data set takes place; the major words in the data set are identified out, and counted. Further, the coding process is divided into two, i.e. priori and emergent coding. For this analysis, priori coding was chosen. In this priori coding procedure, based on background study, the following major categories in the data set were identified.

- Procedure in the designing and development,
- Accessibility Perception,
- Attitude towards accessibility,
- Understanding and knowledge about automatic testing tools
- Knowledge about accessibility guidelines,
- Accessibility Training
- Accessibility Testing, and
- User testing.

The categories were identified according to thematic framework. Besides helping in identifying the major categories, this framework helps to describe the findings of the research (Lazar et al., 2010).

As mentioned earlier, the data set was thoroughly read to immerse intensely into the perspective of the participants and to experience what they feel regarding different

aspects about accessibility. While going through the data, further, two major task was carried out. Firstly, the important key terms were looked and highlighted. It was done as these key terms can provide vital information regarding the categories identified earlier. Secondly, any other important phrase, action, causes, and the sentence that gives important meaning in respect to the categories were also noted down.

Furthermore, during the coding of the data, for detecting vital pattern and information, question that are related to the data were asked. These questions were connected to the response they have provided. Some of the questions asked were:

- How the participants have defined accessibility and to what extent their definition of accessibility meets the common definition of accessibility?
- Have the participants got training before? When and how often?
- Are they familiar with the accessibility guidelines? Which guidelines have they mentioned?
- Have they used any automatic accessibility tools? What are the tools they have used?

Lastly, the comparison of the data was done during the coding process and later in the identifying the accessibility issues. This was done to identify the relations between the data set in different categories. For example, some of the comparison made were:

- Comparison between the experience of the participants working in the NRK and their responses in aspects of different categories.
- Comparison of the definition among the participants.
- How the participants have explained the requirement of automatic testing tools who have provided the good description of accessibility?
- Comparison of the findings with the previous literature. Do the findings match with the findings from the previous literature? Or does it differ? Why does it differ? What might be the difference?

Analyzing the data is not a big factor, however, ensuring the quality of the analysis is. As the author of the thesis solely made the decisions in the findings, the possibility of having conscious or unconscious bias towards the result could be high. Therefore, it

is important to consider the quality of the results produced during the analysis. Consequently, an examination of the reliability of the result was taken utterly into considerations after and during the coding. For the reliability of the findings, two most important factors were noted extremely.

- a. Validity: To increase the findings of the result of this thesis, the procedure in the data analysis was carefully and consciously followed without taking any leap into the next steps before not fulfilling the previous steps. The data were collected through the online Google Form and was later transferred into the database Excel so that it could be easier for the researcher to go back and to check the data again.
- b. Reliability: The challenging aspect of the qualitative analysis is to ensure the reliability of the findings as it comprehends an ambiguous data. For the reliable and consistent result, the above listed procedure was followed specifically. Various measures like, asking questions in the data, comparing the data, finding the categories were applied to increase the characteristic of the coding procedure.

4. Results

This section of the thesis consists the analysis of the data collected through both semi-structured interview, and survey and the identified accessibility issues in the development process of NRK. The first subsection will contain the analysis of the semi-structured interview. Similarly, the second subsection will comprise the analysis of the survey. Lastly, in the final subsection, the accessibility issues will be identified based on the two analysis.

4.1. Data analysis of Semi-Structured Interview

This section comprises the data analysis of the semi-structured interview.

4.1.1. Procedure in the design and development

Integration of accessibility is essential from the beginning phase of the development process to develop an accessible website (Jaeger, 2006; Sánchez-Gordón & Moreno, 2014). To study whether NRK has integrated accessibility in the development process, the study of the design and development process was conducted. The study of the process includes the factors like the task involved in each department, the time allocated for the task, rate of completion before due dates, and tools they use.

Design: The process of designing depends on what the team members has been designing and according to the type of the task. The task varies from adjusting small changes (fixing the title box, changing the size of the image, changing fonts, etc.) to sometimes changing the whole design of the page. The different tools, the designer mostly rely are Sketch and Photoshop. Mostly, they use Sketch and as based on the response from the P1, the advantage of Sketch program is that it is easier to replicate the design into the programming language and to set up style sheets.

For the smaller task, the designer does not make any communication with the other departments. However, while changing the bigger aspect of the design in the webpage, the designer consults with the developers, product owner, and stakeholders. When required, the designer works in parallel with the developer and

tries to combine task altogether during the process of changing the big aspect of the webpage.

For the designing procedure, they follow the Style guidelines, which is developed by the team member in-house. The guideline consists of constraints that the team members should follow in the designing process. The designer informs that they are still working on the guidelines since it has not been completed yet.

The designer mentioned that they create seldom something new in the design. Often, the task in the design are usually based on what has been there before. The designer has the insight that the more often they create or changes the designs layout, the more the users will experience bad user experiences. When the design is completely new or when the team has changed the greater amount of layout in the design, the designer mentioned that they conducts the Gorilla Testing. In this testing process, the team members normally go out in the public, and illustrates the design and requests the publics to provide the feedbacks.

Based on the process explained by the designer, the design process is just editing some of the elements in the page. For a longer period, NRK have not changed the layout of their webpage. Since they are dependent in the bigger changes in the layout to conduct the Gorilla testing, it is clear that they have not conducted any user testing in the design process. Further, being dependent to the Quality Assurance team to conduct the testing of the page supplements that accessibility testing is not an integral part of the process in the design.

Development: Normally, developers begins their work on programming after they receives the sketch from the designers. The designers and developer work in parallel, however, at the end of the development process, the designers are not involved. After the development work is finished, it is forwarded to the quality assurance department. Developers uses two types of tools. The developer use JIRA for the communication process. In addition, the second one is GIT, which is version-controlling system.

The developer added, “If you are talking about accessibility and how this fits into the process, we don’t have any tools for testing the accessibility, systematically or

automatically...” This provides the clear overview that NRK is lacking a clear strategy in their process for the development of an accessible website. Neither accessibility nor accessibility testing has been the integral part in the process.

Further, the developer added, “The responsibility of making pages accessible is part of the designers work so that we have correct kind of contrast, large enough fonts, and right description for the alternative text for the images...” In any organization, only designers are not responsible person for the development of an accessible website. Everybody has his or her specific role to fulfill. This generalizes that the developers’ understanding of accessibility is not ample.

However, on the other hand, the developer mentioned that, “Accessibility testing with is not quite the part of the normal flow, but sometimes we are testing our pages through Apples Platform Screen Reader...” This further summarizes that the accessibility testing is not the part of the process. Nevertheless, the team members in the development department are aware of the accessibility testing and are positive to it.

In the end, the developer added, “The accessibility has not been put in the system although the Norwegian Government has issues a law for accessible pages. As NRK being publicly funded, we must take accessible in account seriously...”

These different points from the developer and designer provides a strong basis that accessibility and accessibility testing has not been prioritized enough in the process in NRK. However, the response from the designer and developer illustrates that they are quite positive towards developing accessible website.

Dependencies: Often the developers and designers works in parallel. The designer creates some design and the developer start to convert those design into sematic code. Both team members communicate as necessary as required and they do few iterations during the project.

4.1.2. Important Factors during designing and developing

The objective of studying important factors in the designing and developing was, as similar to above, to identify whether accessibility plan and accessibility testing are considered or not in these process as the important factors.

In the design process, the critical factors are setting up clear and precise goal, coming up with a good design, understanding what the end users wants from the system, and to gather end user's feedbacks. The total allocated time for designing depends on the type of the task. The half of the total allocated time is spent on discussing and getting feedbacks from the team members and developers.

While for the development process, the critical factor is setting the due date of the task. Product owner, stakeholders, developers and designers are responsible for allocating the due dates through a meeting. Since, the number of the developers are fixed in the house, developer mentioned that they rarely finish the task in the allocated due dates. Sometimes, the due date is absolutely fixed, and the developers need to complete the assigned task in the assigned date.

4.1.3. Testing of the webpage in the design and development department

Accessibility Testing is an essential practice in the process in which the evaluation of the sites is done to identify the possible accessibility barriers (S. Abou-Zahra, 2008; Trewin et al., 2010). Furthermore, to achieve successful development of accessible website, the accessibility testing should be practiced from the beginning in the process. The objective of this study was to identify how NRK conducts the testing and whether the accessibility testing is conducted in the design and development process or not.

As discussed earlier, designer tests the page with the real users when there are big changes in the layout of the page. Otherwise, they are dependent to the quality assurance team for the testing of the product.

After the page is programmatically finished, the developer updates it into their version –controlling system and notifies the quality assurance team to test the attributes they have developed.

Based on the response from the designer and the developer, both departments are dependent on the quality assurance team to test the tasks they have completed.

4.1.4. Communication between Designers and Developers and within their team members

Communication within the team members and with the other department is necessary to discuss the issues and to get updates about accessibility. In NRK, each team in design and development conducts the communication process frequently. Each Tuesday, the designers have a design meeting, where the designer co-ordinate all the tasks that they have done, the tasks they are doing in the present, and the tasks that they need to do in the future. In the meetings, they also discuss about the task they have done and tries to gather feedbacks from other designers. They also use chatting tools for instant chatting with the designers. Furthermore, they communicate with the developers either in meeting or through email when it is necessary.

In the other hand, the developers have face-to-face talk with team members when necessary. In addition, the developers have Stand Up meeting each day for 15 minutes where they stand in a circle. In the Stand-Up meeting, they discuss the task they have completed, the remaining tasks, and the task they are doing in the present. The developers also use chatting tools to communicate with each other.

4.1.5. Opinion regarding accessibility

Normally, when the web authors possess positive opinion toward accessibility, they can commit themselves in developing accessible website. Having enough knowledge about accessibility is not enough when the web authors do not impose positive opinion towards accessibility.

Although both designer and developer has opinion that accessibility is important, they have argument quite differently. The designer has emphasized the planning of the accessibility from the early phase rather than considering at the later stage. However, the designer thinks that accessibility is the challenging aspects to corporate in the design process as it sets a boundary where they can and cannot do certain things in the webpage. As a result, the designer recommends focusing on the accessibility and understanding it before starting the designing phase. Later, the designer added that

they have some tools that measures the accessibility of the website and has pointed that NRK do not have bad designed website at all.

