Working From Home: How the Advent of Remote Work Impacts the Software Engineering Industry

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Essence of Software and Working Remotely

Since the introduction of novel occupations following industrialization, it was the expectation that technical jobs were to be done in person. Whether the role required architecting buildings, filming movies, or trading stock, the employee would be required to communicate and collaborate with their fellow coworkers on-site. While some roles still necessitate in-person work, the spread of the COVID-19 virus in late 2019 and the advent of software engineering some 60 years prior added to the ways in which a person could complete their work. Software engineering can generally be defined as "a discipline that adopts engineering approaches … in the development of large-scale software seeking to result in high productivity, low cost, [and] controllable quality" (Wang & Patel, 2000). Likewise, "software" is defined by the Cambridge dictionary as "the instructions that control what a computer does" (Cambridge English Dictionary, 2023). Anything from Netflix and Google to the programming that makes a calculator work fall under "software," and many people rely on the proper functioning of this technology to go about their daily lives.

As the internet expanded in the early 2000s, software engineers had the potential to complete their work on their own personal computers in their own homes. Internet meant remote communication and collaboration on projects was possible, and since software has no physical form, there was no technical need to be in person. Working without having to be in person is known as remote work, which "generally refers to organizational work performed outside of the normal organizational confines of space and time" (Olson, 1983). In today's society, remote work is usually categorized by one of two things: the hybrid model, in which employees commute to the main office some days and work remotely on others, and the completely remote

model, in which employees work exclusively from their places of living. The junction of remote work and the software industry establishes the core of the research question of this paper: how does working remotely affect the productivity and personal lives of software engineers and the success of their respective places of employment? In an attempt to answer the question, the social construction of technology framework will be used.

The Documentary Research Methodology

How does working remotely affect the productivity and personal lives of software engineers and the success of their respective places of employment? For the analysis of the research question, the documentary research methodology is being used. Since the phenomena of remote work and its implications are largely based on the sentiments of software employees, it is possible to analyze the research surveys previously conducted on these employees, which are the primary source of evidence being used in this paper. This paper also uses sources collected from the keywords of "retention," "turnover," "well-being," and "productivity" with regard to software professionals and the software industry. The terms retention and turnover assist in describing general trends within the industry, which are then synthesized with the sources that collect sentiment analysis of software engineers to generate a conclusion on the efficacy of remote work. On the other hand, the latter two keywords examine the employee's perspective of the transition, and establish whether the happiness of the employee is impacted. In concert with the above sources, the performance of tech companies with particular work practices are being used to draw parallels between characteristics of remote work and good business. Drawing comparisons between these two reveals insights as to why remote work does or doesn't work, and what adjustments can be made. The internet, particularly scholarly databases, is being used to collect all of the aforementioned sources. The structure of the remainder of this paper to will

start with an in-depth discussion on the characteristics of remote work and how they impact the individual employee along with their respective companies. Since the SCOT framework is being used to analyze the provided evidence, the paper will start by identifying the groups at play, and then take a dive into some of these groups to determine the overall effectiveness of remote work from a variety of perspectives. In the analysis of each group, a partial answer to the research question will be revealed, with the known caveats also listed. Eventually, the paper will end by synthesizing the partial answers found through the research, and reach a conclusion on the efficacy of remote work in the software industry from a general perspective, as well as a more individualized perspective that accounts for differences in groups.

Reasons for the Rise of Remote Work

To trigger the transition towards remote work some sort of urgency was required, and the COVID-19 pandemic was the catalyst. For businesses that relied on an in-person business model the pandemic was catastrophic, a prime example being when Montreal-based circus producer Cirque du Soleil "announced it would lay off 95% of its 4,679 staff on March 19, 2020" (Martin, 2020). For software companies who had the capabilities to attempt telework, social distancing meant either closing down or adapting to remote work. According to the New York Times, before "the pandemic, in 2019, about 4 percent of employed people in the U.S. worked exclusively from home; by May 2020, that figure rose to 43 percent" (Goldberg, 2022). Many software companies contributed to the above metric, and it is important to denote that remote work is here to stay; rather than being a reactionary fad to a global pandemic, remote work is a new way of conducting business. A 2022 article by AT&T researchers found that while the "fully remote workplace model is expected to take a dramatic decline from 2021 (56%) to 2024 (19%), the hybrid model is expected to grow from 42% (2021) to 81% (2024)" (Pereira, 2022).

