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IZA DP No. 18020

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ABSTRACT

Determinants and Effects of Remote Work Arrangements: Evidence from an Employer Survey

Remote work arrangements are compelling examples of an organization's ability to utilize digital technology. This study analyzes data from a representative survey of Atlantic Canadian employers to evaluate three phenomena: how remote work evolved during the recent COVID-19 pandemic; the factors influencing these changes; and the impact of these changes on business outcomes. Our findings suggest that urban firms, technologically advanced companies in certain highly skilled industries, and firms offering greater flexibility for remote work were most likely to enhance remote work practices during the pandemic. For the average firm, an increase in the share of remote work correlated with higher organizational productivity, improved employee performance, and greater new product/service innovation. The primary downside was heightened management complexity. Variations were observed along industry and provincial lines.

JEL Classification: J22, J24, J28

Keywords: remote work, Canada, Atlantic provinces, COVID-19, digital technology usage, technology-organization-environment (TOE) framework

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Introduction

Remote work arrangements represent an increasingly important workplace practice that has recently proliferated due to the COVID-19 pandemic (Mariani et al., 2023). Many studies provide positive perspectives of remote working arrangements that hint at technology's long-term significance past the forced adoption due to COVID-19. For example, while remote work commonly scrambles work and non-work hours and directly influences employee work-life balance (Carillo et al., 2021), many employees perceive remote work flexibility as a strong indicator of an organization's commitment to employee well-being (Greenberg & Landry, 2011; Shockley & Allen, 2012), which positively influences job satisfaction (Ferreira et al., 2021; Shockley & Allen, 2010). Indeed, recent research suggests that remote workers in Canada prefer to work from a distance all or most of the time, and about three-quarters had been given the option by their employers to work remotely (Lowe & Hughes, 2023).

Aside from the benefits associated with remote work that contribute to its significant place in the wider context of work, remote work adoption requires detailed examination because of its relation to the growing field of research on the organizational capacity for change (see Judge & Douglas, 2009; Soparnot, 2011). Remote work is also at an early stage of widespread adoption, so its effects, methods of management, and its appropriate use are all deserving of further academic inquiry. This study contributes to this further inquiry by analyzing the increase of a firm's share of remote work relative to broader technological, organizational, and environmental considerations. This study, therefore, employs the Technology-Organization-Environment (TOE) framework to develop hypotheses of the increase in the share of remote work relative to a firm's technological context, organizational context, and environmental context. We differentiate between remote work, defined as telework or working from home

outside of a traditional office or fixed work site, and the increase in the share of that remote work. This delineation allows a more focused analysis of the technological, organizational, and environmental contexts that influence management decisions regarding increasing the share of remote work arrangements during and post-COVID-19 pandemic. This distinction also helps control remote work arrangements that existed before the emergence of the COVID-19 pandemic.

Based on our representative survey of employers in Atlantic Canada conducted in early-mid 2022, this study furthers our understanding of changes in the share of remote work over the course of the pandemic, as well as the determinants of such changes and their impact on business outcomes. This focus on Atlantic Canada has broader implications because it is a cluster of generally less developed provinces compared to other provinces. Its lower cost of housing has led to people relocating to the region to take advantage of working from home. As stated by Smith (2022) about Atlantic Canada: "The pandemic and its lasting impacts—like more people working remotely and the desire for more living and outdoor space—surely amplified its appeal. A big draw of Atlantic Canada is how affordable real estate is in relation to some of the country's most populous cities. This was even more true amid the pandemic when Canadian home prices skyrocketed in already expensive parts of the country where demand surged but supply was low".

Theoretical Background: An Application of the TOE Framework to Remote Work

The TOE framework is a well-established model used to understand the factors that influence a firm's adoption of new technologies (Nguyen et al., 2022). It identifies three core dimensions: technological factors (e.g., perceived benefits, compatibility, complexity), organizational factors (e.g., firm size, human resources, managerial structure), and environmental

factors (e.g., industry characteristics, regulatory environment, competitive pressure). Traditionally, the TOE framework focuses on the likelihood of initial technology adoption, but it can be extended to account for a broader range of technology engagement decisions, including acceleration in use, deceleration, and eventual termination. This broader scope allows for the inclusion of strategic decision-making and employer–employee dynamics as determinants that shape how firms evolve their use of technology over time.

Thus, this extended TOE framework provides a useful lens for examining how firms adopt and expand remote work practices in response to digital transformation (see Figure 1). Each of the hypotheses below aligns with specific elements of the TOE model, linking technological readiness, organizational capacity, and environmental context to the increasing prevalence of remote work. Importantly, we draw empirical evidence from organizational and strategic management literature to support our hypotheses.

Insert Figure 1 about here

Technological (use of technology and digitization)

The TOE posits that technological factors are the main driver of adoption, thereby suggesting that firms already employing advanced digital technologies are more likely to have the infrastructure, tools, and human capital needed to expand remote work. These capabilities include digital competence, technological complementarities, openness to innovation, and digitization.