The developer thinks accessibility as an important aspect because as living in society we need to include everybody, for the democracy purpose, and to ensure the freedom for everyone to participate. On the other hand, the developer outlined that testing accessibility of a website with real users is the most difficult part as there are different types of disability in the society. The developer also added that although there are different types of automatic tools which we can use it to test the accessibility of a website, they are not enough in testing the real issues that disabled people face using the website. Lastly, the developer added that the prioritization of accessibility should be in the agenda and the conduction of user testing should be often to find the issues in the website.

Both designer and developer outlined few of the important aspects regarding accessibility like considering the accessibility at the early stage, the freedom for everyone to participate, and user testing with special users. Both have also highlighted few of the challenges and recommendations in developing accessible websites. This outlines that they are aware, to a certain extent, of the importance of accessibility and challenges it has.

However, based on the response, they do also have false opinion in the context of automatic testing tools and the difficulties of integrating accessibility into the design process. For example, the designer mentioned that corporation of accessibility to design process is challenging and sets up a boundary for the designers. Similarly, the developer beliefs that the automatic testing tools should have the ability to test the real issues that disabled people experience. This indicates a requirement of training to broaden the extent of knowledge concerning the misunderstanding about the accessibility.

4.1.6. Understanding of accessibility and accessibility guidelines

Accessibility guidelines are essential resources to start with while implementing accessibility in the system. As a consequence, clear understanding of guidelines is

necessary as it gives a sight of the techniques, methods, and criteria to achieve accessibility.

At first, designer insisted that he is quite familiar and confident with the guidelines that are related to the design part. However, he failed to name one. In contrary, the designer mentioned the different techniques of accessibility some color contrast, screen size, text size, and insisted that the Sketch Software helps them to measure some of the accessibility attributes that affects the visual aspects of the website. In addition, in the case of automatic accessibility tools, the designer emphasized the features of Style guidelines and its contents. At the end, the designer mentioned that he uses some extension tools in the browser but could not remember the name of the tools at the moment of interview.

On the other hand, although the developer knew WCAG 2.0 as the accessibility guidelines, the developer admitted that he has not gone through it. The developer is also aware of the organization in Norway where people or users can complain if the webpages is not accessible to them. Furthermore, the developer informed about the voting online system (valgomat⁵) they have developed in NRK in which they were failed to achieve the required accessibility level. As a result, they got complaints from the end-user. The developer mentioned that they had to put the system down. The developer also provided a thought that no any external parties are there for helping to fix the issues but the responsible organization must fix them and should target to make it more effective.

4.1.7. Responsible person for implementing accessibility on NRK

In an organization, each and every member from top executive to developers/designers have their own roles and responsibilities in the development of accessible web system. Further, it is necessary for everyone to know theirs and others responsibilities. For instance, stakeholders are responsible for allocating enough time and budget, while designers/developers are responsible for applying the techniques and practice in the development of accessible website.

⁵ <http://www.nrk.no/valg2015/valgomat/>

Although the designer emphasized designer and developer having more responsibility on implementing accessibility, the designer also mentioned stakeholders and product owners so that they could know where the designer and developer lies in the situation of accessibility. On the other hand, the developer insisted that everyone has equal responsibility. The designer added, “The product owner and stakeholders are also responsible because they must have clear picture of the accessibility of the website and during the development why it will take longer time.” Based on the response from both participants, they are well aware of the responsible person in the organization for the development of an accessible website.

4.1.8. Why NRK is lacking accessibility?

The following will outline what the participants thinks about the reasons behinds the inaccessible website of NRK.

According to the designer, there has been lack of awareness about accessibility in the house. There has also been lack of understanding about the process on how to develop the accessible website. In addition, the designer also insisted on focusing more on testing and validating code, browser testing, and accessibility testing.

Similarly, developer insisted that the accessibility problem in NRK is due to the external software they have been using for 5 years. Now they have been developing the new version of the NRK page with the supervision of research and articles and assured that there will be many accessibility features covered. Furthermore, the developer also pointed to the journalists for the lack of understanding in creating accessible articles. Lastly, the developer mentioned that accessibility should be part of the culture and the part of our process.

From these responses, one can outline that some of the major issues that NRK should address to achieve accessible web. They should prioritize the accessibility, should integrate the accessibility into the development process, provide training to the team members so that they can broaden their understanding and knowledge regarding accessibility, should integrate accessibility testing into the process, etc.

4.1.9. Accessibility Training

Many research has outlined that training is an essential approach, organization should adopt to enhance the skills of the web designer/developer and to understand the importance of accessibility (Wood & Hollier, 2013). Thus, it is necessary to know whether NRK has introduced the strategy of accessibility training or not in their organization.

According to the designer, they (developer and designer) have been discussing about accessibility a lot; however, they have not got any opportunity to participate in any courses of accessibility. The designer thinks that the discussion with the team members is the way in creating the environment and dealing with accessibility.

Similarly, the developer has replied, “We had a workshop a year ago where we got to know more about accessibility, however, not everybody from the team could get participate.” The developer insists having this type of training more as such type of training could build more confidents among them on developing the accessible pages. Further, developer mentioned about the research some companies are doing and advising the developer on the techniques to develop an accessible website. However, the developer enhanced the importance of training and prefers to have more training than suggestions.

This provides overview that there has not been frequent training for the team members in NRK. Training can increase the confidence of the team members, hence, NRK should provide training often.

4.2. Data Analysis of Survey

The fundamental goal of the survey was to measure the degree of knowledge the participants do have regarding accessibility, accessibility guidelines, and automatic accessibility testing tools. Furthermore, the survey also focused in collecting information regarding whether or not accessibility is prioritized in NKR, regarding accessibility testing, and whether there has been involvement of special users in the testing procedure. Through collection and analysis of the data from the surveys, we can identify the barriers in NRK that restricts the development of accessible website. The following sections contains the analysis of the data from the survey.

4.2.1. Diversity of respondents

In total, four females and four males responded in the survey. The respondents represented different diversity among the responsibilities they have in the NRK. Among the eight respondents, there were four designers, three developers, and one product owner. The numbers of years working in NRK was various from less than a year to more than 2 years.

4.2.2. Understanding/knowledge about accessibility

The analysis of the understanding and knowledge of respondents about accessibility was based on the several aspects as following.

Association with the term “Accessibility”: In the question, where the respondents were asked to associate the term “accessibility”, the majority of the respondents pointed out that it is an important aspect in the webpage and has provided their own description. Based on the response from the majority and summarizing their descriptions, they described accessibility as the process where the systems are facilitated for everyone to use despite their disabilities.

One of the respondent associated the term as *“That the product should be accessible for everyone, also people with major and minor physical and psychological disabilities.”* Similarly, another respondent associated it as *“to offer our contents to a broad audience, regardless of their device or preferences.”* Likewise, another respondent associated it as *“the website can be used by anyone, also those with some sort of cognitive and physical limitation.”*

Furthermore, some of the other responses associated by the respondents to the term accessibility are “disabilities, WCAG, contrast, facilitated for everyone in the world, WAI, color blindness, accessibility for blind or impaired people, and basic part of the project. It is indisputable to say that the respondents do have a basic level of knowledge.

Participation in Training: Among eight respondents, six insisted that they have participated in accessibility training either in education or in work. Among the six, three have not described where they got the training. Only one respondent, has

mentioned that they got training in the work i.e. at NRK. One of the respondent has mentioned that the respondent has been teaching accessibility and has done some projects in association with DIFI (Agency for Public Management and eGovernment)⁶.

Level of Expertise: Every respondent replied as having only some knowledge regarding accessibility. The respondent with experience of teaching accessibility and working with few accessibility projects has also chosen having some knowledge.

Familiar with accessibility guidelines: One out of eight respondents have stated that the respondent has expert knowledge on accessibility guidelines and has named WCAG 2.0 and Elmer as the guidelines he knows. Other 5 participants have mentioned that they have some knowledge regarding the guidelines and has named the WCAG guideline as the guideline they know.

Resources required to improve the accessibility in nrk.no: Two respondents did not answer this question. The remaining respondents has provided different answers.

Two out of six respondents have stated as the accessibility guidelines and setting a clear goal as the resources to achieve the required accessibility level in nrk.no/nyheter. While, another two respondents, has outlined the prioritization of accessibility, providing training to the responsible person in the house, and allocating necessary time as the required resources to improve the accessibility in nrk.no/nyheter. Similarly, a respondent has put weight on cleaning codebase, and other participants has suggested for providing training and guidelines for journalists to create accessible content in nrk.no website.

Biggest challenge in developing accessible website: Each of the respondent provided different answers on the challenges in developing accessible website. One of the respondent replied that the biggest challenge in developing accessible website is due to not having any clear guidelines. Furthermore, the respondent added that accessibility is about the people's personal preferences.

⁶ <https://www.difi.no/om-difi/about-difi>

Likewise, two of the respondent has mentioned focusing accessibility from the beginning to throughout the project as the challenging aspect. Similarly, another respondent mentioned the lack of time and resources as the challenging aspects in the process of developing accessible website. Equivalently, another respondent, has pointed out that making journalists abide by the accessibility constraints are the challenging aspects.

For the understanding and knowledge level of the accessibility, the above discussed criteria were evaluated. From the various perspective discussed above, we can encapsulate that the respondents do have basic (moderate in case of some respondents) understanding/knowledge about accessibility, however, the extent of knowledge is not adequate in the co-operation of developing an accessible website. Broadening of the knowledge is required.

4.2.3. Accessibility Training/workshop

As discussed in the above section, training in NRK is not often as it is required for the team members. Similarly, to what the developer has said on the semi-structured interview, only one respondent in the questionnaire said that they had a workshop in NRK. Other respondents, who have got training, are mostly during their studies.

4.2.4. Prioritization of accessibility in NRK

Four respondents do not have any idea about it. The inability of these four respondents for not having any awareness about how prioritized accessibility into the process in nrk.no/nyheter could be due to the lack of prioritization at all.

