9-2022

Repercussions of a Disruption: The Impact of Global ICT Supply Chain Trends in Kosovo

Dior Ramosaj
dr5448@rit.edu

RIT | Kosovo

Repercussions of a Disruption: The Impact of Global ICT Supply Chain Trends in Kosovo

An Honors Society Project

Dior Ramosaj

Advisor

Venera Demukaj

Second Readers

Driart Elshani and Mimoza Polloshka

September, 2022

Abstract

This study seeks to analyze what type of impact the global ICT supply chain trends, apparent in the last two and a half years, have had in Kosovo. Specifically, the study will focus on two areas, the global shortage of electronic chips, affecting the hardware sector, and a rise in demand for software, due to the transition of working from home following the recent COVID-19 pandemic. A parallel will be drawn between the global trends and Kosovo. The research methodology is comprised of a combination of primary and secondary data. Primary data has been collected through interviews with representatives from various businesses in Kosovo, and a survey distributed to students and employees in different industries. Secondary data has been acquired through literature review, providing a reflection of the global situation in both sectors. The results of the primary data support the ones from secondary data, showing that Kosovo has in fact been heavily impacted by the global supply chain trends. Businesses operating in industries that sell products or provide services that require electronic chips have felt the impact of the global shortage, creating a domino effect that caused other issues, such as having to change the way they handle their inventory, the way they do marketing, and even begin prioritizing some clients over others. On the other hand, there is a notable increase in the usage of software for work or school activities, ensuing from the need to operate from a home environment.

Keywords: software, hardware, shortage, electronic chips.

Acknowledgments

To my parents: Thank you for providing me with a home environment that inspires growth, both personal and academic. Your constant guidance has been a beacon of light toward the path that I'm on today.

To my triplet siblings: Thank you for always bringing a smile to my face, even in those times of sibling chaos.

To my professors: Thank you for making it possible for me to become the student I am today. Almost four years ago I entered RIT Kosovo with the intention of finding a field that I want to focus on in my future, and throughout their constant academic support, I have gotten immensely closer to that goal. Special thanks go to my advisor, Venera Demukaj, who has guided me throughout this study and the challenges it entailed, and professor Driart Elshani, whose help was especially important with the content of this capstone.

Lastly, to my significant other: Thank you for being a shoulder to lean on, a friend to turn to, and for always putting a smile on my face no matter what the rest of the day has taken me through.

These people have made it possible for me to finish this study, and have constantly aided my growth, both academic and personal.

Contents

Abstract 2
Acknowledgments 3
List of Figures 5
List of Abbreviations 5
1. Introduction 6
2. Background Information 7
2.1. Software 7
2.2. Hardware 9
3. Methodology 11
3.1. Secondary Data 11
3.2. Primary Data 12
3.3. Information about the interviewees 12
4. Limitations 13
5. Analysis of Results 13
5.1. Software 13
5.2. Hardware 18
5.2.1. Group 1 – Sellers of Various Technological Products 19
5.2.1.1. Laptops, Computers, and Graphic Cards 19
5.2.1.2. Smartphones, Tablets, and Smartwatches 19
5.2.1.3. TVs and White Goods 20
5.2.2. Group 2 – Smart home, security, and electronic services 20
5.2.3. Group 3 – Automotive industry 21
6. Conclusion and Recommendations 22
6.1. Conclusion 22
6.2. Recommendations 24
Bibliography 26
Appendices 29
Appendix A – Interview 29
Appendix B – Survey 29
Appendix C – Secondary Data Figures 34
Appendix D – Informed Consent Form 37

List of Figures

Figure 1 – Rise in software use

Figure 2 – Nature of software/applications

Figure 3 – Number of software/applications

Figure 4 – New software/applications

Figure 5 – Impact of software/applications

Figure 6 – Use of software/applications today

Figure 7 – Use of software/applications in the future

List of Abbreviations

ICT – Information and Communications Technology

B2B – Business to Business

Q3 – Third Quarter

Q2 – Second Quarter

PC – Personal Computer

TSMC – Taiwan Semiconductor Manufacturing Company

PS5 – PlayStation 5

GPU – Graphics Processing Unit

1. Introduction

Since the beginning of 2020, due to the impact of COVID-19, many routine aspects of our daily life have transitioned to an online format. Whether it was working, studying, shopping, or some other type of activity, individuals have been able to perform most of these activities from the comfort of their homes. However, along with this new norm came unprecedented needs and demands. For many, this form of operating brought along the realization that they were either lacking the necessary technology to continue with their activities in an online manner, or the technology that they possessed was outdated and would not be able to handle the new format. That realization was converted into an increase in demand for better computers, improved data systems for businesses, new communication software, and many more. The software sector grew alongside this increased demand, with an increase in spending of around 26% from 2019 to 2021, in areas such as enterprise software (Liu, 2021). Nevertheless, the hardware sector experienced a different outcome. Combining the surge in demand with the implications that COVID-19 brought for production and transport, a lack of semiconductor producers, unfavorable weather for those producers, and more, results in the emergence of the electronic chip shortage (Gooding, 2021). An electronic chip can be viewed as the brain of an electronic device, and as that title implies, it is an imperative part of its production (Sweney, 2021). While the demand for both hardware and software in Kosovo is small when viewed from a global scale, the effects of these trends have been noticed. This study seeks to analyze the extent of these global supply trends in Kosovo, how businesses and individuals have adapted to them, and what can be expected in the near future.

2. Background Information

This section reviews data collected throughout reliable internet sources in order to gain an insight into the global situation regarding the supply side of the software and hardware sectors, showing a general increase in software use, and supply difficulties for the hardware sector.

2.1. Software

As previously mentioned, since the beginning of 2020 there have been indisputable changes, leading to needs and demands that would allow individuals to conduct their usual work or school activities, albeit in a different structure. However, initially, the study will set aside the individual and look at these structural changes from the perspective of a business. Even when ignoring the pandemic as a factor, in today's modern society, digital transformation seems like a necessity for business growth. Depending on the industry the business operates in, digital transformation may have different definitions, nonetheless, a general definition would be "The integration of digital technology into all areas of a business, resulting in fundamental changes to how businesses operate and how they deliver value to customers" ("What is digital transformation?"). While ideas for such transformation may have been apparent in a businesses' future plans, the pandemic resulted in these changes being made sooner than initially expected. In a Fortune/Deloitte survey, 85% of CEOs "agreed their organizations' digital transformation has significantly accelerated during the crisis" (Kark et al. par. 31, 2021). A study conducted by McKinsey & Company revealed that respondents believed a transition to remote working, of the same intensity as apparent during the pandemic, would last over a year to implement, when on average it took around 11 days for a solution to be found. This represents that the actual change was implemented around 40 times quicker than what was initially expected (Appendix C – Figure 1). The reason behind such a substantial difference between the expected and actual values is, as implied before, priority. Remote working is but one aspect in the wide range of changes in businesses, which include changing customer needs and expectations, using advanced technologies in operations, increased spending on data security, cloud computing, and many more. (LaBerge et al. 2020)

A survey conducted in 2020 by G2 Research with B2B employees from the United States, United Kingdom, India, Australia, and Canada, dwelled on business software spending during the pandemic. The survey concluded that around 79% of employees expected their employer's software spending to increase or remain the same, with 47% saying it would increase (Fauscette, 2020). In addition, when asked about the number of software/applications that were expected to be introduced in their workplace, 93% of the respondents believed that they would have at least one or more applications introduced, with 24% believing that the number could soar as high as five or more applications. The most introduced type of software in these companies was virtual meeting software, followed by internal messaging, remote desktop tools, and in smaller amounts, time tracking tools and others. For the final question, respondents were asked if they expect to retain the introduced software when the pandemic ultimately passes, to which 76% replied that they expect to keep some or all of them when operating in a post-pandemic society (Fauscette, 2020). The significance of this survey relies upon the reflection that it provides for employees' expectations going forward, and at the same time it shows what types of software are most sought after by businesses in order to adapt to the situation in front of them.

There are many studies supporting the conclusion of the G2 Research survey. Statista data for global spending on enterprise software, show a 26% increase from 2019 to 2021, with spending amounting to 601 billion US dollars in 2021 ("Enterprise software total worldwide expenditure 2009-2022") (Appendix C – Figure 2). This data is backed by Gartner as well, showing an escalation in data center systems spending, and communications services, along with the aforementioned enterprise software ("Gartner Forecasts Worldwide IT Spending to Exceed $4 Trillion in 2022") (Appendix C – Figure 3). Another survey by Statista provides the areas where businesses are increasing their software spending, whereby similar to G2 Research survey, web conference software leads, followed by collaboration tools, remote desktop tools, security software, and others ("Business software spending increases amid COVID-19 worldwide 2020").

