

BUSINESS BENEFITS OF ACCESSIBLE DATA VISUALIZATION



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Opinnäytetyön tarkoituksena oli selvittää, millaisia liiketoimintahyötyjä voidaan saavuttaa, kun käytetään saavutettavia datan visualisointeja. Opinnäytetyön toimeksiantaja oli Tietoevry Oyj ja tarkemmin Tietoevry Create-yksikkö.

Opinnäytetyön tietopohja koostuu datan visualisoinnin ja saavutettavuuden määritelmästä sekä kansainvälisestä sekä suomalaisesta lainsäädännöstä, standardeista ja ohjeistuksista liittyen saavutettavuuteen. Tietopohja koskettaa enemmän saavutettavuutta yleisesti, koska ohjeistusta tai teorioita datan visualisointiin oli saatavilla huonosti. Opinnäytetyö on tutkimuspainotteinen. Tutkimusaineisto kerättiin puolistrukturoiduilla haastatteluilla. Haastatteluissa oli kolme eri kohderyhmää: henkilöt, jotka tarvitsevat saavutettavia datan visualisointeja, henkilöt, jotka tuottavat datan visualisointeja ja henkilöt, jotka hyödyntävät tuotettuja datan visualisointeja. Haastattelut selvittivät, millaisia liiketoimintahyötyjä haastateltavien mielestä olisi mahdollista saada saavutettavalla datan visualisoinnilla. Aineisto analysoitiin hyödyntäen teema-analyysia.

Tutkimuksessa havaittiin kaksi pääasiallista teemaa. Ensimmäinen teema oli, että henkilöt, jotka joko tarvitsivat saavutettavia datan visualisointeja tai tuottivat niitä, näkivät enemmän mahdollisia liiketoimintahyötyjä verrattuna henkilöihin, jotka hyödynsivät saavutettavia datan visualisointeja. Toinen esiin noussut teema oli, että saavutettavan datan visualisoinnin käytöstä täytyy kommunikoida selkeästi, jotta liiketoimintahyödyt saavutetaan.

Avainsanat Datan visualisointi, saavutettavuus, liiketoimintahyödyt.

Sivut 38 sivua ja liitteitä 2 sivua

The purpose of the thesis was to gain new insights of the business benefits that can be achieved by using accessible data visualizations. The aim of the study was to answer the research question “What kind of business benefits can be achieved by using accessible data visualizations?”. The commissioning company of thesis was Tietoevry Oyj, specifically Tietoevry Create unit.

The theoretical framework of the thesis consists of definitions of data visualization and accessibility, as well as international and Finnish legislation, standards, and guidelines related to accessibility. The theoretical framework primarily addresses accessibility in general, as there was limited availability for guidelines or theories specifically focused on data visualization. The thesis is research oriented.

The research material was collected through semi-structured interviews. The interviews were conducted with three different groups: persons who need accessible data visualizations, individuals who create data visualizations, and individuals who utilize the produced data visualizations. The interviews aimed to identify the potential business benefits that could be obtained through accessible data visualization, according to the perspectives of the interviewees.

The study identified two main themes. The first theme was that individuals who either needed accessible data visualizations or produced them saw more potential business benefits compared to individuals who used accessible data visualizations. The second emerging theme was that the use of accessible data visualizations must be communicated clearly in order to achieve the business benefits.

Keywords Data visualization, accessibility, business benefit

Pages 38 pages and appendices 2 pages

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1 Introduction

1.1 Aim of the Research and Research Question

The aim of the research is to gain new insights into what kind of business benefits can be achieved by using accessible data visualization.

The author has chosen to conduct research specifically from a business benefits context because current legislation makes it obligatory for most authorities and institutions governed by public law (Regional State Administrative agency, n.d.) and most of the businesses need to justify using resources like time and money to supporting specified company goals and policies (Rush (Ed.), 2018).

In addition, it has been said that there is a possibility that commercial businesses might be more interested in the topic-, if innovation and market expansion possibilities are researched and for educational and nonprofit businesses brand enhancement possibilities might encourage them to devote more time and resources to accessible data visualizations (Rush (Ed.), 2018).

The research question for this thesis is:

What kind of business benefits can be achieved by using accessible data visualization?

1.2 Hypothesis

The author's hypothesis is, that when accessibility is accounted in data visualizations, it will lead to business benefits in such areas as innovation, market expansion, brand and employer brand enhancement. This hypothesis is based on a business case made by W3C Web Accessibility Initiative (Rush (Ed.), 2018).

1.3 Commissioning company

Tietoevry is a technology company, which was established in 1968. It has a presence in over 90 countries and has workforce with over 24 000 full-time employees. Its headquarters are in Finland, Espoo. Tietoevry's shares are publicly traded on NASDAQ exchanges in Helsinki and Stockholm, as well as on the Oslo Børs. (Tietoevry n.d.; Tietoevry, 2022, p. 2.).

Tietoevry Create is a unit that combines business design and software engineering to support other businesses to accelerate their digital agenda. Tietoevry Create core emphasis is on software and data engineering. Tietoevry Create offers services including software development, data management and cloud solutions. Tietoevry Create is focused on numerous industries such as public sector, telecom, digital commerce, retail and consumer services, manufacturing, automotive and industrial. (Tietoevry, n.d.).

2 Theoretical Framework

2.1 Data Visualization and Concepts of Accessibility

2.1.1 Data Visualization

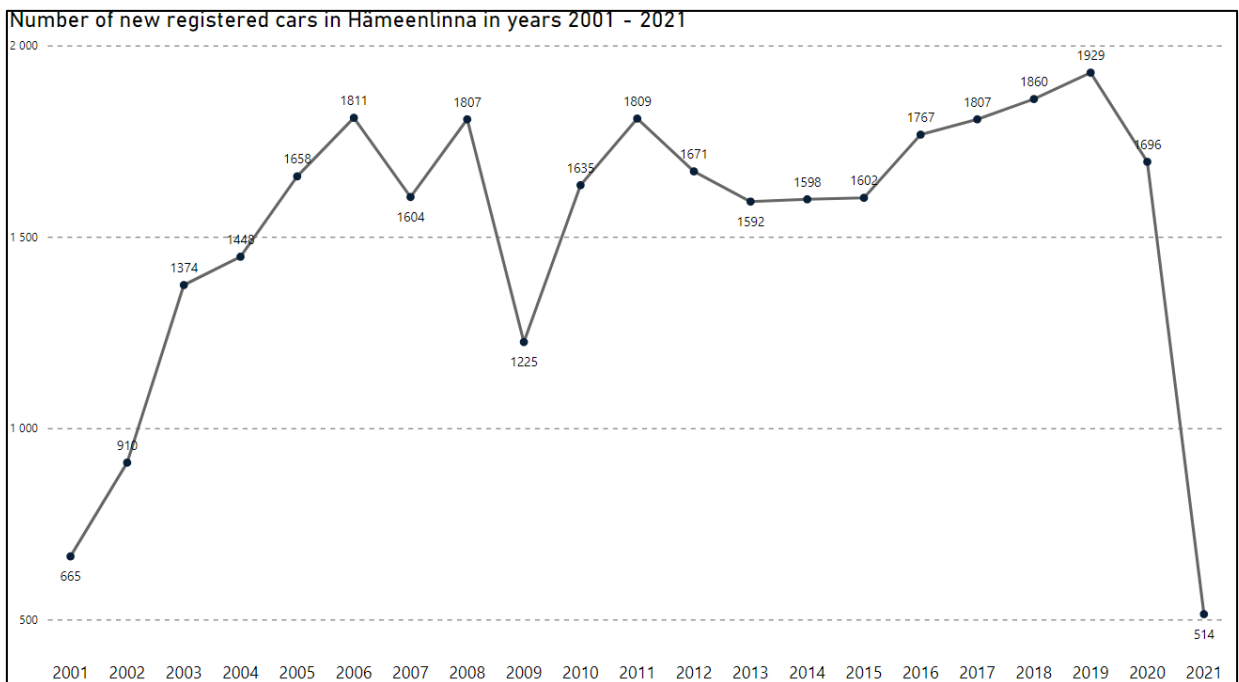
Data visualizations are usually descriptions of raw data and simplified summaries of information (Unwin, 2020). According to Koponen & Hildén, (2019, p. 27) Robert Kosara (2000) describes a data visualization as an image which is based on non-visual and abstract data. Visualization is mainly an image, which can be supported by text providing explanations (Koponen & Hildén, 2019, p. 27). Data visualization is usually computer supported graphic presenting relationships in the data, patterns and trends in user friendly way (Sadiku et al., 2016, p. 12). Data visualizations are mainly used as aids to make a decisions and tools to enhance perceiving, thinking and remembering of information. Data visualization is also an important part of computer sciences. (Sadiku et al., 2016, p. 13).