Digitization is the use of digital technologies to change existing business processes (Li et al., 2016). Specifically, remote work arrangements are a form of digitization through the integration of information and communication technologies (Lee et al., 2021). Digitization routinely spurs innovativeness, or the openness to new ideas and creative processes (Kirton,

2004; Tajeddini, 2010; Kallmuenzer & Peters, 2018). Innovation may materialize, for example, through newly discovered operational efficiencies (Mendling & Brocke, 2018), or through new and improved products and services. Many studies also suggest that innovativeness through digitization and prior technological experience is a strong determinant of subsequent technological adoption decisions (Alshamaila & Papagiannidis, 2013; Giunta & Trivieri, 2007). This study therefore hypothesizes that a firm's use of automation technology and the digitization of business processes is positively related to the increase in the share of a firm's remote work arrangements.

H1: *A firm's use of automation technology and the digitization of business processes/operations is positively related to the increase in the share of a firm's remote work arrangements.*

Organizational (sector)

High-skill sectors often involve knowledge-intensive, computer-based tasks that are more easily transitioned to remote settings. Digital innovation and uptake require a thorough understanding of the digital domain, expertise in available technologies, and familiarity with the value-creation opportunities of digital technologies on the part of the workforce (Yoo et al., 2010). In other words, digital technologies require technological/digital competence (Ng et al., 2022) to be productive. Most often, those workers with above-average IT skills and a high degree of autonomy who have been exposed to new technologies and abstract tasks are most likely to be successful remote workers (Ishii et al., 2023; Offstein et al., 2010). Ultimately, firms with high levels of human capital will be more likely to both adopt ICTs and use ICTs effectively (Giotopoulos et al., 2017). Firms with experience in using advanced digital technologies are likely to possess capabilities that facilitate the implementation and expansion of

remote work, including substantial human capital with high levels of digital competence and skills. As such, applying TOE suggests that these types of sectors attract and retain digitally skilled talent. This study, therefore, hypothesizes that firms in higher-skilled sectors will have a higher increase in the share of remote work.

H2: *Firms in higher-skilled sectors will have a higher increase in the share of remote work.*

Furthermore, applying TOE would suggest that larger firms typically have more financial and technological resources, better economies of scale, and a workforce structure that includes more roles conducive to remote work. In contrast, human capital deficiencies impede ICT adoption, especially among small and medium-sized enterprises (Yap et al., 1992; Giotopoulos et al., 2017). IT adoption and investment may be particularly strenuous for SMEs because of resource constraints relative to large organizations, usually due to the high fixed cost of IT equipment and infrastructure and the investment risk of long-term commitment (Ghobakhloo et al., 2011; Alshamaila et al., 2013). This study, therefore, hypothesizes that larger firms will have a higher increase in the share of remote work than smaller firms

H3: *Larger firms will have a higher increase in the share of remote work than smaller firms.*

Environmental (urban firms)

The geography of remote work, however, is shaped by an inherently uneven spatial distribution of skills, human capital, and opportunity (Braesemann et al., 2022). In Atlantic Canada, the potential of remote work in rural areas is inhibited by the relative lack of broadband internet access in some areas. Firms in rural areas are also faced with smaller markets, smaller pools of labor, and fewer support structures, so investing in the ICT infrastructure required to

support remote work may be difficult. While there is uneven access to high-speed internet between rural and urban areas (Davies, 2021), the urban-rural divide is also a result of factors other than internet service availability and economic structures, most notably socioeconomic factors like income, education, and sector of employment (Whitacre & Mills, 2007)

According to TOE, urban firms will likely benefit from superior internet infrastructure, access to digital labor markets, and greater exposure to peer practices, all of which facilitate remote work adoption. In contrast, rural firms may be more constrained by sectoral demands (e.g., agriculture, tourism) and infrastructure limitations.

H4: *Urban firms will have a higher increase in the share of remote work than will rural firms.*

Effects of an Increased Share of Remote Work: Strategic/Performance Implications

Beyond adoption, the increased share of remote work has implications for organizational outcomes. As remote work has become practically relevant, researchers of several disciplines are trying to come up with different roadmaps for conducting in-depth studies of flexible working practices, especially in the context of remote work (Chebbi et al., 2015, Chatterjee et al., 2020, Mariani et al., 2021)

By applying research on strategic choice to the context of remote work adoption and emerging return-to-office policies, this study contributes to this theoretical development by extending TOE by considering not only technological, organizational, and environmental characteristics as determining technological adoption (reaction), but also as initiating effect-based strategic choices (pro-action) to accelerate, decelerate, or terminate remote working.

Examining the determinants and effects of remote work adoption with strategic choice considerations allows a more refined examination of organizational change as an interaction not

only between firm and exogenous external shock (COVID-19 pandemic) but also between its internal constraints (human resources, skill, financial capital) and its competitive environment (such as competition for profits, competition for labour and talent). In doing so, we extend the TOE framework to hypothesize the strategic/performance implications for several outcomes based on the increase in the share of remote work.

Employee performance and organizational productivity. The existing literature on remote work's effects on employee performance and organizational productivity finds vast differences, generally reflective of contextual factors. Those who report positive changes in productivity as a result of remote work point to improvements in individual worker performance at home rather than on business premises (see Barrero et al., 2021; Bloom et al., 2015; Morikawa, 2023; Toscano & Zappala, 2021). Negative effects are also evident according to possible factors, such as the difficulty of adequately reconciling private work commitments due to a lack of a suitable workspace (Schieman et al., 2021) and a lack of sufficient communication leading to redundant work (Al-Habaibeh et al., 2021). A recent comprehensive review finds no effect from hybrid work, but negative effects of remote work on productivity ranging from -30% to +13%, with an average effect of -10% (Bloom, 2024). This study, therefore, hypothesizes that an increase in the share of remote work is associated with a slightly negative impact on employee performance and organizational productivity.

