

PUBLIC SECTOR ADAPTATION TO REMOTE WORKING DURING THE SARS-COV-2 PANDEMIC. ANALYSIS AND EVALUATION OF THE DETERMINANTS AND EFFECTIVENESS OF ACTION

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Purpose: The purpose of the study is to analyze and evaluate the remote work of public sector employees during the SARS-CoV-2 pandemic, taking into account the evaluation of the efficiency of the tasks performed, taking into account the type of position held, the experience of the employees, technical and organizational aspects, the inconvenience of the work and the level of digital competence.

Design/methodology/approach: Providing remote work is becoming increasingly common, especially in the context of the Sars-CoV2 pandemic. Both employees and employers recognize the benefits of a flexible work model, as well as several limitations and challenges. The findings of past research on remote work and the study's results indicate the relevance of this research area. This is particularly important concerning the public sector, which is not the subject of as much interest as the private sector. The problem of remote work is a complex and multidimensional phenomenon, hence the need for research using various research methods and techniques. Therefore, our research is based on a mixed approach. They took advantage of the literature analysis and legal regulations on remote work in the public sector and applied a diagnostic survey using a survey questionnaire. In turn, statistical methods such as the chi-square test, p-value, and Pearson's coefficient were used for analysis.

Findings: The results of our study showed that the evaluation of the effectiveness of remote work by public sector employees varies. In addition, of the seven hypotheses posed, three were positively verified: (1) the effectiveness of remote work depends on organizational conditions; (2) the effectiveness of remote work depends on the support of supervisors; (3) The effectiveness of remote work is related to perceptions of changes in the quality of services during the e pandemic. The results also suggest the need to develop management training programs that consider the role of support and communication with employees in the context of remote work.

Research limitations/implications: The study provided valuable information on evaluating remote work in the public sector during the COVID-19 pandemic. However, the study has some limitations. On the one hand, confirmation of three of the seven hypotheses indicates the existence of relationships between the variables studied, but at the same time, highlights the need for further research. The analysis focuses on the public sector, which may not be entirely

representative of other sectors, and the focus on employee perceptions may affect the subjectivity of the results obtained.

Practical implications: The study's results highlight several critical recommendations for organizations in the public sector. First, there is a need to develop training programs that focus on support and communication in the context of remote work to ensure higher efficiency. Second, there is a need to implement a communication strategy to ensure that information flows effectively when working remotely. In addition, organizations should regularly monitor and analyze employee satisfaction and performance to identify areas for improvement. Finally, analyzing the impact of remote work on the quality of services provided is essential to identify and provide the necessary resources or support in relevant areas.

Originality/value: The article addresses the timely and relevant topic of the impact of pandemic on remote work, which represents a research gap. From the literature, the issue has been analyzed in the context of the commercial sector, while limited research exists for the government sector. Our research fills a gap in the literature on remote work in the public sector in the context of the COVID-19 pandemic, providing valuable information on the effectiveness and factors affecting the quality of remote work in this sector.

Keywords: remote working, efficiency, work organization, supervisor support, digital skills, digitization of work, ICT.

Category of the paper: research paper.

1. Introduction

The COVID-19 pandemic has introduced changes in many spheres of life, including the way people do their jobs as noted by (Wang et al., 2023). Because of the restrictions and for employee safety, many companies have been forced to switch to remote work (Kurdy et al., 2023), which has become one of the most essential tools for continuing operations. Remote work, previously an option or an exception, has become one of the most important tools, allowing companies to continue their operations. The revolution in how work is done has taken place quickly and has affected virtually all industries and sectors of the economy.

This dynamic process of labor transformation has not been without its challenges. The transition to remote work required not only the provision of appropriate technological tools (Král et al., 2022) but also to adapt the principles of work organization and team management (Wozniak-Jêchorek, 2022). Companies had to provide employees with the appropriate means to work remotely, such as computers, Internet access and software. However, these were not simply technical issues.

It has also become a challenge to manage employees remotely, monitor their performance (Tabor-Blazewicz, Rachoń, 2022; Grant et al., 2013), providing technical support (Král et al., 2022) and maintaining the organizational culture (Deschênes, 2023; Juchnowicz, Kinowska, 2022). This required not only adjustments to the technological infrastructure, but also changes in the legal and organizational rules governing remote work.

The effectiveness of remote work is a topic that has attracted the attention of many researchers (Kurdy et al., 2023; Abdulrahim, Yousif, 2023; Stefanska et al., 2023; Tabor-Blazewicz, Rachoń, 2022; Galanti et al., 2021; Grant et al., 2013; Chandrasekar, 2011; Sardeshmukh et al., 2012; Davis, 2011). The job position occupied has an impact on remote work. As noted by P. Pawlowski, people in managerial positions often face other challenges when working remotely, (Pawlowski, 2020), such as increased responsibilities or the need to coordinate a team.

Organizational conditions, such as a company's structure and procedures, are also crucial. Research by D. Leblebici has shown that companies with well-structured procedures and clearly defined processes have more effective employees (Leblebici, 2012). In turn, researcher T. Galanti showed that autonomy and self-reliance were positively related to employee productivity and engagement when working remotely (Galanti et al., 2021).

In the technology field, research shows that access to modern tools and proper training are crucial to maximizing efficiency (Wang et al., 2023). The transition to providing remote work is not just about the organization's readiness in terms of infrastructure and feasibility, but also requires that employees are ready to accept the transition and that they have the right competencies (Jayawardena et al., 2020; Eberhard et al., 2017). In addition, hardware software used by employees can help organizations improve the quality of work and enhance employee well-being (Segbenya, Okorley, 2022).

