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Master Thesis

遠距工作對創新工作行為之影響

The Effects of Remote Work on Innovative Work Behavior

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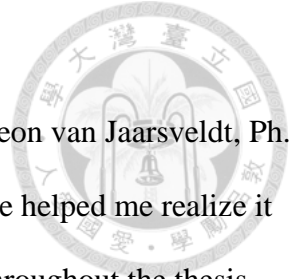
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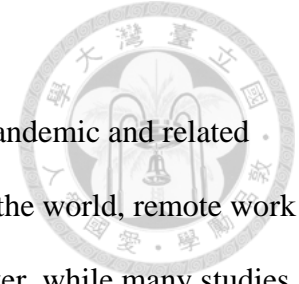
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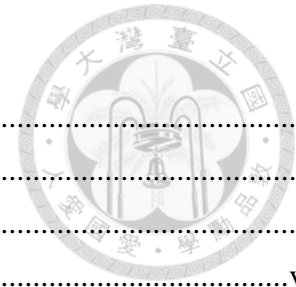
Abstract



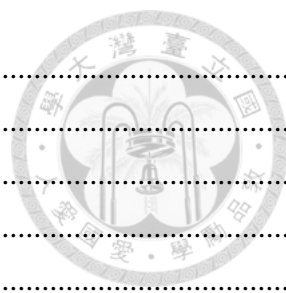
Remote work has become widely adopted in response to the COVID-19 pandemic and related public health measures. Even though the pandemic has abated in much of the world, remote work has now become a seemingly permanent part of the “new normal”. However, while many studies have explored how remote work affects outcomes such as productivity, employee satisfaction, and work/life balance, the effect of remote work on innovation is still understudied. Innovation is considered one of the key factors in firm competitiveness and performance, yet only a handful of studies directly measure what happens to innovation in the context of remote work. This study adds to the small yet growing body of literature that looks at the effects of remote work on innovation by utilizing a cross-sectional survey to investigate innovation in office, hybrid, and remote work modes. One hundred professionals in the United States completed an online questionnaire about their innovative behavior in different work modes during the pandemic. Survey responses reveal that participants reported higher innovative work behavior when working in a remote or hybrid mode as opposed to in the office. These exploratory findings provide inspiration for future areas of research, including the ways creative thinking and idea generation increase when working remotely, which drivers of innovation are specific to remote work, and suggestions for future study methodologies.

Keywords: remote work, hybrid work, innovation, innovative work behavior, COVID-19 pandemic

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Chapter 1: Introduction



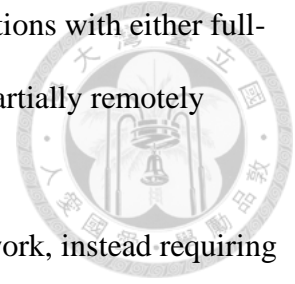
1.1 Background

Before the COVID-19 pandemic, remote work, also known as working from home or telecommuting (Allen et al., 2015), had been growing steadily but was not a widely implemented practice. Though the number of employees who worked remotely half-time or more grew 216% from 2005 to 2019, this only represented 4.1% of the total U.S. employee workforce at the time (Global Workplace "The State of Remote Work 2021," 2021). This number skyrocketed in 2020 when the pandemic and ensuing work from home orders forced both companies and employees to adopt remote work at an unprecedented level. At the peak of the pandemic, 69% of employees in the United States were working from home at least some of the time (Global Workplace Analytics, 2021), and 54% of employees were working from home exclusively (Saad & Wigert, 2021).

As COVID-19 restrictions relax, many employees have returned to work, but the remote work trend seems to have staying power. As of September 2021, 25% of employed adults in the United States reported working from home exclusively, and 20% were working from home some of the time, compared to the May 2020 figures of 54% and 15%, respectively (Saad & Wigert, 2021). White collar office workers are especially likely to continue working remotely, with 41% working from home exclusively and 26% working from home partially in September 2021 (Saad & Wigert, 2021).

Employees value remote work and overwhelmingly support its continuation. Of employees in the United States who work at least partially remotely, 91% hope to be able to continue to do so after the pandemic, 37% would like to work from home exclusively, and 30% say they are extremely likely to try to switch jobs if their company eliminates remote work (Saad

& Wigert, 2021). Many companies are continuing to offer remote work options with either full-time or hybrid models, where employees work partially in the office and partially remotely (Yang et al., 2021).



However, many companies are doing away with full-time remote work, instead requiring workers to work in a hybrid model by returning to the office at least part-time. Reduced innovation is cited as a primary reason for pushing workers to return to the office by high-profile firms such as Apple, Microsoft, and JPMorgan Chase (Reuter, 2021). One of the most salient and high-profile examples of the remote work vs. in the office debate can be found in Apple's recent remote work policy. Apple, which has been in and out of the number one spot for the largest market capitalization in the world and is perennially considered to be a leader in innovation (Ringel et al., 2020), has pushed employees to return to the office by requiring office attendance at least a couple of days per week. CEO Tim Cook has cited the innovative benefits being in the office brings because "it's still very important to physically be in touch with one another because collaboration isn't always a planned activity" (Reuter, 2021). Apple employees have responded negatively; a survey from early 2022 shows that 76% of Apple workers are dissatisfied with Apple's return to office policy (Berger, 2022). This policy has already had consequences on what type of talent will stay with the company. Among the many who have left because of these policies is the former head of Apple's machine learning and artificial intelligence department, who specifically cited a lack of flexibility in remote work options as a reason for his departure to Alphabet Inc. (Gurman, 2022).

This example of Apple's policies not reflecting the wishes of many employees highlights the tradeoffs made when creating policies about remote work. On one hand, pushing employees to return to the office may cause a firm to lose talent (Alexander et al., 2021). On the other hand,

it is commonly believed that allowing employees to work remotely may inhibit innovation, and thus a firm's ability to compete in a rapidly changing market. Since so many employees seek to continue working remotely, companies must consider implementing policies and ideas about what makes for the most effective work situation. The most effective policies will be those based on empirical research and evidence.

This thesis specifically hopes to add to this body of empirical research by exploring remote work and innovation. Given remote work has only recently become a part of mainstream corporate policy due to the pandemic, the existing body of literature that looks at this relationship is rather small. This thesis builds on such literature to provide further insight into the effect of remote work on innovation.

1.2 Research Problem

The motivation for this paper comes from a divergence between corporate policy and empirical research about the association between remote work and innovation. Since the waning of pandemic restrictions in the United States, companies have started encouraging or even forcing workers to return to the office in what has been dubbed "The Great Return" (Smart, 2022). One of the main reasons cited for this push toward the office is the idea that remote work inhibits innovation (Liedtke & Ortutay, 2021). When workers are secluded in their own remote settings, they are prevented from having serendipitous encounters where information is exchanged and problems are solved because they are not running into each other in hallways, cafeterias, or water coolers (Schmidt & Rosenberg, 2014). In one sense the literature supports this claim: remote work does lead to siloed teams and departments (Yang et al., 2021), difficulty in sharing knowledge (Fonner & Roloff, 2010; Lee et al., 2007), diminished trust (Chang et al.,

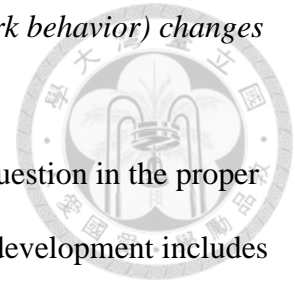
2011; Fayard et al., 2021), and challenges in managing effectively (Parker et al., 2020), all of which can negatively affect innovation.

A closer examination of the literature reveals two interesting findings. First, contrary to the previously mentioned literature, the studies that compare working remotely to working in the office find a positive association between innovation and remote work (Coenen & Kok, 2014; Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008; Sarbu, 2022). This implies either a problem with the research methodology of these studies or that there is some other factor associated with remote work that increases innovation. The second interesting thing is that while many studies measure how traditional drivers of innovation manifest in remote work (Chang et al., 2011; Stanton, 2022; Yang et al., 2021), only a small number directly measure innovation itself in remote settings (George et al., 2020; Konrad-Märk, 2021). This is curious because when innovation is discussed in contexts outside of remote work, such as the importance of innovation for sustained firm performance, scholars continually emphasize the value of innovation (Baregheh et al., 2009; Bessant & Tidd, 2007; Kuratko et al., 2014; Ruttan, 1959). Thus, there is a gap in the literature that has real-world implications for corporate policy decisions on remote work and researchers' understanding of innovation.

1.3 Research Aims and Objectives

In light of this lack of research into remote work and innovation, this study aims to better understand how participants feel innovation changes when working in different working environments: in the office, remote, or hybrid. This study operationalizes innovation through innovative work behavior (Scott & Bruce, 1994), described in further detail in section 2. Based on these objectives, the guiding research question of this paper is:

How do individuals perceive innovation (measured through innovative work behavior) changes when working in the office, hybrid, or remotely?



First, comprehensive coverage of the existing literature will help put this question in the proper context and provide some clues as to possible answers. Important context development includes careful definitions of the often nebulous terms innovation and remote work. Second, primary data collection and analysis provide insight into this research question. Finally, bringing these elements together into a discussion on the implications of the findings can provide guidance and inspiration for future studies.

1.4 Research Methodology

This paper employs a cross-sectional study design to gather primary data about the experience of professionals in the United States working remotely during the pandemic. Participants were asked to rate how innovative they are in different work environments by using a six-item scale that produces an innovative work behavior score. Scores between office and remote modes, office, and hybrid modes, and hybrid and remote modes are then analyzed using paired statistical tests to see in which mode respondents felt the most innovative.

1.5 Importance and Significance of the Study

This thesis contributes to the limited understanding of innovation in the context of remote work in several ways. First, it addresses an area of research that has been woefully understudied given its importance to firms and individuals (George et al., 2020; Konrad-Märk, 2021). Innovation provides a sustained competitive edge to firms. The rapid societal, economic, and work-life changes brought by the pandemic have only deepened the need for innovation. As the lockdowns from the pandemic ease, firms are faced with a decision regarding what degree they should continue allowing remote work. However, they have little to no research to reference that

specifically explores the effects of remote work on innovation. Second, this paper is one of the few studies that operationalizes hybrid and remote work as separate entities. Before the pandemic this was not needed due to the rarity of working remotely full-time; now, however, office, hybrid, and remote work options are commonly available to firms and individuals and deserve to be studied as separate entities.

As working remotely in either a hybrid or full-time mode is part of the new normal, further insight into how these modes of work differ is needed. To make effective policy decisions, firms need to understand the consequences of working remotely or not. This paper provides insight into how remote work affects innovation and ways to extend this research to answer related empirical questions.

1.6 Structure of the Thesis

This thesis consists of four different parts. Chapter 2 discusses the history of remote work and its terminology. The rapid changes that have taken place in terms of technology and cultural acceptance of remote work necessitate clarification of what exactly this term means. Chapter 2 also includes definitional boundaries of innovation, how innovation has been studied, and findings about what drives innovation in traditional work settings. The two subjects of remote work and innovation are then joined together in an examination of the small body of literature that looks at innovation in the context of remote work. From this literature, several hypotheses about the expected influence of remote and hybrid work on innovation are formed.

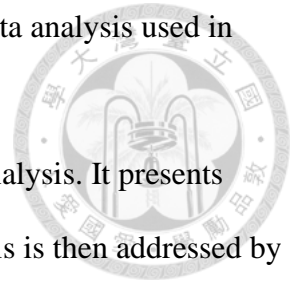
Chapter 3 will discuss the methodology used to collect data, the research instrument, and the data analysis process. It also describes the population, sample, and methods used to obtain the sample. The chapter also provides a detailed explanation of the innovative work behavior scale along with the rationale for choosing this method and a discussion of its reliability and

validity as a research tool. Chapter 3 concludes with a description of the data analysis used in this paper.

Chapter 4, the results section, presents the findings from the data analysis. It presents innovative work behavior scores for each item on the scale. Each hypothesis is then addressed by showing the results of data analysis and whether each hypothesis is supported or rejected.

Chapter 5 ties the results together with the literature by discussing possible alternative explanations and providing suggestions for future research. This chapter ends with a discussion on the limitations of the study.

Finally, Chapter 6 offers a brief conclusion of this thesis as a whole.



Chapter 2: Literature Review



2.1 Remote Work

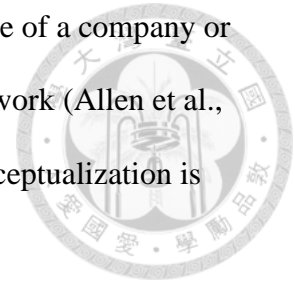
Despite its prevalence in popular literature, remote work is a broad and often ill-defined term. Therefore, establishing a clear definition of remote work is a critical first step in this research study. A solid definition of the term will guide the sampling, methodology, and discussion of this paper.

