Drivers of teleworker productivity: A systematic review of the empirical evidence

Omar Tapasco-Alzate[a,b], Jaime Giraldo-García[b], Eduardo Javid Corpas-Iguarán[c],

Yeison Alberto Garcés-Gómez[d,*]

[a]Department of Mathematics, Universidad de Caldas, Manizales 170001, Colombia
[b]Industrial Engineering Program, Universidad Nacional de Colombia, Manizales 170001, Colombia
[c]Institute for Research in Microbiology and Agroindustrial Biotechnology, Universidad Católica de Manizales, Manizales 170001, Colombia
[d]Faculty of Engineering and Architecture, Universidad Católica de Manizales, Manizales 170001, Colombia

Abstract

This paper aims to identify the factors influencing teleworker productivity by reviewing empirical evidence found in the scientific literature on the topic. A systematic review was conducted to gather and evaluate primary literature sources, complemented by a bibliometric analysis of the volume, distribution, and trends in scientific production over the past 24 years. The effects found are heterogeneous, narrow in scope, and sometimes contradictory. Telework significantly impacts productivity, with its effects varying based on intensity, the nature of the tasks performed, and individual, social, and situational factors. This manuscript provides a comprehensive review of the factors influencing teleworker productivity, analyzing 318 research articles to identify the key determinants of productivity in remote work environments. It systematically categorizes these factors into individual, social, and situational dimensions, offering valuable insights for organizations and individuals adapting to the evolving landscape of telework.

1. Introduction

The significant advancements in digital technologies in recent years have enabled companies to decouple time and tasks from the physical workplace. This progress allows them to distribute daily activities, including synchronous tasks, among employees located remotely. Thus, organizations have gained the ability to adapt to the changing environments and needs of the labor market by implementing new working arrangements that provide flexibility in the "where," "when," and "how" tasks are performed [1]. Official reports indicated that before the pandemic, 7.9% of the global workforce, approximately 260 million workers, worked from home on a permanent basis. [2].

However, the COVID-19 pandemic has brought remote work to unprecedented relevance, resulting in a significant increase in the number of people working from home [3]. In the United States, for example, at the beginning of the confinement, 33 percent of establishments increased teleworking for some or all employees. This resulted in 13 percent of jobs in private sector companies transitioning to full-time teleworking mode and 22 percent to part-time teleworking mode [4].

The term "telecommuting" was first used in the 1970s to indicate remote work activity carried out from outside the usual workplace [2]. From a practical perspective, teleworking has experienced a sudden boom due to measures to protect citizens from coronavirus disease (COVID-19). In early 2020, many governments around the world recommended that companies allow their employees to work from home to ensure their safety and maintain continuity of economic activities [5]. Thus, both private and government organizations turned to telework to continue their operations in an attempt to mitigate the economic or financial consequences introduced by the lockdown [6]. Leading to the fact that, worldwide, a significant growth in the acceptance of telework was observed.

New technological advancements are reshaping how people work and interact, with innovations such as smartphones, social networks, email, and the Internet of Things enabling greater connectivity across distances. These technologies have fostered new working environments, fundamentally altering employee behavior [7]. Accordingly, a great deal of research has appeared to study the impacts of remote work at the individual,

organizational and social levels. However, relatively little research has focused on the factors driving productivity in teleworking, despite it being a critical concern for organizations considering the adoption of this work model [8].

There are multiple and diverse benefits granted to the adoption of teleworking in organizations, even appearing as a win-win scenario for employees and employers. From the teleworker's perspective, the benefits include the freedom to plan time, increased autonomy, reduction of travel time and costs, better work-family life balance, and less work stress, among others [1]. From an organizational perspective, teleworking positively impacts performance by reducing absenteeism, job rotation, and operational costs. It also increases employee satisfaction and their commitment to the organization. Likewise, teleworking serves as an additional tool for recruiting and retaining employees whose knowledge and talent are invaluable and difficult to replace. Moreover, it offers an alternative during unexpected events, such as transportation strikes, severe weather conditions, natural disasters, or epidemics [9]. There is a large literature that labels increased labour productivity as one of the most important arguments for the adoption of telework in organizations [10]. The positive impact of teleworking on productivity is justified by various factors: greater discretion in performing tasks, which allows for alignment of working times with peak efficiency hours; reduction in interruptions while working remotely; increase in effective working hours due to time saved on commutes; perceived increase in autonomy; and greater work commitment due to the flexibility provided by the organization [11].

However, telework also poses some risks to people's well-being, such as excessive preoccupation with constantly arising electronic demands, lack of clarity about job expectations, excessive work demands, and difficulty for some people to set reasonable limits between working from home and resting [12]. In the same sense, Weitzer et al., [13] reported decreased motivation among teleworkers, increased distraction, and difficulties in communicating with colleagues and managers. In addition, global productivity in general, reached a minimum during the period of lockdown by COVID-19 [14].

