



Expertise
and insight
for the future

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Covid-19 Impact on Elisa Internal IT and Digital Workspace

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PREFACE

Studying and working in the same time was quite challenging for me as it was done in the middle of the disruption caused by Covid-19. This challenge also made work more interesting as we started to look into the future from a different point of view. The goal of Elisa's work environment project was to support employees at the office and we studied what are the future needs of the employees at the office. We tried to explore office needs with experiments, but, as there were so few employees in the office, this project was ramped down.

Covid-19 gave me an opportunity to study how the changing situation accelerated Elisa's digital work environment development and what are the future needs for the work environment. To be able to understand how to support employee needs with digital solutions in the future, I read a lot of different types of material outside of the IT domain.

I am grateful to my employer and my boss for the opportunity they have given me and how they emphasized learning as part employee development. It was also pleasure to work with a broad-minded project manager who encouraged me to explore crazy ideas further. Hopefully that work bears fruit in the future. My husband and family - thank you for all the support you have given me during this journey of learning.

Helsinki, 25 May 2021
Ulla Butusina

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<p>In order to avoid Covid-19 infections, the government officials recommended Finnish employees to work remotely starting from spring 2020. The Elisa corporation followed this recommendation.</p> <p>Research was performed for Elisa Oyj. The focus area was the impact of the wide scale transition to remote work on the company internal IT and on the digital work environment. The goal was to get a better understanding of the future digital work environment requirements and how to be prepared for the post Covid-19 period.</p> <p>The research was started, as part of the Elisa Ideal Work project in autumn 2020, with a survey to the Elisa Corporate Customer unit in the Pasila office. The survey investigated Covid-19 impacts on the work methods and estimations on the future work methods. A second phase of the research was done by interviewing Elisa internal IT key persons and then analysing the information provided.</p> <p>Production applications and systems not used in office were out of the scope of the research. Research indicates the key areas to focus on enhancing Elisa internal digital work environment and to meet changing sociological work environment needs both at the office and at home and to offer data to support further enhancement of the office work environment.</p> <p>According the research, employees think that in the future they will come to office to meet, influence and collaborate with one another while individual work will mostly be done at home. This will have impact on facilities and they should support more modular and adjustable meeting and project spaces. Research indicated also that virtual collaboration tools will replace physical whiteboards as they need to be accessed regardless of location and time. It was also concluded that employees need more support from the employer with ergonomics at home.</p>	
Keywords	Remote Work, Telework, Covid-19, Internal IT, IoT

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List of Abbreviations

4G	Fourth Generation (mobile network)
5G	Fifth Generation (mobile network)
EIAM	Elisa Identity and Access Management application
EIW	Elisa Ideal Workplace
IoT	Internet of Things
LAN	Local Area Network
MFA	Multi Factor Authentication
OS	Operating System
THL	Terveyden ja hyvinvoinnin laitos, Finnish Institute for Health and Welfare
TTL	Työterveyslaitos, Finnish institute of occupational Health
VDI	Virtual Desktop Infrastructure
VPN	Virtual Private Network
WLAN	Wireless Area Network
WFH	Work From Home

1 Introduction

Covid-19 forced most of the companies worldwide to do the giant leap to remote work and digital services. Before Covid-19, we used to commute to our workplaces daily. We had a workday 9 to 17 and after workday we returned to our homes. Students did likewise according their studying program. Government officials throughout the world took different actions in order to avoid Covid-19 infections. One of such actions in Finland was a strong recommendation to work remotely starting from March 2020.

The research in this paper was done for Finnish company Elisa which offers telecommunication and digital services. Elisa is almost 140 years old and has about 5000 employees who work mostly in Finland and Estonia. Because of recent acquisitions, Elisa employees have now colleagues from 16 different countries throughout the world.

Elisa's mission is "A sustainable future through digitalization".

Elisa's core values are Customer focus, Responsibility, Renewal, Results orientation and Collaboration. To develop Elisa's work culture, the Elisa Ideal Work (EIW) concept was created. It includes flexible ways of working, continuous learning, improving and innovation. As a company offering telecommunication services, Elisa have been forerunner in remote working.

According to "Great Place to Work" and Equileap -research, Elisa is one of the best workplaces in Europe. In Sustainable Brand Index 2021, Elisa was the industry winner in Finland. Also, ETLA considers Elisa as one of the top significance domestic corporates in 2021.

The focus area of this study is Covid-19 impacts on company internal IT and digital work environment. The research goal is to get a better understanding of the future digital work environment requirements and how to be prepared for the post Covid-19 time

Figure 1 presents how research was performed. Research was done by using qualitative and quotative methods. For qualitative methods office IT key persons; IT Architect, production managers and solution managers were interviewed and Elisa internal surveys

were performed during EIW project 2020-2021. Furthermore for qualitative method, Elisa IT statistics from IT channel orders and network services were investigated.

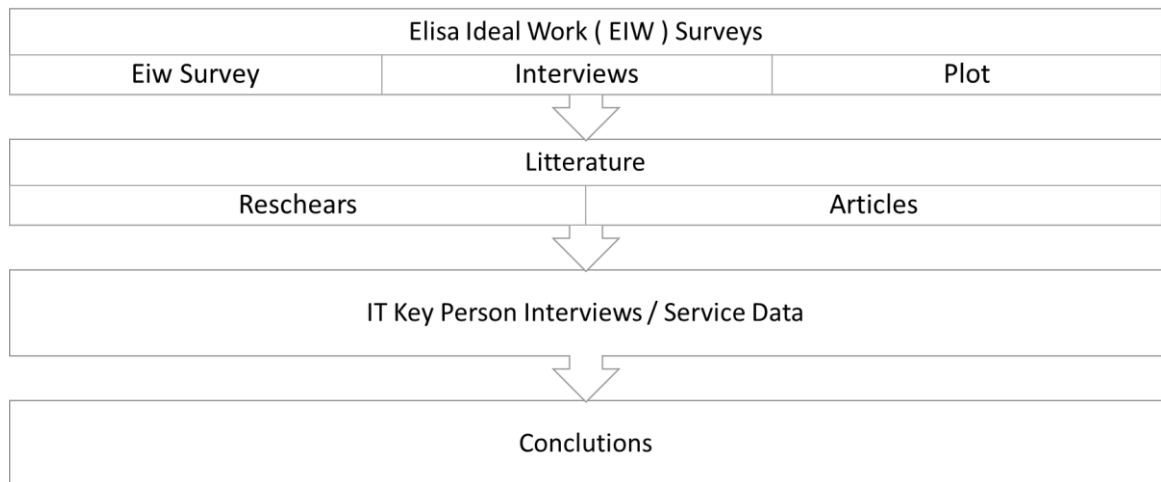


Figure 1. Research Design of the Study.

The thesis has been divided into 8 sections. After introducing the study problem, framework and research methods in the first section, the study describes the Elisa office digital environment in the second section. In the third section the thesis proceeds into introducing other research made during Covid-19 and IT trends. The thesis moves on to explain Elisa specific research including surveys in the fourth section, IT key person interviews in the fifth and data analytics in the sixth section. Finally the thesis summaries Covid-19 impact on Elisa IT in the seventh section and in the eight section summarizes discovered future digital work environment needs.

2 Elisa's Digital Work Environment

This section provides information about Elisa's office digital work environment. First the Elisa office network is introduced and then remote access services to the network, moving on introducing basic tools the company offers to employee and finally describing IT support channels for employees.

Elisa has four main units: Consumer services, Corporate services, Production and Support services. Elisa's internal IT is part of the Production unit and provides basic office tools and IT infrastructure for employees.

2.1 Office Network

The company has offices in 18 different locations in Finland. The headquarter is located in Helsinki. Other main locations are Tampere, Turku, Kokkola and Joensuu. Elisa uses Elisa Corporate MPLS (Multi-Protocol Label Switching) Network. The office network is built between all offices in Finland and network extends to cover Elisa Videra offices in Great Britain and Spain. This network also provides access to different services and different user groups, such as guests. Network services are provided with LAN (Local Area Network) and WLAN (Wireless Local Area Network) connections. Elisa Eesti has own network infrastructure.

The employer provides the employees with a mobile subscription and mobile phone as a taxable benefit. Depending on the work profile of the employee, an extra broadband connection can be provided.

2.2 Remote Access

Working remotely has been a company policy widely adopted in the organization for several years. To support the remote work culture, Elisa provides several remote access services to the office network.

The remote service most commonly used throughout the organization is email in a Microsoft O365 environment. Remote services which require tunnel access to on premise

servers can be divided in services used through VPN (Virtual Private Network) and in services with a dedicated profiles and Citrix. VPN is commonly offered to Elisa employees and Citrix services are used for providing access to partners. Vendors have their own VPN profiles which they can use. Some services like the intranet portal can be accessed from the internet using Microsoft Azure Proxy or Elisa Identity and Access Management (EIAM) application. For authentication to services, employees mainly use Multi Factor Authentication (MFA) and EIAM. Authentication services such as Mobilli Varmente can be used as well.

2.3 Workstations and Peripherals

Employees can order workstations, peripherals and access rights needed for their work from internal portal. The process for handling orders is highly automated.

Most of employee laptops are provided with a Microsoft Windows operating system(OS). In the selection you can find macOS as well. In some rare cases, Linux OS can be provided, but usually these are used for servers, not for individual usage. The basic setup of an employees workstation is a laptop and a mouse. Some roles also require other devices such as headphones.

Work desks in the offices are equipped with one or multiple external displays. In some offices, a keyboard belongs to the basic setup of the work desk. When new office premises are designed, according EIW principles, variation of work profiles is taken into account. This has resulted in different office work desk set-ups in recent years. One aim of these projects was that connecting external displays and peripherals is as easy as possible. To reach that goal, USB-docks were included in the setup. This also raises employee equality as anyone is able to use any work desk without worrying about the interfaces their laptop has.

2.4 Office and Collaboration Tools

The Microsoft Office suite (email manager, word processor, spreadsheet, presentations and collaboration tools) is part of the standard workstation set-up. Employees are able to use cloud based equivalent Microsoft tools as well.

For collaborating with others, employees mainly use the on-premises SharePoint servers. Jira and Confluence are also used. Since Microsoft Teams was launched for Elisa employees in 2018, on premises service use has been decreasing and cloud based service have been taking their place as they consolidate meeting and collaborating tools.

For communicating with others, employees use Outlook, Teams and Mattermost. For conferencing services they use Microsoft Teams and Elisa Videra Cloud Connect Meet. Conferencing services Cloud Connect Meet can be used for conference room video calls with parties outside of the organization. It can also be accessed via regular phone call.

Meeting rooms are equipped with a video camera, a display (or two), a microphone and a speaker system. Mostly, these are equipped with USB-video cameras, but some of the rooms have high quality videoconferencing systems.

For finding suitable working or meeting spaces, employees have the Elisa Reittiopas application, which presents a digital twin of the offices from premises data. The application provides also interior sensor data such as meeting room temperature, CO2 - levels and occupancy information.

2.5 IT Support

IT support has several support channels for employees. These are: a phone service, a chat channel, a ticket system and a physical support point in Helsinki Pasila. In other Elisa offices, face to face IT support is given by trusted subcontractors. Support is given during office hours only.

3 Work Change Around Us

This section provides information about different researches about teleworking and future of the office. Telecommuting, telework or remote work is working for a company from some other location than the company's office using modern technology and telecommunication means to keep in touch with the employer [9]. Remote work has roots in the 1970's when "telecommuting" was used to describe work done elsewhere than office via phone. In the 1980s, teleworking was noted as the "next workplace revolution" [10].

Remote work has been part of Elisa work culture for a long time. In 2017 Elisa announced that 2000 employees already worked part of the week remotely [11]. Some employee groups, such as call center agents or Elisa shop sellers, are not part of this trend due to nature of their work.

As the global pandemic forced companies to protect their employees by requiring them to work from home, the study of remote work accelerated. "A million of Finnish people leaped to work remotely" announced Virpi Ruohomäki from Finnish Institute for Health and Welfare [1]. New kinds of professional groups such as teachers, doctors and therapeutics moved to remote work in the beginning of the pandemic. Eurofund "Living, working and Covid-19" online survey reports on July 2020 that 45,6% of Finnish employees have worked remotely during the pandemic [2].