One of the respondent, who works as product owner, has mentioned that prioritization of accessibility in NRK is hard to quantify and stated that they do not provide contents for specific device properties.

Majority of the respondents didn't reply to this questions at all. One of the respondent, who works as full stack developer, has claimed that designers take into account some of the aspects of the WAI. However, the four designers who have participated into this survey hasn't mentioned anything about WAI. In addition, analyzing the response provided by another respondent, it is clear that NRK is

lacking the prioritization of accessibility but has focused more on the availability of the contents in different kinds of device.

4.2.5. Knowledge of Automatic Accessibility Testing Tools

Knowledge regarding automatic testing tools: Six out of eight respondents mentioned that they have some knowledge regarding automatic testing tools. However, each six of them have provided different names of testing tools. Some of the tools they have mentioned are Total Validator⁷, Web Aim⁸, and Site improve⁹, Contrast Checker¹⁰, and different plugin tools available in the web browsers that is helpful in evaluating the accessibility and contrast of the contents of the website. While two other respondents mentioned that they have no knowledge regarding the accessibility testing tools.

Furthermore, one of the respondent listed Google Page Speed¹¹ and W3C as the tools he knows. However, according to (Ivanos, 2014), Google Page Speed is an open source application designed especially for the webmasters to re-write the codes of the website to make it faster through decreasing latency and bandwidth.

Testing of nrk.no with automatic testing tools: Since only six respondents were aware with the automatic testing tools, they were further asked whether they have tested the nrk.no website with the automatic testing tools. Among six respondents, four addressed that they haven't tested the website. Only two claimed that they have tested the nrk.no site with the automatic testing tools.

Furthermore, the four participants who haven't tested the site provided the reason that it was not necessary in their job and nobody has asked them to do so.

4.2.6. Real-user involvement

Involvement of any real users and in which phase: Seven out of eight respondents mentioned that there has been involvement of users in the development

⁷ <https://www.totalvalidator.com/>

⁸ <http://wave.webaim.org/>

⁹ <https://siteimprove.com/>

¹⁰ <http://webaim.org/resources/contrastchecker/>

¹¹ <https://developers.google.com/speed/pagespeed/>

process of nrk.no. However, each respondent has provided different answers concerning the development phase in which user was involved.

One of the respondent has mentioned that the real users are the part of the feedback and testing process. Two other respondent has mentioned that there was involvement of 4-5 real users during the test of old design, before redesign. One other respondent has added that they try to involve users as early as possible in the process. Similarly, two other respondents have mentioned that there has been involvement of users but they do not have clear idea when it was done.

Furthermore, the seven respondents were asked about how often the user is involved. Similar to earlier, the response from the respondents are not identical. Some of the responses are like according to the need of the project, while making big changes, at least twice a year, etc.

The only respondent who answered that there was no any involvement of any users was asked for the reasons. The participant said that he hasn't been working long in NRK and has no any idea about it. Furthermore, the participant adds that lack of resources, budget, and often prioritizing at the end stage of the project are the often case for the lack of user involvement.

In addition, the seven respondents were asked whether NRK has involved users with special needs. Out of seven respondents, five replied yes and two replied no. Among five, two respondents said that there were users with vision impaired.

From the survey regarding user involvement, it is straightforward that in NRK there has been lack of involvement of users as often as required.

4.2.7. Accessibility Testing

Accessibility testing is the essential factor in the development of an accessible website. To ensure that the product developed is accessible, one should integrate accessibility testing from the beginning of the process. The study of accessibility testing is to identify whether NRK has adopted the accessibility testing plan in the development process or not.

In this section, majority of the respondents has replied that neither NRK nor they have been involved in the accessibility testing procedure. They provide opinion that lacks of prioritization of accessibility into the process, and low domain expertise are the major reasons for not conducting accessible testing. Few even mentioned that they do not have responsibility (order from the manager) to conduct accessibility testing.

4.2.8. Attitude towards Accessibility

Accessibility Perception: Majority of the respondents has pointed out that accessibility is important. However, only three respondents have further provided the clear explanation why they have put accessibility as important things to consider in the website. They have added that the accessible websites are easier to use for everyone and should be an obvious part of every project.

Responsible Person and why: Every single participant mentioned that Designer, Developer, Tester are the most responsible person in developing accessible website. Only six respondents have selected that management team are also responsible.

According to one of the respondent, managers need to prioritize accessibility, developers and designers need to implement and visualize guidelines, while testers needs to make sure that the goal of the accessibility plan has met at the end.

Unvaryingly, one of the respondent, has provided a clear explanation why everyone has responsibilities in developing an accessible website in an organization. According to the respondent, everybody in the organization needs to have awareness and minimal knowledge about accessibility so that they can take accessibility into considerations when they develop, design, or take decisions when implementing or prioritizing features. Further, the respondent believes and from the respondent's experience (in the previous projects) that accessibility is often kept at the end of the project and considered if there is time or resource left. Moreover, the respondent mentions that accessibility is not prioritized as required in NRK although being state company and insists that if the responsible people in NRK is aware about the accessibility, the more accessible the webpage will be.

Undeniably, from the respondent's responses we can straightforwardly summarize how they perceive accessibility as. They have agreed that everyone in the organization are responsible and increasing awareness in the organization can help to develop an accessible website. Likewise, they recommend that in NRK the accessibility should be prioritized and awareness should be increased.

4.3. Findings

In this section, the main findings, after the analysis of the data collected through semi-structured interview and online survey with the front-end team members of NRK's, will be presented. The findings will cover the major issues identified in the analysis part.

4.3.1. Lack of prioritization of accessibility in the development process

First and foremost, from the data analysis, it is evident that NRK lacks the prioritization of accessibility in the development process. Higher level of prioritization of accessibility into the policy will lead to higher number of objectives and goals to achieve it. In the semi-structured interview, neither of the participants mentioned any steps involving accessibility in the design and development process. Likewise, due date and achieving the pre-defined goals are seen as the major constraints and important things to consider in the design and development process while accessibility is not.

The response from the developer in the semi-structure interview furthermore supported that the accessibility is not prioritized in NRK. The developer responded that accessibility testing has not been the part of the system yet neither systematically nor practically. Moreover, the developer pointed toward the designer team for fixing all the accessibility issues in the design process and added that they are responsible just to ensure that the semantic of the markup is correct. The developer added that they sometimes do the testing of page with the Apple Accessibility Features available on the iPhone however highlighted that this process is not the part of the normal flow.

Moreover, through the online surveys with the designer, developer, and product owner, it was enhanced further that accessibility has not been the part of the

development process in NRK yet. Upon asking the respondents for the suggestion in developing accessible website in NRK, the majority of respondents pointed towards making it highly prioritized. The respondents admitted that they do not have responsibility of conducting the accessibility testing and many people do not have any idea of user testing with special user also denotes that the missing factors in NRK for the development of accessible website site is indeed lack of prioritization of accessibility in the development process.

4.3.2. Inadequate understanding/knowledge of accessibility

The following conclusion is drawn on the basis of responses from the participants in terms of accessibility, attitude towards accessibility, accessibility guidelines, automatic testing tools, and the responsible persons in an organization for accessibility.

First of all, when we see the opinion and definition of the accessibility by the participants, it is undoubtedly certain that they do have the understanding of how importance accessibility and who are most benefited through the accessible website. Besides, handful of the participants has defined accessibility very knowledgeably and proficiently. However, in overall, analyzing the majority of the response, there is need for broadening the knowledge of the participants as accessibility is not only about disabled people and making contents on the web easy to access (Petrie et al., 2015).

Secondly, the inability and inconsistency of the participants in answering the accessibility guidelines they have been exposed or they know also sums up that the participants do not have adequate knowledge regarding accessibility and its attributes. For example, the designer in the interview insisted to have the knowledge required in terms of visual attributes however he failed to mention any one accessibility guidelines. Furthermore, the developer in the interview, mentioned that I have heard WCAG 2.0 many times but added that he has not gone through it.

Lastly, in the surveys, none of the participants pointed out that they are expert on the matter of accessibility. The unconventional thing in the term of expertise is that a participant who has mentioned that he had worked in an accessibility organization with few websites also pointed that he has some knowledge regarding accessibility.

Besides, although half of the participants in the survey mentioned WCAG 2.0 as the guidelines they know, the responses they have provided on how familiar the accessibility guidelines are easy to implement are relatively uncertain. These all sums up that the participants in the organization do have a basic level of knowledge regarding accessibility, however, lacks the extent of accessibility knowledge and understanding to be part in the development of accessibility website.

4.3.3. Insufficient understanding/knowledge of accessibility guidelines

In the semi-structured interview, the designer said that he is quite confident with the things that are present on the guidelines about the visual parts, which is his part. However, he failed to mention any accessibility guidelines. On the other hand, the developer clearly mentioned that he knows that accessibility guidelines like WCAG 2.0 exists but he accepted that he has not gone through it once.

On the other hand, although half of the participants replied WCAG 2.0 as the guidelines they know, the majority of the participants responded that they do have some knowledge regarding the accessibility guidelines. In addition, the one of the participant who mentioned to have expert knowledge said that WCAG 2.0 guidelines would be easy to implement. While the rest of the participants provided inconsistent answers. The extent to how much the participants are exposed to the contents of the accessibility guidelines is not clear but it is sure that the participants misses furthermore quite details of the accessibility guidelines.

The design team in NRK is working and developing their own guidelines which includes the constraints for designing the components in the website. They have named it as Styles Guideline. From the interview with the designer, it is clear that the guideline focuses more on the design aspects of the components in the website for example, the size of the different types of buttons, the color of the buttons, font type, font size, and the layout of the page etc. From this it is clear that the basis for the foundation of the guideline is not accessibility rather it is the design constraints of the website. This could also result in the teams less experience about accessibility guidelines.

4.3.4. No any Accessibility Guidelines Followed

As mentioned earlier, the designer team are in the process of developing in-house Style Guideline, which focus more on the design attributes of the components on the website rather than accessibility. Furthermore, from the inconsistent answers from each participant in the matter of accessibility guidelines, it sums up that NRK has not followed any guidelines to make the website accessible.