H5. *An increase in the share of remote work is associated with a slightly negative impact on (a) employee performance and (b) organizational productivity.*

Innovation. While remote work enables long-distance collaboration, it may limit the in-person interactions that foster creativity, especially in the early stages of innovation. Similarly, recent research suggests that the most significant challenge faced when working from home is

the lack of face-to-face communication and eye contact (Al Habaibeh et al., 2021). Moreover, in-person interactions are especially important in the early stages of the innovation process (Barrero et al., 2023). Gibson et al. (2023) similarly find that employers were most concerned with the consequences of working remotely on collaboration, culture, and in-person communication, all of which contribute to innovation. This study, therefore, hypothesizes that an increase in the share of remote work is associated with a decrease in innovation.

H6. *An increase in the share of remote work is associated with a decrease in innovation.*

Talent/retention. Remote work is a valued employee benefit that may enhance employer competitiveness in talent markets. Innovation and creativity are also dependent upon the engagement of highly-skilled personnel. As employers continually redefine their talent attraction and retention strategies amidst the increasing competition and turmoil of the post-COVID-19 context (Chatterjee et al., 2022), the adoption and increase of remote work opportunities has emerged as one strategy through which employers can retain and attract highly-skilled employees. Bloom (2024) highlights that the average employee values two to three days of working from home as equal to an 8% increase in pay on average. Fuller and Kerr (2022) found that amongst 10,000 American workers, 36% reported that they would search for a job alternative if not offered a hybrid or remote work option. This study, therefore, hypothesizes that an increase in the share of remote work is associated with increased talent attraction and retention.

H7. *An increase in the share of remote work is associated with increased (a) talent attraction and (b) retention.*

Management complexity. Managing a dispersed workforce likely involves increased management complexity. For instance, managing remote employees often requires new resources

(i.e., practices and tools for communication). Empirical evidence of Canada's public sector suggests that as remote work increases, organizations must manage not just geographically dispersed teams, but also variation in how support resources influence employee outcomes (Harrison and Halinski, 2020), a key marker of growing managerial complexity.

The intensifying competition for talent is especially important in the context of remote work because highly-skilled employees are often self-leading individuals who set self-standards for work engagement and regulate their motivation (Kotzé, 2018; Harunavamwe et al., 2020). These workers are rare exceptions. The turn to remote management and coordination of employees has been demonstrated to create increasing strains on costly managerial workloads, resulting in increased managerial complexity and operational costs on coordinating employees for collaborative efforts and monitoring progress, creating spaces for socialization and team building, enhancing streams of support and encouragement, and communicating more often to build a virtual culture of trust (Krehl & Büttgen, 2022). Research demonstrates that managers especially shoulder the burden of increased communication demands in remote work contexts. As project complexity increases, so does the level of required communication and its associated costs (Kermanshachi et al., 2016). Mediating these programs virtually often creates a lack understanding of the problem and its solution that the team is working on (Evans & Moodley, 2024); impedes the correct identification of goals and objectives (Krehl & Büttgen, 2022); leads to feelings of 'technostress' (Bauwens et al., 2022; Spagnoli, 2020); and damages the psychological contract between employer and employee (Heath et al., 2024). This paper, therefore, hypothesizes that an increase in the share of remote work is associated with an increase in management complexity and operational costs.

H8. *An increase in the share of remote work is associated with increased management complexity.*

H9. *An increase in the share of remote work is associated with increased operational costs.*

Methods

Data and Procedure

This paper uses data from a representative survey of 805 employers in the Canadian provinces of Newfoundland and Labrador (NL), Nova Scotia (NS), Prince Edward Island (PEI), and New Brunswick (NB). These provinces are collectively known as Atlantic Canada, located in the easternmost region of Canada. The survey was conducted between April and May 2022 for a project aiming to assess the effects of the COVID-19 pandemic on Atlantic Canadian business operations, workplace practices, and labor market dynamics. To yield a more representative sample of employers in the region, the survey sample was stratified along the lines of industry, rural/urban location, and firm size. The survey was conducted via phone to increase efficiency while minimizing the social desirability bias that can be particularly prevalent during in-person surveys. Respondents were either CEOs or owners of the business for smaller organizations, and human resource directors/managers or directors/managers in charge of hiring for medium to large organizations. A double-blind ethics review committee at Memorial University of Newfoundland approved the survey methodology.

Results

Table 1 presents descriptive statistics giving the average percentage of the workforce by industry working remotely at three different points in time for the firms in our survey: 1) pre-pandemic; 2) peak-pandemic during March 11-end of May 2020; and 3) post-pandemic as of March 2022, when the pandemic was in a later stage. The industry categories are broad to provide sufficient sample sizes of firms in each industry.

Table 1 approximately here

Table 1 indicates that before the pandemic, 5.6% of the workforce worked remotely, with wide variation ranging from a low of 2.6% in the service sector where in-person services and an on-site presence are generally required, to a high of 10% in technical and professional services involving knowledge-based work that can be facilitated by information and communications technology so that remote work is more feasible. At the peak of the pandemic, this increased dramatically, generally to about four-fold, to 21.9% of the workforce working remotely, with the ranking by industry remaining exactly the same. In the post-peak period of March 2022, the percentage of the workforce working remotely fell to 8.5%, but still higher than the pre-pandemic norm but lower than the peak. The rankings remained similar, highlighting that there is general stability in the feasibility of remote working by industry. This general picture lines up with data from American studies (e.g., Barrero et al., 2023; Bloom 2024).