2.1.1 History of Remote Work Terminology

The exact origins of remote work are unknown, but academic interest in the subject can be traced back to the 1970s. The Oil Crisis provided one of the primary motivations for reducing commutes, and advances in information and communications technology (ICT) made working remotely possible (Allen et al., 2015). In the early 1970s Jack Nilles, a NASA engineer turned University of Southern California researcher, coined the terms “telework” and “telecommuting” to refer to this new work arrangement (Avery & Zabel, 2001). His pioneering research into working outside of the office suggested that in addition to energy and cost savings, it also provided better worker flexibility, work-life balance, and productivity (Nilles, 1994).

Following in the terminological footsteps of Nilles, researchers have tended to favor the term telecommuting, but many other terms have been used to describe this phenomenon. Indeed, remote work has been referred to as telecommuting, telework, distributed work, flexible work, mobile work, virtual work, flexplace, working from home, and distance work, among others (Allen et al., 2015). These terms are used inconsistently throughout the literature, overlapping at times and diverging at others. For instance, flexible work generally includes both remote work and flexible time arrangements (Shockley & Allen, 2007), but some papers use the term interchangeably with telework (Choi, 2018) or remote work (Hunter, 2019). Likewise, virtual

work and virtual teams often emphasize the geographically dispersed nature of a company or team (Tworoger et al., 2013), but can also mean the same thing as remote work (Allen et al., 2015). Given this disjointed literature, a clear definition with a careful conceptualization is needed.



2.1.2 Definitional Boundaries of Remote Work

Though telecommuting has been the term of choice in academic literature, this term carries some definitional baggage from being in use for so long. In what is the most comprehensive literature review of the subject to date, Allen, Golden & Shockly (2015) synthesize a definition of telecommuting built on previous research (Bailey & Kurland, 2002; Gajendran & Harrison, 2007; Mokhtarian, 1991) and provide definitional parameters that link and clarify these studies. They define telecommuting as:

a work practice that involves members of an organization substituting a portion of their typical work hours (ranging from a few hours per week to nearly full-time) to work away from a central workplace—typically principally from home—using technology to interact with others as needed to conduct work tasks (p. 44)

This is a comprehensive and thoughtful definition, but it and its accompanying parameters feel somewhat lacking in light of pandemic and post-pandemic work arrangements. For instance, when referring to the amount of time one telecommutes, the authors write telecommuting ranges “from a few hours per week to nearly full-time” (p. 44) and “is rarely an all-or-nothing work practice” (p. 45).

The lockdown policies enacted during the pandemic changed this state of affairs, driving the majority of workers away from the office for significant lengths of time. Though not as many workers are working remotely now as compared to at the pandemic peak, a sizeable number still

work remotely full-time (Saad & Wigert, 2021). Another difference comes from location while working remotely. Allen, Golden & Shockly (2015) state telecommuters “work principally within their home during telecommuting periods, with an occasional period possibly spent elsewhere” (p. 44). Before the pandemic this was due to a lack of options, and during the pandemic this work from home situation was due to lockdowns, but now co-working spaces allow employees to work consistently in a remote nature outside of their homes (Bezovski et al., 2021; Bieser et al., 2021). Therefore, although the academic literature has favored telecommuting, this paper will use the term “remote work” to reflect the current technological and cultural environment.

While remote work does not have a strict academic definition, it refers to “an alternative work arrangement that involves individual workers performing tasks away from their primary offices, using information and communication technologies (ICTs) to interact with others inside and outside their organization” (Shirmohammadi et al., 2022). Thus, remote work is broader than telecommuting because it can be a full-time arrangement and is not fixed to any geographic location. Nevertheless, the telecommuting literature offers salient definitional boundaries that can be applied to a working definition of remote work. Allen, Golden, and Shockley (2015) note that it (1) is substitutional rather than additive, meaning that time spent in the office is replaced with time spent out of the office as opposed to overtime work done outside of the office, and (2) refers to members of an organization and not independent contractors, freelancers, those that are self-employed, or outsourced labor. Putting all this together, remote work is when individuals in an organization substitute time in the office for time outside of the office and use ICT to connect with others for work purposes.

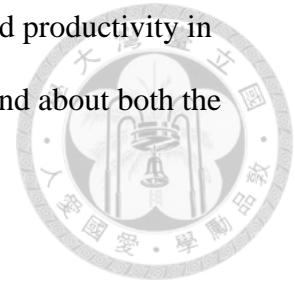
The variations between remote work and other similar terms like telecommuting, telework, distributed work, flexible work, mobile work, virtual work, flexplace, working from home, and distance work are subtle. In many cases, the terms can be used interchangeably with no loss of conceptual clarity. In the following review of the literature, the use of “remote work” will include parallel terms with differences noted when necessary.

Remote work can be classified into work models based on the amount of time spent. On an individual level, full-time remote employees work exclusively remotely, full-time office employees work exclusively in the office, and hybrid workers split their time between remote and office work. Similarly, organizations have different work models based on their arrangements: hybrid work models have hybrid workers, and mixed-mode models have both full-time remote employees and full-time office employees. Based on the opinion and plans of corporate leaders, some predict that most firms will keep a hybrid work model in place (Lund et al., 2020). Though much of the literature does not distinguish between hybrid and remote work, several studies indicate that these two modes of working should be treated separately because they lead to different outcomes (Coenen & Kok, 2014; Golden, 2006). Moreover, it seems that the lack of distinction was more for practical than theoretical reasons: people rarely worked remotely full-time so it was difficult to find study participants and not important to the research agenda (Allen et al., 2015). Now that many people are working both in a remote and hybrid mode, it is much more practical to gather data from both groups. In the survey and data analysis, this paper treats office, hybrid, and remote work modes as distinct from one another.

2.1.3 Benefits and Challenges of Remote Work

The research on remote work provides mixed results as to its efficacy, but some clear themes emerge. Overall, remote workers report higher job satisfaction, work-life balance, and

individual productivity, but also can experience social isolation and reduced productivity in collaborative projects. This section will review what prior research has found about both the benefits and challenges of remote work.



Benefits of Remote Work

The effects of remote work have been studied from both employees' and employers' points of view. The priorities of each group overlap at times and diverge at others.

First, the benefits for employees are discussed. Employees tend to view remote work favorably because of the personal benefits it brings, including less time spent commuting, increased schedule flexibility (Bailey & Kurland, 2002), and better work-life balance (Grant et al., 2013; Morganson et al., 2010). There are exceptions to these findings based on how well employees adapt to remote work. For instance, work-life balance may be harmed when clear boundaries between work and home are not established (Allen et al., 2015) or employees have trouble "switching off" from work at the end of the day (Felstead & Henseke, 2017). The association between remote work and job satisfaction is not so mixed, as many studies have shown a robust relationship between the two (Choi, 2020; Gajendran & Harrison, 2007; Golden, 2006). These findings themselves may not directly benefit employers, but there is evidence to suggest they increase firm metrics such as employee retention and organizational commitment (Martin & MacDonnell, 2012).

There is a healthy body of literature focusing on the employers' perspective, which is often concerned with factors that increase firm performance. A common theme throughout this literature is the increase in productivity (Brittany & MacDonnell, 2012; Butler et al., 2007; Dutcher, 2012; Ollo-Lopez et al., 2010). Tasks that require intense focus and individual performance especially benefit from the large blocks of free time that come from the ability to

organize one's working schedule (Yang et al., 2021) as well as freedom from distractions that are common in the physical workplace (Choudhury, 2020). This effect is still observed despite the disruption caused by the pandemic; a 2020 study by the firm Mercer found that 94% of employers reported that even though employees were working remotely, productivity was the same as or higher than it was before the pandemic (Maurer, 2020).

Challenges of Remote Work

Though remote work can confer benefits to both employees and employers, it also comes with several key drawbacks and challenges for both parties. Though employees outside of the office enjoy more freedom and time to themselves, the other side of this coin brings increased isolation and reduced visibility. Without being physically present in the office, employees miss out on a host of informal interactions with colleagues (such as running into others in common spaces, eating lunch together, or dropping by a colleague's office for small talk) and thus feel more socially isolated (Morganson et al., 2010; Stewart et al., 2010). Employees fear that this social isolation will turn into professional isolation, "the fear that being offsite and out-of-sight will limit opportunities for promotions and other organizational rewards" (Kurland & Cooper, 2002, p. 512).

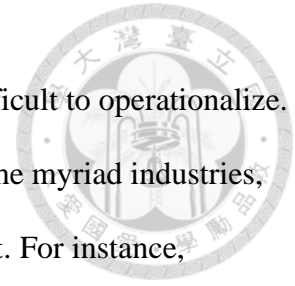
How positive an effect remote work has on productivity and performance often varies depending on the work itself. Performance on tasks that require a higher degree of collaboration tends to suffer because coordination and communication are more difficult than when in-person (Turetken et al., 2010). This point is particularly important for innovation in the context of remote work because collaboration is a key driver of innovation, a point which is further discussed in section 2.2.4.

2.2 Innovation


Innovation is a notoriously tricky term to define and even more difficult to operationalize. These difficulties come from the varied definitions and methodologies of the myriad industries, academic backgrounds, and theoretical approaches seeking to understand it. For instance, innovation is often operationalized differently at the individual, group, and firm levels, and drawing comparisons between these levels is difficult if not impossible. One aspect of innovation that is agreed upon is its importance to the success of firms. This section describes this importance, builds a definition of innovation, and looks at the driving forces of innovation discussed in the literature.

2.2.1 Importance of Innovation

Economic research posits that the Schumpeterian force of “creative destruction” drives economic growth and development (Carayannis & Ziemnowicz, 2007; Ruttan, 1959; Schumpeter, 1942). In this model, entrepreneurs and firms innovate by creating new processes, services, and products. As a result, the economy expands and these firms are rewarded through profits and market share (Tufano, 1989). In today’s VUCA (volatile, uncertain, complex, and ambiguous) world that changes faster than ever before, being on the right side of this process is both more difficult and more important than ever. The creative destruction of Schumpeter is echoed in the disruption of Silicon Valley, and firms are in a constant battle to either disrupt or ward off disruption. Scholars widely agree that corporate innovation is a key competitive edge that allows firms to sustain performance (Baregheh et al., 2009; Bessant & Tidd, 2007; Francis & Bessant, 2005; Kuratko et al., 2014).

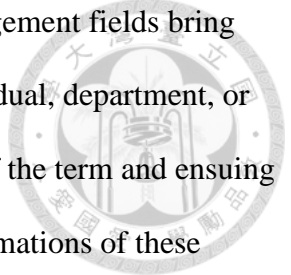


2.2.2 Definition of Innovation



Despite the emphasis on the importance of innovation from both academics and industry leaders, definitions of innovation often come down to some variant of “I know it when I see it.” One of the most popular lists of most innovative companies comes from Boston Consulting Group, which releases a new ranking every year. For two of the list’s four ranking metrics the following operationalizations of innovation are used: “Global Mindshare- The number of votes received from all global innovation executives” and “Industry Peer View- The number of votes received” (Ringel et al., 2020). Management researchers then use such rankings to make further insights into drivers of innovation and how innovation occurs (Höflinger et al., 2018; Kwan & Chiu, 2015). Gathering impressions of innovation is a valid methodological strategy, especially for industry groups interested in providing ready-to-use data, but it is not without deficiencies. For one, it makes comparing companies difficult. Surveys that ask industry leaders their opinions on the most innovative companies tend to gather results that skew towards the largest, most well-known companies and not necessarily the most disruptive ones. Similarly, these types of surveys are prone to a halo effect in which other positive characteristics of a firm make people think it is innovative (e.g. “Apple has the world’s largest market cap, so it must be innovative”). Finally, and possibly most importantly, this loose definition of innovation provides few clues about how to increase innovation, which is what most researchers and firms are interested in. Those who use the term innovation loosely should not be blamed though; it is not an easy term to define.

Though many researchers have approached the subject of innovation and offered definitions, they also agree that it is an inherently ambiguous concept (Adams et al., 2006; McAdam et al., 2004). Part of the reason a precise definition is difficult to pin down is because of the varied disciplines that have defined the term, each with its own theoretical frameworks and



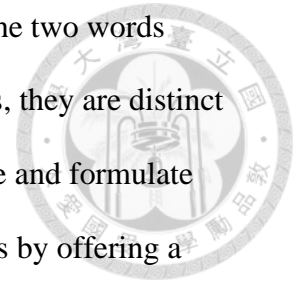
assumptions. For instance, psychology, organizational behavior, and management fields bring different emphases to the definition. Discussing the innovation of an individual, department, or firm requires different conceptual focuses. Despite the ambiguous nature of the term and ensuing difficulty defining innovation, several themes emerge. One of the best summations of these themes can be found in the multidisciplinary definition of Baregheh, Rowley, and Sambrook (2009, p. 1334): “Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, services or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.” Several subtleties are embedded in this definition, so the following paragraph includes additional concepts from the literature to help to flesh out a complete view of innovation.