Support from superiors is significant (Nakrošienė et al., 2019; Leblebici, 2012). This is pointed out, among others, by M. Kozłowski, who argues that regular feedback and support from team leaders increases the commitment and productivity of remote workers (Kozłowski, 2016). In contrast, (de Vries et al., 2018) demonstrate that positive supervisor-subordinate relationships help minimize the impact of remote work on professional isolation.

Demographic characteristics, such as age and education, also have an impact on remote work performance (Juchnowicz, Kinowska, 2022; Szczepanski, Zamecki, 2021; Salesforce, 2020). Studies have shown that younger workers may be more flexible in adapting to remote work (Komorowska, 2022), while employees with more education often have better digital competencies, resulting in higher productivity.

In conclusion, many studies confirm that the effectiveness of remote work is a multidimensional issue that depends on many individual and organizational factors. However, detailed studies are still limited for a more thorough understanding of this issue (Kian, Yusoff, 2012; Bencsik et al., 2016). Particularly if we consider the public administration sector. Studies on the determinants of remote work mainly focus on the private sector. However, the impact of the pandemic on remote work was not limited to the private sector. Public sector units were also forced to react dynamically and adapt their procedures and policies to the new reality. In most cases, these were institutions that previously had no experience with remote work, which created additional challenges. The findings of previous research on remote work and the

study's results indicate the relevance of this research area, especially for the public sector, which is not as much of a focus as the private sector (Hameduddin, 2021).

The above was the source for the formulation of the following research questions, which are the basis for the implementation of the study:

1. How did units adapt existing legal and organizational rules to the requirements of remote working, and were they sufficient?
2. Were the provided ICT tools and supervisor support adequate to provide work from home?
3. Has the shift to remote work resulted in a reduction in service quality?
4. What influenced the effectiveness of remote work in the opinion of respondents?

Therefore, the purpose of the study is to analyze and evaluate the remote work of public sector employees during the SARS-CoV-2 pandemic, taking into account the evaluation of the efficiency of the tasks performed, taking into account the type of position held, the experience of the employees, technical and organizational aspects, the inconvenience of the work and the level of digital competence.

The structure of the article consists of three parts. The first discusses the legal regulation of remote work in the public sector, then focuses on presenting the principles of remote work in public entities, which are complemented by a discussion of remote work in the studied public institution, whereas the last part presents the research methodology along with the obtained research results. During the implementation of the study, research methods and techniques were used, such as: analysis of the literature on the subject, analysis of legal regulations and internal legal acts and rules, diagnostic survey with the use of a survey questionnaire, statistical methods (chi-square test, p-value and Pearson's coefficient). The article concludes with conclusions along with indications of future research directions.

2. Regulating remote work in the public sector

Remote work, also known as telecommuting, is a phenomenon with many dimensions and contexts. There is no single generally accepted definition of the term, but it can be described as a form of work performed in whole or in part at a location other than the default workplace. Terminology related to remote work includes terms such as "remote work", "telework", "work from home" and "home-based work" (International Labour Office, 2020), of which "telework" is a more general term that includes workers using ICT to work remotely. Research on remote work focuses on various aspects of it, such as efficiency, employee health, technologies used for remote work, organizational culture, and the challenges of managing employees in a remote environment.

Evolution of the term teleworking (Barriga Medina et al., 2021) and numerous studies on remote work reflect its significant impact on how employees do their jobs and work lives. As technology and organizations adapt to this work model, it is essential to continue to study and analyze its impact on various aspects of work and social life, especially concerning the public sector.

It should be noted that the popularity and prevalence of remote work is a result of countering the spread of the Sars-CoV-2 epidemic, and not solely a tool for making work more flexible. It is also worth noting that due to the issue's complexity, new regulations governing remote work came into force on April 7, 2023 (Labor Code, 2023), therefore much later than the situation required. As J. Czerw notes from data from the Central Statistical Office, at the end of December 2021, the share of those who worked remotely due to the epidemic situation in the total number of workers surveyed was 6.9%, with the scale of remote work use in the public sector being higher than in the private sector (Czerw, 2023).

Due to the increase in COVID-19 cases and the lack of regulations, there was a need for regulations to limit the spread of the infection. These included restrictions on civil liberties. In Poland, this was both in the nature of freedom of access (regarding cultural facilities, gyms, restrictions on the number of seats on public transportation), prohibition of certain behavior (regarding prohibition of movement of minors during certain hours) and the form of work provision. Concerning the provision of remote work (away from the employer's premises), the legislature found the existing regulation insufficient and introduced the concept of remote work. At the time the law was passed (CoronavirusU, 2020), the potential effects of remote work could only be analyzed concerning telework, present in Polish law since 2007. Accordingly, on November 3, 2020, the Council of Ministers Regulation came into force (Regulation of the Council of Ministers, 2020) allowing remote work for local government employees.

The Council of Ministers has obliged (Regulation of the Council of Ministers, 2020, §24a(1)) heads of public administration offices, general managers or directors of organizational units operating in public administration offices or organizational units performing tasks of a public nature to instruct employees to work remotely. At the same time, §24a(2) stipulated that the exclusion of remote work is possible concerning employees performing tasks necessary to assist citizens or arising from the law or the needs of the office or unit, and it is not possible to perform these tasks by remote work.