FutuRemote surveyed over 1100 Finnish public and private sector employees about work experiences during Corona. According to their report, Finnish employees have well-adjusted to telework. Home office was seen as a distracting work environment by only 24% of respondents and technology-mediated communication was adopted. Videoconferencing tools were used by 40% of respondents several times a day. The report verifies that email and videoconferencing tools were used more often than enterprise social media and instant messaging [3].

The Finnish Institute of Occupational Health discovered in research project "Miten Suomi voi" (How Finland is doing?) that remote workers make more independent work related decisions and have learned more efficient work methods than in-office workers. On the other hand, the institute noted that, remote workers had less brakes during the workday and had less support from colleagues than in-office workers [4].

A CocoDigiReserch study on the public sector found out that employees who had a work station or a dedicated room at home reported higher scores on telework effectiveness. 66% reported that remote office is less noisy and less distracting. 72% employees reported being able to concentrate on work in the same way or even more than before the pandemic. [5]

Microsoft also has done its own research about remote work with over 50 different studies across the corporation since the Covid-19 pandemic started. "As the world transitions to remote work and learning, Microsoft Teams meetings increase at exponential rate", people started to turn video on two times more and in March 2020 total video calls in Teams grow by over 1,000 percent [36].Figure 2 shows how dramatic change was as employees and students started to use Microsoft Teams for communication in the beginning of pandemic.

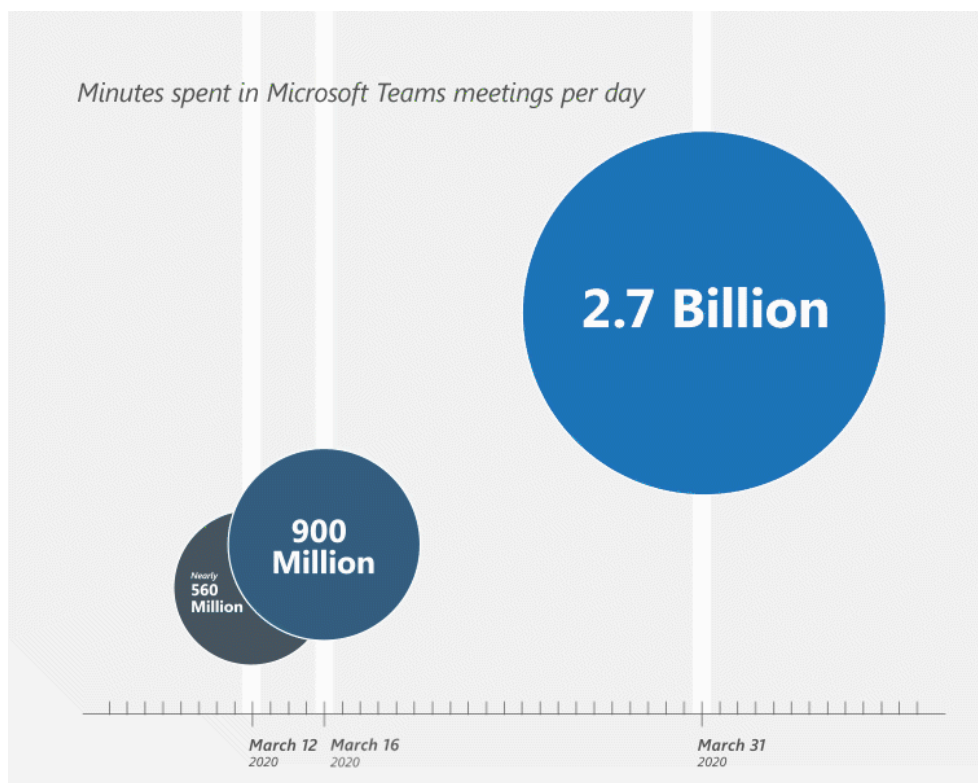


Figure 2. Minutes spent in Microsoft Teams meetings per day[36].

In their study about collaboration and meeting environment they found out that meeting load increased and, out of these meetings, short meetings such as 1:1 increased by 18% while check-ins and team social meetings grew by 10%. [6, p7]Instant message traffic

increased between 65% and 72%, the biggest impact being on managers with a 115% increase from pre Covid-19 figures.

Microsoft China workers noted that voice and videocalls doubled from 7 to 14 hours a week after transition to remote work[6 p.7]. Videoconferencing was found fatiguing as it leaves out nonverbal clues, forces paying attention for others, sometimes had low media quality and people were cognitively multitasking [6,p.35]. Concentration also began to decrease after 30-40 minutes into video meeting. When employees got used to work remotely, video was turned on less frequently due to bandwidth problems and effort needed for improving one's image. A Microsoft study on internal meetings found out that 51% of participants ranked the ability to hear another as the most important factor of the meeting[6, p 11].

Videoconferencing was appreciated for discussions in small groups of participants where the video feed boosted engagement and provided important information for collaboration. When the number of participants grew and documents were presented during the meeting, half of the participants felt that video was distracting. The presenter on the other hand, felt in 27% of the cases that the video of the audience was distracting and 53% of presenters wanted more information / feedback from their audience. On the other hand, the audience wanted to see video of the presenter.

69,7% of Microsoft employees involved in the study reported using parallel chat in meetings for getting more information about issue handled, to participate or to influence others [6, p.13]. In their study they also found out that creative work, new workstreams and extensive collaboration suffers from telework [6, p.18].

On the security side, the increased number of phishing messages was raised as the biggest security threat during the Corona crisis. Other threats were collaboration tool vulnerabilities and an increase in the number of devices used by employees to access company data.[6 p.34]

One of the biggest issues reported by IT security professionals were educating people using remote software and best practices . As IT challenges, poor internet connection and not having appropriate technology or equipment while working remotely were reported (not having same equipment as in the office) [6, p.35]). A One of the biggest

issues reported by IT security professionals were educating people using remote software and best practices . [6,p.35]

A Harvard report suggests that knowledge workers have benefited from the Covid-19 lockdown as they more effectively prioritized and focused on work. Large management meetings took 12% less time than in 2013 and 9% more time was spent doing externally focused work such as interacting with customers and partners. For a third of interviewed persons, time has remained same on desk-based work, but training online increased [7]. Gartner reported that 54% of HR leaders indicated that poor technology and infrastructure is the biggest barrier to effective remote working.[8] Some organizations support remote workers with stipends as they have realized that redirecting investments from real estate to costs for employee ergonomics is beneficial in a long term.[15 p.9]

Over three-quarters of EU employees want to continue working from home at least occasionally, even without Covid-19 restrictions. Most EU workers report a positive experience with teleworking during the pandemic but very few wish to telework all the time, with the preferred option being a mix of teleworking and presence at the workplace [12]. Gartner has predicted that by 2030, when generation Z will start to work, remote work will increase by 30%. [8 p.3] 20-25% of workforce in advanced economies could effectively work remotely 2-5 days / week [13 p.47]. McKinsey Global Institute (MGI) research stated that 70% of computer-based office workers could effectively work remotely [13], although this depends on a board range of factors, including its effect on productivity and working conditions like working spaces and ICT tools [14,p. 8]

Covid-19 related targeted cyber-attacks and cyber-crime campaigns were reported after the outbreak such as scams impersonating public authorities and organizations, targeting support platforms, personal protection equipment frauds and offering Covid-19 cures [16]. Phishing attacks were the biggest cyber security related threat encountered during the pandemic. [17]

3.1 Future of Office

Office vacancy rates increased significantly across major cities in 2020: by 91% in San Francisco, 32 % in London and 27 % in Berlin. At the same time vacancy rates have declined in some smaller cities such as Glasgow, implying that companies may be shifting operations away from larger cities toward smaller ones [13 p.52]. In the Helsinki area office rent development has turned negative in the second half of 2020. Here there was

a considerably lower number of leases compared to previous year along with a decrease in the average size of leased spaces.[18]

There has been speculation about the future of the office in a media. Helsingin Sanomat declared "R.I.P Office" [19] and explained how Corona has killed open offices. Companies like Facebook made a decision to allow most of their employees to work from home permanently [20] and Shopify is becoming "digital by default" [21]. In U.K., 71% of 2500 employees surveyed would like to go back to open office with on-demand privacy spaces (such as phonebooth). People need offices to do collaborative work and a shift from work desk areas to collaborative spaces is wanted, although work desk areas cannot be altogether eliminated. The report suggests that one main reason to come to office is focusing in own work. If a flexibility of hybrid work and shared work desks is given instead of assigned desks, 51% of respondents were willing to do the swap. In the future, in-office presence may be more driven by the team dynamic and meeting needs than by the organization overall.[22]

A Harvard research group including designers developed a new office model comprised of a networked series of nodes across a geographic region as illustrated in Figure 3.

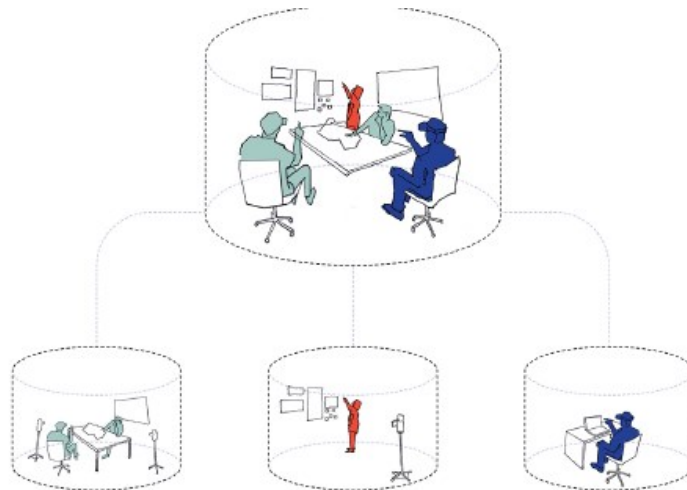


Figure 3. Virtual meetings supplemented by VR/AR and advanced broadcast technology, Illustration [15,p.8].

They argue that this model would benefit collaboration and give more options for employees in the event of disruptions or can bring organizations closer to their customers or even get closer to talent pools in the labor market and more mixed use of diverse

cross-section of workers. This model requires high-quality connections. [15,p.4] Model described needs immersive technology such as virtual/augmented reality to connect co-located clusters of participants seamlessly[15,p.8].

3.2 Potential Remote Work

Following types of work can be done remotely and have growing potential to be done remotely: updating knowledge and learning, interacting with computers, thinking creatively, communicating with and guiding colleagues , processing, analyzing and interpreting information. Least remote working potential was seen in selling and influencing others and physical work actions such as controlling and repairing a machinery.[13 p.49]

Another shift in the view on work from home is on which roles should be allowed to do it. Previously, managers and senior professionals were allowed to work from home as a luxury granted by the title. Covid-19 has proven that less senior employees can do the same if interior requirements for data security and work conditions are fulfilled. In a hybrid model employees can choose where to best perform their work tasks as they are no longer restricted to the work place itself.

The platform economy, which connects consumers to workers, has yet an insignificant foothold in the Nordics [23]. In Finland, platform work is done occasionally. Most common tasks performed via online platforms is software development. [24] The Finnish Institute for Health and Welfare predicts that this kind of work exchange will grow in the future [25] .

3.3 Immersive Virtual Reality

Immersive virtual reality is a big business in the videogames industry and was brought to working life as well. Consumer virtual reality hardware and software market revenue 2020 was 2,6 U.S billion dollars. It is predicted to grow to 5,1 in billion Us dollars by 2023. Industrial usage of VR devices is expected to be three times larger than that of consumers.[26]

VR and AR devices relay information on different tasks in industry maintenance work, healthcare, training, remote access and simulations. The high level of detail in the output of the devices fools the human senses and produces real-life experiences of presence. [25,26]

Immersive technology may bring a new dimension to work from home. Prices of the VR glasses have been decreased during few years. Virtual meeting spaces has been created and Facebook has published its own solution for offices in virtual reality. Multiple customizable screens, which are mimicking multi monitor setups can be added in virtual space.[27, 28]

3.4 Business Travelling

Business travelling decreased significantly because of travelling restrictions. Face to face meetings changed to videoconferencing. Business travel is not likely to recover fast. History shows that, after a recession, business travel takes longer than leisure travel to bounce back. After the 2008–09 financial crisis international business travel took five years to recover. [13 p.64] MIG forecasts that 20% of business trips will not return after pandemic and Scott McCartney in Wall Street Journal says that the cut will be even 36% permanently [29].