Innovation is not a static, one-time event, but rather a dynamic process (Du Plessis, 2007). In addition, there must be an aspect of commercialization, either through a new product or service or through a new process that increases efficiency or brings other benefits (Wong et al., 2009). This leveraging of innovation into competitive advantages is especially important for firm success in more volatile times, such as during the pandemic. This definition of innovation is intentionally broad to include the multi-faceted departments and teams that comprise a firm. It includes softer sources of innovation, such as human capital and internal knowledge management, and harder sources of innovation like technology or research and development (Thether, 2005). Further distinctions are made in the following discussion on how creativity and innovation are separate yet integrally linked ideas.

2.2.3 Creativity and Innovation

In common usage, creativity is often conflated with innovation. In response to this conflation, Vehar (2013, p. 388) eloquently argues “given that words mean something”, it is

important to distinguish between creativity and innovation and to not use the two words synonymously. Though these terms are closely related and overlap at times, they are distinct concepts and need to be treated as such to engage with the correct literature and formulate measures and methodologies. Vehar begins distinguishing the two concepts by offering a definition of creativity synthesized in a metaanalysis by Rhodes (1961, p. 305):



...the phenomenon in which a person communicates a new concept (which is the product). Mental activity (or mental process) is implicit in the definition, and of course no one could conceive of a person living or operating in a vacuum, so the term press is implicit. The definition begs the questions as to how new the concept must be and to whom it must be new.

Thus, creativity is the creation of a new concept or idea that is usually manifested in the business world as a product, service, or organizational change. It implies communicating the idea ex-post-facto but is generally the outcome of a mental process undertaken by an individual. What is the difference between this definition of creativity and innovation?

Creativity is the starting point for innovation (Amabile et al., 1996; Puccio et al., 2010; Rickards, 1996), but innovation takes creativity a step further. If creativity is the creation of a new concept, then innovation is the application of that concept, or “creativity is getting the idea, and innovation is doing something about it” (Firestien, 1996, p. 16). Doing something about it carries several implications, such as commercialization (Davila et al., 2012), increment, or adding to existing knowledge, and realization (Kaufmann, 1993). Realization in turn includes adoption and implementation, or people actually using the product, and diffusion, which is spreading knowledge about the product both internally and externally. Vehar goes on to note that because of the multitude of skills required to effectively perform each part of innovation, it is

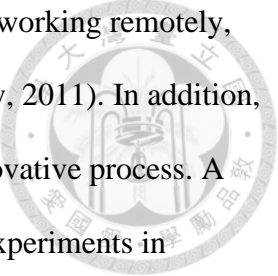
usually carried out by a team. One may exercise creativity by thinking of a new, useful idea when working by themselves, but that does not become innovation until it is developed into a new product, service, or process that brings some type of benefit to the company.



2.2.4 Driving Forces of Innovation

The current research that focuses on the relationship between remote work and innovation builds on the larger body of research studying what drives innovation, much of which has been carried out in traditional work settings, i.e., the office. This research has identified factors that lead to an increase in information flow as the largest drivers of innovation in the work environment. For an organization to see the greatest return on innovation, its workers must know the most important problems to solve and come up with novel solutions, which requires collaboration between departments, external stakeholders, and individual workers. The underlying innovation process is most effective in terms of speed and quality when workers with domain expertise in various areas, such as research and development, marketing, manufacturing, and other functional areas, are able to work together (De Luca & Atuahene-Gima, 2007; Song et al., 1997). This section will detail which factors are important parts of this process and how they may change in the context of remote work.

Innovation involves more than one person, so naturally, the closely related concepts of communication and knowledge sharing are key drivers of innovation. When information flows quickly and smoothly within a company, innovative ideas flourish as well (Kivimäki et al., 2000). Informal interactions such as running into a co-worker in the hallway or chatting after a meeting are often an essential component of knowledge sharing in the office (Behrens & Kret, 2019; Linke & Zerfass, 2011). This philosophy of maximizing serendipitous encounters is embodied in the open offices of companies like Google, Facebook, and Microsoft (Schmidt &



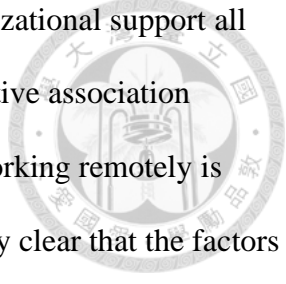
Rosenberg, 2014). These types of interactions do not happen as often when working remotely, where instead meetings and interactions are more formal and planned (Berry, 2011). In addition, the lack of face-to-face interaction can have direct consequences on the innovative process. A recent study utilized laboratory experiments in the United States and field experiments in Finland, Hungary, India, Israel, and Portugal to show videoconferencing, the communication tool that has become de rigueur during the pandemic (Andrea, 2020; Brem et al., 2021), inhibits collaborative idea generation (Stanton, 2022). Both knowledge sharing and communication are vital for innovation to thrive, for as Subramaniam and Youndt (2005, p. 459) write, “unless individual knowledge is networked, shared, and channeled through relationships, it provides little benefit to organizations in terms of innovative capability.” Reduced communication can also negatively influence innovation by reducing the next factor to be discussed, trust.

Trust, which in the workplace is defined as the expectation that others will have positive intentions and behavior in situations that carry risk and interdependence (Rousseau et al., 1998), positively influences the innovative process (Clegg et al., 2002). Trust allows employees to speak their minds without fear of feeling foolish or being sanctioned by others. This allows workers to share new ideas with confidence, knowing that others will seriously consider them. Trust also leads to a more iterative process that results in higher quality outcomes because workers can voice concern or disagreement without fear of repercussion (Hughes et al., 2018; McAllister, 1995). How quickly trust is developed can depend on the communication tools being used. In a study of Taiwanese firms with globally dispersed members and business partners, Chang et al. (2011) compared different forms of communication, including face-to-face, audiovisual, audio, and text-based. When body language, subtle voice tone, and facial expression were absent when communicating, it took longer to establish trust with new collaborators.

Outside of formal workplace interactions, trust is also built through relationships and informal encounters, both of which happen less frequently when working remotely (Fayard et al., 2021). These findings suggest that trust decreases in remote settings, but this may be ameliorated through occasional in-person interactions or starting projects in-person then moving to a remote model (Coenen & Kok, 2014).

Organizational support for innovation encourages individuals to look for opportunities to innovate and provides tools for them to do so. The extent to which an organization provides information communication technology (ICT) to its employees has a large impact on how workers can collaborate and innovate together (Enkel et al., 2020). If workers do not have the tools to communicate with each other or learn about innovations from outside their organizational boundaries, innovation is severely hampered (Bayo-Moriones et al., 2017).

Organizational support also includes management that encourages innovation (Hoang et al., 2006). Management that fosters innovation consists of other drivers of innovation like trust and accessible, open communication, as well as providing autonomy and time to work on new projects (Keum & See, 2017). Other drivers of innovation also directly influence leadership in remote work. For instance, the lack of trust and communication in remote work settings leads to fewer quality interactions between leaders and their subordinates, leading to less effective leadership (Malhotra et al., 2007). In a study on remote work conducted after the outbreak of the pandemic (Coun et al., 2021), managers that practiced empowering leadership by encouraging autonomy and offering support to their subordinates were found to have a more positive effect on innovation than managers who practiced directive leadership. To the detriment of innovation, managers of remote workers often become more directive and controlling in an attempt to better monitor employee behavior (Parker et al., 2020).



In conclusion, communication, knowledge sharing, trust, and organizational support all tend to suffer in remote work settings. Though these factors suggest a negative association between remote work and innovation, it does not necessarily follow that working remotely is worse for innovation than working in the office. While the literature is fairly clear that the factors that traditionally drive innovation in the office are compromised when working remotely, workers may adapt new behaviors or technologies that drive innovation in novel ways. One of the benefits of remote work is the ability to organize one's time more effectively because workers can create their schedules and are free from office distractions (Choudhury, 2020). More control over one's job can lead to greater autonomy and job ownership (Gajendran & Harrison, 2007), which can stimulate idea generation and idea promotion (Dorenbosch et al., 2005; O'Reilly & Binns, 2019). It has also been noted that working remotely can increase cross-functionality because virtual teams can be formed irrespective of geographic location (Coenen & Kok, 2014). Cross-functionality encourages innovation through a greater range of opinions, knowledge, and inter-organizational involvement. In sum, while looking at individual drivers of innovation seems to indicate that remote work negatively impacts innovation, a more holistic approach should be considered to adjust for the adaptations that could be made when people work remotely.

2.2.5 Effects of Remote Work on Innovation

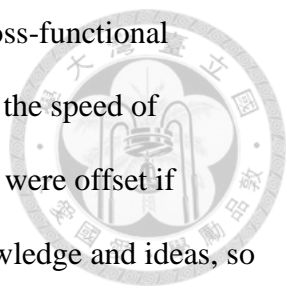
Based on the drivers of innovation covered in the previous association, a negative association between remote work and innovation is expected because working remotely inhibits many of the driving factors of innovation. Curiously, many of the studies that directly look at remote work and innovation find the opposite: innovation tends to increase in remote settings. Currently, only a handful of studies have compared the role office environments play in inspiring

innovation as compared to remote work. This lack of data makes it difficult to declare a consensus of the literature as a whole. However, it can be said that more studies find a positive association between innovation and working remotely than studies that find a negative one. This section covers the existing literature that explores the effect of remote work on innovation, provides possible explanations for why this body of literature is so small, and offers a glimpse into the future of this research.

Sarbu (2022), found that service innovation was higher for remote workers than those in the office, even when controlling for computer use, overtime, new tasks, and teamwork. While this study did have a robust sample of about 20,000 workers, it used a rather broad definition of innovation that may be difficult to apply to other cases. Service innovation was measured by asking employees if they had “been involved in the creation of new services within their direct work environment” (Sarbu, 2022, p. 9). The research instrument did not describe the extent of an employee’s involvement in the innovative process or which parts of this process they participated in.

Two closely related studies (Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008) found that firms with a higher proportion of workers who worked remotely had greater product and process innovation. These studies have been critiqued by Allen et al. (2015) because they rely on CEOs’ assessments of firm innovative performance and not hard data. Thus, the results of these studies may be biased. As will be discussed later in this section, it is often difficult to obtain hard data for both remote work and innovation at individual, group, and firm levels.

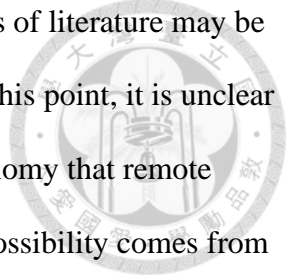
Coenen and Kok (2014) used a case study approach to look at new product development (NPD), a type of innovation model that focuses on the process of creating and implementing new



products. This study found remote work encouraged NPD by increasing cross-functional cooperation (teams with members of different functional backgrounds) and the speed of communication. The authors were careful to note that these positive effects were offset if workers did not interact in person to build trust and communicate tacit knowledge and ideas, so they concluded by recommending a hybrid approach as the best method for encouraging innovation as opposed to relying solely on either a fully remote or fully in the office model. In a study comparing collaboration and communication conducted during the period that lasted from just before the outbreak of the pandemic to the initial period of lockdowns in June 2020, Yang et al. (2021) found that workers were more siloed, and thus less likely to collaborate cross-functionally, when they worked remotely. This may be because they lacked the opportunity to build trust and exchange tacit knowledge in face-to-face settings that Coenen and Kok (2014) described as being so important for innovation.

Though most of the literature finds working remotely has a positive association with innovation, this is not always the case. In a paper that has been submitted but is yet to be published, Nguyen-Duc et al. (2022) report two main findings about remote work and innovation. First, organizational investment in innovation infrastructure and resources increased, but this may be because firms were simply investing in the necessary digital infrastructure to allow employees to work from home rather than making a concerted effort to increase innovation. Second, individuals reported through quantitative and qualitative survey responses that innovation decreased as a result of switching to remote work during the pandemic.

Overall, the literature leans towards a positive association between remote work and innovation. Given that remote work negatively affects many of the traditional drivers of innovation, such as collaboration, communication, and knowledge sharing, these findings are



somewhat curious. One possibility for the deviation between the two bodies of literature may be because certain drivers of innovation increase when working remotely. At this point, it is unclear what these might be, or if they even exist, but they might relate to the autonomy that remote work brings (Dorenbosch et al., 2005; O'Reilly & Binns, 2019). Another possibility comes from the research design of remote work studies. Because many of them focus on self-reported measures of innovation, it is possible that individuals are overestimating their own innovativeness when working remotely. A similar critique was made against two studies that use self-reported measures of innovation (Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008) in a comprehensive remote work literature review (Allen et al., 2015). For reasons described in greater detail later in this section, obtaining hard data about innovation at the individual level is impractical at this time, but it may become more feasible as the literature grows.