The provision formulated in this way simultaneously constituted an obligation (Council of Ministers Ordinance, 2020; §24a(1) – remote work order) and exclusion of the obligation (Council of Ministers Ordinance, 2020; §24a(2)). Similarity to the content of re. 3 of the CoronavirusU, §24a was vague and indefinite in nature, and it was up to the person in charge of the unit and issuing the remote work order to determine altogether: (1) whether the tasks to be performed are necessary and fall within the scope of §24a; (2) whether performance of the tasks is not possible through remote work.

The legislator's intention was to introduce remote work as a rule (as part of countering the SARS-CoV-2 pandemic), and work at the office premises was to be treated as an exception. Also coinciding with this decision was a communiqué of the Joint Commission of Government and Local Self-Government dated October 31, 2020 (Communication of the Joint Commission of Government and Local Government, 2020), preannouncement of the regulation. Although, as rightly emphasized by (Czerw, 2023) remote work should be a solution used not only during the epidemic and not only to counter it, but as a flexible form of employment.

Importantly, the regulations on remote work should also, at a minimum, specify the rules: (1) determination of the location of remote work; (2) direct control by the employer of the performance of remote work; (3) reimbursement to the employee of the costs incurred in connection with the performance of remote work – electricity, Internet, organization of the workstation, others; (4) verification of the organization of the remote workstation in such a way as to ensure safe and healthy working conditions; (5) liability of the employer for accidents to the employee while performing remote work (Czerw, 2023).

3. Characteristics of remote work in the surveyed unit

The case presented here concerns a study conducted at City of Lodz Office (hereafter referred to as UMŁ). The entity, adapting its internal regulations to (Regulation of the Council of Ministers, 2020) and (Law on Prevention and Control of Infections and Infectious Diseases in Humans, 2008), issued an order (Ordinance on Remote Work, UMŁ, 2020) remote work for a limited period (Ordinance of the Council of Ministers, 2021; Ordinance, UMŁ, 2021). It should be noted that the possibility of remote work was not feasible before the pandemic.

Until the introduction of internal rules governing remote work, work orders were given based on generally applicable task responsibility regulations, particularly the Labor Code, the Organizational Regulations and the Work Regulations.

The transition to remote work required a written order from the relevant director or head of the organizational unit. Also, the record of work performed required a written form and required the employee to report electronically the activities performed on a daily basis. An employee working remotely was required to comply with the Data Security Manual and to remain in constant email and telephone contact with his supervisor. The effectiveness of remote work was monitored by the City Secretary.

Despite its unilateral nature, the command was consulted with superiors, the team and colleagues, so that the individual situation in the organizational unit could be considered. In most cases, remote work was used in cases of COVID-19, quarantine or self-isolation and lasted from a few days to a few weeks.

Both those responsible for delegating employees to perform remote work and the employees themselves stressed the need to regulate remote work in the Labor Code urgently. This situation did not change until 2023.

The development of the pandemic in Poland resulted in several successive waves of infections. During the period we analyzed, we can distinguish two consecutive waves. The first lasting from the emergence of COVID-19 disease until the reduction of civil rights restrictions resulting from a sense of control over the spread of the virus, and the second falling in the period from the increase in infections until the start of vaccination. The daily number of SARS-CoV-2 infections in Poland during this period is presented in Figure 1. It is worth noting that the daily nationwide number of diseases during the first wave was relatively small (less than 1000 infections per day), while in the second wave there was a steady increase (nearly 30,000 infections at its peak).

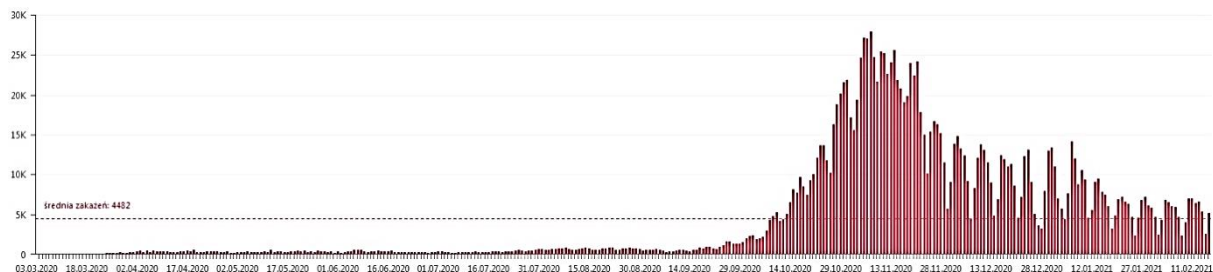


Figure 1. Daily number of SARS-CoV-2 infections in Poland in the period 04.03.2020-15.02.2021.

Source: (Coronavirus in Poland, 2021).

Due to the developing epidemic, the surveyed unit introduced the possibility of remote work and began keeping aggregate records of off-site work orders (Fig. 2, Fig. 3 and Tab.1).