Importantly, the crisis arising from the COVID-19 pandemic necessitates a special analysis of telework. In this regard, Blahopoulou et al., [15] argue that pandemic-induced telework is quite different from conventional telework. The former is telework in response to a crisis, resulting in a sudden and mandatory full-time emergency solution, while the latter is offered as a tool to improve workers' flexibility and well-being. Likewise, particular effects are detected by gender, age and educational level. For example, Moens et al., [16] report that the closure of schools and daycare centers during the COVID-19 pandemic may have exacerbated traditional gender roles, making it more challenging for women to balance home care responsibilities with work-related duties. Weitzer et al., [13] note the existence of inequalities in the distribution of work. Specifically, they note that women were less likely than men to report job satisfaction when working from home during the pandemic. Additionally, working from home was more prevalent among highly educated participants, suggesting that less educated individuals were less likely to benefit from the improvements associated with remote work.

Likewise, environmental, and sociodemographic aspects also emerge as possible factors affecting work productivity. For example, Sutarto et al., [17], in the Indonesian context, found that workspace availability significantly influenced teleworker performance. Additionally, psychological wellness proved to be a strong predictor of job performance in the context of COVID-19.

In relation to knowledge work, the term applies to work with immaterial inputs and outputs, in which people emerge as the main carriers of knowledge [18]. A related issue is the difficulty in obtaining reliable and valid measures of the labor productivity of teleworkers. Therefore, it is important to develop methodologies and indicators to value intangibles and their contribution to productivity [13]. Given that knowledge workers are a strategic resource whose primary contributions stem from their ability to process and apply knowledge and information in executing essential tasks, making decisions, and solving problems, Tapasco-Alzate [19] emphasizes the need to move beyond traditional metrics such as quantity, effectiveness, and efficiency. Instead, greater emphasis should be placed on metrics focused on human resources, such as autonomy, training, human capital, work teams, and knowledge management, among others [19].

This study focuses on individual productivity. Traditionally, productivity is defined as the ratio of outputs generated to inputs used, but such a measure is often inappropriate for the measurement of knowledge work. However, there seems to be agreement that there is no practical and effective method for this purpose. Thus, it is common to find in specialized literature a wide range of measurement approaches rather than a specific measurement method. Productivity is often conceived as an umbrella concept that includes various dimensions, such as efficiency and effectiveness [20]. Likewise, the use of subjective measurement methods is widely accepted. Although these methods have restrictions, they have proven useful in capturing the various intangible and complex aspects associated with the studied phenomenon, which are difficult to measure otherwise [21].

Despite the dynamics of research on teleworking, there is relatively little research on the factors that influence the productivity of teleworkers. In this sense, O'neill et al., [22], call for a wider range of factors to be studied, given the complexity and interdependence of the phenomenon of interest. While Beauregard et al., [23] criticize the large number of subjective recommendations based on anecdotal evidence or generated from a small number of observations. According to Gamal Aboelmaged et al., [24], the studies have focused on determining the advantages, disadvantages, and problems of adopting telework. However, they present a lack of deeper understanding regarding telework performance and productivity. Given the current state of the research, this study systematically reviews the literature to collect, categorize, and discuss factors that have been empirically evaluated and shown to be associated with increased productivity among knowledge workers.

2. Materials and Methods

The investigation was conducted in two phases. In the first instance, a bibliometric study of the existing publications in the Web of Science scientific database collection, related to

teleworker productivity in the context of knowledge work, was conducted. The objective of the bibliometric analysis was to identify trends in the frequency of studies on teleworking and behaviors in elements of scientific production, such as thematic convergence between authors or the concomitant use of specific keywords that indicate particular research interests. It is important to clarify that the bibliometric analysis focused on frequency and interaction patterns to recognize the behavioral dynamics of the descriptors used. Therefore, its relationship with the synthesis of evidence from the systematic review was not considered.

Selection of studies, inclusion and exclusion criteria and data processing for bibliometric analysis. Only the WoS database was used for bibliometric analysis because it integrates a wide collection of databases, with rigorous quality standards. The bibliometric analysis was carried out by using the following search equation: ((Drivers OR Factors) AND (Productivity OR Performance) AND (Telework* OR Telecommut*) AND "Knowledge Work*"), in which words accompanied by an asterisk (*) were used to increase the concordant results with all those words containing said semantic root. The search was conducted on November 29, 2024, and included documents published between 2001 and 2024.

For the process of refining the bibliometric search, the titles obtained were reviewed. On the one hand, texts that specifically aimed to study factors or guidelines related to performance or productivity in remote work activity were included. On the other hand, texts that met the following criteria were excluded: documents not corresponding to the topic of interest, documents catalogued as "Meeting abstract," editorial material, and corrections of scientific articles already considered in the search. The publications integrated into the analysis were in final status and open access or not. Regarding the type of document, Article, Review, and Proceedings Paper were incorporated. The review of the selected articles was carried out by all authors.