4 Surveys at Elisa

As part of corporate responsibility reporting, Elisa measures its CO2 footprint and one way of doing this the work related travelling survey. In 2011, Elisa employees estimated that they work remotely in average 3,4 days per month [30]. In 2015, the corresponding figures were 6,7 remote days/month [31]. In 2017, an average of 6,8 remote days were reported [32]. So far, remote days were increasing. Measurements towards videoconferencing took place and the Gaze Triggers Interaction project was started. This is an investment into Elisa Videra Cloud Connect high-quality videoconferencing systems.

In an 2018 survey, Elisa employees reported to be working remotely 6,5 days per month and in 2019 4,8 days per month [33]. Offices attracted employees to work from there again. There were three big EIW projects to renew office premises in 2019: Kokkola, Joensuu and Turku. At those locations new offices were designed to support work according EIW principles. The project to design Tampere Ratina were also launched and was completed in the middle of corona crises in the summer of 2020.

Because of strong remote work recommendation from the government side, Elisa employees moved to working mostly from office to home and 80% of employees work was done remotely [34]. Employees answered to the same survey that they work remotely 3,35 days a week. This is a 198% increase compared to previous year.

In September 2020, the “EIW Pasila 5th Floor Corporate Customer Project” survey was conducted to find out future work environment requirements in Elisa. The survey tried to find out the work conditions and requirements of the participants, before and during the Corona epidemic and how they see their future work requirements.

Based on those answers some experiments were designed but tightened security measures due to the Corona pandemic prevented their completion. Some changes were initiated and are still in progress.

4.1 Methods for Work Survey

The survey was sent in September 2020 to corporate customer unit personnel who worked at the Pasila campus. 109 employees answered the survey.

The survey consisted of 28 questions and was divided into 4 areas; Work, Collaboration, IT Tools and Security. Employees were asked to estimate their work methods in those areas before Covid-19, during Covid-19 and as a forecast for the future. Background information such as the department and age of employment was requested. 63% of respondents had over 10 years employment relationship at Elisa and 18% of respondents had under 5 year employment relationship.

This study will focus on IT relevant parts of the survey. It was designed to support three dimension of EIW: social, physical and the digital work environment. One of the goals was to find out how many days in a week employees work in the office and why to understand how to change office facilities and how to support remote work. Employees were asked to estimate what kind of work they did during the workday.

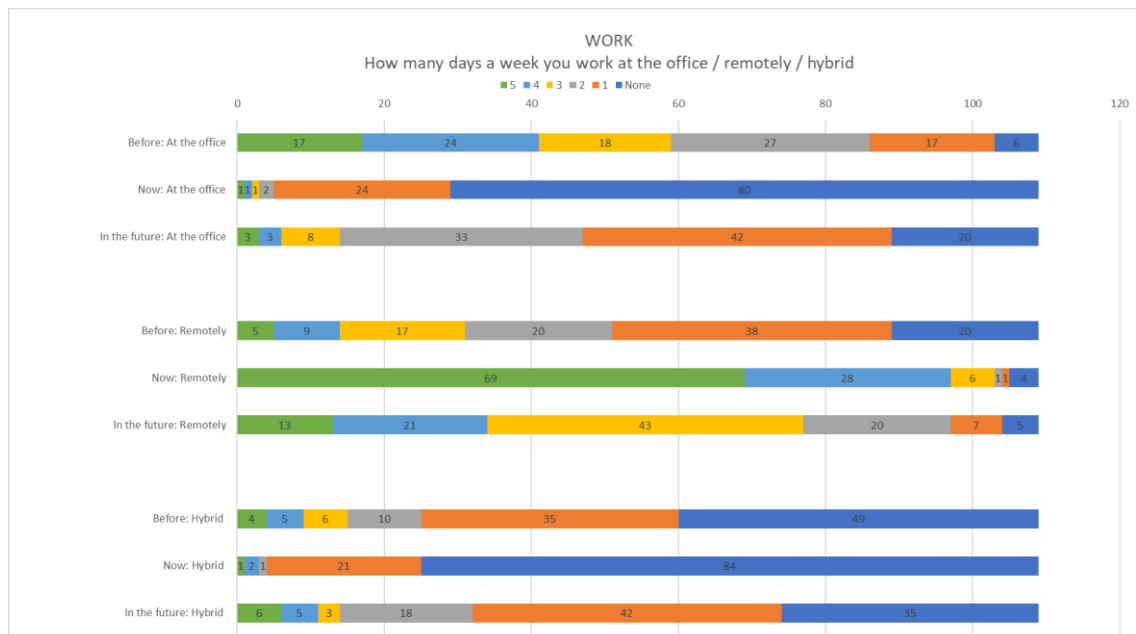


Figure 4. How many days a week do you work at the office/remotely/hybrid answers.

In September, when the survey was conducted, most of the employees worked remotely. The survey results show that, before Covid-19, 59% of employees worked 3 to 5 days per week at the office and 22% of employees answered that they visited the office at least once a week during the pandemic. 75% estimated that they would work 1 to 2 days per week at the office after Covid-19 and 3% wanted to continue working full time at the office.

Before Covid-19, 58% of the respondents estimated that they worked remotely 1 to 2 day per week and 77% of respondents estimated to be teleworking 3 to 5 days per week after pandemic. Working hybrid, in this context of the survey meaning part of the day at the office and part of the day working from some other location, is estimated to increase in popularity by 23%.

To understand the functional differences between office and remote work, the employees were asked for work preferences and the reason why they choose a particular location. Results of the survey show that employees came to office because it was their habit, to meet other people, to cooperate, to influence and because of IT support and work ergonomics. Remote work was selected for better concentration and for fitting work and leisure time together.

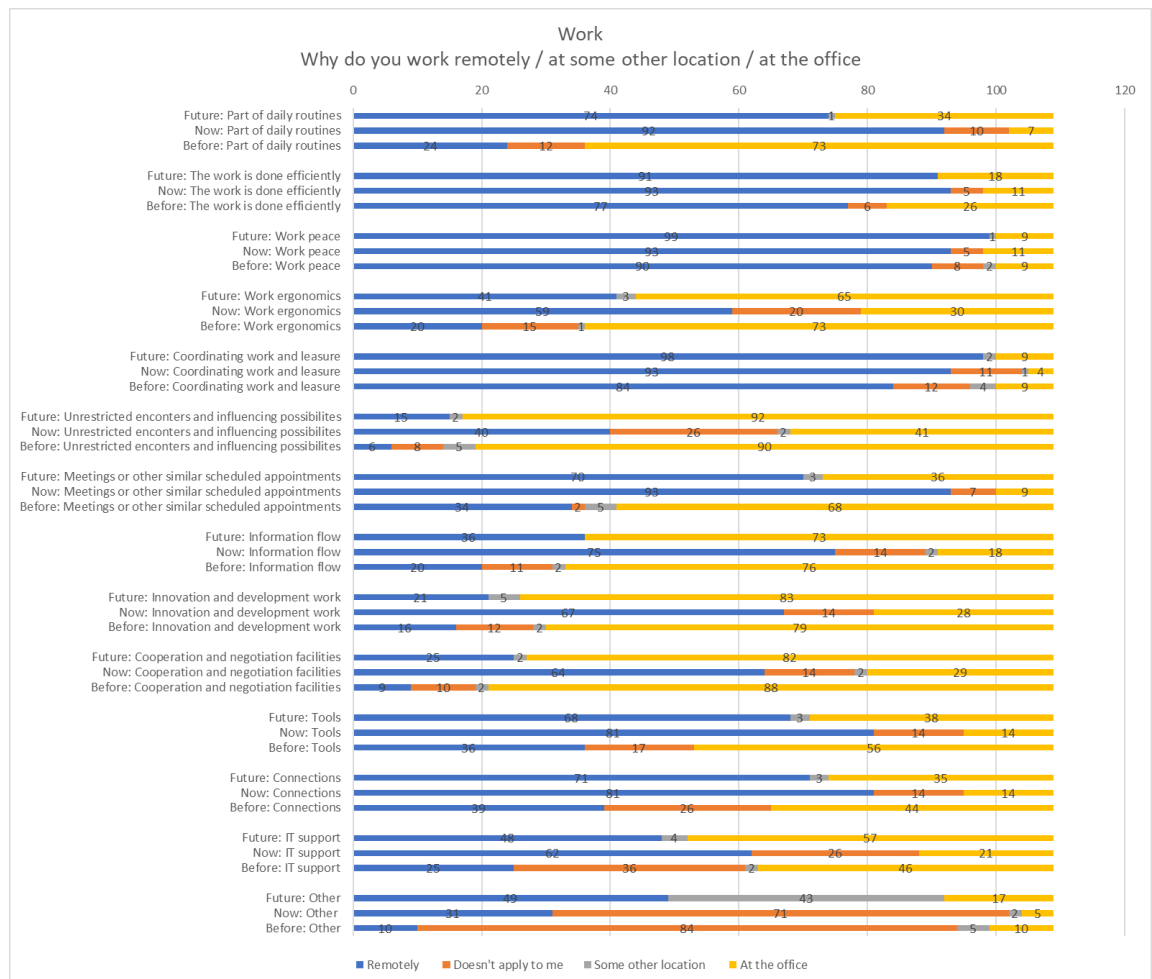


Figure 5. Why do you work remotely / at some other location / at the office results.

Figure 5 indicates that, during the Corona crisis, employees came to office because of unrestricted encounters and influencing possibilities, work ergonomics and to inhouse

meetings or development work. After covid-19 they estimated that they would come to office to meet people and work together with innovation and development work. Cooperation and negotiation facilities were also a main reason.

One goal of the study was to know what kind of work employees would prefer to do remotely or at the office. The results of the survey show that employees see the office as the place to come to for innovation or development work together and as the place for events.

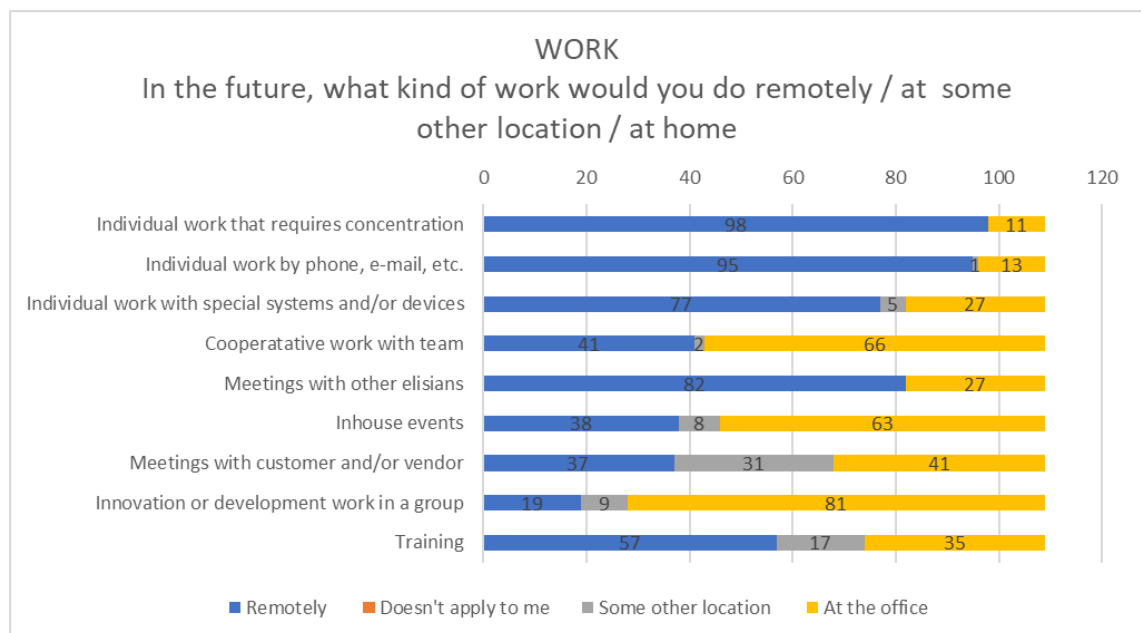


Figure 6. In the future, what kind of work would you do remotely / at some other location / at home answers.