Even though fully remote work is predicted to decline, the hybrid model is of importance as employees may still do most of their work virtually.

Despite COVID-19 being the sparkplug for the transition, that is not the only thing necessary to allow remote work to prosper. Particularly in the software industry, the reason that remote work could not take hold earlier was the lack of efficient collaborative infrastructure that could be used offsite. Before the era of cloud storage, "companies had to store all their data and software on their own hard drives and servers," and these servers were typically onsite (Accenture, 2023). It made more sense for software engineers to be in person, and the high price of personal computers supported the in-person scheme. Moreover, there was no clean way to replicate the collaborative environment that could be achieved in-person. Nowadays, a basic laptop can be had for under $300; even when adjusting for inflation, the price would not have been possible even 20 years ago. Additionally, the advancement of software has given birth to applications that are meant for smooth remote collaboration – Zoom, Slack, Discord, and Microsoft Teams are just a few examples of such applications. Between the low price of powerful computers and means for remote collaboration, the software industry is poised to continue upon the remote work trend that was sparked by the pandemic.

With the pandemic being the focal point of the software industry in the past couple of years, it is easy to overlook the continued growth that the industry has been bringing. In the early 2010s, the software industry had already established itself as a major player in the growth of the United States as a global superpower, and "analysis shows that software accounted for 12.1 percent of all U.S. labor productivity gains from 1995 to 2004 and 15.4 percent of those gains from 2004 to 2012" (Shapiro, 2014). The U.S. Bureau of Economic Analysis also shows that the share of private fixed investment in software has gone from 3% in the 1980s to over 12% in 2012

(Shapiro, 2014). The rise in investment is a testament to the increasing reliance on software for individuals and businesses of all industries. Even more so, at the core of the industry lies software engineers, whose well-being and productivity have a direct impact on the success of tech companies. The technology industry has a notoriously high turnover rate (number of employees who leave a company as a percentage of all employees in a certain time frame) at around 13% in 2022 according to data collected by LinkedIn (Lewis, 2022). It remains to be seen how remote work could affect turnover statistics and impact a tech company's ability to source and retain talented employees.

Social Construction of Technology

To conduct this research, the social construction of technology (SCOT) framework is used. Rather than falling under the realm of technology shaping human lives, SCOT places emphasis on humans themselves in the artifact creation and revision process. Wiebe Bijker, one of the founders of the SCOT school of thought, provides the explanation that "the development of technology can be explained as a social process in which an open variety of relevant social groups participate" (Bijker, 2015). In the case of the bicycle, different groups with different desires imparted their knowledge and ideals upon the design, and it was through this tumultuous process that today's design was achieved. The concept of contributing "groups" is analogous to remote work in that the idea that the way businesses decide to work their employees – and how employees respond to this work – is entirely social. It is human interaction and the presence of distinct groups that define the ability and success of remote work tactics. Thus, examining both the employee and employer perspectives under a SCOT approach is the focus of the analysis.

One use of the framework to analyze a research question comes from the paper by researchers Andrei Kwok and Sharon Koh, in which the two aim to analyze the potential

positives of deepfakes through the SCOT perspective. Deepfakes are a form of media manipulation using artificial intelligence, and are able to change faces, text, and voice in both pictures and videos alike, typically garnering negative attention due to their often-malicious use. However, the researchers insist that rather than attempting to argue whether deepfakes are simply good or bad, they use SCOT "to debate the potential positive application and regulation of deepfake" (Kwok & Koh, 2020). In their approach, they identify several ways how users of deepfakes positively impact society. Some of these approaches include providing interactive virtual exhibits at museums by bringing artists "back to life" and that the increased use of deepfakes will push for better regulation and authentication protocols by governing bodies. Rather than examining how the clashing groups come to create deepfake technology, the researches instead analyze how these groups make deepfakes positively evolve by utilizing them in specific ways. They stand by their view of humans as "technological change agents" that take an artifact and mold its purpose through its uses (Kwok & Koh, 2020). Remote work in the same way cannot be categorized as completely good or bad, and is analyzed in this paper in the same way as the deepfake approach; the relevant social groups shape remote work according to their social decisions, and both the positives and negatives are assessed.