The number of publications was determined concerning the type of document, authors, countries, and year. As for visibility and impact indicators, the number of citations for authors and countries of origin of related institutions was used. The thematic maps of co-authorship among authors and co-occurrence of keywords were obtained for relationship and collaboration indicators. Data collection was done by downloading the records obtained in plain text format from the Web of Science database. The BibExcel and VOSviewer tools were used to organize and classify the bibliometric indicators [25,26]. Regarding data processing, BibExcel facilitated the deconstruction of plain text to establish frequencies in parameters of interest such as document type, number of publications, number of citations, and number of countries. The frequency calculations and the representations through tables and graphs were applied in the Microsoft Excel program. Likewise, the VOSviewer tool allowed the analysis of interaction networks between authors, keywords and related documents through citation.

Selection of studies, inclusion and exclusion criteria and data processing for the systematic review. A systematic review was conducted, resulting in a synthesis of drivers that, according to empirical evidence, have shown a significant impact on teleworker productivity. A systematic review is a literature review method that synthesizes the state of knowledge and identifies gaps in a particular topic, providing a comprehensive understanding of the phenomenon or problem. According to Whittemore et al., [27], it is the only approach that allows the combination of various methodologies, offering great potential for application in evidence-based practice research. The review method includes the stages of problem formulation, literature search, data evaluation, data analysis, and presentation, all of which are described in detail in this research. Regarding the identification of the problem, many researchers emphasize the need to expand information on the circumstances that lead to positive effects of teleworking, as well as those that result in negative impacts. They also lament the lack of clear scientific evidence supporting the actual productivity gains achieved through teleworking [28]. Given the above, the research posed the following guiding question: From the perspective of research based on empirical evidence, what factors have shown significant effects on teleworker productivity?

In addition to the systematic search, and to reduce the risk of excluding relevant literature, a Google Scholar search was conducted for articles of potential interest referenced in the documents selected in the first phase, extending the search period until January 2021. For this phase, this research has focused on the scientific literature that has resorted to quantitative studies. It has contemplated studying the effect of one or multiple factors on productivity or work performance at the individual level. Given the diversity of primary sources, the results were coded according to methodological rigor into two categories: weak conclusions and strong conclusions. To assess the methodological relevance, five criteria were considered. First, the sample size should be proportional to the number of variables studied. In this case, the recommended heuristic is a sample size of at least ten times the number of elements used [29]. Second, the verification of statistical assumptions such as normality, homoscedasticity, or multicollinearity. Third, the use of appropriate methods according to the measurement scales used [30]. Fourth, application of calibration techniques to measurement instruments or use of validated questionnaires. Fifth, objective measurements of productivity or subjective measurements of multiple items are necessary, as productivity in the context of knowledge work is a multidimensional issue [31].

The assigned evaluation was classified as a strong conclusion if it met at least three of the aforementioned criteria; otherwise, its conclusions were classified as weak. The results that emanate from strong conclusions had greater relevance in the conclusions of the study. The data extracted from the sources included sample size, the country of origin for the empirical data, potential explanatory factors of productivity, referenced control variables, data analysis methods, productivity measurement tools, the categorization of the strength of the conclusions, and factors that demonstrated significant effects on productivity. The synthesis developed is presented in a matrix represented in Table 1 for further discussion.

3. Results and Discussion

3.1. Results

After reviewing the abstracts and full content based on relevance and availability, a total of 318 documents were

ultimately included for analysis 80. Fig. 1 shows the evolution of scientific production on the subject for the years 2001-2024. There has been significant growth in the number of publications since 2016, with a notable increase starting in 2020. This trend was amplified in the post-pandemic period, resulting in 83% of the analyzed publications being released between 2020 and 2024. This surge reflects the growing interest in productivity under telework conditions, which can be reasonably attributed to its extensive use in the labor field due to global lockdown measures.

Fig. 1. Publication Numbers and Citation Numbers Per Year (2001-2024)

Regarding the number of citations, [32], [33] and [34] the main references. The first review examines the impacts of telework across multiple aspects, identifying distinctive features of teleworkers and highlighting research challenges in the field. The second review focuses on the impact of professional isolation on job performance and teleworkers' intentions regarding job rotation. In addition, the third study investigated the challenges of remote work during the pandemic. It identified self-discipline as a moderator of variables that positively or negatively influence teleworking performance, such as social support, job autonomy, workload, and monitoring compliance with commitments.

Concerning the country of origin of the research, a total of 75 participating countries were counted in the analysis, almost all of them developed countries. It is important to clarify that only the 10 countries with the highest frequency of publishing articles on teleworking were included in the analysis. Additionally, some of these countries share authorship in scientific products. As anticipated by Gamal Aboelmaged et al., [24], most of the literature on telework has its roots in developed countries, mainly in North America and Western Europe. This indicates a significant gap to be overcome, resulting from the lack of studies in developing country contexts. Figure 2 shows the United States' predominant participation, representing 24.3% of the total of selected publications, followed by the United Kingdom with 11.7% and Portugal with 10.9%.

In relation to the cultural context in which the studies are framed, Allen et al., [35] state that most research on telework focuses on the organizational changes and administrative practices necessary for telework adoption. However, they pay less attention to whether these conditions are equally compatible in different national cultures or how to explain differences between nations.