It has been said that understanding and implementing key principles of visual design may lead to new ways of conveying and emphasizing information (Midway, 2020, p.2). However, it has also been said that golden rule of information design is choosing a method that enable the clearest way to present information (Koponen & Hildén, 2019, p. 43).

Typical visualization techniques are line chart, scatter plot, bar and pie chart (Sadiku et al., 2016, p. 12).

Line charts are used to present relationships between objects. Those can also be used for comparison of changes over a period of time. Line chart is possibly the most often used type of chart. (Sadiku et al., 2016, p. 12; Koponen & Hildén, 2019, p.184). A line chart contains data points which connect to each other with a line. Line is a representation of an estimation of the values between documented observations. Often this means that data points are connected by a straight line, but it is possible that the line is sometimes curved or staggered. For example, a staggered line is utilized when values change abruptly. Usually, data points are marked by dots. However, if a chart has many data points, curved or staggered lines then data points should not be marked. Line charts could be used, when there are high amount of data points and continuity, or when change and trends of the data set needs to be highlighted. (Koponen & Hildén, 2019, p.184-185). Example of line chart is shown in Figure 1.

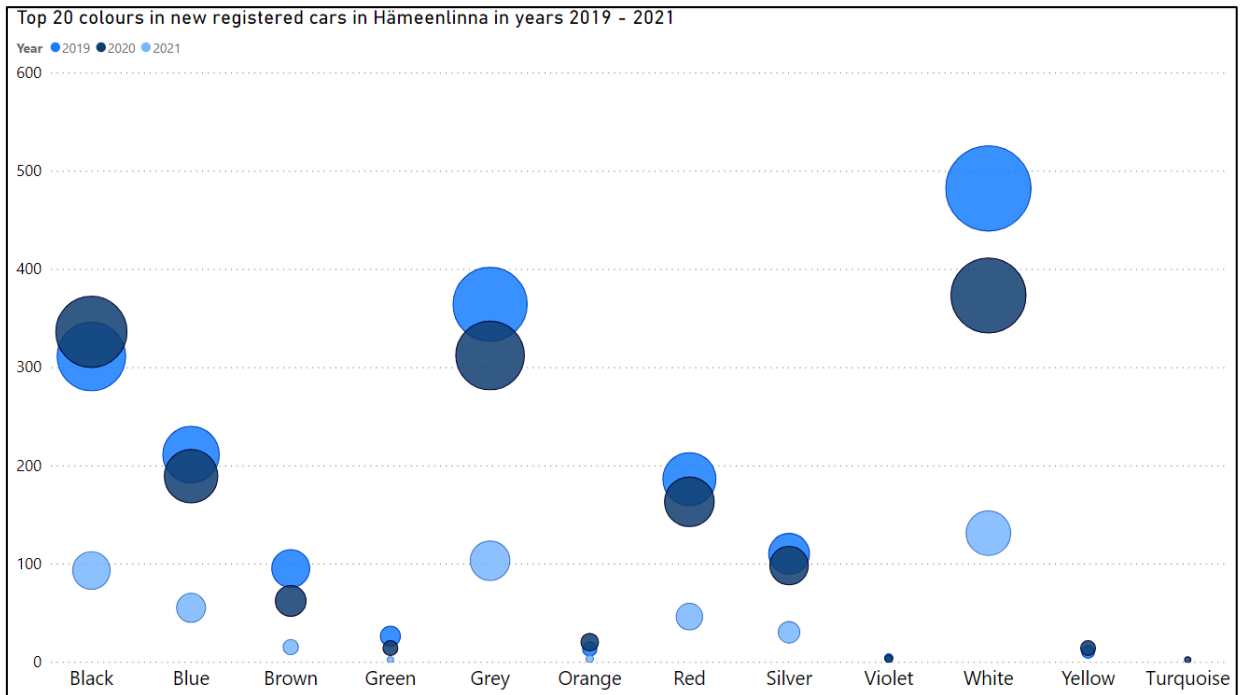
Figure 1. Example of line chart



Scatter plots, which are also called “xy charts” are utilized to reveal the variation of two variables and their distribution. This type of visualization technique is two-dimensional, and it includes horizontally, and vertically placed data points whose attributes are documented as values. (Sadiku et al., 2016, p. 12; Koponen & Hildén, 2019, p.190). Usually, a scatter plot also includes a line or curve called the line of best fit. This line slices the cloud of points in the middle, so the points on either side are on average the equal distance from the line. The line of best fit is used to increase understanding of interdependence strength between variables. Usually if it is assumed that there is a causal relationship between variables, the assumed cause is placed on the horizontal axis. In this case the effect is placed on the vertical axis. If there is not assumed relationship or the explanation is found in third factor, it does not matter how variables are placed on the axis. Interdependence and correlation are indicated in the placement of data point clouds. If the cloud is dense and thin, it indicates high correlation. It also indicates possibility of a causal link. If the data points are distributed everywhere on the picture plane, it indicates that the interdependence is small. A scatter plot is often used in scientific publications and its advantage as a visual is that it makes it

easier to detect more complicated patterns of interdependence like clusters, outliers and groups. (Koponen & Hildén, 2019, p.190-191). Example of scatter plot is shown in Figure 2.

Figure 2. Example of Scatter plot



Bar charts present comparison of amounts in different categories (Sadiku et al., 2016, p. 12). Bar chart can be divided into two main categories, which are vertical bar chart and horizontal bar chart. *Vertical bar chart* (also called column chart) is often scaled quantitatively, which means that both axis of the chart has numbers. *Horizontal bar chart* (also referred as bar chart) is usually used to visualize categorical data. Horizontal bar charts enable easier labelling of the classes, which might have lengthy descriptions. Horizontal bar charts can be read like a list because bars are placed on top of each other. Pyramid chart, also known as population pyramid, is a special case of horizontal bar chart. It is used to, for example, show how age groups and sexes are distributed in population. *Grouped bar chart* (also called a clustered bar or clustered column) is a bar chart that shows multiple bars of the category side by side. *A stacked bar chart* is used to show totals and which parts these totals come from. There is a special case for stacked bar chart that shows percentage of totals, and it is called 100% stacked bar chart. Stacked bar charts can be used as an alternative for pie charts. Bar chart used to show how a variable is distributed is called

histogram. Usually, histogram does not have gaps between the bars, because that way continuity of original distribution is emphasized. When the size of the bins is chosen correctly, the histogram shows how the distribution is shaped. For example, is the distribution symmetrical or skewed. (Koponen & Hildén, 2019, p.180-182). Examples of bar charts are shown in Figure 3 and Figure 4.