It is interesting to observe from Figure 6 that meetings with vendors and customers were almost equally distributed between remote, some other location and at the office.

Employees were asked for their opinion about how the office environment should develop to support post Covid-19 work. As results in Figure 7 show, employees value spaces which support concentration and work desks for individual work. So, even with most of the work requiring focus being done at home as (Figure 5), individual workspaces are highly appreciated. Also spaces for team work are required.

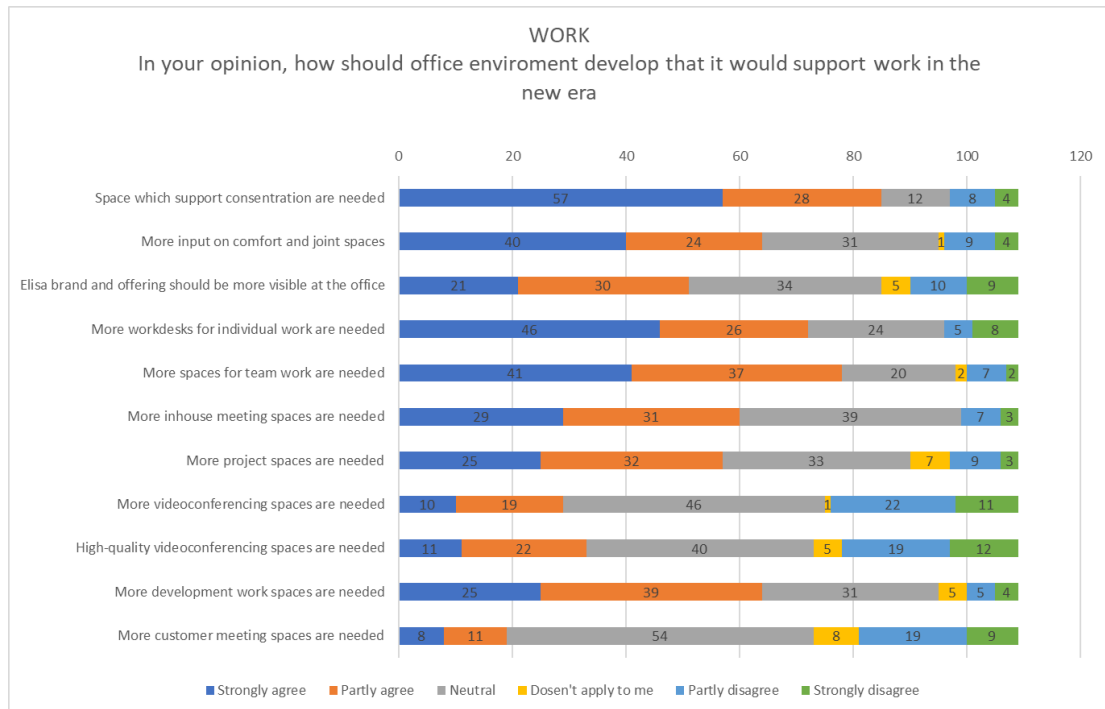


Figure 7. "In your opinion, how should the office environment develop that it would support work in the new era" answers.

At the end of the work section of the survey we asked again, in a slightly different way, how much and where would employees estimate to work in the future. Figure 8 supports the Figure 4 results. In the future most of the working days of the week will be done remotely and the need for office is for 1 to 2 days a week. By a customer or at a vendor once and even twice a week as well as working hybrid. Together with colleagues at some other location was seen to be done once a week.

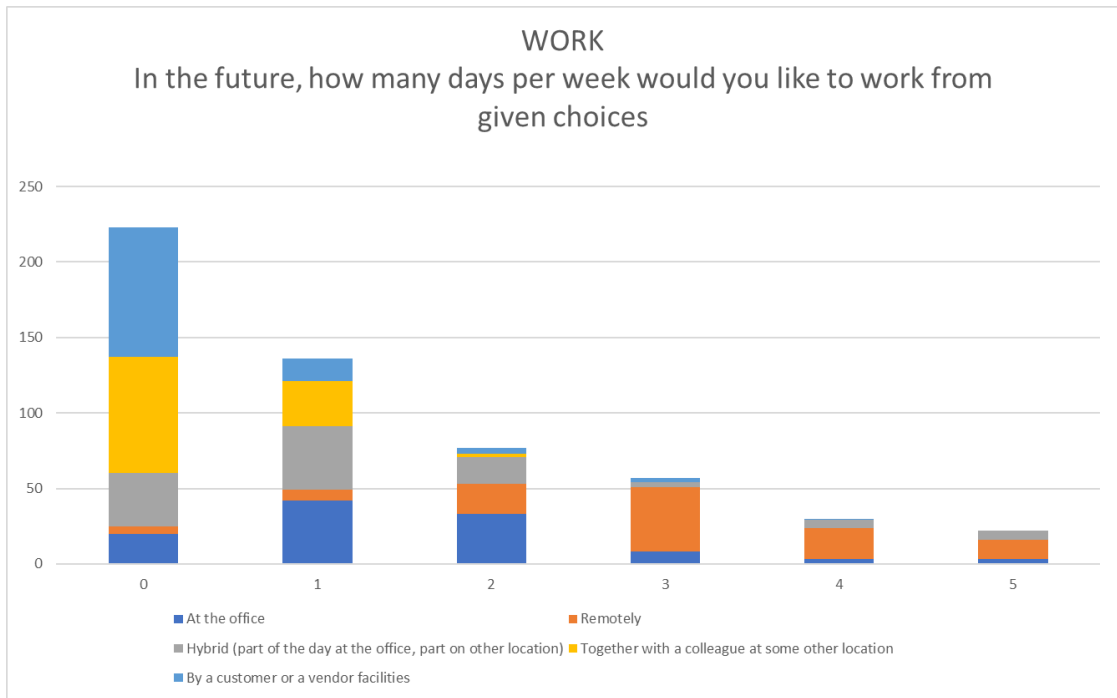


Figure 8. “In the future, how many days per week would you like to work from given choices” answers.

In the communication section of the survey we asked employees to estimate how much and what kind of media they used to keep in touch with others.

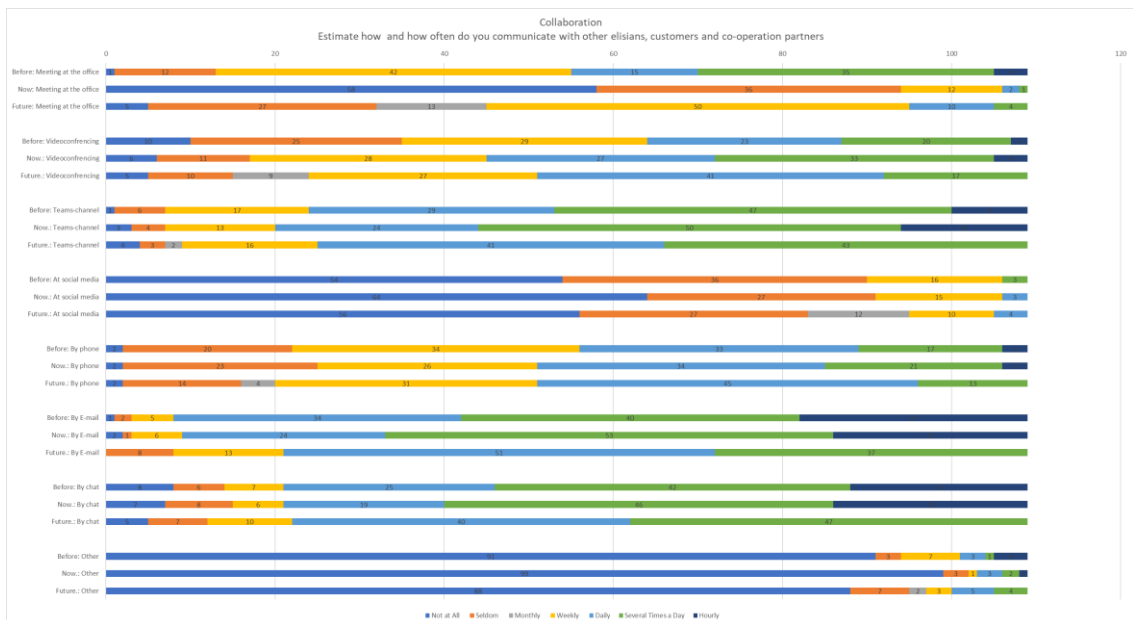


Figure 9. “Collaboration, Estimate how and how often do you communicate with other employees, customers and co-operation partners” answers.

47% of respondents have meetings during Covid-19 at the office at least once a month and after pandemic 53% will have meetings at the office at least once a week. They also estimate that they will have more rarely face-to-face meetings.

Figure 9 also illustrates that videoconferencing has increased in popularity during Corona and will remain almost in the same level in the future. Other digital communication channels will also remain popular but less than during the pandemic.

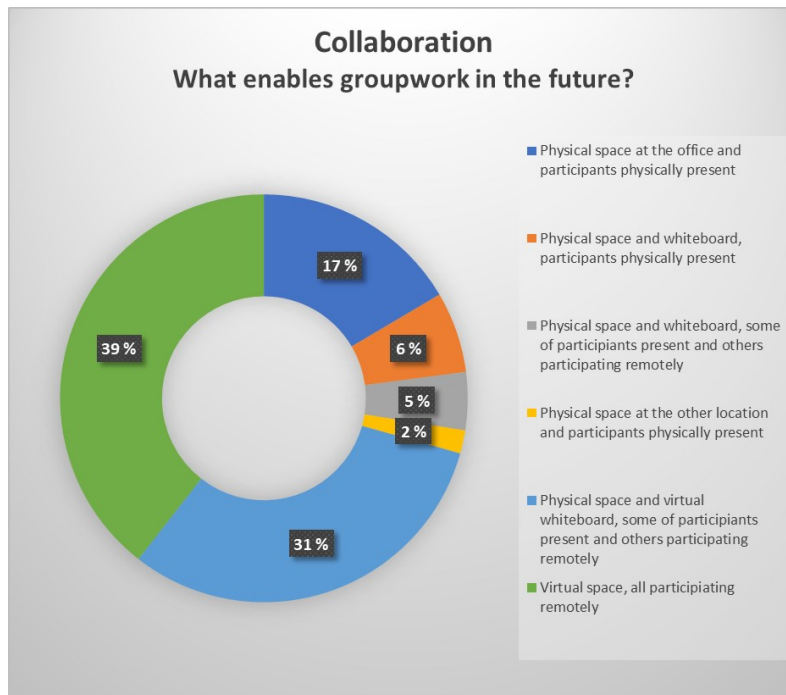


Figure 10. “Collaboration. What enables groupwork in the future” answers.

In the future 25% of respondents think that groupwork is done in physical location, all participants present. 75% of the respondents estimated that groupwork is done either hybrid or remotely in the future and 39 % of them predicts it is done virtually all together.

In the IT Tools part of the survey employees to estimated how the employer provided tools and connections supported their work and how needs of support were tackled.