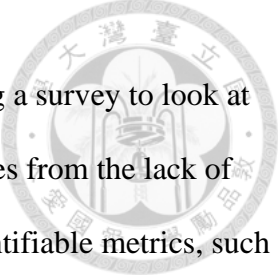
The relative lack of publications about remote work and innovation in itself is a point that should be addressed: if remote work is a part of the new normal and innovation is as important as executives and scholars say, why is there so little research into the association between the two? While this question has no concrete answer, several insights can help provide context and explanations for this gap in the literature.

First and probably most importantly, before the outbreak of the pandemic in 2020, remote work was so scarce that it did not warrant attention from management and organizational researchers. In 2019, only 4.1% of the American workforce was working remotely half-time or more (Global Workplace "The State of Remote Work 2021," 2021). This number includes freelancers and workers who own their own businesses, so the number of remote workers in corporations was even smaller.

Second, because remote work has traditionally been rare, firms generally do not publish statistics measuring remote work. It is unclear if this is because firms do not track this data, or if they do track it but have not made it public. Without readily available data to analyze, studies must use costly and time-intensive methods such as surveys and case studies.

Finally, innovation is difficult to measure. One such way is to measure outputs, such as patent numbers, number of new products, or sales-based performance measures such as the percentage of sales driven by innovation (Baruk, 1997; Michalisin, 2001). Output indicators can be problematic because not all innovations are patented (Santarelli & Piergiovanni, 1996) and linking sales figures to certain innovations can lead to noisy and biased results (Reeb, 2017). Likewise, corporations are not required to disclose many innovations (regulations for these types of disclosures do not exist in the same way as for financial reports, such as earnings, revenue, etc.), so there is a fear that disclosing too much could give a firm's competitors excessive information. Counterintuitively, firms with cautious CEOs tend to engage with more innovation to create a competitive advantage and prepare for the future, but also disclose their company's innovation activity at a lower rate (Reeb, 2017). Despite such critiques, measuring innovation through readily available outputs is a common research method. However, without firm-level data about remote work, comparing the impact of remote work on innovation within the same company over time or between companies is quite difficult without first collecting original data. In response to these difficulties, researchers often use case studies and surveys that focus on qualitative responses and opinions to see how innovation changes for individuals and groups. Nearly every study about remote work and innovation in this literature review uses this approach.

2.3 Innovative Work Behavior



This study follows in the footsteps of others in the literature by using a survey to look at innovation at the individual level. One of the issues with this approach comes from the lack of hard data that can be linked to an individual. Studies that look at easily quantifiable metrics, such as the number and power of patents an individual files (Brand, 1998) or the speed of new product development, are useful for making comparisons but are often limited to departments that focus on creating new products or services, such as research and development. Moreover, these studies tend to focus on the idea generation phase of the innovative process but do not provide much insight into the championing and application phases. In response to this, individual work behavior was developed as a way to measure workers' perceptions of the innovative climate. Doing so captures both softer sources of innovation, such as human capital and internal knowledge management, and harder sources of innovation like technology or research and development (Thether, 2005).

Scott and Bruce (1994) build on Kanter (1988) to describe individual innovation as a three-step process. First, in the idea generation phases, an individual in an organization conceives of a unique solution to a problem that is either novel (creativity) or adopted (open innovation). Second, in the championing phase, the individual looks for others both inside and outside the organization to help support and promote their idea. Finally, in the implementation phase a product, service, or process is created, which can then be diffused and used to create value for the organization. Thus, innovation is a combination of creation, coalition-building, and implementation, and individuals may be performing any combination of these behaviors at a given time. This model, though specifically focused on individuals, dovetails with the literature covered in this thesis' section on innovation. Creativity can be sparked through communication

with others, and one's ability to diffuse and champion ideas is helped by collaboration and trust in one's coworkers.

To measure individual innovative behavior at work, Scott and Bruce (1994) developed and employed a questionnaire consisting of six items (see Appendix). Responses are given using a five-point Likert-type scale ranging from "not at all" to "an exceptional degree." Originally designed as a way for managers to rate their subordinates, Scott and Bruce's (1994) innovative behavior scale has been used in employee self-ratings (Babalola, 2009; Bunpin III et al., 2016). Carmeli, Meitar and, Weisberg (2006) found that reliability was nearly identical for both supervisor ratings of employee innovative behavior and self-ratings of employee innovative behavior. In a seminal paper on innovative work behavior, Janssen (2000) argues that self-reports are more appropriate than observer reports because they are more likely to capture a nuanced version of innovation that observers, such as supervisors, may not see. This is especially true in the case of remote work, where proximity bias may lead to flawed assessments of innovation by managers (Hirsch, 2022). Although there are many ways to measure innovation, it is ultimately driven by the innovative work behavior of the employees in a firm (Liu et al., 2017), thus directly measuring innovative behavior is an effective way to gauge innovation (Janssen, 2000). This operationalization of innovation informs the main survey tool of this thesis, which is detailed in the data collection methods section (3.2).

2.4 Hypothesis Development

This paper adds to the small but growing literature that directly measures the differences in innovation in office, hybrid, and remote work modes. As previously described, several factors are associated with increased innovation. These include communication and knowledge sharing (Kivimäki et al., 2000; Liedtke & Ortutay, 2021; Subramaniam & Youndt, 2005), trust (Clegg et

al., 2002), ICT support (Enkel et al., 2020), and management that encourages and supports innovation (Hoang et al., 2006). However, these factors were all identified in studies that only observed innovation in office models. Individual studies that measure these factors in remote settings often find a negative association between remote work and the specific factor, such as chance encounters (Behrens & Kret, 2019; Linke & Zerfass, 2011), knowledge sharing (Fonner & Roloff, 2010; Lee et al., 2007), trust (Chang et al., 2011; Fayard et al., 2021), and challenges in managing in an effective way (Parker et al., 2020).

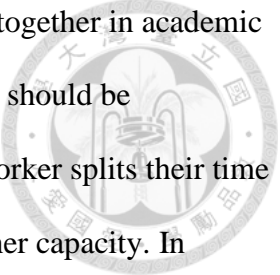
These findings would lead one to believe that innovation decreases in remote work environments because of the apparent lack of these factors. However, in the few studies that specifically analyze the difference in innovation between an office setting and a remote setting, the opposite appears to be true. In fact, these studies indicate a positive association between innovation and remote work (Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008; Sarbu, 2022). The positive association between remote work and innovation found in these studies could be caused by factors that are not significant drivers of innovation in office settings, such as autonomy (Dorenbosch et al., 2005; O'Reilly & Binns, 2019). Thus, after reviewing the literature on innovation in remote settings as measured by the presence of traditional drivers of innovation, as well as the literature that specifically compares innovation in office settings versus remote settings, it has been determined that there is a larger gap in the latter. The following hypotheses attempt to address this gap by directly measuring innovation in office, hybrid, and remote work settings.

Choosing the direction of the hypothesis, or if remote work has a positive or negative association with innovation, requires drawing from either the drivers of innovation literature (negative association) or the literature that directly measures remote work and innovation

(positive association). The two bodies of literature are separate for the most part and do not reference each other. When a study finds a positive association between remote work and innovation, it does not explain why this is the case in terms of communication, collaboration, trust, or other main drivers of innovation. On the other hand, the drivers of innovation literature make theoretical predictions about the effect of remote work on innovation; innovation itself is essentially never measured. Thus, it is difficult to create hypotheses that fully incorporate both sets of literature.

The hypotheses of this study primarily draw from the literature that directly measures innovation in remote settings for the following reason. First, these are the only studies to measure innovation in remote settings. Though these studies use different approaches to measure innovation, such as surveys (Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008), quantitative assessments of participation in new activities (Sarbu, 2022), and interviews as a part of case studies (Coenen & Kok, 2014), they all provide evidence that working remotely increases innovation. Second these studies took place several years before the pandemic (even Sarbu's 2022 study uses a dataset from 2006), so it is expected that since then people have become more competent in working remotely, or at least working with ICT that enables remote work. Third, innovative work behavior (Scott & Bruce, 1994) captures both softer and harder innovation, thus capturing how employees practice innovativeness no matter where they are. This study makes its first hypothesis based on the body of literature that directly measures the association between remote work and innovation:

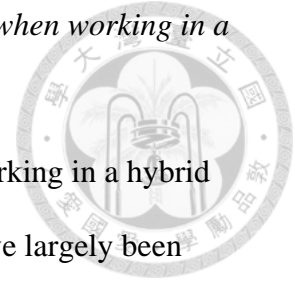
Hypothesis 1: Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in the office full-time.



Though the terms hybrid and remote work have often been grouped together in academic research (Allen et al., 2015), there is sufficient evidence to suggest that they should be considered separate concepts with different expected outcomes. A hybrid worker splits their time between the office and a remote location instead of working full-time in either capacity. In business circles, the use of these terms to differentiate between different modes of work has become increasingly common. Office, hybrid, and remote work have been grouped into separate categories in surveys by companies interested in the outcomes different working modes have on efficiency and productivity (Rozentals, 2022). In the academic literature, only a few studies investigate hybrid and remote work as distinct terms (Coenen & Kok, 2014; Gajendran & Harrison, 2007), but due to the rise in both hybrid and remote work brought by the pandemic and the popularity of the distinction in media outlets, it is expected that academic research will increasingly treat hybrid and remote work as separate concepts. Thus, this thesis treats hybrid and remote work as separate independent variables.

While the first hypothesis compares working remotely full-time to working in the office full-time, the second hypothesis compares working in a hybrid mode, or one to four days a week remotely and the rest in the office, to working in the office full-time. Hybrid workers gain the benefits of autonomy (O'Reilly & Binns, 2019) and the ability to organize their schedules (Choudhury, 2020), allowing them to focus on innovation free from the distractions of the office. They still go into the office to collaborate and share knowledge as well as have access to the more intangible drivers of innovation such as serendipitous encounters and trust building. In this way, they can practice innovative work behavior in multiple settings, leading to more innovation than only working in the office. Based on this underlying framework, the second hypothesis is as follows:

Hypothesis 2: Individuals perceive innovative work behavior to be higher when working in a hybrid mode than when working in the office full-time.



The third and final hypothesis considers the difference between working in a hybrid mode and working remotely full-time. As stated before, these concepts have largely been grouped together in the academic literature; the term “remote work” or the similar terms telecommuting, telework, etc. include hybrid work (time divided between working in the office and working remotely), and full-time remote work. In a detailed literature review of remote work research, Allen et al. remark “[remote work] is rarely an all-or-nothing work practice” (2015, p. 45). In Sarbu’s econometrics-style research paper (Sarbu, 2022), remote work is analyzed as a yes/no dummy variable, thus hybrid and full-time remote work were grouped together. Because of this, using existing literature to form a hypothesis about which will have a more positive effect on innovation is a challenging task.

Nevertheless, full-time remote work is expected to have a more positive association because people must fully adjust to working outside of the office. In an attempt to maximize efficiency, hybrid workers may focus on less innovative parts of work, such as more rote, productivity-based work, and attempt to undertake collaborative tasks such as brainstorming with others while in the office. This means the majority of their innovative work takes place during the few days a week they are in the office instead of every day. Full-time remote workers, on the other hand, are more likely to innovate at any time. Moreover, they can leverage communication tools to reach out to their co-workers immediately instead of waiting till the next face-to-face interaction to collaborate on their idea (Coenen & Kok, 2014). Full-time remote workers are also more likely to adopt flexible work arrangements, in which they do not work according to a set schedule, which can lead to increased creativity (Hunter, 2019). If an innovative idea strikes

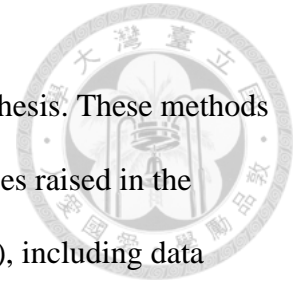
during the evening or weekend, a remote worker can use part of their weekly working hours to expand the idea while it is still fresh in their mind. A hybrid worker might be bound to a more traditional eight-hour work schedule and thus be less willing to work on ideas outside of working hours. There is a chance they will then forget about the idea, and even if they revisit it when they return to work it will be less fresh in their minds. For these reasons, the final hypothesis is as follows:

Hypothesis 3: Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in a hybrid mode.

This study also seeks to understand what type of workers are most affected by working in different environments. Results of survey responses by basic demographic categories, including gender, age, and educational achievement, are provided to provide answers to this question.