Figure 3. Example of Vertical Bar Chart

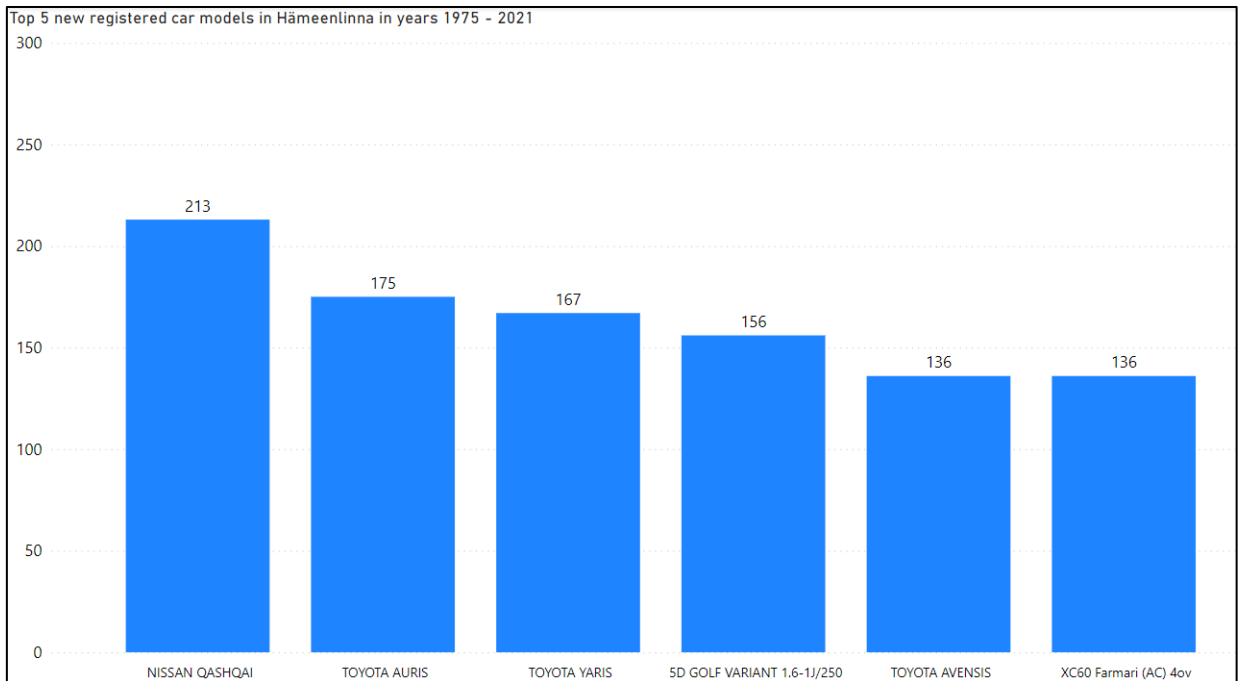
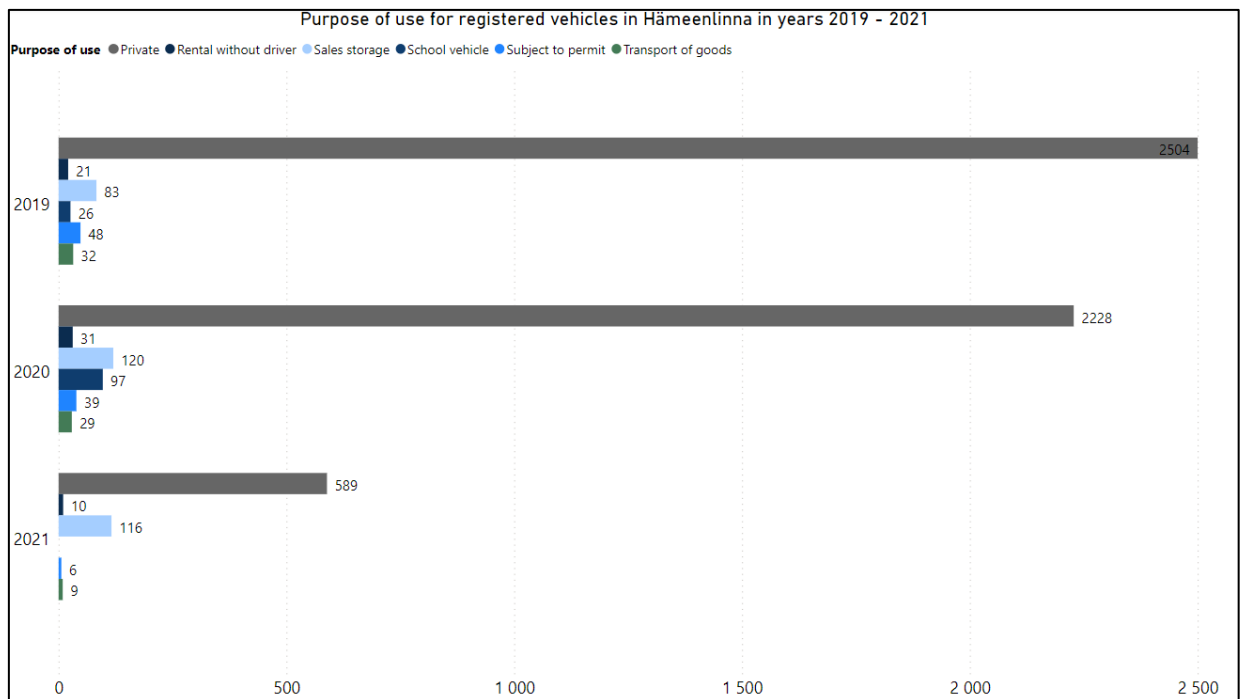
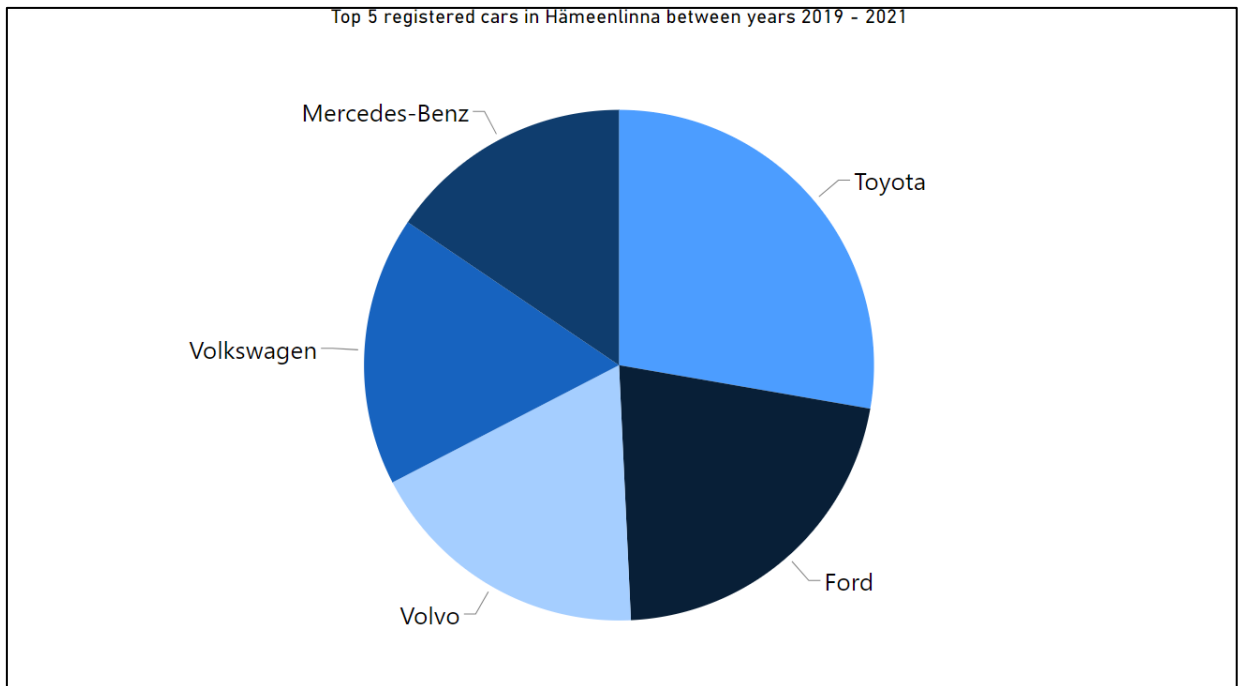


Figure 4. Example of Horizontal Bar Char



Pie chart is used for comparison of portions of whole and to show how percentages are distributed. When it is used to showcase percentage distribution, it should add up to 100% if there is not rounding errors. (Sadiku et al., 2016, p. 12; Koponen & Hildén, 2019, p.188). Pie charts are recommended to be used only in situations where conveying approximate how the sizes of different parts relate to each other, because people have problems estimating angles and areas. However, when amount of data behind pie chart is small enough its interpretation is not remarkably harder than bar charts. For pie chart to be easily readable, it should be in circle shape and the number of slices in the chart should be maximum of 7. Individual slices should be more than 1%, because chart is easier to interpret when slices are clearly different sizes. In addition, individual slices should not be emphasized by highlighting, enlarging or by detaching them from the chart. One well-known variation of the pie chart is donut chart, where middle section of the chart is removed. Donut chart is moderately easier to interpret for people when the slices are small. This is because it is easier for people to interpret lengths than angles and areas. However, in larger slices it seems that there is no difference in readability. (Koponen & Hildén, 2019, p.188-189). Example of pie chart is shown in figure 5.