Interestingly, the share of the post-covid remote work is lower than pre-covid in the natural resource industry. Natural resource industry may not be well suited for remote work because of the nature of jobs and tasks, which need to perform on site as required by production process. Workers in high-skill, knowledge-intensive industries are more likely to work remotely than those in certain lower-skill, client-facing service industries such as accommodation and food services (Saba et al., 2021) because of the nature of their jobs and tasks. The existing

literature on digital transformation is therefore primarily informed through research on the finance, marketing, and innovation management streams (Hausberg et al., 2019). This research trend aligns with the feasibility of remote work by industry. The natural resource industry sector had a low percentage of remote workers prior to COVID (6%, column 1), which shot up due to the shock effects (14.9%, column 2, but was still the lowest percentage increase cross all industries, 147.8%, column 4) but declined to even lower than pre-covid level (3.8%, column 3). We contend this exception was mainly driven by the nature of the production process and the nature of jobs and tasks in this sector.

Some of the stickiness whereby remote work did not fall close to its pre-pandemic level likely reflects the fact that although the pandemic was waning it was not over by March 2022. But much of the stickiness also likely reflects strategic choices made by firms and individuals. Firms often saw strategic benefits in terms of recruiting and retention of talent, as well as savings in office space. Employers had concerns that remote work could stifle innovation, collaboration, company culture, and the need for in-person communication (Gibson et al., 2023). This highlights a need for changing management skill sets and changes in communication practices, employee evaluation techniques, and other workplace practices in order to support remote work (Barrero et al., 2023). These changes may lead to opposition among managers because of uncertainty and potential difficulties regarding how to manage a remote or hybrid workforce as well as the possible loss of their prestige and relevance.

Reversions towards the pre-pandemic norm may also reflect the preferences of workers. Some may miss the camaraderie and personal interactions of the workplace. Lack of facetime with managers may inhibit promotion opportunities. Working from home can facilitate work-life balance for some, but also more conflict for others with respect to household tasks and

distractions as well as the ability to disengage from work and avoid work-related communications outside of working hours. Individuals acquired and learned to use Zoom and other technology and expertise to work remotely, and such technology was quickly supplied by the market. Individuals experienced the benefits of flexibility and reduced commuting and often did not want to return to normal. Many had moved from city centers to surrounding areas with cheaper housing and did not want to engage in a long commute.

In essence, strategic decisions on the part of firms, managers, and workers can be important in explaining both the increase in the share of remote work during the early phases of the pandemic as well as its stickiness post-pandemic, but reversion back towards the pre-pandemic norm. These strategic choices will also inform our discussion of the next two factors that are the focus of our analysis: determinants of remote work; and their effects on business outcomes.

Determinants of Changes in Remote Work

Table 2A contains the means (first column) for the variables used as the determinants of changes between pre-pandemic and peak-pandemic in the percentage of workers doing remote work. The second column gives the Tobit coefficients showing the effect of each explanatory variable on that change, and the third column gives the standard errors of the coefficients.

Insert Table 2A approximately here

As indicated in the table sub-head, the average percentage increase of a firm's workforce that was working remotely between pre-pandemic and peak-pandemic was 16.8 percentage points. As indicated in the means of the first column, only 12.3% of firms stated that they used automation technology at the time of the survey, with a larger percentage (31.3%) digitalizing

core business operations and/or processes because of the pandemic. More flexibility to work remotely during the pandemic was allowed by 22.2% of firms.

Test of Hypotheses 1-4

The remaining variables in Table 2A concerning basic organizational characteristics are largely reflective of the distribution of firms throughout Atlantic Canada, which are quite similar to the breakdown of firm characteristics in Canada as a whole.

As indicated by the Tobit coefficients, the use of automation technology on the part of firms does not appear to have a significant effect on changes in the extent of remote work between pre-pandemic and the peak of the pandemic. However, digitalizing core business operations and/or processes because of the pandemic does accommodate an increase in the extent of remote work. This suggests that the more specific technological use of digitization accommodates remote work, while the more general-purpose technology of automation does not have an effect.

Thus, hypothesis H1, that technological usage correlates with changes in remote work usage, is weakly supported in that only digitization is associated (and only weakly so at the 0.10 level), while general-purpose automation is not associated with changes in remote work
In contrast to the weak effects of technology, firms that allowed more flexibility in remote work have substantially larger effects on increases in the percentage of the workforce that worked remotely between pre- and peak-pandemic, and the effect is statistically significant at the 0.01 level.

Organization size is not significantly related to the increase in remote work between pre- and peak-pandemic, after controlling for the effect of other determinants. Thus, our third hypothesis H3- that larger firms will be more likely to increase remote work is not supported.

Urban organizations are more likely to have allowed remote work during the pandemic than their rural counterparts, albeit the effect is significant only at the 0.10 level. These results weakly confirm our H4 hypothesis, that urban firms, having easier access to technology and facing different market characteristics, are more likely to foster remote work practices. Urban areas were also usually affected more severely by COVID-19 because of their greater concentration of population, experiencing a more pronounced exogenous impact. Our other location variable, the province of operation, does not reach the significance threshold.