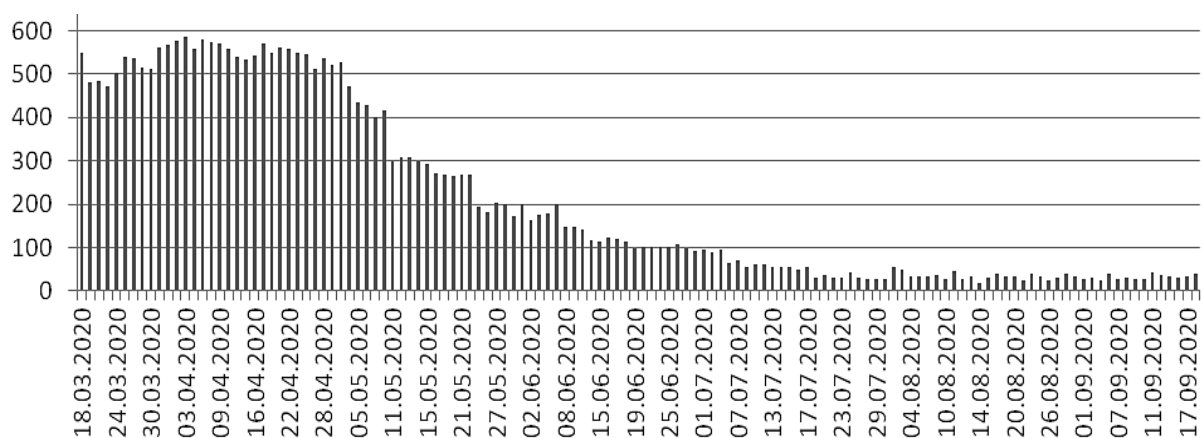


Figure 2. Remote work in UML in the period 18.03.2020 - 18.09.2020.

Source: own study.

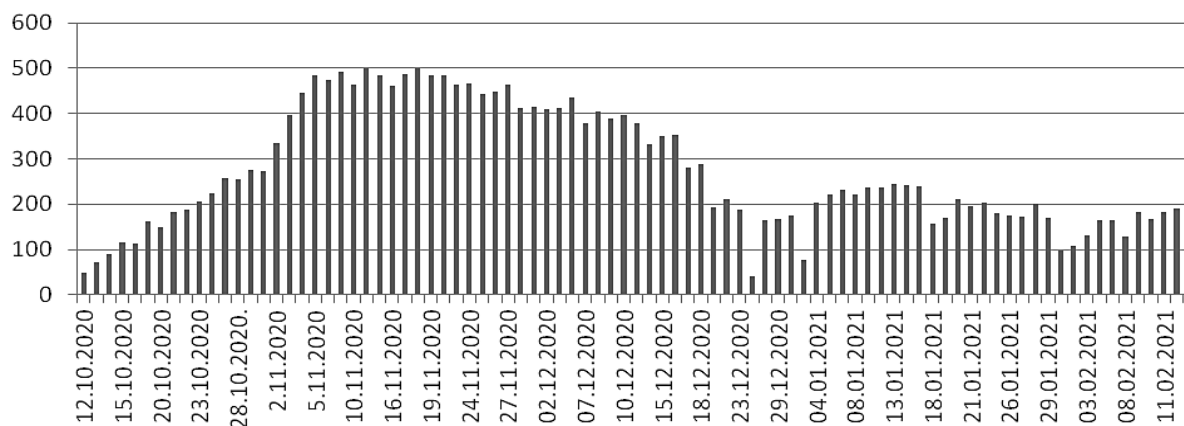


Figure 3 Remote work in UMŁ in the period 12.10.2020 – 15.02.2021.

Source: own elaboration.

During the first wave of the pandemic at UMŁ, we can observe significant differences in the number of employees working remotely between consecutive weeks. On average, during the period from March 18, 2020 until the beginning of May 2020, the number of remote workers exceeded 500 people, but then the number steadily declined to reach only 26 working remotely at the end of August 2020. The second measurement period shows a steady increase in remote workers, which remained between 400 and 500 people in the November-December period, and from Christmas-New Year around 200 people with a downward trend. In total, as of 15/02/2021 148 people were working remotely, however, the days around and before Christmas represent a significant deviation from the norm, usually resulting in absenteeism of about half of the employees.

Table 1.

Remote work in the various Departments of the surveyed entity

Pandemic phase	18.03.2020-18.09.2020					12.10.2020-15.02.2021				
	Date	18.03.20	03.09.20	25.06.20	03.04.20	18.09.20	12.10.20	26.10.20	18.11.20	15.02.21
	Initial day	The lowest number	Closest to the median	The highest number	Final day	Initial day	Closest to the median	The highest number	Final day	
Total		549	26	103	587	40	48	223	501	122
D. President		115	18	42	130	25	24	56	74	35
D. Ecology and Climate		17	0	2	39	5	0	7	19	1
D. Health and Social Affairs		37	0	2	28	1	2	33	50	20
D. Planning and Economic Development		reorganization					0	5	45	8
D. Asset Management		66	0	3	65	0	2	6	63	17
D. Revitalization and Sports		26	0	0	22	0	0	0	5	0
D. Labor, Education and Culture		30	0	5	43	1	10	19	81	4
D. Strategy and Development		106	2	19	92	1	9	78	114	29
D. Office Organization and Resident Services		9	0	1	16	0	1	8	35	6

Cont. table 1.

D. Public Finance	66	0	6	81	1	0	11	15	2
D. Service and Administration	77	6	23	71	6	reorganization			

Source: own study.

Analyzing the data from the two research periods (Table 1), it can be seen that during the critical moments of preventing the spread of COVID-19 (March-April and November-December 2020), the level of remote work referrals was similar. Immediately after the introduction of remote work, it reached a maximum of 587 referrals, and during the second wave it oscillated around 500. With the decrease in the incidence of COVID-19 in the summer of 2020 a decline in the number of people working remotely at UMŁ was also observed. Nevertheless, a higher median overall number of remote work referrals is kept in the second wave, possibly due to the increased number of cases and increased awareness of the disease and its spread. The latest measurement confirms this trend, settling at 122.