Figure 5. Example of Pie Chart



Software that are designed to visualize data are called data visualization tools (Strobieski, 2021). Microsoft Excel, even though it can be used to create data visualizations is spreadsheet software. Actual data visualization tools are for example, Microsoft Power BI, Tableau and Qlik Sense.

Microsoft Power BI consists of software services, applications and connectors which can be used together. Power BI can be used to connect data sources, cleaning and modelling data without need to make changes to the original data source, visualize and share data. Power BI includes desktop and mobile application and online service. (Microsoft, n.d.).

Tableau is an end-to end platform for visual analytics which includes Tableau Cloud, Tableau Desktop and Tableau Prep (Tableau, n.d.-a; Tableau, n.d.-b). The data visualization tool is called Tableau Desktop, which utilizes drag and drop interface, live visual analytics as well as artificial intelligence and machine learning powered augmented analytics (Tableau, n.d.-c).

Qlik Sense is a data visualization product that can be used to create interactive visualizations (Qlik, n.d.). Qlik Sense can be used for self-service visualisations, conversational, mobile and embedded analytics. It can be also used to create reports and data alerts (Qlik, n.d.).

2.1.2 Accessibility

The basic concept of accessibility is that people with different abilities should be able to use the design without need for modification or special adaptation. However, in history accessible design has been seen mostly as accommodations made for people with disabilities (Lidwell et al., 2010, p.16).

According to Lidwell et al. (2010, p.16), accessible design should encompass the following four characteristics: “design should also be perceivable regardless of what kind of sensory abilities a person has, design should be usable no matter a person’s physical abilities, design should be simple enough to understand and use regardless of a person's experience, ability to read, or concentration level, and design should make the possibility and consequences of errors as minimal as possible”.

Recent knowledge about accessible design has shown that most of these accommodations are beneficial to everybody. (Lidwell et al., 2010, p.16).

2.1.3 Need for Accessible Data Visualization

Data visualizations are important part of data-driven communications used by governments, science and business. Data visualizations are also major component of data analytics. However, currently data visualizations are not exclusively used by data professionals, but data visualizations are popularly used in different reports, presentations and textbooks. In addition to this, data visualizations are also becoming more widespread in popular media. (Marriott et al., 2021, p. 47).

The importance and wider use of data visualization in data-driven reasoning and communications creates an equality issue for people with disabilities and tha has been

widely ignored by the data visualization community (Lee et al., 2020, p. 86). Even though visualization has been and is growing field of study, there is a research gap in accessible visualization studies and accessible visualization is not considered its own sub-discipline (Kim et al., 2021, p.173). There are also challenges for people with disabilities to create and interact with data visualizations with tools currently provided (Marriott et al., 2021, p. 48).

Accessible visualization has a special challenge, because of content and structure of visualizations (Kim et al., 2021, p. 173). Another challenge of accessible data visualization is that even though accessibility standards help, they only take into account some of the persons with disabilities (Evalsky et al., 2022, p. 57). These accessibility standards are introduced later in this thesis. Also, generic accessibility standards do not work properly with data visualizations because of their information-rich nature and because most guidelines created for data visualization rarely consider accessibility (Evalsky et al., 2022, p. 57).

Usually when thinking challenges faced in data visualization people tend to think people who are blind or have low vision. However, people with other kinds of disabilities may also face challenges with data visualizations. For example, it is often troublesome for people who have either cognitive or learning disabilities to interpret symbolic conventions and abstractions utilized in data visualizations. Another example is the capability to use interactive data visualization, which might be hard or impossible for people who have challenges in fine motor coordination or people who have tremors. (Marriott et al., 2021, p. 48).

There are estimates that more than one million people in Finland who need more accessible services (Regional State Administrative Agency, n.d.). It has been said that people with disabilities are commonly defined as the largest minority group in the world (Khan et al., 2019, p. 170).

It has been said that people with disabilities have a unique position in developing new solutions that push technology forward and drive innovation, because disability creates limitations and working with those limitations can create creative solutions. For example,

creation of the first commercial email service was heavily influenced by Vint Cerf, who is hearing impaired. Also, sonification, which is a non-visual system created to study stellar radiation was developed by blind astronaut Wanda Diaz Merced. (Girma, 2017).

Protecting and enhancing their brands is vital need for businesses (Rush (Ed.), 2018). Current socio-demographic change trends, globalisation, higher mobility of employees and shortage of knowledge workers leads to greater need for employer branding than ever. However, it has been said that talking about diversity branding activities rather than just talking about employer branding might be useful way to show different stakeholders that the organization is a diverse employer. (Jonsen et al., 2021, p.6).

An effective marketing strategy takes into account inclusion and accessibility and does not see universal design as a limiting factor, but as an opportunity. Marketing strategy based on the universal design can for example help expanding product or service markets and improving user experience. (Riviera et al., 2020, p. 47).

2.2 Accessibility Acts, Standards and Guidelines

2.2.1 Global Acts, Standards and Guideline

United Nations Convention on the Rights of Persons with Disabilities later referred as CRPD “is an international treaty that identifies the rights of persons with disabilities” (United Nations, n.d.-a). CRPD currently advances, protects and secures persons with disabilities of their human rights and fundamental freedoms (United Nations, n.d.-b). If a state has ratified the CRPD, it has legal obligation to respect the CRPD’s standards. However, if a state has not ratified the CRPD, the state should try to respect is an international standard. (United Nations, n.d.-a). Regarding accessibility of information and communication CRPD specifies the state must enable equal access to information and communication, including technologies and systems that are created to information and communication for people with disabilities. A state also must advance accessibility of new information and communications technologies. Information and communication systems should be designed,

developed, produced and distributed from early stages as accessible as possible, so these systems and technologies are accessible at lowest possible cost. (United Nations, n.d.-c).

Approaches of accessibility design theory's begun when changes in public policies and design practises started in 1950s. This change was led by United States President's Committee on Employment of the Handicapped, the Veterans Administration and other organizations by starting to create national standardisation called Barrier-free design for barrier free buildings. (Persson et al., 2015, p. 512). Currently there are many approaches that mainly focus on how to create more accessible interactive systems, for example design for all and universal design (Persson et al., 2015, p. 505).

Design for all is currently one of the most applied concepts. It started as a movement which purpose was that products would be designed with usability for as many people as possible. However, at present there are multiple definitions for design for all. (Persson et al., 2015, p. 507). European Institute for Design and Disability's (later referred as EIDD) definition is presented in next chapter of this thesis.

Universal Design is rooted in barrier-free design and the term was created by Ronald L. Mace. His vision was, that the concept of universal design is to design products and environments in such a way that everybody can use them regardless of their age, ability or life situation. (Persson et al., 2015, p. 508). However, it should be noted, that following principles of universal design does not mean that the product or service complies with accessibility standards (National Disability Authority, n.d.).

According to Persson et al. (2015, p.508) Ronald L. Mace's seven principles of Universal Design are:

1. Equitable Use - The design is useful and marketable to people with diverse abilities.
2. Flexibility in Use - The design accommodates a wide range of individual preferences and abilities.

3. Simple and Intuitive Use - Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills or current concentration level.
4. Perceptible Information - The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. Tolerance for Error - The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. Low Physical Effort - The design can be used efficiently and comfortably and with a minimum of fatigue.
7. Size and Space for Approach and Use - Appropriate size and space are provided for approach, reach, manipulation and use regardless of the user's body size, posture or mobility.