4.3.5. Lack of training/workshop

Only the developer from the semi-structured interview mentioned that there was a workshop regarding the accessibility in NRK. The developer added that only few team members from the front-end got to take participate in the workshop which was just for a single time. This informs that not all team members got to take participate in the workshop. Besides, a workshop is not enough for the team members to get full knowledge on accessibility and raising their confidence on developing the accessible website.

Similarly, in the survey, six out of eight said they have taken participation in accessibility training/workshop. Among six, two got training during their education, one has been teaching and has worked in some accessibility projects, and one got to take participate in short workshop organized by NRK, and the remaining two didn't explained clearly where they took the training. The confidence and consistency of the participants in answering different questions has shaded their knowledge regarding the accessibility. From the overview of the response from the participants in both procedure, it sums up that there has not been relatively regular accessibility training to the team members in the NRK. As the year goes by, there has been major updates on the techniques, successful criteria, and has development concerning the fulfillment of these criteria on the different platforms and device. Thus, having training once in a while is not enough. To get frequent updates and to get familiarity with the techniques and ideas, the training program should be regular where all the team members from each department of NRK should get opportunities.

4.3.6. Lack of User Testing

The developer and designer admitted that there has not been main focused on the real user testing. Furthermore, they also informed that the real user testing system takes place when there is major change on the webpage of NRK. On the user testing system, they go on the street and asks the persons about the new design, their feedbacks, and the expectations from the new system. Furthermore, they admitted that they have only done once such kind of testing.

Similarly, from the survey, there came different answers. One participant informed that real users are a part of the feedback and testing process. Other three participants informed that there were 4-5 real users, which tested the old design of the website. Another participant responded that NRK involve users as early as possible when making any big changes. Three participants responded that they have not been long working in NRK and do not have information about this matter. Although the answers from the different participant is not consistent, it is clear that there has been involvement of real users at times. However, the problem is the user testing is not so frequently as required.

4.3.7. Lack of accessibility testing

The developer in the semi-structure interview distinctly informed that, in NRK, they have not included any accessibility testing systematically or automatically. The developer in the house conduct some accessibility testing in their iPhones as the majority of the developers carry the iPhones. They use the accessibility features available on the iPhone like screen reader. However, the issue is that this is not a normal flow rather a voluntary practice. Furthermore, the developer insisted that accessibility page is not put into the system although the law from the government has required all the organization to follow the accessibility guidelines and to make the system accessible to all.

Similarly, in the survey, there is irreconcilable results obtained in the accessibility testing. More than half of the participants are unaware of this process in the NRK. Only two participants mentioned that some 4-5 blind users tested their system once.

4.3.8. Lack of Accessibility Experts

First of all, during the interview, both of the participants did not mention anything about the availability of an accessibility expert in the house. Secondly, from the survey, nobody mentioned anything about an accessibility expert in the whole questionnaire. Thirdly, in the survey, one of the respondents outlined that the respondent has the responsibilities of “Interaction Design”, “User Experienced Design (UX)”, and “Accessibility”. This sums up that NRK lacks an accessibility expert in the team members whose responsibilities are assigned to the accessibility of the NRK website.

5. Discussions and Recommendations

This section includes the discussion of the barriers identified in the result and the recommendations NRK can imply in their process to improve the accessibility of their website.

5.1. Discussions

Findings from this thesis outlines that there exist several factors, which have hindered in the development of an accessible website of NRK. The barriers are drawn from the study of the development process, organizational strategy, and web authors involved in the development process. The identified accessibility barriers from this research are as following:

- Lack of prioritization of accessibility into the development process,
- Not enough accessibility training,
- Absence of accessibility expert,
- Lack of accessibility testing, and
- No any accessibility guidelines followed

In the first place, the prioritization of accessibility in the NRK appears to be low then required. From the semi-structured interview and survey, no any distinctive plan and strategy for achieving accessibility was found. Furthermore, the participants and respondents also added that NRK has not highly prioritized accessibility. According to Foley and Regan (2002), prioritization of accessibility will allow organization to

- have a clear vision or plan to achieve accessibility,
- integrate and implement the accessibility from the beginning phase of the project,
- adopt accessibility standards/guidelines,
- allocate enough budget and time,
- raise awareness within the team members and in the organization, and
- To implement accessibility evaluation early in the development process.

Furthermore, employing accessibility plan will provide the prospect for the organization and team members to understand the issues the disabled people face

while accessing the online contents, importance and benefits of the accessibility and accessible online solution, and the techniques and process to design and develop an accessible online system.

Due to low prioritization of accessibility, lack of awareness, and organization's less interest towards accessibility, accessibility is not considered at all in many organizations (Hoffman, 2014). Accessibility has become an afterthought even if the organization has considered it. The organizations perceive it as something that can be fixed or could be maintained at the final stage of the web development process. However, research (Sánchez-Gordón & Moreno, 2014) shows that retrofitting accessibility at the later stage of the development cycle is costly and even sometimes impossible as it requires accessibility to be planned from the beginning stage of the development cycle. For the successful development of an accessible website, accessibility and accessibility evaluation should be a fundamental aspect of each major phases in the development cycle. Integrating accessibility evaluation into the development process helps organization to ensure whether the proposed accessibility plan has fulfilled or not.

In the second place, the finding indicates that NRK does not provide or conduct accessibility training as often as required for the team members. Training/workshop/course is important in building and expanding the knowledge about accessibility (Abu-Doush et al., 2013). Accessibility training can have several advantages such as the team members can broaden their knowledge on accessibility, its important components, its advantages, barriers resulting in inaccessible website, accessibility standards/guidelines, and techniques to develop accessible web pages.

The team members working in the front-end section of NRK have basic understanding/knowledge about accessibility and few misconceptions. The inadequate knowledge of participants in NRK could be the due to less training and low prioritization of accessibility. Knowledge about accessibility means having profound exposure towards different aspects of accessibility such as, the attributes of accessibility, its importance, barriers the disabled people face in accessing the web page, international and national laws and regulations, accessibility guidelines, techniques on developing accessible web pages etc.

Different research has found that the degree of accessibility knowledge of web authors directly proportional in the development of an accessible website. The more understanding the web authors have, the more accessible website they will develop (Petrie et al., 2015; Yesilada, Brajnik, Vigo, & Harper, 2012). Thus, having adequate information about accessibility is must. In addition, having a proper understanding of the accessibility will provide a clear overview of responsibility the team member possesses in the development of an accessible system.

Furthermore, research shows that lack of training to the team members has resulted in the bad accessible of the online system (Lazar et al., 2013). With lack of training, the team members are not comprehensively exposed to the standards, the techniques, and the updates in the new technology and designing accessible solutions. Researchers S. L. Henry et al. (2014) has mentioned that raising awareness about accessibility and understanding about accessibility issues can also help the team members to integrate of accessibility into the development process. Therefore, it is very essential for NRK to devote on providing training to their team members.

As over time, there are lots of changes in the technology thus occurring changes in the accessibility as well. To catch the pace of the updates and to be up to date, the team worker must have training frequently. Training can help them to learn new techniques, the issues disabled people face during the accessing of online system in the new technologies, etc. Thus, the accessibility training should be often and every team members should have the chance to participate. For the accessibility training, organizations can hire third party organizations who provides services on providing accessibility training to the web authors. In the other hand, having accessibility expert in the team can also contribute organization in conducting accessibility training.

The findings from this thesis shows that, in NRK, they do not have any accessibility expert in the team. One of the reason for the development of inaccessible website could be the missing of accessibility expertise in the development team (Aizpurua et al., 2014; Hong et al., 2015; Yesilada, Brajnik, & Harper, 2009). Having an accessibility expert in an organization has many advantages. An accessibility expert can help organization in providing training, creating accessibility plan, integrating accessibility into the development process, and to monitor the accessibility of the

website (Giorgio Brajnik et al., 2011; Yesilada et al., 2009). Although, it can be costly, having an expert in the organization for full time, however, when seen it in the long run, the advantage of having an expert and his/her contribution in the development can suppress the cost.

Besides providing training, accessibility expert can intrinsically help organization to conduct evaluation process i.e. automated testing, manual testing, or end-user testing. Research shows that the quality, reliability, effectiveness, and significance of the result produced by the expertise are immeasurably and distinctly better than the results produced by the non-experts (Giorgio Brajnik et al., 2011; Yesilada et al., 2009). In addition, they can have more confidence in the evaluation of websites, can have extensive knowledge in comparison to the other non-expertise, and can identify issues and rate pages diversely and differently.

Moreover, researcher believe that better communication with web authors regarding accessibility barriers and solutions could easily solve accessibility issues and greatly improve accessibility of the web (Pascual et al., 2014). Expert can initiate and take the lead helping the team members to have better communication with reference to accessibility.

From this study, it was found that NRK do have their own guidelines which contains the constraints that designers need to follow. However, this study did not explore in depth whether the guideline is based on any accessibility guideline. In addition, from the questionnaire and interview, it was summarized that NRK have not followed any accessibility guidelines. Research shows that accessibility guidelines are the good things to start with (Rømen & Svanæs, 2012). Conformance of any accessibility guidelines in the development process correspondingly enhances in the development of an accessible website. Thus, many researcher has recommended for following the accessibility guidelines.

However, relying only on the accessibility guidelines is not a wise thing to consider in achieving accessibility. The results show that only around half of the accessibility issues people faced on the website are fulfilled by fully adopting the success criteria of the guidelines (Power et al., 2012; Sierkowski, 2002). Furthermore, the guidelines

are technical documents and in-depth training are required to understand it (Lazar et al., 2013).

Likewise, from the findings, it was found that NRK do not have any strategy for accessibility testing. In the interview process, the developer mentioned that they used the accessibility feature options available at the iPhone to test nrk.no/nyheter although it was not a normal process in the development. Neither the NRK organization has asked them to do the testing. However, the practice demonstrates that the web authors are positive in accessibility and conducting accessibility testing.