On the other hand, regarding the themes addressed in the publications, reflected in the key words used, a total of 1509

key words were recorded, of which 64 had at least ten appearances. In the Fig. 3, which represents the map of networks of co-occurrence of keywords, we can see that the predominant themes are telework (136 occurrences), performance (123 occurrences), impact (86 occurrences), COVID-19 (78 occurrences) and teleworking (73 occurrences). The words telework, teleworking and telecommuting (38 occurrences) reflect the most used names for this configuration of work. Telecommuting is the term most rooted among North American authors, who retain the original designation coined by Jack Nilles in the mid-1970s. In the context of the oil crisis, Nilles highlighted the need to reduce transportation costs by allowing work to be done from home. While telework is the most widespread term in Europe and in general, in the rest of the world [36]. Another significant aspect of Fig. 3 is the orientation of the clusters. For example, the main cluster, displayed in red, reflects studies investigating telecommuting within the framework of the COVID-19 pandemic. It includes responses related to performance, productivity, impact, and outcomes generated in remote work, as well as incident elements in this transition, such as flexibility, arrangements, attitudes, motivations, perceptions, and family. On the other hand, the third cluster, displayed in blue, denotes the investigation of aspects of care in teleworking. It includes terms such as life balance, health, stress, well-being, conflict, and family conflict.

Fig. 2. Participation of countries (Top 10) in relation to the number and year of publication

Fig. 3. Network mapping of co-occurrence of keywords

It also highlights the term "performance," which is closely related to productivity. These terms are often confused and considered interchangeable. However, performance is a broader concept that includes almost any objective related to competition and excellence, such as cost, flexibility, speed, reliability, or quality. It is considered an umbrella term encompassing all concepts that gauge the success of a company and its activities [37].

Regarding authors, the total number of registered authors was 1057. Using the free software VOSviewer, the co-authorship network map shown in Fig. 4 was generated, highlighting 64 authors involved in co-authored publications. Notably, authors such as Timothy Golden, who explored subordinate work experiences, interactions among teleworkers, and the willingness to seek help; Ana Junça Silva, who focused on quality of life indicators, affection, and the role of pets in teleworking; Christine Anne Grant and María Charalampous, both studying the environment and well-being conditions of teleworkers; and Yoshihisa Fujino, who investigated the deterioration of mental health, the influence of the physical environment, and support in teleworking during the pandemic. In addition, the network mapping of co-authorship shows that knowledge about teleworking is not promoted from solid and interconnected clusters. On the contrary, endogamous management prevails.

Complementing the analysis of co-authorship between authors, the co-citations between publication sources indicated that among the 195 journals, 60 reached the threshold of 50 or more co-citations. The scientific journals with the highest total link strength were the Journal of Applied Psychology, Journal of Organizational Behaviour, and New Technology, Work and Employment. These journals are related to management and organizational behaviour, topics that are prevalent in most of the scientific journals included in the analysis (see Fig. 5). The two main clusters are diverse yet convergent in terms of areas of knowledge. They relate to journals focused on workplace psychology, human resource management, employment and organization, business ethics, and public health.

Regarding the sources of publication in the conducted search, only Sustainability, International Journal of Manpower, Frontiers in Psychology, and Work: A Journal of Prevention, Assessment & Rehabilitation published 10 or more articles on the central topic of the bibliometric analysis.
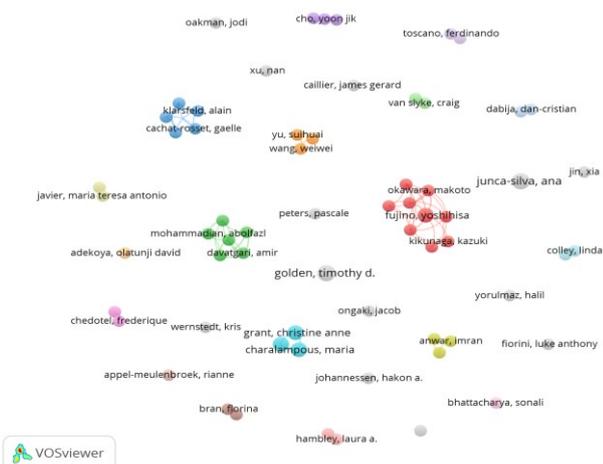
Fig. 4. Network mapping of co-authorship networks between authors
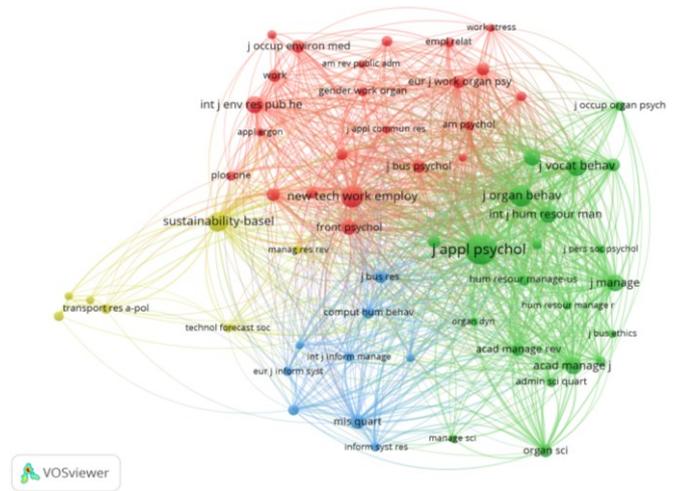