In addition to general accessibility guidelines there are also global guidelines for web content accessibility. Web Content Accessibility Guidelines also known as WCAG are standards that are used internationally to make web more accessible for everyone. WCAG is a technical standard, and its primary users are people who develop content to the web, web authoring tools and web accessibility evaluation tools. It is also intended for with a need or desire for a web accessibility standard. (W3C Web Accessibility Initiative, n.d.). Current Web Content Accessibility Guidelines 2.1, which is later referred as WCAG 2.1 takes into account many different disability groups, like people with visual impairments, deaf and people suffering from hearing loss, people whose ability to move is limited, people with speech disabilities, people who suffer from photosensitivity and also to some extent people with learning disabilities and people who has cognitive limitations. However, even though there are accommodations for earlier mentioned groups WCAG 2.1 does not offer guideline for every need of those groups. (W3C Web Accessibility Initiative, 2018).

Four principles for accessibility are defined in WCAG as follows:

1. Perceivable - Information and user interface components must be presentable to users in ways they can perceive.
2. Operable - User interface components and navigation must be operable.
3. Understandable - Information and the operation of user interface must be understandable.
4. Robust - Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies. (W3C Web Accessibility Initiative, n.d.).

2.2.2 European Acts, Standards and Guidelines

European Institute for Design and Disability (later referred as EIDD) is European network including members from 44 different organizations that operate in 19 different European countries and in 4 Extra European countries (EIDD – Design for all Europe, n.d.). In 2004 EIDD issued declaration about Design for All. Declaration states that “Design for All is design for human diversity, social inclusion and equality” (EIDD – Design for all Europe, 2014). Design for all approach is built on top of Scandinavian functionalism, ergonomic design and A “Society for all”-concept. Design for All focuses on creating equal opportunities for everyone to participate in every part of society. This means that, when designing anything, it must first be designed so that everyone in the society can use it and secondly that it considers that human diversity is evolving. To achieve this, analysis of human needs and desires should be used and, in addition, end users should be involved in every part of the designing process. (EIDD – Design for all Europe, 2014).

There are multiple European accessibility standards, which have been created to help organizations to apply ‘Design for all approach’ and implement accessibility. These standards were created, because accessibility of information and communication is a requirement in United Nations Convention on the Rights of Person with Disabilities. (European Union, n.d.).

A standard created for ICT products and services is called EN 301 549 Accessibility requirements for ICT products and services (ETSI, n.d.).

Intention of the current version of EN 301 549 is that it would be used with the web based, non-web and hybrid technologies. Intender users are ITC products and service providers and procurers. It currently contains specified functional accessibility requirements, descriptions for testing procedures and methodology how to evaluate accessibility requirements so that products and services are suitable for public procurement in Europe. (EN 301 549, 2021, p.11).

Current version of the EN 301 549 was published in 2021 and it is the official support for Directive on the accessibility of the websites and mobile applications of public sector bodies. Using EN 301 549 can be a demonstration of compliance with Directive on the accessibility of the websites and mobile applications of public sector bodies. (ETSI, n.d.).

Directive on the accessibility of the websites and mobile applications of public sector bodies states that current direction development in the society is toward digitalization where users are provided with new possibilities for accessing information and services. Also, information and service providers use internet much more for providing information services to everyone. (Directive (EU) 2016/2102 on the accessibility of the websites and mobile applications of public sector bodies). Goal of this directive is to make accessibility of public sector's websites and mobile applications better and to harmonise different standards, that are currently used in member countries (European Union, 2021).

Main points in the directive are, that public sector bodies need to make their websites and mobile applications "perceivable, operable, understandable and robust" (European Union, 2021) in order to ensure accessibility especially for people with disabilities. However, this directive gives only minimum requirements and member countries may have national legislation that goes beyond the requirements of this directive.

New version of the EN 301 549 is targeted to publish in 2025 to support the European Accessibility act (ETSI, n.d.).

(Directive (EU) 2019/882 on the accessibility requirements for products and services) later referred as “European Accessibility Act” aims to facilitate the operation of the internal market easier by standardizing various laws, regulations and administrative positions regarding accessibility requirements for certain products and services (Directive (EU) 2019/882 on the accessibility requirements for products and services). These products and services are the ones that have been identified to probably have the most differences in accessibility requirements. These products and services also consider CRPD’s obligations. These products and services include for example computers and operating services, smartphones, banking services, e-books and e-commerce. (European Union, n.d.). European Accessibility Act will apply to products and services that have been put on the market after 28 June 2025 (Directive (EU) 2019/882 on the accessibility requirements for products and services). Impact analysis of the European Accessibility Act indicates that the European Accessibility Act will improve cross-border trade, increase competition between businesses and thus more freedom of choice, better quality and lower prices in accessible products and services for customers (Deloitte, n.d., p. 95).

2.2.3 Finnish Acts, Standards and Guidelines

Act of the Provision of Digital Services (Laki digitaalisten palvelujen tarjoamisesta) is a law that enforces in Finland EU’s directive on the accessibility of the websites and mobile applications of public sectors bodies (Laki digitaalisten palvelujen tarjoamisesta 306/2019 § 1). One of the goals of this act is to normalize accessibility as part of activities authorities needs to consider (Regional State Administrative Agency, n.d.).

Three main requirements of the act are that first, all the digital services in its scope need to meet the requirements of Web Content Accessibility Guidelines 2.1 in A and AA level. Second, all the digital services must be evaluated, and shortcomings and current level of accessibility needs to be reported to accessibility statement. Third, all digital services also must have and feedback channel where people can leave feedback on how accessible service is. This channel must be electronic and service provider needs to respond to the feedback within 14 days. (Regional State Administrative Agency, n.d.).

It should be noted that this law obligates not only authorities, but also institutions governed by public law, as well as organisations that develop or maintain websites or mobile applications that get funding from public authorities. As an extension to EU's directive on the accessibility of the websites and mobile applications of public sectors bodies minimum requirements of this law obligate also banks, and insurance companies. Also, this law extends requirements to water and energy, transport and postal service providers in the case when the authority influences their activities. (Regional State Administrative Agency, n.d.).

Due the European Accessibility Act there are also changes made to Act on the Provision of Digital Services in the beginning of 2023. New services covered in the Act on the Provision of Digital Services after the transition time are e-commerce, e-books, parts of transport industries and banking services, services that provide audio-visual content and communication services. However, micro businesses do not have to comply the law. Micro businesses are defined as businesses where there are under 10 employees and yearly revenue is under 2 million euros. (Regional State Administrative Agency, n.d.).

Another important law in Finland regarding accessibility is Non-discrimination Act (Yhdenvertaisuuslaki), which was imposed to improve equality and prevent discrimination. It also adds protection provided by law for people who have faced discrimination. (Yhdenvertaisuuslaki 1325/2014 § 1).

Non-discrimination Act states that services providers need to make reasonable accommodations to ensure that person with disabilities has an equal chance to get education and job, deal with authorities and commonly offered goods and services as well as perform in work and move ahead with their career (Yhdenvertaisuuslaki 1325/2014 § 15).

Non-discrimination Act also states that person who has been discriminated is entitled to compensation from the service provider who has discriminated the person against the law (Yhdenvertaisuuslaki 1325/2014 § 23). Compensation must be proportionated equally to the severity of the discrimination act. Assessment of severity include type, extend and the duration of infringement (Yhdenvertaisuuslaki 1325/2014 § 23).

The Constitution of Finland (Perustuslaki) also states that everyone is equal before the law. In addition, no one can be treated differently from others on the ground of health or disability (Perustuslaki § 6).

3 Methodology

3.1 Qualitative Research

Qualitative research is a broad term that refers to a variety of techniques and methodologies used to study human social behaviour. Collected and analysed data are usually non-quantitative like interviews transcripts, documents and visual material such as photographs. The objectives of qualitative research are diverse and can vary depending on the goal of each research. (Saldana et al., 2011, p.4)

Induction is a research approach that is suitable to use when the topic is new and there is not very much existing literature about the research topic. Induction as a research approach emphasises understanding what kind of meanings people attach to events and the context of research and collection of qualitative data. Induction offers possibility for more flexibility during the research process and lessens the need for generalisation. (Saunders et al., 2009, p. 12).