To better reflect these findings, data has been collected from the annual reports of software/applications companies that fall into the abovementioned categories of software. Perhaps the most prominent and prosperous software in these recent times has been the virtual meeting software Zoom. In December 2019, Zoom had around 10 million users, however, this figure quickly rose to over 350 million users by December 2020 (Iqbal, 2022). The most recent financial reports from Zoom showed that their Q3 2021 total revenue was around 1 billion US

dollars, an increase of 35% in comparison to their previous year ("Zoom Reports Financial Results for the Third Quarter of Fiscal Year 2022"). Other software, such as the internal messaging application Slack, disclosed that their revenue in Q1 2021 was 273.4 million US dollars, rising 36% year-over-year (Slack, 2021). Experiencing the same trend as Zoom and Slack, TeamViewer also reported that their billings went up by 42% in 2020 when compared to 2019 ("TeamViewer Annual Report 2020"). Simultaneously, evident in both secondary and primary data, individuals, as well as businesses, have comprehended that this new structure of operating can be beneficial, and as such, many of the software companies that have experienced growth are continuing to make incremental improvements so that they can continue their services even in a post-pandemic society.

2.2. Hardware

As evident by the data, the software sector has efficiently adapted to the working structure requirements that emanated from the pandemic, with businesses considering using the introduced software even in their future operations. Nevertheless, hardware is a necessity for individuals and businesses to use these software; in order to use Zoom, Slack, TeamViewer, and others, one would need a phone, tablet, laptop, or PC. One of the most pivotal components in electronic hardware production is the electronic chip. An electronic chip is "a set of electronic circuits on a small flat piece of silicon" that is used to process and store information, providing electronic devices with the ability to conduct various necessary tasks, and as such is dubbed the 'brain' of these devices ("The Basics of Microchips"). This vital component has been in short supply in recent years, due to multiple reasons. As previously mentioned, there has been a sudden surge in demand for electronic hardware due to many individuals and companies switching to an online manner of working and studying, which alone raised issues for manufacturing. However, when combining the rise in demand with other factors such as factories in Asia shutting down due to COVID-19, transportation prices rising severely, a lack of suppliers of electronic chips, and unfavorable weather and conditions for those few suppliers, all lead to a global shortage of electronic chips (Gooding, 2021).

There are few producers of electronic chips, with TSMC and Samsung holding the biggest share of chip manufacturing. When it comes to electronic chip manufacturing, water is a crucial component of production, and Taiwan has experienced one of its worst droughts in over

50 years. Adding this event to factory fires, power outages, and factories shutting down, undoubtedly hindered TSCM's capacity for chip manufacturing (Gooding). Nevertheless, quite thought-provoking is the fact that while Samsung sells approximately 56 billion US dollars of electronic chips and uses 36 billion US dollars for itself, they still find themselves in a position where they have to postpone the release of their new Samsung Galaxy Note smartphone (Sweney). Ranging from delayed launches to lowering its production of new models, tech giant Apple, who is also the largest buyer of electronic chips, buying around 58 billion US dollars of them, has run into multiple issues itself (Gooding). Apple reported a loss of 6 billion US dollars due to the shortage of electronic chips (Rosenbaum, 2021). Nonetheless, the mobile phone industry is not the only one affected by the shortage.

Along with isolation, many individuals found themselves dwelling in the gaming world, with Statista data showing that time spent video gaming had globally increased by 39% as of June 2020 (Clement, 2020) (Appendix C – Figure 4). Yet, the two biggest gaming console producers, Sony and Microsoft, have struggled to keep up with the demand for their consoles, with the new PS5 and Xbox models, Series X and Series S, still difficult to be found in stores, even one year after their release (Gooding). Even the GPU industry has experienced issues, with NVIDIA, which is one of the largest manufacturers of gaming GPUs, predicting an inability to meet demand throughout 2021. As would be expected, this shortage was followed by an increase in prices as well, with some graphic card models selling at prices as high as $1279, even though their release price was $569 (Kan, 2021). The electronic chip shortage has also seeped into the industries of television and home appliances as well, however, the hardest-hit industry remains the automotive industry.

At the same time, many automobile manufacturers have stated that they expect large amounts of profit losses. Ford have valued their expected losses at $2.5 billion, and General Motors valued theirs at $2 billion (Sweney). In general, data shows that the opportunity cost for this industry amounts to $47 billion. Many of these companies have also found themselves cutting their production by as much as 50%, leading to delays in the supply chain. The reason behind these large amounts of losses comes down to the fact that, initially, the demand for cars declined. With the transition from the normal structure of working to working from home, individuals had no need for a new vehicle, therefore manufacturers lowered their demand for electronic chips as they were not producing as much. Nonetheless, with the situation beginning

to improve, and individuals giving a higher value to private transportation, the demand was increasing again in 2021 (Gooding). Even before the automotive industry decreased its demand for electronic chips, it was buying around 37 billion US dollars' worth of semiconductors, which is less than what Apple buys by itself (Sweney). Now the industry was in a position where it needed to resume production. However, being one of the latest industries to return to the market of electronic chips, it found itself at the bottom of the supply chain, leading to delay issues. Potential customers in the automotive industry were now unable to buy new models, which lead to increasing second-hand car sales, and in the case of the UK, in 2021 these sales grew by over 100% compared to the previous year ("Second-Hand Car Sales Soar amid Shortage of New Models," 2021).

In an article by Deloitte, it is predicted for the shortage to ease down, but not completely stabilize, throughout the course of 2022, and come to a balance during the first quarter of 2023 (Stewart et al, 2021). The accumulation of these events has revealed exactly how vulnerable the electronic chip supply chain is to disruption such as the recent pandemic. Due to this revelation, many companies are increasing their investments in the manufacturing of these chips, and at the same time are spreading their activities (Gooding). One example would be Samsung planning to open a new semiconductor factory in Texas by 2024 ("Samsung to build $17bn semiconductor factory in Texas"). In conclusion, these events have made it apparent that there are areas where the supply chain can improve, and have left companies with a vision of being more diverse when it comes to locations, and at the same time to try and produce more for themselves.

3. Methodology

Being that the study aims to look at the impact that the new global ICT trends have had in Kosovo, it uses a combination of primary data obtained through interviews, and secondary data obtained online.

3.1. Secondary Data

The secondary data has been obtained through multiple online sources available. Given the nature of the study, the information was gathered through articles, surveys, and annual reports. Most of the articles used came from sources such as The Guardian, Forbes, Financial Times, Reuters, and others, the majority of which provided information about the electronic chip

shortage. On the other hand, a bulk of the information regarding the software section came from surveys done by G2 Research, Statista, Gartner, Fortune/Deloitte, McKinsey & Company, and through annual reports from Zoom, Slack, and TeamViewer respectively. The collected data served as a direction toward the format of the primary data, and a guideline for their content.

3.2. Primary Data

Primary data has been collected through a series of semi-structured interviews, and a survey completed by 104 participants. A mixed-method of purposive and convenience sampling methods was used to choose the participants for the interviews and survey. In total, 11 individuals were interviewed as representatives of their respective companies. All of the interviews were conducted in person and contained 13 questions, followed by additional ones depending on the information provided by the interviewee, and the nature of the organization. All of the interviews were conducted with businesses that operate in Kosovo, and mostly contained questions about the hardware sector. The survey was conveniently distributed to students and employees of various businesses. It also contained 7 questions in total, with their nature focusing purely on the software sector.

3.3. Information about the interviewees

Interviewee A representing Company A: Operations Manager at an online sales platform, specializing in recent and most popular technological products.

Interviewee B representing Company B: Manager at an electronics store that focuses on computers and other electronics.

Interviewee C representing Company C: Employee of a retail seller of electronic products such as TVs, computers, mobile phones, home appliances, etc.

Interviewee D representing Company D: Operations manager at a company that provides various outsourcing services.

Interviewee E representing Company E: CEO at a company that provides various outsourcing services with a focus on marketing, but including branches of software development as well.

Interviewee F representing Company F: Senior Software Developer at a data processing company that improves business processes.

Interviewee G representing Company G: Senior Engineer at a company that provides smart home and security systems services among others.

Interviewee H representing Company H: General Manager at a company that is an authorized importer and seller of various French automobiles.

Interviewee I representing Company I: General Manager at a company that is an authorized importer and seller of various German automobiles.

Interviewee J representing Company J: Sales Assistant at a company that is an authorized importer and seller of various Japanese automobiles.

Interviewee K representing Company K: Sales Assistant at a company that is an authorized importer and seller of various French automobiles.

4. Limitations

In regards to the secondary data, given the nature of the study, most of the information was found through various articles online, and while the sources are credible, there was a noticeable lack of studies conducted about the information that was required. At the same time, the value of lost profits apparent in them cannot be taken as an absolute value, as it is just a projected value.