Fig. 5. Network mapping of co-citations networks between publication sources

On the other hand, the synthesis of the results from the systematic review is presented in Table 1, which uses the following acronyms: LMX (Leader-Member Exchange Theory), CFA (Confirmatory Factor Analysis), PLS-SEM (Partial Least Squares Structural Equation Modeling), and n (sample size). Once again, a North American predominance is observed in the empirical research carried out on the subject. Regarding the factors studied, it is observed that they impact various disciplines, such as administration, psychology, engineering, organizational behaviour, and information systems. Moreover, regarding the analysis methods used, among the 19 studies analyzed, the most frequently used method is regression analysis, accounting for 31.6%. This is followed by correlational analysis and hierarchical regression analysis, each at 21.1%.

3.2. Discussion

In line with the findings obtained from the review on flexible working and performance by Menezes and Kelliher [38], there is a high heterogeneity in the results generated. However, unlike such a revision, the evidence found shows strong indications of the positive impact of remote work on worker performance. This impact is nuanced by the presence of other factors that emerge as possible mediators and moderators of these relationships [39]. Following the categorization proposed by Neufeld et al., [8], which groups the drivers of productivity into individual, social, and situational factors, and incorporating the aspect related to the nature of the tasks performed—shown to significantly impact the productivity of knowledge work [31]—the main findings are outlined below.

As a synthesis, the trends and patterns evidenced in the bibliometric analysis carried out were the following: 1. There has been a sustained increase in the number of studies published since 2016, particularly during the pandemic and post-pandemic periods, which can be attributed to the widespread adoption of remote work during this time. 2. The factors affecting the implementation of teleworking are of special interest to developed countries, where technological, regulatory, administrative, and cultural progress has favored its adoption. 3. The studies address key aspects of remote work,

including communication, motivation, flexibility, work-life balance, and health and well-being. Additionally, they explore the influence of these factors on job satisfaction and examine elements that facilitate or hinder the full implementation of teleworking, such as managerial support, regulatory and normative conditions, psychosocial factors, and more. 4. Teleworking encompasses various dimensions and competencies, including those related to the worker—such as technological adoption and autonomy management—those tied to administrative conditions, the nature of the work performed, and the characteristics of the available physical environment. Consequently, the journals publishing these studies are diverse, reflecting a wide range of knowledge areas. Some are in computer science, psychology and of course administration, an area that houses the main sources of knowledge generation regarding teleworking.

3.2.1. Individual factors

There is limited empirical evidence that leads to a suitable profile for a teleworker candidate. The study by Al-Dabbagh et al., [40] concluded that ICT (information and communication telework) self-discipline positively influences individual worker productivity. In turn, research by O'neill et al., [22] did not find significant differences in the traits of dedication and organizational skills between teleworkers and their office colleagues. However, there was a direct effect of autonomy and an inverse relationship between the teleworker's sociability and work performance. Meanwhile, Torten et al., [41] found statistically significant relationships between training, telework experience, and productivity. Likewise, Turetken et al., [42] found a significant relationship between productivity, work experience, and communication skills. Additionally, Neufeld et al. [8] discovered that teleworkers' beliefs and attitudes are strongly associated with productivity. In the same sense, George et al., [43] state that the response of teleworkers to stressors is very diverse. For [12], the reduction of stress and increase in job satisfaction largely depend on the level of autonomy each person needs to do their job. Considering the wide variety of associated experiences, remote work may not be for everyone [44].

4.2. Social factors

Research by Neufeld et al., [8] concludes that social interactions with colleagues, managers, and family members are the most critical aspects of teleworker beliefs and attitudes. These interactions, in turn, have been shown to be the key determinants of teleworker productivity. Research by [24] emphasizes job security as one of the most influential aspects of teleworker productivity. This is justified by the fact that if the worker is not well-established or insured, they will not choose to telework in the first place. Furthermore, they assume that the teleworker's effort is unlikely to diminish if teleworking benefits are perceived.

In relation to work teams, [43] posit that supportive coworkers play a relevant role in changes in productivity, meaning, and stress. The implication for employers is to invest in ways that allow remote workers to maintain frequent contact with coworkers by whom they feel supported. The same authors suggest that such investments will pay off in terms of productivity and creativity at work, as well as increased meaning and interest in life, stress reduction, and better health.

3.2.2. Situational factors

The results from Nakrošienė et al., [45] highlight the suitability of the home workspace as a key factor in the success of teleworking. In contrast, Gamal Aboelmaged et al., [24] report a negligible impact of the company's information technology (IT) infrastructure on the perceived productivity of telework. They argue that while IT resources may encourage teleworkers to perform their tasks, they do not necessarily affect their level of productivity. In this respect, [28] points out that more than the working environment and availability of suitable facilities, the determining factor for increased productivity from telework is the reduction of work distractions. They note that if a worker perceives a reduction in distractions through telework, the positive effect on productivity will increase.