Purpose of this study is to seek new insights from business benefits of accessible data visualizations. This is the reason why the author decided to conduct exploratory research, which is a useful method when there is need to clarify the problem better (Saunders et al., 2009, p.139). According to Saunders et al., (2009, p. 140) the three main ways of conducting exploratory research are, exploring literature about subject, subject expert interview and focus group interviews.

The author chose to use subject matter expert interviews as their method of conducting exploratory research, because subject matter experts can provide in-depth knowledge and experience about accessible data visualization when there is not so much theory or literature about the subject. Another reason for choosing subject matter expert interviews was that

the purpose of the study is to gain new insights and subject matter experts' expertise may provide those and also generate new ideas.

3.1.1 Semi-structured Interviews

According to Saunders et al., (2009, p. 318) interview can be defined as a deliberate discussion where there are two or more participants. In research, interviews can be used as a data collection method for valid and reliable data. Research interview is an umbrella term for several different types of interviews. Nature of the research question, purpose of the research and research strategy should be considered when deciding what type of interview is used for data collection. (Saunders et al., 2009, p. 318). According to Saunders et al., (2009, p. 320) King (2004) states that often semi-structured and in-depth interviews are referred as qualitative research interviews.

When researchers have a list of themes and questions to be covered, but from interview to interview there can be variety in themes or questions, the interview type is semi-structured interview. Variety in themes and questions means that there might be some questions skipped in specific interviews or additional questions may be added to examine research question further. Also, it might mean that there is variation in the order of the questions to ensure flow of the conversation. (Saunders et al., 2009, p. 320).

When there is a need for understanding reasons of research participants' decisions making process, attitudes and opinions, qualitative interview is probably included in the research process. (Saunders et al., 2009, p. 324). If there is a possibility to choose from several people for the interview it is important that the researcher considers that interviewees represent social and cultural settings as diversly as possible (Saldana et al., 2011, p. 33).

The author chose semi-structured interviews as a data collection method, because to answer to the research question there was a need to understand people's decisions, attitudes and opinions regarding accessible data visualizations. Interviewees were searched through a LinkedIn post, the authors personal network and trade unions. The authors original plan was to have three different groups of interviewees, with three persons within each group.

Planned groups where: people who create data visualizations (for example, data analysts, business analysts), people who work in marketing or HR and people with disabilities. These groups were chosen to get the point of view about business benefits of accessible data visualizations from different perspectives. The idea behind of the groups were to interview both data visualization creators and different types of data visualization consumers. However, finding interviewees was a challenge, so the groups were smaller than originally planned. Groups only had two persons per group and people working with marketing could not be interviewed.

Interviews were conducted between 22nd of March and 23rd of April individually through Microsoft Teams, except one that was conducted in person. The author had some premeditated questions to each group and some of the interviewees' responses lead to added questions spontaneously during the interview. Premeditated questions for each group can be found on appendix 1.

The premeditated questions were thought and written first in Finnish and then translated to English. Interviews were conducted either in Finnish or in English depending on the interviewees preferred language. In each interview, the author first described what accessibility means and then what data visualizations mean in the context of this thesis. This description was given, so that every interviewee would have the same understanding of data visualization and accessibility in the context of this thesis. The interviews lasted approximately between 30 minutes and 1 hour.

3.1.2 Categorizing

According to Saunders et al., (2009, p. 488) Kvale (1996) states that processes of research data collection, data analysis, development and verification are meshed and interdependent. According to Saunders et al., (2009, p. 488) Kvale (1996) also states that data analysis happens also during the collection process and this mid-process data analysis can be used to shape direction of data collection.

Usually, qualitative data is analysed through conceptual framework, which is created before, during or after data collection (Saunders et al., 2009, p. 484).

Data categorization is conceptual framework in which the first researcher develops categories and then afterwards attach meaningful data with these categories. Categories can be formulated either from collected data or from theoretical framework and they are identified by purpose of the research. To a get well-organized analytical framework to guide the data analysis, created categories should be part of comprehensible sets. (Saunders et al., 2009, p. 492-493).

When categories are initially identified they might be more descriptive, and through development of analysis there can be found more hierarchy in the data categories. These categories can have codes and labels that are used to find links between the data and interpretation of the data. (Saunders et al., 2009, p. 493). It should also be noted that even the final categories are not perfectly bounded, because created data categories are only researchers' best effort to group together things that appear to be similar into the groups that seem most appropriate (Saldana et al., 2011, p. 91).

For this research the author chose to categorize data from interviewees relation to accessible data visualization. Meaning, that the categories are first, data visualization creators such as data analyst and business analyst, second, data visualization users that utilize data visualizations in their work such as people working in HR and marketing and third, data visualizations users that need accessible data visualizations such as people with different types of disabilities or impairments.

3.1.3 Reliability and Validity

Reliability of the study is defined as how well researchers' data collection and analysis process will get consistent results (Saunders et al., 2009, p. 156). According to Saunders et al., (2009, p. 156) Easterby-Smith et al., (2008) has defined three questions to assess reliability, which include whether the measures yield the same results on other occasions,

whether similar observations will be reached by other observers, and if there is transparency in how sense was made from the raw data.

According to Saunders et al., (2009, p. 156) Robson (2002) has defined four possible threats to reliability, which are subject or participant error, subject or participant bias, observer error, and observer bias. Subject or participant error can occur when factors such as the time of day or the weekday influence interviewee responses. Subject or participant bias may manifest when interviewees respond in a manner they believe their company or manager would prefer. Observer error might arise from how interviewers frame their questions, impacting the answers obtained. Lastly, observer bias could lead different observers to interpret answers differently.

When examining the research reliability, there are some points that need to be considered. The author did try to make results easy to repeat on each occasion by explaining what data visualization and accessibility means in context of this research. However, these are very wide concepts and there is possibility of some participants understanding data visualization and accessibility differently in other occasion.

Validity of the study is defined as whether the conclusions made from the research are really about what they appear to be about (Saunders et al., 2009, p. 157). Validity can be divided into internal validity and external validity. Internal validity refers to how accurately the research demonstrates cause-and-effect relationship between identified variables. This is proven by using logical arguments and empirical evidence. (Taylor, 2013, p. 11). External validity refers how generalizable and applicable to populations research findings are (Taylor, 2013, p.14).

According to Saunders et al., (2009, p. 157-158) Robson (2002) has defined following as threats to validity: history, testing, instrumentation, mortality, maturation and about causal direction. History can affect research findings for example when conducting study about customers views about quality of certain product is happening right after a big product recall it might affect findings quite much and make results from the research misleading. Testing can affect research for example, when research is conducted about the time it takes for

teleoperators to handle customer enquiries, and the operators believe that the research results might affect it negatively, then there is a high possibility that it will affect the results. Instrumentation may affect to research in situation where for example, research is conducted about the time it takes for the teleoperators to handle customer enquiries and between the first and the second batch of teleoperators tested are given instructions to use every possibility to sell new products and services, the later batch might have longer calls which will affect research findings. Mortality is threat that means that the participants that drop out from the research before it has ended. Maturation is threat where for example, there is year-lasting research about management styles of managers that participate management development program, and during that year there are other events and things that affect their management style. Ambiguity about causal direction is threat where there is no way to know, if an event A is caused by an event B or other way around.

When examining validity of this research, there are two points to consider. The first is that due to time management limitations, there were not as many interviewees as the author would have liked to have. Also, people working with marketing could not be found for interviewing.

The second is that the interviewees were mainly from the IT sector. The author's assumption is that this is due to the subject of this research is perceived challenging outside of the IT sector.

4 Results

4.1 Persons Needing Accessible Data Visualizations

As mentioned above, the author interviewed two persons with disabilities. The author wanted to focus on other disabilities than ones related to vision. The interviewees have slight dyslexia and ADHD. To protect interviewees anonymity, it is not specified which interviewee had which. Interviewee A is entrepreneur in sports and coaching business and physiotherapist who has been working in sports field over 10 years. Interviewee B is working in HR with apprentice program.