Different research has outlined the lack of accessibility testing as one of the major hindering factors in inaccessible web system (Hong et al., 2015; Loiacono & Djamasbi, 2013). Accessibility testing is the process of evaluating whether the page developed is accessible or not. This is the essential part in achieving the accessibility of a website. Research shows that the accessibility should be integrated into major stages of development life cycle to ensure the accessibility from the beginning and avoiding retrofitting at the end (S. Abou-Zahra, 2008).

The lack of accessibility training in NRK was furthermore supported by the lack of frequent involvement of real user testing. Lack of real-user testing is also one of the major reason in inaccessible website. As from the research, it was clear that they have not involved end-users as frequently as required. For the development of an accessible website, it is essential and important to consider the involvement of the end-users (Aizpurua et al., 2014; WAI, 2010a). The earlier users are involved, it is much safer and secure for the organization in producing the accessible website and saving their budgets avoiding last moment's retrofitting.

Involving the end-users from the beginning phase of the project can provide visual perception over what they feel about the system, how they interact with the system with assistive technologies or adaptive strategies, and where they might have the accessibility issues in interacting the system. Furthermore, this process of involving user can help the responsible team members to understand what the users want from the system thus providing them the better idea and implementing the user requirements effectively. Understanding the accessibility issues, further can help the team members to plan better accessible solutions on the future project, to select the

suitable choices, to better understand and to have clear overview over the accessibility standards and guidelines, to avoid wasting their important times on going back and editing the accessibility issues, and making compromises (WAI, 2010b). This will not only improve the accessibility issues but it will also make the overall system usable to everyone.

However, finding special end-users is not an easy task, can be time-consuming, and challenging. Besides, several considerations must be taken while selecting the users for the evaluation. According to Aizpurua et al. (2014), reliable result can be obtained by the special users if they have good knowledge regarding the use of the assistive technology, navigation in the website, and if they know about website accessibility. Furthermore, the setting environment where evaluation takes place, questions, and task give to the participants also influence validity and reliability of the result. In the process of user testing with special users, evaluators have to analyze the obtained result from the participants and should identify the accessibility issues. The evaluators also need to consider the factors that could bias the result of the evaluation like the selection of the disabilities for the participation, methods used, and interpreting results from the data.

From the result, it was also found that NRK haven't prioritized automated testing. Low prioritization of automated testing tools can be due to lack of awareness, lack of accessibility training, and lack of prioritization of accessibility. Automated testing is widespread practice and can help developer and designer in identifying the accessibility barriers early in the process. The web author in NRK can also benefits the advantages of automated testing tools as it can also outline some of the accessibility issues early into the process. However, over-reliance on the automated evaluation should be avoided as it can entail the other two evaluation methodology namely manual and user testing, outlines the research (Vigo et al., 2013). The research has also outlined that the automated testing tools only cover the half part of the WCAG success criteria.

5.2. Recommendations

The following includes the suggestion for NRK about what they can practice to develop accessible website. The list is drawn out based on the findings from this research and previous research on related fields.

5.2.1. High Prioritization and implementation of Accessibility into process

Essentially, for any organization like NRK, to make their web application accessible, the priority of accessibility should be high in the development process. Accessibility is not an afterthought aspect in the development of the website and therefore it should be planned properly from the beginning of the process. Providing higher prioritization and implementing it in the process will let NRK to plan accessibility properly and from the beginning phase. Furthermore, it helps NRK to allocate enough budget and time required, to think about the accessibility guidelines they will follow, laws and regulations they are obliged to, tools and techniques to use that supports accessibility, and the most important thing is that they will include accessibility in the major phases during the development process.

At the first place, as seen from the analysis, in NRK many of the accessibility issues in their process is due to not prioritizing accessibility at the first place and not implementing it in the process. This will let NRK to make accessibility as the part of a project requirement. Furthermore, allocating accessibility into the different major parts of the process will give NRK the opportunity to test it and to take fast action if something unplanned happens. In brief, the prioritization of accessibility in NRK will leads to:

- Integration of accessibility and accessibility testing into the major phases in the development cycle,
- Raising awareness among the team members, stakeholders, and produce owner,
- Allocating enough budget and time during the development,
- Providing frequent accessible training to the team members,
- Frequent user testing with diverse (special) users, and
- Implementation of accessibility guidelines into the process.

Integrating accessibility and accessibility evaluation from the beginning of the project obviously will take more time and cost than the normal development process. Furthermore, having an accessibility expert in the team can further add the cost. Thus, NRK should allocate enough time and budget for accessibility. At first, it seems that the development of an accessible website could be costlier, however, over the long run, the advantage factors of accessibility like accessibility website reaching to larger number of audience, positive perception from the normal users, and increase in revenue can help to surpass the cost.

5.2.2. Following or customizing accessibility Guidelines

NRK should follow or customize accessibility guidelines. Accessibility guidelines can help NRK to start implementing accessibility practice into the process. For the easiness, NRK can customize accessibility guideline according to the needs of the website. The accessibility guideline can help NRK by:

- Providing important resource to start implementing accessibility in the website and in the development process.
- To ensure that the regulations enforced by the government are fulfilled.

5.2.3. Increasing awareness among stakeholders, product owners, and team members

The awareness about accessibility among the developers and the responsible person in the organization are also dependent in the development of an accessible website (Sierkowski, 2002). Thus, NRK should also train and raise awareness among the managerial, stakeholders, and product owners. Raising awareness among these people will help NRK to

- Understand the accessibility and its importance,
- Allocate enough budget and resources required,
- Integrate accessibility from the beginning, and
- Conduct accessibility evaluation.

5.2.4. Provide training to team members

One of the important aspect NRK should consider is providing training to its team members and recommending various helpful resources to broaden their knowledge about accessibility. Through the training and useful resources, team members at NRK can expand and broaden their awareness and understanding about accessibility commanding themselves into developing an accessible system. Furthermore, the training and resources can help the team members to identify the correct tools and techniques to evaluate the web page, to integrate these techniques into their task, and to provide reliable and consistent results. Training can help the team members to

- Expand their knowledge about accessibility, techniques, and guidelines in developing accessible website
- Understand the importance of accessibility
- Understand the accessibility evaluation and the procedure involved in it,
- Be more confidence, and
- Get updates with the recent technologies, guidelines, and other aspects that could influence in the development of an accessible web system

5.2.5. Having accessibility expert in the team

NRK is a gigantic broadcasting organization which is state owned and provides various services through different web platforms. Therefore, it is inevitable to have an accessibility expert in the NRK. Since, the accessibility testing should be integrated into the major parts of the development process and in each steps the procedure of the testing is different, it is essential to have an expert in the domain of accessibility testing to achieve the best practice and reliable result (Sánchez-Gordón & Moreno, 2014). The advantages of having expertise in the development team, according to Yesilada et al. (2009), are:

- Interpretation of the result effectively, efficiently, and confidently,
- can help to conduct training to the team members and responsible person, and
- To build accessibility plan and to integrate accessibility from the beginning.

5.2.6. Accessibility testing at the major development phase

NRK needs to enact accessibility testing at the major phases of development like in project planning, designing, developing, testing, and during implementation.

Integration of accessibility testing at major stages can ensure that the accessibility enactment into the system is to fulfill the objectives of developing accessible webpages (Sánchez-Gordón & Moreno, 2014). Integration of accessibility into major phase will:

- Ensure whether accessibility is according to the plan,
- will help to identify issue, if there are any, at early stage of the process
- will help to minimize the process of retrofitting at the end

Accessibility testing is the process of identifying the barriers and making the quality of the system better than the previous. However, testing is not an easy task. Further, the evaluators with less experience can find themselves producing variable and unreliable results. To conduct the conformance testing with WCAG 2.0, WAI recommends having expert (Brajnik et al., 2010). For NRK to produce a reliable result from the accessibility testing, they should have a well-qualified expertise on the field of accessibility.

In addition, there are various accessibility testing techniques NRK can implement. The major accessibility techniques are, according to (Brajnik et al., 2010):

- Inspection: In this method, an evaluator inspects the web page with the criteria from a set of guidelines. The most popular inspection method is conformance testing (heuristic evaluation). To provide the efficient and quality result in the inspection, the evaluator needs to have a greater understanding of the guidelines, ability to review, and to recommend solutions (Brajnik et al., 2010).
- Automated Testing: In this method, an evaluator tests the web page with automatic accessibility evaluation tools to verify to what extent the web page meets the conformance criteria of a guideline.

- Screening Techniques: In this process, evaluators try to interact the web pages and try to identify the barriers by acting the role of how the disabled people uses the web page.
- Subjective Assessment: Evaluators gathers feedbacks by hiring set of users who explores and interacts the web page.
- User testing: Evaluators conducts formal or informal testing with the real users where the users are asked to goal-based task. The behavior and feedbacks of the users are noted by the evaluators.

5.2.7. Providing the knowledge about automatic evaluation tools

The team members in the NRK should have knowledge about the automatic evaluation tools, its advantages, and the process in accessibility testing with the tools, and the kinds of errors the tool identifies. NRK should identify few automatic testing tools according to its performance and should provide training about it to the team members. Advantages of automatic evaluation to NRK can be:

- Identification of accessibility issues at the early stages,
- Saving of time and cost in the evaluation process,
- Easier to use for the non-expert team members

However, it is not good to be always reliable on the automatic tools to test the pages since it does lacks the judgement from the human perspective. Unless the result generated by the tools are interpreted by the expert evaluators, it is not wise to rely completely on the results the tools have produced. In addition, the tools do not determine the conformance of accessibility, however, it only contributes.

5.2.8. User testing with real users

Some of the literature has criticized over the accessibility guidelines metrics over emphasizing more on the properties of website attributes (technical artefacts) rather than providing emphasis on the needs of the user and their requirements.

Accessibility guidelines are only a part of broad approach on developing inclusive system to the diverse user. The approach is not only measuring the success criteria of the guidelines but also measuring the positive experience of the end users.

(Cooper et al., 2012)

To ensure that the people can use the site according to their preferences, NRK should conduct user testing with diverse special users. Testing of the system with the users is the essential part in ensuring an accessible website. Furthermore, such testing will help NRK to identify where the users has concern in interacting with the website. In addition, NRK must consider different aspects before assigning the users for the testing. The attributes of users like their levels of expertise in using the computer, their knowledge in terms of accessibility can also effect the result. (Aizpurua et al., 2014)

6. Conclusion

Web accessibility has become an integral aspect in web due to its broad importance. Organization should focus on accessibility because of human rights, ethical issues, large market benefits, requirement from the law, for designing better products, and for better perception from the people with and without disabilities.