In the context of the pandemic, the findings of George et al., [43] indicate a strong negative impact of the change in working methods on various areas of a worker's life, both work-related and personal. Leading to an evident intrusion of work into other aspects of life, with negative consequences on multiple aspects of workers' well-being. The clear implication for organizations is the need to prioritize support for remote workers in establishing and maintaining boundaries between their work and personal lives. For their part, [18] highlight in their findings that the three main disadvantages of teleworking are limitations related to having a home office, work uncertainties, and the lack of appropriate tools.

3.2.3. Nature of tasks

According to [22], the tasks carried out by teleworkers present a wide variability, making the comparability of results difficult. They state that tasks of less complexity could be more suitable for remote work, as they are likely to be carried out independently and require minimal feedback and collaborative support. The results from [46] indicate a positive association between low levels of interdependence, telework intensity and work performance. Similar findings are reported by Turetken et al., [42], who argue that highly interdependent jobs require high levels of coordination. Consequently, the physical separation caused by teleworking creates management difficulties. They do not advise implementing telework programs for this type of work. On the other hand, the findings reported by Martin et al., [12], highlight the advantages of familiarity with digital tools in terms of communication and collaboration, job performance, and as a protective factor against the adverse effects associated with remote work. These tools help generate proximity links that mitigate the isolation of teleworkers.

Table 1. Synthesis of the systematic review on individual productivity drivers in telework

Reference	Country (n)	Drivers studied	Approach	Productivity measurement	Conclusion	Effects found
[8]	Canada (132)	Individual, social, and situational factors and telecommuter beliefs and attitudes	Discriminant analysis	Self-reported productivity	Strong	Telecommuter beliefs and attitudes, and the quality of their social interactions are strongly associated with productivity.
[47]	Australia (50)	Organizational, work and household factors and work style	Correlational analysis	Self-reported productivity	Weak	Significant correlations between productivity with most variables of job characteristics and some of the organizational variables.
[10]	United States (375)	LMX quality and degree of virtual work. Control variables: gender and tenure	Hierarchical regression analysis / CFA	Percentage of increase in salary received	Strong	Employees with LMX quality high, working extensively in virtual mode, performed better.
[22]	Canada (156)	Organization, diligence, sociability, need for achievement and autonomy, and complexity of work	Correlational analysis	Single item self-reported performance	Weak	Sociability, need for autonomy and need for achievement were related to effectiveness differentially for teleworkers and non-teleworkers.
[42]	United States/ Canada (89)	Media richness, work experience, communication skills, measurability of work and variety and interdependence of tasks	Factor analysis / PLS-SEM	Perceived productivity referred to quantity of outputs	Strong	The media richness, work experience and the low interdependence of tasks positively affect the productivity of teleworking.
[48]	United States (125)	Inside and outside the laboratory. Types of tasks: dull and creative	Experimental design	Divergent thinking and creativity	Strong	Telecommuting environment has a positive effect on the productivity of creative tasks, but a negative influence on repetitive tasks.
[24]	Egypt (199)	Individual, attitudinal organizational, demographic, and technological factors	Regression analysis / Factor analysis	Multi-item self-reported productivity	Strong	Job security emerges as a determining factor and job satisfaction, commitment, job flexibility and administrative support as relevant factors.
[28]	Nether lands (141)	Extent of telework, variation in the level of distraction (office-home)	Hierarchical regression analysis	Multi-item self-reported productivity	Strong	Reducing distractions will increase the positive effect of the knowledge teleworker on productivity.
[49]	Pakistan (89)	Economic and socio-environmental factors, motivation, time management, and job satisfaction	Correlational analysis	Quantity of work	Weak	All the factors studied show a positive and significant correlation with productivity while telecommuting.
[11]	United States (323)	Telecommuting intensity and normativity, LMX, and perceived autonomy	CFA/ Regression analysis	Task performance and contextual performance	Strong	Telecommuting has beneficial associations with performance. LMX, perceived autonomy and normativity emerge as moderate variables.
[40]	New Zealand (443)	ICT connectivity and ICT self-discipline	Factor analysis / PLS-SEM	Multi-item self-reported productivity	Strong	The effect of ICT connectivity on productivity was weak. The impact of the ICT self-discipline depends on the characteristics of the job.

Table 2 continued. Synthesis of the systematic review on individual productivity drivers in telework

