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Economic Effectiveness of Remote Work in Organizations of the Public Utility Sector

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Łódź, 2024

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Introduction

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Technological developments, such as smartphones and tablet computers, have revolutionized everyday working life in the 21st century. Even though employees do not commute to work physically, they can instantly connect with their co-workers and supervisors through technological devices. Most of today's office workers have technological devices and internet access support. If almost everyone can reach the internet quickly, employees can work from anywhere, anytime. This new spatial independence dramatically changes technology's role in the working environment, offering new opportunities and challenges (Messenger and Gschwind, 2016). The opportunities provided by information technologies in the information society have increased flexibility in business life, so the working environment has become portable, from traditional offices to homes (Hardill and Green, 2003). Remote work is a way of working outside the enterprise because the employee works outside the organization's premises but is in contact with the organization (Yu, 2008).

Nowadays, remote work has become a response to the needs of modern economies where private and public institutions operate and create networks of connections. The public utility sector, which refers to an activity, good, or service that brings benefits or collective interests to the residents of a country (Bruijn, Dicke 2006), is among them. Careful implementation of remote work in public organizations may improve the quality of working conditions and work sustainability (Eurofound, 2023). With the widespread use of remote work, there is a need to identify whether and under what conditions remote work is economically effective in public utility sector organizations. However, public utility sector organizations are in an extraordinary situation because their primary goal, the current and continued satisfaction of social needs, partly determines innovative behavior. The lack of classic market determinants, such as profit orientation and private ownership, slows the adjustment to the new conditions. Consequently, effective remote work implementation presents a significant challenge for public utility sector organizations. This study aims to identify whether and under what conditions remote work is economically effective in public utility sector organizations from three perspectives: technological, management, and resource allocation.

Justification of the choice of the dissertation topic and revealing the research gap

Remote work is not a new working method; however, with the COVID-19 pandemic, it has grown in popularity swiftly, and many firms have had to adjust quickly to it (Bick, Blandin and Mertens, 2020; Marzano and Zając, 2022; Hansen et al., 2023). Also, raw statistics support this expression. According to data from Eurofound in July 2020, 33.7% of employees worked remotely in Europe (Eurofound, 2020). Even if when society across Europe began to re-open after the first intense lockdown, the proportion decreased, it was still remarkable. According to data that Eurofound collected in February and March 2021, 24% of employees worked remotely in Europe (Eurofound, 2021). Before the COVID-19 pandemic 2018, the proportion of employees in Poland who could work remotely was lower than the average among EU member states. It accounted for approximately 4.6%, whereas 5.2% of individuals regularly engaged in remote work from their homes across the entire EU. However, in 2020, Poland's percentage of remote workers doubled compared to the 2018 data, reaching 8.9% (Radziukiewicz, 2021). Today, remote work is still a significant work method. The report of Aksoy et al. (2023) reveals that remote work is still preferable by employers and employees partially or fully worldwide. According to the report, English-speaking countries exhibit the highest remote work levels globally (on average, 1.4 days per week). Respectively, Australia 1.3 days, Canadia 1.7, New Zealand 1.0, UK 1.5 and USA 1.4 days per week. Remote work levels average 0.9 days per week in Latin American countries and South Africa and 0.8 days per week in European countries. In the case of Poland, 0.7 days per week. Lastly, 0.7 days per week in Asian countries. Additionally, a study by Barrero, Bloom, and Davis (2023) indicates that as of 2023, 12% of full-time American employees now work remotely on all or almost all workdays. Nearly 29% have a hybrid arrangement, splitting the workweek between home and their employer's worksite. Statistical data indicates that remote work is becoming a global trend, driven significantly by technological advancements. Empirical and practical evidence suggests that public utility services must understand and implement appropriate technological, resource allocation, and management strategies to manage remote work and achieve economic effectiveness.

European Commission's 2030 Digital Decade report states that the success of the EU's digital transformation requires a substantial acceleration and a deepening of the EU's and Member States' action to make reforms, improve the business environment, create incentives and boost investment in digital technologies, skills and infrastructures (European Commission, 2023a).

European Commission's Digital Decade Country report indicates that Poland can improve its performance in the digital transition and contribute to the collective efforts to achieve the EU's Digital Decade targets, including achieving 100% public digital services. There has been progress in digitalizing public services, with notable improvements to the flagship e-government app and e-health. Poland has also progressed in its skills, but it should strive further to achieve the Digital Decade targets. Poland's performance in digitalizing business remains below the EU average, with significant progress still needed to uptake advanced technologies (European Commission, 2023). In total, the report estimates that achieving the Digital Decade goals could unlock over €2.8 trillion in the European economy. Additionally, the report indicates that achieving the Digital Decade goals could unlock 491 billion PLN in the Polish economy (PublicFirst, 2022).

In the literature, the effectiveness of public services is studied by Andrews and Entwistle (2010), Mihaiu, Opreana, and Cristescu (2010) and Kachniarz (2012), Mustafa, Farida and Yusriadi (2020), Hakim (2021). However, these studies do not focus on the effectiveness of public services while working remotely. On the other hand, researchers use different methods to measure economic effectiveness in remote work organizations, depending on the nature of the work. The researchers mainly focus on employees' or managers' productivity and job performance in literature (Mutiganda et al., 2022). Most studies were descriptive or analytical cross-sectional studies; Anakpo et al. (2023), Bao et al. (2022), Delanoeije and Verbruggen (2020), De Menezes and Kelliher (2017), Feng and Savani (2020), Gajendran et al. (2015), Golden et al. (2008), Golden et al. (2008), Golden and Gajendran (2019), Hill et al. (2003), Hyland et al. (2005), Kitagawa et al. (2021), Medina-Garrido et al. (2017), Morikawa (2020), Narayanamurthy and Tortorella (2021), Ralph et al. (2020), Sherman (2020), Tsukamoto (2021), van der Lippe and Lippenyi (2020), Vega et al. (2015), Buckingham, M. (2021).

However, these studies have narrow approaches to asses economic effectiveness; therefore, comprehensive measurements for assessing the economic effectiveness of remote work are still a challenge (EY, 2021; Carrotspot, 2021; Deloitte Insight, 2021). Moreover, the literature review reveals that studies are limited in this subject. Therefore, the study assesses the economic effectiveness of remote work in public utility services and proposes a new systematic methodology to fix the research gap.

Theoretical context of research

The theoretical background of the study determines the significance of remote work. Justifications for the effectiveness of remote work were made in two categories: economic justification by the knowledge-based economy (KBE) and the flexible-firm model and social justification by feminization of the workplace concept, social exchange theory, and generational theory. According to the theories, using remote work may give public utility services opportunities and advantages to having a more skilled labor force.

The KBE refers to the value of knowledge and human capital that has increased daily in the global economy. Also, the KBE states that with the development of communication technologies, work no longer depends on location. It is widely acknowledged that we have transitioned to a knowledge-based economy, defined by at least two key characteristics: knowledge is a significant factor in economic growth, and the innovation process is systemic (Llerena, 2005). From this point of view, public utility services must generate their working systems for remote work, considering the dynamics of knowledge-based innovation. If they want to provide high-quality services to their citizens, it is critical to have skilled labor forces. When it considers that the roots of the KBE are spreading worldwide dramatically and have become a significant trend (Hines and Carbone, 2013), if the international laws/regulations are acceptable with such employment in related countries (on both employer and employee sides), talent can be sourced worldwide. From this perspective, organizations should stay caught up in significant trends in the knowledge-based economy and apply remote work to achieve economic effectiveness.

The flexible firm model claims that public utility services may achieve a flatter and faster communication structure and a more proactive workplace with flexible working methods such as remote work. Flexible working refers to employees' flexibility over how long, where, when, and what times they work (CIPD, 2021). If companies are flexible, they can gain significant long-term competitive benefits. Firstly, a flexible business can deploy its employees and utilize their talents more effectively and efficiently than one that is not. Secondly, the more adaptable an organization is, the better it will adjust to change. Finally, employee flexibility, particularly regarding working hours, is highly valued by employees and can thus aid in recruiting and retaining top performers (Taylor, 2018). Naqshbandi et al. (2024) findings reveal that flexible work significantly and positively affects job performance.

According to the Office of National Statistics (ONS), two-thirds of individuals working at least half of their time from home are self-employed, while a third work part-time. Remote work goes hand in hand with other forms of flexible work, and trends in these fields of work may explain at least some of the growth of remote work (Felstead and Henseke, 2017). Remote work is one of the flexible working methods which is significantly popular worldwide. The flexible firms model refers to the fact that when public utility services use flexible working methods such as remote work, they will have functional, numerical, and financial flexibility to make organizations more dynamic. That is why public utility services need to apply remote work, which provides flexibility to employees and makes their work attractive.

The feminization of the workplace concept claims that the women's labor force has increased in the labor market. On this point, public utility services have to apply the proper working methods to be attractive to women. Taking into consideration that working women contribute considerably to household, national, and global economic development, failing to create women-friendly work practices such as fair remuneration may eventually reverse all of the gains made as a result of increased female engagement in the workplace (Stamarski and Song Hing, 2015; Munongo and Pooe, 2021). Therefore, public utility services shall adjust their employment practices in response to the feminization of the labor force and the rising participation of mothers in the job market to meet the demands.

Laß, Vera-Toscano, and Wooden's (2023) study findings suggest the main benefit of remote work for workers arises from the improved ability to combine work and family responsibilities, something that matters more to women given they continue to shoulder most of the responsibility for house and care work. In this regard, organizations providing remote work possibilities may be attractive centers for the women's labor force.

The feminization of the workplace and remote work are two parts of a big puzzle. The workplace is feminizing, with women entering the labor market. If organizations apply for remote work, they can be attractive centers for qualified women in the labor force. After working remotely in organizations and providing employees with flexible and comfortable workplaces, women would enter the labor market more intensely. With women entering the labor market intensely, the competition in the labor market may be more challenging as well. After all, positively evaluated

candidates may be recruited, and a more qualified workforce can provide better outputs, higher employee performance, and customer satisfaction with organizations.

Generational theory argues that members of the generation born and growing at different times and periods, affected by the historical, social, cultural, and political events of the period in which they grew up, have different values, beliefs, attitudes, and expectations and that all these differences have an effect on employee behavior (Kupperschmidt, 2000; Howe and Strauss, 2007; Lepeyko and Blyznyuk, 2016). Over the years, new generations have joined the workforce, so the generation profiles of public utility services have been changing and diversifying. Significantly, new generations, such as Generation Z, inhabit an environment rich in new technological developments, advanced communication systems, and efficient transportation facilities. In this regard, new generation members can use technology well and work remotely successfully; they tend to be physically alone and prefer to avoid geographical limitations. Remote work is a proper system that allows employees to work anywhere and anytime; hence, it meets their expectations.

Finally, social exchange theory claims that there is a social exchange between employees and organizations. A successful relationship may be possible by meeting common expectations between them. Not only should organizations pay attention to employee expectations, but employees should also pay attention to institutions' requests. In other words, if an employer treats an employee well and gives him or her a pleasant working environment, proper working methods, numerous social rights, reasonable compensation, and other benefits, the employee may return to practical work, high performance, and positive outcomes. When considering social exchange theory's basic assumptions and previous studies about remote work, it reveals that if public utility services apply for remote work fully or partially as their working method, employees may provide practical work and better performance. Effective working methods in public utility services can bring positive outcomes; however, ineffective methods may negatively impact employee performance and results.

Research subject

Undoubtedly, the COVID-19 pandemic has determined the global trend of changing work from stationary to remote in both the private and public sectors. Although remote work is not a novelty in the labor market, challenges related to its effectiveness have recently been caused by the prevailing scale of remote work in various organizations. In the private sector, profit is the most critical driver that provides economic effectiveness for remote work. However, public utility services do not operate in the interests of profit. The lack of classic market determinants, such as profit orientation and private ownership, slows the adjustment to the new conditions. That is why organizing remote work and measuring the economic effectiveness of remote work regarding public utility services is challenging. Nowadays, flexible work applications such as remote work are spread worldwide. It is leading to opportunities and challenges in today's dynamic work environment. Remote work is a response to the needs of modern economies, where private and public institutions operate and create networks of connections. Especially in public utility services, meeting immediate and ongoing social needs is crucial. Remote work trends rearrange traditional office work to optimize outcomes in public utility services. Achieving operational goals becomes increasingly critical to maintaining successful service delivery due to the dynamic of the work environment. This brings out the significance of implementing remote work in public utility services.

In this study, the classic definition of the public utility sector, in which three types of public services can be distinguished (Kachniarz, 2012; Miłek and Nowak, 2021):

- Administrative services (e.g., decision, strategic planning, registrations, local taxes): administrative services typically involve performing authoritative functions of public authority and legalizing areas of human activity. Their essence is not related to the provision of specific goods; instead, they represent actions carried out ex officio or at the request of the service recipient. Such specific services include vehicle registration, issuing driver's licenses, and obtaining environmental or building permits. Separate laws usually regulate the scope and type of these services, and the procedures and methods are specified by the Code of Administrative Procedure.

- Civil services (e.g., education, culture, sports, social care): social services aim to distribute goods that meet a society's basic needs. They are an element of shaping and enriching individuals' material and intellectual resources. Social services include education (at every level of education), healthcare, culture, sports, social assistance, public safety, and housing needs. Socio-political agreements between public authorities and society shape the level and standard of these goods.
- Technical/infrastructural services (e.g., water supply, public transport, maintenance of roads, public spaces): technical services are related to municipal infrastructure, involving its management and availability. In this context, they meet collective needs. Due to the high costs of creating infrastructure, they often operate on a monopoly basis. These services include, among others, water and energy supply, transport and communication, land management, green space management, cemetery maintenance, and waste disposal.

The study covers administrative and civil services only. Infrastructure services are excluded since they are closely related to the use of technical infrastructure in the physical space, which significantly reduces the scale of remote work. In addition, these services are most often outsourced to the private sector.

In this study, remote work is considered part of the work process in the public utility sector. According to ISO 9000, a "*process*" can be defined as a "*set of interrelated or interacting activities, which transforms inputs into outputs*." These activities require allocating resources such as people and materials (Corrie, 2004). Achieving desired outcomes also relies heavily on technological infrastructure and effective management practices. Both inputs and desired outputs can be physical (such as equipment, materials, or components) or intangible (such as energy or knowledge) (Corrie, 2004). According to ISO 9000, effectiveness is achieving desired results (Tsim et al., 2002; Corrie, 2004). From this point of view, remote work is an input to achieving the desired output of the work process in the public utility sector. This study defines the effectiveness of remote work as the ability to achieve desired results from an economic point of view based on technological effectiveness, resource allocation effectiveness, and management effectiveness perspectives.

Efficiency is the ratio of the results achieved to the resources used. Efficiency in the holistic meaning of remote work is challenging to estimate due to too complex cost categories, which are often immeasurable or difficult to value in money directly. That is why the study only focuses on the economic effectiveness of remote work in public utility sector organizations.

Aim of the study and research hypotheses

The study aims to identify whether and under what conditions remote work is economically effective in public utility sector organizations. According to this primary aim, the following objectives are assessed to bridge literature gaps and provide a comprehensive perspective:

I. Whether remote work saves public utility services' indirect employee costs;
II. The effect of remote work on public utility services' goal achievements;
III. The effect of remote work on the control mechanism of managers in public utility services;
IV. The effect of remote work on the organizational structures of public utility services;
V. Investigating the extent of empowerment dynamics between employees and managers in remote work within public utility services;
VI. Whether there is any significant difference between generation members regarding work-life balance levels during remote work in public utility services;
VII. Comparing transnational companies and public utility services regarding the context of economic effectiveness to indicate the differences in the application of remote work and emerge suggestions for improvement of public utility services.

The economic effectiveness of remote work is a multi-dimensional category. Identifying whether and under what conditions remote work is economically effective in the public utility sector requires a holistic approach. This study defines the holistic economic effectiveness of remote work based on three perspectives:

I. Resource allocation effectiveness: It focuses on whether organizations use resources effectively to maximize productivity and minimize costs;

II. Technological effectiveness: It focuses on whether organizations use technology effectively to improve the remote work experience for their employees;

III. Management effectiveness: It evaluates organizational effectiveness within purposeful, system, multi-criteria, and team management approaches.

In this study, six research hypotheses (H1-H6) under resource allocation effectiveness, technological effectiveness, and management effectiveness (purposeful, system, multi-criteria, and team approaches) were formulated to identify the economic effectiveness of remote work.

H1. If public utility services work remotely, they lower indirect employee costs.

H2. The technological readiness of employees is determined by employers' involvement in the infrastructure support of remote work.

H3. If public utility service works remotely, the dominant form of goal control is task control.

H4. If a public utility service works remotely, its organizational structure is flat and flexible.

H5. If the employee has a good work-life balance during remote work, the public utility service effectively achieves its goals.

H6. If public utility service works remotely, they are not self-management teams.

Information sources and research methods

This dissertation's research problems and objectives guided the choice of data sources and research methods. Key secondary data sources utilized in this work encompass subject literature in English, Polish, and other foreign languages; legislative documents at national and EU levels; and research outputs in the form of reports and studies. These sources include publications from the European Commission, European Labor Authority (ELA), Eurofound, Organization for Economic Co-operation and Development (OECD), International Labor Organization (ILO), and the World Bank.

This study adopted desk research as a qualitative research method involving literature review and critical text analysis. The survey was also adopted as a primary quantitative research method. A telephone interview in the case of utility sector bodies and a direct interview in the case of transnational companies supported the survey. Three separate survey forms were adopted for this study. These are:

- Survey 1: It consists of 61 questions and was conducted in the public utility services (Appendix 1),
- Survey 2: It collected utility expense data (resource usage) from 2019 to 2022 in the public utility services (Appendix 2),

- Survey 3: It consists of 61 questions (the same methodology used as survey 1; the only difference is that survey questions are modified to fit transnational companies) and was conducted in transnational companies (Appendix 3).

The data were collected between February and May 2022 for public utility services (survey 1) and between April and August 2023 for transnational companies (survey 3). The study covers administrative and civil services only. Infrastructure services are excluded since they are closely related to the use of technical infrastructure in the physical space, which significantly reduces the scale of remote work. In addition, these services are most often outsourced to the private sector. As a result, units that provide civil and administrative services and met the following conditions were selected for the survey:

- team working as a mode of delivering outcomes,
- innovation potential in services,
- highly able to use remote work,
- a complex range of tasks is provided by the employees.

The criteria allow for identifying areas of public sector activity that are most demanding in terms of work organization and management system. Administrative service providers include various types of departments, where residents and business entities are clients. The basic types of administrative services that meet the criteria defined above include those related to issuing decisions, strategic planning, spatial planning, and marketing management. Thus, city hall units with the greatest scope of autonomy were selected for the study. The survey was conducted in all 16 capital cities in regions of Poland to eliminate potential regional differences in the organization and provision of services. In each city, the survey was conducted in two selected departments. Due to the substantive scope of the survey, the direct respondent was the head of the unit. The head of the units evaluated their remote operations within survey questions. The total general population was 32 units. Ultimately, 26 units (81%) participated in the survey (survey 1).

The scope of civil service providers is much broader, as educational, cultural, recreational, and other services can be included. Since similar criteria were applied to the selection of entities (compared to administrative services), the higher education sector has been pointed out for the study. It was also assumed that regional differences in their organization and provision might exist. To this end, the best university in each region was selected (using the Perspectives 2021

comparative ranking of higher education institutions: Ranking Szkół Wyższych Perspektywy 2021). A survey was conducted in the 16 best universities in each region. Unlike clerical and administrative work, academics work primarily with independent research teams. Each university has a specific organizational structure and varied self-governance. Hence, it was decided to conduct the survey at the level of each independent organizational unit, that is, at the level of each faculty (a total of 185 faculties were identified). Faculties have their managers – deans – who are responsible for shaping how work is organized within the unit, including its structure and the tools utilized. Faculties are often divided into smaller organizational units, including departments, institutes, laboratories, and research teams.

Nevertheless, the environment for creating working conditions in these units is similar at the level of the entire department. Hence, using simple random sampling in each department, one unit (e.g., department, research team) was selected for the survey. The direct respondent was this unit's head due to the survey's substantive scope. The head of the units evaluated their remote operations within survey questions (survey 1). Ultimately, the survey was implemented in 139 units, representing 75% of the general population.

Meanwhile, private transnational companies employing remote work for day-to-day operations were specifically chosen to offer insights to enhance remote services within public utility services. Owing to budgetary and time limitations, the study was exclusively carried out in the city of Lodz. Direct respondents for the survey comprised team leaders and department heads. Each survey included only one carefully selected department or team leader from a chosen private transnational company. The leaders evaluated their remote operations using survey questions. The comprehensive target population consisted of 15 companies. Ultimately, the survey achieved full participation, with 100% involvement from the leaders of all 15 private transnational companies (survey 3).

On the other hand, utility expense data has also been collected through a separate online survey (survey 2) between April and August 2023 to calculate costs in financial terms for the period 2019 to 2022 in public utility services. The survey was conducted in all 16 capital cities in regions of Poland to eliminate potential regional differences. The total general population was 16 capital city municipalities and 16 universities. Finally, the survey was answered by 13 capital city municipalities (81%) and 9 universities (56%).

These data allowed us to conduct simplified analyses of public utility services' resource usage. Data was collected using a questionnaire on the costs or the amount of consumption of raw materials: water, electricity, gas, cleaning agents, waste production, and the costs of monitoring and protecting buildings (appendix 2). Data collected for 2019-2022, assuming that individual years, due to the COVID-19 pandemic, have different characteristics regarding the use of remote work in public sector organizations (2019: stationary work; 2020: poorly organized remote work, 2021: well-organized remote work; 2022: hybrid work).

Summing up, research was conducted on 165 heads of departments in public utility services in Poland (survey 1) and 15 team leaders in transnational companies in Lodz (survey 3). The utility expense data survey (survey 2) was also collected from 22 public utility services (13 capital city municipalities and 9 universities).

Structure and content of the study

The study has a theoretical and empirical character and consists of six chapters. These chapters are logically interconnected, with the framework of these connections centered on the economic effectiveness of remote work. The ongoing globalization around the world and the significant increase in information technologies are shaping the labor market trends that influence every type of organization, whether public or private. Remote work is a flexible work trend that has been frequently applied in the labor market. Assessing the labor market trends is critical to underline the development of demand for flexible work types such as remote work. That is why chapter one is dedicated to discussing labor market trends worldwide.

The first chapter, "Labor Market Trends Towards the Territorial Disintegration of the Employee and Employer – Development of Demand for Flexible Work Types," examines trends to highlight the changes in the labor market. Additionally, it underlines the increasing adoption of flexible work types and their economic effects on the labor market. This chapter describes labor market trends such as artificial intelligence, Industry 5.0, the app economy, and the gig economy and their interconnectedness with flexible work types such as remote work.

On the other hand, as remote work application is raised in the labor market, evaluating the theoretical underpinnings and conceptual frameworks that justify its effectiveness in organizations becomes substantial. That is why chapter two discusses theories and concepts to justify remote work. The second chapter, "Justification for the Effectiveness of Remote Work in Theories and

Concepts," focuses on raising remote work from past to present, justification of the work in selected theories and concepts from economic and social points of view, and different methods to measure remote work effectiveness in the literature. Firstly, remote work implementation from past to present was explained, and future direction was addressed within statistical and empirical data from the literature. Secondly, justifications for remote work were provided from economic and social perspectives. Economic justifications for remote work were provided through the knowledge-based economy and the flexible-firm model, and social justifications for remote work were provided through the feminization of the workplace concept, social exchange theory, and generational theory. Lastly, the social and economic methods to measure remote work effectiveness are discussed by providing different approaches from the literature.

Another critical aspect of ensuring remote work effectiveness is adopting legal conditions smoothly. A secure and effective remote work environment can only be achieved through understanding legal requirements for remote work implementation in organizations. That is why chapter three discusses the formal conditions of using remote work. The third chapter, "Formal Conditions for Using Remote Work," reviews relevant international, European, and Polish laws/reports regarding the implementation of remote work. The legal conditions for using remote work differed before (teleworking) and after (remote work) the COVID-19 pandemic in Poland. That is why the legal situation of using remote work was explained before and after the COVID-19 Pandemic; additionally, differences and similarities of legal situations of remote work were compared.

Implementing remote work may require unique approaches for public and private organizations, representing two fundamentally different entities due to a unique set of characteristics and goals. It is essential to identify the characteristics of public and private organizations to evaluate the effectiveness of remote work. That is why chapter four discusses the differences and similarities between public and private organizations. The fourth chapter, " Specificity of Public Sector Versus Private Sector – Differences and Similarities" explores the dynamics of both sectors and offers general insights into organizing remote work. It is not only focused on the main differences between both sectors but also similarities. Differences and similarities between sectors are provided regarding organizational goals, ownership of goods, services, and resources, organization structure and design, decision-making conditions, and organizational culture.

The fifth chapter, "Research Methodology - A Holistic Approach to Examining the Economic Effectiveness of Remote Work, " is of a technical nature and provides an identification and presentation of the adopted work methodology. This methodology applies to both theoretical and empirical research. Therefore, it serves as a justification for the theoretical analyses conducted in chapters one through four and a presentation of the empirical research concept outlined in chapter six. Chapter five includes a justification for the research area, identifying the research subject and the gap. It also includes data collection tools, techniques, and sample characteristics of the research. The chapter presents the research goals, questions, and hypotheses from resource allocation, technological and management effectiveness perspectives, and a triangulation of research methods. It explains the research methods, including methods for comparing transnational companies and public utility services. A mixed-methods approach—triangulation of research methods—was employed in this study to achieve the research goals and answer the research questions.

The sixth chapter, "Economic Effectiveness Assessments in the Public Utility Sector," is dedicated to presenting the research results. It evaluates the economic effectiveness of remote work in public utility services organizations separately from resource allocation, technological, and management effectiveness perspectives. On the other hand, it evaluates the overall economic effectiveness of remote work in public utility services with a holistic overall assessment. Additionally, the chapter briefly evaluates the economic effectiveness of remote work in transnational companies and compares results within public utility services regarding resource allocation, technological, and management effectiveness perspectives. Lastly, it holistically compares the economic effectiveness of remote work within transnational companies and public utility services to emerge suggestions to improve remote work implementation in public utility services.

1. Labor Market Trends Towards the Territorial Disintegration of the Employee and Employer – Development of Demand for Flexible Work Types

1.1. Artificial Intelligence - Impersonal Performance of Work

We call ourselves Homo sapiens, meaning "*wise human*," because intelligence is crucial to us. For millennia, we have sought to comprehend our thinking - how a small amount of matter can perceive, understand, predict, and manipulate a vast and complex world. The field of artificial intelligence (AI) extends this endeavor by not only aiming to understand intelligence but also to create intelligent entities (Russell and Norvig, 2003).

The AI technological landscape has evolved significantly from the 1950s when British mathematician Alan Turing first asked whether machines can think (Turing, 2009). The field of AI has been developing very rapidly in recent years. Many individuals and organizations have been conducting research and continuing their work from past to present in the field of AI, which is an area where research is conducted to enable machines to think and act like humans (Russell and Norvig, 2022). AI is one of the newest fields in science and engineering. Work started in earnest soon after World War II, and the name itself was coined in 1956 (Russell and Norvig, 2003). John McCarthy, who first coined the term AI and is known as its inventor, defined AI as "the science and engineering of making intelligent machines" (Toosi et al., 2021). According to Nabiyev (2012), AI can be defined as a computer or computer-assisted machine possessing human-specific qualities. These systems are capable of performing tasks related to high-level logical processes such as problem-solving, understanding, interpreting, generalizing, and learning from past experiences, much like humans (Nabiyev, 2012).

The term AI contains an explicit reference to the notion of intelligence. However, since intelligence (both in machines and in humans) is a vague concept, although it has been studied at length by psychologists, biologists, and neuroscientists, AI researchers use mostly the notion of rationality, which refers to the ability to choose the best action to take in order to achieve a specific goal, given certain criteria to be optimized and the available resources. Of course, rationality is not the only ingredient in the concept of intelligence, but it is a significant part of it (European Commission, 2018).

The concepts related to this field are also being updated daily, and it is observed that some concepts are used with different meanings; there is confusion about the meanings attributed to the concepts and, more importantly, the concepts used, even if the processes are short, change semantically over time (Eryilmaz, 2023). Below figure, we see eight definitions of AI laid out along two dimensions. The definitions on top concern thought processes and reasoning, whereas those on the bottom address behavior. The definitions on the left measure success in terms of fidelity to human performance, whereas those on the right measure against an ideal performance measure called rationality. A system is rational if it does the "*right thing*," given what it knows (Russell and Norvig, 2003).

Table 1. Some definitions of artificial intelligence, organized into four categories

Thinking humanly	**Thinking rationally**
"*The exciting new effort to make computers think (...) machines with minds, in the full and literal sense*." (Haugeland, 1985) "*[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning (...)"* (Bellman, 1978)	"*The study of mental faculties through the use of computational models*." (Charniak and McDermott, 1985) "*The study of the computations that make it possible to perceive, reason, and act.*" (Winston, 1992)
Acting humanly	**Acting rationally**
"*The art of creating machines that perform functions that require intelligence when performed by people."* (Kurzweil, 1990) "*The study of how to make computers do things at which, at the moment, people are better*." (Rich and Knight, 1991)	"*Computational Intelligence is the study of the design of intelligent agents."* (Poole et al., 1998) "*AI (...) is concerned with intelligent behavior in artifacts."* (Nilsson, 1998)

Source: (Russell and Norvig, 2016).

On the other hand, the European Commission also proposed a definition for AI, "*Artificial intelligence (AI) refers to systems that display intelligent behavior by analyzing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g., voice assistants, image analysis software, search engines, speech, and face recognition systems), or AI can be embedded in hardware devices (e.g., advanced robots, autonomous cars, drones, or Internet of Things applications)"* (European Commission, 2018). Additionally, OECD's definition of an AI system is *' a machine-based system that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can*

influence physical or virtual environments. Different AI systems in their levels of autonomy and adaptiveness after deployment' (Russell, Perset and Grobelnik, 2023).

Historically, different individuals have pursued the four approaches to AI using various methods. The human-centered approach (thinking and acting humanly) is empirical, relying on observations and hypotheses about human behavior, while the rationalist approach (thinking and acting rationally) combines mathematics and engineering (Russell and Norvig, 2016). AI approaches vary significantly. Table 2 below explains the four main fundamental approaches regarding artificial intelligence.