Relative to the reference group of the service sector which requires personal interaction, firms in every other industry allowed a greater rate of remote working, albeit the effects are statistically significant only for the technical and professional services sector and the public and educational services sector. These sectors are likely to have the knowledge-based skills required for remote work, and for the education sector, it was necessitated by school closings and accommodated by the availability of computers. The same applies to public (government and non-profit) organizations, many of which were also closed to the public, and which are much more likely to allow remote work than private employers.

The results by industry and by the public/private sector largely align with our H2 hypothesis, that organizations in high-skill industries where work is frequently knowledge-based and completed on computers are more likely to increase remote work intensity.

Table 2B reported the results for the remote work Tobit model for determinants of change in remote work from Peak-Covid to Post-Covid. As expected, the positive coefficients turned negative but remained statistically significant, implying remote work reversed to normal prior to the Covid, and so did the determinants of change in the percentage of remote workers.

Insert Table 2B approximately here

Test of Hypotheses 5-9

The third tranche of our analysis focuses on the effect of an increase in the share of remote work on organizational outcomes based on the subsample of firms where some employees worked remotely.

The first six of the eight outcomes in Table 3 are positive or desirable from an organization's perspective, and the last on management complexity and operational costs are negative or undesirable if they increase.

As indicated by the mean values in the top row of Table 3, the rankings for the proportions of firms that indicated positive effects on the outcomes ranged from 25.7% for the increase in product improvement of innovation, 24% for the increase in new product innovation, 21.4% for improved employee performance, 21% for organizational productivity, 15.5% for talent retention, and 11.6% for talent attraction. The largest effects, however, were for the negative outcomes where 38.9% of firms said that the pandemic increased management complexity, and 27.4% indicated that it increased operational costs.

Insert Table 3 approximately here

For each of the eight outcomes, the table entries in Table 3 give the marginal effects from a Probit regression on each binary-coded dependent variable indicating whether the outcome increased or increased greatly vs. whether it did not change or decreased or decreased greatly as given by a five-point Likert scale (hereafter referred to simply as the outcome increased). A hypothesis on the expected effect of remote work on these outcomes was outlined previously in Section 3 on hypothesis development. Our key independent variable is the increase in the percentage of the workforce working remotely between pre-Covid and peak-Covid (mean =

0.168). The other variables are the same as those in Table 2 with different numbers of observations due to the different number of complete responses.

For the outcomes where increases are desirable for the firm, the increase in the percentage of the workforce working remotely between pre-Covid and peak-Covid had a positive effect on employee performance and organizational productivity outcomes, albeit it was statistically significant only for organizational productivity. These reject our hypothesis H5, which predicted declines in performance and productivity. Increases in working remotely had a statistically significant effect on increasing new product innovation but not improved product innovation for existing products. These reject our hypothesis H6, which predicted declines in innovation from increases in remote work. Increases in working remotely had no effect on talent attraction and retention, rejecting our hypothesis H7 which predicted improvements in such outcomes.

The increase in remote working had a statistically significant effect on the undesirable outcome of increasing managerial complexity, which is likely to occur immediately, providing support for our hypothesis H8. Similarly, an increase in the share of remote work is associated with increases in operational costs, but the coefficient is not statistically significant. Our hypothesis H9 is not supported.

Overall, increases in remote work over the initial stages of the pandemic increased employee performance, organizational productivity, and new product innovation. However, it had no effect on increasing talent attraction and retention. These came at the expense of greater increases in managerial complexity and operational costs. Clearly, difficult tradeoffs are involved.

As indicated in the second row, providing more flexibility to do remote work did have positive and statistically significant effects on increases in employee performance as well as innovation in new products and product improvements or talent attraction. As outlined previously, these came at the expense of increases in managerial flexibility and operation costs associated with providing such flexibility.

Most of the other control variables have effects that are not statistically significant in affecting the organizational outcomes, although there are notable exceptions. Use of automation technology reduced management complexity presumably by reducing the issues management had to deal with when tasks are automated. Digitizing core operations increased organizational productivity, innovation, and talent retention, but at the expense of increased management complexity. Large firms are associated with greater management complexity, and urban firms with lower operating costs. There is no systematic pattern of effects across sectors or provinces, reflecting their different individual circumstances. For example, the natural resources industry is associated with increased management complexity since it requires an on-site presence. Similarly, the negative effect on talent retention for arts and culture can reflect the frustration of not being able to do in-person work during the pandemic. The large positive effect of remote work in talent attraction and retention for New Brunswick can reflect the importance of remote call-center work in that province given that bilingualism is prominent in that province and it is often required in call-centers.

Discussion

Drawing data from a survey of 805 employers located in the four Atlantic Canadian provinces that was conducted in mid-2022, our empirical evidence broadly supports the hypotheses on how changes in remote work arrangements during the COVID pandemic are

determined and how such changes affect employee performance and organizational productivity, based on the TOE framework.

Knowledge-based industries experienced a 3.5 to 4.5 times increase in the intensity of remote work during the COVID-19 pandemic. At the low end, industries reliant on in-person interaction experienced approximately 1.5 times increases in remote work from a lower pre-pandemic level. Knowledge-based industries diverged, however, in the extent of their pullback from remote working as the pandemic waned. Service-oriented industries where the core business is performed in-person, such as healthcare and social assistance and arts and cultural industries, were more likely to substantially pull back remote work arrangements after the pandemic shock than did knowledge-based industries such as technical and professional services, where much of the core work can be performed remotely and remote work can be used as a strategic function to attract and retain high-skilled talent even before the pandemic shock. The healthcare and social assistance and arts and cultural industries had a share of remote workers that was barely higher in March 2022 than it was pre-pandemic despite experiencing a large pandemic-induced remote work increase.