Reference	Country (n)	Drivers studied	Approach	Productivity measurement	Conclusion	Effects found
[41]	United States (406)	Years of experience working and teleworking	Anova/ Canonical correlation	Perceived productivity	Weak	Experience working and teleworking, but not the intensity of teleworking, showed a significant relationship with productivity.
[50]	Nether lands (111)	Telework intensity, motivation and office hours. Control variables: Autonomy and feedback	Correlation analysis/ Regression analyseis/ Anova	Self-reported productivity	Strong	The association of productivity with low intensity of telework was positive but not significant, with high intensity it was negative and significant.
[39]	Costa Rica (164)	Worker responsibilities levels and control by the supervisor	Hierarchical regression analysis	Proficiency, pro-activity, adaptability to tasks	Strong	High levels of supervisory control over teleworkers were found to impair their proactivity and adaptability to tasks.
[46]	United States (273)	Extent of telecommuting, social support, problem solving and job complexity	CFA / Hierarchical regression analysis	Multi-item performance rated by supervisor	Strong	Results support a positive relationship between the extent of telecommuting and performance. Jobs with high complexity, low interdependence and low social support increase performance.
[7]	Indonesia (64)	Financial compensation and flexibility of working hours	Regression analyseis	Actual achievement/ achievement expected	Weak	Flexibility of working hours influences employee performance
[45]	Lithuania (128)	Time planning skills; communication with colleagues; travel expenses; possibility of caring for family members and workplace	Regression analysis	Single item self-reported productivity	Weak	Higher productivity was related to reduced time in communicating with co-workers, a suitable working place at home and the possibility to take care of family members when teleworking.
[51]	Japan (9200)	Working places, duration of telework, stress, life and work satisfaction, and happiness	Panel-logit model	Labor productivity	Strong	Low hours of telecommuting increase productivity, high hours of telecommuting decrease productivity. Telecommuting increases satisfaction with life and it improves productivity.
[52]	Thailand (398)	Demographics factors, job satisfaction, work flexibility, commitment and attitude toward teleworking	Inferential analysis	Perceived productivity	Weak	Gender, age, marital status, academic level, organizational commitment and attitude towards telework have a weak positive relationship with productivity.

3.2.4. Discussion on methodological deficiencies

Criticism of the appropriateness of the techniques used arises from the observation in various studies (e.g. [49,45] and [52]) of the omission of underlying statistical assumptions regarding the nature of the data analysed. Despite the availability of categorical data—often derived from the common use of the Likert scale with ordinal scores ranging from 1 to 5 for the items studied—quantitative techniques such as variance analysis and correlation analysis are frequently misapplied. This misuse undermines the validity of the results obtained. It should be noted that for these cases the use of poly-correlation, data transformation or non-parametric methods are more recommended [30]. Also, some research (e.g. [47] and [7]) makes use of sample sizes considered inappropriately small for the respective multivariate analyses [29].

According to [15], most studies are cross-sectional, involving a single point of data collection. They often compare teleworkers with office workers without analyzing differences in working characteristics and conditions. In this regard, Moens et al., [16] call for the use of different research designs to examine strong associations and reveal objective causal mechanisms.

3.2.5. Discussion on measuring productivity

The difficulty of measuring the job performance of teleworkers appears as another challenge. In this regard, Bosch-Sijtsema et al., [53] emphasize the difficulty of measuring real productivity in work modes that involve multiple remote locations. This problem is exacerbated when teleworkers perform knowledge-related tasks, where the product is typically intangible and difficult to quantify. It is found that, on many occasions, productivity is not measured directly but through its components, such as efficiency or effectiveness. This approach is taken because it is easier to understand and evaluate these parts than productivity itself [31]. In addition, several researchers (e.g., Neufeld [8] and Baker [47]) have adopted and developed self-reported measures, which has led to criticism due to potential judgmental biases, commonly associated with self-reported data. In contrast, [54] state that self-generated employee reports have great validity, as employees can best judge whether their work efforts are accurately represented in individual performance measurements. They add that an employee-driven measurement process will make the resulting performance measures more reliable and understandable. According to Smite et al., [44], given the heterogeneity and complexity of the tasks involved, it should come as no surprise that subjective measures have become popular instruments in productivity research within the context of knowledge work.

3.2.6. Telework as a productivity driver

In different ways, the results point to telework as a productivity driver. For Golden et al., [10], there is a direct association between work performance and intensity of work in virtual mode. They justify this by stating that remote work allows individuals to establish a pace that best suits their preferences, enabling them to work productively during the periods and in the locations where they feel most comfortable. The effect of teleworking on productivity is also reflected indirectly through the mediation of this working arrangement on other productivity drivers. In this respect, [55] describe the high impact that teleworking has on job satisfaction, motivation, and loyalty, as well as the decline in the intention to change jobs. The freedom and flexibility offered by a higher degree of virtual work create a context in which people may be willing to work more as a form of reciprocity. This is supported by the fact that employees with higher levels of organizational commitment increase their desire to achieve organizational goals [10]. However, this seems to have a counterpart, manifested in an increase in the number of hours worked, becoming a double-edged sword. Although they have greater flexibility in executing their tasks, they also increase their work activity excessively [22].

The results of the panel data study by Kazekami [51] indicate that an increase in telework hours improves productivity up to a certain point. However, when telework hours become too long, this effect is reversed, leading to a decrease in labor productivity. Among the explanations attributed to this curvilinear behavior is the idea that teleworking increases life satisfaction, which in turn improves work productivity. However, extremely high levels of telework intensity are associated with increased difficulties in separating work and family life. This leads to increased stress and reduced productivity [23]. Supporting this argument, Golden et al., [46] comment that people who spend a small amount of time teleworking each week are likely to have drastically different experiences than those who telework most of their time away from the home office. They note that the negative impact of professional isolation on job performance is accentuated at low teleworking intensities. Specifically, the research carried out by [50] concludes that the optimal number of hours of teleworking is around eight hours per week.