Table 2. Explanation of four fundamental approaches regarding artificial intelligence

Thinking Humanly: The Turing Test approach	**Thinking Rationally: The "*laws of thought*" approach**
The Turing Test, introduced by Alan Turing in 1950, aimed to establish a practical definition of intelligence. A computer is considered to have passed the test if a human interrogator, after asking a series of written questions, cannot distinguish between the responses of the computer and those of a human.	The Greek philosopher Aristotle was among the first to formalize "right thinking" principles through irrefutable reasoning processes. His syllogisms established patterns for argument structures that consistently led to correct conclusions when based on true premises. For instance, "Socrates is a man; all men are mortal; therefore, Socrates is mortal." These laws of thought were supposed to govern the operation of the mind; their study initiated the field called logic.
Acting Humanly: The cognitive modelling approach	**Acting Rationally: The rational agent approach**
If we are going say that a program thinks like a human, we must understand human thought processes. This requires examining the workings of the human mind in three ways: introspection, which involves observing our thoughts as they occur; psychological experiments, which involve observing people in action; and brain imaging, which involves observing the brain in action. With a sufficiently precise theory of the mind, we can translate this theory into a computer program. If the program's input-output behavior matches that of humans, it suggests that some mechanisms of the program may also function in humans. For instance, Allen Newell and Herbert Simon developed the General Problem Solver (GPS) based on this approach.	An agent is just something that acts (agent comes from the Latin agere, to do). Of course, all computer programs do something. However, computer agents are expected to do more: operate autonomously, perceive their environment, persist over a prolonged period, adapt to change, and create and pursue goals. A rational agent acts to achieve the best outcome or, when uncertain, the best-expected outcome.

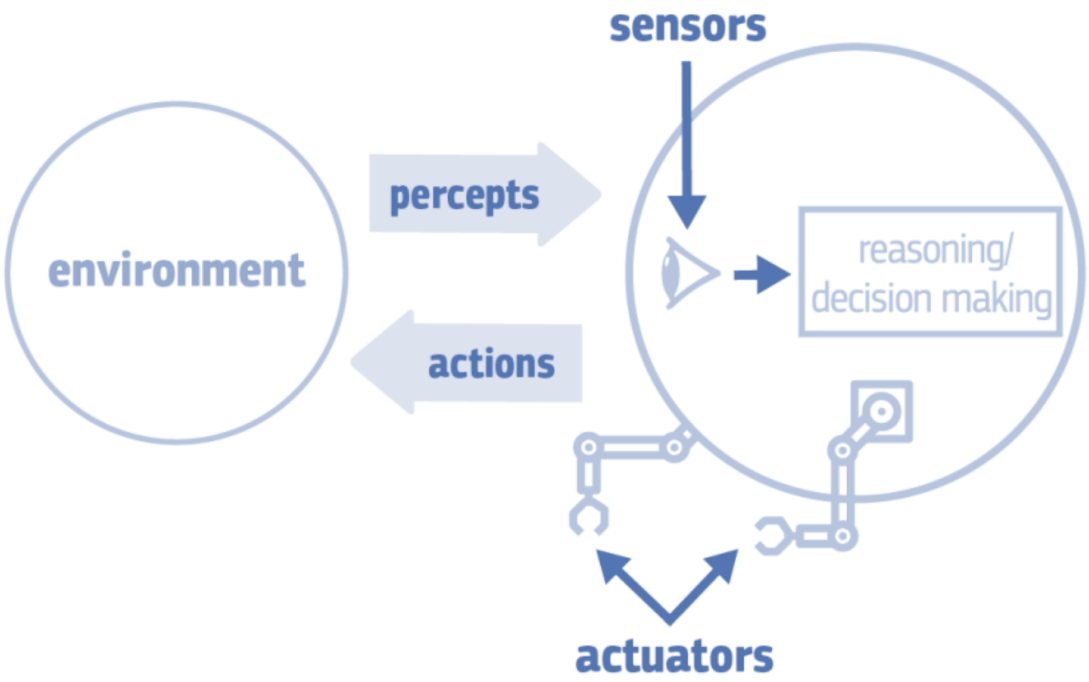
Source: (Newell and Simon, 1961; Russell and Norvig, 2016).

AI is commonly recognized as an interdisciplinary research field that has captured substantial attention from various sectors, including society, economics, and the public sector, thereby creating numerous opportunities (Boyd and Wilson, 2017; Wirtz et al., 2019; Reis et al., 2019). The global trend of integrating AI technologies into various aspects of daily life, including complex systems in fields such as transportation, space, medicine, research, emergency services,

and others, has sparked discussions regarding its application in public administration (Mikhail, 2018; Reis et al., 2019). AI has advanced to a point where it can make significant predictions based on people's digital footprints. Vendors can use algorithmic modeling to generate macro-level digital footprints of individuals' and organizations' behaviors and apply AI to make predictions (Zuboff, 2019).

From this point of view, first of all, we need to understand how AI systems work. AI systems perceive their environment through sensors, reason based on these perceptions, decide on the optimal action, and then execute it through actuators, potentially altering the environment (European Commission, 2018). The diagram in Figure 1 below illustrates this process.

Figure 1. Schematic depiction of an AI system



Source: (European Commission, 2018).

According to the European Commission's High-Level Expert Group on Artificial Intelligence report, the main components of AI, which are sensors and perception, reasoning and decision-making, and actuators, represented in Figure 1 above, will be explained (European Commission, 2018).

Sensors and perception: The system's sensors are represented as eyes in Figure 1. In reality, these sensors could be cameras, microphones, keyboards, websites, or other input devices, as well as sensors that measure physical quantities like temperature, pressure, distance, force/torque, or tactile sensations. Generally, an AI system must have appropriate sensors to perceive relevant environmental data according to its given goal. For instance, an AI system designed to clean a dirty floor automatically would require cameras to capture images of the floor.

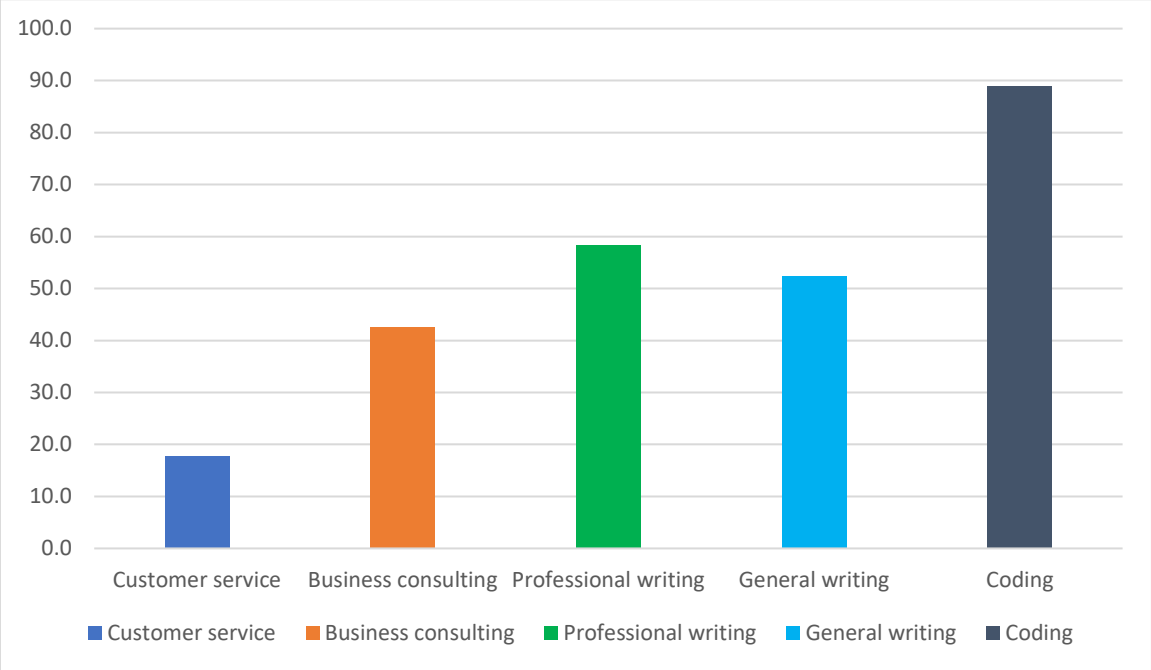
Reasoning and decision making: At the heart of an AI system is its reasoning module, which processes sensor data and determines the appropriate action to achieve the set goal. This requires converting sensor data into information that the reasoning module can interpret. Continuing with the example of a cleaning AI system, the camera provides an image of the floor to the reasoning module, which then decides whether or not to clean the floor to achieve the desired outcome.

Actuation: The AI system can act as the available actuators once the action has been decided. The cartoon above depicts the actuators as arms and legs, but they do not need to be physical. Actuators could be software as well. In our cleaning example, the AI system could output a signal that activates a vacuum cleaner if the action is to clean the floor. The action performed will possibly modify the environment, so the next time, the system needs to use its sensors again to perceive possibly different information from the modified environment.

Digitalization has a central role in the fabric of modern society, it emerges as an essential element that simplifies information management and extends its roots into critical sectors such as education, healthcare, industry, research, and public services (Mazzarella and Di Piazza, 2024). The utility sector is undergoing a swift digital transformation. It leverages advanced sensors and deploys advanced computing technologies (Slate et al., 2024). Technological advancements, particularly in digitalization, have been a significant trend in public management for many years, recently accelerating due to the COVID-19 pandemic and the rapid development of AI systems. These processes are usually framed within the concept of e-government. The evolution of e-government in developed economies has followed four consecutive but overlapping stages: digitization (providing equipment to the institutions), transformation (developing electronic government), engagement (shift to electronic governance), and contextualization (policy-driven electronic governance) (Gustafsson 2017; Janowski 2015). Recent literature has introduced the

notion of algorithmic government, driven by the increasing use of AI in public utilities (Engin and Treleaven, 2018). More extensive use of digital technologies (Internet of Things, Big Data, Blockchain technologies, and AI) in public and private sectors is perceived as a way to increase the quality of services delivered to individuals and businesses (Dobrolyubova 2022; Durkiewicz and Janowski 2018). According to the OECD 2024 Economic Outlook report, the net effect of AI on aggregate productivity will depend on many factors, including the extent to which new technologies are widely diffused or concentrated in a few leading firms and the extent to which AI is labor enhancing as opposed to labor replacing (OECD, 2024). The report also underlined that AI can improve performance in the various fields. Figure 2 below illustrates AI's potential average impact on worker performance in areas such as customer service, business consulting, professional writing, general writing, and coding.

Figure 2. AI's potential average impact on worker performance (95% confidence interval)



Source: (OECD, 2024).

Figure 2 illustrates the potential upper-bound impact of AI on worker performance in various fields. The values represent the highest estimated improvement in performance that AI could bring in each area, indicating the following: customer services by up to 17.7%, business

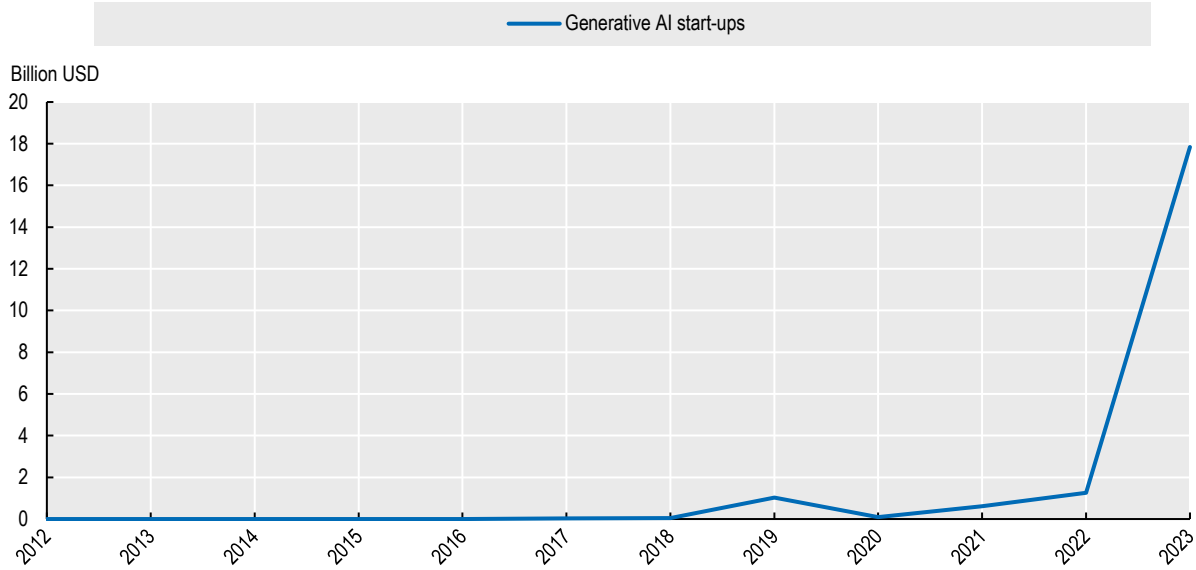
consulting by up to 42.6%, professional writing by up to 58.3%, general writing by up to 52.3%, coding by up to 89.0%.

On the other hand, AI capabilities have made it possible to use machines in a wide range of new domains; some of its significant applications are listed below (Roser, 2024):

- When you book a flight, an artificial intelligence, no longer a human, often decides what you pay. When you get to the airport, it is an AI system that monitors what you do at the airport. And once you are on the plane, an AI system assists the pilot in flying you to your destination.
- AI systems also increasingly determine whether you get a loan, are eligible for welfare or get hired for a particular job. Increasingly, they help determine who is released from jail.
- Several governments have purchased autonomous weapons systems for warfare, and some use AI systems for surveillance and oppression.
- AI systems help program your software and translate the texts you read. Virtual assistants, operated by speech recognition, have entered many households over the last decade. Now, self-driving cars are becoming a reality.
- In the last few years, AI systems have helped to make progress on some of the most complex problems in science.
- Large AIs called recommender systems determine what you see on social media, which products are shown in online shops, and what gets recommended on YouTube. Increasingly, they are not just recommending the media we consume, but based on their capacity to generate images and texts, they are also creating the media we consume.

The above-listed items regarding AI capabilities highlight its significance in daily life. AI technologies have advanced rapidly over the last several years. As technology continues to improve, it may substantially impact the economy concerning productivity, growth, inequality, market power, innovation, and employment (Agrawal et al., 2019). AI holds the potential to revive trend productivity growth and trigger an acceleration of innovation, even if estimates of the impact of AI on productivity are subject to considerable uncertainty. The share of firms using AI has risen rapidly, though most are large companies (OECD, 2024). When it comes to the general trend of financial investment, it is seen that AI startups are the general trend of Venture capital (VC) investments nowadays (Figure 3).

Figure 3. Venture capital (VC) investments in AI and generative AI start-ups, 2012-23



Source: OECD.AI (2024) using data from Preqin. Also available at: www.oecd.ai/en/data?selectedArea=investments-in-ai-and-data.

As Figure 3 above shows that generative AI start-ups jumped from USD 1.3 billion in 2022 to USD 17.8 billion in 2023, a significant increase from 1% of total AI Venture capital (VC) investments to 18.2%. The rise was mainly spurred by Microsoft's USD 10 billion investment in OpenAI (OECD, 2023).

AI is set to profoundly change the global economy, with some commentators seeing it as akin to a new industrial revolution (Melina et al., 2024). It helps to accelerate the development of innovation and digitalization (Dăscălescu, 2022). Millions of new jobs can be created based on AI, intelligent robots, and new technology in the labor market (Johannessen, 2020). It holds the potential to enhance productivity and drive growth, though its effects on economies and societies remain unpredictable, differing across various job roles and sectors (Ilzetki and Jain, 2023).

This is particularly clear in labor markets, where AI is expected to boost productivity but poses a risk of displacing workers in certain roles while enhancing their capabilities. Almost 40% of global employment is exposed to AI, with advanced economies at greater risk but also better poised to exploit AI benefits than emerging markets and developing economies. In advanced economies, about 60% of jobs are exposed to AI due to the prevalence of cognitive-task-oriented jobs (Melina et al., 2024).

In recent years, significant progress has been made in AI, especially in areas like image and speech recognition, natural language processing, translation, reading comprehension, computer programming, and predictive analytics (Georgieff & Hyee, 2021). This progress has expanded the range of digital tools available for workplace tasks, encompassing everything from HR systems to email, document sharing, reporting systems, laptops, phones, and meeting room technologies (Ashri, 2019). AI-driven digital tools have facilitated new trends in flexible working methods, allowing employees to choose how, when, and where they work. Essentially, digital workplaces support remote work by providing the necessary tools and technologies for effective work from any location.

AI for remote work can assist individuals in various ways, such as enhancing video conference software performance, streamlining scheduling and time tracking, aiding in email management, and strengthening cybersecurity. These examples of remote work technology with AI capabilities demonstrate what is possible. However, it is essential to remember that artificial intelligence is not perfect. Many AI-based tools, however, show performance improvements with regular use as they learn to recognize and adapt to users' habits (Newton, 2022).

In this regard, it can be stated that Al can change the nature of work dramatically in the coming years by interacting with remote work desires (Conerly, 2024). On the other hand, the relationship between human beings and machines in the workplace is undergoing a significant transformation. At the same time, AI is shaking up manager and employee dynamics and expectations. A study reveals that artificial intelligence changes how people perceive their work. 64% of people would trust a robot more than their manager, and half used a robot instead of their manager for advice. 82% of people believe robots can do things better than their managers. When asked which robots can do better than their managers, survey respondents said that robots are better at providing unbiased information (26%), maintaining work schedules (34%), solving problems (29%), and budget management (26%). On the contrary, when asked what managers can do better than robots, workers said that the first three tasks were to understand their feelings (45%), train them (33%), and create a work culture (29%). While some individuals still worry about potential job losses that could come with greater use of AI in the workplace, study findings suggest that most employees feel enthusiastic about these technologies. For instance, 39% of the Gen Z respondents in Oracle’s 2019 survey believed that robots will replace managers (Oracle, 2019). In this scenario, routine managerial tasks could be automated. As a result, location and time may no longer be a

limitation for the workers. Due to the new generation's significant adaptation to the digital environment and AI technologies, it is most likely that traditional work methods will be abandoned, and flexible work methods such as remote work and hybrid work will be more dominant soon.

AI has enormous potential to increase productivity and economic growth, mostly in advanced economies because they have many cognitive-task-oriented jobs. On the other hand, it is also a technology that transforms economies and societies dramatically. Moreover, it may help to recover from global issues such as health crises, climate change, and scarcity of resources. However, it also presents new risks. AI will affect different people, firms, and geographies differently, potentially exacerbating inequality and polarization within and across countries. AI and underlying data can also aggravate concerns over privacy, algorithm bias, political control, and surveillance. AI could erode an already embattled information ecosystem by flooding it with inaccuracies and misinformation, deepening social divides and political polarization. AI also poses new cybersecurity risks and vulnerabilities. To sum up, AI is a general technology that people can use to achieve some excellent and terrible goals. Therefore, the global adoption of AI raises questions about trust, fairness, privacy, safety, and accountability (OECD, 2024; Roser, 2024; World Bank, 2024).

1.2. Industry 5.0 - a Human - Centric and Sustainable Development - Oriented Approach to Work Organization

Industry 1.0 began in the late 18th century, addressing the rise of industrialized mechanical systems powered by coal, human labor, water, and steam. Industry 2.0 emerged in the late 19th century and was characterized by mass production enabled by electrical energy. Key developments of this era included the telephone, mass production techniques, the telegraph, assembly lines, and mechanization. Industry 3.0 started in the early 20th century and introduced computerization and microelectronics to the industrial sector. This period saw increased automation regarding robots, information technology, and microprocessors, which are closely connected to information and communication technology (ICT). Innovations such as computer-integrated manufacturing, computer-aided process planning, design, and flexible manufacturing systems emerged during this time (Skobelev and Borovik, 2017; Özdemir and Hekim, 2018; Nahavandi, 2019; Qiu et al., 2019; Aslam at el., 2020; Chander and Kumaravelan, 2021).

In the early 21st century, Industry 4.0 began, bringing about transformative changes in manufacturing by incorporating cyber-physical systems (CPS). Industry 4.0 is characterized by CPS, cloud computing, big data analytics, augmented reality, IoT, simulation, and intelligent devices, focusing on end-to-end digitalization and fully integrated digital industrial ecosystems. A significant aspect of Industry 4.0 is the connectivity of IoT devices with industrial plants (Skobelev and Borovik, 2017; Özdemir and Hekim, 2018; Nahavandi, 2019; Qiu et al., 2019; Aslam et al., 2020; Chander and Kumaravelan, 2021). The advancement and growing accessibility of new technologies have facilitated the digitalization of the manufacturing sector. Additionally, many governments have promoted digitalization and the adoption of advanced technologies through national initiatives (e.g., Advanced Manufacturing Partnership, Made in China 2025) to revitalize industry and address societal challenges like the aging population (Kuo, Shyu, and Ding, 2019).

When it comes to the latest trend in today's world, Industry 5.0, that paradigm building on the advances of Industry 4.0, is the next industrial revolution that will leverage human intervention in collaboration with intelligent, logical, and smart machines to attain even more user-preferred and resource-efficient manufacturing and supply chain solutions (Agrawal et al., 2024). There are many different definitions of Industry 5.0 in the literature. According to Cotta et al. (2021), Industry 5.0 is a thoughtful concept considering the industry's future as a manufacturing/production system that is human-centric, sustainable, and resilient (Leng et al., 2022). Figure 4 below displays the core values of Industry 5.0.

Figure 4. Core values of Industry 5.0

Source: (European Commission, 2021b).

The human-centric approach puts core human needs and interests at the heart of the production process, shifting from technology-driven progress to a thoroughly human-centric and society-centric approach. As a result, industry workers will develop new roles as a shift of value from considering workers as "*cost*" to "*investment*" (Xu, 2021). One of the most essential paradigmatic transitions characterizing Industry 5.0 is the focus shift from technology-driven progress to a thoroughly human-centric approach. This means the industry needs to consider societal constraints, aiming not to leave anyone behind (European Commission, 2021b). In other words, human-centricity requires acknowledging that not everything that "can" be automated "must" be automated and that automation should lead to human flourishing and empowering workers in the workplace rather than replacing humans with digital artifacts (Dixson-Declève et al., 2023).

The sustainable approach refers to the fact that the industry needs to respect planetary boundaries to be sustainable. It needs to develop circular processes that reuse, repurpose, and recycle natural resources, reduce waste and environmental impact, and ultimately lead to a circular economy with better resource efficiency and effectiveness. Sustainability means reducing energy

consumption and greenhouse emissions to avoid depletion and degradation of natural resources and to ensure the needs of today's generations without jeopardizing the needs of future generations. Technologies like AI and additive manufacturing can play a significant role by optimizing resource efficiency and minimizing waste (European Commission, 2021b). In addition, remote work applications can also play a significant role in contributing to sustainability if implemented effectively.

The resilience approach refers to enhancing industrial production's robustness to withstand disruptions better and maintain critical infrastructure during crises (European Commission, 2021b). It requires enhanced human capital investment to supervise and oversee machines and mitigate the risk of malfunctioning while maximizing their productivity-enhancing features (Dixson-Declève et al., 2023). Future industries must be resilient enough to adapt to shifts and natural crises, such as the Covid-19 pandemic. It should be balanced by developing resilient strategic value chains, adaptable production capacity, and flexible business processes, mainly where value chains serve basic human needs, such as healthcare or security (European Commission, 2021b). Such investment should be focused on complementary skills through a vision of technology that augments, rather than replaces, human intelligence; relatedly, anticipatory policies and research should address future challenges related to technologically augmented humans entering the job market (Dixson-Declève et al., 2023).

In addition, Friedman and Hendry (2019) indicated that Industry 5.0 is expected to force business professionals, information technologists, and philosophers to concentrate on human factors when implementing new technologies in industrial systems (Leng et al., 2022). On the other hand, Industry 5.0 emphasizes collaboration among humans and machinery types, which means the fifth industrial revolution is more captivated by forward-thinking human-machine interfaces through human-machine interaction (Chander et al., 2022). Table 3 below presents the evaluation from Industry 1.0 to Industry 5.0 shortly.

Table 3. From Industry 1.0 to Industry 5.0

Phase	Period	Description	Identification by	Key point	Work Trends
Industry 1.0	1780	Industrial manufacture based on stream and water machines	Mechanization Water and stream	First mechanical Loom	Blue-collar jobs (Physical work)
Industry 2.0	1870	Mass production with electrical energy	Electrification Division of labor Mass production	First assembly line	Blue-collar jobs (Physical work) - reducing manual labor but still requiring physical operation.
Industry 3.0	1970	Automation with electronic and IT system	Automation Electronics IT systems	The first programmable logic controller	Rise of white-collar jobs and early telecommuting.
Industry 4.0	2011	The connected device, data analytics, computerized machinery programs to automate the industry production	Globalization Digitalization IoT, Robotics, Big data, Cloud computing	Cyber-physical systems	Rise of remote work, hybrid work and gig work
Industry 5.0	Future	Cooperation among human intelligence with a machine to improve products and services	Personalization Robotics and AI Sustainability	Human-robot coworking Bio-economy	AI supported remote work, remote gig work

Source: own compilation based on Chander et al., (2022).

Table 3 above shows, Industry 5.0 is the latest trend of a progressive industrial revolution. It is future-oriented and has two main visions. First, it refers to human-robot co-working. In this vision, robots and humans will work together whenever and wherever possible. In this regard, AI-supported remote work and remote gig work may rise and be a significant trend in the future world economy. Humans will focus on tasks requiring creativity, and robots will do the rest. The second vision is a bio-economy, where renewable biological resources are used to transform existing industries. Smart use of biological resources for industrial purposes will help balance ecology, industry, and economy.

Additionally, themes such as space life, space-based industries, and space mining could play a significant role in the forthcoming revolution (Demir, Döven, and Sezen 2019). Industry 5.0 main intention is to progress Industry 4.0 to an advanced level. This brings the concept of collaborative robots, also known as cobots. With the successful integration, cobots will fulfill

today's need for enterprises that produce personalized products (Chander et al., 2022). Table 4 below provides a comparison of Industry 4.0 and Industry 5.0 visions.

Table 4. Comparison of Industry 4.0 and Industry 5.0 visions

	Industry 4.0	**Industry 5.0 (vision 1)**	**Industry 5.0 (vision 2)**
Motto	*Smart manufacturing*	*Human-robot co-working*	*Bio-economy*
Motivation	Mass production	Smart society	Sustainability
Power source	Electrical power Fossil-based fuels Renewable power sources	Electrical power Renewable power sources	Electrical power Renewable power sources
Involved technologies	Internet of things (IoT) Cloud computing Big data Robotics and artificial intelligence (AI)	Human-robot collaboration Renewable resources	Sustainable agricultural production Bionics Renewable resources
Involved research areas	Organizational Research Process improvement and innovation Business administration	Smart environments Organizational research Process improvement and innovation Business administration	Agriculture Biology Waste prevention Process improvement and innovation Business administration Economy
Work trends	Rise of remote work, hybrid work and gig work	AI supported remote work, remote gig work	

Source: own compilation based on Demir, Döven, and Sezen (2019).

Over the years, Industry 4.0 has focused less on the original principles of social fairness and sustainability and more on digitalization and AI-driven technologies for increasing the efficiency and flexibility of production. Hence, industry 4.0 is subject to the rise of remote, hybrid, and gig work. The concept of Industry 5.0 provides a different focus. It highlights the importance of research and innovation in supporting the industry's long-term service to humanity within planetary boundaries (European Commission, 2021b). That is why it is likely that AI-supported white-collar jobs will be a trend in the future. In other words, AI-supported remote work and remote gig work can be future trends in advanced economies.

Industry 5.0 combines human subjectivity and intelligence with the efficiency, artificial intelligence, and precision of machines in industrial production, reflecting the value of humanistic care, thus realizing the evolution toward the symbiotic ecosystem. In other words, it aims to place

humans' well-being at the center of manufacturing systems, thereby achieving social goals beyond employment and growth to provide robust prosperity for the sustainable development of all humanity (Leng et al., 2022). To sum up, it recognizes the power of industry to achieve societal goals beyond jobs and growth to become a resilient provider of prosperity by making production respect the boundaries of our planet and placing the well-being of the industry worker at the center of the production process (European Commission, 2021b).

1.3. App Economy - Enhancing Accessibility and Comfort

The mobile telecommunications industry is one of the fastest-growing sectors worldwide (Gruber, 2005). Over the past decade, the importance of apps has grown significantly and continues to grow as smartphones become an indispensable part of modern life (World Bank, 2024). The app economy, where users access content and services through software applications via the internet or mobile web, is becoming a significant driver of modern social communication and economic growth (Mendelson and Moon, 2018). The term '*app*' was first popularly used as an abbreviation for 'software application' in 1985 with the release of Apple's MacApp programming tool. However, it was not until the launch of the App Store in July 2008 that '*app*' became widely recognized as referring primarily to software designed for mobile platforms and devices (Goldsmith, 2014). The current state of the economy can be described as app economy, as every sector is shaped by a connected, mobile, app-based world where customers are more inclined to interact through a software application than a human representative (OECD, 2021).

The '*app (or apps) economy'* has been defined as "*a collection of interlocking innovative ecosystems. Each ecosystem consists of a core company, which creates and maintains a platform and an app marketplace, plus small and large companies that produce apps and/or mobile devices for that platform*". The term *'app economy'* was introduced in 2009 to describe the significant revenues generated, particularly in the gaming industry, from app sales, in-app purchases, and in-app advertising on platforms such as Facebook or through app stores (Goldsmith, 2014).