In conclusion, analysis of the data on remote work orders for individual Departments does not support the thesis of the proportional nature of these orders. It can be seen that the number of referrals varied from Department to Department, with variation due to various factors, such as COVID-19 employee infections or a change in supervisors' views on the legitimacy of using this form of work (in the second of the periods studied). A trend of recommending remote work during the virus outbreak was noted, as well as a reduced number of commands in some Departments in the second wave of the pandemic. In addition, there were no units where remote work was introduced permanently, except for the Legal Department. On the other hand, there were business units where no remote work orders were recorded. Most of these are in the Department of Office Organization and Resident Services. A low number of remote work orders can also be seen in the Department of Public Finance. In the remaining organizational units, remote work orders correlate with employee infections. We can also note incidental preventive remote work orders for most employees of a specific Office or Department due to many diseases.

4. Research Methodology

The empirical research was conducted in 2021, using a survey questionnaire and was anonymous. Employees received an invitation to complete the survey with a link to a Google Docs form. The Office of Human Resources Management of the UMŁ sent an electronic invitation to all employees at their work email address. Respondents were granted complete anonymity to maintain voluntariness and avoid the influence of official subordination on the survey results. The survey return rate was 26% (N = 503) and representative of the unit.

The survey questionnaire consisted of twenty-three closed questions, which included 0-1 (yes, no) responses, on a scale of 1-3 or 1-5. The questions were divided into three groups. The first concerned the nature of the work performed. The second group included questions diagnosing the level of access to equipment and digital competence. The last group of questions was metric. The structure of the respondents is shown in Table 2.

Table 2.
Structure of respondents

	Employed - as of 15.02.2021.					Answers provided					
	Women		Men		SUM	Women		Men		SUM	
Employment status											
Total	1393	71,11%	566	28,89%	1959	368	73,16%	135	26,84%	503	25,68%
Type of position											
Executive	172	61,87%	106	38,13%	278	69	71,13%	28	28,87%	97	34,89%
Non-managerial	1221	72,64%	460	27,36%	1681	296	73,45%	107	26,55%	403	23,97%
Age											
20-30	143	71,50%	57	28,50%	200	43	67,19%	21	32,81%	64	32,00%
31-40	392	71,27%	158	28,73%	550	110	72,37%	42	27,63%	152	27,64%
41-50	431	75,88%	137	24,12%	568	113	76,35%	35	23,65%	148	26,06%
51-60	337	75,90%	107	24,10%	444	83	85,57%	14	14,43%	97	21,85%
61- and above	90	45,69%	107	54,31%	197	19	45,24%	23	54,76%	42	21,32%
Seniority											
0-10	337	68,36%	156	31,64%	493	90	67,67%	43	32,33%	133	26,98%
11-20	450	74,26%	156	25,74%	606	128	74,42%	44	25,58%	172	28,38%
21-30	323	73,58%	116	26,42%	439	87	78,38%	24	21,62%	111	25,28%
31 and over	283	67,22%	138	32,78%	421	63	72,41%	24	27,59%	87	20,67%

Source: own study.

To achieve such a goal, the following research questions were verified in the course of the conducted analyses:

1. How did units adapt existing legal and organizational rules to the requirements of remote working, and were they sufficient?
2. Were the ICT tools and supervisor support made available adequate to provide work from home?
3. Has the shift to remote work resulted in a reduction in service quality?
4. What influenced the effectiveness of remote work in the opinion of respondents?

The analysis was divided into the following stages:

Stage 1 – Preparation of the survey questionnaire.

Step 2 – Create a contingency table.

Step 3 – Conducting a chi-square test.

Based on the tables created, a chi-square test was performed, indicating the differences between the observed and expected frequencies of phenomena in the groups. To accurately interpret the result, a p-value was calculated to assess whether the differences were statistically significant.

Therefore, to analyze and evaluate the work of public sector employees, resulting from the need to switch to remote work during the SARS-CoV-2 pandemic, taking into account the evaluation of the effectiveness of the tasks performed in the perspective of the type of position held, technical and organizational conditions, support of superiors, digital competence of employees, the following research hypotheses were established:

H1: The effectiveness of remote work is dependent on the job position held (managerial, non-managerial).

H2: The effectiveness of remote work depends on organizational considerations.

H3: The effectiveness of remote work depends on technical considerations.

H4: The effectiveness of remote work depends on employees' digital competence.

H5: The effectiveness of remote work depends on the support of supervisors.

H6: The effectiveness of remote work depends on the structure of the respondents (gender, age, education, seniority).

H7: The effectiveness of remote work is related to perceptions of changes in service quality during the pandemic.

The final stage of the analyses was verifying the hypotheses and interpreting the results obtained. All calculations were performed using the Python program.

5. Test results

It was indicated above that a chi-square test was used to verify the research hypotheses. Accordingly, contingency tables were first created and then it was verified whether the rating given by the respondents was influenced by each variable. The analysis results applied to all the established research hypotheses are presented below. The results of the examinations conducted are shown in Table 3.

Table 3.

Results of the chi-square test for each research hypothesis

Research hypotheses	chi-square	p-value	Pearson's contingency coefficient:	Verification H
H1: The effectiveness of remote work is dependent on the job position held (managerial, non-managerial).	8,77	0,07	0,13	Not
H2: The effectiveness of remote work depends on organizational considerations.	46,86	0,00	0,29	Yes
H3: The effectiveness of remote work depends on technical considerations.	3,60	0,46	0,08	Not
H4: The effectiveness of remote work depends on employees' digital competence.	25,09	0,07	0,22	Not
H5: The effectiveness of remote work depends on the support of supervisors.	18,27	0,02	0,19	Yes

Cont. table 3.