For the primary data, the biggest limitation is with regards to the hardware sector, as there is a small number of businesses operating in the preferred industries, however, given their share in the Kosovo market, the number of interviews conducted is considered satisfactory. Similar to the secondary data, evaluations about the loss in profit were mostly estimated values, and thus cannot be taken as absolute information.

5. Analysis of Results

This section covers the results of the interviews and the survey regarding both the software and hardware sector, which, in general, have supported the view that the global situation has impacted businesses and individuals in Kosovo as well.

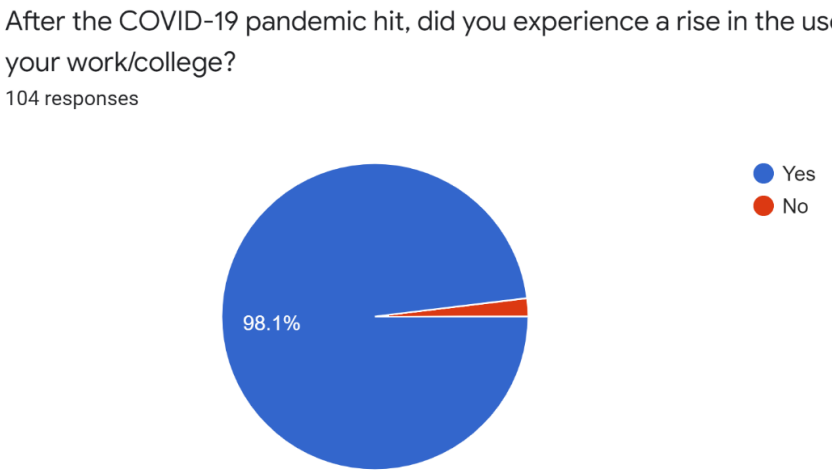
5.1. Software

As evident in the collected secondary data, there was an indisputable rise in the use of software/applications, an occurrence which holds true for individuals and businesses in Kosovo

as well, simply as a result of the necessary measures that needed to be taken in order to continue operating through the COVID-19 pandemic. Initially, the results of the survey are analyzed, followed afterward by the information gained through interviews regarding software use.

When analyzing the employment status of the respondents, 48.1% of the respondents were students, while only 3.8% were currently unemployed, with the others working part-time, full-time, or as interns. The reason behind the question is to simply gain a reflection on the demographic of the respondents. When respondents were asked if they experienced a rise in the use of software in their work or college after COVID-19 had begun. To this question, 98.1% of the participants answered positively. Similarly, all of the interviewees responded in the same way.

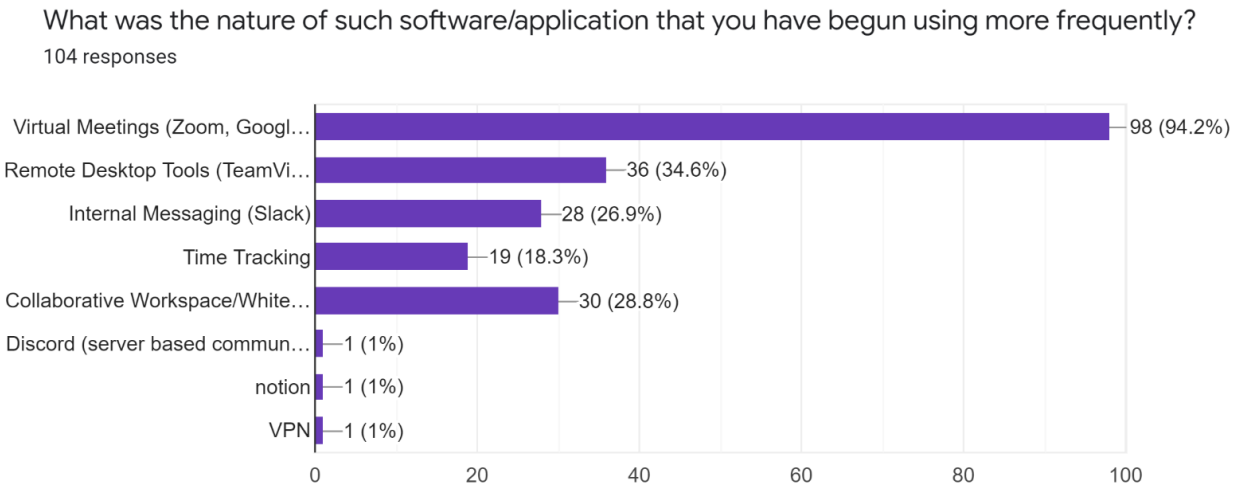
Source: Survey with 104 participants 1



The secondary data revealed that video conferencing was the type of software that experienced the most growth during the pandemic, with various software such as Zoom, Google Meet, etc., followed by other types. When analyzing the type of software that the respondents began using more frequently, 94.2% of the respondents said they began using video conferencing software, with other types such as Remote Desktop and Collaboration tools following quite far behind. While conducting interviews, similar results were apparent. Given the fact that transportation had become increasingly more difficult during the past two and a half years, every business began using video conferencing software for meetings, and some even started using them for interviews, whereas before they would simply travel to whatever country or city they had to, in order to participate in these activities. Nevertheless, excluding video conferencing, the majority

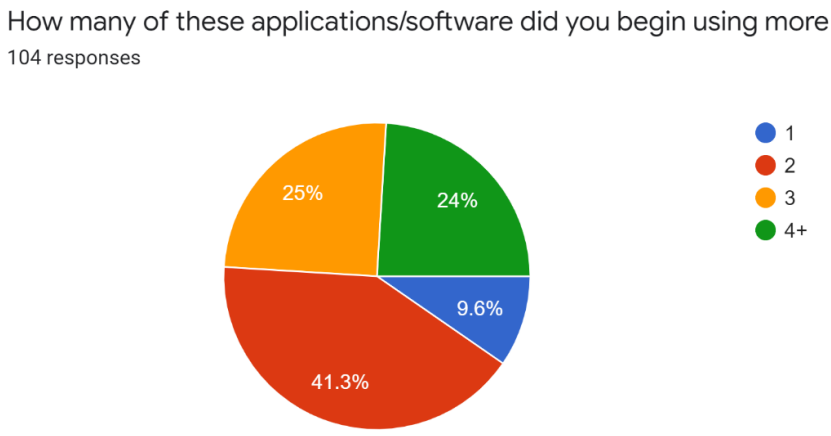
of the interviewees said that they did not experience a rise in other types of software, as due to the nature of their work, they were already operating with the tools and systems that were necessary even before the pandemic. An exclusion to this would be interviewees D, E, and F, with their respective companies, where they also began using new software for internal messaging, collaborative tools, time-management tools, and others.

Source: Survey with 104 participants 2



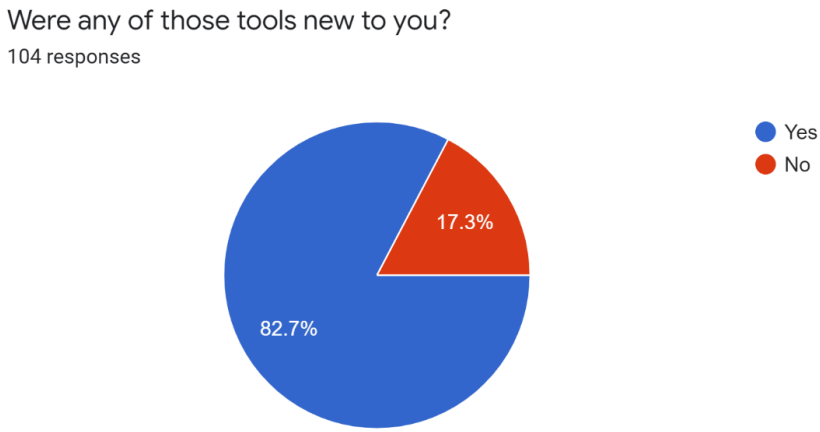
When analyzing the number of software/applications they began using more frequently, it was revealed that 66.3% of the respondents were using 2 to 3 new applications, 24% were using 4 or more, and only 9.6% were using only 1 application. As implied above, these results differ from the interview results, as most of them did in fact begin using only one application, for the purpose of video conferencing, with few exceptions.

Source: Survey with 104 participants 3



When asked whether these tools were new to them, 82.7% responded positively. A similar result was found during the interviews as well, as while some of the interviewees were familiar with a few of the software, they simply were not using them before in their work operations.