Technological usage exhibits an interesting relationship with remote work. In our Tobit models with the percentage change of remote workers in an organization as the dependent variable, these technological indicators are only sometimes statistically significant. Technologically advanced firms may have been more capable of supporting a larger share of remote workers during the pandemic.

Urban firms are somewhat more likely to allow more remote work than rural firms, likely due to structural economic and technological factors. Knowledge-based industries reliant on office work are likely driven by strategic consideration to accommodate remote work, while

public sector organizations (government and non-profit combined) allow more remote work, likely due to the strong influence of labor unions and lack of profit pressures.

Finally, we conducted Probit regressions with the reported effects of remote work on various organizational outcomes as dependent variables. Predictably, most firms surveyed reported an increase in remote work during the pandemic, although a small number reported a decrease or a stable non-zero level of remote work. The main negative effect for firms that increased their share of remote work during the pandemic is that they are more likely to report an increase in the complexity of management. However, firms that increased their share of remote work due to the exogenous COVID-19 shock are more likely to report increased organizational productivity, employee performance, and innovation in terms of new products/services. The overall impact of remote work therefore appears to be positive. Regarding general firm characteristics, rural firms experience increased operation costs as a result of remote work more frequently. Results sometimes differ by industry and province, but few strong patterns emerge.

Ultimately, differences in remote work outcomes are evident along the lines of technology, the organization, and the environment. Technology can smoothen the remote work transition; various organizational factors influence the remote work context; and the geographical environment of an organization has an impact as well. Future research should consider the linkages between the three parts of the TOE framework, the environmental aspect in particular, and the evolution of remote work as it becomes a more mature business practice.

Limitations

As our data is reliant on survey responses, social desirability bias is a possibility. We believe this is mitigated by several factors: a professional survey firm administered the survey; it was administered over the phone and anonymized to reduce social pressure; and respondents

were managers or executives with significant autonomy and knowledge of workplace practices such as remote work and organizational performance. Response error is another possible problem, although we anticipate it to be minimal for some of the aforementioned reasons, and we have no reason to believe that errors are distributed unevenly throughout the sample. As the data we use is cross-sectional, we are not in a position to claim causality, although we asked explicitly how changes in the percentage of remote workers affected various dimensions of organizational performance. Furthermore, the nature of our data precludes the examination of individual-level differences at the firm level (e.g., workforce composition and worker characteristics).

Practical Implications

This study provides practitioners and policymakers with details on what types of organizations adopt remote work, and what types of organizations tend to benefit from it. Within the specific context of our survey, remote work has several positive effects on average according to employers themselves, such as increasing organizational productivity, employee performance, and the creation of new products/services. The primary drawback of remote work is that management complexity increase. Remote work impacts firms heterogeneously according to our results, so there is no one-size-fits-all approach. Organizations will have to weigh the pros and cons in line with their particular characteristics and cultures. Some level of experimentation is encouraged, and it should be noted that remote work is still in an early stage of adoption for most firms. As such, the long-term antecedents and consequences of remote work are certainly worth further investigation.

Conclusion

Our data from a representative survey of Atlantic Canadian employers is used to evaluate three phenomena: how remote work evolved during the recent COVID-19 pandemic; the factors

influencing these changes; and the impact of these changes on business outcomes. Our findings suggest that urban firms, technologically advanced companies in certain highly skilled industries, and firms offering greater flexibility for remote work were most likely to enhance remote work practices during the pandemic. For the average firm, an increase in the share of remote work correlated with higher organizational productivity, improved employee performance, and greater new product/service innovation. The primary downside was heightened management complexity and increased operational costs. Variations were observed along industry and provincial lines.

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Figure 1. Determinants and Effects of Remote Work Arrangements