Chapter 3: Method

This section outlines the research design and methods used in this thesis. These methods were drawn from the innovation literature and are used to test the hypotheses raised in the previous section (2.4). The subsections describe the study participants (3.1), including data collection (3.2), and data analysis (3.3)



3.1 Participants

3.1.1 Population and Participant Demographics

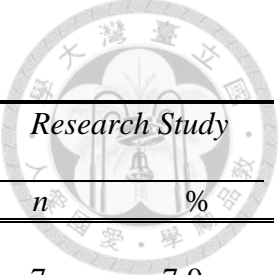
The population of interest for this study was adult workers (18 years of age or older) in the United States who worked remotely or in a hybrid model during the pandemic. Prior to the pandemic studies of remote work focuses on those who worked remotely in a voluntary capacity. However, studying the subject of remote work during the pandemic provides an interesting research opportunity because many of the people that switched to remote work were forced to do so by the pandemic lockdowns. While the exact size and demographic characteristics of the population of interest do not exist, estimates can be made using figures from the United States Bureau of Labor Statistics (BLS) (2022). In May 2020, the BLS began collecting monthly data about “employed persons who teleworked or worked at home for pay at some point in the 4 weeks preceding the survey specifically because of the pandemic” (BLS, 2022). Though this data does not perfectly measure the population, it provides a rough estimate of size and a suitable estimate of demographic characteristics.

The total number of hybrid and remote workers during the pandemic is not perfectly reported by the BLS for two main reasons. First, the survey only asks about those who work remotely “specifically because of the pandemic” (BLS, 2022), which does not include those who voluntarily chose to work remotely. Second, only monthly data, not data from an entire year or

since the beginning of the pandemic, is collected; there is no way to know if the remote workers in June are the same as the remote workers in July. BLS reported 46,674,000 hybrid and remote workers in May 2020, the highest month since recording such data (Dey et al., 2021). Though the true population of hybrid and remote workers is most likely higher due to the aforementioned reasons, the BLS figure is used as a reasonable proxy for the population of hybrid and remote workers in the United States since the beginning of the pandemic.

BLS demographic characteristics are quite accurate and stable because they are a ratio and not a number. From when BLS first began recording monthly telework in May 2020 to the latest release in April 2022, the proportion of teleworkers of a specific age, gender, race, and educational attainment has remained quite stable from month to month, even when the total number of teleworkers increases or decreases. The demographic figures from May 2020, the month in which the greatest number of workers were working hybrid or remote, are compared to this study's sample population in the table below.

Table 1 *Demographic Information (N=100)*



Characteristic	Bureau of Labor Statistics	<i>Research Study</i>	
	%	<i>n</i>	%
Age			
16 to 24 years ¹	5.6	7	7.0
25 to 34 years	25.0	39	39.0
35 to 44 years	25.0	31	31.0
45 to 54 years	21.8	13	13.0
55 to 64 years	17.2	8	8.0
65 years and over	5.4	2	2.0
Gender			
Male	46.8	42	42.0
Female	53.2	55	55.0
Non-Binary		1	1.0
Prefer not to say		2	2.0
Education			
Less than a high school diploma	0.8	0	0
High school graduates, no College	9.5	11	11.0
Some college or associate		4	4.0
Degree	17.2		
Bachelor's degree only	39.3	48	48.0
Advanced degree ²	33.2	37	37.0
Master's degree		31	31.0
Doctorate		6	6.0

¹The minimum age for participants in this study is 18. BLS uses 16 as the lower part of its range, so the 16-24 range was used to be consistent with BLS data presentation

²BLS does not distinguish between Master's and Doctorate degrees

As Table 1 shows, the sample demographics of this study are quite close to being representative of the population of interest. However, the sample does skew somewhat younger than the population, as seen by the overrepresentation of respondents 25-44 years of age. The overall educational achievement skews higher in the sample than in the actual population. Despite these small differences, the sample and population are comparable.

3.1.2 Sampling Method

In order to collect a sample from the desired population, an online questionnaire was distributed through Facebook, Reddit, and Prolific. Facebook is the third most visited website and largest social network in the United States (Semrush, 2022). It has gained popularity in social science research because of its large and diverse body of users that are easily recruited as study participants (Kosinski et al., 2015). Reddit, the seventh most visited website and second most visited social media website in the United States (Semrush, 2022) has been suggested as a data collection tool due to its ability to provide access to free and fast data collection from large samples (Shatz, 2017). Prolific is an online subject recruitment platform that offers high-quality recruitment standards at a reasonable cost (Palan & Schitter, 2018).

The use of online questionnaires distributed in such ways has several disadvantages and advantages. One of the advantages is that the relatively low cost and ease of distribution allow for researchers with limited resources, such as students, to gather large amounts of data in short amounts of time (Fricker, 2016). As for disadvantages, online surveys of this type are considered non-probability samples because anyone who sees the survey can opt in or opt out (Fricker, 2016). Only results from people who responded to the survey are accounted for, but there is no way to measure who did not take the survey and why they did not take it. This is referred to as non-response bias and may negatively influence results (Duda & Nobile, 2010). While this limits a survey's ability to make inferences about a population, this type of data collection can still be useful for identifying issues or collecting non-inferential data (Fricker, 2016). After accounting for responses removed during the data cleaning process, the final number of responses used for data analysis was 100.



3.1.3 Unit of Analysis

This study examines innovation using individuals as the unit of analysis. Comparing individual responses allows for a wide range of subjects that are easier to access and compare than other potential units of analysis such as firms or teams within firms. The unit of observation is innovation as operationalized by Scott and Bruce's Innovative Behavior scale (1994).

3.2 Data Collection Method

3.2.1 Research Instrument

This paper utilizes a cross-sectional survey collection method to measure respondents' opinions about how innovative they are in various work environments. The rapid shift to remote work during the pandemic forced many people to work remotely or hybrid for a period of time. However, now that the peak of the pandemic in America is over, capturing this phenomenon in a longitudinal format would be difficult, especially given the time constraints of a master's thesis. Thus, a cross-sectional survey was employed as the data collection tool because it allows for collecting data on people's beliefs, opinions, and attitudes in a short amount of time (Creswell, 2002).

The overall instrument consists of 31 total questions. All respondents were asked an initial screening question, three questions about their industry, three to five questions about their working environment in the past three years (essentially from just before the pandemic until the time of the survey), and four demographic questions. Based on their responses about which working environments applied to them, participants were also asked 12 to 18 multiple choice questions about their innovative work behavior.

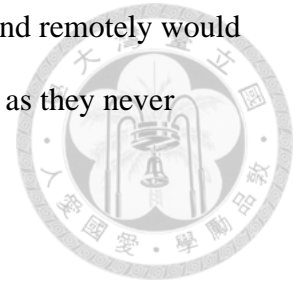
The independent variable is a categorical variable where participants chose which of the following work environments they had worked in over the past three years: in the office, hybrid,

or remote. These categories are derived from the literature (Gratton, 2021; Yang et al., 2021), yet few studies separate hybrid work from remote work in their analyses. Before the pandemic working remotely was “rarely an all-or-nothing work practice” (Allen et al., 2015, p. 45), so the literature often includes hybrid work in its definition of telecommuting or remote work. Given that all three work modes are now common, they should be analyzed as separate items (Coenen & Kok, 2014). A screening question ensured participants has experience in at least two of these environments so their impressions of the differences between them could be compared. In the survey, hybrid work was defined as “splitting time between remote and office work in a given week (1-4 days in the office and the rest remotely).” Remote work was defined the following way: “also known as working from home or telecommuting, [remote work] refers to doing your job from a location other than a central office operated by the employer.”

The dependent variable, Scott and Bruce’s (1994) Innovative Behavior Scale, is a questionnaire consisting of six items (see Appendix). Participants were asked about the extent to which they felt they displayed innovative work behavior through questions addressing idea generation, spreading ideas to others, and implementing innovation. Responses were given using an ordinal Likert-type scale consisting of five choices: (1) Not at all (2) Very little (3) Somewhat (4) Quite a bit (5) An exceptional degree. Items include questions such as “to what extent have you seen yourself as someone that generates creative ideas?” and “to what extent have you seen yourself as someone that is innovative?” (Scott & Bruce, 1994) that measure the idea generation, championing, and implementation phases of the innovative process.

Qualtrics was used as the data collection tool to collect survey responses. Qualtrics was chosen for its flexibility in creating data reports and exporting data in various formats. Another useful feature of Qualtrics is its skip logic, which only shows relevant questions to respondents.

This means that, for example, respondents who only worked in the office and remotely would not be shown innovative behavior questions for working in a hybrid mode, as they never experienced that mode.



3.2.2 Validity and Reliability.

Choosing a research instrument with validity is a crucial step in verifying the intended targets are being measured (Muijs, 2004). Reliability refers to how accurate a research instrument is, or how consistently it will return the same results from multiple samples (Heale & Twycross, 2015). Muijs (2004) writes that in order to ensure reliability and consistency in research, Cronbach's alpha needs to be greater than 0.7. The survey instrument utilized in this study, Scott and Bruce's (1994) Innovative Behavior scale, has a well-documented history of reliability in various workplace studies. Several studies show it has a high level of reliability ($\alpha = .83 - .94$) (Binyamin et al., 2018; Song et al., 2018; Sun & Huang, 2019; Yuan & Woodman, 2010). In this thesis, Cronbach's alpha is calculated for innovative work behavior while working remotely ($\alpha = .925$), hybrid ($\alpha = .926$), and in the office ($\alpha = .933$), showing high levels of reliability that are similar to other studies. Combining this study's reliability findings with that of past research indicates a high level of reliability and internal consistency.

Validity describes how well an instrument measures the concept it is supposed to measure (Creswell & Creswell, 2005). One of the ways of ensuring validity is to use a validated scale, or one which has been compared to other instruments that attempt to measure the same thing and found to produce accurate results (Boateng et al., 2018). A key reason the innovative work behavior scale developed by Scott and Bruce (1994) was chosen for this study was the extent to which it has been validated in a wide variety of fields. In the paper that first utilizes this scale (Scott & Bruce, 1994), the scale is validated by both other scales and objective measures of

innovation based on participants' innovative history. Since then, the scale has seen widespread use and validation (De Bruin & Steyn, 2019; Lin & Lee, 2017).



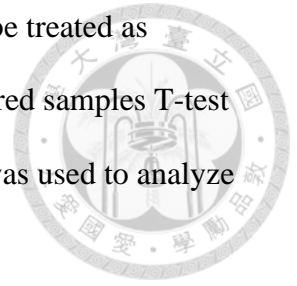
3.3. Data Analysis

After the data was collected, data was exported to Excel using a .CSV file then cleaned and prepared for further analysis. Basic analyses such as descriptive statistics were performed using Excel, while more advanced analyses were performed using R.

Participants were asked to report how innovative they felt via Scott and Bruce's (Scott & Bruce, 1994) innovative work behavior scale when working in different environments. This results in paired data in which different observations from the same individual are recorded, in this case, how innovative they are when working remotely, hybrid, or in the office. All respondents worked in at least two of these environments over the past three years and the environment was used as the independent variable. The design of this study treats different working environments as a modified pre-test post-test study. These types of studies typically use a longitudinal format, but they also have been applied to gather retrospective data that compare the perceptions of the same subject between two points in time with an intervention introduced (Daniels et al., 2021; Hunter, 2019; Mouratidis & Papagiannakis, 2021). In the case of this study, the two points in time are the different work environments participants worked in just before and during the pandemic. The effects of this change based on working environments are then measured. Innovative work behavior scores for different work environments were used as dependent variables and compared and tested for significant differences.

Data for the six survey items of the innovative behavior scale (Scott & Bruce, 1994) was measured with ordinal variables on a Likert-type scale. Analysis was conducted by combining these scores into one overall innovative behavior score as suggested by Scott and Bruce (1994),

Janssen (2000), and De Jong and Den Hartog (2008), allowing the data to be treated as continuous and analyzed with a paired samples T-test (Norman, 2010). Paired samples T-test was used to analyze parametric data, while paired samples Wilcoxon test was used to analyze non-parametric data.



Chapter 4: Research Results

This chapter reports the findings of participants' responses about how they perceived innovative behavior when working either in the office, in a hybrid mode, or remotely during the pandemic. It first presents innovative work behavior scores by item. After that, each hypothesis and its corresponding data analysis is shown. Based on the results of the data analysis, each hypothesis is either supported or rejected.