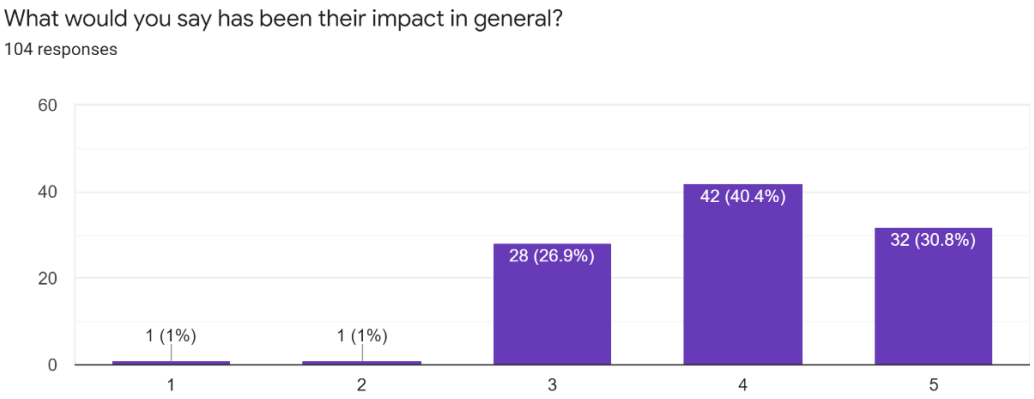
Source: Survey with 104 participants 4



The last three questions made had similar purposes. One asked what the impact of these applications was in general, the next asked whether the respondents were still using the tools today, and the final one asked if the respondents expected to keep using these tools in the future. These questions are meant to give an idea as to how the respondents have perceived these software, and simultaneously reveal whether they are here to stay even in a post-pandemic society. As for the general impact, 71.2% of the respondents said that the impact was positive,

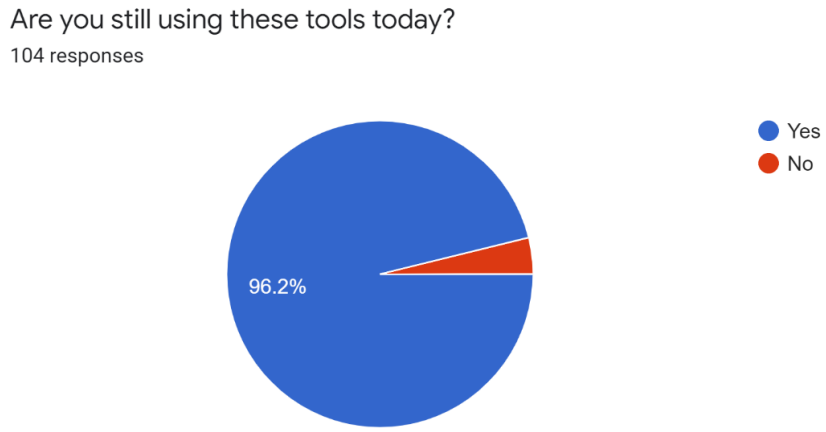
with 26.9% holding a more neutral view. The graph below shows the results with the notations being 1 for negative and 5 for positive.

Source: Survey with 104 participants 5

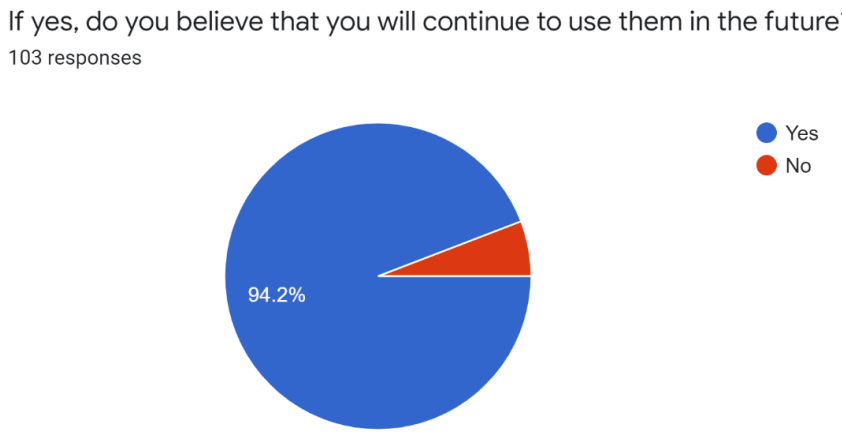


96.2% of the respondents were still using these tools today, and 94.2% of them believed that they will continue to use them in the future.

Source: Survey with 104 participants 6



Source: Survey with 104 participants 7



When these questions were made during the interviews, similar results were achieved. The types of software that have an expectation for continued use in the future are video conferencing, internal messaging, and collaboration tools. When it comes to video conferencing, businesses have realized that holding virtual meetings when possible saves a lot of costs, and at the same time it does not lower the productivity of such meetings. On the other hand, software for internal messaging and collaboration will be used in businesses where remote working has proven to be viable, as a hybrid method is now a possibility due to the already adapted structure in these businesses.

5.2. Hardware

Information about the hardware sector was collected through the conducted interviews. For a clearer representation of the data, and due to the similarities between results, the interviews will be divided into three groups. The first group will include information on computers, smartphones, graphic cards, TVs, and home appliances gathered from companies A, B, and C, all businesses that sell various technological products. The second group will comprise company G, as a provider of smart home, security, and other electronic services. And the last group will include companies H, I, J, and K, as businesses operating in the automotive industry. Initially, the results of the first group will be analyzed below, which will be followed by the other two groups. Due to the interview being semi-structured, only the collected information will be apparent in this section, while the interview can be found in the appendices section.

5.2.1. Group 1 – Sellers of Various Technological Products

In the initial time period following the pandemic, the group experienced no issues in supplying the demand of their customers. As per the three companies, the difficulties started being noticed at the beginning of Q2 2020. The products most affected differed between the companies, whereas for company A the largest shortage was noticed in graphic cards, smartphones, and powerful PCs, company B experienced most issues with processors and graphic cards, while for company C the shortage was most apparent in TVs, smartphones, and home appliances.

5.2.1.1.Laptops, Computers, and Graphic Cards

When it comes to laptops, the three companies expressed that they had done fairly well in meeting the demand of their customers, a situation similar to today. The reason behind this, as mentioned by interviewee B, is that while the demand itself grew substantially, for most people in education and work, the systems that were now necessary didn't have to belong to the latest line in technology. A laptop or tablet that's a few years old was more than sufficient for completing required tasks from home. Nevertheless, this situation changes when the focus is shifted toward personal computers, with drastic shortages in graphic cards, and some issues with processors as well. Unlike laptops, more often than not only the newest models of these PC components are demanded by customers, leading to both companies A and B being unable to meet this large demand. The shortage of these products started to be felt in October 2020, and while the situation has improved for processors, it remains the same for graphic cards as of early 2022. Both companies stated that another reason for the shortage of graphic cards in Kosovo is the increased interest when it comes to cryptocurrency mining. To recall the global shortage of gaming consoles, company A also had difficulties meeting the demand for the new PlayStation and Xbox models, generally being incapable of securing these products for clients. Consequently, the shortage for this group of products was followed by an increase in prices, where a graphics card/processor that is 2-3 years old, is still as expensive today as it was on its initial release.

5.2.1.2.Smartphones, Tablets, and Smartwatches

Smartphones and tablets are a few of the products that haven't been subject to a shortage in Kosovo until September 2021, which is when companies A and C reported shortages in products from Apple and Samsung, including smartwatches and tablets, on top of smartphones.

As a result, both companies have implemented a strategy of stocking up on these products beforehand as much as they can, since they do not expect the market to stabilize until Q2 2022, which leads to the clients feeling the shortage in the form of delays rather than an inability of the company to meet their demand.

5.2.1.3.TVs and White Goods

The last category of this group includes TVs and home appliances, otherwise referred to as white goods. For company C, TVs were their most affected products. With China being one of the biggest manufacturers of TV panels, the shortage was felt from early 2020. Along with TVs, this company also experienced shortages in white goods, more notably in dishwashers and washing machines. Nevertheless, contrary to the previous two categories, the situation for TVs and home appliances had already improved by late 2021.

For all three categories, what is similar is an increase in product prices, which comes as a chain reaction from the price increase by suppliers, with interviewee C reporting that for the transport that they once paid $2,000, they now pay approximately $15-16,000.

5.2.2. Group 2 – Smart home, security, and electronic services

Unlike the companies in the other two groups, company G offers services in the industry of home electronics, providing clients with smart home utilities, including here security tools, the software for which requires the latest hardware in order to operate efficiently. To distinguish it from the first group, shortages became apparent at the beginning of 2021. Simultaneously, up until the third quarter of 2021, most of the issues came in the form of delays. An order that would usually arrive in two weeks, would now arrive in around seven weeks. As reported by interviewee G, in the final quarter of 2021 there was a notable shortage of final products, with the most critical months being October and November, a situation still apparent as of January 2022. When asked about the strategies in place for these issues, the interviewee responded that the company simply does not partake in projects that they cannot supply the components for, and at the same time has been notifying investors about potential delays, which for the most part has met by positive reactions, given that the situation is similar for all companies of the same nature in the region.