This research provides the insight of accessibility barrier in the development process, organizational strategy, and people involved in the development process.

Organization can increase the accessibility level of their websites by avoiding the barriers identified in this research and following the recommendations provided.

In this research, to identify the accessibility barriers, factors like the front-end development process, the organizations strategy, and the people involved in the development of NRK were evaluated. With qualitative data collection approach i.e. interview and questionnaire, and content analysis, the evaluation of the above-mentioned factors was done.

The findings from this research depicts that there exist several issues in the process, strategy and in the people. From the findings, the inaccessible website of NRK is due to the lack of high prioritization of accessibility into the process, lack of awareness among the team members and stakeholders, lack of accessibility training, lack of accessibility evaluation, absence of accessibility expert within the team members, and lack of integration of accessibility from the beginning.

To mitigate the above identified barriers, NRK can highly prioritize accessibility into the development process, integrate accessibility from the beginning, raise awareness among stakeholders and team members, provide training to the team members, follow accessibility standards, hire accessibility expert in the development team, and conduct accessibility evaluation.

NRK is in the process of improving their accessibility issues found out by the two researchers. During the time period until the completion of this master thesis, they have done quite impressive work to improve the accessibility level of their website. Now they have developed their own home page and they have requested the public

audiences to test their site and to provide the feedbacks. Furthermore, they have also changed many layouts in the page for e.g. the video player in the webpage has got new styles of subtitle button and also help section. The help section provides the users to get information regarding how to interact with the video with only keyboard.

This pattern shows that NRK are completely dedicated in the process of improving their website for accessibility. In addition, the result from this thesis could also help them to improve accessibility.

7. Limitations and Future Work

This research has several limitations. First and foremost, not enough participants were available for the data collection procedures. In the semi-structured interview, few participants were informed about the data collection, however, only two became available. Considering of getting numerous participants in a short period of time, survey was conducted. In the two months of period, only eight replied to the survey although the survey was sent to more than 13 participants.

From the data analysis, it was found that NRK has developed Style Guideline which consists of design attributes that the NRK designer needs to follow. However, it was not clear whether the guideline is compatible with any accessibility guidelines and whether it helps the designers in designing accessible website. As a result, in the future, the evaluation of the accessibility guideline can be done against the WCAG 2.0 to determine to what extent the Style Guideline helps the designers in NRK to design accessible website.

8. References

- Ivanos, A. (2014, Jun 16 2014). "PageSpeed Module: Improving Your Websites' Performance." Retrieved 30.01.2017, 2017, from http://www.huffingtonpost.com/alex-ivanovs/pagespeed-module-improvin_b_5130698.html.
- 8878, A. (n.d.). 16 Steps. Retrieved from <https://www.access8878.co.uk/getting-started-with-bs-8878/16-steps.aspx>
- (WAI), W. A. I. (2005, 02.10.2012). Web Content Accessibility Guidelines (WCAG) Overview. Retrieved from <https://www.w3.org/WAI/intro/wcag.php>
- (WAI), W. A. I. (2009). A Cautionary Tale of Inaccessibility: Sydney Olympics Website. Retrieved from <https://www.w3.org/WAI/bcase/socog-case-study>
- (WAI), W. A. I. (2010, 18.10.2010). Web Accessibility and Older People: Meeting the Needs of Ageing Web Users. Retrieved from <https://www.w3.org/WAI/older-users/>
- (WHO), W. H. O. (2011). *Global Health and Aging*. Retrieved from
- Abou-Zahra, E. E. S. (2006, March 2016). Web Accessibility Evaluation Tools List. Retrieved from <https://www.w3.org/WAI/ER/tools/>
- Abou-Zahra, S. (2008). Web accessibility evaluation *Web Accessibility* (pp. 79-106): Springer.
- Abou-Zahra, S. (2012, 1 August 2012). How People with Disabilities Use the Web. Retrieved from <https://www.w3.org/WAI/intro/people-use-web/Overview>
- Abu-Doush, I., Bany-Mohammed, A., Ali, E., & Al-Betar, M. A. (2013). Towards a more accessible e-government in Jordan: an evaluation study of visually impaired users and Web developers. *Behaviour & Information Technology*, 32(3), 273-293.
- Adams, A., Lunt, P., & Cairns, P. (2008). A qualitative approach to HCI research.
- Aizpurua, A., Arrue, M., Harper, S., & Vigo, M. (2014). *Are users the gold standard for accessibility evaluation?* Paper presented at the Proceedings of the 11th Web for All Conference.
- Ambrose, I. (2011). BS 8878:2010 Web Accessibility. Code of Practice. Retrieved from <http://www.accessibletourism.org/?i=enat.en.reports.1083>
- Aslaksen, F., Bergh, S., Bringa, O. R., & Heggem, E. K. (1997). Universal design: Planning and design for all.
- Blandford, A., Cox, A. L., & Cairns, P. (2008). Controlled experiments.
- Brajnik, G., Yesilada, Y., & Harper, S. (2010). *Testability and validity of WCAG 2.0: the expertise effect*. Paper presented at the Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility.
- Brajnik, G., Yesilada, Y., & Harper, S. (2011). The expertise effect on web accessibility evaluation methods. *Human-Computer Interaction*, 26(3), 246-283.
- Brajnik, G., Yesilada, Y., & Harper, S. (2011). The Expertise Effect on Web Accessibility Evaluation Methods. *Human-Computer Interaction*, 26(3), 246-283. doi:10.1080/07370024.2011.601670
- Cairns, P., & Cox, A. L. (2008). *Research methods for human-computer interaction* (Vol. 12): Cambridge University Press New York (NY).
- Communication Department, N. (2007, 14.12.2016). A gigantic small broadcaster. Retrieved from <https://www.nrk.no/about/a-gigantic-small-broadcaster-1.3698462>
- Consortium, W. W. W. (2008). Web content accessibility guidelines (WCAG) 2.0.
- Cook, A. M., & Polgar, J. M. (2014). *Assistive technologies: Principles and practice*: Elsevier Health Sciences.
- Cooper, M., Sloan, D., Kelly, B., & Lewthwaite, S. (2012). *A challenge to web accessibility metrics and guidelines: putting people and processes first*. Paper presented at the Proceedings of the international cross-disciplinary conference on Web accessibility.

- Elcessor, E. (2014). <ALT="Textbooks">: Web accessibility myths as negotiated industrial lore. *Critical Studies in Media Communication*, 31(5), 448-463.
- Foley, A., & Regan, B. (2002). Web design for accessibility: Policies and practice. *Educational Technology Review*, 10(1), 62-80.
- Fuglerud, S. (2014). *Inclusive design of ICT: The challenge of diversity*. PhD dissertation. Oslo: Department of Media and Communication, University of Oslo. Available full-text DOI: 10.13140/2.1.4471.5844.
- Grantham, J., Grantham, E., & Powers, D. (2012). *Website accessibility: an Australian view*. Paper presented at the Proceedings of the Thirteenth Australasian User Interface Conference-Volume 126.
- Hanson, V. L., & Richards, J. T. (2013). Progress on website accessibility? *ACM Transactions on the Web (TWEB)*, 7(1), 2.
- Harper, S., & Chen, A. Q. (2012). Web accessibility guidelines. *World Wide Web*, 15(1), 61-88.
- Harper, S., & Yesilada, Y. (2008). *Web accessibility: a foundation for research*: Springer Science & Business Media.
- Henry, J. B. S. L. (2006, 25 August 2006). Policies Relating To Web Accessibility. Retrieved from <http://www.w3.org/WAI/Policy/-ADA>
- Henry, S. L., Abou-Zahra, S., & Brewer, J. (2014). *The role of accessibility in a universal web*. Paper presented at the Proceedings of the 11th Web for All Conference.
- Hoffman, A. (2014). Accessibility: The Missing Ingredient. Retrieved from <https://alistapart.com/article/accessibility-the-missing-ingredient>
- Hong, S. G., Trimi, S., Kim, D. W., & Hyun, J. H. (2015). A Delphi Study of Factors Hindering Web Accessibility for Persons with Disabilities. *Journal of Computer Information Systems*, 55(4), 28-34.
- Horton, S., & Leventhal, L. (2008). Universal usability *Web Accessibility* (pp. 346-355): Springer.
- Ivanos, A. (2014, Jun 16 2014). PageSpeed Module: Improving Your Websites' Performance. Retrieved from http://www.huffingtonpost.com/alex-ivanovs/pagespeed-module-improvin_b_5130698.html
- Jaeger, P. T. (2006). Assessing Section 508 compliance on federal e-government Web sites: A multi-method, user-centered evaluation of accessibility for persons with disabilities. *Government Information Quarterly*, 23(2), 169-190.
- Jay, C., Lunn, D., & Michailidou, E. (2008). End user evaluations *Web Accessibility* (pp. 107-126): Springer.
- Kaasin, H. (2014, 01.07.2014). Tilgjenglighet på nett og mobil. Retrieved from <https://www.nrk.no/retningslinjer/tilgjengelighet-pa-nett-og-mobil-1.7772019>
- Kessel, S., Sanderson, N., & Chen, W. (2014a). Public Media on the Web for Everyone—An Evaluation of the Norwegian Broadcasting Cooperation's Website *HCI International 2014-Posters' Extended Abstracts* (pp. 32-36): Springer.
- Kessel, S., Sanderson, N., & Chen, W. (2014b). *Public media on the web for everyone—an evaluation of the Norwegian broadcasting cooperation's website*. Paper presented at the International Conference on Human-Computer Interaction.
- Kuzma, J., Yen, D., & Oestreicher, K. (2009). Global e-government web accessibility: an empirical examination of EU, Asian and African sites.
- Kuzma, J. M. (2010). Accessibility design issues with UK e-government sites. *Government Information Quarterly*, 27(2), 141-146.
- Lazar, J., Dudley-Sponaugle, A., & Greenidge, K.-D. (2004). Improving web accessibility: a study of webmaster perceptions. *Computers in Human Behavior*, 20(2), 269-288.
- Lazar, J., Feng, J. H., & Hochheiser, H. (2010). *Research methods in human-computer interaction*: John Wiley & Sons.
- Lazar, J., Wentz, B., Almalhem, A., Catinella, A., Antonescu, C., Aynbinder, Y., . . . Chelden, B. (2013). A longitudinal study of state government homepage accessibility in Maryland and the role of