In a similar vein, scholars Julian Kilker and Geri Gay used the SCOT framework to examine the inner workings of the digital library (DL) in its infancy. Immediately, the idea of a digital library draws parallels to remote work for software engineers, as a DL is inherently remote and requires software developers who will ultimately leave their influence upon the library. Rather than examining just the use cases by different groups as Kwok and Koh did, Kilker and Gay rather attempt to dissect the DL into distinct groups and then measure the interactions between groups that keep the digital library afloat. In their research paper, they

identified the relevant groups as "the project's funders, faculty, librarians, software developers, students, and evaluators" (Kilker & Gay, 1998). Beyond identification of relevant players, the researchers went one step further to define the priorities of each group that shaped the construction of the digital library. An example of differing priorities is developers highly prioritizing customizable output and interface display features, while librarians favored the ease of accessing information such as copyrights and document display. Moreover, the researchers introduce the idea of "closure," stating that "unlike bicycles, for which most of us share a similar image, DL technology has not yet reached closure" (Kilker & Gay, 1998). The same holds true for remote work, in which the relationship between company and employee is highly variable based upon the type of business being conducted and the types of employees being hired. A very methodical business with older employees will shape a different type of remote work than a highly agile company with a younger core. The analysis of the proposed research question in this paper also utilizes the SCOT approach of Kilker and Gay, admitting that the idea of remote work is highly variable and has not reached closure. It is very necessary to drill down and identify the relevant actors that shape the idea of remote work, and to determine further if any of these actors are suppressing or mediating the others.

Though SCOT is the ideal framework for analysis of the research question, it does pose particular strengths and weaknesses. Touched on in the previous paragraphs, one of the main strengths of the SCOT frameworks is that a complex technology can be broken down by observing the interactions and uses of relevant groups. A researcher can break down the influences and respective impacts upon various players of a technology, and postulate how other groups could impact or improve the technology. The separation of influences is accounted for in the analysis of the research question by breaking down the groups as discretely as possible

without overgeneralizing the impact of each. However, a large weakness of SCOT comes from this group-splitting because some groups may be "suppressed or deliberately excluded" (Winner, 1993). If employees have significantly less power than the employer in making social decisions in the context of this research, then the question of remote work's effectiveness would essentially follow a technologically deterministic framework for employees. To show that none of the groups are suppressed, the analysis carefully considers evidence from both perspectives, attempting to show that employees are also a social contributor to remote work.

A Perspective-Based Discussion on Remote Work

In the midst of the world's most recent global crisis – the COVID-19 pandemic – humanity continued to rely upon software. With employees of all fields suddenly facing stringent social distancing policies, software provided the appropriate infrastructure to make remote work possible; however, how were software engineers and the software industry faring under the drastic shift in work situation? Through the below analysis, the research question is answered from both the business and employee perspectives, with caveats to each. From the business standpoint, the research suggests that, in general, hybrid and remote work have little downsides with regard to productivity and performance. As the research shows, the productivity is dependent upon company and team dynamics, as well as the aptitude of the engineer. Remote work offers the benefit of flexibility, allowing the motivated software engineer to work at a pace that is most suited to their style of work, resulting in a high level of performance. The dynamic of the team and company need to be considered, but the performance trend generally holds true. Transitioning into the individual perspective, the research shows that the employee also benefits from remote work in most situations in terms of work life balance and overall happiness. The flexibility of remote work allows for employees to work hours that benefit them, allowing them

to tend to other matters when appropriate. The versatile work schedule then encourages a better balance between work and life, rather than always prioritizing work.