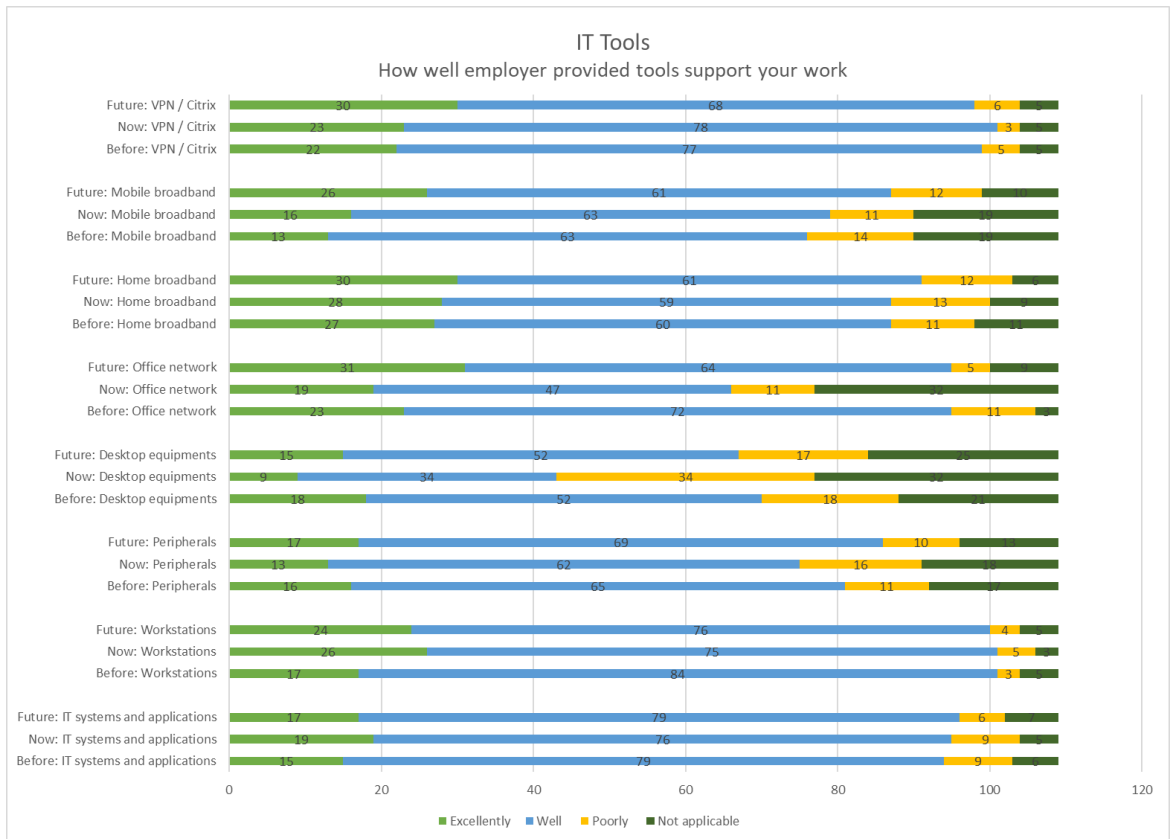


Figure 11. "IT Tools. How well employer provided tools support your work" answers.

Elisa employees were and are satisfied with the connections and services used to access the Elisa office network. There was a slight increase in the rating of the way mobile broadband connections support work. For the future, this might be a consequence of expectations about the 5G network capabilities. On the other hand, the Elisa network at the office was rated lower since it couldn't be used due to the restrictions.

Employees estimate that employer provided It systems, applications and workstations support their work well and the expectation is that the quality of IT tools will continue at the same level. One third of respondents have not been satisfied with the desktop equipment before Covid-19 and they do not believe that in the future the situation would change. During Covid-19, the biggest lack is seen in desktop equipment and peripherals.

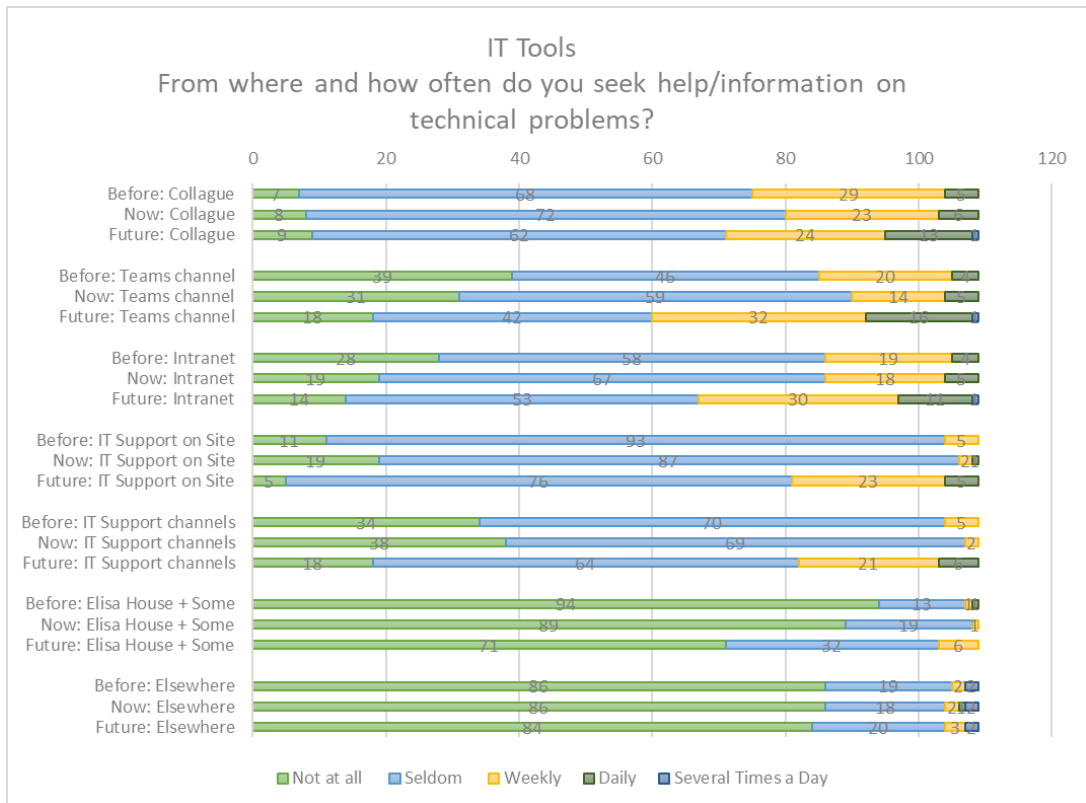


Figure 12. “IT Tools From where and how often do you seek help/information on technical problems” answers.

Figure 12 shows that the biggest source of information and help on IT related problems is another colleague. Digital channels were expected to increase in popularity for seeking information or getting help on IT related questions and problems in the future .

The goal of the security section was to find out how secure employees consider their environment while working from office or remotely and how would they improve it. Respondents feel that the office was a secure place to work but, during Covid-19, this assessment saw a decrease. When working at a work desk, 96% of respondents saw data security as excellent or good by before covid-19 but now 29% of those are not that confident. The same kind of trend can be observed from Figure 13 for meeting rooms and office joint areas. Employees evaluate that data security requirements are fulfilled when working from home at a work desk.

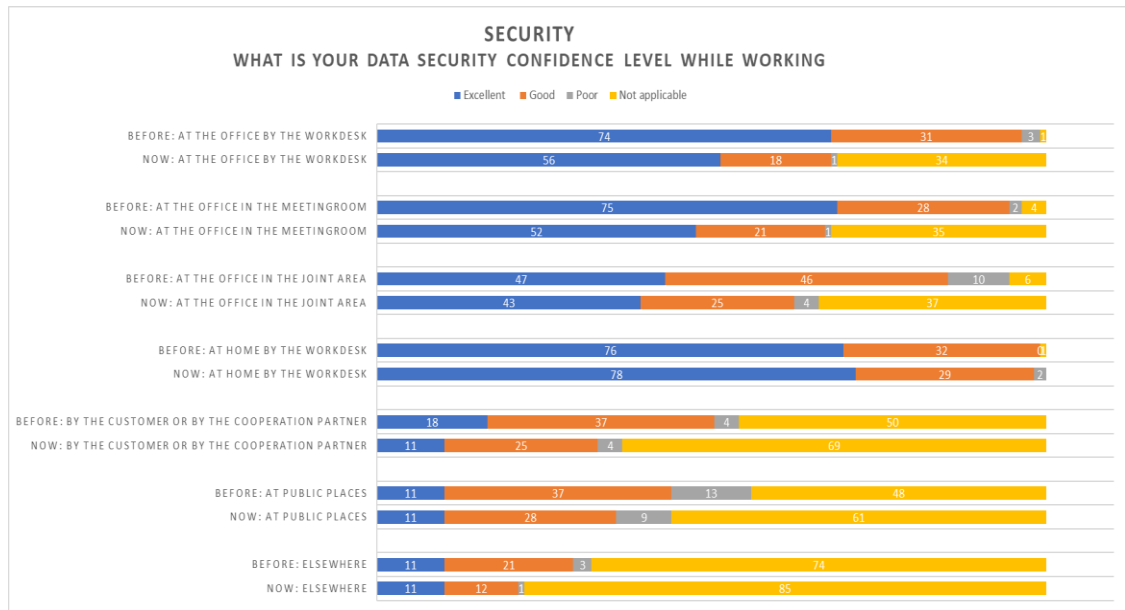


Figure 13. “Security What is your data security confidence level while working” answers.

Most of respondents feel that instructions are the best way to enhance data security. About 20% of respondents feel that applications or peripherals would enhance data security.

Responders could also provide free feedback and on the IT side the most appreciated were inhouse IT support and work ergonomics in the Pasila premises. Better virtual collaborating tools and enhancing work ergonomics at home were wished for.

4.2 Microsoft Teams Plot

As people worked mostly remotely in March 2021, it was not possible to examine with experiments future office requirements. To achieve a better user experience and to increase the response rate, questions were posted on Teams channels in a manner similar to social media. Answering was made as easy as possible by asking employees to press the like button if a comment described an IT tool setup that they wanted. We got 152 responses to posting and some additional comments.

Results were:

- Additional display: 43 likes
- Two additional displays: 19 likes
- Additional video camera and audio system: 15 likes
- Connection / router: 30 likes

- Printer: 10 likes
- USB- dock: 29 likes
- Nothing - everything is fine: 6 likes

Remote workers wanted to enhance their work ergonomics with additional monitors and docking stations. Higher bandwidth or a better router was also desired for improving the network connection. 4% of the employees were satisfied with their work conditions.

4.3 Remote Work Environment Interviews

A senior researcher from the University of Tampere interviewed 10 employees from the corporate customer unit about the remote work environment. The goal was to be able to design experiments for the project.

Themes / questions in the interviews were:

- Evaluate the remote work environment
- What kind of technology promotes your work
- What is needed from the employer for developing the physical and digital work environments
- Problems with the digital work environment

The biggest challenges with the work environment were perceived to be social isolation and work ergonomics. Another issue reported was that remote work does not support spontaneous interaction.

Most of those interviewed had personally bought additional IT equipment that met their needs. The process for ordering and justifying additional devices via the Elisa IT channel was seen inflexible. The selection of devices was deemed suitable for most employees. To support remote work, respondents wished for one or two additional displays, an additional keyboard and mouse, comfortable headphones, a suitable desk and a fast internet connection.

One conclusion from the interviews was that there should be standard procedures for teleworking equipment and software. Currently these are handled on a case by case basis. Also there is a need to calculate and compare the cost of the work space and tools for an employee in the office and at home.

5 IT Key Person Interviews

Key persons in company IT were interviewed. The aim was to find out what changed in internal IT because the Covid-19 epidemic. Interviewees were asked how Covid-19 affected their area and what lessons were learned from it. Interviews were conducted with the IT architect, two production managers and two solution managers whose responsibilities are the office network and digital services.

5.1 Contingency Plan

Elisa followed the global development of Covid-19. Thanks to the experience of the swine influenza back in 2009, preparations and measurements for handling this kind of crisis were familiar to the directors. Teleoperators are obliged by law 838/2003 to ensure telecommunication services during crisis. The security department developed clear instructions and guidance to be followed in such conditions.