Table 2 *Innovative Work Behavior Score (Scott & Bruce, 1994) by Item*

Innovative Work Behavior Item	Average response by work environment		
	Office (N=93) ¹	Hybrid (N=69)	Remote (N=94)
1. Searched out new technologies, processes, techniques, and/or product ideas	2.98	3.18	3.36
2. Generated creative ideas	3.15	3.34	3.50
3. Promoted and championed ideas to others	3.26	3.22	3.33
4. Investigated and secured resources needed to implement new ideas	2.92	3.12	3.10
5. Developed adequate plans and schedules for the implementation of new ideas	3.06	3.26	3.43
6. Been innovative	3.08	3.30	3.43
Innovative Behavior Score	3.08	3.25	3.35

¹ Participants have worked in at least two work environments in the last three years

Table 2 above displays the individual items that comprise the innovative work behavior score developed by Scott and Bruce (1994) and how participants responded to each item based on the work environment. Responses are given through a 5-point Likert-type scale that asks respondents to report the extent to which they have performed each item, from 1- "Not at all" to 5- "An exceptional degree". While the innovative behavior score is meant to be analyzed as a whole (De Jong & Den Hartog, 2008; Janssen, 2000; Scott & Bruce, 1994), presenting

participants' responses in an item-by-item fashion shows the composition of the innovative behavior score and provides an overall picture of the data before diving into in-depth data analysis. Participants reported the highest innovative behavior for five out of the six items when working in a remote work environment, which is contrary to what the literature predicts. The items with the smallest difference in score between office and remote work are both collaborative in nature: 3 (promoted and championed ideas to others) and 4 (investigated and secured resources). The other four items can involve working with others but can also be carried out individually.

The data presented in Table 2 provides an overall picture of participants' innovative work behavior when working in different environments. To draw empirical conclusions from the data, further analysis was conducted to compare paired responses. The following sections describe the results of the data analysis for each hypothesis.

Hypothesis 1

Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in the office full-time.

This hypothesis is supported by the findings of this study.

Paired measurements of innovative work behavior from individuals that worked in the office and worked remotely were compared. A paired samples T-test was first considered to see the difference in mean between a given pair of these two groups. Because parametric tests require normal distribution, a Shapiro-Wilk normality test was run on the dependent variable innovative behavior, which showed non-normal distribution ($W=0.97$, $p < 0.01$). A nonparametric test, the paired samples Wilcoxon test, was used to compare the perception of innovative behavior when working in the office to working remotely. Respondents ($n=82$)

reported a higher innovative behavior score ($Mdn=3.3$) when working remotely than when working from home ($Mdn=3.0$). A paired samples Wilcoxon test indicated the difference was statistically significant ($z= -2.72, p=0.003$). Given these findings, the data collected supports the hypothesis that innovative work behavior will be higher when working remotely full-time than when working in the office full-time.

Age, gender, and educational achievement were also analyzed to see if these different groups differed in their reports of innovative work behavior in respective work environments. Table 3 below shows these results. Mean innovative work behavior scores and their standard deviations are provided for full-time office and full-time remote work. For the purpose of this study, the most important variable is not the scores themselves, but rather the difference between scores, which is calculated by subtracting the office mean innovative work behavior score from the remote mean innovative work behavior score. The difference between scores shows how much more innovative participants felt when working remotely compared to working in the office. A positive number indicates they reported higher innovative work behavior when working remotely, while a negative number indicates they reported higher innovative work behavior when working in the office. This difference is reported in the far-right column.

Table 3 shows younger workers report more innovative work behavior when working remotely, while older workers tend to report more innovative work behavior when working in the office. These differences were not found to be significant using regression analysis. The age group that reported the highest levels of innovation in the office compared to remote work was 45 to 54 and not one of the older groups.

There is a very small difference between the difference in male and female respondents' innovative work behavior scores. Respondents who preferred not to say or are agender/nonbinary

had a large difference in innovative behavior scores, but the low sample size of this demographic means the results are unlikely to be significant. These differences were not significant as part of multiple regression analysis or when analyzed with an unpaired T-test.

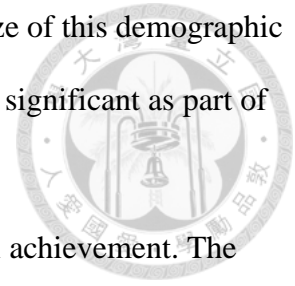


Table 3 also shows innovative work behavior scores by educational achievement. The difference between remote and office innovative work behavior scores narrows as educational achievement increases, but this correlation was not found to be significant using regression analysis. Age and educational achievement were not found to be significantly correlated.

Table 3 *Innovative Work Behavior Scores for Office and Remote Work by Demographic (n=82)*

Characteristic	<i>n</i>	Mean Office	σ Office	Mean Remote	σ Remote	Difference (Remote – Office) ¹
Age						
16 to 24 years	6	2.92	1.31	3.47	0.96	0.56
25 to 34 years	30	2.93	1.19	3.41	1.07	0.48
35 to 44 years	28	3.20	0.85	3.53	0.75	0.34
45 to 54 years	10	3.12	1.03	2.82	0.56	(-0.30)
55 to 64 years	7	2.83	0.65	2.83	1.00	0
65 years and over	1	4.00	0	3.83	0	(-0.17)
Gender						
Male	39	3.04	0.95	3.28	0.68	0.24
Female	40	3.10	0.99	3.40	1.03	0.30
Prefer not to say	2	1.17	0	2.50	2.12	1.33
Agender/Non-binary	1	5	0	5	0	0
Education						
High school graduates, no college	9	2.76	0.89	3.39	0.81	0.63
Some college or associate degree	3	2.78	1.58	3.17	1.15	0.39
Bachelor's degree only	38	2.88	1.16	3.30	0.99	0.41
Master's degree	26	3.24	0.69	3.31	0.86	0.06
Doctorate	6	3.83	0.78	3.78	0.84	(-0.06)

¹Difference calculated by subtracting the office mean innovative work behavior score from the remote mean innovative work behavior score.

A positive number indicates participants reported higher innovative work behavior when working remotely, while a negative number indicates they reported higher innovative work behavior when working in the office.

Note: All scores derived are from the innovative work behavior scale developed by Scott and Bruce (1994)

Hypothesis 2

Individuals perceive innovative work behavior to be higher when working in a hybrid mode than when working in the office full-time.

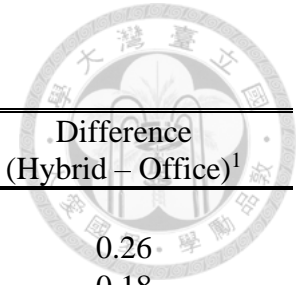


The data collected was not significant 0.05 level.

Respondents' reports of innovative behavior when in the office were compared to working hybrid. A Shapiro-Wilk normality test showed the data was not normally distributed ($W=.95, p < 0.01$) so a paired samples Wilcoxon test was used to assess statistical significance. Innovative behavior scores when working hybrid ($Mdn=3.5$) appeared higher than when working in the office full-time ($Mdn=3.17$) but were not statistically significant ($z= -1.50, p=0.067$). Given the lack of statistical significance, it cannot be said that the innovative behavior scores differ when working hybrid compared to working in the office.

In the same manner as in Hypothesis 1, demographic variables and corresponding innovative work behavior scores for working in a hybrid mode and in the office full-time are presented in Table 4 below. Difference is the most important variable for this study and is calculated by subtracting the innovative work behavior score when working in the office from the innovative work behavior score when working in a hybrid mode. All age groups except 45 to 54 reported equal or higher innovative work behavior when working in a hybrid mode as compared to working in the office full-time. Differences by gender were not significant with further analysis, but female respondents reported a higher difference than male respondents. Educational achievement has no measurable effect on difference between hybrid and office scores.

Table 4 *Innovative Work Behavior Scores for Office and Hybrid Work by Demographic (n=58)*



Characteristic	<i>n</i>	Mean Office	σ Office	Mean Hybrid	σ Hybrid	Difference (Hybrid – Office) ¹
Age						
18 to 24 years	7	3.07	1.20	3.33	0.89	0.26
25 to 34 years	21	3.12	1.20	3.30	1.01	0.18
35 to 44 years	19	3.14	0.87	3.45	0.75	0.31
45 to 54 years	6	2.86	1.28	2.58	0.72	(-0.28)
55 to 64 years	3	3.28	0.63	3.50	1.01	0.22
65 years and over	2	3.67	0.47	3.67	0.47	0.00
Gender						
Male	25	2.99	1.05	3.07	0.89	0.08
Female	30	3.24	0.95	3.42	0.89	0.19
Prefer not to say	1	1.17	0	3.00	0	1.83
Agender/Non-binary	2	3.92	1.53	4.50	0.71	0.58
Education						
High school graduates, no college	3	3.28	0.63	3.33	0.76	0.06
Some college or associate degree	4	3.33	0.71	3.58	1.00	0.25
Bachelor's degree only	25	2.79	1.21	3.04	1.00	0.26
Master's degree	20	3.35	0.68	3.40	0.69	0.05
Doctorate	6	3.58	1.30	3.92	0.66	0.33

¹Difference calculated by subtracting the hybrid mean innovative work behavior score from the office mean innovative work behavior score.

A positive number indicates participants reported higher innovative work behavior when working in a hybrid mode, while a negative number indicates they reported higher innovative work behavior when working remotely.

Note: All scores are derived from the innovative work behavior scale developed by Scott and Bruce (1994)

Hypothesis 3

Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in a hybrid mode.

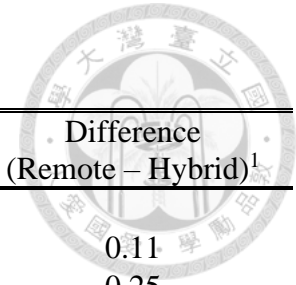


This hypothesis is supported by the findings of this study.

Participants' perception of innovative behavior when working remotely full-time compared to working hybrid was also analyzed. To check for normal distribution of innovative behavior scores, a Shapiro-Wilk normality test was performed and did not show evidence of non-normality ($W = 0.98, p = 0.13$). This does not show that the variable is normally distributed, only that it may be, so normal distribution was confirmed visually using a density plot, which showed a bell-shaped normal distribution, and a quantile-quantile plot. Participants who had worked both hybrid and remotely ($n=58$) showed a lower innovation score when working in a hybrid mode ($M=3.15, SD= 0.869$) than working remotely full-time ($M=3.38, SD= 0.842$). A paired samples T-test was performed, which showed a difference in means, 0.23, 95% CI [0.05,0.41], that was statistically significant ($t(57)= 2.53, p= 0.014$). These findings provide evidence to reject this hypothesis.

Results by demographic are presented in Table 5 below. As the chart shows, age has no discernible effect on the difference in scores between remote and hybrid work. Male respondents reported a greater difference in scores than female respondents. Difference in scores by educational achievement shows some interesting variation, as respondents with a bachelor's degree reported a large difference in scores, but respondents with other educational achievement levels reported no difference or negative difference.

Table 5 *Innovative Work Behavior Scores for Remote and Hybrid Work by Demographic (n=59)*



Characteristic	<i>n</i>	Mean Remote	σ Remote	Mean Hybrid	σ Hybrid	Difference (Remote – Hybrid) ¹
Age						
16 to 24 years	6	3.14	0.61	3.03	0.74	0.11
25 to 34 years	19	3.48	1.14	3.24	1.03	0.25
35 to 44 years	20	3.56	0.64	3.43	0.76	0.13
45 to 54 years	9	2.83	0.72	2.41	0.68	0.43
55 to 64 years	4	3.50	0.76	3.46	0.83	0.04
65 years and over	1	3.83	0	4.00	0	(-0.17)
Gender						
Male	30	3.27	0.73	3.01	0.73	0.26
Female	27	3.41	0.95	3.29	0.98	0.12
Prefer not to say	1	4.00	0	3.00	0	1.00
Agender/Non-binary	1	5.00	0	5.00	0	0
Education						
High school graduates, no college	3	3.00	1.17	3.00	1.32	0
Some college or associate degree	2	3.50	1.41	3.50	1.65	0
Bachelor's degree only	26	3.45	0.92	2.81	0.88	0.63
Master's degree	22	3.30	0.75	3.42	0.70	(-0.11)
Doctorate	6	3.53	0.97	3.92	0.66	(-0.39)

¹Difference calculated by subtracting the remote mean innovative work behavior score from the hybrid mean innovative work behavior score.

A positive number indicates participants reported higher innovative work behavior when working remotely, while a negative number indicates they reported higher innovative work behavior when working in a hybrid mode.

Note: All scores are derived from the innovative work behavior scale developed by Scott and Bruce (1994)

Based on these results, individuals perceive innovative work behavior to be influenced by work environment (office, hybrid, or remote). As noted in the previous discussion of each hypothesis, age, gender, and educational achievement seem to have some impact on how individuals perceive innovative work behavior in different working environments, though these correlations were not significant. To summarize the findings of this section, Table 6 below displays the results of each of the three hypotheses.