The Productivity of the Individual

To explore the answers to the research question posed above, the concept of remote work is split up into four main groups: industry, company, team, and individual. The software industry generally dictates hiring and layoffs, as well as the power of an individual to acquire a job in the market. One scope lower exists the company, which decides how to organize their employees and whether or not remote work is permitted. One step down from the company is the team, who's unique workflow establishes an ideal method of executing tasks. Finally, a team consists of individuals, who's separate tendencies and skills determine what work environment best suits them. The level of effectiveness of remote work, as is shown in the following research, is most impacted at the individual and company levels; companies are the enactors of work policies and individuals are the respondents. Because effectiveness is based on individual response, the analysis starts with evidence coming from individuals, particularly those who were software professionals during the COVID-19 pandemic. Analyzing the research question through the lens of the pandemic is the easiest way to assess the effectiveness of remote work, as the pandemic marks a time when remote work was required and effective software was essential to keep the world economy afloat.

A key piece of pandemic-period research is a 2020 research study that analyzed Brazilian software professionals working remotely during the COVID-19 pandemic. The study revealed that "74.1% of the participants consider their productivity remains good or excellent, and 84.5% feel motivated and have easy communication with their co-workers" (Bezerra et al., 2020). To come to their conclusion, the researchers assessed a number of individual and organizational

factors, such as work environment, experience, and communication within teams. The analyzed organizational factors directly coincide with the intergroup negotiations that define the SCOT framework. At the individual level, interactions with the family decide the noise level of the work environment, and interactions with the team decide the ability to focus on one's work rather than being hindered by subpar communication. In the study, it was observed that many participants (67.2%) had a reserved work environment that they believed to be satisfactory and productivity inducing, with some complaining about external interruptions such as noise within the home. Similarly, the research survey asked targeted questions regarding whether they believed the relative experience of the team members positively or negatively impacted remote work. When asked, many participants expressed that when a team consists of "all experienced professionals, … this leads to greater maturity," suggesting that there is a correlation between the effectiveness of remote work and the skillset of the individual (Bezerra et al. 2020). The sentiment demonstrates that other individuals are a relevant social group when it comes to one's own remote work experience, and remote work is not a one-way relationship between a company and a person. When a software engineer possesses more individual knowledge, the lower the likelihood they will be roadblocked by some of the communication issues that arise from not being on-site, with less losses in productivity.

From the SCOT perspective, the intersection between individual skill and communication illustrates how the relationship between the team and the individual is dictated by experience; an individual with less experience may be less productive in remote work when attempting to interact with the encompassing team. The implication presented by varying experience levels in remote work is both common sense and supported in academia. A study by researchers Keisuke Kokubun and Yoshinori Yamakawa explored the impacts of physical proximity of employees to

one another on certain characteristics across a variety of occupations. In particular, social characteristics such as interdependence and response to aggression and knowledge characteristics such as information processing and specialization, were correlated with the physical proximity between workers. Through their analysis, it was found that "interdependence, response to aggression, and customer showed a positive correlation, while information processing, interaction outside the organization, and remote working showed a negative correlation with physical proximity" (Kokubun & Yamakawa, 2021). In other words, entry-level software developers and new hires will initially not fare well in a low proximity remote setting due to their dependence upon other engineers, while specialized, experienced engineers benefit from being remote. Interpretive flexibility, which is defined by SCOT as the ability of different social groups to view and experience the same technology uniquely, then arises with the experience level of the individual. It would make sense for an experience software engineer to prefer and seek remote work positions as they are able to thrive in such situations, while engineers just a few years into their career may view remote work as a detached, inconvenient experience.

Despite the initial entry-level problem, it seems that all software engineers will eventually find remote work to be beneficial as they attain experience and knowledge in their respective roles over time. In addition, junior roles only consist of a small fraction of all software engineers, indicating that, in general, remote work will tend to be beneficial productivity-wise for most of the software engineering population and the companies that employ these software engineers.

The Satisfaction of the Individual

Completely aside from business productivity, it is important to determine whether the lives of software engineers are being improved by a remote situation. As the software industry is

notorious for wringing out and overworking employees, the ethical and health aspect of remote work is of paramount importance when considering a move towards the work practice. From a common-sense perspective, it would make sense that the lives and satisfaction of software engineers would increase under a remote work model, which is shown via individual surveys once again. The first reason for increased satisfaction is increased flexibility in completing one's work. Rather than being placed under a stringent set of hours that may be expected from an on-site work scheme, engineers are able to work at their own pace and take breaks when needed. In a Hong Kong study done to assess remote work interactions and the behavior of employees under remote work, researchers found that work "flexibility increases employees' concentration levels during remote work, as it allows employees to manage the time they allot to work and to family life. This also increases family satisfaction" (Ng et al., 2022). The method used for this particular study was a survey conducted on 238 correspondents, with a relatively even distribution of males and females. Not only does remote work directly affect the individual, but here even the family of the individual is considered to be a relevant social group. If family happiness could be considered a driver for a person's ability to perform good work, then companies should seek to implement policy that causes positive interactions with the family surrounding the individual. Being able to allot time to work and to other priorities at will emphasizes the benefits of remote work.