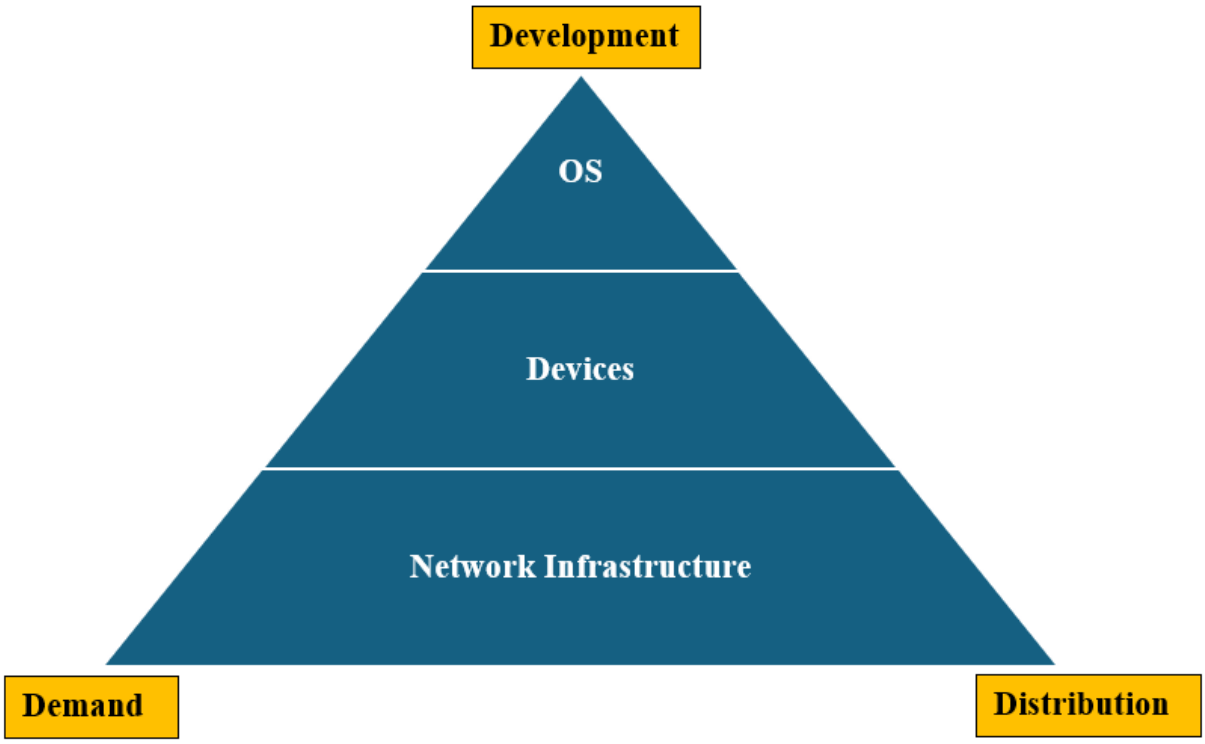
The iPhone and the App store began a global app economy, in other words, an army of app developers writing mobile applications for billions of users (Mandel and Long, 2017). Apps are one of the primary new sources of innovation in the economy and remain an area of spectacular growth during this economic downturn. Economies rely on information to function effectively, and

the app economy represents a leap towards an informed and efficient knowledge-based society (OECD, 2013b).

The app economy is highly dynamic and evolving, and policymakers are keen to maximize its innovative potential and benefit all sectors of the economy and society. Policymakers need to understand the mechanisms of the app economy in order to support innovation and ensure the maximum benefits possible for users (OECD, 2013b).

The app economy is part of the internet ecosystem, which consists of network infrastructure, devices, content, and users. Apps are a subset of content and can add to the attractiveness of the broadband network by providing services that are of considerable practical use. The app economy cannot be viewed in isolation since it is part of a highly networked and interdependent ecosystem. Its functioning depends on a robust network infrastructure, appropriate devices, and a supportive operating system (OS) landscape (Kathuria et al., 2015). The app ecosystem is undergoing swift and profound changes. The advent of smartphones, substantial enhancements in mobile network infrastructure, notable progress in payment platforms, and the soaring demand for mobile applications have generated vast revenue opportunities for all participants in the ecosystem (Basole and Rouse, 2008; Basole and Karla, 2012). Figure 5 below captures the different aspects of an app ecosystem.

Figure 5. The app ecosystem



Source: (Kathuria et al., 2015).

As seen in Figure 5 above, the app economy comprises three core activities—development, distribution, and demand —depicted as the nodes of a pyramid. The key factors affecting these core activities are network infrastructure, devices, and OS (Operating Systems), represented as different layers within the pyramid. Each of these dimensions is discussed below.

Development: The first element of the app economy's core activities is development. Most app stores allow almost anyone to submit an app for review. While developing an app can be inexpensive, the real challenge is reaching the final user, known as the last-mile constraint (Kathuria et al., 2015). Developers are essential to the app ecosystem as they create the apps that form its foundation. Platform providers seek to attract developers because a successful platform needs many appealing apps. Developers also face decisions about how to build their apps. For instance, open web tools can broaden the app's audience but might limit its functionality compared to building it for a specific platform. Another crucial factor for developers is the revenue potential (OECD, 2013b).

Distribution: It is the second element of the app economy's core activities. International app stores such as Play Store, Apple App Store, Amazon App Store, Samsung Galaxy Store, Microsoft Store, and Huawei AppGallery dominate the distribution of apps. Rather than packing software and selling via retail channels, app stores make apps available for online download. Due to the vast number of independent app developers, a platform that aggregates apps and facilitates payment enhances efficiency in distribution (Kathuria et al., 2015; OECD,2013b). Additionally, when apps are deployed through platform application distribution markets that attract all users to a single location, marketing, update, and distribution costs are reduced (Dibia and Wagner, 2015).

Demand: The last element of the app economy's core activities is demand. Consumers, including enterprises, government agencies, and end-users, drive the demand for new apps and services. Developers target consumers when they build their apps. Platform providers attempt to create an eco-system that pulls together the hardware and apps in attractive packages at affordable prices (OECD, 2013b). On the other hand, the key factors affecting core activities (network infrastructure, devices, and OS) are discussed below.

Network infrastructure: A robust network infrastructure in terms of both coverage and capability is necessary to support the growth of the app-based economy (Kathuria et al., 2015). The app systems rely on networks with sufficient, reliable connectivity to function well, and hardware manufacturers want to be available on as many networks as possible. Users increasingly rely on apps such as GPS navigation that may require continuous network connectivity to function effectively. Hence, platform providers, developers, and device manufacturers benefit from the most reliable networks (OECD, 2013b).

Devices: Technological advancements, including smartphones, tablets, and laptops, have transformed daily work life in the 21st century. These devices are integral to our routines and are crucial to the app economy. They serve as the access platform, stimulate technological innovation, improve user experience, broaden market opportunities, and facilitate various revenue generation strategies. The penetration of smart devices facilitates the growth of the app economy since apps require devices with advanced computing capabilities and features such as Wi-Fi connectivity, touch screens, GPS, web browsing, and graphic displays (Kathuria et al., 2015; Messenger and Gschwind, 2016; Kam, 2023).

Operating systems (OS): The OS of mobile devices serves as the foundational software platform on which applications run (Kathuria and Srivastav, 2014). An OS is software that enables applications to interact with a computer's hardware. They are used on various devices, including cell phones, automobiles, personal computers, and mainframe computers such as iOS and Android. Typically, in most computer systems, a user initiates a request for the computer to act (such as running an application or printing a document), and the operating system coordinates the software and hardware to achieve the desired result (Deitel, Deitel and Choffnes, 2004). To sum up, the life cycle of an app is influenced by its appeal during the stages of development, distribution, and demand. Each stage is closely connected to the supporting ecosystem, including network infrastructure, mobile devices, and OS platforms.

The 21st century has been characterized by the extensive utilization and advancements of information and communication technology (ICT) (Feltynowski, 2016). The effects of these developments are notable in emerging ICT trends, including mobile applications, which have gained prominence in mobile computing due to their significant impact on business and society (Ike et al., 2022). The app economy has experienced explosive growth alongside the rise of smartphones. As the fastest-adopted technology in human history, these devices have fundamentally transformed the software industry (Godfrey, Bernard and Miller, 2014).

The app economy's development affects both traditional and emerging sectors. Recently, numerous scholars have concentrated on specific types of apps in traditional fields like healthcare, pharmacy, and surgery. Some apps, such as mobile medical apps, apps for healthcare professionals, and apps for physical activity, are gaining global popularity (Aungst, 2013; Ventola, 2014; Conroy, Yang, and Maher, 2014; Troise et al., 2020). Additionally, well-known examples of new sectors are the taxi-hailing industry (i.e., Uber), the hospitality industry (i.e., Airbnb), and the sharing economy industry such as carsharing or ridesharing (i.e., Drivy and BlaBlaCar) (Troise et al., 2020). Moreover, apps have permeated business models in several ways. Many firms integrated apps into the way they provide services to their clients. For example, European airline and railway companies facilitate booking and travel with mobile apps (Deloitte, 2022).

On the other hand, the sophisticated advancements of modern technology with the rising various types of mobile apps have been major players in the flourishing of the competitive environment of workplaces. With its huge capacity of interconnecting lines across the globe,

communication has worked seamlessly, thus opening more doors to enhancing the workforce in the corporate world (Flores, 2019) through remote work. With the widespread use of mobile applications, remote work has become a significant option for employees and companies.

The suitability of remote work jobs depends on the type of skills required to carry out occupational tasks. Jobs that can be done remotely have occupational and sectoral characteristics often associated with office jobs (OECD, 2021). In other words, white-collar jobs mostly have become possible to do remotely.

Technically, remote work is a way of working outside the enterprise because the employee works outside the organization's premises but is in contact with the organization (Yu, 2008) via mobile applications such as Outlook, Gmail, Zoom, Microsoft Teams, and a virtual desktop (Microsoft remote desktop, Citrix workspace). With the advancement of these mobile applications, remote workers can effectively manage their daily tasks and cooperate with their teammates regardless of location. On this point, widespread remote work also significantly contributes to app economy growth.

The economic influence of this growth is evident in various areas, such as job creation, contributions to GDP, increased efficiency from mobile app usage, and positive effects on unrelated sectors that have benefited from mobile apps. These effects extend beyond economic gains to include social advantages in health, education, and media (Mobile, 2013). Table 5 below shows how the jobs of the EU, the United Kingdom, Switzerland, and Norway's app economy changed significantly from 2019 to 2023.

Table 5. App economy jobs comparison from 2019 to 2023 (thousands)

	European Union	**European Union, United Kingdom, Switzerland and Norway**
2019*	1,906	2,378
2023	2,919	3,706
Percentage change	53%	56%

Source: (Mandel, 2023).

The jobs generated by the app economy became an essential part of the recovery from the financial crisis of 2008-2009 and the subsequent economic expansion. When the pandemic hit, the

need to conduct life remotely supercharged the use of apps and resulted in many new app economy jobs in Europe (Mandel, 2023). According to the latest estimate from the Progressive Policy Institute, since 2019, employment in the EU App Economy has risen by 53% to 2.9 million in 2023. On the other hand, when the United Kingdom, Switzerland, and Norway are included in the calculation with EU countries, it is seen that employment has risen by 56% to 3.7 million in 2023. Additionally, U.S. App Economy employment was 2.6 million in 2022, a gain of 14% from 2019. As per the statistical data, the number of jobs in the app economy is increasing due to their enormous potential and significance day by day. App Economy employment is associated with mobile operating systems such as iOS and Android. World Bank's 2024 report shows that these two systems represented 99 percent of smartphone operating systems in 2022. Table 6 below shows app economy jobs comparison in the EU and EU, United Kingdom, Switzerland and Norway by operating system.

Table 6. App economy jobs by operating system (thousands)

	European Union		**European Union, United Kingdom, Switzerland and Norway**	
	2019*	**2023**	**2019***	**2023**
IOS ecosystem	1,396	2,116	1,775	2,729
Android ecosystem	1,553	2,363	1,940	2,988
Total app economy	1,906	2,919	2,378	3,706

Source: (Mandel, 2023).

As of October 2023, the iOS ecosystem supports 2.1 million jobs within the European Union, while the Android ecosystem accounts for nearly 2.4 million jobs (the two categories sum to more than the total number of App Economy jobs because many app developer jobs are in both ecosystems). Including the United Kingdom, Switzerland, and Norway, the iOS ecosystem in these 30 countries totals 2.7 million jobs, and the Android ecosystem approaches 3 million jobs (Mandel, 2023).

Combining two factors drives the stunning growth of EU App Economy employment. The first factor is information and communications technology (ICT) (Mandel, 2023). ICT was the most innovative technology field during the past few decades and a key enabler of innovation in other sectors (World Bank, 2024). Data from Eurostat shows that the number of ICT professionals in the EU rose by 30% from 2019 to 2022. It should be noted that the EU's growth of ICT professionals

far exceeded that of the U.S. over this period. Based on BLS data, the number of ICT professionals in the United States rose by only 10% from 2019 to 2022, much less than the gain in the EU (Mandel, 2023). On the other hand, fields related to ICT technology have been among the most rapidly growing fields in patent publications; their share of total patent publications grew from less than 10 percent in 1980 to 26 percent in 2021. From personal computers, the internet, digital platforms, 4G/5G, smartphones, and cloud services to AI, the ICT sector dominated the most significant technological breakthroughs during the past few decades. Additionally, the world's seven biggest spenders on research and development in 2020 were all ICT companies: Alphabet, Amazon, Apple, Huawei, Meta, Microsoft, and Samsung. Generative AI tools such as ChatGPT and Stable Diffusion dazzled the public in late 2022. Moreover, the ICT sector's total value-added exceeded US$6.1 trillion in 2022, representing around 6 percent of the global gross domestic product (GDP) (World Bank, 2024).

On the other hand, a wide variety of essential services on mobile phones, such as financial, healthcare, shopping, and government services, is the second major contributor to the growth of the EU App Economy. According to the latest report from data.ai, French mobile users spent nearly 4 hours per day on mobile devices in 2022, up from approximately 2.7 hours in 2019, reflecting a 45% increase. Similarly, German mobile users spent 3.6 hours daily on mobile applications in 2022. It was about 2.6 hours in 2019. If we compare the data, we see an increase in German mobile users, too, reflecting 38% (Mandel, 2023). These findings show that there is a significant increase in mobile app usage. Finally, fifteen years after the launch of the first app stores, the EU App Economy is growing significantly and contributing to overall employment growth. It also generates opportunities across various countries, industries, and demographics as a gateway to the future (World Bank, 2024).

1.4. Systematic Organization of the Gig Economy

Gig work, a term coined around 1915 and more recently popularized by platform work, describes the exchange of labor for money on a short-term and payment-by-task basis (Zeid et al., 2024). The ongoing debate about gig work reflects a similar discourse from the late 1980s and 1990s (e.g., Abraham 1988, 1990; Barker and Christensen 1998). During both periods, there were discussions about the significant increase in the number of individuals engaged in contingent or precarious employment—jobs characterized by the lack of long-term affiliation with a specific

business and defined by task completion or limited-duration contracts—or other nonstandard employment forms (Abraham et al., 2017).

The widespread use of the internet and the growing prevalence of smartphones enabled users from different countries to connect through digital platforms. This facilitates organizations in communicating their talent requirements and reaching out to remote workers via these platforms (Roy and Shrivastava, 2020). That is why more considerable interest has recently been in the gig economy. In other words, there is a rapid spread of start-ups connecting and mediating between buyers and sellers in various markets, particularly markets for in-person services (Healy et al., 2017). Currently, gig work term describes non-standard employment forms that deviate from the conventional parameters of standard employment (Zeid et al., 2024). Churchill and Craig (2019) defined gig work as *'short-term, task-based, insecure, and precarious*.' (Bulian, 2021). According to Techtarget (2020), the gig economy is a free market system where organizations contract with independent workers for a short-term project or service engagement (Roy and Shrivastava, 2020).

Also, the European Commission defines the gig economy as an economy in which digital technologies enable teams to assemble around a given project – and often across borders – while platforms connect buyers with sellers seamlessly (Eurofound, 2019). The gig economy has commonly been associated with benefits such as '*freedom*' from the *'9-5'* schedule, employer savings, and improved work efficiency. However, these arrangements have been criticized for exploiting individuals and people who provide these services (Kerikmä and Kajander, 2022).

Churchill and Lyn's (2019) research revealed that the most common gig tasks include driving for men (27.8%) and photography and design-related work for women (24.1%). Given the broad scope of gig work, it is unsurprising that gig workers engage in various other occupations. These tasks range from caregiving, cleaning, and software or graphic design to delivery, driving, maintenance, repair, gardening, and construction. Conversely, Friedman (2014) notes that gig workers earn low wages in roles like personal care attendants, dog walkers, and landscapers' day laborers and high wages as IT managers, accountants, editors, lawyers, and business consultants (Bulian, 2021).

As noted by various authors (Churchill and Craig, 2019; De Stefano, 2015; Wood et al., 2019; Bulian, 2021), gig work, facilitated by apps and platforms, does not necessarily have to be online. Gigs can be physical or digital tasks performed locally or remotely, depending on whether

the worker's physical presence is required (Bulian, 2021). Platform-based gig works can be categorized into two types (World Bank, 2023):

- **Location-based gig works**, in which digital platforms allocate tangible work delivered to a client in a physical location such as taxi, delivery, domestic care, and home services or platform work through Uber (a ride-sharing service), Deliveroo (a food-courier service), Glovo (a food-courier service) and Airtasker (an online broker for odd jobs). These and other similar firms are frequently described as 'disruptors' of established markets and firms. In some cases, their influence also extends to cultivating new market niches by bringing additional providers on-stream (e.g., restaurants that did not previously offer home delivery) and increasing customers' ease of use (Healy et al., 2017).
- **Remote gig works**, which include tasks or work assignments such as image tagging, data entry, website design, or software development, are performed and delivered remotely by workers. Remote gig work is of two types;
    - ❖ **Remote freelancing**, also called e-lancing, tends to involve larger projects that are performed over longer times and typically include complex tasks targeting more intermediate- or high-skilled workers—for example, software development, graphic design, and e-marketing (Meyers et al., 2017).
    - ❖ **Microwork,** on the other hand, consists of projects divided into small subtasks that remote workers can finish in seconds or minutes via online platforms (Kuek et al. 2015). Microworkers are usually paid small amounts for each task they complete, often requiring only basic numeracy and literacy skills. These tasks include image tagging, text transcription, and data entry (Meyers et al., 2017). Due to its lower entry barriers than remote freelancing, microwork is an appealing income-generating option for unemployed and underemployed individuals with limited or no specialized skills.

Gig economy online platforms are significant for the global economy. However, due to the vast area of their activities, it is a challenge to refer to the total number of these platforms. Table 7 below gives us an overview of the gig economy online platforms.

Table 7. Overview of gig economy online platforms

Reference	Platform types and number
ILO (2021)	Global, any type; identified a total of 283 online and 449 location-based platforms
Kässi, Lehdonvirta, and Stephany (2021)	Global, online web-based; identified 351 platforms
European Commission (2021)	Active in European Union, any type; 600 platforms

Source: (World Bank, 2023).

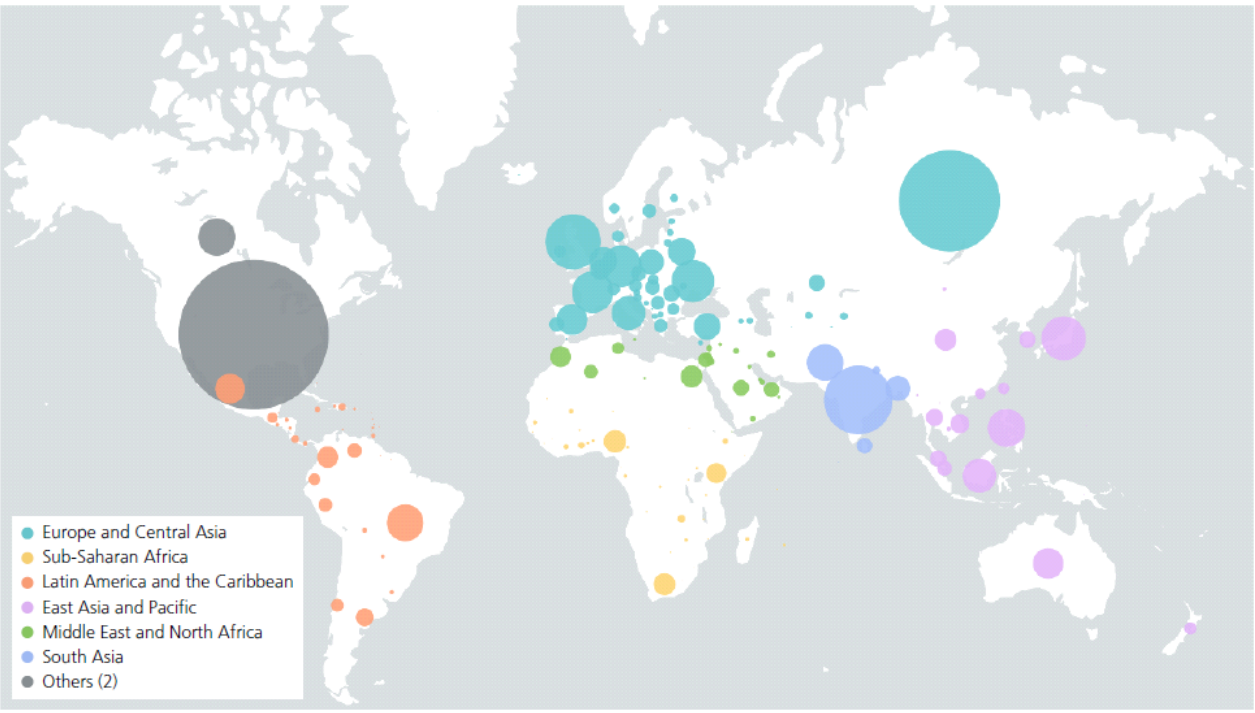
The table shows that the literature lacks a comprehensive registry of gig platforms at a global level that also systematically identifies regional and local platforms. One reason such databases do not exist is the challenge of obtaining data for such platforms. Data on transactions, revenue, registered users, and website visitors, which are commercially sensitive and not shared publicly, are available only internally to website owners. At the same time, platform markets tend to be dynamic, with firm entry and exit and mergers and acquisitions happening frequently, making updated data challenging to gather. Nonetheless, the obtained data by ILO (2021), Kässi, Lehdonvirta, Stephany (2021), and the European Commission (2021) indicates the enormous economic potential of online gig platforms locally and globally (World Bank, 2023). On the other hand, the World Bank's 2023 report underscores 545 online gig work platforms globally. This number exceeds the 351 and 283 online gig platforms identified by Kässi, Lehdonvirta, Stephany (2021), and ILO (2021) but also less than the 600 any type of gig platforms identified by the European Commission (2021). Figures 6 and 7 below display the details of the report.

Figure 6. Global distribution of gig platforms by headquarters

Source: (World Bank, 2023).

Figure 6 above displays the global numbers of platforms in the mapping with headquarters in each country. The World Bank's 2023 report indicates 348 online gig platforms with headquarters in 63 countries and platform workers and clients in 186 countries.

Figure 7. Global distribution of gig platforms by share of traffic



Source: (World Bank, 2023), the circle sizes represent different levels of traffic.

Figure 7 above illustrates global trends concerning the locations among the sample of 545 gig platforms and the origin of their traffic, revealing a significant network effect where major global platforms dominate the majority of user activity. Notably, around 70% of regional platforms operate within North America, Europe, and Central Asia, many targeting European or Russian-speaking populations. In contrast, about 10% of these platforms cater to East Asia and the Pacific, 6% to South Asia and Sub-Saharan Africa, and a mere 3-4% to the Middle East and North Africa, as well as Latin America and the Caribbean. The remaining 9-10% are distributed across other locations.

Additionally, the World Bank's 2023 report measures the geographical traffic of the gig economy platforms in terms of platform users. The findings reveal that almost a third (30 percent) of the traffic to gig platforms stems from visitors in the United States, followed by the Russian Federation (14 percent) and India (6 percent). Around a fifth of visitors (18 percent) are from low- and lower-middle-income countries (driven by India, Indonesia, Nigeria, Pakistan, the Philippines, and Ukraine), and 22 percent come from upper-middle-income countries (Belarus, Brazil, Mexico, Russia, and Türkiye). Low- and middle-income countries account for 40 percent of traffic to gig

platforms. This underscores both the relevance of gig platforms in emerging economies and the importance of emerging economies for gig platforms. In other words, the gig economy is no longer only a phenomenon in developed countries but is becoming increasingly important in emerging markets.

Regarding the economic effects of the emergence of gig economy platforms, their ability to match workers to clients is critical. Gig economy platforms typically develop innovative matching algorithms that use digital technology to simultaneously track demand for services and labor supply at a very disaggregate level. Empirical evidence from the personal transport industry suggests that the resulting increases in matching efficiency can be significant. For instance, a study conducted by Cramer and Krueger (2016) for the United States finds that capacity utilization (as measured by the fraction of time or mileage a driver has a paying customer) is up to 50% higher for Uber drivers than for traditional taxi drivers. Additionally, studies by Rayle et al. (2016) and Nistal and Regidor (2016) reveal that waiting times for Uber customers appear to be significantly shorter than for traditional taxi customers (Schwellnus et al., 2019).

Platform-driven technological and organizational innovations have reduced the prevalence of market failures in the services market, suggesting that several existing product market rules have become obsolete. However, the emergence of platforms also poses new challenges for product market policies, including promoting intense competition between platforms in the presence of significant network effects (Schwellnus et al., 2019; Zeid et al., 2024). Estimates of the number of workers involved in the gig economy are challenging to provide, considering this is a global workforce composed of individuals who may register on multiple platforms at once, and that is not easy to take apart from broader figures on freelancing, contingent work, and nonstandard employment (Gandini, 2019). However, the European Parliament 2024 report indicates that gig works have become more prevalent due to changes in the world of work, such as increasing digitalization and the creation of new business models. More than 28.3 million people were working for digital labor platforms in the EU in 2022, and this figure is expected to rise to 43 million by 2025. 26.3 million (93%) of gig workers are classified as self-employed, but there are suspicions that around five million might be misclassified (European Parliament, 2024).

Like any phenomenon, the gig economy has both advantages and disadvantages. The literature offers a valuable framework for examining the benefits and challenges associated with

the increasing adoption of the gig economy. The discussion on the pros and cons of these expanding occupations can be categorized into two groups: those affecting firms and those impacting workers. Figure 8 below displays those items.

Figure 8. Pros and cons of gig work

	Advantages	Disadvantages
For firms	• Flexibility to hire by task • Quicker response to shocks • A wider pool of talent of more specialized labor • Lower labor costs	• Firm-specific skills not accumulated • Combining tasks can be challenging and may result in overwork and mismanagement • High turnover rates
For workers	• Low barriers to entry • Potential pathway to fulltime job opportunities • Highly flexible, allowing individuals to customize their schedule, location, and level of commitment.	• Higher risk of unemployment and job insecurity compared to their standard counterparts • Less opportunities for professional development due to lack of training and feedback • Lower earnings in some occupations or jobs of certain skill levels

Source: (Zeid et al., 2024).

The rise of the gig economy presents both challenges and opportunities for firms. On the one hand, gig work can reduce labor costs and provide a larger pool of qualified, readily available workers, allowing employers greater organizational flexibility to address short-term or seasonal demands cost-effectively. It also enables businesses to access specialized labor that may not be available in-house and, under the right conditions, source motivated and productive non-standard workers. On the other hand, an overreliance on gig work can negatively impact the firm. A study of Italian firms (Cirillo et al. 2021) indicates that it can lead to underdeveloped skills within the firm and diminish incentives to invest in training, research and development (R&D), productivity-enhancing technologies, and resource allocation. Therefore, firms must balance leveraging gig work for immediate benefits with investing in long-term growth (ILO, 2016; Dunn 2020; Cirillo et al. 2021; Zeid et al., 2024).

Gig workers also face significant trade-offs. While gig work can serve as an entry point into the workforce and a means to gain valuable experience, as well as a pathway for re-entering the labor market after periods of unemployment, it also provides unparalleled flexibility for various workforce segments, particularly vulnerable groups like the elderly, individuals with disabilities, caretakers, and women with childcare responsibilities (Cherry and Aloisi, 2016; Garcia-Cabo and Madera, 2019; Zeid et al., 2024).

Another significant aspect of the gig economy is the minimal barriers to entry for workers. While standard employment typically demands professional diplomas and formal qualifications, traditional self-employment necessitates business setup costs, client network development, and potential licensing requirements; gig economy platforms lower these barriers. A study by Garcia-Cabo and Madera (2019) indicates that in countries with strict labor laws, like Spain, Italy, and Portugal, gig work can be a more accessible option than traditional employment. Additionally, gig economy platforms often use reputation rating mechanisms as alternatives to formal qualifications to indicate the quality of providers, and workers usually avoid the costs associated with starting a business (Schwellnus et al., 2019; Garcia-Cabo and Madera, 2019).

However, gig workers often deal with concerns about job security, transitioning to full-time employment, and potential income loss. These issues are particularly pronounced among certain groups, such as women. Additionally, as indicated by Gousia et al. (2021), the United Kingdom Household Longitudinal Study: Understanding Society (UKHLS) data found that women were less likely than men to transition from part-time or temporary work to a permanent job. It also showed that they are more likely to transition to care work. Moreover, according to European and US studies, gig workers have more trouble getting credit and housing. Research also shows that they have trouble transitioning to permanent jobs and are more likely to delay family planning until they have more stable jobs. Furthermore, gig work typically falls outside the scope of social safety nets, including social insurance schemes that protect against income shocks like unemployment, work injury, or disability (Cherry and Aloisi, 2016; Garcia-Cabo and Madera, 2019; Gousia et al., 2021; Zeid et al., 2024).

Overall, demand for remote gig work is growing rapidly; the gig economy accounts for up to 12 percent of the global labor market—much higher than previously estimated—and holds particular promise for women and youth in developing countries (World Bank, 2023b). The global rise of gig work creates opportunities and challenges for the labor market and requires public policy responses to realize their benefits and mitigate their adverse effects. Nevertheless, taking full advantage of their potential to raise productivity and employment will require adapting product and labor market policies. Public policy should aim to harmonize rules for standard and non-standard employment, rules on collective bargaining, update social protection systems and support lifelong learning to ensure workers can manage transitions and better navigate a constantly changing world of work (Schwellnus et al., 2019; Zeid et al., 2024).