5.2.3. Group 3 – Automotive industry

The final group of interviewees belongs to the automotive industry, which both the primary and secondary data revealed to have been hit the hardest by the chip shortage. The reports from all four companies were significantly similar. Initially, the group reported that there had been no issues up until the beginning of the second quarter of 2021. However, the shortages began immediately after this period, having an immense impact on these businesses. As reported by all companies but company K, the most difficult period included the summer of 2021. Interviewee I reported that, for the first time in 10 years, there was no possibility of completing vehicle deliveries. The interviewees expressed that during this period, their showrooms could be described as almost empty, meaning that in an average space of 600-800 square meters, you would now see 2-3 cars instead of 20. On the rare occasion when the companies would be able to order new cars, instead of the usual delivery time of 2-3 months, they would now wait up to 7 months for those cars to arrive. The situation had worsened in early 2022, as now these companies cannot ensure their clients that the cars they want to buy would arrive at all, let alone arrive within a specific period. This led to the inevitable removal of a delivery time in the contracts of clients, as the companies cannot provide an assured legal guarantee. Consequently, this has resulted in dissatisfaction and loss of clients. When asked about the loss in revenue, most of them reported a 25-30% loss from what was projected for the year, with company K reporting that it expects losses of up to 70% for 2022.

Currently, the situation is no better for these companies. To put it in the words of interviewee J, they have come to a point of complete stagnation, meaning that they don't expect to operate with the capacity they were used to any time before late 2022, or early 2023. Interviewee I mentioned that they were surprised by the demand for automobiles. Whereas one would expect this demand to decrease, because of the pandemic the demand increased as individuals would now value private transportation more than before, only adding to the previously mentioned issues. As with the other industries, this one has also experienced price increases, with some companies reporting an increase of up to 30%. At the same time, all companies blame these issues almost entirely on the electronic chip shortage, as there have been no issues when it comes to their logistics. The strategies put in place to thwart these issues differ between the companies. Company H has been attempting to stock up on products more than what its capacity allows, a similar strategy that was seen with companies A and C. Company I has

begun selecting clients, where they now prioritize private clients instead of fleets, since they're aware that the products that they'll be able to bring will be in small quantities. Thus, instead of focusing on fulfilling an order for a business that provides taxi services and would subsequently demand 50 cars at once, they now try to fulfill small orders for private clients, being that that's the best of their current abilities. On the other hand, company K reported that it has stopped its marketing campaigns since September 2021, a strategy that has proved successful in lowering demand; where cars would be sold within 2 weeks at most with marketing campaigns, now they may take up to 2 months. Another relevant piece of information that was gathered from the companies, is that they agree with the view that due to the small demand that Kosovo has, it stands at the bottom of the supply chain for when the situation begins to improve, which is one of the reasons as to why these companies may not notice such an improvement before 2023.

6. Conclusion and Recommendations

6.1. Conclusion

The goal of this study was to analyze the global ICT trends in the hardware and software sectors, and to what extent they have impacted individuals and businesses in Kosovo.

Beginning with the software sector, the secondary data revealed that there was a significant increase in the global use of software. As expected, the most prominent type of software during the past two and a half years was video conferencing/virtual meetings, followed by remote desktop tools, collaboration tools, internal messaging, time-tracking tools, and others. At the same time, surveys showed that employees expected to use the introduced software even in the future. These points were all, unsurprisingly, apparent in the results of the primary data conducted in Kosovo. The results of the interviews and survey concluded that almost 100% of individuals and businesses had started using some new software for their daily operations during the pandemic, with 94.2% using virtual meeting software such as Zoom, Google Meet, or Microsoft Teams, followed by other types of software such as remote desktop tools, collaboration tools, and various other types in smaller amounts. At the same time, due to how efficiently these tools were adapted into business operations, there is a positive expectation for their use in the future, a statement that holds especially true in work cultures where a hybrid structure of working has become a norm.

Being a country with a small demand in respect to the global scale, initial thoughts may be that Kosovo's demand for technological products can be conveniently fulfilled. Nevertheless, as presented through the secondary data about the automotive industry, in a market of increasing competition for products, requiring small quantities of such products can lead you to the bottom of the supply chain. Secondary data revealed issues for companies such as Apple and Samsung, with both tech giants having to postpone releases for their products, or complete them in smaller amounts. Samsung also reported shortages of TVs and home appliances. The same phenomena were noticeable from the primary data in Kosovo. The situation with mobile phones has significantly worsened during the last quarter, and Apple products, in general, are difficult to get a hold of, with some orders experiencing months of delay. Simultaneously, in the past two years, it has been reported an increasing shortage of TVs and home appliances as well, however, there are significant improvements as of early 2022. Also similar in both the secondary global data and primary data in Kosovo is the shortage of graphic cards. As reported by the first group of interviewees, the graphic card shortage has been present since October 2020, the prices for such cards have risen tremendously, and there is yet time before the market can get to a point of stability. Apart from gaming, another factor to have affected the GPU shortage in Kosovo is the substantial increase in crypto mining, as stated by two interviewees.

The last industry for which data was gathered is the automotive industry. In both secondary and primary data, it is clear that this industry is the one that was affected the most by the electronic chip shortage. Along with removing delivery times from contracts, and experiencing empty showrooms, the industry was subject to significant losses. Apart from one company that reported losses of up to 70%, most automotive businesses in Kosovo reported an estimation of 30% in revenue losses, a figure that is similar to various global manufacturers due to production shutdowns. These companies were also directly affected by the price increases of their suppliers, which were simultaneously directly affected by the price increases of the manufacturers of the products. This is a chain reaction that can be felt from the producers in Asia, all the way to the small Balkan country of Kosovo. In a similar fashion to the global occurrences, businesses expect that even when production resumes, they will be one of the last ones that will be supplied, which is the same reason why the global automotive industry is the one most heavily impacted.

In conclusion, the data collected reveals that the global ICT trends in the hardware and software sectors are also apparent in Kosovo. Software use has surged and been adapted efficiently to business operations, and the hardware shortages have caused issues for many businesses in Kosovo that work in the same industries where these shortages were most prominent in.

6.2. Recommendations

Due to the nature of the issues stated in this study, solutions would be difficult to recommend, or they are unrealistic to say the least. The issues experienced in the hardware sector would be difficult to solve for Kosovo. Even countries such as the US have been affected by the shortages, and plans to improve the supply of electronic chips include building semiconductor factories that cost tens of billions of US dollars to build, a figure that is astronomical and unachievable for a country as small as Kosovo. Some more realistic recommendations can be as followed:

Make contracts with suppliers stating that the quantity demanded will be fulfilled in the delivery time agreed upon, meaning that the businesses' orders in the supply chain will not plummet due to the low quantities demanded.

Change customer expectations. This can come in the form of finding replacements for the product demanded or making the customer aware of the supply issues before they make an order that may or may not be fulfilled.

Nevertheless, the issues are present globally, and their solutions are at scales that exceed Kosovo's capacities.

On the other hand, a recommendation to individuals who may be interested in replicating the study would be to try and take into consideration sales that are done in second-hand markets in their respective country. Although that information is difficult to obtain, it would provide a great reflection if we are to look at options that customers have when faced with these types of shortages in the market.

Bibliography

Arif, R. (n.d.). *In The Post COVID-19 World, Zoom Is Here To Stay.* Forbes. Retrieved January 16, 2022, from https://www.forbes.com/sites/raufarif/2021/02/26/in-the-post-covid-19-world-zoom-is-here-to-stay/

Clement, J. (n.d.). *Growth in time spent gaming during COVID-19 worldwide 2020*. Statista. Retrieved January 17, 2022, from https://www.statista.com/statistics/1188545/gaming-time-spent-covid/

Fauscette, M. (n.d.). *Business Software Spending During the COVID-19 Crisis*. G2. Retrieved January 16, 2022, from https://www.g2.com/articles/business-software-spending-during-covid-19

Gartner Forecasts Worldwide IT Spending to Exceed $4 Trillion in 2022. (n.d.). Gartner. Retrieved January 15, 2022, from https://www.gartner.com/en/newsroom/press-releases/2021-10-20-gartner-forecasts-worldwide-it-spending-to-exceed-4-trillion-in-2022

Gooding, M. (2021, July 9). Why is there a global chip shortage and when will it end? *Tech Monitor*. https://techmonitor.ai/technology/chip-shortage-tsmc-samsung-us-uk-taiwan-automotive

Iqbal, M. (2020, April 9). *Zoom Revenue and Usage Statistics (2022)*. Business of Apps. https://www.businessofapps.com/data/zoom-statistics/