Analysis of their interviews brought up some common themes. Both of them feel that data visualizations they encounter are not made accessible to them and in general they would find it helpful, if data visualizations would be made accessible for them. Interviewee A brought up studying and research in relation to data visualizations. They felt that during the studies “you learn to manage” (Personal communication, n.d) with non-accessible visualizations but says that it would make studying much faster and easier to get the whole picture of studied subject if data visualizations were accessible. Interviewee B also mentioned that it’s hard to find the main point of the subject and data visualizations would help them consume and understand information better.

Both interviewees also feel that there might be possibilities for new innovations if data visualizations would be made accessible. In the discussion, interviewee B highlighted that one possible outcome of innovative accessible data visualizations would be better communication and understanding of each other.

Both interviewees told that usage of accessible data visualizations would affect their image of the company. Interviewee A brought up that by using accessible data visualizations company would appear to be more professional and customer friendly. Interviewee A also stated that accessible data visualizations would add their interest and time spent exploring the company or the product company is offering.

Both interviewees expressed that by using accessible data visualizations company can convey its values. Interviewee A felt that usage of accessible data visualizations would tell that company values quality. Interviewee A also highlighted that by using accessible data visualizations company would convey their ideology. Interviewee B stated that “Everyone wants to be inclusive” (personal communication, n.d.) but would I like to see more diversity.

Usage of accessible data visualizations would affect both interviewees choice of employer. Interviewee A brought up a point, that if company’s public material is unclear and all over the place it would raise concerns regarding the working environment of the company.

Both interviewees also felt that by using accessible data visualization company could affect people’s purchase choices. Interviewee A has returned product, because of given

information about product has not matched with the actual product. Interviewee B brought up a perspective, that data visualizations can be used to manipulate people. For example, bright and colourful advertisement can lead to purchase decision more easily.

4.2 Persons Creating Data Visualizations

For data visualization creators author found two persons for interviewing as mentioned in previous chapter. Interviewee C is BI Specialist in medium sized IT company and has been working with data visualizations six months. Interviewee D is HR analyst, who uses native dashboard and reporting capabilities of the company's HR system in big IT company and has been working with data visualizations for 7 years.

During analysis of their interviews, common themes could be found. Both of the interviewees expressed that guidance provided by current data visualization tools was inadequate, even though there were some guidance offered by current tools. Both of them brought up guidance for visually impaired and used examples like alt text for graphs and some guidance about colours and contrast. Both of them also felt that it would be good, if the tools would provide more guidance and guidelines for accessibility, because it would make it easier to remember taking accessibility into account. Interviewee C pointed out that accessibility guidelines are more geared toward websites and software development, and they need to apply those guidelines for data visualization. Both of them also expressed that there would be need for general guidebook or help centre for accessible data visualizations.

Both also thought that accessible data visualization innovations could be made in tools used for data visualizations. Both brought up that these innovations could lead more automatic help from data visualization tools for taking accessibility into account. Interviewee C mentioned that AI or something similar could already add alt text for graphs while data visualizations are created. Interviewee C also made a point that making creating accessible data visualizations easier would also help the end user. Interviewee C reasoned that if as many people as possible can use the data visualizations, those visualizations will be used more. Interviewee D also brought up point that there are room for innovations related to accessibility in processes also.

Both interviewees said that company they are working takes accessibility into account to some extent. However, interviewee D pointed that taking accessibility into account is more relying of one's personal interest and there is need for more general accessibility guidelines. Both of them also felt that usage of accessible data visualizations in companies' material would affect company image and market share at least in certain reference groups. However, interviewee C was not sure how big of an impact it would have, and interviewee D pointed out that if person does not need or are interested in accessibility, these kinds of things might matter less. Both expressed that in their opinion accessibility needs to be clearly communicated to matter in choice of employer or purchase decisions.

4.3 Persons Utilizing Data Visualizations

As mentioned in previous chapter, the author would have liked to interview people from marketing also for this part of the research, but interviewees could not be found. So, both interviewees that utilize data visualizations in their work are working in HR. Interviewee E is global learning and development specialist in big IT-company. Interviewee E's job includes working with different kind of learning and development related projects and opportunities and also some employee engagement related projects. Interviewee F is Global HR Operations Lead in big IT company. Interviewee F's current role is to build HR function to big IT company's sub business. Both of them mostly utilize different kinds of graphs, tables and some infographics.

Interviewees experience how accessible data visualizations they use are vary. Interviewee E says that they would like to think that data visualizations they use are accessible, but also says that they know that is not the reality. They estimate that 70% of data visualizations they utilize are accessible. On the other hand, Interviewee F says that they have not thought of accessibility of data visualizations they utilize and for that reason cannot say how accessible data visualizations they utilize are.

Their experiences also vary regarding how well company they work for offers guidelines for creating and using accessible data visualizations. Interviewee E says that they think taking accessibility into account is heavily dependent on team and business unit people work in,

because company does not offer any general guidelines for accessible data visualizations. However, they point out that in company's biggest training materials accessibility is at least tried to take into account, but smaller trainings probably not. Interviewee F's experience is that company they work does not offer guidelines for accessible data visualizations "Because if I as HR person don't know, I question does for example marketing know".

However, both of them bring up a point, that if somebody would raise accessibility need company, they work for would create more accessible data visualizations and guidelines for those. Interviewee E feels that company they work for could be more proactive regarding accessibility of data visualizations and not wait for need to arise.

Both of them see that taking accessibility into account in data visualizations could enable innovations. Interviewee E points out that very often innovations come from persons with disability or person close to person with disability because there is want and need to make person with disability life easier, faster and more comfortable. Interviewee F brings up possibilities of artificial intelligence regarding innovations related to accessible data visualizations.

Both think that usage of accessible data visualizations would affect company image. Interviewee E pointed out that "it impacts company image if you are either very good or very bad at it, middle part does not affect that much". Interviewee E feels that level of accessibility that company they are working on has currently is enough not to hurt company images. They also describe that company they work on takes accessibility into account in company materials to some level but not above the standard.

Both interviewees feel that usage of accessible data visualization would tell about company's values. Interviewee E points out that would be one way to make everyone more welcome and that company is truly inclusive and not just saying that they are inclusive.

Both of them feel that by using accessible data visualizations, company can affect people's choice of employer. Interviewee E feels that this is especially affecting younger generations, who wants to know company's values, working environment and how inclusive they are when making choice of employer. Interviewee F feels that she has not seen any company

taking accessible data visualizations into account, so first company doing that would have very positive affect in the company image.

Neither of the interviewees has not heard that accessibility of data visualizations would have affected anyone's purchasing decisions, but both of them feel that there is possibility for accessible data visualizations to affect people's purchasing decisions.

4.4 Analysis

From interviews it could be seen, that closer the person was to either need for accessibility or created data visualizations more useful they found accessibility in data visualizations and saw more detailed business benefits.

It also could be seen from the interviews that people that personally do not need accessible data visualizations thought that the business benefits primarily served certain group of people. There is conflict between theoretical framework and interviewees experience, since Universal Design and Design for All main principles are that by using those guidelines, product or service would be beneficial as many people as possible.

Hypothesis was, that there would be possibilities for innovation related business benefits when using accessible data visualizations. This hypothesis was based on the idea that disabled community has driven innovations forward (Girma, 2017). From the interviews innovations related to data visualization tools stood out. Interviewees brought up possible innovations regarding artificial intelligence, processes and communication in general in context of accessible data visualizations. However, ideas about innovations were on very abstract level.

As protecting and enhancing brand, be it general brand or employer brand is vital for businesses (Rush (Ed.), 2018) its easy to see from the interviews that in this are there are quite lot of opportunities for business benefits. Even though interviewees opinions about amount of affectivity of accessible data visualizations varied, all of them thought that by

using accessible data visualizations business can communicate their values and affect how customer friendly, inclusive, and professional image company has. On the other hand, interviewees brought up that accessibility needs to be clearly communicated for it to be effective. Like interviewee E mentioned you need to be very good at it to affect positively.