- web page templates for improving accessibility. *Government Information Quarterly*, 30(3), 289-299.
- Loiacono, E. T., & Djasmasbi, S. (2013). Corporate website accessibility: does legislation matter? *Universal access in the information society*, 12(1), 115-124.
- Loiacono, E. T., Romano Jr, N. C., & McCoy, S. (2009). The state of corporate website accessibility. *Communications of the ACM*, 52(9), 128-132.
- Lopes, R., Van Isacker, K., & Carriço, L. (2010). Redefining assumptions: accessibility and its stakeholders. *Computers Helping People with Special Needs*, 561-568.
- Mander, J. (2014). *Digital vs Traditional Media Consumption Summary*. Retrieved from http://insight.globalwebindex.net/hs-fs/hub/304927/file-1414878665-pdf/Reports/GWI_Media_Consumption_Summary_Q3_2014.pdf
- Mankoff, J., Fait, H., & Tran, T. (2005). *Is your web page accessible?: a comparative study of methods for assessing web page accessibility for the blind*. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems.
- McGee, S. P. a. L. (2009, 14 December, 2009). Case Study of Accessibility Benefits: Tesco. Retrieved from <https://www.w3.org/WAI/bcase/tesco-case-study>
- Miñón, R., Moreno, L., Martínez, P., & Abascal, J. (2014). An approach to the integration of accessibility requirements into a user interface development method. *Science of Computer Programming*, 86, 58-73.
- NRK. (2012). *NRK - Annual report 2012 - english summary*. Retrieved from <http://www.nrk.no/about/a-gigantic-small-broadcaster-1.3698462>
- NRK. (2015). A gigantic Small Broadcaster. Retrieved from <http://www.nrk.no/about/a-gigantic-small-broadcaster-1.3698462>
- NRK, C. D. (2007, 20.10.2015). A world class producer. Retrieved from <https://www.nrk.no/about/a-world-class-producer-1.4029931>
- Olalere, A., & Lazar, J. (2011). Accessibility of U.S. federal government home pages: Section 508 compliance and site accessibility statements. *Government Information Quarterly*, 28(3), 303-309. doi:10.1016/j.giq.2011.02.002
- Olalere, A., & Lazar, J. (2011). Accessibility of US federal government home pages: Section 508 compliance and site accessibility statements. *Government Information Quarterly*, 28(3), 303-309.
- Olivier Nourry, C. M. (2014, 11 June 2014). Accessibility is good for the planet. Retrieved from <http://openweb.eu.org/articles/accessibility-is-good-for-the-planet>
- Pascual, A., Ribera, M., Granollers, T., & Coiduras, J. L. (2014). Impact of accessibility barriers on the mood of blind, low-vision and sighted users. *Procedia Computer Science*, 27, 431-440.
- Petrie, H., Savva, A., & Power, C. (2015). *Towards a unified definition of web accessibility*. Paper presented at the Proceedings of the 12th Web for all Conference.
- Power, C., Andr, #233, Freire, Petrie, H., & Swallow, D. (2012). *Guidelines are only half of the story: accessibility problems encountered by blind users on the web*. Paper presented at the Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Austin, Texas, USA.
- Rand-Hendriksen, M. (2014). Web Accessibility as a Right - Should WCAG be Mandated by Law? Retrieved from <https://mor10.com/web-accessibility-right-wcag-mandated-law/>
- Rømen, D., & Svanæs, D. (2012). Validating WCAG versions 1.0 and 2.0 through usability testing with disabled users. *Universal access in the information society*, 11(4), 375-385.
- Sánchez-Gordón, M.-L., & Moreno, L. (2014). Toward an integration of Web accessibility into testing processes. *Procedia Computer Science*, 27, 281-291.
- Sanderson, N. C., Chen, W., & Kessel, S. (2015). *The Accessibility of Web-Based Media Services—An Evaluation*. Paper presented at the International Conference on Universal Access in Human-Computer Interaction.

- Schiavone, A. G., & Paternò, F. (2015). An extensible environment for guideline-based accessibility evaluation of dynamic Web applications. *Universal access in the information society*, 14(1), 111-132.
- Sierkowski, B. (2002). *Achieving web accessibility*. Paper presented at the Proceedings of the 30th annual ACM SIGUCCS conference on User services.
- Statistisk sentralbyrå, S. (2016a). Disabled people, Labour force survey, 2016, 2nd quarter. Retrieved from <https://www.ssb.no/en/arbeid-og-lonn/statistikker/akutu>
- Statistisk sentralbyrå, S. (2016b, September 6, 2016). ICT usage in households, 2016, 2nd quarter. Retrieved from <https://www.ssb.no/en/teknologi-og-innovasjon/statistikker/ikthus/aar>
- Statistisk Sentralbyrå, S. (2017). Stabil andel TV-seere, flere leser nettviser. Retrieved from <https://www.ssb.no/kultur-og-fritid/artikler-og-publikasjoner/stabil-andel-tv-seere-flere-leser-nettviser>
- Trewin, S., Cragun, B., Swart, C., Brezin, J., & Richards, J. (2010). *Accessibility challenges and tool features: an IBM Web developer perspective*. Paper presented at the Proceedings of the 2010 international cross disciplinary conference on web accessibility (W4A).
- UNESCO, S. D. U. (2014). *United Nations Expert Group Meeting on Disability Data and Statistics, Monitoring and Evaluation: The Way Forward- a DisabilityInclusive Agenda Towards 2015 and Beyond*. Retrieved from Paris, France: http://www.un.org/disabilities/documents/egm2014/EGM_FINAL_08102014.pdf
- United Nations, U. (2007). *United Nations Convention on the Rights of Persons with Disabilities (UNCRPD)*. Retrieved from
- Vigo, M., Brown, J., & Conway, V. (2013). *Benchmarking web accessibility evaluation tools: measuring the harm of sole reliance on automated tests*. Paper presented at the Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility.
- W3C. (2005, September 2005). Introduction to Web Accessibility. Retrieved from <https://www.w3.org/WAI/intro/accessibility.php>
- W3C. (2015). Accessibility. Retrieved from <http://www.w3.org/standards/webdesign/accessibility - case>
- WAI. (2010a, 3 August 2010). Involving Users in Evaluating Web Accessibility. Retrieved from <https://www.w3.org/WAI/eval/users>
- WAI. (2010b). Involving Users in Web Projects for Better, Easier Accessibility. Retrieved from <https://www.w3.org/WAI/users/involving>
- Web Accessibility Initiative, W. (2005, 7 Sep 2012). Legal and Policy Factors in Developing a Web Accessibility Business Case for Your Organization. Retrieved from <https://www.w3.org/WAI/bcase/pol - risks>
- WebAIM. (2012, Oct 12, 2012). Motor Disabilities. Retrieved from <http://webaim.org/articles/motor/motordisabilities>
- WebAIM. (2013a, Aug 9, 2013). Auditory Disabilities. Retrieved from <http://webaim.org/articles/auditory/>
- WebAIM. (2013b, Aug 9, 2013). Cognitive. Retrieved from <http://webaim.org/articles/cognitive/>
- WebAIM. (2013c, Aug 28, 2013). Visual Disabilities. Retrieved from <http://webaim.org/articles/visual/ - maincontent>
- Wood, D., & Hollier, S. (2013). *Bring your own problems: the path to WCAG 2.0 conformance through industry based training*. Paper presented at the Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility.
- World Health Organization, W. (2011). *World report on disability*: World Health Organization.
- Yesilada, Y., Brajnik, G., & Harper, S. (2009). *How much does expertise matter?: a barrier walkthrough study with experts and non-experts*. Paper presented at the Proceedings of the 11th international ACM SIGACCESS conference on Computers and accessibility.

Yesilada, Y., Brajnik, G., Vigo, M., & Harper, S. (2012). *Understanding web accessibility and its drivers*. Paper presented at the Proceedings of the international cross-disciplinary conference on web accessibility.

9. Appendix

9.1. Consent form for Interview

1. Project Title

Procedures for achieving universally designed website for the Norwegian Broadcasting Cooperation [NRK]

2. General descriptions

Researcher's Name: Vaskar Shrestha

Supervisor's Name: Siri Fagernes

University Name and Department: Oslo and Akershus University of Applied Science, ICT Department

Researcher's Contact Address: s237421@hioa.no

3. Research Question

What are the main factors behind the development of inaccessible website in NRK?

What will be the best solutions to mitigate the hindering factors during the development of an accessible website for NRK?

4. Purpose

The purpose of this study is to investigate the factors that are preventing in designing the accessible nrk.no/nyheter development. In this interview, the interviewer will approach to the interviewee to gain the basic understanding of the regular process during the design and development of the nrk.no/nyheter webpages. Also this round will let know how well designer/developer are aware of the accessibility and the guidelines to develop accessible webpages.

5. Participants

In order to take participate in this research, one need to be the staff of NRK working in the designing and development department of nrk.no webpage.

6. Procedure

The interview will contain few questions each about procedure, involvement of user, use of guidelines and about WCAG. Participants are required to provide answer what they think are the best and to provide their opinions. Then interview can take 50-60 minutes for completion. The interview is volunteer activity and participant can withdraw at any time they like. Also, it is not obligation to participant in further studies after you completed interview. Participant can skip any question if they don't like to answer.

7. Risk and Benefits

There is no risk at all upon participant on this survey. The miss-thinking could be that the survey is pointing out their weakness which is absolutely incorrect. It is to be clear that the research is not finding out the imperfection of the staffs but the issues in the procedure how they use it to produce NRK webpages. There will be various benefits of this research to NRK organization and their IT Department staffs on developing accessible websites.