H6: The effectiveness of remote work depends on the structure of the respondents: gender, age, education, seniority.	2,71 26,10 18,26 17,03	0,61 0,05 0,11 0,15	0,07 0,22 0,19 0,18	Not Not Not Not
H7. The effectiveness of remote work is related to perceptions of changes in service quality during the pandemic.	27,11	0,00	0,23	Yes

Source: own study.

First, the associations between the evaluation of remote work effectiveness and the type of job held (managerial, non-managerial) were examined. Table 4 shows the contingency table for hypothesis H1.

Table 4.

Efficiencies of remote work in relation to job type - contingency table

Efficiency of remote work	Workstation		
	executive	non-managerial	Final total
no	28	134	162
large	14	81	95
small	21	47	68
full	5	35	40
average	29	109	138
Final total	97	406	503

Source: own study.

Research indicates that the effectiveness of remote work can depend on many variables, such as the type of tasks performed or the nature of the position held. Specific activities may adapt better to remote working conditions than positions requiring teamwork or direct contact with customers. The survey asked respondents about their assessment of the effectiveness of remote work. According to the results, 46% of respondents considered remote work less effective compared to the traditional work model, while only 8% of respondents expressed the opposite opinion. Interestingly, almost half of the respondents (45%) assessed that they were unable to complete all tasks while working remotely. During the analysis, attention was paid to the responses of respondents who declared that performing tasks remotely was inefficient for them.

Examination of hypothesis H1, which focused on the relationship between task performance and the nature of the job position held (managerial versus non-managerial), did not provide sufficient statistical evidence to support the relationship. The obtained value of the chi-square statistic was 8.77, with an obtained p-value (p-value) of 0.07, with an assumed significance level (α) of 0.05. Therefore, we have no grounds to reject the null hypothesis. In addition, Pearson's contingency coefficient values of 0.13 suggest a very weak relationship between the analyzed variables. The correlation between job performance and organizational (Tab. 5) and technical conditions (Tab. 6) was further investigated.

Table 5.*Efficiencies of remote work in relation to organizational considerations – contingency table*

Organizational conditions						
Efficiency of remote work	very good	good	average	bad	very bad	Final total
full	12	12	9	4	3	40
large	11	47	29	3	4	94
average	15	67	42	12	0	136
small	7	18	30	10	3	68
no	9	64	64	15	10	162
Final total	54	208	174	44	20	500

Source: own study.

The survey found that only half of the respondents (52.4%) gave a positive assessment of the employer's organization of remote work, while as many as 48.8% showed an ambiguous positive and negative assessment. The negative assessment became the reason for H2 verification, which aimed to test whether the effectiveness of remote work is dependent on organizational conditions. The χ^2 (46.86) independence test allows us to reject the null hypothesis of independence of the studied characteristics. This means there is a statistically significant relationship between the effectiveness of remote work and organizational conditions. In addition, Pearson's contingency coefficient suggests a moderate relationship between the variables.

Organizational determinants were related to the structural aspect, hierarchy, division of authority, communication, formal rules, division of responsibilities, and guidelines for the operation of the studied unit. In light of the results, it can be concluded that the right organizational conditions significantly impact remote work efficiency, which can be necessary during the implementation or optimization of remote work. It is also worth pointing out that respondents in the surveyed unit, positively assessed the provision of appropriate tools for communication and cooperation, building a positive atmosphere in the team and maintaining bonds between employees during remote work.

Another important factor affecting the efficiency of remote work is technical considerations, as they relate to the infrastructure and tools required to perform tasks online. Requirements include software, reliable computer hardware with equipment, or fast and stable Internet access. In the case of our study, only 20% of respondents indicated that the employer, when issuing a remote work order, provided the necessary technical equipment (computer, software, camera) for the work. The rest of the respondents used their private computer equipment to carry out business work and rated its usefulness as very good and good (85%). In the course of the survey, an effort was made to verify whether technical conditions affect the effectiveness of remote work.

Table 6.*Efficiencies of remote working vs. technical considerations – contingency table*

Efficiency of remote work	Technical considerations		
	Not	Yes	Final total
full	28	11	39
large	79	16	95
average	106	30	136
small	56	10	66
no	128	34	162
Final total	397	101	498

Source: own study.

In this case, the χ^2 independence test does not allow rejecting the null hypothesis of independence of the studied characteristics. This means there is no statistically significant relationship between technical conditions and the effectiveness of remote work. In addition, Pearson's contingency coefficient indicates a very weak relationship between the variables. The need for digital tools was imposed during the COVID-19 pandemic and the transition from the traditional form of work to a remote model. Employees were confronted with the need to adapt to the new conditions, which included using various applications, communication and messaging platforms, or cloud storage systems.

It is worth emphasizing that employees' digital competencies, which include the ability to use computer equipment, multimedia tools and the internet, among other things, may show variation depending on factors such as age, education and work experience. Consequently, the impact of the pandemic on the level of these competencies may vary for different demographic groups of employees. Analysis of the responses of respondents from the surveyed unit indicated that the vast majority rated their digital competencies as high or very high (74%). Only a marginal portion of respondents (3%) indicated that adaptation to remote work had contributed to their digital competence. Moreover, more than half of the respondents expressed the belief that gaining these competencies would not have a significant impact on their future career path. It is worrisome that despite the positive self-identification of their digital skills, respondents do not see a direct link between them and their potential career development.