2. Justification for the Effectiveness of Remote Work in Theories and Concepts

2.1. From Telework to Remote Work – Genesis and Evolution

The genesis of interest in remote work can be traced back to the 1970s, with the term "*telecommuting*" employed to describe the practice of working away from the conventional office setting, primarily relying on telephone communication as a surrogate for physical proximity (Nilles, Carlson, Gray and Hanneman, 1976). In the 1980s, interest in remote work grew among workers, employers, transport planners, communities, and the telecommunications industry (Handy and Mokhtarian, 1996) and there were predictions that remote work would become more dominant in future (Toffler, 1980). In the 1990s, remote work experienced a significant proliferation, and contemporary reports suggest that it has evolved into one of the predominant pillars of flexibility programs (WorldatWork, 2015; De Vries, Tummers and Bekkers, 2019). In the 2000s, remote work popularity has been remaining. Among the key drivers of change in working life, developments in ICT have played a crucial role. Technology has contributed to new ways of organizing work by providing workers with increased flexibility in the timing and location of task performance, thereby fostering the growth of remote work and other forms of ICT-based mobile working (Eurofound, 2021). On the other hand, a study by Santana and Cobo (2020) suggests a scientific mapping analysis of the future of work using bibliographic networks for the period 1998–2019. The study identifies remote work as a motor theme in the 2009–2014 and 2015–2019 periods (Petcu and Cișmașu, 2023). Census data from the United States in 2015 and the European Union in 2016 show that 23% and 5% of employees work remotely at least some of the time (De Vries, Tummers and Bekkers, 2019).

International Labor Organization (ILO) 2021 data indicate that 7.9% of the global workforce – approximately 260 million people permanently worked from home before the pandemic. Workers accounted for 18.8% of the total number of entirely home-based workers worldwide. However, in high-income countries, this share was as high as 55.1% (ILO, 2020; Soares et al., 2021; Eurofound, 2023). The rapid surge in the popularity of remote work has been observed in the wake of the COVID-19 pandemic, necessitating swift adjustments by numerous firms (Bick, Blandin, and Mertens, 2020; Marzano and Zając, 2022; Countouris et al., 2023). Public health

measures designed to stem the spread of COVID-19 have included active encouragement of homeworking for those in a position to do so. With many workplaces in enforced closure from the spring of 2020, remote work became customary for many employees with limited or no experience working in this way. Also, raw statistics support this expression. According to data from Eurofound in July 2020, 33.7% of employees worked remotely in Europe (Eurofound, 2020). Even as European society commenced reopening after the initial stringent lockdown, a notable proportion of individuals continued to engage in remote work. As per data from Eurofound in February and March 2021, 24% of European employees were reported to be working remotely (Eurofound, 2021). Additionally, it is seen that remote work was more common among workers who were self-employed, female, young or living in an urban area (Eurofound, 2022).

According to reports from French (Klein and Ratier, 2012), German (Deutscher Bundestag, 2013), and Swedish (Vinnova, 2007) sources, as well as Lithuanian expert assessments, remote work has significant positive effects such as a higher level of autonomy, and flexibility compared to traditional working methods (Eurofound, 2015). Zhang et al. (2021) indicated that for small companies, implementing remote work increases productivity, mainly due to better use of working time through unlimited access to work. Complementarily, introducing the concept of work-from-anywhere, Choudhury et al. (2021) show that remote work can improve productivity due to spatial, temporal and geographical flexibility (Petcu and Cișmașu, 2023).

Findings from the Remote Working National Survey conducted in Ireland in April 2021 indicate that 8% of respondents had relocated within the country due to their remote work experience since the COVID-19 outbreak. A further 24% said they would consider relocating, with most respondents residing in the Dublin capital region. In this regard, in Ireland, there has been increasing interest in the role of remote work hubs in a post-COVID scenario. Workers who moved farther from their employer's premises would likely prefer a co-working space close to home. Data from the Pulse Survey collected in November 2021 (by the Irish Central Statistics Office) reveals that 18% of remote workers would work from a hub, or a combination of home and hub, in the future (Bisello and Profous, 2022; Williamson, 2022).

In 2018, before the COVID-19 pandemic, the proportion of employees in Poland who could work remotely was lower than the average among EU member states. It accounted for approximately 4.6%, whereas across the entire EU, 5.2% of individuals aged between 15 and 64

regularly engaged in remote work from their homes. However, in 2020, Poland's percentage of individuals who "usually work from home" doubled compared to the 2018 data, reaching 8.9%. Notably, by the end of the first quarter of 2021, the sectors with the highest proportion of remote workers among the total workforce were financial and insurance services (36.1%), education (45.9%), and IT (66.8%). These sectors had already been leading in digitalization and automation even before the onset of the pandemic (Radziukiewicz, 2021).

Generally, the direction of change is so similar around the world. According to the American Time Use Survey, which the Bureau of Labor Statistics conducted, the percentage of remote workers in May/December nearly doubled during the COVID-19 pandemic in 2020, rising from 22% to 42%. On the days they worked, more than half of workers in management, business, and financial operations occupations and professional and related occupations did some or all of their work remotely (59% and 57%, respectively). In contrast, individuals employed in other occupations were less inclined to work remotely on their working days. According to the American Time Use Survey 2021 results, among workers aged 25 and above, individuals with an advanced degree exhibited a higher propensity for remote work than those with lower educational qualifications. Specifically, 67% of those holding an advanced degree engaged in working from home on the days they worked, contrasting with only 19% of individuals with a high school diploma and no college education. Additionally, individuals with an advanced degree were more inclined to work on an average day, with a participation rate of 74%, as opposed to 64% for those with a high school diploma and no college degree (BLS, 2021).

The share of employed persons who spent time working at home on days worked decreased slightly from 38% in 2021 to 34% in 2022. However, workers were still more likely to work at home in 2022 than in 2019, before the COVID-19 pandemic. Workers with higher education levels were likelier to work at home than those without. According to the American Time Use Survey 2022 results, among workers aged 25 and over, 54% of employed persons with a bachelor’s degree or higher performed some work at home on days worked, compared with 18% of those with a high school diploma and no college. On average, workers with a bachelor’s degree or higher were equally likely to work, as were those with a high school diploma and no college (68%) (BLS, 2022). Furthermore, Eurofound 2020 and 2021 reports indicated that those working from home were disproportionately urban-based, white-collar, well-educated, service sector employees (Eurofound, 2020; Sostero et al, 2020; Eurofound, 2021). In this regard, it can be concluded that remote work

can be applied significantly in sectors with knowledge as a critical component. In addition, Dingel and Neiman (2020) revealed that 37% of jobs in the United States could be performed at home, significantly varying across cities and industries. These jobs typically pay more than jobs that cannot be done at home and account for 46% of all US wages. Applying their occupational classification to 85 other countries reveals that lower-income economies have a lower share of jobs that can be done at home (Dingel and Neiman, 2020).

A study conducted by del Rio-Chanona et al. (2020) analyzed the supply and demand shock for the economy in remote work through the COVID-19 pandemic. Compared to the pre-COVID period, these shocks were projected to endanger approximately 20% of the US economy's GDP, imperil 23% of jobs, and diminish total wage income by 16%. At the industry level, sectors such as transport are likely to be output-constrained by demand shocks, while manufacturing, mining, and services sectors are more likely to be (del Rio-Chanona et al., 2020).

Moreover, Ramiro Albieu (2020) and Foschiatti and Gasparini (2020) conclude that 26% to 29% of occupations can be performed remotely in Argentina. Guntin estimates that between 20% and 34% of Uruguayan workers are in occupations that can be done at a distance. Finally, Boeri, Caiumi, and Paccagnella (2020) estimate remote work potential as 24% for Italy, 28% for France, 29% for Germany, 25% for Spain, and 31% for Sweden and the United Kingdom (ILO, 2020). These findings reveal that remote work has significant implementation potential around the world.

For instance, according to a national study, managers might resist remote work, especially in high power distance countries like India, because of their inability to control or monitor physically dispersed subordinates who, by remote work, also reduce their dependence on them. To reclaim their power, the supervisors may increase direction and control of work procedures or even increase the surveillance of subordinates (Eurofound and the International Labor Office, 2017).

Another national study in Belgium indicates that employers with experience in adopting remote work appreciated its advantages more than those without that experience. This finding reveals that some employers might be prejudiced against remote work. (Eurofound and the International Labor Office, 2017).

On the other hand, many organizations allow employees to engage in partial remote work. They often adopt a hybrid work model where employees combine remote and on-site work as their primary work structures (McPhail et al., 2024). Popma (2013) indicates that some employers prefer

for remote work to cut costs. They can reduce the office space they need by letting their workers work elsewhere some days a week. Similar findings were also reported in some of the case studies. For instance, when the Greek Microsoft Hellas introduced remote work, it completely reconstructed its headquarters. Because everyone may work from home, so they do not need an individual workspace in the office. The number of workplaces has been cut by 50%, and no one, including the CEO and the director general, has a fixed office space (Eurofound, 2015).

Hybrid work indicates flexible work regarding the situation, place and time, with work carried out partly from the employer's premises and partly from home or elsewhere with the help of digital tools and platforms facilitating work, communication and cooperation (Eurofound, 2023; Eurofound, 2023b). Eurofound 2023 's study revealed that the 27 country reports and other online documents linked to the country reports contained 80 examples of the implementation of hybrid work from different organizations. These organizations represented 21 different sectors of activity: finance (N = 23), ICT and telecommunications (N = 19), insurance (N = 6), public administration (N = 6), utilities (N = 6), online retail (N = 3) and others (N = 17).

For instance, a Hungarian financial institution with 3,300 employees decided to switch permanently to a hybrid working model once the pandemic allowed a return to the office. In other words, workers must spend at least half their monthly working hours in the office in jobs where remote work is possible. Working hours are flexible. Workers can allocate their working time between 7 a.m. and 8 p.m. Meetings can only be organized between 8 a.m. and 5 p.m. (Eurofound, 2023).

Generally, most organizations require employees to spend one to three days in the office per week, but this is defined in various ways. In some cases, a minimum number of remote work days was specified, whereas, in others, the policies defined a minimum number of days that should be spent in the office. However, not all jobs are compatible with remote work. Hence, these specifications apply only to specific groups of workers. In many organizations, employees were grouped into those who permanently worked in the office, permanent remote workers, and those who could adopt a hybrid model (Lodovici et al., 2021; Eurofound, 2023).

In specific scenarios, employees with the ability to work remotely were granted complete autonomy in selecting their work location, while in contrast, work had to be conducted within the country but retained a degree of flexibility. Some organizations defined a specific number of

working days when an employee could work abroad. In some cases, teams were given autonomy and responsibility to agree on the number and organization of office working days based on team-specific needs. For instance, the hybrid work model adopted by the Portuguese Municipality enables employees whose job responsibilities permit remote work up to a maximum of four days per week. This model mandates that, under all circumstances, at least one working day per week must be conducted in person, and on one designated day of the week, the entire team must collaborate in person. Furthermore, there were general policies regarding the use of office space. For instance, one German company did not offer fixed workstations, reducing the number of workstations available. If no working spaces were available, the employee could leave after one hour and end their working day (Eurofound, 2023).

In some scenarios, organizations implementing hybrid work identified supporting practices and structures believed to facilitate its success. Technological tools and applications were the most central category of support structures. Virtual platforms facilitating online collaboration were considered valuable communication tools when face-to-face meetings were impossible. Additionally, companies have developed new systems, for example, for managing and booking workstations in the office. Management and employee training and guidelines were mentioned in several cases as important support structures; examples include training for managing remote teams, health and safety guides for working from home, and employee training in digital skills and data security. Regular formal and informal communication practices and virtual events have been implemented to ensure a sense of community and organizational culture. In some organizations, employees were given a monetary allowance or furnished with an ergonomic home office. Lastly, new support structures for maintaining physical and mental well-being in hybrid workforces were implemented. For instance, in a Cypriot consultancy, a psychologist was made available around the clock for workers (Eurofound, 2023).

In summary, public and private organizations have adopted remote work, either partially or fully, employing diverse managerial and organizational approaches. Current trends of remote work practices show that it will be more likely to spread worldwide significantly. In this regard, the type of implementation of remote work procedures and strategies will be critical to shaping future directions.

Eurofound 2023a' s report indicates that considerations about the future of remote work and hybrid work must address its implementation and potential implications. The future of remote and hybrid work depends on critical factors, including the nature of work, adopted work organization models, managerial and organizational capabilities, as well as the integration of technology. In addition, if organizational decisions on these drivers are taken with greater awareness and the involvement of employees, the results will be better for employees and organizations. Other vital factors – such as remote work and hybrid work legislation and regulations, telecommunications infrastructure, and public/private investment in infrastructure – will depend on the intervention of public authorities (Eurofound, 2023a).

2.2. Economic Justification of Remote Work in Selected Theories and Concepts

Remote mobility of knowledge in the theory of the knowledge-based economy

Nowadays, economies are rapidly moving towards being more knowledge-based, supporting the force of knowledge as a vital component of productivity and economic growth (Karagiannis, 2007). Over the past several decades, many academics and commentators have suggested that technologies based on knowledge, information production, and transmission have become the driving force behind the economy in developed countries (Powell and Snellman, 2004).

Economic growth was explained by Romer (1986, 1990) and Lucas (1988) as the accumulation and spillover of technological knowledge. Knowledge is acknowledged as a critical component of economic success, along with physical capital and labor. New knowledge is an essential input factor for innovation; it may be converted into products and procedures and commercialized by creating new goods, processes, and organizations (Mueller, 2006). It is widely acknowledged that we have transitioned to a knowledge-based economy, defined by at least two key characteristics: knowledge is a significant factor in economic growth, and innovation processes are systemic (Llerena, 2005).

The OECD characterized knowledge-based economy (KBE) in 1996 as *'economies which are directly based on the production, distribution, and use of knowledge and information'* (Godin, 2006). The KBE has two widespread visions: the *'weightless economy'* and the *'information economy.'* The first observes that knowledge would be more significant in quantity and quality than

before. In other words, non-material objects are increasingly concentrated in economic worth. The second refers to the critical role that information and communication have assumed in the modern economy. From this point of view, information and communication technology (ICT) applications would drive the new economy (Harris, 2001; Godin, 2006).

The transition to a KBE was documented in the early 1970s and has steadily advanced across economies, propelled by advancements in high technology and the expansion of the information and communication service sectors (Schiliro, 2012). Overall, the KBE is widely recognized as a predominant trend in international society in the 21st century (Hsu, Lin, and Wei, 2008). The underpinnings of knowledge-based economies lie in growing specialization, research, innovation, and learning. Notably, a vital characteristic of these economies is their reliance on new information technology, such as remote work (Schiliro, 2012).

According to the theory, an emerging economic system prioritizes intangible economic assets, such as new ideas, software, and services, over tangible assets. From this standpoint, educated professionals with access to bodies of theoretical, specialized, and abstract knowledge create added value to the economic system with their brains rather than their hands. Because knowledge creation is less geographically constrained, changing the balance between the work's physical and metaphysical natures diminishes the work's fixedness. Consequently, the knowledge economy theory suggests that remote work growth can partly be explained by this economic transformation (Felstead and Henseke, 2017).

As per the study by Kuzior et al. (2022), there can be a positive correlation between digitalization, such as remote work, and increased organizational sustainability. Additionally, a huge part of the world's population commutes to work with a car. Driving a car has one of the highest impacts on polluting the air. A study run by Sun Microsystems revealed that a daily car commute to and from work is responsible for 98% of an employee's work-produced carbon footprint. Given that most of the workers start and finish almost simultaneously, creating huge traffic jams, these cars produce tons of greenhouse gases daily (Kuzior et al., 2022). From this point of view, remote work can be a significant solution to reduce carbon footprint and greenhouse gases due to employees' commuting to workplaces. This contributes to sustainable economic growth.

On the other hand, remote work is considered a catalyst for job creation because of its potential to bring remote employment chances by breaking geographical barriers in regions with low incomes and high unemployment rates. Therefore, it has been promoted as a new economic development strategy by governments, third-sector organizations, and the private sector (Anwar and Graham, 2021).

When it considers that the roots of the KBE are spreading worldwide dramatically and have become a significant trend (Hines and Carbone, 2013), if the international laws/regulations are okay with such employment in related countries (on both employer and employee sides), talent can be sourced worldwide. From this perspective, organizations shall stay caught up in significant trends in the knowledge-based economy and must apply remote work to achieve economic effectiveness.

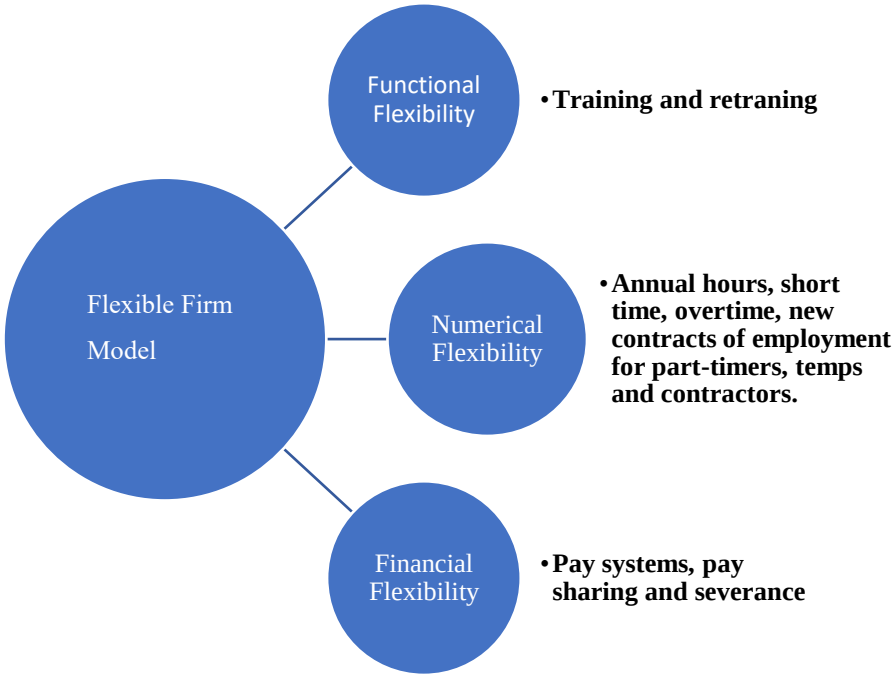
Over the last two decades, the workforce's composition has witnessed a significant shift, particularly in the increased employment of managers, professionals, and associate professionals. Between 1994 and 2014, their share of employment increased by ten percent, expecting them to constitute roughly half of the total workforce in 2024 (Felstead and Henseke, 2017; Wilson et al., 2016). When it is an account that remote work spreads among white-collar employees who use their knowledge as their work asset, it can be said that remote work has enormous potential to be more prevalent in the labor market.

Flexibility of work provision in the flexible-firm model

At the 1983 IMS senior executives conference, considerable interest was generated in the opportunities for introducing new ways of organizing labor, which loosened the contractual bonds between employer and employee, for example, through more extensive use of out-sourcing, short-term contracts, remote work, and temporary staff. Under the combined influences of profound economic recession, uncertainty about market growth, technological change in products and production methods, and reduced working time, employers have introduced novel and unorthodox formations in their labor deployment. They mark a significant break with the conventional, unitary, and hierarchical internal labor markets, which dominate manpower management in theory and practice. The capacity of labor markets to adjust to changes in the structure of final demand and changes in technology is widely recognized as a critical element in achieving economic growth.

The sources of such adjustments have principally been thought of as movements of workers between enterprises, sectors, regions, and occupations in such a way that the productive potential of the labor force is optimized. As a result, Atkinson proposed the flexible firm model and defined it as having three types of flexibility within organizations: functional, numerical, and financial. These items are presented in Figure 9 and explained below (Atkinson, 1984);

Figure 9. Flexible firm model



Source: own compilation based on Atkinson (1984).

Functional flexibility: It is sought so employees can be redeployed quickly and smoothly between activities and tasks. This might mean the deployment of multi-skilled craftsmen moving between mechanical, electrical, and pneumatic jobs; moving workers between indirect and direct production jobs; or a complete change of career from, say, draughtsman to technical sales. As products and production methods change, functional flexibility implies that the same labor force changes its activities with them in both the short and medium term.

Numerical flexibility: It is sought so that worked hours can be quickly, cheaply, and easily increased or decreased in line with even short-term changes in the level of demand for labor. The result would be that the number of workers deployed precisely matched the number needed at any given time. There are two ways that such numerical flexibility could be achieved. On the one hand,

it may simply require greater freedom for employers to hire and fire at will, which could, for example, be achieved through changing the contractual relationship between worker and employer (a fee-for-work-done relationship, towards a temporary contract of employment, or part-time labor). On the other hand, achieving numerical flexibility need not have such potentially brutal implications for employees because it may require no more than the deployment of worked time within shift patterns more flexibly, for example, through the use of annual hours contracts, flexible rostering, variable shift lengths, call-out arrangements.

Financial flexibility: It is sought for two reasons; first, pay and other employment costs reflect the state of supply and demand in the external labor market. The model's purpose lies more in relativities and differentials between worker groups than in an across-the-board push to reduce wages, and the implications include a bargaining and widening differential between skilled and unskilled workers. Secondly, and of greater importance in the long term, financial flexibility means a shift in the structure of pay systems towards pay and remuneration systems that facilitate the operational flexibility sought, such as assessment-based pay systems in place of rate-for-the-job systems, to encourage functional flexibility.

Finally, remote work is one of the flexible working methods that is significantly popular worldwide. The flexible firms model refers to the fact that when organizations use flexible working methods such as remote work, they will have functional, numerical, and financial flexibility. In the twenty-first century, Atkinson's flexible firm model, which he established in 1984, still has significant guiding and practical value. Organizations can use this strategy flexibly to sustain competitiveness in an open talent economy (Zhao, 2020). The flexible firm model is a comprehensive model that contains all the main parameters of change observed in the research work developed by the Institute of Manpower studies and describes flexible firm parameters and types (NEDO, 1986).

Flexible working refers to employees' flexibility over how long, where, when, and what times they work (CIPD, 2021). If companies are flexible, they can gain significant long-term competitive benefits. Firstly, a flexible business can deploy its employees and utilize their talents more effectively and efficiently than one that is not. Secondly, the more adaptable an organization is, the better it will adjust to change. Finally, employee flexibility, particularly regarding working hours, is highly valued by employees and can thus aid in recruiting and retaining top performers

(Taylor, 2018). Naqshbandi et al. (2024) findings reveal that flexible work significantly and positively affects job performance.

According to the Office of National Statistics (ONS), two-thirds of individuals working at least half of their time from home are self-employed, while a third work part-time. Remote work goes hand in hand with other forms of flexible work, and trends in these fields of work may explain at least some of the growth of remote work (Felstead and Henseke, 2017). From this point of view, remote work engages with other forms of flexible work. It provides advantages to organizations to adjust their labor force from a numerical flexibility point of view. When organizations need to extend their labor force during peak seasons, they may hire new employees who can work remotely anywhere. Almost everyone has an internet connection, smartphones, and computers worldwide. From a functional flexibility point of view, the flexible firm model refers to a flat and faster communication structure and a more proactive workplace. Remote work can secure a faster communication structure because, based on ICT infrastructure, workers and supervisors might communicate faster and flatter worldwide.

2.3. Social Justification for Remote Work in Selected Theories and Concepts

Rationale based on the feminization of the workplace concept

Women's participation in the paid labor market increased dramatically during the 20th century (Cohler, 2008). However, the gender revolution effectively took off in the 1960s. While at the beginning of the decade, marriage bars preventing women from continuing to work after marriage were still present in some organizations (e.g., the marriage bar was only lifted in the Midland Bank in 1962), by the end of the decade, the Ford workers strike for equal pay had secured an agreement to introduce an equal pay act. This changing world of work reflected rapidly changing social attitudes as contraception liberated women from unplanned pregnancies and the expansion of higher education (Rubery, 2015).

In the 1970s and 1980s, against the background of a popular feminist resurgence, unprecedented changes in the relationship of women workers to the organized labor movement were generated. Union membership became increasingly feminized, and issues of particular concern to women gained new prominence on many unions' collective-bargaining and political

agendas. Yet rapid private-sector de-unionization and related processes of economic restructuring, which occurred in precisely the same period that the social effects of workforce feminization became manifest, set limits on union responsiveness to the growth of the female workforce (Milkman, 1994).

In the 21st century, as more women enter the workforce, the workplace has become more feminized daily (Parthasarathy, 1994; Moore, 2005). Despite considerable advances in the feminization of the workplace, women's participation percentages remain low compared to men worldwide (Lagarde and Ostry, 2018; Heath et al., 2024). In 2024, the ILO estimates that 45.6 percent of women (aged 15 and above) are employed, compared to 69.2 percent of men, a gap of 23.6 percentage points. Novel ILO evidence suggests that this gap mainly stems from family responsibilities (marriage and parenthood), indicating that women's disproportionate share of unpaid care work plays a major role in shaping gender employment gaps globally (ILO, 2024). This statistical data shows that recent progress in reducing the gender gap has been unsatisfactory. The modest growth in female labor force participation rates over the last two decades emphasizes the imperative need for change to propel economic growth (Klasen, Pieters and Santos Silva, 2021).

Women and economic growth is a reality that has played out quietly for centuries. Whether this reality has taken place in the world's most advanced economies or those that are rudimentary (not to mention those recovering from the devastation of armed conflict, excessive risk-taking, or ethical lapse), one constant remains—the participation of women in economic activity has moreover, it will continue to spur economic growth (Greg et al., 2011).

Sustainable development can only be achieved through long-term economic, human, and environmental capital investments. The female half of the world's human capital is undervalued and underutilized. Women – and their potential contributions to economic advances, social progress, and environmental protection – have been marginalized as a group. Better use of the world's female population could increase economic growth, reduce poverty, enhance societal well-being, and help ensure sustainable development in all countries (OECD, 2008). In recent decades, a large share of economic growth in the OECD has come from employing more women. Since 1995, narrowing the gap between male and female employment rates has accounted for half of the increase in Europe's overall employment rate and a quarter of annual economic growth. It is

estimated that if female employment were raised to the male rate, economic growth would be substantial (Credit Suisse Research, 2007).

Lagarde and Ostry's study underscores that closing the gender gap for countries ranking in the bottom half of gender inequality could, on average, elevate GDP by 35%. Among these gains, four-fifths stem from adding workers to the workforce, while the remaining one-fifth results from the positive impact of gender diversity on productivity (Lagarde and Ostry, 2018). Extensive microeconomic evidence further reveals that women and men contribute distinct abilities and perspectives to the workplace. Studies also affirm that greater gender equality on company boards correlates with improved financial success (Lagarde and Ostry, 2018). In light of this knowledge, it is imperative for organizations to proactively incorporate qualified women into their workforce to leverage the diverse potential they bring to organizational success.

Women are essential in the workplace, especially in countries where labor shortages are a constant concern due to the aging population. Women are a vital organizational resource for a firm's competitiveness and long-term growth; therefore, engaging them in the workplace is unavoidable in today's environment (Chepkemei et al., 2013; Loichinger and Cheng, 2018). Taking into consideration that working women contribute considerably to household, national, and global economic development, failing to create women-friendly work practices such as fair remuneration may eventually reverse all of the gains made as a result of increased female engagement in the workplace (Stamarski and Song Hing, 2015; Munongo and Pooe, 2021).

Nowadays, employers looking to gain competitive advantage, be a magnet for top talent, win the fight for critical skills, and do the right thing are increasingly focused on attracting more significant female talent. In fact, some 78% of large organizations are actively trying to recruit higher numbers of female talent – remarkably more experienced and senior-level female talent (Flood, 2017).

Cultural stereotypes, social norms, and national circumstances strongly influence women’s participation in and entry into the labor market to varying degrees across developed and developing countries. In today’s society, where talent is increasingly mobile and can be accessed via internet opportunities anywhere in the world, it is increasingly urgent for both the private and public sectors to focus on developing, attracting, and retaining female talent with remote work opportunities more aggressively than before (IOE, 2017). The rise of remote work could potentially increase women’s

labor supply. While remote work is currently most common in high-income countries, it seems likely to spread to low and middle-income countries as technology improves (Heath et al., 2024).

One of the most promising avenues for future research on gender in the workplace asks: What can be done to address the challenges women face? Many scholars, such as Catalyst (2000), Moen and Roehling (2005), and Rapoport et al. (2002), have outlined suggestions to eliminate the glass ceiling, reduce sexual harassment, reduce gender inequality in pay, and help individuals meet their work and family responsibilities. In this regard, Glass (2004) proposed schedule flexibility (adapting the timing and location of work) (Cohler, 2008). The globalized world and advanced infrastructure technologies enable employees to work remotely anytime and anywhere. Virtually, remote work provides employees flexibility about place and time. When it is accepted that women's responsibilities are more than men's in families, flexible working methods such as remote work can encourage women to join the labor market. Therefore, organizations shall adjust their employment practices in response to the feminization of the labor force and the rising participation of mothers in the job market to meet the demands.

Laß, Vera-Toscano, and Wooden's (2023) study findings suggest the main benefit of remote work for workers arises from the improved ability to combine work and family responsibilities, something that matters more to women given they continue to shoulder most of the responsibility for house and care work. In this regard, organizations providing remote work possibilities may be attractive centers for the women's labor force.

Finally, the feminization of the workplace and remote work are two parts of a big puzzle. The workplace is feminizing, with women entering the labor market. If organizations apply for remote work, they can be attractive centers for the qualified women labor force. After working remotely in organizations and providing employees with flexible and comfortable workplaces, women would enter the labor market more intensely. With women entering the labor market intensely, the competition in the labor market may be more challenging as well. After all, positively evaluated candidates may be recruited, and a more qualified workforce can provide better outputs, higher employee performance, and customer satisfaction with organizations.

Rationale derived from generational theory

Generation term can be described as a cohort that shares birth years, age location, and significant life events, especially during the critical late adolescent and early adulthood years

(Zemke, Raines and Filipczak, 1999; Meredith, Schewe and Karlovich, 2002). The theoretical basis for the term generations can be traced back to the 1950s. Its early origins are in sociology, most notably in the work of the German philosopher and sociologist Karl Mannheim (1893-1947). In his paper '*The Problem of Generations'* (1952), Mannheim used the idea of generations to understand and explain the structure of social and intellectual movements (Eduardsen, 2011).

Generational theory argues that members of the generation born and growing at different times and periods, affected by the historical, social, cultural and political events of the period in which they grew up, have different values, beliefs, attitudes and expectations and that all these differences have an effect on employee behavior (Kupperschmidt, 2000; Howe and Strauss, 2007; Lepeyko and Blyznyuk, 2016). Over the years, the generation profiles of organizations have been changing and diversifying. The reason for this is that new generations are joining the workforce. According to generational theory, different generations have different expectations and perspectives on work life. Therefore, in today's intensely competitive environment, organizations must know the human resources that will make them achieve sustainable success and must develop appropriate work methods to enable generations to focus on organizational goals (Anholt, 2007; Anholt, 2013; Kam, 2019; Kam and Trippner Hrabi, 2021). The characteristics and expectations of the population structure in organizations emerge as a critical factor in achieving goals.