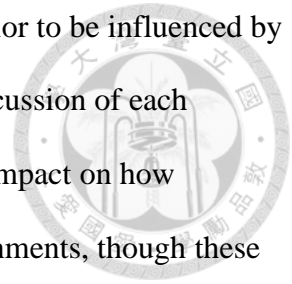


Table 6 *Hypothesis Results*

Hypothesis	Result
1. Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in the office full-time.	Supported
2. Individuals perceive innovative work behavior to be higher when working in a hybrid mode than when working in the office full-time.	Results not statistically significant
3. Individuals perceive innovative work behavior to be higher when working remotely full-time than when working in a hybrid mode.	Supported

Chapter 5: Discussion



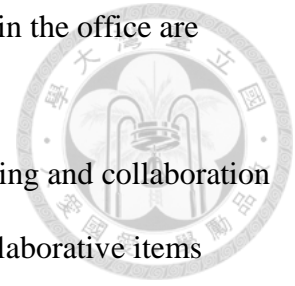
5.1 Discussion

The results show that remote work leads to higher innovative work behavior than either working in the office or in a hybrid mode. The findings of this research run contrary to the idea that remote work negatively influences individual drivers of innovation, which in turn negatively influences innovation in remote settings. However, these findings do support the nascent literature that directly compares innovativeness in the office to innovativeness while working remotely (Coenen & Kok, 2014; Martínez-Sánchez et al., 2007; Martínez-Sánchez et al., 2008; Sarbu, 2022). This chapter discusses why this may be the case, the implications of these findings for real-world practitioners and academics, the limitations of this study, and potential areas for future research.

5.2 Research Implications

Given that the hypotheses used in this study were constructed based on literature that applied drivers of innovation to remote work, the results are somewhat surprising. Even though the individual drivers of innovation like serendipitous encounters (Behrens & Kret, 2019; Linke & Zerfass, 2011; Schmidt & Rosenberg, 2014), communication and knowledge sharing (Kivimäki et al., 2000; Subramaniam & Youndt, 2005), trust (Clegg et al., 2002; Hughes et al., 2018; McAllister, 1995), and supportive leadership (Coun et al., 2021; Keum & See, 2017) are negatively affected by remote work (Bayo-Moriones et al., 2017; Brucks & Levav, 2022; Chang et al. 2011; Fayard et al., 2021; Parker et al., 2020), the results of this study show a positive association between remote work and innovativeness. This implies that there are drivers of innovation that manifest more strongly in remote work than in the office. These potential remote

work drivers of innovation and how they differ from drivers of innovation in the office are discussed below.




A main theme running through the literature is that knowledge sharing and collaboration diminish when working remotely. This is reflected in the results, as the collaborative items “Promoted and championed ideas to others” and “Investigated and secured resources needed to implement new ideas” have scores that diverge the least between office and remote work. Scores for items that can be performed individually, such as “Searched out new technologies, processes, techniques, and/or product ideas” and “Generated creative ideas”, display the greatest difference between office and remote work, suggesting there is an individual element to the idea generation phase of the innovation process. This individual element could come from the increased autonomy and control over one’s work (Gajendran & Harrison, 2007; O’Reilly & Binns, 2019). With more autonomy, workers are more confident and thus search out new processes and ideas and generate new ideas themselves. More research focusing on the drivers of innovation in remote work is needed to understand why we are seeing this positive association between remote work and innovation.

Participants of older age, namely 45 and older, reported lower innovation when working remotely full-time compared to working in the office full-time. This could be due to other factors associated with older age, such as a lack of ICT expertise or access. Older workers have been shown to make use of ICT to a lesser extent than their younger peers and to be less proficient than their younger peers when using ICT (Behaghel et al., 2014; De Koning & Gelderblom, 2006). ICT tools such as instant messaging, emails, and videoconferencing are the main forms of collaborating when working remotely. If workers cannot use these tools effectively, they cannot collaborate effectively, which reduces individual innovation (Bayo-Moriones et al., 2017; Enkel

et al., 2020). On the other hand, while lack of ICT proficiency or access can help explain why individual innovativeness decreases, increased ICT proficiency and access do not explain why individual innovativeness might increase when working remotely. Though ICT is necessary for reaching the same levels of innovation as the office because it allows workers to collaborate, brainstorm, and develop trust as effectively as in the office, the review of the literature performed for this paper did not uncover any research that suggests ICT can cause individuals to be more innovative when working remotely than when working in the office.

Another curious finding is that participants reported higher innovative work behavior when working remotely full-time than in a hybrid mode. Though very few studies differentiate hybrid and remote work as distinct concepts, most that do suggest a hybrid mode will lead to more innovation than a remote work mode (Coenen & Kok, 2014; Gajendran & Harrison, 2007). This is because the negative effects of working remotely, such as diminished trust and difficulty sharing knowledge, can be addressed when employees are in the office. The literature does not offer much insight as to why this study found higher innovativeness when working remotely full-time than when working in a hybrid mode. It could be that the time gained from increased productivity (Dutcher, 2012; Ollo-Lopez et al., 2010) and the ability to organize one's time (Choudhury, 2020) while working remotely allow workers to focus more on innovative work behavior. As companies continue to enact hybrid and remote work policies, there will hopefully be more academic research into the differences between the two modes of working.

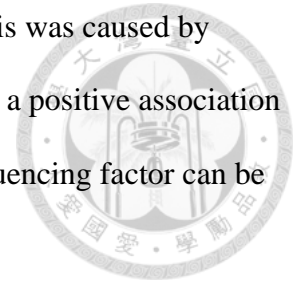
An important caveat is that the results of this research do not distinguish between innovation caused by remote work and innovation caused by behaviors people adapted while working remotely. This distinction is subtle but important. If remote work inherently leads to increased innovation, then adopting a remote work policy would be the best method to increase



innovation. On the other hand, if it is not remote work itself, but rather certain habits easily fostered through remote work that actually are the cause of the increased innovation, then companies could attempt to foster these habits in an office setting as well. Coenen and Kok (2014) found this to be the case in their study of new product development. The most innovative teams and individuals were the ones that most effectively used ICT to communicate in the manner that best suited the information being transferred. These individuals and teams leveraged the wider range of ICT options to increase cross-functionality, which in turn increased innovation speed and quality. Though everyone had access to the same ICT, those that worked remotely were more likely to use it, even after they returned to the office. Additionally, simply using more ICT did not result in more innovation; ICT had to be used to increase the level of cross-functionality to positively influence the innovative process.

It could be argued that because the periods in which the greatest number of people worked remotely coincided with the peaks of the pandemic in the United States (BLS, 2020), the effects of the pandemic cannot be disentangled from the effects of remote work. A paper that reported that the switch to remote work led to increased siloing and decreased collaboration (Yang et al., 2021) has been criticized for not clearly differentiating the effects of the pandemic from the effects of working remotely. An alternative explanation is that uncertainty, fear, and disruption caused by the pandemic could also lead people to communicate less frequently with the weak ties of their social network and instead focus on those closest to them, such as their immediate teams at work (Kelly, 2021). While there is a chance that the results of this paper are driven by the pandemic and not by remote work, this is probably not the case because the stress of the pandemic is more likely to hamper innovative work behavior than encourage it (Coun et al., 2021; Montani & Staglianò, 2022). If the results of this paper showed a negative association

between remote work and innovation it would be difficult to ascertain if this was caused by remote work or by the stress of the pandemic, but because the results show a positive association between remote work and innovation, the stress of the pandemic as an influencing factor can be ruled out.



Finally, the disparity between the findings of this study and the broader discussion around remote work and innovation are addressed. The latter is understood through three main sources: academic research and reports, businesses (including their employees and executives), and media outlets such as business journals and newspapers (or their more modern counterparts podcasts and blogs). The rest of this section will describe this discussion and provide possible reasons why the findings of this study differ from commonly held beliefs about remote work and innovation.

As discussed in the introduction, many corporate policies that reduce full-time remote work are based on the idea that workers need to meet in person to innovate, few firms provide few details beyond that. Though reduced innovation is the reason given for calling workers back to the office, firms rarely specify what type of innovation they are referring to and to what extent it is reduced. A definition of innovation is hardly ever if at all provided by companies when discussed in the context of remote work. Firms rarely state if innovation refers to fewer new products being produced, fewer new ideas being generated, diminishing revenue from new products, or something else. Firms also rarely provide insight into what types of work are most affected by innovation; they claim innovation as a whole is harmed by remote work as opposed to specific groups of people, departments, or tasks.

Firms have incentives to be cryptic in their discussions of remote work and innovation. Understandably, firms are hesitant to release details about their reasoning because they could

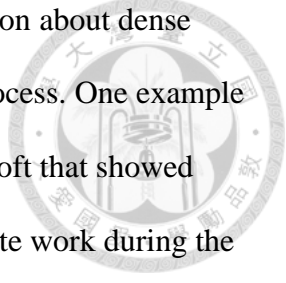
open themselves to significant backlash if they claim that sensitive demographics such as age, gender, or race are less innovative. Another reason for releasing limited innovation data is firms do not want to give more information than necessary to competitors. Indeed, firms with cautious CEOs tend to encourage more innovation while at the same time disclosing less of their firm's innovation activity (Reeb, 2017). These factors make it difficult for researchers to ascertain why it is broadly believed that remote work curbs innovation. To my knowledge, there are no published research studies on this subject.

When executives provide insight into their reasoning behind why innovation inhibits remote work, their views generally align with the drivers of innovation literature. Apple CEO Tim Cook used such reasoning when he said in a 2021 interview (Reuter, 2021):

My gut says that, for us, it's still very important to physically be in touch with one another because collaboration isn't always a planned activity. Innovation isn't always a planned activity. It's bumping into each other over the course of the day and advancing an idea that you just had. And you really need to be together to do that.

Similarly, Chase CEO Jamie Dimon stated remote work “doesn't work for spontaneous idea generation” (Reuter, 2021) because brainstorming is more difficult virtually, which echoes the findings of Bruck and Levav (2022). They do not provide hard numbers or detailed reasoning behind their beliefs, but it seems that Cook, Dimon, and other executives are drawing from the drivers of innovation literature when they say reduced collaboration, communication, and serendipitous encounters lead to reduced innovation.

Besides firms and executives, writers at media outlets such as newspapers, magazines, and blogs influence the broader discussion about remote work and innovation. Much of their writing about remote work and innovation involves reporting on the actions and policies of



companies or summarizing new research. While they disseminate information about dense academic articles in an easily digestible form, nuance is often lost in the process. One example can be seen in how media outlets covered a study commissioned by Microsoft that showed collaboration decreased and networks shrank when workers shifted to remote work during the pandemic (Yang et al., 2021). An *Inc.* (2022) article declared “Remote work threatens long-term innovation” in its headline, a *ZDNet* piece (2021) was headlined “Remote work is making productivity and innovation harder, says Microsoft study”, and a *Forbes* article (2022) concluded with “Siloed work. Less collaboration. Stunted creativity. Fewer innovations.” The authors of the Microsoft article, however, did not make such claims, stating “although we believe that changes to workers’ communication networks and media will affect productivity and innovation, *we were unable to measure these outcomes directly* [emphasis added]” (Yang et al., 2021). Media outlets draw from the drivers of innovation literature, but they sometimes overstate the findings of this literature. This can in turn influence the thinking of managers and executives (Hirsch, 2022).

The drivers of innovation literature, firms, and media outlets generally agree that remote work should negatively impact innovation, but firms and media outlets tend to be vaguer in their discussion of who is affected and the extent of these effects. Possible reasons for how the results of this study differ from the common understanding of remote work and innovation are discussed below.

Innovative work behavior is only one of many ways to study innovation. Though it has been validated and shown to correlate with measurable innovation outputs (De Bruin & Steyn, 2019; Lin & Lee, 2017; Scott & Bruce, 1994), in certain cases the two forms of innovation could deviate. The newness and uncertainty of the pandemic present a challenge for research, including this study, because we simply do not know how the stress it caused influences other factors. It is

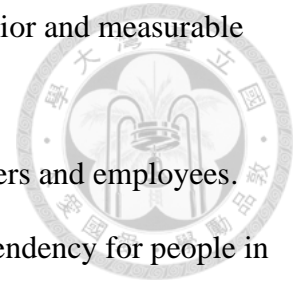
possible that the conditions of the pandemic caused innovative work behavior and measurable innovation outputs to deviate for some reason.