Jung-a, S. (2021, April 29). Samsung says chips crunch hitting TV and appliance production. *Financial Times*. https://www.ft.com/content/4b7b284a-a280-4252-bcc7-0fb6a4ef5d92

Kan, M. (n.d.-a). *Inside the GPU Shortage: Why You Still Can't Buy a Graphics Card*. PCMAG. Retrieved January 17, 2022, from https://www.pcmag.com/news/inside-the-gpu-shortage-why-you-still-cant-buy-a-graphics-card

Kan, M. (n.d.-b). *Read It and Weep: Here's How Bad Nvidia GPU Prices Got in a Single Year*. PCMAG. Retrieved January 17, 2022, from https://www.pcmag.com/news/read-it-and-weep-heres-how-bad-nvidia-gpu-prices-got-in-a-single-year

Kark, K., Smith, T., & Gill, J. (n.d.). *Maximizing the impact of technology investments in the new normal*. Deloitte Insights. Retrieved January 16, 2022, from https://www2.deloitte.com/xe/en/insights/focus/cio-insider-business-insights/impact-covid-19-technology-investments-budgets-spending.html

Laberge, L., O'Toole, C., Schneider, J., & Smaje, K. (2020.). *COVID-19 digital transformation & technology | McKinsey*. Retrieved January 16, 2022, from https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/how-covid-19-has-pushed-companies-over-the-technology-tipping-point-and-transformed-business-forever

Learn the microchip basics. (n.d.). Retrieved April 4, 2022, from https://www.asml.com/en/technology/all-about-microchips/microchip-basics

Liu, S. (n.d.-a). *Business software spending increases amid COVID-19 2020*. Statista. Retrieved January 17, 2022, from https://www.statista.com/statistics/1116831/business-software-spending-covid19-forecast/

Liu, S. (n.d.-b). *Worldwide IT enterprise software spending 2009-2022*. Statista. Retrieved January 15, 2022, from https://www.statista.com/statistics/203428/total-enterprise-software-revenue-forecast/

Provan, S., & Campbell, P. (2021, July 6). Jaguar Land Rover halves sales expectations as chip shortage bites. *Financial Times*. https://www.ft.com/content/6c37dc10-3800-4505-abf6-831365d8d783

Rosenbaum, E. (2021, October 29). *Apple chip shortage will end, but U.S.-China supply chain "train wreck" is coming*. CNBC. https://www.cnbc.com/2021/10/29/apple-chip-woes-will-end-but-us-china-supply-chain-war-just-starting-.html

Samsung to build $17bn semiconductor factory in Texas. (2021, November 24). *The Guardian*. https://www.theguardian.com/technology/2021/nov/24/samsung-to-build-a-17bn-semiconductor-factory-in-texas-us-chip-shortage

Second-hand car sales soar amid shortage of new models. (2021, August 10). BBC News. https://www.bbc.com/news/business-58150025

Shepardson, D. (2021, September 3). GM to cut North American production, citing chip shortage. *Reuters*. https://www.reuters.com/business/autos-transportation/gm-cut-north-american-production-citing-chip-shortage-2021-09-02/

Slack. (n.d.). *Slack Announces First Quarter Fiscal Year 2022 Results*. Slack. Retrieved January 17, 2022, from https://slack.com/blog/news/slack-announces-first-quarter-fiscal-year-2022-results

Snapshot. (n.d.-a). Retrieved January 15, 2022, from https://www.theguardian.com/business/2021/mar/21/global-shortage-in-computer-chips-reaches-crisis-point

Snapshot. (n.d.-b). Retrieved January 15, 2022, from https://techmonitor.ai/technology/chip-shortage-tsmc-samsung-us-uk-taiwan-automotive

Stewart, D., Bucaille, A., Hamling, D., & Crossan, G. (n.d.). *My kingdom for a chip: The semiconductor shortage extends into 2022*. Deloitte Insights. Retrieved January 17, 2022, from https://www2.deloitte.com/xe/en/insights/industry/technology/technology-media-and-telecom-predictions/2022/semiconductor-chip-shortage.html

Sweney, M. (2021, March 21). Global shortage in computer chips "reaches crisis point." *The Guardian*. https://www.theguardian.com/business/2021/mar/21/global-shortage-in-computer-chips-reaches-crisis-point

Teamviewer Anual Report 2020. (n.d.). Retrieved January 17, 2022, from https://annualreport.teamviewer.com/

What is digital transformation? (n.d.). Retrieved January 16, 2022, from https://enterprisersproject.com/what-is-digital-transformation

Zoom Reports Financial Results for the Third Quarter of Fiscal Year 2022. (n.d.). 6.

Zoom Reports Financial Results for the Third Quart.pdf. (n.d.). Retrieved January 17, 2022, from https://investors.zoom.us/node/9666/pdf

Appendices

Appendix A – Interview

Hardware

Following the time after the COVID-19 pandemic hit, have you dealt with any shortages when it came to technological products?

If not, how did you as a company 'strive' through a global shortage of electronic chips?

If yes, what sorts of products did you notice the biggest effect on?

What was the projected revenue loss from these shortages (question to be made in terms of percentages)

For your company, was the shortage caused by the global chip shortage, or did you actually have the demanded quantity but couldn't receive them due to other reasons (e.g. problems with product transportation)

What is the situation for you today when it comes to the quantity you can provide for technological products?

If you were not able to meet the demand, then how did you respond?

Do you have any strategies of dealing with the situation currently?

Do you have any expectations of when the situation will improve?

Software

Following the time after the COVID-19 pandemic hit, did your business incur significant changes in its way of operating?

Did you as an employee face a new way of working, and if yes, in what way?

Did you have to work with software that you never worked on before?

What effect would you say that this sort of change had on your way of working? Are there positive outcomes from this situation?

How is your company operating today?

Do you believe that you will keep on using some of the introduced software in the future?

Appendix B – Survey

1. What is your current status of employment?

Student

Part-Time

Full-Time

Unemployed

2. After the COVID-19 pandemic hit, did you experience a rise in the use of software/applications in your work/college?

Yes

No

3. What was the nature of such software/application that you have begun using more frequently?

Virtual Meetings (Zoom, Google Meet, etc)

Remote Desktop Tools (TeamViewer)

Internal Messaging (Slack)

Time Tracking

Collaborative Workspace/Whiteboard

4. How many of these software did you begin using more frequently?

1

2

3

4+

5. What would you say has been their impact in general?

Negative to Positive scale

6. Are you still using these tools today?

Yes

No

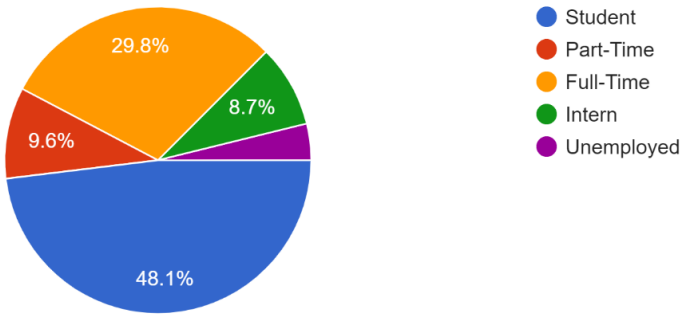
7. If yes, do you believe that you will continue to use them in the future?

Yes

No

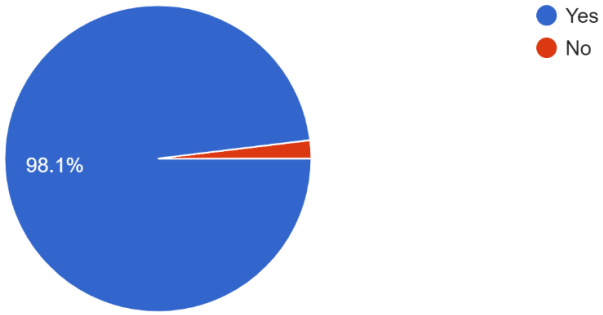
What is your current status of employment?