An extension of flexibility touched on above is the idea of "family-friendly policies," in which the practices of a company allow employees with families to have a greater degree of autonomy and control. Remote work is inherently a family friendly policy, as employees are able to tend to urgent needs with young children and the elderly when necessary. In a Scotland-based research study done to determine the impact of employer flexibility on work-life balance,

researchers found that employer "strategies of 'respect', embodied for example in family-friendly policies, have already been shown to have positive outcomes for the job satisfaction of technical workers … as well as for Work-life balance and the software worker commitment, turnover and absenteeism" (Scholarios & Marks, 2004). Though not particularly speaking about remote work, the idea of remote work generally creates the idea of "respect" for the employee's time and other priorities, which then is reciprocated by the employee in terms of lower turnover and higher commitment to the company. In other words, remote work and related employee-focused policies not only increase worker happiness, but the employer's ability to retain their work force. Respect-oriented strategies help move remote work closer to "closure" in the SCOT framework; as the relevant social groups, whether that be the family or the individual, take less issue with the main aspects of remote work, it is able to provide overarching benefits and stabilize in its development as a tool.

The trend of at-home benefits is reinforced by another study in which software engineers working from home at Microsoft were surveyed during the peak of the pandemic. These employees cited things such as a lack of commute, increased breaks, and money saved as prime reasons why their lives were improved by a remote mode (Ford et al., 2021). Even in a highly productive and intense company setting as Microsoft's, remote work still shows benefits on the employee end. However, even the "individual" social group varies greatly based on demographics, and the increasingly thin line between work life and non-work life isn't always optimal. Engineers that are single instead of having children and have differing degrees of motivation may react to a remote policy differently. Varying levels of discipline introduce interpretive flexibility for remote work, reinforcing the fact that differences in character bring forth different views of the work model. In fact, the same study cited above found that

"respondents also reflected on routines they previously had to distinguish boundaries for that were now lost" (Ford et al., 2021). When the work-related tasks are in such close proximity to normal life, it becomes harder to make the mental distinction between the two, often leading to emotional exhaustion. Moreover, some studies have found that because of the higher accessibility to work, stress arises due to longer expected hours and the expectation to complete tasks outside the normal 9-5 working hours (Borse et al, 2021). As has been mentioned throughout this paper, remote work is not an end all be all solution and is highly dependent on the groups involved; in the context of the research, the individual and the intensity of the team are in question. In addition, some participants of the study mentioned a lack of moving around in a remote setting; such tendencies could potentially cause health complications long-term, unbeknownst to the engineer.

Since remote work is a technology, and technology can have adverse impacts if not fully accounted for, it is crucial to also assess the impact upon marginalized groups. With certain segments of software engineers already facing adversity due to implicit biases stemming from race and sexuality, any answer to the research question that disregards the impacts on these marginalized groups will be harmful. However, evidence shows that even certain marginalized groups of software engineers have increased work satisfaction under a remote work situation, and some of these beneficial characteristics of remote work extends to other marginalized groups. A study that interviewed a series of transgender software developers at various corporations found that, from the limited pool of interviewees, transgender software developers favor remote work circumstances due to various reasons. In the study, "participants acknowledged that they strategically [have] been able to distance their technical merits from their personal identity" (Ford et al., 2019). "Identity disclosure," as the paper references it,

allows for transgender developers to have greater control over the image that appears over remote communication channels, encouraging coworkers – whether consciously or sub-consciously – to regard them as highly capable software engineers before anything else. The "rules of access," as explained under SCOT as the degree to which a group is able to affect a technology, to remote work do not preclude marginalized groups. Despite critics of the framework often pointing to the absence of social groups in the defining a technology, marginalized groups benefit under remote work through being seen as any normal employee. As opposed to a physical setting, these groups of software engineers are able to freely work and address their issues with a project without becoming the unintentional target of their coworkers.