Another possibility comes from the differing perceptions of managers and employees. Remote and hybrid workers are likely to suffer from proximity bias, “the tendency for people in positions of authority to show favoritism or give preferential treatment to employees who are closest to them physically” (Hirsch, 2022). Remote work can limit managers’ ability to accurately measure employee performance because they cannot directly observe what employees are doing (Hill et al., 2003). Likewise, the lack of face-to-face contact with managers leads to remote workers being promoted less frequently than their in-office counterparts, even after controlling for objective performance measures (Bloom et al., 2015). Though proximity bias has not been looked at in the context of remote work and innovation, there is a good chance that this bias impairs managers’ and executives’ ability to judge employees’ innovativeness. The difference between self-reported innovation and manager or executive-reported innovation could explain the difference between this study’s findings and the broader discussion about innovation and remote work.

This study takes an exploratory step towards understanding the connection between remote work and innovation. It presents evidence that this connection is positive, which runs contrary to what is often discussed by firms and media outlets. Future studies could expand on these findings to discover factors that drive innovation in remote settings.

5.3 Limitations

Though this paper expands the current understanding of the effects of remote work on innovation, several limitations should be considered. First, the survey was distributed using online questionnaires. While this is a convenient way to collect a large amount of data in a short



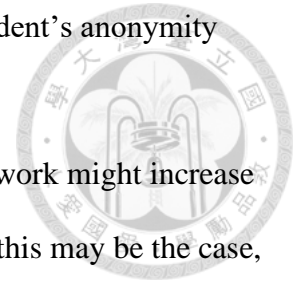
amount of time, this non-random approach also means it may be difficult to extrapolate results outside of this context. Second, the use of a longitudinal study would have been the ideal study design method to capture participants' innovative work behavior at various points of time and in different working environments. Due to time constraints, a cross-sectional survey design was used, which allowed for a large number of responses to be collected in a limited amount of time (Creswell, 2002), but also required participants to remember their innovativeness at different points in time. Faulty memory could lead to inaccurate results.

Though Scott and Bruce's innovative work behavior scale (Scott & Bruce, 1994) has been found to be reliable and valid in many different fields (Binyamin et al., 2018; De Bruin & Steyn, 2019; Lin & Lee, 2017; Sun & Huang, 2019), it has been primarily been used to measure innovative work behavior in the office. As such, it has not been specifically validated for remote settings, which could lead to inaccurate results. Given that remote work is now a common occurrence, future studies could validate innovative work behavior scales for remote work.

The sample size was sufficient to answer two out of three of the hypotheses at a statistically significant level, but a larger sample size would be able to provide results with greater power. The sample was close to being representative in terms of common demographics like age, gender, and level of education, but this study did not obtain a representative sample across industries and functional areas of work.

Collecting data via self-reports has the potential to obtain biased results. People are most likely to respond in a biased manner when survey instruments inquire about controversial subjects (Creswell, 2002) or feel their responses may lead to negative consequences for themselves. These two concerns were limited through the use of a topic that is not

psychologically controversial and by providing a guarantee of each respondent's anonymity (Muijs, 2004).



Finally, the survey design of this study cannot answer why remote work might increase innovativeness. The current literature does not offer many clues as to why this may be the case, so further research into the drivers of this connection is needed.

5.4 Areas for Future Research

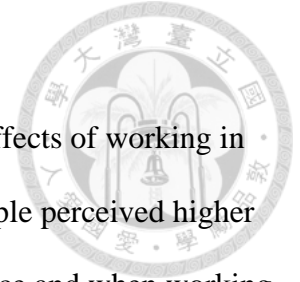
Now that remote work has become a part of the new normal, increased interest in the subject will hopefully lead to more resources available for research and more people interested in studying this area (George et al., 2020). Even in the short two years since the outbreak of the pandemic, there has been a growing scholarly interest in the connection between remote work and innovation, whether that be comparing remote work to office work (Nguyen-Duc et al., 2022) or testing which factors influence innovation while working remotely (Coun et al., 2021). Outside of published journal articles, another promising sign is research carried out for theses and dissertations (Albrecht & Hillenbrand, 2021; Bolick, 2020; Karachatzis & Parameshwarappa, 2021), which have been able to respond quickly to the changes brought upon by the pandemic. This paper falls into the same category; hopefully future studies build upon this work.

The findings of this study provide inspiration for several areas of future research. The relative increase in innovative work behavior as a result of working remotely during the pandemic implies that there is either a driver of innovation that is more prevalent in remote work than in the office or that people adapted their working style and habits to increase innovation. Using a qualitative or case study approach could help discover these remote innovation drivers. Our current understanding of drivers of innovation is based on in-person studies, so a

quantitative factor analysis method is unlikely to provide answers to why remote work increases innovation unless it used a very large amount of factors. Interviews or open-ended questions would thus be more effective. Indeed, if this study had more time and resources, it would have included open-ended questions in the survey to ascertain why people felt more or less innovative and if there was a pattern to their responses.

Additionally, using multiple measures of innovation would increase validity and potentially show the ways in which innovation differs between remote and office work. It is possible that remote work has a positive association with innovative work behavior but a negative association with other measures of innovation, such as number of patents or revenue from new products and services. For example, the study in which Scott and Bruce (1994) developed and validated the innovative work behavior scale was conducted on employees in the research and development department. When developing theories of innovativeness, beginning with research and development departments is a good choice because they tend to already track easily measurable metrics such as new products developed or patents and the employees have a shared goal of innovating new products. This approach was also used in a study of innovation at 3M (Brand, 1998). The work habits of employees with the most successful patents were studied and a working theory of innovative work habits was developed. A similar approach could be used with highly innovative employees in remote work settings. Based on the results of this study, it is expected that such a study would uncover drivers of innovation that differ from those in the office.

Chapter 6: Conclusion



This paper contributes to the existing literature that compares the effects of working in office, hybrid, and remote modes on innovation. The results show that people perceived higher levels of innovative work behavior when working remotely than in the office and when working remotely than in a hybrid model. Through a detailed literature review, this paper also provides an up-to-date definition of remote work, brings the concept of hybrid work into the innovation equation, and covers what the drivers of innovation in traditional work settings predict for remote work. The findings of this study show remote work can have a positive impact on innovativeness; hopefully researchers and practitioners will use and expand upon these findings to know more about individual innovation and choose the policies best suited to their goals.

Appendix A: Questionnaire

My name is Kyle Whitehouse, a master's student at National Taiwan University. I am conducting research for my thesis that explores perceptions of the effects of remote work on innovation. You are being asked to participate to share your views on working remotely in the United States over the past three years.

Your response may help us learn more about the connection between remote work and innovation. Your participation in this study is anonymous and all data collected will be strictly confidential. Any papers, reports, or publications that come from this research will only use group data and will not identify you or any individual as being part of this study.

Your participation in this study is completely voluntary. You can refuse to answer any question.

If you have any questions, please feel free to contact Kyle Whitehouse at R09749047@g.ntu.edu.tw.

Thank you for your time and willingness to participate in this study.

Sincerely,
Kyle Whitehouse

1. Have you lived or worked in the United States in the past three years?

- No
- Yes



The following questions ask about your industry, functional area, and length at current job

2. Years at Current How many years have you worked at your current organization/company?

▼Dropdown Menu 1 (1) ... Over 25 (25)

3. In which industry do you work? (select one)

- Construction
- Education
- Finance and Insurance
- Government
- Health Care and Social Assistance
- Information and Telecommunications
- Leisure and Hospitality
- Manufacturing
- Professional Services
- Real Estate
- Retail
- Transportation
- Utilities
- Other (please specify) _____

4, In which functional area do you work?

- Accounting
- Administration
- Customer Service
- Distribution
- Engineering
- Finance
- Human Resources
- Information Technology
- Legal
- Logistics
- Management
- Marketing
- Manufacturing
- Operations
- Procurement -Purchasing
- Production
- Research & Development
- Sales
- Other (please specify) _____



The following questions will ask about the work environments you have worked in over the past three years.

In this survey, remote work, also known as working from home or telecommuting, refers to doing your job from a location other than a central office operated by the employer.

Hybrid work refers to splitting time between remote and office work in a given week.

5. Office, Hybrid, Remo Over the past three years, in which of the following ways have you worked for at least one week? Select ALL that apply

- Full-time in the office (5 days a week)
- Hybrid (1-4 days in the office and the rest remotely)
- Full-time remote (5 days a week)

6-11. Remote IB In your experience working remotely full-time, to what extent have you:

	Not at all (1)	Very little (2)	Somewhat (3)	Quite a bit (4)	An exceptional degree (5)
searched out new technologies, processes, techniques, and/or product ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
generated creative ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
promoted and championed ideas to others?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
investigated and secured resources needed to implement new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
developed adequate plans and schedules for the implementation of new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
been innovative?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12-17. Hybrid IB In your experience working hybrid (1-4 days in the office and the rest remotely), to what extent have you:

	Not at all (1)	Very little (2)	Somewhat (3)	Quite a bit (4)	An exceptional degree (5)
searched out new technologies, processes, techniques, and/or product ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
generated creative ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
promoted and championed ideas to others?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
investigated and secured resources needed to implement new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
developed adequate plans and schedules for the implementation of new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
been innovative?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

18-23. In your experience working in the office full-time, to what extent have you:

	Not at all (1)	Very little (2)	Somewhat (3)	Quite a bit (4)	An exceptional degree (5)
searched out new technologies, processes, techniques, and/or product ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
generated creative ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
promoted and championed ideas to others?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
investigated and secured resources needed to implement new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
developed adequate plans and schedules for the implementation of new ideas?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
been innovative?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questions ask about the frequency you worked in different working environments.

24. In total, how long have you worked remotely full-time over the past three years?

- Less than 1 month
- 1-3 months
- 4-6 months
- 7-9 months
- Over 9 months

25. In total, how long have you worked hybrid (1-4 days in the office and the rest remotely) full-time over the past three years?

- Less than 1 month
- 1-3 months
- 4-6 months
- 7-9 months
- Over 9 months



26. In total, how long have you worked in the office full-time over the past three years?

- Less than 1 month
- 1-3 months
- 4-6 months
- 7-9 months
- Over 9 months

27. Current Which best describes your current work environment?

- Full-time in the office (5 days a week)
- Hybrid (1-4 days in the office and the rest remotely)
- Full-time remote (5 days a week)

The following questions ask about demographic information. All survey responses will be kept confidential and this information will not be used to identify individuals.

28 What is your age (years)?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- Over 65
- Prefer not to say

29. What is your gender?

- Female
- Male
- Other (please specify)
- Prefer not to say

30. What is your ethnicity?

- Asian / Pacific Islander
- Black or African American
- Hispanic or Latino
- Native American or American Indian
- White
- Other (please specify) _____
- Prefer not to say

31. What is the highest degree or level of school you have completed?

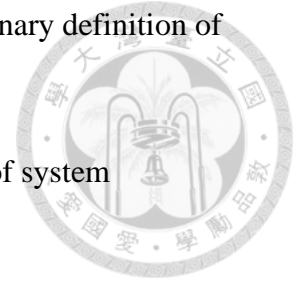
- Less than a high school diploma
- High school degree or equivalent
- Bachelor's degree (e.g. BA, BS)
- Master's degree (e.g. MA, MS, MEd)
- Doctorate (e.g. PhD, EdD)
- Other (please specify)
- Prefer not to say



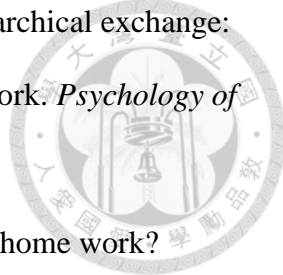
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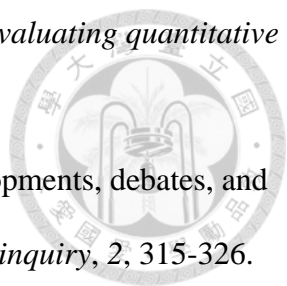
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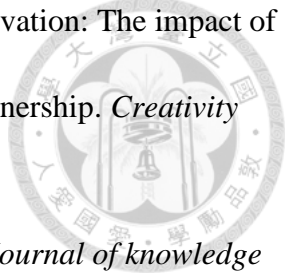
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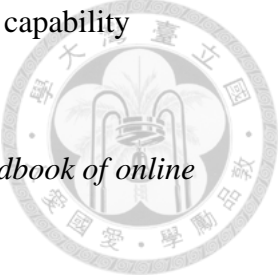
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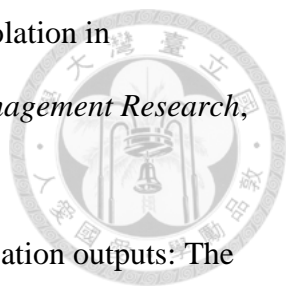
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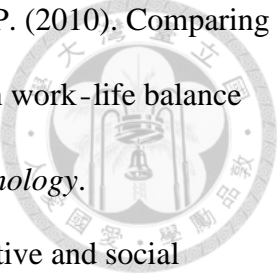
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