News of the approaching pandemic made employees cautious and many switched to remote working before the official recommendation. IT professionals were advised by supervisors to take their portable equipment with them when leaving office on 6th of March. The Finnish government issued the official recommendation for remote work on 26th of March and the lock-down of the Uusimaa region on 28th of the same month. Elisa followed government official recommendations, sometimes with strict security measures and remote work requirements or, when the pandemic status was better, allowing employees to work from office. A total lockdown of offices was not yet implemented as to ensure a suitable workspace for employees who did not have appropriate facilities at home.

An Elisa production "War Room" meeting took place every week to evaluate the changing situation. Resource management plans were made to ensure vital functionalities. This meant focusing on the production management instead of service development and allocating backup support personnel for IT systems. The company IT group initiated its own virtual "war room" which was following office network load and the capacity of remote services.

5.2 Processes

IT personnel, senior professionals and managers are used to work remotely and they sometimes forget that this might be something really new for employees in other positions. In some departments and locations, due to nature of the work, such autonomy was considered almost impossible before the Corona crisis. The IT department incorrectly assumed that, since Elisa is an IT company, all employees have good IT skills and knowledge about accessing information and instructions. This resulted in IT tools and information not fully matching the needs of all employees now working remotely and in a temporary peak of support requests in April 2020.

Cloudification of services means that the company IT is not in control of changes made to these services. This in turn makes it difficult keep information and training material up to date. Basic IT instructions are located in the IT support service portal but training material for some of the services is distributed within different sites, making it difficult to find certain information.

Language can also cause difficulties with information access. The main technical training material is available in Finnish but there is a large quantity of information available only in English, especially on the internet.

IT also faced challenges with the process of delivery of IT devices. Some locations have a parcel locker in the Elisa premises where devices ordered by users from the IT service portal are delivered by transport companies. If the employee does not pick the parcel from locker within 7 days, the package is returned back to the sender. The process caused some confusion and extra work as it was more common for employees working from home not to pick the delivery on time.

One major vendor had difficulties because of the lockdown of their country. Employees were not able to work from office due to imposed curfew in the area but the security agreement with Elisa required access from particular locations only. Vendor employees also had no tools and means for remote work. Contract changes and special arrangements were made quickly to allow the use of new devices and applications from home.

5.3 Technical Environment

Technical point of view covid-19 act as an accelerator of development path which was already on the process. During corona crises VPN traffic increased and counter measurements were done such as allowing some of the services bypass VPN e.g. video meetings and streaming services. New remote services were initiated for vendors in lockdown on other countries.

Luckily just before pandemic started in Finland remote platforms renewal was partially done. Spend of VPN profile IP address pools and CPU load of platform were actively monitored. A thousand IP addresses were added to Elisa Office pool to ensure capacity. CPU load of the platforms were never reached to the critical point.

System Center Configuration Manager has also capability of delivering updates to computer via internet. This development work was on the process already and was launched during covid-19 to reduce Elisa office network load.

Elisa Reittiopas, application for locating and reserving suitable meeting or other facilities, normal development work was set aside. For safety reasons, to be able to follow up real time employee capacity of buildings and to offer this information to employees via application, new development was done. It was designed to show number of employees in each building floor and Pasila office canteen. New development took advantage of Internet of things (IoT) solution and real estate existing technology with some enhancements such as adding counters on canteens entries.

Safety distances were applied to buildings and half of work desks were not allowed to use. In Elisa Reittiopas, as a digital twin of the building, this required new development to be able to mark some of the work desks as non-available. In addition work desk reservation was placed on application.

Whole world were lacking of headphones, video cameras and some other IT devices. In call center employees were used to work with IP-phone although most of them already had a software phone on their laptop. IP-phone requires own headphones and when employees started to work remotely lack of USB-headphones were faced. Elisass whole-sale had run out stock of headphones and extra effort was put for getting headphones from the world to the employees in need.

Employee basic set up was a laptop and a mouse. To enhance employee work conditions and ergonomics at home monitors were allowed to borrow from the office. This opportunity was recorded by 127 employees.

2020 To avoid layoffs of shop personnel employer offered work on call center side. Shop personnel did not have their own workstations nor peripherals and to enable their work laptop lease period changes were delayed from other employees. Those who had already laptop, their lease period extended and recently ordered laptops to warehouse were given in use to those who did not have employer provided laptop.

2021 laptop lease period were briefly extended again, because of long delivery time from a supplier. Long delivery time was explained due to lack of computer components.

5.4 Security and Data Protection

One of the biggest issues pointed was conflicts between data protection policy and remote access. Traditionally, company services are access via VPN which increase load and latency in the network.

Employees were allowed to access to the company network with their own devices. Authentication is set to username, password and a notification from a MFA application. In this way, some of the services which do not require a strict data policy, can be safely accessed without VPN. Categorizing services in different security levels allows the IT department more flexibility in providing better performance and user experience.

6 Examining Elisa Statistics

At the very beginning of the Covid-19 pandemic, the performance of the Elisa services was monitored in several dimensions:

- WLAN usage in the Pasila headquarters versus other offices
- Remote service capacity
- Videocall statistics
- IT Support cases

Unfortunately Microsoft Teams is excluded from this comparison as it does not offer comparable statics to other examined services.

6.1 Network Usage

Network usage decreased dramatically in April 2020 and has not yet recovered as restrictions are still in place. In the beginning of the pandemic, WLAN usage drop by 89% of the usage in the previous months. Differences in usage between Figure 14 and Figure 15 are partially caused by different restrictions in the capital city area versus other regions.

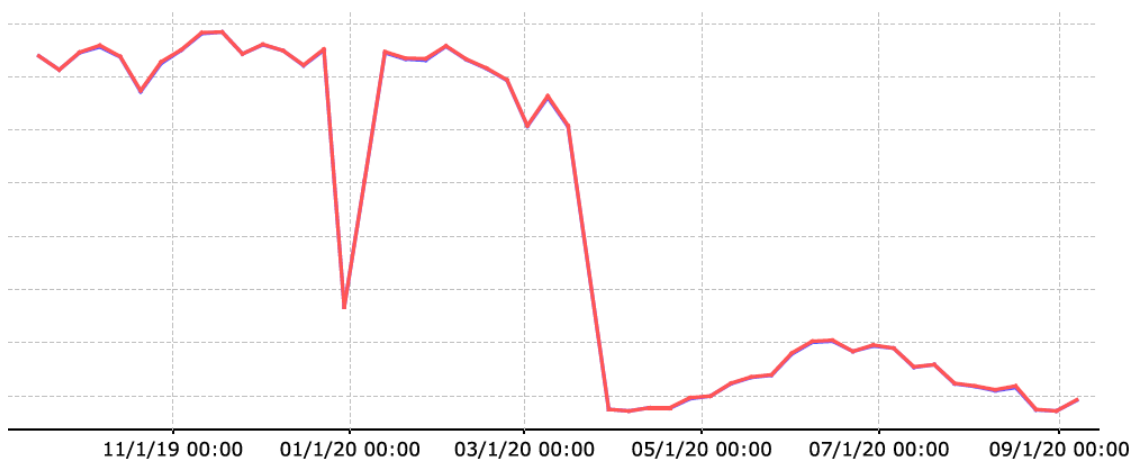


Figure 14. WLAN usage in other offices than the headquarters.

During the vacation period the WLAN usage was almost at the same level as in previous years but it decreased again in the autumn.

Figure 14 indicates how increasing number of Covid-19 infections in autumn affected the network usage in the Kokkola area and Figure 15 shows a decrease of Covid-19 infections in the Helsinki area during the same period.

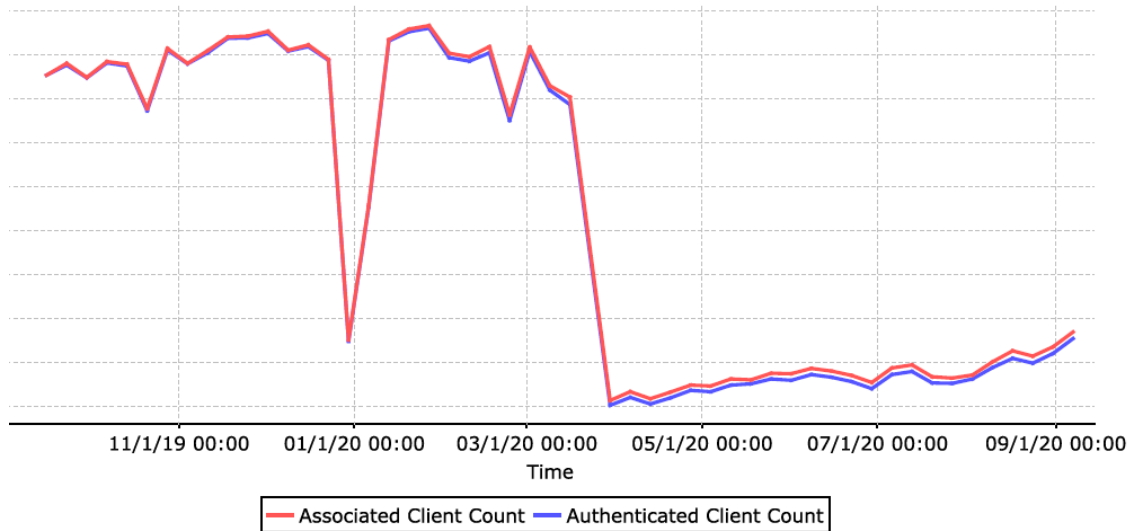


Figure 15. Headquarters WLAN usage.

WLAN usage in the Pasila headquarters remained low whole summer and increased to normal vacation level by autumn.

6.2 Remote Services Usage, VPN and Citrix

The peak of number of sessions connecting to Elisa's network or remote services was seen in April 2020, when the number of sessions grew by 53% compared to previous months. As of April 2021, the number of sessions was 27% higher than in the period before the pandemic. Almost half of the sessions needed in the beginning of the pandemic to connect to Elisa's network are now covered by some other means, e.g. by cloud services. Employees learned that it is not mandatory to be connected to the company network to be able to use Elisa's services. The percentage of the change was calculated based on information given by responsible solution managers of the area.

6.3 Videocalls

In the beginning of the Covid-19 pandemic, as the Figure 14 illustrates, the number of videocall minutes increased by 225% compared to the time before the pandemic. Microsoft had troubles with the Teams service in April 2020 and this might also have contributed to the high volume of videocalls

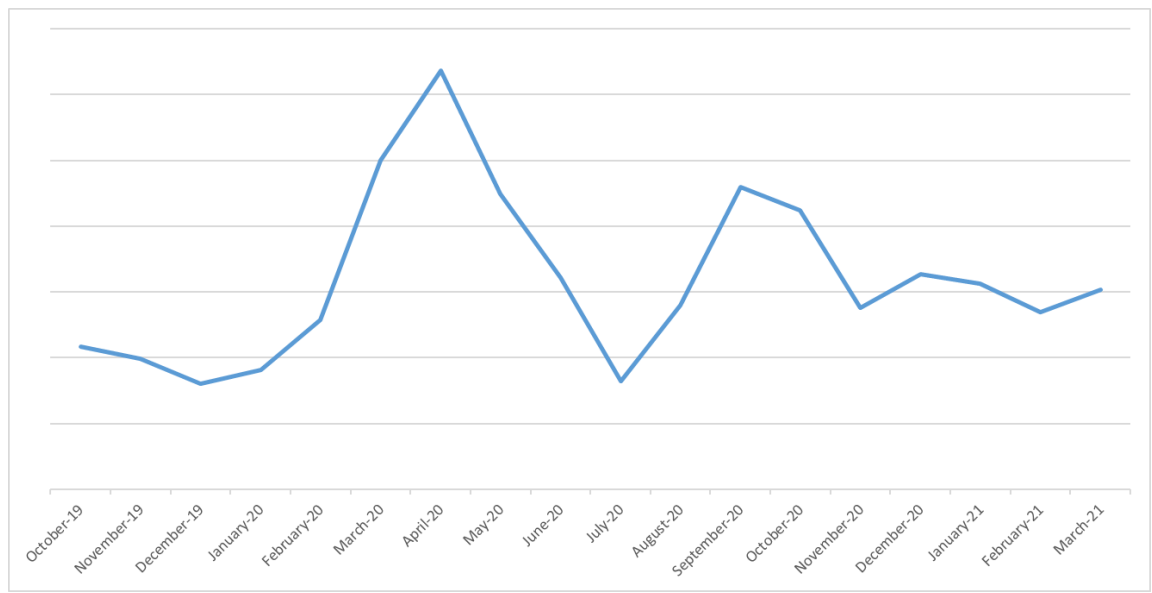


Figure 16. Elisa videoconferencing service minutes trend.