104 responses



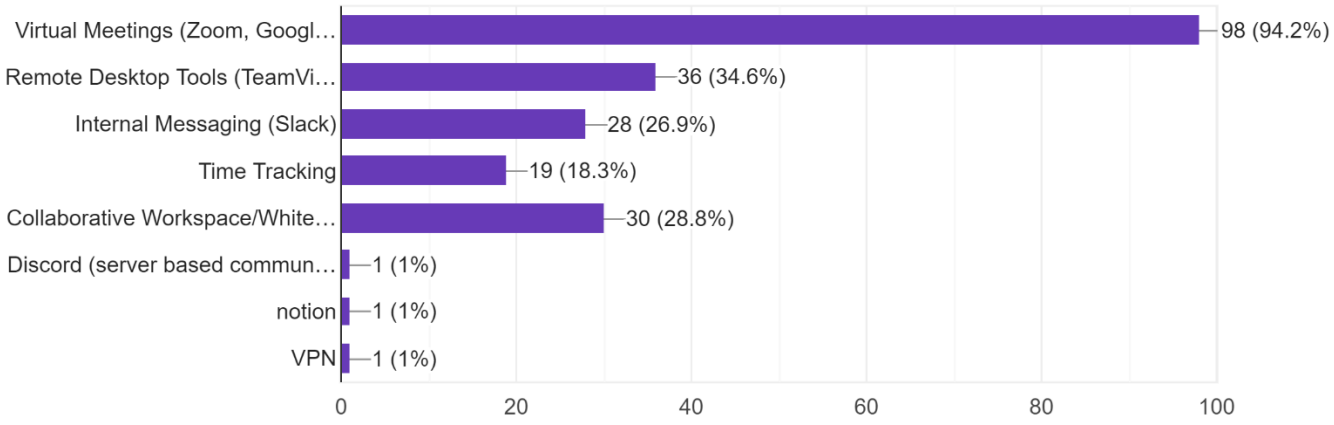
After the COVID-19 pandemic hit, did you experience a rise in the use of software/applications in your work/college?

104 responses



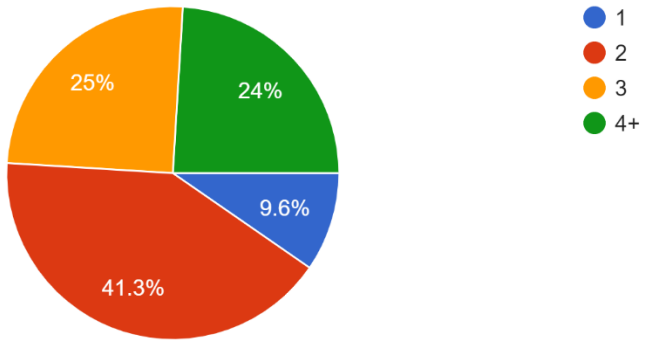
What was the nature of such software/application that you have begun using more frequently?

104 responses



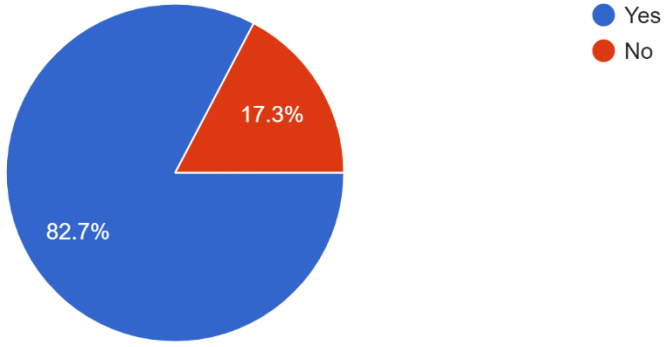
How many of these applications/software did you begin using more frequently?

104 responses



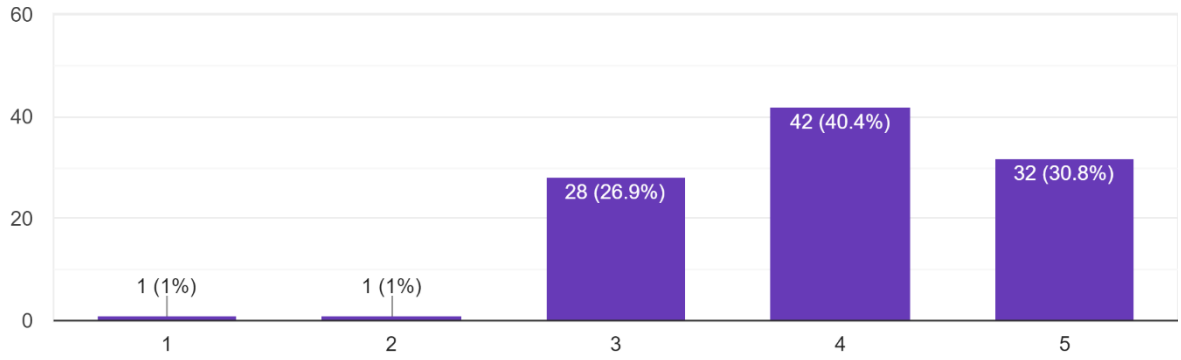
Were any of those tools new to you?

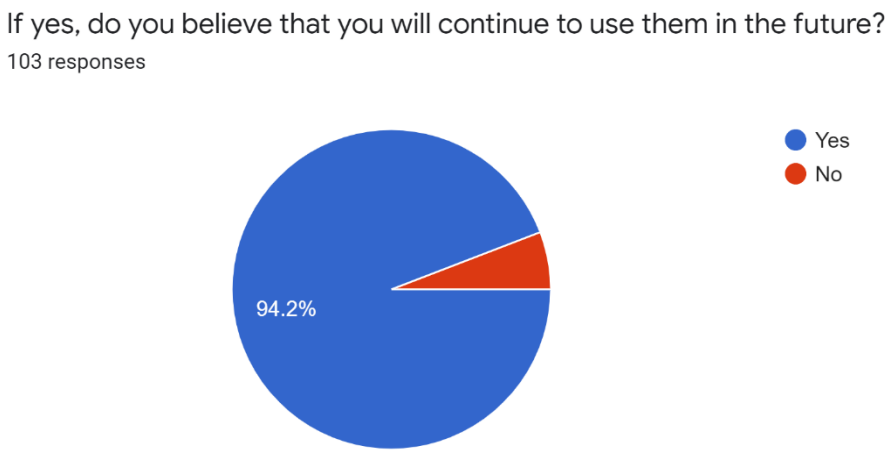
104 responses



What would you say has been their impact in general?

104 responses



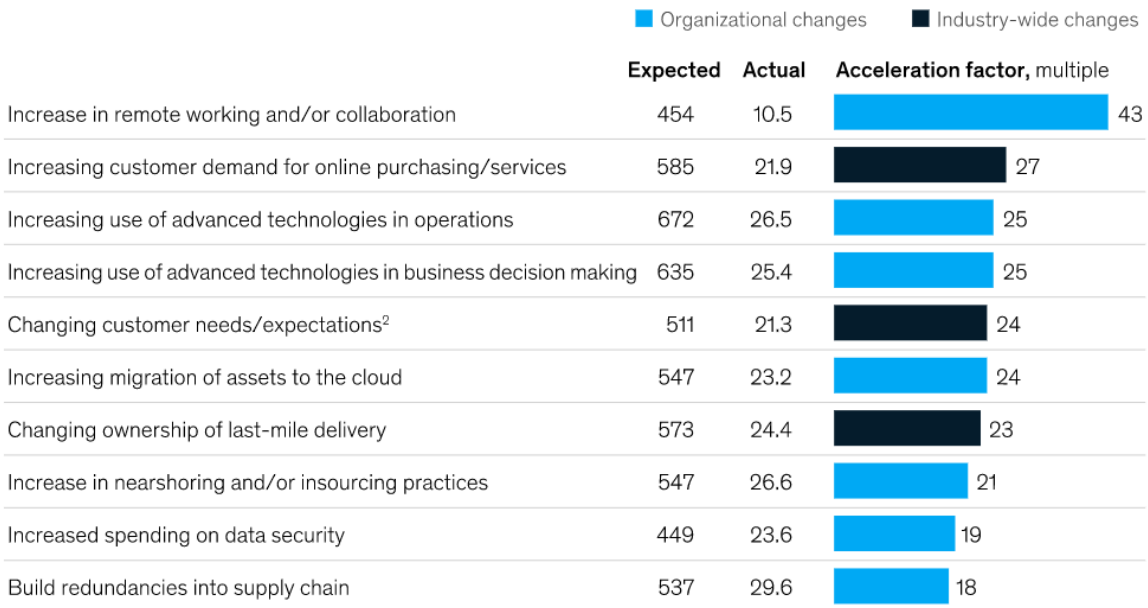


Appendix C – Secondary Data Figures

Figure 1 – Source: McKinsey & Company

Executives say their companies responded to a range of COVID-19-related changes much more quickly than they thought possible before the crisis.