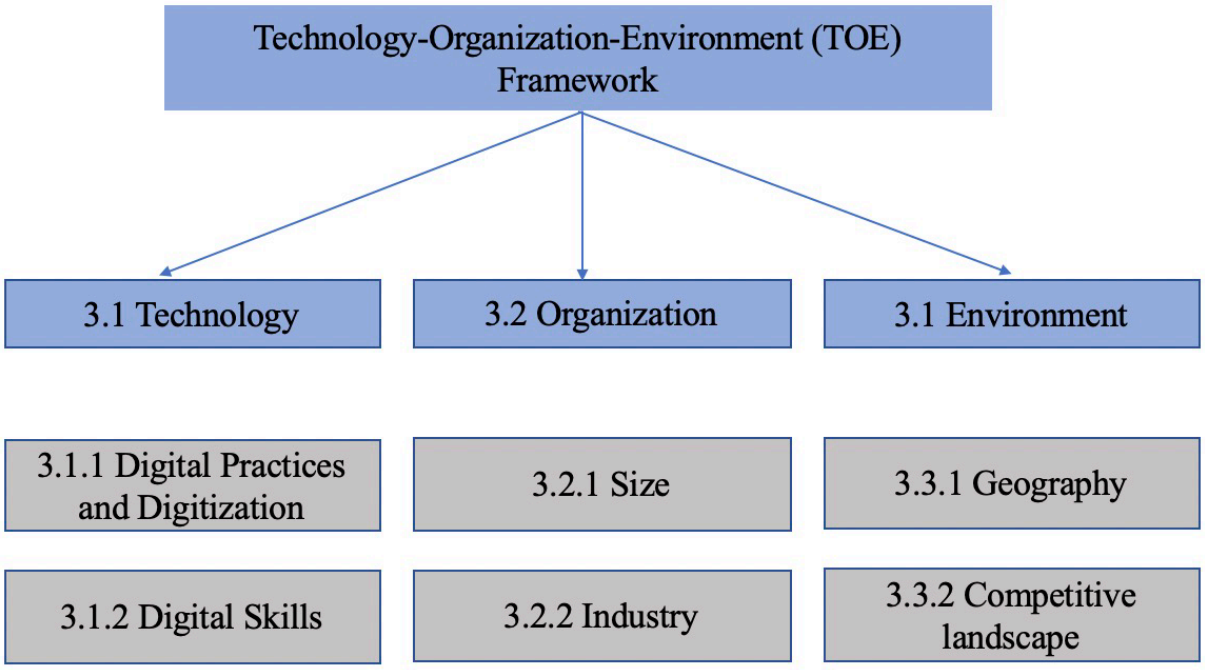

Table 1. Percent of Remote Workers Over Time, by Industry

Industry	Pre-Pandemic Mean %	Peak- Pandemic Mean %	Post- Pandemic Mean %	% Change Pre-Peak Pandemic	% Change Peak-Post Pandemic	% Change Pre-Post Pandemic
All Industries (n= 805)	5.6	21.9	8.5	291%	-61.2%	61.8%
Public & Education (n=100)	7.8	36.9	12.6	372.6%	-65.9%	61.1%
Healthcare & Social Assis (n=72)	5.6	26.9	6.0	382.5%	-77.8%	6.9%
Other (n=74)	4.4	14.9	8.8	236.6%	-41.0%	98.6%
Service Sector (n=241)	2.6	6.6	3.9	151.8%	-41.8%	46.6%
Arts & Cultural (n=32)	7.8	42.5	8.3	443.6%	-80.5%	6.0%
Technical & Professional (n=82)	10.0	46.6	16.6	366.1%	-64.3%	66.5%
Secondary Sector (n=171)	3.9	11.8	7.0	203.5%	-40.9%	79.2%
Natural Resources (n=33)	6.0	14.9	3.8	147.8%	-74.6%	-37.1%

Table 2A. Tobit Model for Determinants of Change in Remote Work Pre-Covid to Peak-Covid
(Dependent Variable= Change in Percentage of Remote Workforce Pre-to Peak-Covid, Mean=0.168)

Independent Variables	Mean	Coefficient	SE
Use automation technology	0.123	0.027	(0.033)
Digitize core business operations	0.313	0.046*	(0.024)
More flexibility to work remotely	0.222	0.252***	0.037
(Small firm) reference category	0.649		
Medium	0.275	-0.038	(0.025)
Large	0.076	-0.065	(0.041)
(Rural) reference category	0.410		
Urban	0.590	0.043*	(0.023)
(Service sector) reference category	0.300		
Natural resources production	0.038	0.047	(0.068)
Secondary sector	0.217	0.042	(0.030)
Arts & cultural industries	0.042	0.087	(0.097)
Public & educational services	0.127	0.123***	(0.035)
Healthcare & social assistance	0.087	0.052	(0.046)
Technical & Professional	0.104	0.273***	(0.047)
Other services	0.086	0.008	(0.035)

(Public sector) reference category	0.198		
Private sector	0.802	-0.288***	(0.040)
(Prince Edward Island) reference	0.121		
New Brunswick	0.243	-0.010	(0.033)
Newfoundland & Labrador	0.253	-0.031	(0.031)
Nova Scotia	0.383	0.022	(0.033)
Constant		-0.403**	(0.200)

N = 734, Significance level *0.1, **0.05, ***0.01, Pseudo $R^2 = 0.619$

Table 2B. Tobit Model for Determinants of Change in Remote Work Peak-Covid to Post-Covid
(Dependent Variable= Change in Percentage of Remote Workforce Peak-to Post-Covid, Mean=-0.133)

Independent Variables	Mean	Coefficient	SE
Use automation technology	0.123	0.032	(0.029)
Digitize core business operations	0.313	-0.060***	(0.022)
More flexibility to work remotely	0.222	-0.132***	(0.035)
(Small firm) reference category	0.649		
Medium	0.275	0.020	(0.027)
Large	0.076	0.012	(0.045)
(Rural) reference category	0.410		
Urban	0.590	-0.001	(0.023)
(Service sector) reference	0.300		
Natural resources production	0.038	-0.067	(0.046)
Secondary sector	0.217	-0.033	(0.025)
Arts & cultural industries	0.042	-0.117	(0.085)
Public & educational services	0.127	-0.104***	(0.038)
Healthcare & social assistance	0.087	-0.066	(0.051)
Technical & Professional	0.104	-0.203***	(0.041)
Other services	0.086	0.002	(0.032)