The current work environment accommodates four distinct generations: Baby Boomers, born between 1946 and 1964; Generation X, born between 1965 and 1980; Generation Y, born between 1981 and 1995; and Generation Z, born in 1996 and later (Oblinger and Oblinger, 2005; Kam, 2019). Considering that each generation reflects the characteristics of their time frame and has different values and worldviews, these elements directly affect business life. According to generational theory, every four generations currently in the work environment can reveal significantly different levels of effectiveness for different work systems.

Baby Boomers (1946-1964), this generation is called such because of the extra seventeen million babies born during that period relative to previous census figures (O'Bannon, 2001). They are recognized for their exceptional commitment to organizations and have witnessed substantial technological advancements throughout adulthood. In contrast, their offspring exhibit a greater proclivity for technology, being accustomed to rapid information access (Delahoyde, 2009; Kam, 2019; Oblinger and Oblinger, 2005; Kelle, Simonson, and Henning, 2024). This situation has

forced Baby Boomers to adapt to these innovations. In fact, it is not uncommon to encounter middle-aged people returning to university despite their advanced age (İzmirlioğlu, 2008).

This generation's values and beliefs were shaped by events such as the Civil Rights Movement, the advent of the birth control pill, Woodstock, the assassination of President John F. Kennedy, and the Korean and Vietnam Wars. Baby Boomers grew up in a time of economic prosperity and educational expansion. Therefore, many individuals from this generation were allowed to attend college. According to Coates (2007), "*Their sheer numbers motivated them to do whatever they could to become successful and to stand out from the crowd*" (Delahoyde, 2009). Generations members are not a big part of the labor force because most are retired.

Generation X (1965-1980) members emphasize individual rather than collective work and have met with substantial technological developments in adulthood. However, they have adapted to technological developments and mainly have used phones as a communication tool (Kupperschmidt, 2000; Hammil, 2005). Members of Generation X are the children of older boomers who grew up in a period of financial, familial, and societal insecurity. They grew up in a stagnant job market, corporate downsizing, and limited wage mobility, and they were the first individuals predicted to earn less than their parents did. They have grown up in homes where both parents worked or in single-parent households because of high divorce rates, and as such, became latchkey kids forced to fend for themselves (Karp, Fuller and Sirias, 2002).

When examining the personal characteristics of Generation X members, they exhibit high brand loyalty, are relatively easily satisfied, content, combative, and dynamic, enjoy being independent, and are cautious and security-oriented. They advocate radical values and are considered an essential transitional generation due to their late acquaintance with technology. Notable events witnessed by this generation include the fall of the Berlin Wall, the Challenger Disaster, and the global oil crisis (Coates, 2007; Delahoyde, 2009; İzmirlioğlu, 2008; Ceylan, 2014).

Generation X exhibits a different commitment to organizations in the workforce than previous generations. This generational characteristic directly results from the environment in which these individuals were raised. Generation X watched as their Baby Boomer parents gave up spending time with their families to advance in their careers. As a result, this generation collectively seeks more balance in their lives and values spending time with family at home, even if it means

making less money. They also expect work to be fun as they balance leisure and work time (Kupperschmidt, 2000; Coates, 2007; Delahoyde, 2009).

Generation Y (1981-1995), known as the "*WHY*" generation due to their inquisitive nature, is also referred to as the Millennial generation in some sources but is more commonly known as Generation Y (Washburn, 2000; Lamm and Meeks, 2009). They are fond of freedom in business life and interest in the media and communication, and most consumer are fragile in their commitment to their workplaces. There is a general belief that they will work in more than ten different companies throughout their lives as an assumption. Their most distinguishing trait is that they were born when technology was still widely used. Technological tools such as smartphones and computers are a part of their life. They use them not only to communicate, play games, and spend spare time but also to get the information and data they want as soon as possible. They are open to change and innovation, impatient, dislike bureaucracy, not easily pleased, and love their freedom and comfort when it comes to personality traits (Hammil, 2005; Schwarz, 2008; Zemke, Raines and Filipczak, 2013; Miroński and Gawlik, 2018). They view their actions as steps toward their goals and can simultaneously handle multiple tasks. For them, their tasks are duties that need to be fulfilled. Generation Y members primarily use email, voice messages, and social media as communication tools. When balancing work and family life, it is evident that Generation Y members are keen on maintaining a balance between their professional and personal lives (Hammill, 2005; Schwarz, 2008). Among the significant events witnessed by the members of this generation are the Iraq War, the September 11 terrorist attacks, the widespread increase in terrorism, violence, and drug use, as well as the explosion of technology (Delahoyde, 2009; Schwarz, 2008).

Generation Y, characterized by their seamless integration of technological tools into daily life, engages with them during leisure, stays informed through online news, and pursues educational endeavors in digital spaces. Therefore, the technological environment is familiar to them. Their knowledge of the technological environment enables them to work remotely effectively. They are fond of freedom in business life and fragile in their commitment to their workplaces, which reveals that they may work remotely more effectively and comfortably. Since remote work may provide more freedom than working on organizational premises, from this point of view, their expectations are meeting with remote work exactly. In addition, they are open to change and innovation. So they will not have any problem working remotely (Kam, 2023).

Lastly, it is noteworthy that members of Generation Z (1996- and later) inhabit an environment rich in the presence of new technological developments, advanced communication systems, and efficient transportation facilities. They can use technology well and are growing up with small portable devices (smartphones, computers, MP3 players, iPods, and DVD players). Even if there are long distances between the generation members, they can establish a mutual connection by communicating verbally and visually with digital devices at any time. In addition, they tend to be physically alone. For these reasons, there is a prediction that they will be more willing to live alone. The most distinctive features of this generation are technology addiction, lack of geographical limitations, and individuality (Williams, 2010; Csobanka, 2016; Kam, 2023). According to Dorot's (2018) study, new technologies are a natural environment for Generation Z. Although they are willing to take foreign business trips, they are not so willing to relocate for work. In the light of this finding, remote work is an appropriate work method for them.

The most striking differences distinguishing Generation Z from other generations are their experience of a period in which the pace of change has reached unpredictable levels and manifested as disruptions, as well as being the first generation whose characteristics could be defined long before they were born. It is anticipated that Generation Z will be a generation that enjoys innovation and creativity while simultaneously seeking security. It is also believed that many phenomena will change as members of this generation enter the workforce. The dependency on speed introduced by Generation Y through technology is expected to be taken even further by Generation Z (Dorot, 2018; Kam. 2019; Kam. 2023).

As Generation Z grows within the workforce, organizational dynamics are anticipated to undergo significant changes. Furthermore, Generation Z will carry the speed dependency that emerged with the technology brought by Generation Y to working life (Williams, 2010). It seems that, for successful business cooperation, getting to know and understand young people is critical. Cooperation between the generations is inevitable. Willingness to share knowledge and learn from one another can be advantageous in today's competitive labor market (Dorot, 2018). In conclusion, Generation Z members can use technology well and work remotely successfully; they tend to be physically alone and prefer to avoid geographical limitations. Remote work is a proper system allowing them to work anywhere and anytime; hence, it meets their expectations.

Rationale from social exchange theory

The social exchange theory, a prominent perspective in social psychology and one of the most influential conceptual paradigms in organizational behavior is grounded in the norm of reciprocity (Cropanzano and Mitchell, 2005). Four figures were primarily responsible for the theory: George Homans, John Thibaut, Harold Kelley, and Peter Blau. In *"Social Behavior as Exchange"* (1958), Homans consciously tried to identify and advance this point of view. In 1961, he amplified his argument in Social Behavior: Its Elementary Forms, which has been revised (1974). Also, in the late 1950s, Thibaut and Kelley constructed their compact conceptual scheme in The Social Psychology of Groups (1959). While different in essential ways, their work converged with Homans's, strengthening the general exchange approach. When Blau's Exchange and Power (1964) appeared, the exchange approach assured a future in the field (Cook et al., 2013).

According to this theory, the exchange process initiates as one party provides a benefit to another, fostering positive interactions. If the recipient reciprocates, a sense of duty is engendered between the parties (Coyle-Shapiro and Shore, 2007). The resources exchanged could be physical, such as commodities or money, or intangible, such as social benefits or friendship. The theory's core premise is that people enter and sustain relationships to get something from them (Lambe, Wittmann, and Spekman, 2001). The foundational principle of the social exchange theory lies in the concept of a 'win-win exchange relationship,' which endures as long as it remains reciprocal. The relationship power between parties is significant in order to sustain social exchange. Emerson's (1962) seminal contribution to the theory focuses on the impact of power and reliance in exchange relationships. He believes that power imbalances make relationships unstable and that interdependence is essential for the long-term survival of a social exchange relationship (Lambe, Wittmann, and Spekman, 2001).

Emerson's determination is correct because if the power of parties is not balanced, the social relationship cannot be maintained for the long term. When one person treats another well, reciprocity dictates that the other person be treated adequately (Gouldner, 1960). In other words, if an employer treats an employee well and gives him or her a pleasant working environment, proper working methods, numerous social rights, reasonable compensation, and other benefits, the employee may return to practical work, high performance, and positive outcomes. When considering social exchange theory's basic assumptions and previous studies about remote work, it

reveals that if organizations apply remote work as their working method, employees may provide practical work and better performance. The results of previous studies conducted in remote worked organizations showed advantages such as better quality of life, greater productivity and flexibility, better assessment of the workload, and reduced costs, stress, and commuting time (Baruch, 2000; Grant, Wallace, and Spurgeon, 2013; Fílardí, Castro and Zaníní, 2020). It means that when employees work remotely, they are productive and flexible. If organizations apply for remote work, they can provide the advantages mentioned to their employees.

On the one hand, proper working methods appear to have positive outcomes in organizations; on the other hand, inappropriate work methods may adversely impact personnel performance and outcomes (Townsend et al., 1998; Trippner-Hrabi, Chądzyński and Kam, 2023). Therefore, the working method is significant for organizations. There is no doubt that the employee profile is essential as the working method in order to generate positive outcomes (Kianto, Saenz and Aramburu, 2017). So, organizations have to shape their employee profile regarding their working method. When they have good employee profiles for remote work, the social exchange process may trigger naturally then they will receive positive outcomes (higher performance, higher productivity).

Consequently, employees are motivated to reciprocate favorable treatment by contributing work that aligns with the organization's preferences and values (Eisenberger et al., 2001). Social exchange models have extensively examined diverse facets of the employment relationship (Johnson and O'Leary-Kelly, 2003), revealing that various variables contribute to shaping social exchange relations. Nevertheless, the preeminent factor in this dynamic is the psychological contract. Psychological contracts represent a distinctive form of social exchange between employers and employees. The predominant focus of psychological contract research has been identifying components within an employee's contract and the consequences of employer contract fulfilment or non-fulfilment. For instance, Robinson et al. (1994) discerned that the psychological contracts of MBA graduates encompass expectations of swift career progression, competitive salaries, enduring employment security, and opportunities for training (Johnson and O'Leary-Kelly, 2003).

The psychological contract emphasizes the significance of employee expectations in applying social exchange. To comprehensively understand employee expectations, it is essential to

consider generational traits when analyzing employee profiles within the labor market. While each generation possesses distinct characteristics and values, some commonalities can be identified. From this standpoint, organizations must accurately grasp generational characteristics to establish psychological contracts seamlessly. Generation Z and Y are the youngest groups actively working in the labor market. In other words, they will work in the labor market for a long. Therefore, organizations need to plan their current and future work method, remote work, to meet generations' expectations. Examining the characteristics of both generations reveals that technology is part of their life; they are fond of freedom and weak in their commitment to their workplaces. In addition, especially Generation Z tends to be physically alone (Hammil, 2005; Schwarz, 2008; Delahoyde, 2009). Organizations may apply psychological contracts with these generation members to facilitate a smooth social exchange. By applying psychological contracts with generations, they may receive positive outcomes from employees, such as high performance and higher productivity.

Consequently, social exchange theory indicates that if organizations apply for remote work, they will receive positive outputs from their employees because it has various advantages for employees. Employees with a flexible and proper work environment may work effectively and productively. Positive social exchange can occur only when employees have appropriate working methods that meet their expectations. Afterwards, organizations could have a total capacity of their labor force abilities (Kam, 2023).

2.4. Social and Economic Methods of Measuring Remote Work Effectiveness

Remote work is a response to the needs of modern economies, where private and public institutions operate and create networks of connections. Amongst them is the public utility sector, which refers to an activity, good, or service that brings benefits or collective interests to the residents of a country (Bruijn and Dicke, 2006). The public sector's ability to adapt to remote work depends mainly on complying with institutional arrangements, quality and control management, and human resource management (Mousa and Abdelgaffar, 2021). Public sector entities apply the required organizational arrangements to implement remote work effectively. It can be achieved when: a) employees are equipped with critical information and communications technology (ICT) devices and solutions, applications, software, and online connectivity to internal and external networks; b) work guidelines are established and adopted, and remote communication and

collaboration tools are used; c) the execution of management functions (planning, organizing, and leading, i.e., motivating and controlling) are adapted to remote work (Milasi et al., 2021).

Organizations, regardless of whether they are public or private, want to increase organizational effectiveness. Flexible work arrangements seem to be a way to reduce costs and improve employees' work satisfaction, motivation, commitment, work-life balance, and, as a result, boost their performance. Some authors have used the terms '*effectiveness*' and '*efficiency*' as synonyms. However, these terms have separate definitions in the literature (Bartuševičienė and Šakalytė, 2013; Kiwert and Walecka, 2022).

Efficiency refers to the resources used to achieve the organization's goals. It is based on the quantity of raw materials, money, and employees necessary to produce a given output level. Effectiveness is a broader term, meaning the degree to which an organization achieves its goals (Low, 2000; Zheng, Yang, and McLean, 2010; Bartuševičienė and Šakalytė, 2013; Daft, 2015). It implicitly considers a range of variables at both the organizational and departmental levels. Effectiveness evaluates the extent to which multiple goals—official or operative—are attained. Efficiency is a more limited concept that pertains to the organization's internal workings. Organizational efficiency is the amount of resources used to produce a unit of output. It can be measured as the ratio of inputs to outputs. If one organization can achieve a given production level with fewer resources than another, it would be described as more efficient. Sometimes efficiency leads to effectiveness, but in other organizations, efficiency and effectiveness are unrelated. An organization may be highly efficient but fail to achieve its goals because it makes a product for which there is no demand. Likewise, an organization may achieve its profit goals but be inefficient. Efforts to increase efficiency, particularly through severe cost-cutting, can sometimes make the organization less effective. For instance, one regional fast-food chain, wanting to cut costs, reduced food waste by not cooking food until it was ordered. The move reduced the chain's costs, leading to delayed service, irritated customers, and lower sales (Daft, 2015).

In the literature, organizational performance is treated as the measure of organizational effectiveness (Pyszka, 2015). However, organizational effectiveness is a broad term connected to the performance of the whole organization (Sparrow and West, 2002; Kiwert and Walecka, 2022) as it encompasses different and increasingly more complex performance outcomes that include (Sparrow amd Cooper, 2014): such as proximal (i.e., commitment, satisfaction), intermediate

(customer service) and distal or organizational performance outcomes (financial performance). On the other hand, 'work efficiency' is used to refer to the organization's human resources (Kiwert and Walecka, 2022). Table 8 below displays several definitions regarding work efficiency and organizational effectiveness.

Table 8. Definitions of work efficiency and organizational effectiveness

Work efficiency	Organizational effectiveness
Work efficiency is the ratio of the result of an action to the costs incurred (material, human, moral, social, etc.), and work is efficient when significant results are achieved with fairly low costs (Karney, 1998)	Organizational effectiveness is the company's ability to adapt strategically to changes in the environment on an ongoing basis and to use its resources productively and economically to achieve the adopted structure of objectives (Zięb icki, 2010)
Work efficiency is the relation of the value of material and nonmaterial benefits obtained thanks to human labor to the amount of material and non-material expenditure incurred as a result of human labor (Jasiński, Chomątowska and Janiak-Rejno, 2002)	Organizational effectiveness is both effectiveness of functioning, as well as additional results obtained in connection with operational activities, therefore, quantitative and qualitative determinants (inc. work effects, customer satisfaction, employee satisfaction, innovation, etc.) (Waśniewski, 2018)
Work efficiency is the ratio of work effects, in terms of results, to broadly understood work expenditure (Skowron-Mielnik, 2009)	Organizational effectiveness encompasses a wide range of increasingly complex performance outcomes, including commitment, satisfaction, customer service, organizational, and financial performance (Bustinza et al., 2019)

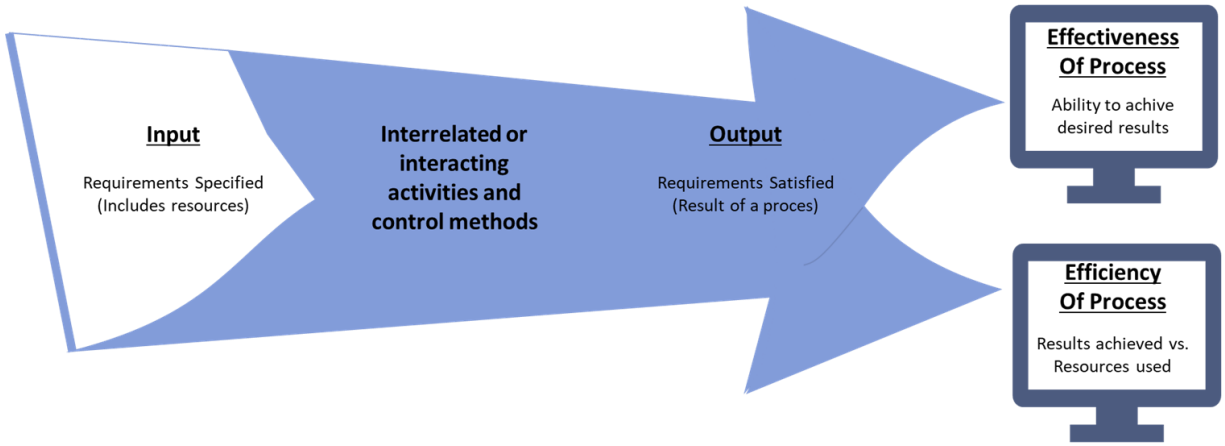
Source: (Kiwert and Walecka, 2022).

Effectiveness and efficiency are components of various factors that directly or indirectly affect the performance of the organization and the employee. Researchers, especially during the COVID-19 pandemic, focus more and more on the factors influencing the effectiveness and efficiency of remote and hybrid work arrangements, as well as the consequences of these work models for the organization and the employees (Kiwert and Walecka, 2022).

In this study, remote work is considered part of the work process in the public utility sector. According to ISO 9000, a *"process*" can be defined as a "*set of interrelated or interacting activities, which transforms inputs into outputs*." These activities require allocating resources such as people and materials (Corrie, 2004). Achieving desired outcomes also relies heavily on technological infrastructure and effective management practices. Both inputs and desired outputs can be physical (such as equipment, materials, or components) or intangible (such as energy or knowledge) (Corrie, 2004). According to ISO 9000, effectiveness is achieving desired results (Tsim et al., 2002; Corrie, 2004). From this point of view, remote work is an input to achieving the desired output of the work

process in the public utility sector (Figure 10). This study defines the effectiveness of remote work as the ability to achieve desired results from an economic point of view based on technological effectiveness, resource allocation effectiveness, and management effectiveness perspectives.

Figure 10. Effectiveness of public utility sector – the key subject of research



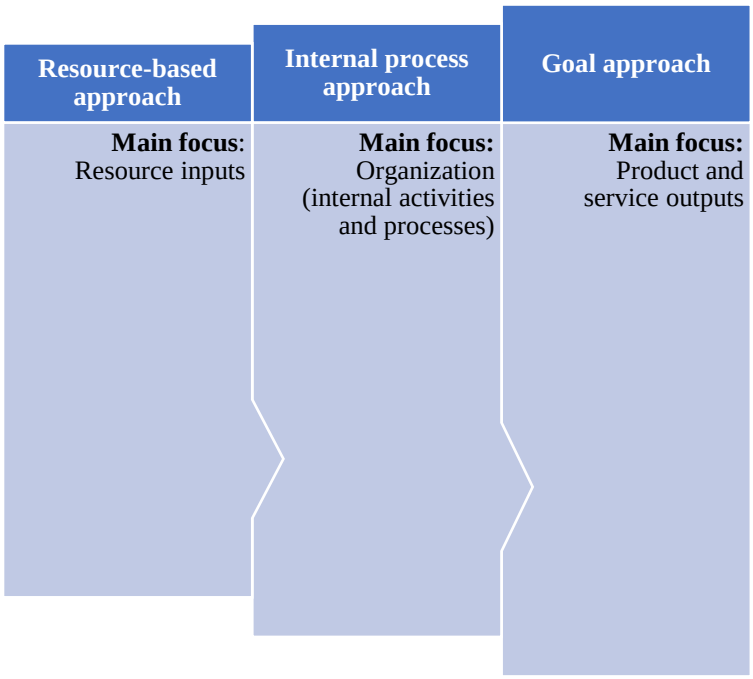
Source: (Kam, Przygodzki and Trippner-Hrabi, 2023 based on ISO 9000).

Efficiency is the ratio of the results achieved to the resources used. Efficiency in the holistic meaning of remote work is challenging to estimate due to too complex cost categories, which are often immeasurable or difficult to value in money directly. That is why the study only focuses on the economic effectiveness of remote work in public utility sector organizations.

Overall, effectiveness is challenging to measure in organizations. Organizations are large, diverse, and fragmented. They perform many activities simultaneously, pursue multiple goals, and generate many outcomes, some intended and some unintended. Managers determine what indicators to measure to gauge their organizations' effectiveness. Studies and surveys have found that many managers have difficulty evaluating effectiveness based on characteristics that are not subject to complex, quantitative measurement (Daft, 2015).

In the literature, it is seen that there are several different approaches to measuring effectiveness in organizations. According to Daft (2015), these approaches can be categorized as traditional and balanced scorecard approaches. Traditional perspectives include the goal approach, resource-based approach, and internal process approach. These approaches are used to obtain specific pictures of organizational effectiveness. Figure 11 below displays these approaches.

Figure 11. Traditional approaches to measuring organizational effectiveness



Source: own compilation based on Daft (2015).

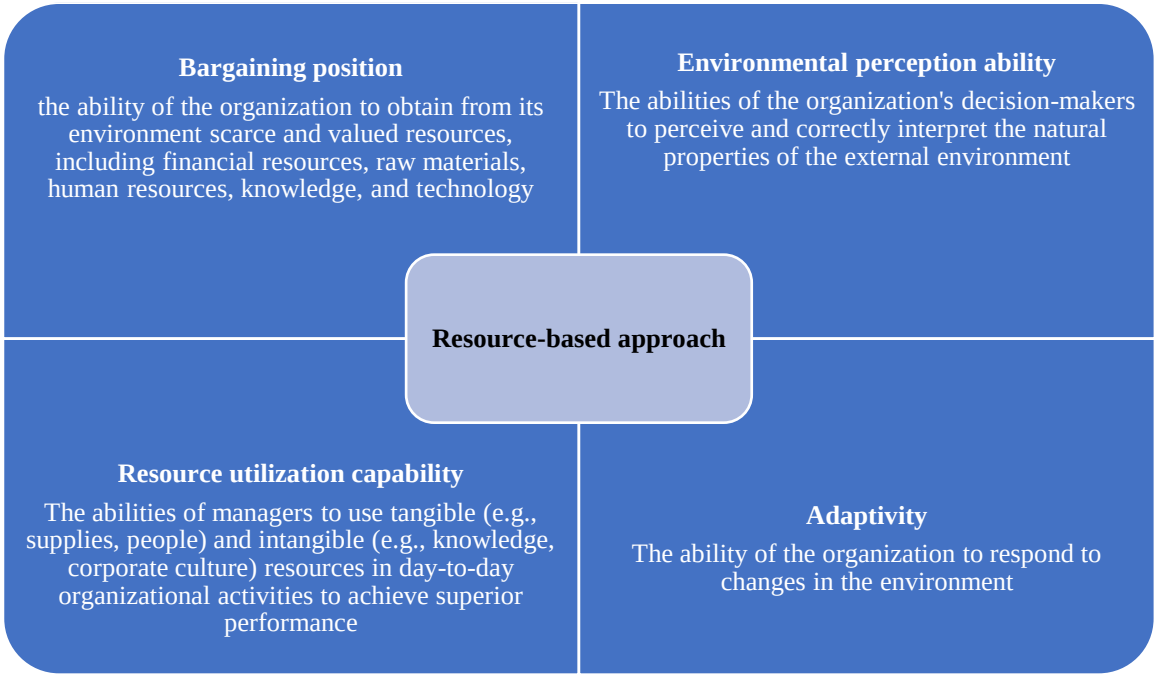
Goal approach consists of identifying an organization's output goals and assessing how well it has attained them. This is a logical approach because organizations try to attain specific output, profit, or client satisfaction levels. The goal approach measures progress toward the attainment of those goals. The essential goals to consider are operative goals because official goals (mission) tend to be abstract and difficult to measure (Price, 1972; Hall and Clark, 1980; Daft, 2015). Figure 12 below shows indicators tracked with the goal approach.

Figure 12. Indicators tracked with the goal approach

Source: own compilation based on Daft (2015).

On the other hand, another significant traditional approach to measuring effectiveness is the resource-based approach. It assumes organizations must be successful in obtaining and managing valued resources in order to be effective. From a resource-based perspective, organizational effectiveness is defined as the organization's ability, in either absolute or relative terms, to obtain scarce and valued resources and successfully integrate and manage them. The resource-based approach is valuable when other performance indicators are difficult to obtain (Russo and Fouts, 1997; Daft, 2015). Figure 13 below shows indicators tracked with the resource-based approach.

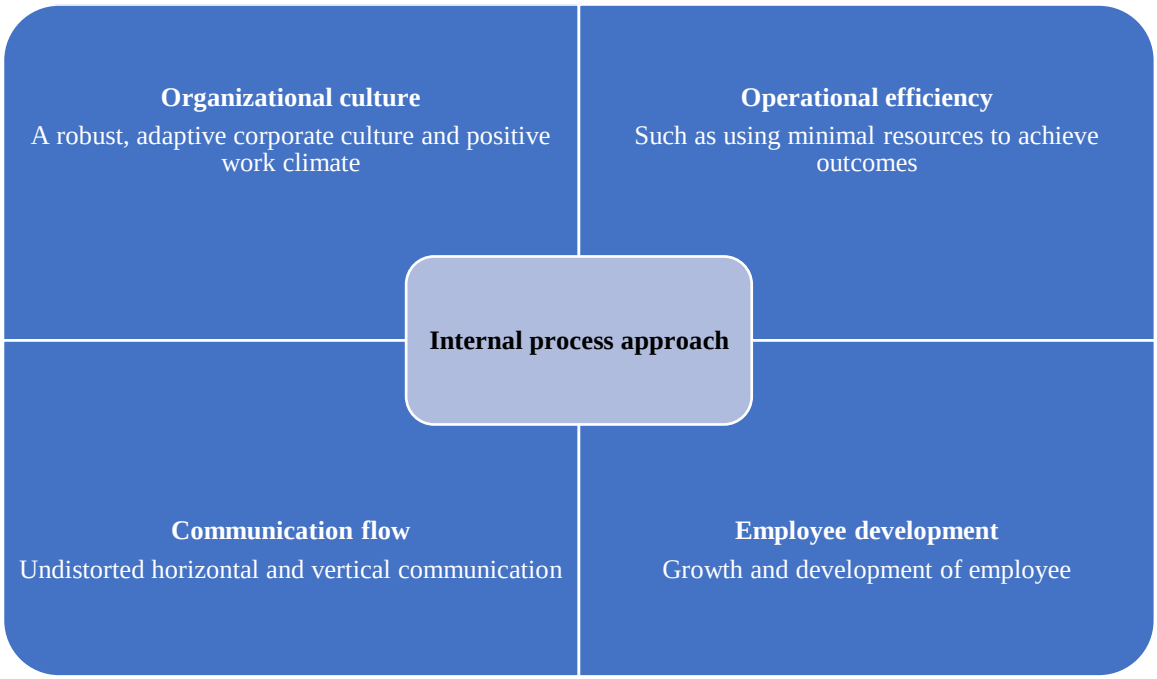
Figure 13. Indicators tracked with resource-based approach



Source: own compilation based on Daft (2015).

The last traditional approach to measuring effectiveness is the internal process approach. It measures effectiveness as internal organizational health and efficiency. An effective organization has a smooth, well-oiled internal process. Employees are happy and satisfied. Department activities mesh with one another to ensure high productivity. This approach does not consider the external environment. The critical element in effectiveness is what the organization does with its resources, as reflected in internal health and efficiency. The best-known proponents of an internal process model are from the human relations approach to organizations. Such writers as Chris Argyris, Warren G. Bennis, Rensis Likert, and Richard Beckhard have all worked extensively with human resources in organizations and emphasize the connection between human resources and effectiveness (Argyris, 2017; Daft, 2015). Figure 14 below shows indicators tracked with the internal process approach.