From the point of view of the demographic structure, there was a noticeable disparity in digital competence ratings between men and women; with women rating their digital skills at a higher level (40% of the total surveyed, and 57% among women). The survey also showed that employees with higher education, aged 31-50 and with 11-20 years of work experience marked a higher level of digital competence.

Table 7.

Effectiveness of remote working in relation to the level of digital competence of employees – contingency table

Efficiency of remote work	Level of digital competence					Final total
	very low	very high	low	average	high	
no	0	29	4	50	79	162
large	1	29	1	21	43	95
small	0	13	1	17	37	68
full	0	14	0	5	21	40
average	0	29	3	23	83	138
Final total	1	114	9	116	263	503

Source: own study.

H4 suggesting that the effectiveness of remote work is dependent on employees' digital competence was examined (Tab. 7). The chi-square statistical test showed a value of 25.09, with a p-value of 0.07, suggesting insufficient statistical evidence to support this hypothesis. In addition, Pearson's contingency coefficient of 0.22 indicates a weak relationship between digital competence and remote work efficiency. As a result, there was insufficient evidence to support the relationship between remote work effectiveness and employees' digital competence.

Another vital issue affecting employee performance is the support of supervisors, especially in the context of adaptation to remote work caused by the COVID-19 pandemic. The ability of management to provide the necessary support, communication and commitment is critical to maintaining the level of performance and commitment of remote workers. In analyzing the survey results, it was noted that more than 75% of respondents rated the engagement and support of their supervisors at the same level as during traditional desktop work. This observation underscores the importance of maintaining high levels of interaction and support from management, even in altered working conditions.

Table 8.

Effectiveness of remote work versus supervisor support – contingency table

Efficiency of remote work	Support from superiors			Final total
	lower	unchanged	higher	
no	33	122	7	162
small	13	47	7	67
average	14	111	11	136
large	13	73	9	95
full	10	22	7	39
Final total	83	375	41	499

Source: own study.

In verifying hypothesis H5, the χ^2 (18,27) independence test allows us to reject the null hypothesis of independence of the studied characteristics. This means a statistically significant relationship exists between the effectiveness of remote work and support from superiors. In addition, Pearson's contingency coefficient of 0.19, although indicating a weak correlation, confirms the presence of a relationship between management support and remote work effectiveness.

These findings highlight the importance of management support in the context of remote work, which should be considered by organizations planning or pursuing this work model. Effective support from supervisors can contribute to maintaining or even increasing the effectiveness of remote work, which can consequently contribute to achieving organizational goals, even under challenging circumstances. In light of the above data, organizations may consider developing management training programs that focus on communication and support for employees in the context of remote work, as well as monitoring and continuously surveying employee satisfaction and performance levels to identify areas for improvement. The study also sought to assess the impact of the structure of the respondents surveyed (gender, age, education, seniority of service) on the effectiveness of tasked work, allowing for a deeper understanding of the phenomenon (Table 9-12). The results indicate that women were generally better at performing remote duties than men. In terms of age groups, middle-aged workers (41-50 years old) experienced slightly more difficulty in performing all tasks while working remotely. The percentage of those who were unable to perform all tasks tended to increase with age, with the exception of the over 61 age group, where the percentage was relatively low, especially among men. As for the level of education, those with secondary education seem to have more problems compared to those with higher education. On the other hand, employees with less seniority (up to 10 years) indicated that remote work was more burdensome.

Table 9.

Effectiveness of remote work in relation to gender of respondents – contingency table

Efficiency of remote work	Gender		Final total
	woman	man	
no	116	46	162
small	47	21	68
average	102	35	137
large	75	20	95
full	28	12	40
Final total	368	134	502

Source: own study.

Table 10.

Effectiveness of remote work in relation to age of respondents – contingency table

Efficiency of remote work	Age					Final total
	20-30 years old	31-40 years old	41-50 years old	51-60 years old	over 61 years old	
no	13	38	60	35	16	162
small	8	24	14	17	5	68
average	20	44	41	23	10	138
large	14	28	28	17	8	95
full	10	17	5	5	3	40
Final total	65	151	148	97	42	503

Source: own study.

Table 11.*Effectiveness of remote work in relation to respondents' education – contingency table*

Efficiency of remote work	Education				Final total
	middle school	medium	higher	professional	
no		17	142		159
large	1	10	78	1	90
small		5	61		66
full		4	34	1	39
average		25	109		134
Final total	1	61	424	2	488

Source: own study.

Table 12.*Effectiveness of remote work in relation to the seniority of respondents – contingency table*

Efficiency of remote work	Seniority				Final total
	0-10 years old	11-20 years old	21-30 years old	over 31 years old	
no	32	57	39	34	162
large	30	26	22	17	95
small	19	21	16	12	68
full	18	11	6	5	40
average	35	56	28	19	138
Final total	134	171	111	87	503

Source: own study.

The results of the statistical analysis presented in the context of research hypothesis H6 indicate that there is no significant relationship between remote work effectiveness and the structural variables analyzed, such as gender, age, education and seniority. According to Table 3 of the study results, the chi-square values indicate that there is no strong relationship, while the p-value values suggest that the observed differences are not statistically significant. Pearson's contingency coefficients, a measure of the relationship between variables, also suggest weak relationships. Thus, H6 did not find significant support in the data, suggesting that the demographic structure of respondents does not show a strong relationship with their remote work effectiveness. Also, research by J. Szczepanski and L. Zamecki shows that age is not a significant variable and had no impact on the way work was done (Szczepanski, Zamecki, 2021).