(Public sector) reference	0.198		
Private sector	0.802	0.266***	(0.037)
(Prince Edward Island) reference	0.121		
New Brunswick	0.243	0.026	(0.035)
Newfoundland & Labrador	0.253	0.034	(0.041)
Nova Scotia	0.383	0.022	(0.033)
Constant		-0.273***	(0.051)

N = 734, Significance level *0.1, **0.05, ***0.01, Pseudo R^2 = 0.443

Table 3. Probit Models for the Effect of Increases in Remote Work on Organizational Performance, Marginal Effects on the Probability of the Outcome Increasing or Increasing Greatly Vs. No Change or Decreasing or Decreasing Greatly, Pre-to Post-Covid

Independent Variables	(1) Employee perform (Mean.214)	(2) Organization productivity (mean.210)	(3) New product innovation (Mean.240)	(4) Improved product innovation (Mean.257)	(5) Talent attraction (mean.116)	(6) Talent retention (Mean.157)	(7) Management complexity (mean .389)	(8) Operation costs (mean.274)
% change remote work post-pre-Covid	0.105	0.140*	0.128*	-0.042	-0.064	0.028	0.182**	0.052
	(0.069)	(0.074)	(0.076)	(0.077)	(0.057)	(0.062)	(0.090)	(.079)
Flexible to work remote	0.123**	0.034	0.118**	0.109*	0.085*	0.037	0.085	0.107*
	(0.051)	(0.052)		(0.057)	(.048)	(0.044)	(.066))	(.059)
Use automation	-0.050	0.076	0.058	0.078	0.120	-0.011	-0.138*	0.105
	(0.060)	(0.073)	(0.071)	(0.074)	(0.078)	(0.053)	(0.079)	(0.076)
Digitalize operations	0.055	0.089*	0.191***	0.135**	0.034	0.093*	0.189***	0.059
	(0.053)	(0.052)	(0.057)	(0.059)	(0.049)	(0.049)	(0.068)	(0.061)
(Small firm)								
Medium firm	0.004	0.056	-0.046	-0.057	-0.015	0.041	0.081	0.057
	(0.057)	(0.059)	(0.059)	(0.060)	(0.051)	(0.052)	(0.075)	(0.066)
Large firm	-0.058	-0.013	-0.041	0.007	0.128	0.002	0.287***	-0.036
	(0.073)	(0.088)	(0.090)	(0.094)	(0.097)	(0.072)	(0.109)	(0.092)
(Rural)								
Urban	0.012	-0.063	0.043	-0.032	-0.062	0.025	-0.052	-0.111*
	(0.053)	(0.057)	(0.057)	(0.061)	(0.051)	(0.044)	(0.069)	(0.063)
(Service)								
Natural resources	0.031	-0.010	-0.089	0.079	0.246	0.115	0.469***	0.030

	(0.154)	(0.155)	(0.122)	(0.196)	(0.223)	(0.170)	(0.131)	(0.157)
Secondary sec.	-0.130**	-0.045	0.002	-0.076	-0.043	-0.054	0.150	-0.051
	(0.056)	(0.072)	(0.097)	(0.088)	(0.062)	(0.065)	(0.118)	(0.089)
Arts & cultural	-0.037	0.077	-0.019	0.122	-0.038	-0.110**	-0.086	-0.035
	(0.102)	(0.136)	(0.125)	(0.151)	(0.076)	(0.049)	(0.148)	(0.127)
Public& educat	-0.119	-0.039	0.114	0.168	0.060	-0.021	0.049	0.050
	(0.073)	(0.089)	(0.127)	(0.130)	(0.098)	(0.080)	(0.135)	(0.121)
Health & social	-0.072	-0.028	0.114	0.232	0.032	-0.085	0.160	0.008
	(0.083)	(0.103)	(0.143)	(0.152)	(0.101)	(0.060)	(0.142)	(0.121)
Tech/Profes	-0.038	-0.087	0.022	0.115	-	-0.009	-0.078	-0.096
	(0.078)	(0.071)	(0.108)	(0.116)	-	(0.076)	(0.114)	(0.088)
Other services	-0.179***	-0.050	0.362**	0.425***	0.093	-0.069	0.113	-0.107
	(0.043)	(0.099)	(0.152)	(0.149)	(0.131)	(0.072)	(0.160)	(0.106)
(Public)								
Private	0.083	0.083	0.064	0.115*	-0.003	-0.026	-0.031	0.170**
	(0.062)	(0.068)	(0.067)	(0.069)	(0.055)	(0.058)	(0.090)	(0.069)
(PEI)								
New Brunswick	0.181	0.008	0.046	0.173	0.258*	0.260*	-0.059	0.049
	(0.119)	(0.089)	(0.105)	(0.135)	(0.141)	(0.151)	(0.116)	(0.110)
Nfld/Lab	0.002	-0.062	0.023	0.173	0.185	0.142	-0.042	0.004
	(0.102)	(0.081)	(0.103)	(0.134)	(0.136)	(0.133)	(0.117)	(0.109)
Nova Scotia	0.071	-0.142*	-0.013	0.144	0.138	0.256**	-0.041	-0.057
	(0.096)	(0.075)	(0.093)	(0.114)	(0.099)	(0.115)	(0.108)	(0.097)
Observations	258	258	255	258	206	255	258	259
R^2	0.103	0.082	0.126	0.111	0.142	0.089	0.103	0.066

Significance level *0.1, **0.05, ***0.01, Omitted reference category in parentheses.