While remote work does not at all fix the larger problems of misogyny, racism, or transphobia in the workplace, it does offer a sense of protection and freedom to these marginalized groups. The idea of protection transitions directly into the second main reason why remote work is favorable to marginalized groups, which is the "autonomy to disengage or re-engage" (Ford et al., 2019). The paper mentions that while companies in the modern age may attempt to appear progressive by implementing "safe" spaces and organizations that support marginalized groups, such initiatives often lack appropriate intent and place an even larger target on the backs of these individuals. On the other hand, remote work offers the ability to simply disconnect whenever necessary and remove all interaction from a toxic environment by closing one's laptop. The reverse is also true, allowing individuals to provide impact and spread their voice without having to appear directly in person, as was somewhat addressed by the prior point. In concert, the ability to disconnect and reconnect provide a greater sense of safety to marginalized groups, improving "emotional safety" for the tech worker. Unlike the average software engineer, interpretive flexibility allows marginalized workers view remote work as a

safe space free of prejudice. Overall, the concept of remote work seems to be overwhelmingly positive in improving the lives of marginalized software engineers.

The Company Perspective

As SCOT has illustrated in this paper, individuals are not the only ones with an impact on remote work. The companies that hire these individuals also hold a significant influence. Moving up two levels from the individual to the company, a comparison between the business practices of certain companies and the structure of remote work reveals why remote work is effective. A simple way to do so is to observe the practices of highly successful companies, and draw parallels between these practices to remote work. Observing the relationship between employer and employee is important in understanding the ability for remote work to prosper.

One such company is Google, a highly successful company often revered as the cornerstone of utilizing employee-forward practices. A key characteristic to observe at Google is the setting that employees work in. In a case study done to determine the key factors behind Google's success in maintaining employee happiness, it was noted that the "working environment at Google is so comfortable so that employees will not think of it as a working room, with a full area of work, relaxation, exercise, reading, watching movies" (Tran, 2017). It is clear from the above statement that Google is doing everything it can to mimic the home environment. From extensive gym equipment, entertainment, and even areas to take naps, the comforts of the home are brought to the office setting. In terms of SCOT, the design of the office setting by the company clearly influences the satisfaction of individuals, who in return provide valuable work to the company. As further evidence, remote work is not foreign to Google either, who, beyond already having a hybrid-model currently established, offer employees four weeks of "work from anywhere time." For Google employees the policy means that "while they can still

take vacation time as they always have, they can also opt to work remotely up to four weeks per year" (Main, 2022). Though the company already places a lot of emphasis on a comfortable work environment, the fact that they are willing to allow regular remote work demonstrates their trust in flexible work practices. Even so, employees' well-being and general success of the company has not faltered, showing that remote work is a viable option.

On the topic of company practices and environment, there is also evidence to suggest the opposite of what Google has currently set up: that an open office space without adequate amenities is detrimental to engineer productivity. An experimental study in the Netherlands observed which office design was most favorable for tech companies by subjecting a series of workers to four possible designs: "Open-plan, Zoned open-plan, Activity based, and Team offices" (Pitchforth et al., 2020). By using a mix of surveys of the individuals as well as sensor data to record the levels of light, humidity, noise, and other environmental factors, the research team found that the open design "was rated more poorly by employees, had higher levels of unsafe noise, and once employees no longer had to be in the Open-plan office design of the experiment, they spent more time at their desks" (Pitchforth et al., 2020). Despite the open-plan being the primary office design utilized by many modern-day tech companies, it is clear that it is often not favorable in terms of both productivity and well-being of employees. As soon as employees were able to mimic the home environment, they did so by returning immediately to the safety of their individual desks. From the study, it is seen that office designers are a sub-group that exerts influence on an in-person setting and have a direct impact on business function. However, if remote work is offered by the company, individual employees take on the role that the officer designers previously had, tailoring their work environment to their exact needs. In the scenario explored by the researchers, SCOT shows that the practices of the employer have heavy

influence upon worker satisfaction. Even if a hybrid model is utilized, if a company were to require even a few days within a sub-optimal environment, the benefits associated with remote work could easily be reversed. Likely, even the productivity gains that an employee would have within the comfortable confines of their home would be counteracted by the negative mindset that comes from commuting to an inadequate work environment. Here, it is important to note that even if a company does allow remote work, the additional policies that it enacts have a large impact upon the efficacy of the work model.