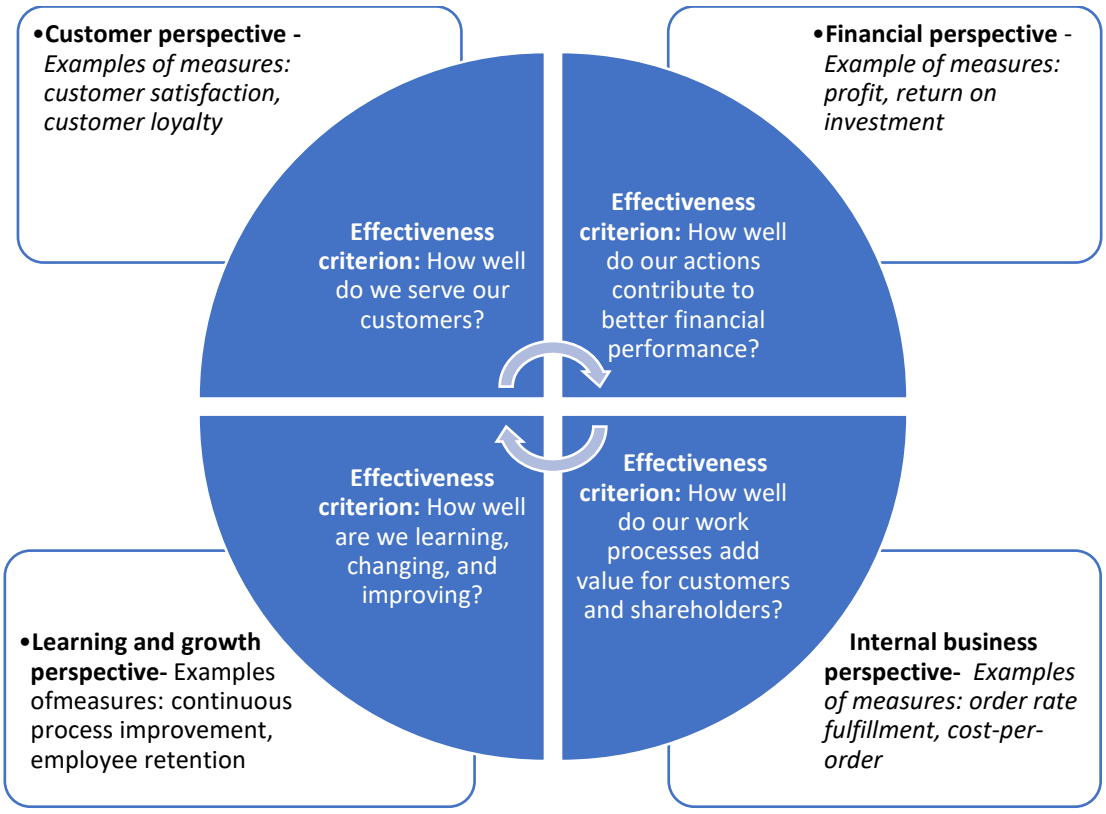
Figure 14. Indicators tracked with internal process approach



Source: own compilation based on Cunningham (1977).

Business organizations have typically focused on financial measures such as profit and return on investment to assess performance. Nonprofit organizations also have to assess budgets, spending, and fund-raising income; each measure is concerned with finances. Traditional approaches based on goal, resource-based, and internal process indicators have something to offer, but each one, like sole reliance on financial numbers, tells only part of the story. On the contrary, the balanced scorecard approach is a new approach that balances a concern for various parts of the organization rather than focusing on one aspect that has become popular. It combines several effectiveness indicators into a single framework, balancing traditional financial and operational measures relating to an organization's critical success factors (Kaplan and Norton, 2005; Daft, 2015). Figure 15 below illustrates the four effectiveness perspectives that are considered by the balanced scorecard approach.

Figure 15. Balanced scorecard effectiveness criteria



Source: own compilation based on Kaplan and Norton (2005), and Daft (2015).

As illustrated in Figure 15 above, the balanced scorecard approach includes four primary areas of effectiveness: financial performance, customer service, internal business processes, and the organization's capacity for learning and growth. The financial perspective reflects a concern that the organization's activities contribute to improving short and long-term financial performance. It includes traditional measures such as net income and return on investment. Customer service indicators measure how customers view the organization and customer retention and satisfaction. The internal business process perspective focuses on production and operating statistics, such as order fulfillment speed and cost per order. The final component looks at the organization's potential for learning and growth, focusing on how well resources and human capital are managed for the company's future. Measurements include employee satisfaction and retention, the amount of training people receive, business process improvements, and introducing new products. The balanced scorecard helps organizations assess their activities from many perspectives to understand total effectiveness better (Daft, 2015). Just as there are various approaches to measuring

effectiveness in organizations, there are also different approaches to assessing the effectiveness of remote work. In the literature, we can most often find research results on such areas of remote work effectiveness measurement as:

- reduction of commuting costs (Marasigan, 2020; O'Brien and Aliabadi, 2020; Caulfield and Charly, 2022),
- reduction of job maintenance costs (Gajendran, 2017; Licite-Kurbe and Leonovica, 2021),
- improvement of the efficiency of working time management (Beckmann, 2016),
- reduction of office service costs (Rayome, 2018),
- increase in work efficiency, increase in autonomy and self-reliance of employees (Bloom et al., 2015),
- the impact of remote on the key research areas of work-life balance, job effectiveness, and well-being (Grant, Wallace, and Spurgeon, 2013),
- remote work and public value creation (García-Contreras et al., 2024),
- effectiveness of remote employees (Staples, 2001),
- communication effectiveness and leader performance (Neufeld, Wan and Fang, 2010),
- remote work effectiveness perceived by managers- effectiveness of the manager's work, the team, and the cooperation with other business areas (Kowalski and Ślebarska, 2022),
- remote work effectiveness- the perspective of resource allocation (Kam, Przygodzki, and Trippner-Hrabi, 2023).

A systematic literature review by Aleem et al. (2023) results identify eight research themes regarding remote work: (1) Effect on employees at a personal level, (2) Effect on employees' careers, (3) Family life and gender roles, (4) Health, well-being, and safety, (5) Labor market dynamics, (6) Economic implications, (7) Remote work management, (8) Organizational remote work strategies (Aleem et al., 2023).

In addition, the literature review by Mele, Belardinelli, and Bellé (2023) that is conducted especially regarding remote work in public institutions, reveals a few established antecedents of remote work, including individual characteristics like family responsibilities and expected productivity, but also organizational aspects like supportive leadership, and contextual features like natural disasters. Self-reported productivity and work-life balance stand out as remote work's most

widely studied outcomes, although evidence is often conflicting regarding its effects (Mele, Belardinelli, and Bellé, 2023).

On the other hand, a systematic literature review by Petcu and Cișmașu (2023) identified the most studied subjects regarding the economic effectiveness of remote work as listed: (1) the impact of remote work on the degree of employment, aiming to reduce unemployment through measures at the company level, but also government policies; (2) technology and digital infrastructure development, primary conditions in the practice of companies that implement remote work; (3) economic performance and productivity under remote work circumstance; (4) carrying out economic activities from the perspective of remote work (Petcu and Cișmașu, 2023).

Regarding methods to measure the economic effectiveness of remote work at organizations, researchers mainly focus on employees' or managers' productivity and job performance in literature (Mutiganda et al., 2022). Most studies were quantitative that are used key outcome measure as self-reported performance or productivity: (1) Sherman (2020) conducted a study on Abcam PLC life sciences company in England; the key outcome measure was the employees' job performance; (2) Bao et al. (2022) conducted a study on a large IT firm in China, the key outcome measure was the productivity, e.g., the number of builds/commits/code reviews; (3) Delanoeije and Verbruggen (2020) conducted a study on construction and property development firm in Belgium, the key outcome measure was person-and day-level job performance; (4) De Menezes and Kelliher (2016) conducted a study on four organizations in the professional sector, e.g., pharmaceutical, banking in UK, the key outcome measure was individual performance; (5) Feng and Savani (2020) conducted a study on full-time employees in USA, the key outcome measure was perceived work productivity; (6) Gajendran et al. (2015) conducted a study on employers and employees, a wide assortment of organizations in USA, the key outcome measure was task performance; (7) Golden et al. (2008) and Golden et al. (2008a) conducted a study on large high-tech company, in USA, the key outcome measure was job performance; (8) Golden and Gajendran (2018) conducted a study on supervisors and employees, a single organization, in USA, the key outcome measure was job performance; (9) Hill et al. (2003) conducted a study on IBM in USA, the key outcome measure was job performance, productivity, workload success; (10) Hyland et al. (2005) conducted a study on eight private and public organizations in Ireland, the key outcome measure was employee performance; (11) Kitagawa et al. (2021) conducted a study on four chemical and automobile manufacturing companies in Japan, the key outcome measure was perceived productivity; (12) Medina-Garrido

et al. (2017) conducted a study on employees of banking sector in Spain, the key outcome measure was job performance; (13) Morikawa (2020) conducted a study on organizations in Japan, the key outcome measure was perceived productivity; (14) Narayanamurthy and Tortorella (2021) conducted a study on multiple organization sectors in UK, the key outcome measure was employees' performance (i.e., output quality and delivery); (15) Ralph et al. (2020) conducted a study on software developers in the several countries, the key outcome measure was perceived productivity; (16) Tsukamoto (2021) conducted a study on workers in Japan, key outcome measure was productivity; (17) van der Lippe and Lippenyi (2020) conducted a study on workers in nine EU countries, key outcome measure was task performance, individual and team; (18) Vega et al. (2014) conducted a study on government organization in USA, key outcome measure was job performance.

In the literature, different performance indicators are used by researchers to measure economic effectiveness in remote work organizations depending on the nature of the work: (1) Bloom et al. (2015) conducted a study on a travel agency in China; the performance indicator was the number of phone calls; (2) Choudhury et al. (2021) conducted a study on Patent and Trademark Office in USA; the performance indicator was total actions and rework; (3) Giovanis (2018) employed a study on management in random workplaces in UK; the performance indicator was workplace performance within two alternative measures: financial performance and labor productivity; (4) Kotey and Sharman (2019) applied a study on public, private, and non-profit organizations in Australia; the performance indicator was return on labor; (5) Lee and Hong (2011) conducted on federal agencies in USA; the performance indicator was proportion of met or exceeded annual performance; (6) Monteiro et al. (2021) employed a study on large Portuguese firms in Portugal; the performance indicator was sales per employee; (7) Neirotti et al. (2012) conducted a study on different Italian firms from industry groups in Italy; the performance indicator was value added per employee; (8) Phillips (2014) was employed a study on health and life insurance company in USA; the performance indicator was number of claims processed and examined; (9) Rocha et al. (2021) was applied a study on firms in Cyprus, Georgia, Greece, Italy, Moldova, and Russian Federation; the performance indicator was sales growth; (10) Ruostela et al. (2015) was conducted a study on managers, salespeople and consultants in a production company in Finland; the performance indicators were space usage, occupancy costs, and environmental impact; (11) St George et al. (2009) was employed a study on the Department of Human Services

in Australia; the performance indicators were quality of advice, risk incidents, and the number of phone calls; (12) Viete and Erdsiek (2020) applied a study on German service firms in Germany; the performance indicator was sales; (13) Zhang et al. (2021) was conducted a study on small businesses in USA; the performance indicators were operating revenue, disruption of the supply chain, business closures, and cash flows; (14) Kitou and Horvath (2008) was simulated scenarios based on national data in USA; the performance indicators were energy and fuel costs, and external costs related to air emissions; (15) KlindŽi´c and Mari´c (2019) was employed a study on large-sized organizations in Croatia; the performance indicators were return on assets, return of equity, and revenue per employee.

As listed above, several studies regarding the economic effectiveness of remote work are based on different performance indicators. However, these studies have narrow approaches to asses economic effectiveness; therefore, comprehensive measurements for assessing the economic effectiveness of remote work are still a challenge (EY, 2021; Carrotspot, 2021; Deloitte Insight, 2021).

3. Formal Conditions of Using Remote Work

3.1. Remote Work Regulations in International and European Law

Among the international regulations directly or indirectly affecting remote work, prominent ones include the International Labor Organization's (ILO) Home Work Convention No. 177 and Home Work Recommendation No. 184, the European Social Charter, the European Convention on Human Rights, the Bangemann Report, the Human Rights Convention, and the European Framework Agreement on Telework (Şanlı, 2023).

The EU's most significant legislation on remote work is the European Social Partners' Framework Agreement on Telework of 16 July 2002 (*"the agreement on teleworking*"). It is the first autonomous agreement negotiated by the European social partners, and as such, it represents a landmark in EU industrial relations. For the first time, the European social partners and their member organizations at the national level directly addressed the emerging challenge posed by new forms of work organization by defining a set of principles and rules and by undertaking to ensure their timely implementation across the Member States of the European Union and the countries of the European Economic Area (EEA). (ILO, 2020a). The Framework Agreement on Telework, adopted with the participation of ETUC (The European Trade Union Confederation), UEAPME (The European Association of Craft, Small and Medium-Sized Enterprises), and CEEP (The European Centre of Employers and Enterprises providing Public Services and Services of General Interest) (Gok Metin and Yaldiz 2021).

The agreement recalls that teleworkers benefit from the same legal protection as employees working at the employer's premises and defines a general framework for using telework at the workplace in a way that corresponds to employers' and workers' needs. It concentrates on the aspects specific to working at a distance from the employer's premises. It highlights key areas requiring adaptation or specific attention, such as employment conditions, data protection, privacy, equipment, health and safety, work organization, training, and collective rights (European Social Partners, 2006). Member States are to give particular attention to equality and anti-discrimination rules, especially concerning the amount of remuneration for stationary workers. The teleworking agreement was introduced into the law at different times in most member states. In some countries, the contract's provisions have been implemented through collective agreements. Some countries,

including Poland, have introduced remote work regulations via national legislation, mainly in labor codes (Kobron-Gasiorowska, 2022).

The agreement defined '*telework*' as organizing and performing work using information technology, where work, which could also be performed at the employer's premises, is carried out away from those premises regularly. It concerns teleworkers with an employment contract and does not deal with self-employed telework. Neither does it concern employees of call centers who are performing their work at the premises of the call center employing them. The EU framework agreement deals both with workers who are directly recruited as teleworkers and those who wish to opt for this form of work organization during their employment relationship and highlights that when telework is not part of the initial job description, the passage to telework is voluntary both for the employer and the employee (European Social Partners, 2006).

The essential principles of this particular form of work, which are still relevant to the legislation of the European Union Member States, are 1) voluntary nature of remote work; 2)written information on employment conditions; 3) permanent employment status; 4) equal employment conditions; 5) respecting the privacy of the employee; 6) protection of the employee's data; 7) equipping the employee with the necessary work equipment; 8) responsibility; 9) health and safety; 10) work organization; 11) training; and 12) rights under collective agreements (Kobron-Gasiorowska, 2022). However, the legality and feasibility of remote work depend on the laws and policies of the countries where employers and workers are located. This is because there is not, even within the EU, a comprehensive legal regulation of remote work at the supranational level: many aspects of the legal regulation of remote work remain territorial (Grušić, 2023).

In many EU countries, the need to update legislation and regulations to clarify the responsibilities of employers and workers' rights regarding remote work has been recognized with the COVID-19 pandemic. 13 Member States have updated or passed new national legislation (or an agreement) on remote work since the outbreak of the pandemic (Spain, Portugal, France, Luxembourg, Belgium, Netherlands, Ireland, Austria, Slovakia, Latvia, Greece, Romania, and Poland). The focus is first on statutory regulation, and second, on the role of collective bargaining, a regulatory mechanism used most extensively in Scandinavian countries. In contrast, Central and Eastern European Member States attempt to adopt statutory definitions and legislation, but the role of collective bargaining (except Slovenia) remains marginal (ELA, 2023). The COVID-

19 pandemic was a cornerstone for Polish law remote work regulations. In other words, before the COVID-19 pandemic, Polish labor law did not define remote work. Instead, the legislation only encompassed teleworking and comprehensive regulations outlining its implementation. Therefore, the legal situation in Poland will be introduced in two main parts, before the COVID-19 pandemic, and after the COVID-19 pandemic, in chapter 3.2.

3.2. Remote Work Regulations in Polish Law

The legal situation in Poland before the COVID-19 pandemic

Before the COVID-19 pandemic, remote work was not defined within Polish labor law. Instead, the legislation only encompassed *teleworking* and comprehensive regulations outlining its implementation. This framework was established through an amendment to the Labor Code on 24 August 2007. According to the definition in the Labor Code (LC), teleworking is work performed regularly outside the workplace with the use of means of electronic communication. The notion of means of electronic telecommunication is defined in the Act of 18 July 2002 on providing services by electronic means (Journal of Laws No. 144, item 1204, as amended). It should also be understood as such in the definition of teleworking. According to this Act, these are technical solutions, including ICT devices and software tools cooperating with them, enabling individual communication at a distance through data transmission between ICT systems, particularly electronic mail. Moreover, a teleworker defined as an employee who performs telework and communicates the results of his/her work to the employer using electronic communication (Article 67 item 2 of the Act of 26 June 1974 Labor Code) (Lewiatan, 2023; Berisha and Klich, 2024).

According to the report that the Polish Confederation Lewiatan (Lewiatan, 2023) publishes related to skills and competencies for the post-COVID-19 workplace (Better skilled) co-funded by the European Union (Project: 101051787), due to its high formalization and the need to establish its principles through intra-company regulations, teleworking has not gained much popularity in the Polish labor market. At the same time, employers have decided to introduce remote work, which is not teleworking (often the so-called home office). Usually, the main element that distinguishes remote work from teleworking is its incidental and irregular character. The Lewiatan 2023 report describes the legal situation regarding *teleworking* before the COVID-19 pandemic as below;

According to the Labor Code (LC), detailed conditions for the use of teleworking in enterprises should be set out in a collective agreement or, if there is no such agreement, in regulations. The provisions of the Code place a strong emphasis on ensuring that this form of work performance is voluntary. An agreement between the parties to provide teleworking can occur at any time, either before the employment relationship is established or during employment. However, both parties must always have consented to the employment relationship. The absence of the employee's consent or cessation of teleworking cannot constitute grounds for termination of the employment relationship with the employee.

During the employment, the transition to teleworking can only take place by agreement between the parties; in no case can it be made by way of a change notice, nor can it be assigned to the employee for three months due to the employer's legitimate needs. Once teleworking has been undertaken, both parties to the employment relationship, i.e. the employer and the employee, may, within three months, resign from teleworking by requesting to stop teleworking. After the expiry of this period, if the teleworker takes the initiative to stop teleworking, the employer should grant the request as far as possible. In contrast, if the employer is the initiator of the change, then it should be done by way of a change notice.

The provisions of the Code also take into account the need to ensure the teleworker's contact with the workplace by allowing the teleworker, on the terms and conditions adopted for the general workforce, to be on the premises of the workplace, to communicate with other employees, and to use the employer's premises and equipment. The employer is also obliged to inform the teleworker where the teleworker is employed in the organizational structure of the establishment and to name the person or body responsible for cooperation with the teleworker.

The teleworker should also be informed of the entities with control over him/her. The teleworker must obtain this information at the latest on the commencement date of telework. On the other hand, the rules of communication between the employer and the teleworker, the manner of confirming attendance at the workplace, and the manner and form of controlling the teleworker's work performance should be agreed upon between the parties in a separate agreement.

The Code also outlines the employer's obligations to provide the teleworker with the tools to perform the work. This primarily involves the obligation to provide the teleworker with equipment (e.g. computer, fax, telephone) and to insure it. The employer also covers the costs

related to the equipment's installation, service, operation and maintenance and provides technical assistance and the necessary training to use this equipment unless the parties agree otherwise on the above in a separate agreement. The equipment with which the employer equips the teleworker's workstation must meet the requirements of health and safety regulations.

The parties to the employment relationship may also establish in a separate agreement the terms and extent of insurance and use of equipment belonging to the teleworker. In this case, they should also determine the amount of the monetary allowance for using such equipment, considering its wear and tear standards, documented market prices, and the amount of material used for the employer's needs and market prices.

Also, using an agreement, the employer shall specify the teleworker's data protection rules and, if necessary, the type and timing of the instruction and training in this regard. The fact that the teleworker has been made aware of the data protection rules shall be confirmed in writing. The employer has the right to control the teleworker, even if the work is carried out at the teleworker's home. The inspection may concern the performance of the work, the use of the equipment entrusted and health and safety. However, in no case may the carrying out of the inspection violate the privacy of the teleworker and his/her family or impede the use of the home premises. However, an inspection at the teleworker's home may only be carried out if the teleworker consents in writing or by electronic communication.

The provisions in question contain guarantees to treat the teleworker like other employees – working in traditional forms of employment for the same or similar work – about establishing and terminating the employment relationship, conditions of employment, promotion, and access to training. An employee cannot be discriminated against for taking up telework or for refusing to do so. Due to the specific nature of teleworking, especially at the teleworker's home, some requirements for providing safe and hygienic working conditions by the employer have been limited. The provisions of the Code in the field of occupational health and safety do not apply in the case of the obligation of the person in charge of employees to take care of the safe and hygienic condition of the premises (Article 212(4) of the Labor Code), concerning the requirements concerning building facilities and work premises (Chapter III of Section X of the Labor Code) and the obligation to provide hygienic and sanitary facilities (Article 233 of the Labor Code). On the other hand, all other requirements, including those concerning the organization of workstations

equipped with screen monitors, should also apply in the case of teleworking. The provisions of the Labor Code allow a person with a severe or moderate disability to be employed in the form of teleworking for an employer that does not provide sheltered employment conditions.

The legal situation in Poland after the COVID-19 pandemic

Mainly after the outbreak of the coronavirus pandemic, the Polish legislator decided to introduce provisions for remote work carried out when instructed by the employer. First of all, this was intended to limit contact between employees in workplaces as effectively as possible. Thus, where remote work was possible, it made it easier for employers to comply with work organization recommendations during a pandemic, such as ensuring a distance between employees (Lewiatan, 2023).

The first legal response to the COVID-19 pandemic in Poland came soon after the first coronavirus cases had been diagnosed in March 2020. The Act of 2nd March 2020 on specific solutions related to the prevention, counteraction and eradication of COVID-19, other infectious diseases and crises caused by them (Journal of Laws 2020 item 1842 with amendments, further referred to as the COVID-19 Act), promulgated by the Polish legislator, in its Article 3 introduced an institution previously unknown in the Polish legal system — "*remote work*" (Mędrala, 2021; Naumowicz, 2022). According to Article 3 of the COVID-19 Act: "*During the period of an epidemic threat or epidemic state announced due to COVID-19, and within three months after their cancellation, in order to counteract COVID-19, the employer may instruct the employee to perform for a specified period, work specified in the employment contract, outside the place of its permanent performance (remote work)"* (Naumowicz, 2022). Hence, remote work has ceased to benefit employees and has become necessary and an opportunity to reduce the risk of infection (Dolot, 2020). Act of December 1, 2022 (Journal of Laws of 2023, item 240) amending the Labor Code and some other Acts introduced remote work to the Labor Code while repealing the provisions on teleworking. The new regulations on remote work came into force on April 7, 2023.

The new article 67 item 18 of the Labor Code introduces a definition of remote work: "*The work may be carried out wholly or partly at the place indicated by the employee and agreed with the employer in each case, including at the employee's home address, in particular by means of direct communication at a distance (remote work)".* In the following, the latest remote work regulations in the Polish labor code are explained by using Lewiatan 's 2023 report and the Ministry

of Family, Labor and Social Policy article regarding remote work regulations that are based on the Act of December 1, 2022, amending the Labor Code and certain other acts (Journal of Laws of 2023, item 240);

The new provisions of the Labor Code define not only what *remote work* is but, above all, the rules and obligations of the employer as well as those of the employee regarding remote work—a two-month vacatio legis period had been adopted for the new regulations. Remote work is provided based on the following:

1. Arrangements between the parties to the employment relationship. An agreement between the parties to the employment contract regarding the performance of remote work by the employee may take place:
   a. when concluding an employment contract or
   b. during employment. In such a case, the arrangement may be made either at the employer's initiative or at the employee's request, which is made on paper or electronically.
2. At the instruction of the employer.
3. Or occasionally, at the employee's request.

When it comes to basic principles of remote work regarding newly adopted provisions of the Labor Code, Article 67 item 1 of the Labor Code does not exclude the possibility for an employee to perform remote work from different locations, as long as these are agreed with the employer on a case-by-case basis. In addition, the place of remote work performance is always indicated by the employee and each time agreed upon (i.e., accepted by) the employer. As a general rule, this is the employee's place of residence or other place(s) chosen by the employee and agreed to by the employer, which is always mutually agreed upon between the parties to the employment relationship. On the other hand, the legislation does not allow total freedom of choice regarding where the employee performs remote work (i.e., without agreeing on this place with the employer).

As a general rule, a remote work request is binding on the employer when made by:

1. a pregnant worker,
2. an employee raising a child up to the age of four,
3. an employee caring for another member of his/her immediate family or another person in the common household who has a disability certificate or a severe disability certificate,
4. an employee referred to in Article 1421 item 1 points 2 and 3 of the Labor Code:

- an employee who is a parent of a child with the certificate referred to in Article 4(3) of the Act on support for pregnant women and families “Za życie”, i.e. a certificate of a severe and irreversible disability or an incurable life-threatening illness, which arose during the prenatal period of the child’s development or during birth;
- an employee who is a parent of a child with a disability certificate or a certificate with a moderate or significant degree of disability as defined in the regulations on professional and social rehabilitation and the employment of disabled persons;
- an employee who is a parent of a child with, respectively, an opinion on the need for early childhood development support, an evaluation of the need for special education or an evaluation of the need for remedial classes referred to in the provisions of the Act of 14 December 2016 on Education Law.

The employer is obliged to grant this employee's request unless this is not possible due to the organization of work or the type of work performed by the employee. In this case, the employer has to inform the employee on paper or electronically of the reason for refusing the request within seven working days of the request. On the other hand, the employer may instruct (rather than agree with) the employee to carry out remote work in case of below conditions:

1. during a state of emergency, a state of epidemic emergency or a state of epidemic emergency and for three months after their revocation or
2. during a period when it is temporarily impossible for the employer to provide safe and hygienic working conditions at the employee’s existing workplace due to force majeure (e.g., the destruction of the workplace by fire).

Such an order is possible if the employee submits a declaration immediately before the order is issued that he/she has the premises and technical conditions to perform remote work. In the case of remote work performed based on an order, the employer may revoke the order to perform remote work at any time with at least two days’ notice.

The rules for remote work are to be set out in an agreement concluded between the employer and the company trade union organization, and if there are no company trade union organizations operating at the employer’s site, the employer shall set out the rules for remote work in the regulations after consultation with employee representatives selected by the procedure adopted at the employer’s site. Regulations may also be issued if, within 30 days from the date of presentation

of the draft agreement by the employer, no agreement is reached with the trade unions. An individual agreement with the employee setting out the rules for remote work may be concluded when no company agreement (or no regulations were issued). Thus, this means any case where there is no internal act in the workplace regulating the rules of remote work.

If remote work is activated during the employment (not applicable to the agreement at the conclusion of the employment contract), either party may make a binding request to stop the remote work and restore the previous terms and conditions of work. The parties shall agree on a time limit for the restoration of the previous working conditions, which shall not be longer than 30 days from the date of receipt of the request. In the absence of an agreement, the restoration of the previous working conditions shall occur on the day following the expiry of 30 days from receipt of the request. However, the employer's right in this respect will not be able to apply to employees performing remote work at their request binding for the employer unless it is not possible to continue performing remote work due to the organization of work or the type of work performed by the employee. Suppose remote work is agreed upon after the employment contract. In that case, it is impossible for the employee or the employer to unilaterally stop remote work, calling the employee to work at a location designated by the employer (e.g., in the office).

The detail of how the employer covers the costs of remote work (and determines the cash equivalent or lump sum) is a mandatory part of an intracompany agreement or regulations or an agreement with the employee where no company agreement has been concluded or regulations have been issued.

The employer has an obligation to:

1. provide the remote worker with the materials and working tools, including technical equipment, necessary to perform the remote work,
2. provide the remote worker with the installation, servicing, operation and maintenance of the work tools, including technical equipment, necessary to perform the remote work or cover the necessary costs related to the installation, servicing, operation and maintenance of the work tools, including technical equipment, necessary to perform the remote work, as well as cover the costs of electricity and telecommunication services necessary to perform the remote work,

3. pay costs other than those referred to in point 2) that are directly related to the performance of the remote work if the reimbursement of such costs has been stipulated in an agreement concluded with the trade unions, remote work regulations, an order, or in an agreement with the remote work employee if no agreement with the trade unions has been concluded or no regulations have been issued,
4. provide the employee performing the remote work with the training and technical assistance necessary to perform that work. The parties may also establish rules for the use by the employee performing remote work of work materials and tools necessary for the performance of remote work not provided by the employer. In this case, the employer must pay a cash allowance.

On the other hand, the obligation to cover the costs of remote work or pay an allowance may be replaced by an obligation to pay a lump sum, which corresponds to the expected costs incurred by the employee in carrying out the remote work. The labor Code only indicates that, in determining the amount of the equivalent or lump sum, it will be necessary to take into account, in particular, the norms of consumption of materials and work tools, including technical equipment, their documented market prices and the quantity of material used for the employer's needs and the market prices of this material, as well as the norms of consumption of electricity and the costs of telecommunication services. On the other hand, technical issues related to determining these benefits are left to the parties' discretion and to regulation at the company level.

The mandatory cost coverage only applies to the costs of electricity and telecommunications services necessary for remote work. Therefore, it does not cover the costs of water consumption or the use of space in the home unless regulations regarding the obligation to reimburse such costs have been introduced in intra-company legal acts (agreements or regulations).

The employee's request for occasional remote work is not binding on the employer, so the employer may refuse to grant it. The extent of occasional remote work shall be no more than 24 days per calendar year. It shall be independent of the employee's working hours (full-time equivalent) and the number of hours resulting from the employee's work schedule on the day the employee performs work in this manner. Employers must also pay attention to the issue of safe and hygienic conditions for working remotely. This involves, in particular, the need to develop a risk assessment of the employee performing remote work. Based on the results of this assessment, the

employer prepares the relevant information for the employees. Before being allowed to work remotely, the employee confirms in a statement submitted on paper or electronically that:

- He/she has read the employer's risk assessment and information containing the principles of safe and healthy remote work and undertakes to comply with them,
- Safe and hygienic working conditions are provided at the remote workstation at the location indicated by the employee and agreed upon with the employer.

The new provisions of the Labor Code further address the issue of conducting inspections of employees working remotely, protecting information and personal data when working remotely or prohibiting discrimination against employees working remotely. Table 9 below displays the main difference between teleworking and remote work applications in Polish labor law.

Table 9. The main differences between teleworking and remote work

Evaluation criteria	Teleworking	Remote work
Definition	The work performed regularly outside the workplace with the use of means of electronic communication.	It may be carried out wholly or partly at the place indicated by the employee and agreed with the employer in each case, including at the employee's home address, in particular by means of direct communication at a distance.
Legal framework	The framework was established through an amendment to the Labor Code on 24 August 2007.	Act of December 1, 2022, amending the Labor Code and some other Acts introduced remote work to the Labor Code while repealing the provisions on telework. The new regulations on remote work came into force on April 7, 2023.
Employment contracts	Teleworking required mutual agreement between employer and employee, could be included in employment contracts or agreed upon during employment.	Remote work can be agreed upon in the employment contract, initiated by employer's instruction, or requested by the employee.
Implementation authority	Employers cannot introduce telework independently. Mutual agreement of the employee and the employer is required	Employers can introduce remote work by a work order during a state of emergency, epidemic, or force majeure, or by mutual agreement.
Occasional work application	Not applicable	Remote work may be performed occasionally, at the employee's request, submitted on paper or electronically for not more than 24 days in a calendar year (so-called occasional remote work), subject to employer approval.
Revocation of work	Once teleworking has been undertaken, both parties to the employment relationship, i.e. the employer and the employee, may, within three months, resign from teleworking by requesting to stop telework.	If remote work is activated during the employment, either party may make a binding request to stop the remote work and restore the previous terms and conditions of work. The parties shall agree on a time limit for restoring the previous working conditions, which shall not be longer than 30 days from receipt of the request. Remote work by employer's instruction can be revoked at any time with at least two days' notice.