The last hypothesis that was verified was the relationship between opinions on the effectiveness of remote work and perceptions of changes in service quality during the pandemic (Tab. 13). In the survey conducted, almost 77% of respondents indicated that the pandemic did not affect the quality of services, while 17% of respondents believe, it was at a lower level. However, it was decided to examine the relationship between the variables.

Table 13.

Effectiveness of remote working in relation to perceived changes in service quality during a pandemic – contingency table

Efficiency of remote work	Quality of services provided			Final total
	At a lower level	At a higher level	No impact	
no	43	7	112	162
large	9	8	78	95
small	14	2	52	68
full	6	6	28	40
average	14	7	115	136
Final total	86	30	385	501

Source: own study.

Research hypothesis H7 suggests a relationship between remote work effectiveness and perceptions of changes in service quality during the pandemic. Statistical analysis indicates a chi-square value of 27.11 suggesting a connection between the variables. The p-value of 0.00 is very strong evidence of this, the ascendancy of the relationship between the variables, and indicates a very high level of significance. On the other hand, Pearson's contingency coefficient of 0.23 suggests a moderate relationship between the effectiveness of remote work and perceptions of changes in service quality. Although the relationship is not very strong, it is significant and may indicate critical practical implications.

In summary, the results suggest that employees who were effective at working remotely were also able to perceive changes in the quality of services provided by their organizations during a pandemic. This may suggest that adaptation to remote work and maintaining high service quality are linked. This is vital for organizations seeking to maintain customer satisfaction and operational efficiency during difficult periods such as a pandemic.

The ability to adapt to the requirements of remote work is also an essential factor in the transition and provision of remote work. In the case under review, the unit responded correctly to the changing circumstances, adjusting its legal and organizational rules in response to nationwide regulations on remote work. Of particular note is the speed and flexibility with which the institution made decisions and issued orders in response to state guidelines.

The introduction of mechanisms to control the remote work process was a crucial step in maintaining the quality and efficiency of employees' task performance. The obligation of daily reporting and constant contact with the supervisor ensured that, although employees performed their duties remotely, they were still accountable and obligated to comply with established standards.

The introduction of data security regulations was an important element in the whole process of adjusting to the new form of work. Caring about personal data indicates the institution's responsibility and commitment to ensuring compliance with data protection regulations.

At the same time, UMŁ's flexibility in applying remote work regulations is worth highlighting. Although the remote work orders were unilateral, the fact that they were consulted with the team shows that the institution sought to consider the individual needs and situations of employees.

6. Summary

The study was conducted to assess the remote work of public sector employees in the context of the COVID-19 pandemic and helped fill a research gap due to limited research in this sector.

We adopted seven hypotheses for the study. Only three of them were positively verified: (1) remote work efficiency depends on organizational conditions; (2) remote work efficiency depends on supervisor support; (3) remote work efficiency is related to perceptions of changes in service quality during the pandemic.

Our research also indicates that institutions should consider developing management training programs that focus on communication and employee support in the context of remote work to maintain or increase the effectiveness of remote work. It is necessary to develop a communication strategy that enables effective information flow between teams and supervisors when working remotely. Implement an employee satisfaction and effectiveness survey, through continuous monitoring and research to identify areas for improvement and understand the impact of remote work on the organization and employees. It is also not insignificant to analyze the impact of remote work on the quality of services provided, for identifying areas that may require additional support or resources to maintain quality services. While minimizing technical barriers is possible by making investments in technology infrastructure.

It is also worth noting that despite the lack of previous experience arising from remote work in the public administration, the transition to this type of work has not caused significant formal problems, and its evaluation is positive. The surveyed unit demonstrated its ability to adapt to the dynamically changing situation related to the COVID-19 pandemic, and the introduction of regulations on remote work was a response to the new challenges that emerged in 2020. Also, research (Szczepanski, Zamecki, 2021) emphasize the importance of making remote work regulations more flexible.

In addition, the effectiveness in adapting to the challenges of remote work was due to, among other things, reactivity and speed of decisions, maintaining control over the work process, flexibility in adjusting regulations, or attention to data security. Since, as highlighted by researchers J. Szczepanski and L. Zamęcki, with the delegation of public employees to remote work significantly reduces the security of transmitted information (Szczepanski, Zamęcki, 2021).

In addition, we can also see a permanent change in internal practices in the unit, e.g., some meetings have permanently taken the form of videoconferencing (e.g., mayor's colleges, multi-person internal or external meetings).

It should be noted that our study was quantitative, which limits the analysis of certain aspects. While quantitative data provides essential information on trends and correlations, qualitative research could provide more detailed information on employees' experiences, feelings and perspectives. Such information could be key to understanding why some employees may experience challenges in remote work, while others adapt to it without difficulty.

In addition, although our research sample is large, it was limited to one public institution, which may affect the generalization of the results. Public entities may have different organizational culture, structure and procedures that affect the experience of working remotely. It is also worth noting that the survey was conducted during a specific period. External factors, such as the pandemic situation, can shape how employees feel about working remotely. Therefore, it is important to conduct similar studies at different periods to understand how these factors affect the results.

Therefore, while our survey provides essential insights into remote work in the public sector, it is vital to understand its limitations and interpret the results with these limitations in mind.

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