Telework offers organizations benefits such as talent retention, reduced real estate costs, and increased employee engagement. In exchange for work flexibility, employees can demonstrate greater reciprocity and productivity. However, the implementation of telework requires organizational restructuring that includes decentralization, interconnection, and new control and monitoring mechanisms based on results. Research suggests that a moderate degree of schedule flexibility, regular supervision, and strong IT support are crucial to the productivity and satisfaction of teleworkers.

3.2.7. Contradictory findings

It is important to highlight that, despite numerous experiments and studies in this field, no consensus has been reached regarding the factors that influence teleworker productivity. Opposing positions reveal the inconclusive or contradictory nature of the results obtained so far. For example, [55] did not find a significant relationship between teleworking and worker performance, while the meta-analysis carried out by [1] found positive effects of teleworking on worker performance. Other contradictory results arise in specific aspects; for example, Turetken [42] report that employees with routine tasks and limited dependence on co-workers can work remotely more efficiently and that low task variability results

in higher productivity. In contrast, Glenn Dutcher et al., [48] report that workers who work in environments outside the office are more productive when performing creative tasks and less productive when performing monotonous tasks. Concerning socio-demographic variables, the study by Gajendran and Harrison [1] recorded better performance by women. It suggests that better career prospects and a more significant perceived benefit of teleworking, relative to men, could be reasons for this outcome. Conversely, Gamal Aboelmaged et al., [24] mentioned that gender and marital status appear to have a negligible impact on the perceived productivity of teleworking. However, they noted that they might have an impact on the work-life balance of the teleworker.

In this regard, [15] state that the findings on the relationship between telework and performance are contradictory, making research on the effects of telework on employee performance inconclusive.

While telework offers benefits such as greater autonomy and reduced work-family conflict, it also presents paradoxes. It can affect work relationships, communication, and sense of belonging. The key lies in finding a balance, since both excessive telework and its absence can affect productivity. Factors such as the intensity of telework, home environment conditions, and organizational support play a moderating role in its impact.

4. Conclusion

The study presents a literature review on individual productivity in teleworking, focusing on the identification and analysis of empirically validated drivers. The results confirm the significant impact of teleworking on increasing individual productivity, contingent on other influencing factors. Regarding telework intensity, the relationship appears curvilinear, with productivity increasing at low levels of telework but declining in more extensive teleworking arrangements. Individual factors, such as the direct relationship between teleworking and job satisfaction, experience, autonomy, and the perceived benefits for employees, play a significant role. Additionally, social factors, like the quality of the subordinate-supervisor relationship—characterized by rich communication and minimal control—are equally important. In relation to situational factors, the evidence is weak, suggesting that it is not the physical space itself, but rather the decrease in distractions with teleworking that leads to an increase in productivity. The nature of the tasks performed also exerts a significant influence, with task interdependence having a negative effect, while creative or highly complex tasks have a positive impact. Special attention should be paid to the selection of personnel with attributes of self-management, autonomy, and discipline, especially those who perform tasks with low levels of interdependence and monotony.

The discrepancies in the findings suggest the need to investigate the effect of telework in different subgroups. This would help identify the positive and negative effects of telework on worker well-being and performance in various circumstances. We encourage future longitudinal studies to reveal objective causal mechanisms. Focus efforts on ensuring that their teleworkers perceive the benefits of the telework

program and are satisfied with their work circumstances.

As for the limitations of the research, there are restrictions in the representativeness of the documents found, as the search is limited to the English language. This limitation does not guarantee sufficient exhaustiveness in capturing all relevant articles in the field. Likewise, the journals surveyed exclude many journals outside typical Web ~~World~~ of Science extent, especially those in business, and technology. Similarly, there are limitations in generalizing and obtaining conclusive results due to the inherent heterogeneity of the cultural and organizational contexts associated with the findings. Also limiting the generalizability of the findings is the fact that the circumstances surrounding the pandemic have altered the characteristics of teleworkers, their perceptions, and therefore the determinants of their productivity.

Among the topics to be addressed in the future of work are platform innovation and, in general, how to improve organizational innovation. Additionally, sustainable change through digital technology and the impact of hybrid work on organizational dynamics are key areas of focus. Given that human resource management is a key driver of organizational development, more research is needed to determine how the remote work hiring landscape is challenging companies and what new approaches are emerging for managing talent in the virtual workspace. Additionally, there is a need to explore specific work configurations for certain profiles and contexts. An additional challenge for decision-makers should be to prioritize building trust and autonomy among remote workers, creating a supportive organizational culture that empowers employees and positively influences productivity. Providing the necessary resources and technological support further improves research productivity by enabling effective collaboration and access to relevant information. It is important to highlight the fundamental role of perceived social support in mitigating the impact of work interruptions on performance. When employees perceive adequate organizational support, they feel valued and recognized, which is reflected in greater motivation. This also leads to greater freedom to share ideas and propose innovative solutions for the organization.

Acknowledgments

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