Source: own elaboration based on Act of 24 August 2007 (Journal of Laws 2007 no. 181 item 1288) and Act of December 1, 2022 (Journal of Laws of 2023, item 240).

As displayed in Table 9 above, there are main differences between teleworking and remote work regarding legal conditions. One of the critical differences is that remote work may be permanent (where the only way of performing work by a given employee is remote work), hybrid (where in parallel with remote work), and occasional (not exceeding 24 days in a calendar year) (Szymura, 2024). However, teleworking had one way of application: regularly working outside the workplace as a teleworker (Lewiatan, 2023). That is why it was a challenge to spread in the labor market. On the contrary, remote work addresses a future work method with its flexibility (Berisha and Klich, 2024).

4. Specificity of Public Sector Versus Private Sector – Differences and Similarities

4.1. General Insights into Organizing Remote Work in Public and Private Sector Organizations

Remote work is a response to the needs of modern economies where public and private organizations operate and create networks of connections. According to some authors, the public sector is a provider of public services funded by public finance, which is governed by public administration, decided by public choice, and performs worse than the private sector. Therefore, innovations such as remote work in the public sector are critical to improve work performance. Public sector innovation is defined by Osborne and Brown (2005) as the introduction of new elements into public service – in the form of new knowledge, a new organization, and new management or process skills that represent discontinuity with the past (Svidronova, Merickova and Nemec, 2016).

The public sector is known for its slow-moving and archaic nature regarding technological innovation. With the constantly changing workforce and generational differences of employees, one common request amongst people is the ability to work remotely, which has become increasingly common in the private sector but is not as popular in the public sector. This is due to assumptions that remote work does not produce the same level of productivity (Buckingham, 2021).

Conversely, the implementation of remote work in the public sector can lead to significant cost reductions for organizations by lowering expenses related to office facilities, utilities, and maintenance. This shift in approach allows organizations to optimize their resources, improve operational efficiency, and allocate budgetary resources more effectively toward vital services and programs (Obrenovic et al., 2020; Awada et al., 2021). Furthermore, remote work also helps to reduce the environmental impact of commuting, contributing to sustainability goals within government agencies. Moreover, it enables public sector organizations to access a diverse talent pool beyond geographic boundaries, allowing them to recruit individuals with specialized skills and expertise from different regions (Kam, 2023).

The first factor crucial for successful remote work is providing the remote worker with the necessary technological and ergonomic resources (Buckingham, 2021). This includes equipping employees with essential information and communications technology (ICT) devices and solutions, applications, software, and online connectivity to internal and external networks. Remote work has gained significant traction during the COVID-19 pandemic and has introduced new experiences and concerns in work processes. These experiences necessitate establishing and adopting work guidelines and effectively using remote communication and collaboration tools. Implementing remote work as an innovative alternative to enhance service efficiency in the public utility services domain is, therefore, imperative. Moreover, remote work can provide significant benefits by boosting productivity, effectiveness, and service quality, provided the execution of management functions (planning, organizing, and leading, i.e., motivating and controlling) is adapted effectively to remote work (Kazekami, 2020; Varotsis, 2022; Milasi et al., 2021).

Research by Caillier (2012) has shown that government employees who feel appreciated develop a sense of obligation toward the organization. This appreciation can be demonstrated through a flexible schedule and remote work opportunities. Such arrangements enhance employees' productivity and enable them to complete the same if not more, work than they would in a distracting office environment (Buckingham, 2021). On the other hand, some researchers argue that although digital technologies positively impact the quality of governance, the role of digitalization has been overestimated. A successful implementation requires developing and implementing a digitalization strategy based on redesigning business processes in an informed and planned manner, not ad hoc (Gabryelczyk, 2020).

The public utility sector refers to an activity, good, or service that brings benefits or collective interests to the residents of a country (Bruijn and Dicke, 2006). They are classically defined as three types of services: administrative, civil, and technical/infrastructural, which play a crucial role in our society. Effective implementation of remote work deals with a technological revolution, a transformation not just about efficiency but also the fabric of our public services.

Remote work cannot be implemented in all public utility services because some utility services' work scope is unsuitable for remote work, such as technical/infrastructural services (e.g., water supply, public transport, road maintenance, and public space). Because they are closely

related to the use of technical infrastructure in physical space, and their virtual dimension is limited (Kam, 2023).

On the other hand, administrative services are rapidly transitioning towards e-administration and readily embracing artificial intelligence solutions in customer service. One positive change in digitalization in the public utility sector is delivering more efficient, effective, and transparent services (Andersson et al., 2022). However, Argwal (2018) argues that public administrations are not prepared to deal with challenges arising from the technological revolution, which, to some extent, results from limited public services access to highly skilled professionals who can implement new digital solutions in the government sector (Argwal, 2018). The situation is more challenging in civil services, encompassing health care, education, culture, recreation, counteracting unemployment, housing, social assistance, supporting the disabled, and supporting families. Here, there is a deficit in services' availability and underdevelopment. However, the potential of technology, particularly the increased availability of e-services supported by remote employment of civil servants, holds promise as an effective remedy for current difficulties.

In the private sector, profit is the most crucial driver, which provides the effectiveness of remote work. However, the public utility sector does not operate in the interests of profit. Hence, the lack of a systemic mechanism provides challenges in dealing with remote work effectively. Nonetheless, remote work in public utility services can potentially have a high level of work performance if certain factors are addressed (Buckingham, 2021; Kam, 2023). The public utility services' ability to adapt to remote work depends mainly on complying with institutional arrangements, quality and control management, and human resource management (Mousa and Abdelgaffar, 2021). Public utility services must apply the required organizational arrangements to implement remote work effectively (Milasi et al., 2021).

Organizations subject to political rather than economic controls are likely to face multiple sources of authority that are potentially conflicting (Boyne, 2002). In the public sector specifically, one constant assumption is that the sector is not innovative or able to keep up with the changing and fast-paced working environment (Buckingham, 2021). In this regard, it is more likely that public organizations face more challenges regarding implementing remote work effectively and making necessary adjustments to their work arrangements than private organizations. However, a study conducted by Cooper and Kurland (2002) searched the impact of remote work on public and

private employees' perceptions of professional isolation, bringing out that employees in public organizations value informal developmental activities less than private employees during remote work. In other words, the professional development of private sector employees is more likely to be hindered than that of the public sector by remote work. Furthermore, although remote work can be a valuable option for public and private organizations, public sector firms typically have more formalized systems, negating the importance of informal interactions. Therefore, remote work has the potential to negatively impact private sector employees more than public sector employees (Cooper and Kurland, 2002).

On the other hand, there is another significant organizational model for remote work usage: transnational companies. Due to globalization, many businesses have transformed into multinational structures by transcending their national boundaries (Zakaria, Amelinckx, and Wilemon, 2004). Sherman and Bohlander (1992) defined transnational companies as "*businesses operating in two or more countries, with some of their investments located in foreign countries, and deriving a portion of their profits from activities in foreign countries.*" (Sherman and Bohlander, 1992). When it comes to ownership of transnational companies, they can be either private or public.

Although headquartered in a particular country, transnational companies are large organizations that conduct their operations in two or more countries through branches or subsidiaries connected to the headquarters. The central headquarters makes strategic decisions regarding these organizations' investment, production, research activities, and personnel policies. They produce goods and services across national borders, market and distribute their products, services, and technologies worldwide, and implement global strategies by planning on a global scale. These enterprises play a fundamental determining role in the entire global economic structure, particularly in production, finance, technology, security, energy, and trade (Kurtyemezoğlu, 2015).

With the increasing use of virtual communication for interactions in the global business environment in this era, more and more transnational companies have become globally integrated, resulting in a geographically dispersed workforce. The growing interest in remote work has accelerated and aided this trend (Balachandran et al., 2023). Thus, transnational company headquarters popularly apply remote work to cooperate with branches in different countries,

sometimes from different continents. Digital communication platforms, such as Zoom, Microsoft Teams, Slack, and Google Meet, differ in their characteristics and capabilities while serving various organizational purposes. Consequently, these platforms emerge as pivotal enablers for ensuring practical remote work, thereby enhancing the success of transnational companies (Bartlett and Ghoshal, 1992; Schwab, 2017; Bartlett and Ghoshal, 2002; Vora and Kostova, 2007).

Remote work has changed how transnational companies conduct their work, enabling them to connect with others worldwide, regardless of place and time. Although remote work is not a new concept, the adoption of remote work has already become the norm in many organizations and is considered critical for success (Balachandran et al., 2023). Transnational companies have unique challenges and opportunities owing to the convergence of cultures, geographies, and business techniques, making remote work important (Rao et al., 2023). Knowledge is one of the most critical resources for transnational companies to sustain competitive advantage (Erez, Glikson, and Harush, 2023). From this point of view, remote work is a significant input in sustaining competitive advantage in transnational companies since it can transmit knowledge quickly and effectively worldwide.

Over the years, the debate on the similarities and differences between public and private organizations has gained significant traction that underlines the importance of the subject. Many researchers have contributed to this discussion. Generally, they confirm that while public and private organizations differ obviously, they also share significant similarities (Rahman and Shahriar, 2016).

In conclusion, the main significant difference between public and private organizations is their ownership. Whereas entrepreneurs or shareholders own private firms, public agencies are owned collectively by members of political communities. This difference is associated with two further public/private contrasts. First, unlike their private counterparts, public agencies are primarily funded by taxation rather than fees paid directly by customers. Secondly, public sector organizations are controlled predominantly by political forces, not market forces. In other words, the primary constraints are imposed by the political system rather than the economic system (Boyne, 2002).

The following part identifies and categorizes the similarities and differences between public and private organizations based on organizational concepts, including goals, goods and services,

resource ownership, organization structure and design, decision-making, and organizational culture. The reason for applying these concepts is that they are fundamental to organizational analysis to systematically understand public or private organizations' features (Rahman and Shahriar, 2016).

4.2. Goals of Public and Private Organizations

An organizational goal is a condition that an organization seeks to attain. Organizations are goal-directed, purposive entities, and their effectiveness in pursuing those goals influences the quality of their lives and even their ability to survive. Organizations often consider goals necessary as expressions of guiding organizational values that can stimulate and generally orient employees to the organization's mission. In addition, clarifying goals for individuals and work groups can improve effectiveness and productivity. The concept of a goal has many complications, with important implications for organizing and managing and the debate over whether public and private organizations differ. These complications include the problem that goals are always multiple; that is, a goal is always one of a set of goals one tries to achieve (Rainey, 1993; Rainey, 2009). Most often repeated observations about public organizations are that their goals are particularly vague and intangible compared to those of private business firms and that they more often have multiple conflicting goals. Public organizations produce goods and services that are not exchanged in markets. Government auspices and oversight imposed on these organizations include multiple, conflicting, and often intangible goals such as constitutional, competence, and responsiveness values (Rainey, 2009). For instance, police chiefs must try to balance keeping the peace, enforcing the law, controlling crime, preventing crime, assuring fairness and respect for citizen rights, and operating efficiently and with minimal costs (Moore, 1990; Hur, 2007).

As Ferlie et al. (1996) and Flynn (1997) indicated, public sector organizations have distinctive goals, such as equity and accountability, that are absent in the private sector (Boyne, 2002). These goals arises from the shared ownership of public organizations and endeavors to regulate their conduct to accomplish collective aims (Ransom and Stewart, 1994). Public sector organizations are controlled predominantly by political forces and not market forces; the goal differences between these two organizations are apparent. It is not easy to find similarities in this regard because both organizations hold two different ideologies and are controlled by those ideologies. Political factors control public organization goals, and market forces dominate private

organization goals. One of the exciting anomalies concerning the comparison between public and private organizations is the complexity and ambiguity of goals (Rahman and Shahriar, 2016).

Boyatzis (1991), in a study of the competencies of a broad sample of managers, found that public managers displayed weaker " goal and action " competencies — those concerned with formulating and emphasizing means and ends. He concluded that the difference must result from the absence of clear goals and performance measures such as sales and profits in the public sector. In this way, goal ambiguity also supposedly contributes to weakening top leaders' authority in public organizations. Their control over lower levels is weakened because they cannot assess performance based on relatively clear measures. The absence of clear performance measures also allegedly contributes to weakening their attentiveness to developing their agencies. They must play more political, expository roles to develop political support for their programs because they cannot simply refer to their performance against unambiguous targets to justify continued funding (Rainey, 2009).

Farnham and Horton (1993) argue that private organizations are constrained by the single profit goal, with success or failure in the market serving as the ultimate measure of effective private organization management. In contrast, public organizations face the challenge of balancing multiple goals imposed by numerous stakeholders. They are pushed and pulled in various directions simultaneously, necessitating reconciling conflicting objectives to ensure effective governance (Boyne, 2002).

4.3. Differences in the Ownership of Goods, Services and Resources

Public organizations have higher levels of formalization and centralization than private organizations. Public organizations differ sharply from private organizations in terms of formalization and red tape in processes subject to jurisdictional rules and the authority of oversight agencies that come with governmental ownership, such as personnel and purchasing (Rainey and Bozeman, 2000).

Wamsley and Zald (1973) pointed out that an organization's place along the public-private continuum depends on at least two significant elements: ownership and funding. Organizations can be owned by the government or privately owned. They can receive most of their funding from government sources, such as budget allocations from legislative bodies, or from private sources, such as donations or sales within economic markets. Ownership brings the formal authority of

oversight agencies to impose rules, usually governing personnel, purchasing, and accounting and budgeting procedures. Pugh, Hickson, and Hining's (1969) study indicates that government ownership often subjects organizations to central oversight rules over personnel, purchasing, and budgeting and accounting procedures (Rainey, 2009). Bretschneider (1990) provided more evidence in analyzing decisions about computer systems in public and private organizations. Managers in public organizations experienced longer delays in getting approval to purchase computer equipment and processing those purchases. The delays reflect the procurement rules supervised by central procurement agencies such as the General Services Administration (Rainey and Bozeman, 2000).

On the other hand, Rainey, Facer, and Bozeman (1995) reported results of surveys in several different states involving all levels of government and many different organizations at different points across fifteen years and compared the responses of public and private managers to numerous questions about constraints under personnel rules. They asked whether the rules made it hard to fire a poor manager or reward a good manager with higher pay and similar questions. The differences between the public and private managers were huge by survey research standards. Roughly 90% of the public managers agreed that their organization's personnel rules make it hard to find poor managers and reward good managers with higher pay, whereas 90% of the business managers disagreed (Rainey, 2009).

Boyne (2002) indicates that goods and services offered by public organizations fundamentally diverge from those provided by private entities. In their unique adaptability, private organizations tailor their goods and services in response to market dynamics, adhering to the principles of demand and supply. In contrast, public goods and services exhibit different characteristics. They do not operate in a competitive market. Even when competition is present, public organizations are frequently dominant (Rahman and Shahriar, 2016).

In private organizations, owners and shareholders possess a direct monetary incentive to monitor and regulate managerial behavior. This motivation extends to managers, who stand to gain from improved performance, whether through company share ownership or financial rewards tied to organizational success. Conversely, property rights within the public sector tend to be diffuse and ambiguous, with managers typically lacking direct financial incentives linked to enhanced organizational efficiency (Boyne, 1998).

The dominance of public sector organizations in providing public goods and services does not necessarily mean they can overlook or underestimate their counterparts. Many goods and services that are traditionally delivered by the public sector, such as transportation, telephone, health, and education, are also being delivered by the private sector; on the other hand, ownership of public organizations is similar to private organizations in some cases (Rahman and Shahriar, 2016). For instance, many big public organizations, such as British Airways and Turkish Airlines, have shares in the market.

4.4. Differentiated Approach to Organization Structure and Design

According to Bozeman and Kingsley (1998) and Farnham and Horton (1993), public organizations have more formal procedures for decision making, and are less flexible and more risk-averse than their private sector counterparts. Bureaucratic structures may stem from monitoring bodies' requirements and demands for accountability in public organizations. As Rainey, Backoff, and Levine (1976) indicated, *'the coercive nature of most government actions might be cited as a fundamental justification for constitutional checks and balances and extensive formal control mechanisms'* (Boyne, 2002). Public organizations worldwide are the most pertinent example, following the Weberian bureaucracy principles. On the other hand, Morgan (1997) opines that some private organizations have had tremendous success using the mechanistic model of organization proposed by classical theorists. Moreover, he cited examples of McDonald's and similar firms in the fast food industry that follow the Tayloristic principles of scientific management in structuring and designing organizations (Rahman and Shahriar, 2016).

When it comes to organizational structure (pervasiveness of rules, number of levels) and hierarchical delegation, executives and managers in public agencies tend to add even more rules and clearance requirements in addition to externally imposed rules and procedures. Additionally, they add more hierarchical levels of review and generally resist delegation to control the units and individuals below them. The absence of clear, measurable, well-accepted performance criteria thus induces a vicious cycle of "*inevitable bureaucracy*" in which the demand for increased accountability increases the emphasis on rule adherence and hierarchical control. Some authors add that these conditions breed a paradox in which the proliferation of rules and clearance requirements fails to achieve control over lower levels. Rules provide some protections for people at lower levels through civil service protections and the safety of strict compliance with other

administrative rules. Superiors ' efforts to control lower-level employees through additional rules and reporting requirements add to bureaucratic complexity without achieving control (Warwick, 1975; Buchanan, 1975; Rainey, 2009).

Hage's (1965) axiomatic theory of organizations, a cornerstone in the study of organizational structures, offers a framework for defining two ideal types of organization structures: mechanistic (bureaucratic) and organic (professional) (Hage, 1965).

Table 10. Mechanistic and organic structure of organization

Mechanistic structure	**Organic structure**
High horizontal and vertical differentiation	High complex horizontal and vertical integration
High formalization	Low formalization
Centralization	Decentralization
Standardization	Joint problem solving and interaction
Close Supervision	Personal expertise and creativity without supervision
Vertical communication	Horizontal communication

Source: (Rahman and Shahriar, 2016).

Mechanistic and organic organizations are opposite ends of a continuum of organizational structure possibilities. Mechanistic organizations are efficient, rigid, predictable, and standardized organizations. Specifically, mechanistic organizations are characterized by a rigid hierarchy; high levels of formalization; a heavy reliance on rules, policies, and procedures; vertical specialization; centralized decision making; downward communication flows; and narrowly defined tasks. For instance, due to their nature, public organizations are more likely to have mechanistic structures (Lunenburg, 2012).

In contrast, organic organizations are flexible, adaptable, and team-directed. In particular, organic organizations are characterized by weak or multiple hierarchies, low levels of formalization, loose rules, policies, and procedures, horizontal specialization, decentralized decision-making, communication flows in all directions, and fluidity of tasks adaptable to changing conditions (Lunenburg, 2012). With their flexibility and adaptability, organic organizations are particularly relevant in the modern business environment (private organizations) (Nwonu, Kalu, and Ozioma, 2017).

4.5. Different Decision - Making Conditions

Decision-making in an organization is defined as identifying and solving problems using a variety of alternatives. It can occur in response to a problem or relate to a desire to increase effectiveness or innovate (Rahman and Shahriar, 2016). Managers in public organizations have less freedom to react as they see fit to their circumstances. Allison (1980) claims that 'p*rivate management proceeds much more by direction or the issuance of orders to subordinates by superior managers with little risk of contradiction*.' Similarly, Weinberg (1983) notes that '*private sector executives are often assumed to be able to formulate and carry out "rational" strategies because they control tightly structured hierarchical organizations'*. By contrast, public managers have the costs of hierarchy (rules and red tape) without the benefits (the freedom and power to manage their subordinates) (Boyne, 2002). Many decision-making approaches exist, such as rationalistic, incremental, and garbage can models in organizations. Table 11 below displays these decision-making models.

Table 11. Decision making models in the organizations

Rationalistic model	Incremental model	Garbage can model
In the rationalistic model, a decision maker becomes aware of the problem, posits a goal, carefully assesses the possibilities of all the consequences, evaluates each set of consequences, and chooses among them according to his/her estimates of their respective merits concerning the state of affairs he/she prefers.	In the incremental model, a decision-maker focuses only on those policies that differ incrementally from the existing policies. In this model, relatively few policy alternatives are considered, only a few "*important*" consequences are evaluated, a problem is continuously redefined, and there is no best solution. It is mainly remedial to present social imperfection.	In a garbage can model, decision opportunities are viewed as fundamentally ambiguous stimuli. A decision is an outcome or interpretation of several relatively independent streams within the organization, namely problems, solutions, participants, and choice opportunities that exist independently.

Source: own elaboration based on Etzioni (1986); Allison and Zelikow (1971); Cohen, March and Olsen (1972).

Incremental model is best suited for an organization in a stable environment where routine is the best policy (Bedeian and Zammuto, 1991; Rahman and Shahriar, 2016). Public organizations usually perform routine-based activities, and they mostly debunk incrementalism. The government budget is the best example, primarily based on additions or deductions from the previous budget

(Rahman and Shahriar, 2016). In this regard, it suits public organizations because they mostly have a stable environment. In the incremental model, decision-makers prioritize policies that deviate incrementally from existing ones. This approach entails considering relatively few policy alternatives, evaluating only a few "significant" consequences, continuously redefining the problem, and acknowledging the absence of a definitive solution. Primarily, this model addresses existing social imperfections (Lindblom, 1995).

Private organizations typically operate within dynamic, competitive, and unpredictable environments, necessitating decisions grounded in rational thinking. To effectively navigate business operations and respond to market forces, private organizations must methodically assess constraints and opportunities. The garbage can model of decision-making emerged from the concept of organized anarchy, which characterizes organizations marked by rapid change and non-bureaucratic structures. In such contexts, the garbage can model is particularly apt for private organizations. This decision-making model provides suitable solutions when innovation and adaptation to shifting circumstances are paramount. Nonetheless, determining the appropriate decision-making approach for organizations remains challenging. Some scholars contend that achieving complete rationality is difficult, leading decision-makers to adhere to the principles of bounded rationality (Daft, 2001; Rahman and Shahriar, 2016).

4.6. Differences in Organizational Culture

Organizations, like societies, have their own culture and shared cultural values (Seymen, 2008). Organizational culture encompasses the distinctive features that set one organization apart, including the underlying norms, beliefs, and fundamental assumptions (Doğan, 2007). Schein (1984) provides a more comprehensive definition of organizational culture, describing it as the set of assumptions and beliefs that a particular group creates and develops while addressing its integration within itself and adaptation to the external environment; it directs new members on how to perceive, think, and feel about problems (Schein, 1984).

Cameron and Quinn (1999) examined the relationship between organizational culture and success, developing the "Competing Values" model. The model identifies four types of organizations: clan culture, hierarchy culture, adhocracy culture, and market culture. A notable characteristic of these four culture types is their representation of opposing or competing assumptions about organizations (Kam, 2019).

Strong interpersonal bonds, extensive individual sharing, and a family-like atmosphere characterize *clan culture*. Leaders or managers in the organization are perceived as mentors or even parental figures. Loyalty traditions and a sense of trust keep everyone together. The organization emphasizes the long-term benefits of developing human resources, highlighting it with commitment, and emphasizes morale, teamwork, participation, and consensus in decision-making. The reflections of clan culture are seen in Japanese companies (Seymen, 2008; Cameron and Quinn, 2006).

In organizations with a *hierarchical culture*, the characteristics of organizational culture are formalized and structured. The tasks performed by organizational employees are controlled through specific methods, effective leaders coordinate and organize their organizations well. Many organizations ranging from the American fast-food restaurant chain McDonald's to the automotive company Ford and even public institutions such as the US Department of Justice, serve as prototypes of hierarchical culture. In such structures, the presence of hierarchical culture is evidenced by the emphasis on a considerable number of standard processes, multiple levels of hierarchy, and the implementation of rules (Cameron and Quinn, 2006).

Organizations with an *adhocracy culture* foster an entrepreneurial, dynamic, creative, and rapidly adaptable environment to environmental changes. In this culture, assumptions have been developed due to the diminishing half-life of product and service superiority. These assumptions include the belief that innovative and pioneering initiatives lead to success, the fundamental goal of organizations is to develop new products and services, and the primary task of management is to support entrepreneurship, encourage creativity, and promote advanced technological activities. Adhocracy culture is more commonly found in organizations operating in aerospace, software development, consultancy, film production, idea consultancy, e-commerce, marketing, electronics, and cosmetics industries, among others (Cameron and Quinn, 2006).

Organizations with a *market culture* have no centralized power and authority relationships. Instead, power is delegated from one individual to another or from one task team to another based on the issue. For example, in the movie "*Apollo 13*" (1995), which depicts the Apollo 13 space mission, leadership is shown to continuously and unpredictably change, team membership is temporary, and there is no fixed process for determining communication and control systems (Cameron and Quinn, 2006). To sum up, hierarchical culture is most likely for public organizations;

clan culture, adhocracy culture, and market culture are more likely for private organizations. However, it is not appropriate to set borders, and every organizational unit may have any organizational cultural type, regardless of public and private organizations.

5. Research Methodology - A Holistic Approach to Examining the Economic Effectiveness of Remote Work

5.1. Identification of the Research Subject and Research Gap

Remote work is not a new working method; however, with the COVID-19 pandemic, it has grown in popularity swiftly, and many firms have had to adjust quickly to it (Bick, Blandin and Mertens, 2020; Marzano and Zając, 2022; Hansen et al., 2023). Also, raw statistics support this expression. According to data from Eurofound in July 2020, 33.7% of employees worked remotely in Europe (Eurofound, 2020). Even if when society across Europe began to re-open after the first intense lockdown, the proportion decreased, it was still remarkable. According to data that Eurofound collected in February and March 2021, 24% of employees worked remotely in Europe (Eurofound, 2021). Before the COVID-19 pandemic 2018, the proportion of employees in Poland who could work remotely was lower than the average among EU member states. It accounted for approximately 4.6%, whereas 5.2% of individuals regularly engaged in remote work from their homes across the entire EU. However, in 2020, Poland's percentage of remote workers doubled compared to the 2018 data, reaching 8.9% (Radziukiewicz, 2021). Today, remote work is still a significant work method. The report of Aksoy et al. (2023) reveals that remote work is still preferable by employers and employees partially or fully worldwide. According to the report, English-speaking countries exhibit the highest remote work levels globally (on average, 1.4 days per week). Respectively, Australia 1.3 days, Canadia 1.7, New Zealand 1.0, UK 1.5 and USA 1.4 days per week. Remote work levels average 0.9 days per week in Latin American countries and South Africa and 0.8 days per week in European countries. In the case of Poland, 0.7 days per week. Lastly, 0.7 days per week in Asian countries. Additionally, a study by Barrero, Bloom, and Davis (2023) indicates that as of 2023, 12% of full-time American employees now work remotely on all or almost all workdays. Nearly 29% have a hybrid arrangement, splitting the workweek between home and their employer's worksite.

Statistical data indicates that remote work is becoming a global trend, driven significantly by technological advancements. Empirical and practical evidence suggests that public utility services must understand and implement appropriate technological, resource allocation, and management strategies to manage remote work and achieve economic effectiveness.

European Commission's 2030 Digital Decade report states that the success of the EU's digital transformation requires a substantial acceleration and a deepening of the EU's and Member States' action to make reforms, improve the business environment, create incentives and boost investment in digital technologies, skills and infrastructures (European Commission, 2023a).

European Commission's Digital Decade Country report indicates that Poland can improve its performance in the digital transition and contribute to the collective efforts to achieve the EU's Digital Decade targets, including achieving 100% public digital services. There has been progress in digitalizing public services, with notable improvements to the flagship e-government app and e-health. Poland has also progressed in its skills, but it should strive further to achieve the Digital Decade targets. Poland's performance in digitalizing business remains below the EU average, with significant progress still needed to uptake advanced technologies (European Commission, 2023). In total, the report estimates that achieving the Digital Decade goals could unlock over €2.8 trillion in the European economy. Additionally, the report indicates that achieving the Digital Decade goals could unlock 491 billion PLN in the Polish economy (PublicFirst, 2022).

Undoubtedly, the COVID-19 pandemic has determined the global trend of changing work from stationary to remote in both the private and public sectors. Although remote work is not a novelty in the labor market, challenges related to its effectiveness have recently been caused by the prevailing scale of remote work in various organizations. In the private sector, profit is the most critical driver that provides economic effectiveness for remote work. However, public utility services do not operate in the interests of profit. The lack of classic market determinants, such as profit orientation and private ownership, slows the adjustment to the new conditions. That is why organizing remote work and measuring the economic effectiveness of remote work regarding public utility services is challenging. Nowadays, flexible work applications such as remote work are spread worldwide. It is leading to opportunities and challenges in today's dynamic work environment. Remote work is a response to the needs of modern economies, where private and public institutions operate and create networks of connections. Especially in public utility services, meeting immediate and ongoing social needs is crucial. Remote work trends rearrange traditional office work to optimize outcomes in public utility services. Achieving operational goals becomes increasingly critical to maintaining successful service delivery due to the dynamic of the work environment. This brings out the significance of implementing remote work in public utility services.

In this study, the classic definition of the public utility sector, in which three types of public services can be distinguished (Kachniarz, 2012; Miłek and Nowak, 2021):

- Administrative services (e.g., decision, strategic planning, registrations, local taxes): administrative services typically involve performing authoritative functions of public authority and legalizing areas of human activity. Their essence is not related to the provision of specific goods; instead, they represent actions carried out ex officio or at the request of the service recipient. Such specific services include vehicle registration, issuing driver's licenses, and obtaining environmental or building permits. Separate laws usually regulate the scope and type of these services, and the procedures and methods are specified by the Code of Administrative Procedure.
- Civil services (e.g., education, culture, sports, social care): social services aim to distribute goods that meet a society's basic needs. They are an element of shaping and enriching individuals' material and intellectual resources. Social services include education (at every level of education), healthcare, culture, sports, social assistance, public safety, and housing needs. Socio-political agreements between public authorities and society shape the level and standard of these goods.
- Technical/infrastructural services (e.g., water supply, public transport, maintenance of roads, public spaces): technical services are related to municipal infrastructure, involving its management and availability. In this context, they meet collective needs. Due to the high costs of creating infrastructure, they often operate on a monopoly basis. These services include, among others, water and energy supply, transport and communication, land management, green space management, cemetery maintenance, and waste disposal.