Rush ((Ed.), 2018) suggested that and for educational and nonprofit businesses brand enhancement possibilities might be interesting benefit which could be achieved by using accessible data visualizations. Interviewee A specifically pointed out that studying would be easier and faster with accessible data visualizations. Interviewee A also said that “you learn to manage” with non-accessible data visualizations. Reflecting on this the author would see that by using accessible data visualizations especially educational organizations would have possibility the enhance their brand.

Impact analysis for upcoming European accessibility act predicts that act will make cross-border trade easier, increase competition between businesses and more give freedom of choice, better quality and lower prices in accessible products and services for customers (Deloitte, n.d., p. 95). Also, in interviews persons with disabilities told that by using accessible data visualizations would affect people purchasing choices and Interviewee A has returned product due information given about the product has not matched the actual product. Interviewee B also brought up point that data visualizations could be used to manipulate people and used bright and fun advertising leading buying product or service more easily.

Interviewees without disabilities thought that usage of accessible data visualizations might affect people’s purchasing decisions, but none of them had heard personally about situation where not using accessible data visualizations would have affected persons purchase decisions. It was also mentioned by interviewees without disabilities, that like in case of employer branding accessibility needs to be clearly communicated it to affect the purchasing decision.

Reflecting that people with disabilities are often defined as largest minority group (Khan et al., 2019, p. 170) and that in Finland there are estimated to be over one million persons with

disabilities in Finland (Regional State Administrative Agency, n.d.) the author would say that even though group of people with disabilities interviewed is small it should be noted that both of them said that usage of accessible data visualizations would affect their purchasing decisions. This gives indication that by using accessible data visualizations company could expand their market share.

5 Recommendations

The aim of this thesis was to research what business benefits could be achieved by using accessible data visualizations. According to conducted study, most of the concrete business benefits could be found on branding side and purchasing decisions.

For example, company could enhance their brand as inclusive and customer friendly by using accessible data visualizations in their materials and communicating clearly that data visualizations they use are made accessible. By clear communication about usage of accessible data visualizations also people who do not need accessible data visualizations could take that as an example of company's values, which might affect their purchasing decisions or choice of employer.

From innovation perspective tools and guidelines and help of artificial intelligence were brought up by interviewees. Proactively making a creation of accessible data visualizations easier, first, -with tools offering guidance and support, and second, with companies' internal guidelines and support, would make at least data visualization creators' job easier.

6 Conclusion

The objective of the thesis was to research what kind of business benefits could be achieved by using accessible data visualizations and explore the hypothesis which was based on business case made by W3C Web Accessibility Initiative. According to the hypotheses usage of accessible data visualizations would lead benefits in areas of innovation, market expansion, and brand and employer brand enchantment. The research question was what kind of business benefits can be achieved by using accessible data visualization?

Theoretical framework was based on concepts of data visualization and accessibility as well as acts, degrees and guidelines about accessibility in general. This decision was made by the author because guidelines and research focusing specifically for accessible data visualizations were limited. However, the acts, degrees and guidelines offer baseline for reflecting possible business benefits by creating minimum standard for accessibility.

Qualitative and explanatory method was chosen for this study because aim of the study was to gain new insights about topic. As there was also a need to understand the problem better the semi-structured interviews were chosen as the data collection method. Semi-structured interviews gave the author the possibility to explore the thoughts of people and needs regarding accessible data visualizations.

The main observations of the study were, that the closer people were either a need for accessibility or data visualizations, the more they saw benefits for businesses from using accessible data visualizations. Another important observation was, that many interviewees felt that accessibility of data visualizations needs to be clearly communicated to achieve business benefits.

For the future research the author suggest that it would be beneficial to conduct a bigger study with wider range of persons with disabilities and research what kind of needs they have regarding accessibility of data visualizations. Another interesting and useful study could be conducted about what kind of support and guidelines data visualization creators would need.

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Appendix 1. Data management plan

The author, commissioning company and thesis supervisor from Häme University of Applied Sciences have signed thesis agreement.

The data for the thesis is collected through semi-structured expert interviews. Interviews were conducted in Microsoft Teams and one in person. Interviews were recorded. The author will share the recordings only with interviewees themselves and thesis supervisor if necessary. Data will be saved for commissioning company's or school's cloud during the thesis process. The recordings will be kept saved one year after the publication of the thesis in authors computer and memory stick and after that data will be destroyed.

During the interviews, some indirect personal data was collected. This data includes interviewees explanation of their current job role. The role will be described in thesis in a way that interviewee stays anonymous. Interviewees gave their oral permission to collect and save the data for research purposes.

Due the research subject it was necessary to collect some sensitive data. In this case it was couple of interviewees health-related information. Interviewees gave their oral permission to collect and save the data for research purposes. In this thesis data is presented in a way that it can not be connected to specific person.

Appendix 2. Interview questions

Persons needing accessible data visualizations:

- Would you describe your job current role?
- How long have you been working in current role?
- How much and what kind of data visualizations you encounter in your everyday life?
 - o How much of them do you consider accessible to yourself?
 - o How do you think that it would affect your everyday life, if the data visualizations you encounter would be accessible?
- Have you had any challenges to read data visualizations you encounter?
 - o If yes, what kind of challenges?
- The first commercial e-mail server was developed because hearing-impaired people wanted a better way to communicate with other people instead of a telephone. Do you think it would be possible to find such new inventions/innovations in data visualizations?
 - o If yes, what kind of innovations/inventions?
- If company used accessible data visualization in its materials, would it affect your image of the company?
 - o If yes, how?
- Do you feel that if the company uses/would use accessible data visualizations in its channels that it would tell about company's values?
- Do you feel that if the company used accessible data visualizations, it would affect your choice of employer?
- Do you know if there is someone who hasn't purchased service/product because accessibility has not been taken into account in data visualizations?

Persons creating data visualizations:

- How long have you been working in positions that include data visualization?
- Would you describe your current role?
- Do you utilize data visualization tools in your current role?

- If yes, what?
- If yes, do current tools offer enough support for accessibility considerations in data visualizations?
 - If not, what kind of additional support would you need?
- What kind of data visualizations do you produce and for what purpose?
- Do you feel that there is enough and easily available information about accessible data visualization?
 - If yes: Where have you been found the information and do you feel that information provided helps you with your work?
 - If no: What kind of information would you need and what kind of benefits would you feel would get from then?
- Is accessibility taken into account in the company you work for?
- Does company you work for offer guidelines for supporting and utilizing accessibility?
 - If yes: Do you feel that it supports creating or utilizing accessible data visualizations?
- The first commercial e-mail server was developed because hearing-impaired people wanted a better way to communicate with other people instead of a telephone. Do you think it would be possible to find such new inventions/innovations in data visualizations?
 - If yes: What kind of innovation/inventions?
- Does company you work for use accessible data visualizations in its materials (website, newsletters, job announcements, etc)? Do you think it affects company image?
- Do you feel that if the company uses/would use accessible data visualizations in its channels that it would tell about company's values?
- If company uses accessible data visualizations in its channels/materials, do you feel it would affect people's choice of employer?
- Do you know if there is someone who hasn't purchased service/product because accessibility has not been taken into account in data visualizations?
- Do you think that taking into account accessibility in data visualizations would have an impact on people's purchasing decisions?

Persons utilizing data visualizations:

- Would you describe your job current role?
- How long have you been working in current role?
- What kind of data visualization you encounter in your everyday work life?
 - o How much of them do you consider accessible?
- Is accessibility taken into account in the company you work for?
- Does company you work for offer guidelines for supporting and utilizing accessibility?
- The first commercial e-mail server was developed because hearing-impaired people wanted a better way to communicate with other people instead of a telephone. Do you think it would be possible to find such new inventions/innovations in data visualizations?
 - o If yes: What kind of innovation/inventions?
- Do you feel that if the company uses/would use accessible data visualizations in its channels that it would tell about company's values?
- If company uses accessible data visualizations in its channels/materials, do you feel it would affect people's choice of employer?
- Do you know if there is someone who hasn't purchased service/product because accessibility has not been taken into account in data visualizations?
- Do you think that taking into account accessibility in data visualizations would have an impact on people's purchasing decisions?
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