Time required to respond to or implement changes,[1] expected vs actual, number of days



	Expected	Actual	Acceleration factor, multiple
Increase in remote working and/or collaboration	454	10.5	43
Increasing customer demand for online purchasing/services	585	21.9	27
Increasing use of advanced technologies in operations	672	26.5	25
Increasing use of advanced technologies in business decision making	635	25.4	25
Changing customer needs/expectations[2]	511	21.3	24
Increasing migration of assets to the cloud	547	23.2	24
Changing ownership of last-mile delivery	573	24.4	23
Increase in nearshoring and/or insourcing practices	547	26.6	21
Increased spending on data security	449	23.6	19
Build redundancies into supply chain	537	29.6	18

Figure 2 – Source: Statista

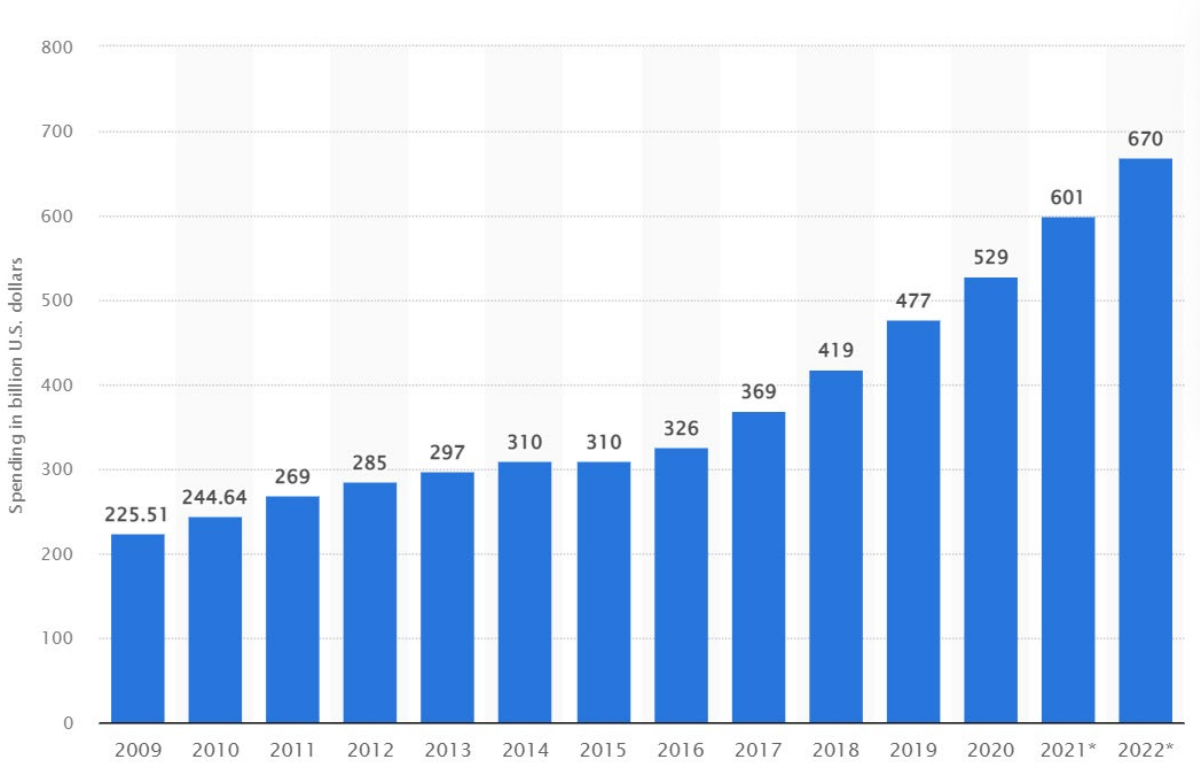


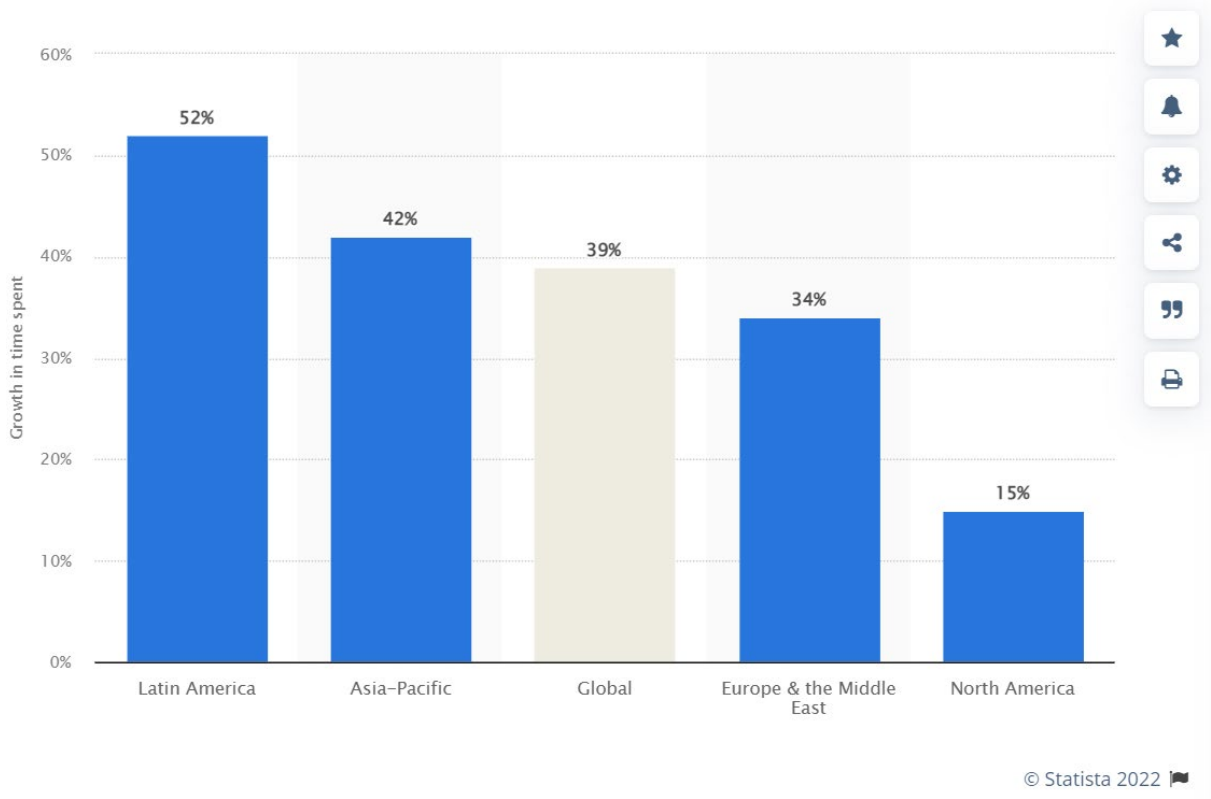
Figure 3 – Source: Gartner

Table 1. Worldwide IT Spending Forecast (Millions of U.S. Dollars)

	2020 Spending	2020 Growth (%)	2021 Spending	2021 Growth (%)	2022 Spending	2022 Growth (%)
Data Center Systems	178,836	2.5	196,142	9.7	207,440	5.8
Enterprise Software	529,028	9.1	600,895	13.6	669,819	11.5
Devices	696,990	-1.5	801,970	15.1	820,756	2.3
IT Services	1,071,281	1.7	1,191,347	11.2	1,293,857	8.6
Communications Services	1,396,334	-1.5	1,451,284	3.9	1,482,324	2.1
Overall IT	**3,872,470**	**0.9**	**4,241,638**	**9.5**	**4,474,197**	**5.5**

Source: Gartner (October 2021)

Figure 4 – Source: Statista



Appendix D – Informed Consent Form

Informed Consent Form for Social Science Research

RIT Kosovo

Title of Project: *Repercussions of a Disruption: The Impact of Global ICT Trends in Kosovo*

Principal Investigator: Dior Ramosaj, RITK Student
Gërmia Campus, Dr. Shpëtim Robaj st. nn
10000 Prishtina,
045-910-757; diorr@auk.org

1. **Purpose of the Study:** The purpose of this research study is to explore *the impact that the COVID-19 pandemic (as a disruption) has had on hardware and software sectors of ICT, in Kosovo businesses. From the hardware perspective, the study will look into how businesses were able to deal with the electronic chip shortage that happened during this period; while from the software perspective, the study will look into the changes that businesses incurred in their way of operations (usage of software for continuing to operate, and their type). The study will compare these two sections in Kosovo and fare them against the global trends to see any similarities or differences.*

1. **Procedures to be followed:** You will be asked to answer *15-20 questions* during this interview.

1. **Duration:** It will take about *45* minutes to complete the interview.

1. **Statement of Confidentiality:** Your participation in this research is confidential. The data will be used only to get an overview of the situation of businesses in Kosovo in terms of how they fared against global trends when it came to a global shortage (hardware perspective), and how much did their operations change (software perspective).

1. **Voluntary Participation:** Your decision to be in this research is voluntary. You can stop at any time. You do not have to answer any questions you do not want to answer.

You must be 18 years of age or older to take part in this research study. If you agree to take part in this research study and the information outlined above, please sign your name and indicate the date below.

You will be given a copy of this form for your records.

_____ _____

Participant Signature Date

_____ _____

Person Obtaining Consent Date