Due the vacation time at July 20 videoconference minutes decreased and got up again in the autumn. There was the 53% increase in videocalls in period February 2020 – March 2021 relative to February 2019 – March 2020. . Since then, the videoconferencing service usage has been stable.

6.4 IT Support

Support requests had a peak in April 2020 and a smaller peak in October of the same year. Contact requests were made by phone, IT site and IT chat. The April peak of service requests mainly consisted of support requests for remote services.

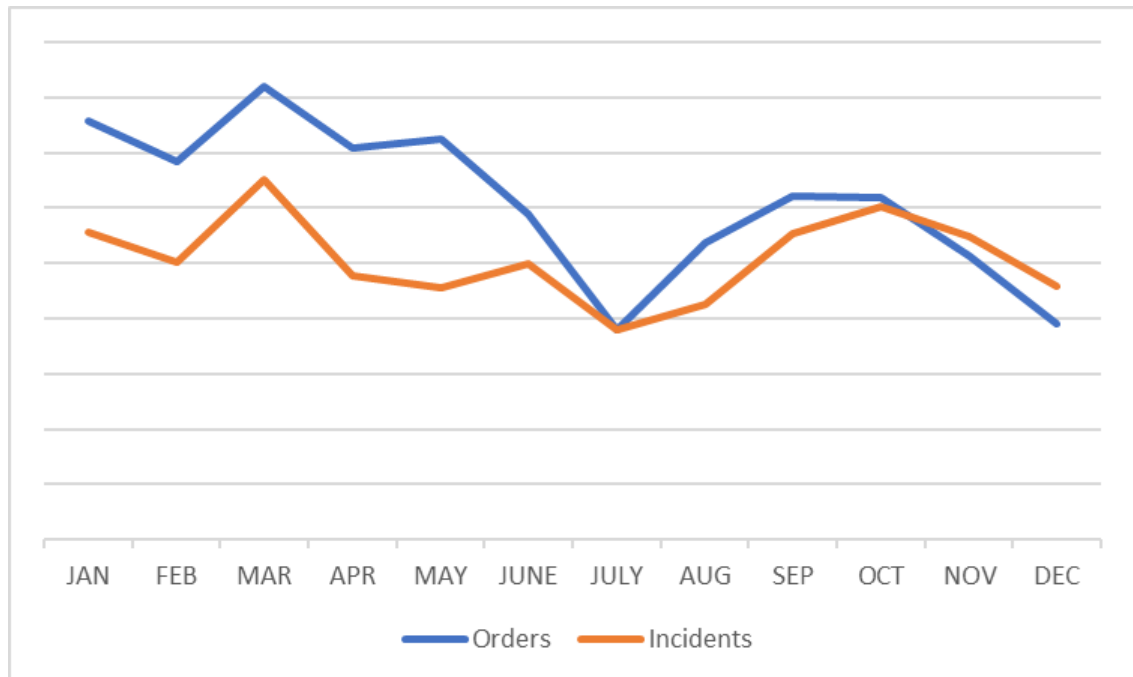


Figure 17. IT Request, orders and incidents trend 2020.

The trend of IT orders followed that of support requests. The amount of devices were ordered did not increase compared to previous year. During the peak of orders, most were for "new remote workers".

Headset, keyboard and mouse orders maintained at the same level as in the previous year. Compared to the previous year, the number of orders for HD pro web cameras increased by 636%, docking station orders increased by 342% and privacy screen and backpack orders dropped by 32%.

7 Summary of Covid-19 Impact on Elisa IT

Remote work was a common practice in Elisa. The majority of the employees had the workstations, devices and connections needed for remote work. In the early phase of the pandemic, the rest of the employees were offered remote access tools.

From technical point of view, the biggest changes during the pandemic were: optimizing the VPN network traffic, enabling vendor access through Citrix, development of the “Elisa Reittiopas” application that supports work desk reservation and providing displays to employees to enhance the ergonomics of remote work. Due to the strong recommendation to telework, office usage, including network components and ergonomic work desks with devices, was low. Videocall usage increased significantly. Most of the interviewed IT professionals said that the biggest challenge was user guidance for remote services. From a security point of view, they pointed out that different security policies are needed for different work tasks.

The crisis also showed that, if Elisa wants to be more flexible, the Virtual Desktop Infrastructure (VDI) should be expanded. VDI access to Elisa servers enables usage of different OS giving more flexibility to employees and vendors. The virtual environments also allow recording of actions thus increasing security.

More applications are planned to be made available safely directly from outside Elisa’s network, without a VPN connection. When directing network traffic wisely, the speed of data transmission can be optimized and the user experience is seamless regardless of location.

Work has become less dependent on place and a time. Employees have more autonomy than ever before. Distributed teams, internationalization and employees growing autonomy require new managing skills from employees and managers. Learning new IT skills and methods of work will have bigger role in daily work.

Remote work research and surveys at Elisa predict that the popularity of remote work is likely to increase. A year of remote work have taught employees new methods of working which bring new demands on facilities. The office will offer facilities for collaboration, innovation and co-operating. The individual work shall be done in larger scale remotely. A modular and flexible office space, along with data about indoor conditions gathered

from premises, help physical environment developers to respond to social environment needs. The digital environment also needs to support these changes.

If in the future Elisa will maintain smaller facilities, the impact on the network infrastructure has to be considered. We got used to work remotely using remote services so connections from small office premises to Elisa's Multi-Protocol Label Switching network has to be considered seriously. Means for safe connections exist already, such as 5G solutions. Always-connected light PCs (AC PC) with a fast mobile connection, reduce the need to use open WIFI networks while teleworking. This also ensures connectivity in scenarios in which the employer offers employees smaller hubs provided by a third company. In case AC PC processing power is not enough, VDI options can be enabled.

In bigger Elisa office facilities, the Elisa Älykäs Lähiverkkoratkaisu project (EÄL, Elisa Intelligent Local Network solution) is about to be completed. EÄL is software defined (SD-LAN) and has a policy-driven architecture. Compared to traditional network architecture, SD-LAN simplifies hardware functionalities and reduces switch and router level computing. Switch computing is replaced with software layers which create self-organizing and centrally-managed networks. This reduces network operation work and makes the network more scalable. Chosen WIFI base stations of EÄL give also the possibility to locate WLAN traffic so location analytics can be provided by the Cisco Connected Mobile Experiences(CMX) software. This is a powerful tool assisting with designing office floor plans. CMX has the possibility to divide office floor to sectors. WIFI traffic can then be monitored and analysed by sector. The information gathered can be presented to employees as floor traffic maps and hot-spots and makes the availability of work desks visible in real time. This data is also useful for maintenance work.

When new facilities are designed considering the shift in office functionalities needed, the floor network infrastructure needs to be rethought. EIW research indicates that the work desk area will be reduced and that the need for LAN interface connections will decrease. This brings along a decrease in the network hardware capacity of the floor. When the quantity of work desks in an office decreases, Elisa, as a sustainable workplace, can allocate the unused displays to employees to support remote work.

EIW survey indicates that people want individual workspaces and that, while individual work will be mostly performed from home, there will still be a need for work desks in the office. EIW research also indicated that there is a need for team spaces. Currently, work

areas are defined to support workflows and processes and teams have their own appointed area. Teams are familiar with their work desk equipment as they have been responsible of it. In the future office this is no longer the case and appointed work areas are likely to vanish. Employees should be able to reserve workspaces or work desks in advance. During the Corona crisis the functionality to manage work desk reservation was developed in application Elisa Reittiopas. To meet the requirements of the future, reservation for work areas should be implemented. To be able to decide on a suitable workspace, the employee has to be able to see what devices are present on the work desks. This can be provided by the work desk management system where each work desk has assigned equipment. The natural place to present this information would be the Elisa Reittiopas application. As already mentioned, employees were responsible for their work desk devices. This process should be reorganized and responsibility should be shared with the IT department and the facilities management.

EIW surveys and IT portal orders indicates that the employer should support more the employee ergonomics at the home office. The main need is additional display and peripherals. Elisa policy supporting home ergonomics is insufficient and can be improved. It is complicated to interpret tax authorities guidelines and laws do not cover remote work. Therefore a clear employer responsibility to support employees in the home office is lacking. Steps to better remote work ergonomics have been taken by loaning monitors, but more can be done. According to surveys at Elisa, employees need other devices as well, e.g. docking stations, multiple displays, routers. To meet this requirement Elisa could enhance the asset management and the process for loaning devices and in addition it could offer channel for employees to purchase needed peripherals from Elisa suppliers with affordable price.

The videocall data examined and HD web camera orders imply an increase of demand of face-to-face interaction between employees to employees and third parties. In the EIW survey also virtual and the need for digital collaboration tools was raised. When all participants are using virtual tools, their experience is the same but when collaboration is done both in a virtual and physical space is more difficult to give everyone same opportunities. To help in such scenarios, a digital or virtual whiteboard using a touch screen in a meeting room can be used.

Immersive reality may help to meet the need of presence during communication. VR technology devices such as VR glasses are yet quite expensive and not comfortable

when used for long sessions. It is worth to explore VR meeting offerings and a prospective VR meeting space could be initiated. Due to development in the gaming industry, more and more employees have VR glasses for leisure purposes. If the company does not want to invest at this stage in VR devices and workstations supporting VR glasses, it could be inquired if there is a willingness to use private devices. This way Elisa could support remote workers and offer them better feeling of a presence compared to video-calls. On the other hand, in the future, digital immersive reality may give us digital workspaces mimicking physical work spaces. When this point is reached physical monitors are no longer needed in the office nor at home.

Printing services are today offered inhouse only. In order to reach the goal of higher mobility, cloud based printing services can be enabled. This gives employee in remote location the option to print documents on any chosen public printer without violating data security.

The EIW survey also revealed that the first query about technical problems are first directed to another colleague. In the future employees estimate that they will get help and information mostly from electric channels such as Teams, IT Support and the internet. The IT Support point in Pasila is appreciated as an important support channel.

The data security section of the survey indicates that employees feel safe working remotely. Office facilities are seen as a less secure place to handle data in the future. Employees feel that data protection is well taken care of and, to enhance data security, they see that guidance is enough. Privacy screen orders statistics show that, during the period of increased remote work, these screens were not ordered as much as in the previous year, even though during the ordering process of a new laptop you are offered to select compatible privacy screens. Considering that nearby colleagues in office have gone through same security clearance, it can be concluded that people are actually protecting their own digital environment instead of company data.

8 Discussions and Conclusions

Due to nature of Elisa's core business of serving telecommunication services to consumers, it is natural that remote work is commonly adopted by Elisa employees. The remote work culture has developed from a luxury granted with high seniority levels to autonomy of employees to choose a place where to perform their work best. During the pandemic, a minor part of the employees which did not work remotely before, had to learn new work methods and IT skills.

Internal IT together with IT Support worked intensively providing employees with devices, tools and accesses to remote systems and user guidance in the beginning of the Covid-19 pandemic. The situation was handled rapidly, internal IT optimizations of office network latency and load increased the quality of the user experience for using remote services.

Elisa employees have faced same problems as discussed in Microsoft, Eula and Coco-Digi research. Multiple online meetings one after another have impacted the wellbeing and ergonomics of employees. Forced work from home led to feelings of being isolated. On the other hand, employees enjoy the autonomy granted by remote work and the possibility of mixing work and free time.

According the research, employees think that in the future they will come to office to meet, influence and collaborate with one another while individual work will mostly be done at home. This will have impact on facilities as work requirements for the office change. Facilities will provide more modular and adjustable meeting and project spaces. Work desk areas will be smaller and reserved in advance as needed via a new supporting process.