8. Voluntary Participants

Participation in this research is voluntary. You have the rights to withdraw from this research study anytime you like without any jeopardy. If in case you chose to withdraw from the research, the collected data will not be used in any part of the research and the data will be destroyed.

9. Confidentiality

All the information collected will remain confidential and the participants will be anonymous. The data collected, the questionnaires use will remain in the confidential folder and nobody will have access in it accept the members that are involved in this project.

10. Consent

I have understood the objectives of this research and the points in this consent form. Furthermore, I have had questions answered satisfactorily and I will contact the researcher group if I have any further suggestion.

I have been provided the copy of this consent form.

Date:

Signature

[For further information or if you have anything to add, please don't hesitate to contact in the above mentioned e-mail address.]

Thank you so much for the participation.

9.2. Semi-Structured Interview Question

Main Questions	Additional Questions	Clarifying Questions
1. What is the overall present procedure for designing page for nrk.no?	<ol style="list-style-type: none"> 1. What type of software do you use? 2. What are the strengths and weakness of the software you use? 3. What type of communication do you use during the communication between team members of other departments? 4. How do you decide on finalizing the design aspects of website? 5. How you test the design? 6. Have you any involvement of user during the design process? 7. What type of guidelines do you use during design process? 	<ol style="list-style-type: none"> 1. Can you explain bit more on this? 2. Can you provide example on this?
2. What do you know about accessibility of website?	<ol style="list-style-type: none"> 1. Why accessibility is important in website? 2. Have you followed any accessibility guidelines in nrk.no? 3. Why don't nrk.no have not used any accessibility guidelines? 	

	<p>4. Have you tested nrk.no among user regarding accessibility issues?</p> <p>5. How many guidelines you know those are available for the improvement of the accessibility of website?</p> <p>6. Have you any plans or future scope to implement accessibility guidelines?</p>	
<p>3. How well are you familiar with WCAG guidelines?</p>	<p>1. What is the purpose of WCAG?</p> <p>2. Have you gone through the guidelines?</p> <p>3. What are the weaknesses of the guideline?</p> <p>4. Have you used WCAG guidelines in nrk.no?</p> <p>5. (if they used and stop) What were the reasons you left using WCAG?</p> <p>6. What are the problems you faced on going through the guidelines?</p>	
<p>4. What are critical factors during design of the software?</p>	<p>1. How much time do you allocate for designing?</p> <p>2. How much time do you allocate for testing of the designing?</p>	
<p>5. What do you think about accessibility?</p>	<p>1. Is it really important in current scenario?</p>	

	<p>2. How useful are the guidelines?</p> <p>3. Why is there more focus on the accessibility?</p>	
--	--	--

9.3. Survey Questionnaire

Survey for Master Thesis regarding the web accessibility of nrk.no/nyheter

CONSENT SECTION

Purpose and Procedure

The purpose of this study is to find the issues in the process of front-end design and development section of www.nrk.no/nyheter and to help NRK to develop an accessible website. As the NRK's official website is vague, so the research will only focus to the sub-section of the NRK's website i.e. news section (nrk.no/nyheter).

The questionnaire is more OPEN ENDED, where you are required to give your opinion. And few questions are objective where you have to choose one or in few multiple answers. In few questions, descriptions are provided in order for you to understand the questions. Your opinions are highly appreciated.

Risk and Benefits

There is no risk in participating in this survey. THE RESEARCH IS NOT EVALUATING YOU, NOR EXAMINING YOU. The research does not have any intention to identify the staffs but study the issues related to the design and development of NRK's nrk.no/nyheter news web pages. This research is intended to help and suggest NRK organization and their IT department staffs to identify the main issues that are hindering in developing accessible websites.

Voluntary Participation

Your participation in this research is highly voluntary. You have the rights to withdraw from this research anytime without any jeopardy. If in the case of your withdrawal of participation from the research, the collected data will not be used in the research and the uncompleted data will be destroyed instantly.

Confidentiality

All the information collected in the research will be kept confidential and the participants will be kept anonymous. The data collected in the questionnaires will be

stored in the private folder and only the research members will have access. After the completion of the project, the data will be handled according to the rules and regulations of the Norwegian Data Law.

Consent

I have understood the objectives of this research and the points in this consent form. Furthermore, I have had questions answered satisfactorily and I will contact the research group if I have any further suggestion. The Submit of this survey will represent you being accepted the consent of this research.

I would like to thank you in advance for participating in this research, for providing your opinion and giving your valuable time. If you have any questions you can contact me at the below contact address.

Vaskar Shrestha

Master Student in Universal design of ICT
Oslo and Akershus University College

s237421@stud.hioa.no

vaskarshrestha01@gmail.com

* Required

1. Approval of Consent *

Mark only one oval.

- Yes, I agree with the terms and conditions and would like to contribute to this survey.
-

No, I disagree and don't want to participate. Stop filling out this form.

General Information

In this section, you will be asked few questions regarding your age, gender, experiences as working in NRK, and your designation.

2. Your gender. * Mark only one oval.

- Male

Female

3. Your designation? * (Your position in NRK.) Mark only one oval.

- Designer

 Developer _____

Other:

4. How long have you been working in nrk.no/nyheter? *

(Your total work experience as working inside NRK for nrk.no/nyheter) Mark only one oval.

- Less than 1 year.

 More than 1 year and less than 2 years.

More than 2 year and less than 5 years.

More than 5 years.

5. What are your major responsibilities/duties in nrk.no/nyheter? *

(Provide short list of your duties.)

Accessibility Understanding

This section contains questions that are related to accessibility.

6. What do you associate with the term "accessibility"? *

The things that come to your mind after hearing the term accessibility of a website.

7 Have you participated in any training/course/workshop regarding accessibility? *

8. What level of expertise in accessibility do you consider yourself to have?

* Mark only one oval.

- Expert.
-
- Some Knowledge.

Very little or No Knowledge.

9. How prioritized are accessibility features in nrk.no/nyheter within NRK organization? *

10. What resources are needed to improve the accessibility of nrk.no/nyheter? * (For example: training, specific guideline)

11. Are you familiar with any accessibility guidelines? * Mark only one oval.

- Expert Knowledge. Skip to question 12.
-
- Some knowledge. Skip to question 12.

very little or no knowledge. Skip to question 14.

Accessibility Guidelines (Part 1)

This section contains questions related to the accessibility guideline.

12. Can you name accessibility guidelines you know or familiar with? *

13 Are the guidelines easy to implement in the real case scenario? *

Skip to question 16.

Accessibility Guidelines (Part 2)

14. What are the reasons for your lack of experience with accessibility guidelines? *

Mark only one oval.

- Not enough time to think about it.
-
- Have no idea regarding accessibility and accessibility guidelines.
-
- Not interested.

- Not needed in the work.

15. What factors can motivate you to go in depth regarding accessibility guidelines?

*

Automatic Accessibility Testing Tools

Automatic accessibility testing tools are online tools or web browser extensions which can be used to find accessibility problems of the website and to modify the results.

16. Are you familiar with automatic accessibility testing tools?

* Mark only one oval.

- Expert knowledge. Skip to question 17.
-
- Some knowledge. Skip to question 17.

Very little or no knowledge. Skip to question 21.

Automatic Accessibility Testing Tools (Part 2)

This section contains a few more questions regarding the automatic accessibility testing tools. 17. Which tools have you used? How you find these tools? *

18 Have you ever tested nrk.no/nyheter with automatic testing tools? * Mark only one oval.

Yes Skip to question 19.

No Skip to question 20.

Automatic Accessibility Testing Tools (Part 3)

19. If yes, was the result of the accessibility testing tools helpful to improve the accessibility of nrk.no/nyheter? *

Skip to question 21.

Automatic Accessibility Testing Tools (Part 4)

20. If no, is there any reason for not testing nrk.no/nyheter with automatic accessibility testing tools? *

Accessibility Perception

This section contains questions related to what you think about accessibility.

21. What is your personal importance regarding web accessibility? *

22. In your opinion, what is the biggest challenge in developing an accessible website?

*

23 Who in organizations like NRK, do you think, is responsible for the accessibility of nrk.no/nyheter? *

If you have other points in your mind beside listed down on the list, then you can add in other options.

Check all that apply.

- Management Team
 -
 - Developer
 -
 - Designer
-

Tester

Other:

24. Why you feel that the above selected person are responsible? *

Please provide your answer based on the selection you have done in the above question.

User Involvement

User involvement is the process of actively involving users in the development process to find out what the user wants from the system and how they want the system to be so that the system can be more usable and user-friendly.

25. To your knowledge, has NRK involved any real users in the development of nrk.no/nyheter? *

Mark only one oval.

- Yes. Skip to question 26.
- No. Skip to question 31.

User Involvement (Part 1)

26. In which development phase, and how NRK have involved end users? * Can you explain a little about the user involvement process and in which phase.

27. How often does NRK involve end-user?

Mark only one oval.

- Once a year.
-
- Twice a year.
-
- One time in two years.

One time in 5 years.

Other:

28 Have NRK involved users with special needs? *

For example, users with vision impaired, hearing impairment, autism, or amputee. Mark only one oval.

- Yes.
-
- No.

29. If yes, what kind of special end user, has

NRK involved in the development process?

30. Was the result of the user involvement helpful in making nrk.no/nyheter more accessible? Explain your answer? *

Skip to question 34.

User involvement Perception

31. What can be the reasons to skip end user involvement? *

What can be the reason for NRK's lack of user testing with the real and special user?

32. In which phase, do you think the user involvement process is most effective during the development of the accessible website? * Check all that apply.

- Design phase
-
- Testing Phase
-
- Planning Phase

Deployment Phase

Other:

33 What can be the major reasons for avoiding user with special needs in the usability testing? *

(Why NRK hasn't included any disabled user in the usability testing?)

Accessibility Testing

34. Have you or NRK performed any manual or automatic accessibility testing for nrk.no/nyheter for accessibility? * Mark only one oval.

Yes.

No.

35. What might be the main reason for not doing NRK accessibility testing? *

Powered by



(The original form is available at: [Google Form](#)).