Transitioning to a more positive note, it is no secret that hybrid models and remote work have been successful for the top technology companies, even in the height of the pandemic. In fact, when observing video conferencing platform Zoom, if one had purchased "$10,000 in Zoom's stock at the beginning of [2020], you'd have roughly $55,000" by the close of the year (Tenebruso, 2020). Even though a partial reason for the rise is due to Zoom being an excellent product and one of the prime reasons remote work has been able to thrive, their developers were also required to enact a remote model, with "only 1% [of employees] wanting to work full-time in the office" (Steckelberg, 2021). The phenomenon of immense success during a global pandemic with employees who worked primarily remote is a testament to the capabilities of remote work: if done correctly by the company, remote work is successful. With the company being the focus here, SCOT is once again touched on; a streamlined remote work or hybrid model, with the proper company policies, as well as motivated and capable software engineers, are the combination of social groups and strategies necessary in making remote work successful.

Limits to Analyzing Remote Work

As with any analysis, there are limitations to the possible research regarding remote work. While a general conclusion may be possible to achieve, it is difficult to account for the

complete effects that remote work has on all sub-groups of software engineers. The difficulty arises from the fact that each engineer has a truly unique situation; the very way their brain functions has an impact on whether remote work will be beneficial for them. No amount of research will be able to represent all software engineers, and making a blanket statement on the efficacy of remote work will exclude certain groups of individuals. Though these groups may be small, the way the answer to the research question is framed is significant to avoid harm to any relevant groups of software engineers. Moreover, a lot of the analysis conducted above is based on surveys, placing inherent trust in the truthful answers of software engineers. In general, it is fair to assume that most engineers are being truthful, but this trust completely disregards the fact that an honest answer doesn't necessarily correspond to the truth of the situation. An engineer may believe that they are more productive, while in reality they may be less productive while remotely working. Of course, such a limitation will exist in any study that involves human respondents, but it is worth noting as a limitation of the research. Finally, the last large limitation is that the analyzed case studies are limited to the areas they were taken in. While the surveys have been taken in a range of areas from Scotland to Hong Kong to the United States, research in more countries would be beneficial in crafting a more holistic conclusion. Expanding to future areas of research, it would also be interesting to see to what extent remote work is feasible in other fields of work. In addition to broadening to other fields, finding ways other than individual surveys to assess productivity and well-being would be very helpful in making the results more concrete rather than relying on possibly untrue or biased survey responses.

The Overall Efficacy of Working Remote

Through the research, the conclusion can be made that remote work, when properly enacted by the company and coupled with qualified employees, is very beneficial for the

majority of software engineers – both for productivity and health. With the wave of remote work, the findings are incredibly significant as they greatly expand the number of new software engineers that can be hired with no requirement to be in-person. All of a sudden, engineers from Mexico can be employed by Irish tech companies, removing many of the traditional physical barriers preventing engineers from working. In addition, the cost of commuting and other associated workplace costs are relieved from the employee, giving much more flexibility to software engineers. Not only are physical barriers removed, but financial ones as well. The combination of these points presents the following takeaway: there is little to no harm for tech companies to continue remote work, and it is rather encouraged from both the company and individual perspectives. As the wave continues to sweep the world, it could be very profitable for newer tech companies to accept it with grace and ensure that their policies and practices support such a work model. Again, it is very important to note that remote work is not a panacea; there will be key instances and groups that do not benefit from such a model, including those who feel they are more productive within an office setting, or those who have teams that rely heavily upon fast communication and deal with highly sensitive work. For these cases, caution is advised and a different work model should be considered. However, for the general working population with external priorities and expenses, remote work is the best way to satisfy the needs of both the software industry and the happiness of the average software engineer.

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