Research indicated that virtual collaboration tools will replace physical whiteboards as they need to be accessed regardless of location and time. High quality video and audio systems with digital whiteboards are needed in meeting rooms to support hybrid meetings. Possibility to have VR meeting rooms should be investigated to meet the need of physical presence.

It was also concluded that employees need more support from the employer with ergonomics at home. This support should be providing external displays, docking stations

and other peripherals. Another form of support is the employees ability to deduct part of the home work space costs from taxation.

Research also showed that employees seek help to their technical problems from other colleagues and various digital channels. In the future, internal IT should put more effort on following discussions in Teams channels, and if problems are not solved inside the teams, give support either within the discussion group or by directing the users to IT Supports own communication channel.

It was found that data protection is well taken care off while working remotely. It can be concluded from the research that employees use protection screens to protect their own data environment in the workplace rather than employer's data as the laptop and laptop's content is seen as personal.

The user experience of seamless connectivity to office tools regardless of location and time will enhance if Elisa keeps up with evolving technology in the digital work environment. A big part of this development path is using cloud based services. The workplace culture, which connected office and the work environment in the past, has to reached out to virtual, mobile dimensions.

References

- 1 Virpi Ruohomäki, Miljoona suomalaista loikkasi etätöihin [Internet]. TTL; 15 Jun 2020 .<<https://www.ttl.fi/miljoona-suomalaista-loikkasi-etatoihin/>>. Accessed 23 April 2021<https://www.eurofound.europa.eu/sites/all/libraries/viewerjs/index.html#https://www.eurofound.europa.eu/sites/default/files/presentation_virtual_emco_-_11_march_2021_-_oscar_vargas_llave.pdf>
- 2 Oscar Vargas Llave, Telework, ICT-based mobile work in Europe: Trends, Challenges and the Right to Disconnect[Internet]. Eurofund Online; 11 March 2021.<https://www.eurofound.europa.eu/sites/default/files/presentation_virtual_emco_-_11_march_2021_-_oscar_vargas_llave.pdf>. Accessed 25 April 2021<<https://www.ttl.fi/tutkimushanke/miten-suomi-voi/>>
- 3 KirsiMarja Blomqvist, Anu Sivunen, Matti Vartiainen, Thomas Olsson, Annina Ropponen, Kaisa Henttonen, Ward Van Xoonen, Remote Work in Finland During the Covid-19 Pandemic: Results of a Longitudinal Study[Internet] Futuremote Online;09 December 2020. <<https://futuremote.fi/wp-content/uploads/2020/12/Remote-work-in-Finland-during-the-Covid-19-pandemic.pdf>>. Accessed 23 March 2021<<https://www.microsoft.com/en-us/research/uploads/prod/2021/01/NewFutureOfWorkReport.pdf>>
- 4 Jari Hakanen, Janne Kaltiainen, Miten Suomi Voi[Internet].Työterveyslaitos;26 November 2020 .<<https://www.ttl.fi/tutkimushanke/miten-suomi-voi/>>. Accessed 23 April 2021
- 5 KirsiMarja Blomqvist, Anu Sivunen, Matti Vartiainen, Thomas Olsson, Annina Ropponen, Kaisa Henttonen, Ward Van Xoonen, National Remote Work Survey: Remote Work During The Corona Crisis[Internet].May 2020.<https://cocodigiresearch.files.wordpress.com/2020/05/remote-work-survey-covid-19_en.pdf> Accessed 15 March 2021
- 6 Teevan, Jaime, Brent Hecht, and Sonia Jaffe, eds. The New Future of Work: Research from Microsoft on the Impact of the Pandemic on Work Practices. 1st ed. Microsoft, 2021. <<https://aka.ms/newfutureofwork>>. Accessed 20 April 2021
- 7 Julian Birkinshaw, Jordan Cohen, Pawel Stach, Performance Measurement Research: Knowledge workers are more productive from home[Reprint HO5T92] Harvard Business Review, Article; 31 August 2020
- 8 Asia HR Research Team, Coronavirus in Mind: Make Remote Work Successful! [PDF]Gartner;5 March 2020
- 9 Market Business News, What is teleworking? Definition and meaning [Online]<<https://marketbusinessnews.com/financial-glossary/teleworking-definition-meaning/>> Accessed 23 April 2021
- 10 David Lamond, Peter Standen DEFINING TELEWORK: WHAT IS IT EXACTLY? [Online] September 1997 <https://www.researchgate.net/publication/236111508_Defining_Telework_What_is_it_Exactly> Accessed 11 April 2021

- 11 Elisa Yrityksille, Esimerkkinä Elisa:Uusi työ vaatii uudenlaista johtajuutta.[Online]22 June 2017.<<https://yrityksille.elisa.fi/ideat/esimerkkina-elisa-uusi-tyo-vaatii-uudenlaista-johtajuutta/>> Accessed 24 April 2021
- 12 Ahrendt, Daphne; Cabrita, Jorge; Clerici, Eleonora; Hurley, John; Leončikas, Tadas; Mascherini, Massimiliano; Riso, Sara; Sándor, Eszter, Covid-19:Living, Working and Covid-19.[Online] 6 November 2020.<https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef20059en.pdf> Accessed 25 April 2021
- 13 McKinsey Global Institute, The post pandemic economy: The Future of Work after COVID-19-Report-F[PDF]. February 2021
- 14 The European Commission's science and knowledge service, Telework in the EU before and after the COVID-19: Where We Were, Where We Head To [Online]June 2020.<https://ec.europa.eu/jrc/sites/jrcsh/files/jrc120945_policy_brief_-_covid_and_telework_final.pdf> European Union, 2020–JRC120945. Accessed 21 April 2021
- 15 Peter Bacevic, John Mack, Pantea Tehrani and Mat Triebner, Workspaces: Reimagining the Urban Office[Reprint HO5ROD]Harvard Business Review, Article; 14 August 2020
- 16 Harjinder Singh Lallie¹, Lynsay A. Shepherd, Jason R.C. Nurse, Arnau Erola, Gregory Epiphaniou, Carsten Maple, and Xavier Bellekens, Cyber Security in the Age of COVID-19: A Timeline and Analysis of Cyber-Crime and Cyber-Attacks during the Pandemic.21 Jun 2020.arXiv:2006.11929v1
- 17 Anna Georgiadou, Spiros Mouzakitidis, Dimitris Askounis, Working from home during COVID 19 crisis: a cyber security culture assessment survey, Security Journal[PDF] 4 February 2021 <https://doi.org/10.1057/s41284-021-00286-2>
- 18 Helsinki Region Trends, Office Rents: Development of rental prices of office premises in the centre of Helsinki Turned Negative[Online] 18 March 2021 <<https://www.helsinginseudunsuunnat.fi/en/housing-and-premises/business-premises-market/office-rents>>
- 19 Veera Luomaaho, R.I.P Toimisto 1726-2020[Online Article] 17 March 2021 <<https://www.hs.fi/visio/art-2000007863738.html>>.Accessed 17 March 2021
- 20 Kate Conger, Facebook Starts Planning for Permanent Remote Workers, The New York Times[Online article]21 May 2020.<<https://www.nytimes.com/2020/05/21/technology/facebook-remote-work-coronavirus.html>> Accessed 19 April 2021
- 21 Megan Gills, Shopify Is Going Digital by Default, Closing Offices Until 2021, Ottawa Citizen [Online]21 May 2020.<<https://ottawacitizen.com/business/local-business/shopify-is-going-digital-by-default-closing-offices-until-2021>> Accessed 17 March 2021
- 22 Kerri Henderson, Jane Clay, Julia Simet. What Does the Shift to a Hybrid Work Model Mean for Office Spaces in the U.K.?, Gensler [Online]5 November 2020 <<https://www.gensler.com/blog/uk-workplace-survey-hybrid-work-model-mean->

for-office-space?utm_source=dialogue-now-email_2020_nov06&utm_medium=email&utm_campaign=dialogue-now&utm_content=master-list>. Accessed 25 March 2021

- 23 Kristin Jesnes and Sigurd M. Nordli Oppegaard, Marianne Jenum Hotvedt, Anna Ilsøe, Bertil Rolandsson, Tiina Saari, Antti Saloniemi, Jon Erik Dølvik. Platform Work in the Nordic Models: Issues, cases and responses. Nordic Council of Ministers[Online PDF] March 2020.<<http://dx.doi.org/10.6027/temanord2020-513> Accessed 2 April 2021
- 24 European Observatory of Working Life. Platform Work. Eurofound[Online]29 June 2018.<<https://www.eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/platform-work>> Accessed 2 April 2021
- 25 Lauri Kokkinen. Hyvinvointia työstä 2030-luvulla : Skenaarioita suomalaisen työelämän kehityksestä. Työterveyslaitos[PDF]ISBN 978-952-261-943-3
- 26 Thomas Alsop, Global AR/VR forecast spending by segment 2020[Online]Statista;17 November 2020 <<https://www.statista.com/statistics/528779/virtual-real-ity-market-size-worldwide/>> Accessed 2 May 2021
- 27 Scott Stein, Facebook Has VR Plans for Your Virtual Office, with Smart Glasses Coming Soon[Internet].CNET;14 January 2021.<<https://www.cnet.com/news/facebook-evolving-plans-for-vr-are-aiming-for-your-virtual-office-with-smart-glasses-coming-soon/>>. Accessed 2 May 2021
- 28 Oculus, The Future of work and productivity on Quest[Online]Oculus;16 September 2020.<<https://www.oculus.com/blog/facebook-connect-oculus-quest-2-aaa-gaming-partnerships-and-more/>>. Accessed 2 May 2021
- 29 Scott McCartney, The Covid pandemic could cut business travel by 36 percent—permanently[Online]Wall Street Journal;1 December <2020.<<https://www.wsj.com/articles/the-covid-pandemic-could-cut-business-travel-by-36permanently-11606830490>> Accessed 17 April 2021
- 30 Elisan Ympäristövastuu Mittari Raportti[Online PDF] Elisa; March 2012.<<https://www.e-julkaisu.fi/elisa/ymparistovastuumittariraportti-2011/pdf/Ymparistovastuun-mittareiden-raportti-H1-2011-DRAFT.pdf>>. Accessed 6 March 2021
- 31 Elisan CO2 Päästösäästämistareiden Laskentadokumentti[Online PDF]Elisa Oyj;1 March 2016<<https://corporate.elisa.fi/attachment/content/Elisan-CO2-mittarit-laskentadokumentti-2015.pdf>>. Accessed 6 March 2021
- 32 Elisan ympäristölaskennan laskentadokumentti.[Online PDF] Elisa Oyj;20 March 2018.<https://corporate.elisa.fi/attachment/content/Elisan-CO2-mittarit-laskentadokumentti-2017_.pdf>. Accessed 6 March 2021
- 33 Elisa Vastuullisuus 2019[Online PDF]Elisa Oyj.2020<https://corporate.elisa.fi/attachment/elisa-oyj/annual-report-2019/Elisa_Vastuullisuusraportti_2019.pdf> Accessed 6 March 2021

- 34 Elisa Energy and CO2 Emission Disclosure 2020[Online PDF] Elisa Oyj;1 March 2021.<https://static.elisa.com/v2/image/2tqyb-bhjs47b/2zPLRmgLXG1ox93ufK479t/Elisa_Energy-Emission_Disclosure_2020.pdf> Accessed 5 March 2021
- 35 Julia Sklar, 'Zoom fatigue' is taxing the brain. Here's why that happens.[Internet]National Geographic;24 April 2020.<<https://www.nationalgeographic.com/science/article/coronavirus-zoom-fatigue-is-taxing-the-brain-here-is-why-that-happens>> Accessed: 23 April 2021
- 36 Jared Spataro, Remote work trend report: meetings.[Internet]Microsoft;9April 2021<https://www.microsoft.com/en-us/microsoft-365/blog/2020/04/09/remote-work-trend-report-meetings/>> Accessed 14 May 202