The study covers administrative and civil services only. Infrastructure services are excluded since they are closely related to the use of technical infrastructure in the physical space, which significantly reduces the scale of remote work. In addition, these services are most often outsourced to the private sector. In the literature, the effectiveness of public services is studied by Andrews and Entwistle (2010), Mihaiu, Opreana, and Cristescu (2010) and Kachniarz (2012), Mustafa, Farida and Yusriadi (2020), Hakim (2021). However, these studies do not focus on the effectiveness of public services while working remotely. On the other hand, researchers use different methods to measure economic effectiveness in remote work organizations, depending on the nature of the

work. The researchers mainly focus on employees' or managers' productivity and job performance in literature (Mutiganda et al., 2022). Most studies were descriptive or analytical cross-sectional studies; Anakpo et al. (2023), Bao et al. (2022), Delanoeije and Verbruggen (2020), De Menezes and Kelliher (2017), Feng and Savani (2020), Gajendran et al. (2015), Golden et al. (2008), Golden et al. (2008), Golden and Gajendran (2019), Hill et al. (2003), Hyland et al. (2005), Kitagawa et al. (2021), Medina-Garrido et al. (2017), Morikawa (2020), Narayanamurthy and Tortorella (2021), Ralph et al. (2020), Sherman (2020), Tsukamoto (2021), van der Lippe and Lippenyi (2020), Vega et al. (2015), Buckingham, M. (2021).

However, these studies have narrow approaches to asses economic effectiveness; therefore, comprehensive measurements for assessing the economic effectiveness of remote work are still a challenge (EY, 2021; Carrotspot, 2021; Deloitte Insight, 2021). Moreover, the literature review reveals that studies are limited in this subject. Therefore, the study assesses the economic effectiveness of remote work in public utility services and proposes a new systematic methodology to fix the research gap.

5.2. Data Collection Tools, Techniques, and Sample Characteristics

In this study, a quantitative research method, the survey, was adopted as a primary research method. A telephone interview in the case of utility sector bodies and a direct interview in the case of transnational companies supported the survey.

The data were collected between February and May 2022 for public utility services (survey 1) and between April and August 2023 for transnational companies (survey 3) through an online survey that comprised 61 questions assigned to the research questions and hypotheses. When constructing the survey, in addition to the author’s methodologies, the following concepts were used: Personality types (according to Jung 1921), Team roles (according to Belbin 2012), the Plan-do-check-act (PDCA) cycle (according to Deming), the process approach (according to ISO 9000), Decision level concept: Empowerment and delegation stage (according to Conger et al., 1998), Work-Life Spill-Over (according to Felstead and Henseke 2017). A Likert-type 0 to 5 scale was used for the survey questions, with the percentage calculated as follows: 0=0%, 1=20%, 2=40%, 3=60%, 4=80%, and 5=100%. Collected data were analyzed through the IBM SPSS Statistics 29.0 software program.

On the other hand, utility expense data has also been collected through a separate online survey (survey 2) between April and August 2023 to calculate costs in financial terms for the period 2019 to 2022 in public utility services. The survey was conducted in all 16 capital cities in regions of Poland to eliminate potential regional differences. The total general population was 16 capital city municipalities and 16 universities. Finally, the survey was answered by 13 capital city municipalities (81%) and 9 universities (56%).

These data allowed us to conduct simplified analyses of public utility services' resource usage. Data was collected using a questionnaire on the costs or the amount of consumption of raw materials: water, electricity, gas, cleaning agents, waste production, and the costs of monitoring and protecting buildings (appendix 2). Data collected for 2019-2022, assuming that individual years, due to the COVID-19 pandemic, have different characteristics regarding the use of remote work in public sector organizations. These characteristics are presented in Table 12 below.

Table 12. The dominant form of work in the public utility services in the period 2019-2022 in Poland

Years	Type of work	Symbols
2019	Stationary work	
2020	Poorly organized remote work	
2021	Well organized remote work	
2022	Hybrid work	

Source: own prepared

The study covers administrative and civil services only. Infrastructure services are excluded since they are closely related to the use of technical infrastructure in the physical space, which significantly reduces the scale of remote work. In addition, these services are most often outsourced to the private sector. As a result, units that provide civil and administrative services and met the following conditions were selected for the survey:

- team working as a mode of delivering outcomes,
- innovation potential in services,
- highly able to use remote work,
- a complex range of tasks is provided by the employees.

The criteria allow us to identify those areas of public sector activity that are most demanding in terms of work organization and management system. Administrative service providers include various types of departments, where residents and business entities are clients. The basic types of administrative services that meet the criteria defined above include those related to issuing decisions, strategic planning, spatial planning, and marketing management. Thus, city hall units with the greatest scope of autonomy were selected for the study. The survey was conducted in all 16 capital cities in regions of Poland to eliminate potential regional differences in the organization and provision of services. In each city, the survey was conducted in two selected departments. Due to the substantive scope of the survey, the direct respondent was the head of the unit. The head of the units evaluated their remote operations within survey questions. The total general population was 32 units. Ultimately, 26 units (81%) participated in the survey (survey 1).

The scope of civil service providers is much broader, as educational, cultural, recreational, and other services can be included. Since similar criteria were applied to the selection of entities (compared to administrative services), the higher education sector has been pointed out for the study. It was also assumed that regional differences in their organization and provision might exist. To this end, the best university in each region was selected (using the Perspectives 2021 comparative ranking of higher education institutions: Ranking Szkół Wyższych Perspektywy 2021). A survey was conducted in the 16 best universities in each region. Unlike clerical and administrative work, academics work primarily with independent research teams. Each university has a specific organizational structure and varied self-governance. Hence, it was decided to conduct the survey at the level of each independent organizational unit, that is, at the level of each faculty (a total of 185 faculties were identified). Faculties have their managers – deans – who are responsible for shaping how work is organized within the unit, including its structure and the tools utilized. Faculties are often divided into smaller organizational units, including departments, institutes, laboratories, and research teams.

Nevertheless, the environment for creating working conditions in these units is similar at the level of the entire department. Hence, using simple random sampling in each department, one unit (e.g., department, research team) was selected for the survey. The direct respondent was this unit's head due to the survey's substantive scope. The head of the units evaluated their remote operations within survey questions (survey 1). Ultimately, the survey was implemented in 139 units, representing 75% of the general population.

Meanwhile, private transnational companies employing remote work for day-to-day operations were specifically chosen to offer insights to enhance remote services within public utility services. Owing to budgetary and time limitations, the study was exclusively carried out in the city of Lodz. Direct respondents for the survey comprised team leaders and department heads. Each survey included only one carefully selected department or team leader from a chosen private transnational company. The leaders evaluated their remote operations using survey questions. The comprehensive target population consisted of 15 companies. Ultimately, the survey achieved full participation, with 100% involvement from the leaders of all 15 private transnational companies (survey 3). Table 13 below displays the data collection method regarding Survey 1 and Survey 2 in public utility services and Survey 3 in transnational companies.

Table 13. Data collection method regarding research surveys

Type of the organizations	General population	General population size	Type of the research survey	Respondent	Number of completed surveys
Public utility services	*16 capital cities in regions of Poland (each capital city municipalities)*	*32 selected departments in regional capital city municipalities*	Survey 1 (appendix 1)	Head of the department	26
		16 capital city municipalities	Survey 2 (appendix 2)	Head of the organization	13
	16 best universities (the best university in each region) according to ranking list Perspektywy 2021)	*185 selected departments (one randomly chosen department in every faculty)*	Survey 1 (appendix 1)	Head of the department	139
		16 best universities	Survey 2 (appendix 2)	Head of the organization	9
Transnational companies	*15 Private transnational companies in Lodz region*	*15 Private transnational companies employing remote work for day-to-day operations*	Survey 3 (appendix 3)	Team Leader/ Manager	15

Source: own prepared

Summing up, research was conducted on 165 heads of departments in public utility services in Poland (survey 1) and 15 team leaders in transnational companies in Lodz (survey 3). Additionally, the utility expense data survey (survey 2) was conducted on 13 capital city municipalities (81%) and 9 universities (56%).

Among the one hundred sixty-five public utility services leaders, seventy-five are in the 58-76 age range, eighty-five are in the 42-57 age range, and five are in the 27-41 age range. Among the fifteen transnational company leaders, five are in the 42-57 age range; ten are in the 27-41 age range. The marital status of the leaders is married one hundred forty-six (88.5%) and single nineteen (11.5%) for public utility services, married ten (66.7%), and single five (33.3%) for transnational companies.

5.3.Aims, Research Questions, Hypotheses and Scope of the Research

The study's main aim is to identify whether and under what conditions remote work is economically effective in public utility sector organizations. Additionally, the specific objectives below are evaluated:

I. Whether remote work saves public utility services' indirect employee costs,
II. The effect of remote work on public utility services' goal achievements,
III. The effect of remote work on the control mechanism of managers in public utility services,
IV. The effect of remote work on the organizational structures of public utility services,
V. Investigating the extent of empowerment dynamics between employees and managers in remote work within public utility services,
VI. Whether there is any significant difference between generation members regarding work-life balance levels during remote work in public utility services,
VII. Comparing transnational companies and public utility services regarding the context of economic effectiveness to indicate the differences in the application of remote work and emerge suggestions for improvement of public utility services.

The economic effectiveness of remote work is a multi-dimensional category. Identifying whether and under what conditions remote work is economically effective in the public utility sector requires a holistic approach. This study defines the holistic economic effectiveness of remote work based on three perspectives:

I. Resource allocation effectiveness: It focuses on whether organizations use resources effectively to maximize productivity and minimize costs,
II. Technological effectiveness: It focuses on whether organizations use technology effectively to improve the remote work experience for their employees,
III. Management effectiveness: It evaluates organizational effectiveness within purposeful, system, multi-criteria, and team management approaches.

The following section details each perspective individually, including the associated research questions and hypotheses. Eighteen research questions (RQ1-RQ18) and six research hypotheses (H1-H6) were formulated to identify the economic effectiveness of remote work. Table 14 below displays the matrix of research questions and hypotheses.

Table 14. Matrix of research questions and hypotheses to identify the economic effectiveness of remote work in organizations of the public utility sector

Perspective of the economic effectiveness of remote work		Research questions	Hypotheses
Resource allocation effectiveness		**RQ1. RQ2. RQ3. RQ4. RQ5. RQ6.**	**H1.**
Technological effectiveness		**RQ7. RQ8. RQ9. RQ10.**	**H2.**
Management effectiveness	*Purposeful approach*	**RQ11. RQ12. RQ13.**	**H3.**
	System approach	**RQ14. RQ15.**	**H4.**
	Multi-criteria approach	**RQ16. RQ17.**	**H5.**
	Team management approach	**RQ18.**	**H6.**

Source: own prepared

Resource allocation perspective

Resource allocation refers to a decision-making process about distributing limited and scarce resources among recipients (Paccagnan, Chandan, and Marden, 2022). In this study, remote work is considered part of the work process in the public utility sector. According to ISO 9000, a "*process*" can be defined as a "*set of interrelated or interacting activities, which transforms inputs into outputs*." These activities require resource allocation, such as people and materials (Corrie, 2004). Both inputs and desired outputs can be physical (such as equipment, materials, or components) or intangible (such as energy or knowledge) (Corrie, 2004). Resource allocation is pivotal in achieving economic effectiveness during remote work in public utility services. Given the absence of classic market determinants such as profit orientation and private ownership, maintaining productivity in these services under new conditions poses a significant challenge. Therefore, these services must allocate their physical and intangible resources effectively.

From a resource allocation perspective, assessing whether public utility services proactively meet employees' equipment needs and provide adequate knowledge-sharing platforms during remote work is critical. This perspective also examines how budgets are allocated for infrastructure, training, and employee support. Additionally, it considers the allocation of employees' work time and whether public utility services assist with home office costs. Lastly, it evaluates utility expenses, including water, electricity, and overall consumption reports, to determine the cost-effectiveness of remote work in terms of utility expenditures. Hence, six research questions (RQ1-RQ6) and one hypothesis (H1) under the resource allocation perspective were formulated to identify the resource allocation effectiveness (Table 15).

Table 15. Research questions and hypotheses to identify the resource allocation effectiveness

Perspective	Research questions	Hypotheses
Resource allocation effectiveness	**RQ1**.Is the employer proactively ensuring employees' equipment needs and knowledge-sharing platforms during remote work? **RQ2.**What part of the annual budget is allocated to financing remote work requirements in the public utility services? **RQ3**.Does the employer finance employees' psychological and physiological needs adapting to remote work? **RQ4.**Does the employer finance home office maintenance costs? **RQ5.**To what extent can remote work replace work at the public utility services' headquarters? **RQ6.**Does remote work save public utility services' resources?	**H1.**If public utility services work remotely, they lower indirect employee costs

Source: own prepared

Technological perspective

Recent research studies indicate that some organizations have challenges achieving their operational goals during remote work due to low employee productivity. These difficulties are mainly due to mistakes in implementing remote work and a lack of skills in managing remote workers (Harrington and Emanuel, 2021; Morikawa, 2023). That is why researchers focus primarily on the challenges and barriers limiting the use of remote work (Schuster et al., 2020). The key challenges include technical and technological aspects. Barriers noted include access to technology (OECD, 2020b), operability of ICT solutions, or insufficient support infrastructure (Schuster et al., 2020). The technological aspect warrants special focus in public utilities due to their lack of traditional market orientation and limited proactivity in adapting to new conditions.

The employees' technological security is the primary area that guarantees effective remote work in public utility services. Hence, the technological perspective assesses whether employers in public utility services secure all technological needs of employees related to the organization of remote work to maximize work effectiveness.

From a technological perspective, assessing whether public utility services provide the necessary technological infrastructure to support employees' needs is crucial. This perspective also examines the utilization of ICT infrastructure within the utility services' premises. Another important consideration is the effectiveness of the technical help desk during remote work. Additionally, it evaluates whether public utility services employ innovative outsourcing for employee training or rely on their internal capacity to meet training requirements. Overall, the technological perspective assesses the level of technological readiness essential for facilitating the effectiveness of remote work. Consequently, four research questions (RQ7-RQ10) and one hypothesis (H2) were formulated to determine technological effectiveness (Table 16).

Table 16. Research questions and hypotheses to identify the technological effectiveness

Perspective	Research questions	Hypotheses
Technological effectiveness	**RQ7.** Does the employer provide the technological infrastructure to meet the needs of employees who are working remotely? **RQ8.** To what extent is the ICT infrastructure at the premises used during remote work? **RQ9.** Is the employer's technical help desk effective during remote work? **RQ10.** Are public utility services using innovative outsourcing to provide training to their employees while working remotely?	**H2.** The technological readiness of employees is determined by employers' involvement in the infrastructure support of remote work.

Source: own prepared

Management perspective

Remote work requires reengineering management nature and practices to achieve maximum effectiveness; adjusting external and internal rules and procedures may be necessary to adopt remote work effectively. The public sector's ability to adapt to remote workability depends mainly on complying with organizational arrangements, quality and control management, and human resource management (Mousa and Abdelgaffar, 2021; Milasi et al., 2021).

Organizing and managing remote work is challenging for public utility services due to prevalent intensive bureaucratic practices and limited proactivity in adapting to new conditions. That is why the management aspect requires special attention in public utility services. Management perspective assesses management's effectiveness during remote work in public utility services. The management perspective is complex and is examined using four approaches: the purposeful approach, the system approach, the multi-criteria approach, and the team management approach.

Purposeful approach investigates whether organizations meet their operational goals during remote work. It also examines the motivational tools and monitoring methods used by managers.

System approach assesses whether organizations engage in research and development activities to enhance the effectiveness of remote work. It also explores the characteristics of relational capital within organizations during remote work.

Multi-criteria approach evaluates whether organizations improve time management efficiency for operational activities during remote work and examines the impact of remote work on work-life balance.

Team management approach examines whether managers empower their employees during remote work.

Eight research questions (RQ11-RQ18) and four research hypotheses (H3-H6) were formulated to identify each area of management effectiveness (Table 17).

Table 17. Research questions and hypotheses to identify the management effectiveness

Perspective		Research questions	Hypotheses
Management effectiveness	*Purposeful approach*	**RQ11.** How effective has the public utility service been in achieving its remote work goals? **RQ12.**What strategies and tools are applied to motivate remote employees within the public utility services? **RQ13.** What strategies and methods do employers utilize to monitor remote work performance?	**H3.** If public utility service works remotely, the dominant form of goal control is task control
	System approach	**RQ14.** Do public utility services apply research and development activities to enhance remote work effectiveness? **RQ15.** What are the attributes defining relational capital within the context of remote work in public institutions?	**H4.** If a public utility service works remotely, its organizational structure is flat and flexible
	Multi-criteria approach	**RQ16.** Does remote work implementation in public utility services lead to improved time management efficiency for operational activities? **RQ17.** What is the impact of remote work on work-life balance?	**H5.** If the employee has a good work-life balance during remote work, the public utility service effectively achieves its goals
	Team management approach	**RQ18.** What is the level of decision-making of employees who work remotely in public utility services?	**H6**. If public utility service works remotely, they are not self-management teams

Source: own prepared

5.4. Methods for Comparing Transnational Companies and Public Utility Services

In seeking to address the implementation of a specific objective VII (*comparing transnational companies and public utility services regarding the context of economic effectiveness to indicate the differences in the application of remote work and emerge suggestions for improvement of public utility services*), the logic underlying the definition of effectiveness in the public utility sector, as previously outlined, was applied. Similar data collection tools (substantively adapted to the study of transnational companies) and research methods were also used. This methodology facilitated direct comparisons of the results.

Table 18. The scope of comparison in the analysis of the transnational companies and public utility services

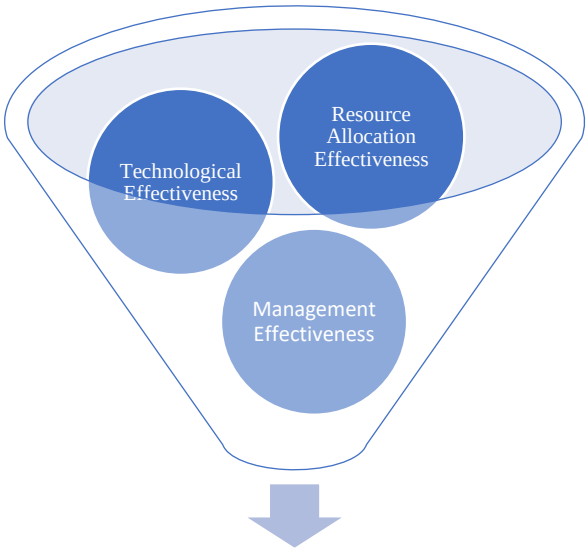
Resource allocation effectiveness		**CQ1.** Is there a difference in the effectiveness levels of allocation of resources within organizations?	
Technological effectiveness		**CQ2.** Is there a difference regarding technological effectiveness within organizations?	
Management effectiveness	*Purposeful approach*	**CQ3.** Is there a difference in overall management effectiveness within organizations?	**CQ3a.** Is there a difference in purposeful approach evaluation within organizations?
	System approach		**CQ3b.** Is there a difference in system approach evaluation within organizations?
	Multi-criteria approach		**CQ3c.** Is there a difference in multi-criteria approach evaluation within organizations?
	Team management approach		**CQ3d.** Is there a difference in multi-criteria approach evaluation within organizations?

Source: own prepared

As a result, the findings will reveal the differences in assessing effectiveness across selected areas between the respondent groups surveyed (identification of effectiveness gaps, considering the potential challenges and errors associated with comparing results between the public and private sectors). Additionally, Figure 16 below displays the method to evaluate economic

effectiveness and compare results within surveyed public utility services and transnational companies.

Figure 16. Comprehensive evaluation of economic effectiveness and comparison of results among surveyed public utility services and transnational companies



Source: own prepared

In this study, the results of the resource allocation effectiveness, technological effectiveness, and management effectiveness are independently evaluated and compared within surveyed public utility services and transnational companies. Additionally, as displayed in Figure 16 above, these three perspectives consist of the economic effectiveness evaluation that overall evaluates the economic effectiveness of remote work in surveyed public utility services but also compares the economic effectiveness of remote work within surveyed transnational companies (identification of effectiveness gaps, considering the potential challenges and errors associated with comparing results between the public and private sectors) and provides suggestions to enhance remote work implementation in public utility services.

5.5. Triangulation and Integration of Research Methods

The economic effectiveness of remote work is derived directly from evaluating key components: resource allocation effectiveness, technological effectiveness, and management effectiveness. The below matrix displays data sources and research methods depending on the scope of analysis (Table 19).

Table 19. Matrix of data sources and research methods depending on the scope of analysis

Scope of research	Source of data	Research method
Resource allocation effectiveness	Survey 1. in regional capital city municipalities (appendix 1) Survey 1. in best universities (ranking list Perspektywy 2021) (appendix 1)	• Exploratory Factor Analysis • Cronbach Alpha Coefficient • Descriptive statistics
	Survey 2. in regional capital city municipalities (appendix 2) Survey 2. in best universities (ranking list Perspektywy 2021) (appendix 2)	• Time series analysis • Descriptive statistics
Technological effectiveness	Survey 1. in regional capital city municipalities (appendix 1) Survey 1. in best universities(ranking list Perspektywy 2021) (appendix 1)	• Exploratory Factor Analysis • Cronbach Alpha Coefficient • Descriptive statistics
Management effectiveness	Survey 1. in regional capital city municipalities (appendix 1) Survey 1. in best universities (ranking list Perspektywy 2021) (appendix 1)	• Exploratory Factor Analysis • Cronbach Alpha Coefficient • Descriptive statistics • Parametric statistical tests (correlation analysis, regression analysis and one way ANOVA test)
Economic effectiveness of remote work- holistic overall assessment	Survey 1. in regional capital city municipalities (appendix 1) Survey 1. in best universities (ranking list Perspektywy 2021) (appendix 1)	• Exploratory Factor Analysis • Cronbach Alpha Coefficient • Descriptive statistics
Comparative analysis - economic effectiveness of remote work in public utility services versus transnational companies	Survey 1. in regional capital city municipalities (appendix 1) Survey 1. in best universities (ranking list Perspektywy 2021) (appendix 1) Survey 3. in transnational companies (appendix 3)	• Descriptive statistics • Non-parametric statistical test (Mann-Whitney's test)

Source: own prepared

Exploratory factor analysis: factor analysis is the overarching term encompassing various multivariate statistical methods that aim to delineate the underlying structure of a data matrix and can assume significant roles in applying diverse statistical techniques beyond their fundamental functions (Alpar, 2011). In order to utilize exploratory factor analysis, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Two methods are employed to assess the suitability of the dataset for factor analysis: the Bartlett test (Bartlett, 1937) and the Kaiser-Meyer-Olkin (KMO) test (Kaiser, 1970). The Bartlett sphericity test informs us about the presence of a sufficient level of correlation among variables. If the p-value of the Bartlett test is lower than the 0.05 significance level, there is a significant relationship among variables, indicating adequacy for conducting factor analysis. The KMO value, ranging from 0 to 1, evaluates the sampling adequacy and the suitability of inter-variable correlations for factor analysis. The acceptable lower limit for the KMO value, indicating sampling adequacy, is 0.50 (Durmuş, Yurtkoru and Çinko, 2013; Kalaycı, 2014). In addition, Kaiser (1960) has recommended the eigenvalue greater than one as the most suitable method for determining the number of factors (Akbaş et al., 2019; Büyüköztürk, 2005). According to these standards, exploratory factor analyses will be utilized.

Resource allocation effectiveness: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.669. The results of the Bartlett Sphericity test are also significant ($\chi 2=438.793$, $p< 0.001$). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to resource allocation effectiveness. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 20. Results of the exploratory factor analysis related to resource allocation effectiveness

Corresponding items	*Knowledge sharing and equipment needs*	*Budget allocation for infrastructure, training and employee support*	*Remote work participation and time allocation*	*Employer support for home office costs*
Employer facilitation of knowledge-sharing meetings for remote employees	**0.804**	0.242	0.016	-0.044
Employer documentation of informal knowledge exchange in remote work	**0.797**	0.257	0.046	-0.023
Remote work equipment needs: Employer survey	**0.651**	-0.109	0.120	0.414
Allocation of annual team budget for ICT infrastructure and software access	0.111	**0.786**	0.038	0.033
Allocation of annual team budget for skill training	0.055	**0.765**	0.140	0.181
Workplace adaptations and professional consultations	0.228	**0.593**	0.074	0.095
Proportion of team employees engaging in remote work	0.062	0.070	**0.933**	-0.041
Extent of monthly time devoted to remote work by team employees	0.061	0.157	**0.911**	0.115
Employer support for home office maintenance costs	-0.041	0.071	0.064	**0.869**
Remote work internet cost coverage by employers	0.139	0.246	-0.016	**0.795**
Total variance explained	**29.18%**	**15.49%**	**13.71%**	**11.17%**

Source: own prepared

A total of 10 expressions related to the four constructions in the study were subjected to factor analysis. The analysis revealed the existence of four dimensions with eigenvalues exceeding 1, according to Kaiser (1960). These four dimensions account for a total variance of 69.55%, explaining 29.18%, 15.49%, 13.71% and 11.17% of the variance, respectively.

Technological effectiveness: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.716. The results of the Bartlett Sphericity test are also significant ($\chi 2=104.727$, $p< 0.001$). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to technological effectiveness. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 21. Results of the exploratory factor analysis related to technological effectiveness

Corresponding items	*Technological effectiveness*
Equipment provision	**0.734**
Ownership of remote work equipment	**0.627**
Access to network infrastructure	**0.707**
Technical support	**0.619**
Internal training percentage: Employee-to-employee	**0.517**
Total variance explained	***41.65%***

Source: own prepared

A total of 5 expressions related to the one-dimensional construction in the study were subjected to factor analysis. The analysis revealed the existence of one dimension with an eigenvalue exceeding 1. This dimension accounts for a total variance of 41.65%.

Management effectiveness: Management effectiveness is complex and is examined using four approaches: the purposeful approach, the system approach, the multi-criteria approach, and the team management approach.

Purposeful approach: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.862. The results of the Bartlett Sphericity test are also significant ($\chi 2=814.917$, $p< 0.001$). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to purposeful approach. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 22. Results of the exploratory factor analysis related to purposeful approach

Corresponding items	*Plan-do-check-act (PDCA) Deming cycle*	*Monitoring remote work performance*
Decision-making in team	**0.889**	0.044
Team activity proportion	**0.889**	0.012
Execution of strategic and ongoing activities	**0.875**	0.091
Task and project control	**0.834**	0.034
Team communication	**0.817**	0.075
Goal achievement	**0.699**	0.140
Primary remote control method	-0.015	**0.883**
Task control frequency	0.160	**0.862**
Total variance explained	***53.72%***	***18.59%***

Source: own prepared

A total of 8 expressions related to the two constructions in the study were subjected to factor analysis. The analysis revealed the existence of two dimensions with eigenvalues exceeding 1. These two dimensions account for a total variance of 72.31%, explaining 53.72% and 18.59% of the variance, respectively.

System approach: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.583. The results of the Bartlett Sphericity test are also significant ($\chi 2=256.453$, $p< 0.001$). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to system approach. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 23. Results of the exploratory factor analysis related to system approach

Corresponding items	*Research and development activities*	*Relational capital*
Customer satisfaction measurement	**0.937**	0.041
Research on customer needs	**0.923**	0.141
Dominant employee-management relationship	0.230	**0.811**
Predominant cross-team employee relationships	0.125	**0.796**
Formal remote work procedures: Existence	-0.067	**0.666**
Total variance explained	***43.80%***	***27.38%***

Source: own prepared

A total of 5 expressions related to the two constructions in the study were subjected to factor analysis. The analysis revealed the existence of two dimensions with eigenvalues exceeding 1. These two dimensions account for a total variance of 71.18%, explaining 43.80% and 27.38% of the variance, respectively.

Multi-criteria approach: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.634. The results of the Bartlett Sphericity test are also significant ($\chi 2=209.711$, $p< 0.001$). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to multi-criteria approach. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 24. Results of the exploratory factor analysis related to multi-criteria approach

Corresponding items	*Multi-criteria approach*
Work-life balance achievement	**0.914**
Personal time	**0.877**
Time management efficiency	**0.742**
Total variance explained	***71.83%***

Source: own prepared

A total of 3 expressions related to the one-dimensional construction in the study were subjected to factor analysis. The analysis revealed the existence of one dimension with an eigenvalue exceeding 1. This dimension accounts for a total variance of 71.83%.

Team management approach: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.769. The results of the Bartlett Sphericity test are also significant ($\chi 2$=203.024, p< 0.001). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to team management approach. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 25. Results of the exploratory factor analysis related to team management approach

Corresponding items	*Team management approach*
Remote work commitment level	**0.770**
Remote decision-making capacity	**0.738**
Task modification autonomy	**0.680**
Assessing employee competence	**0.637**
Power-sharing in the team	**0.562**
Final task executor	**0.516**
Total variance explained	***43.14%***

Source: own prepared

A total of 6 expressions related to the one-dimensional construction in the study were subjected to factor analysis. The analysis revealed the existence of one dimension with an eigenvalue exceeding 1. This dimension accounts for a total variance of 43.14%.

The results of the above resource allocation effectiveness, technological effectiveness, and management effectiveness exploratory factor analyses were displayed. These three factors consist of the economic effectiveness factor that overall evaluates the economic effectiveness of remote work in surveyed public utility services but also compares the economic effectiveness of remote work within surveyed transnational companies (identification of effectiveness gaps, considering the potential challenges and errors associated with comparing results between the public and private sectors) and provides suggestions to enhance remote work implementation in public utility services. The economic effectiveness exploratory factor analysis results are displayed below.

Economic effectiveness: the suitability of the data for factor analysis was examined using the KMO coefficient and the Bartlett Sphericity test. The KMO value is 0.697. The results of the Bartlett Sphericity test are also significant ($\chi 2$=160.494, p< 0.001). Upon reviewing the outcomes of both tests, it was deemed appropriate to conduct factor analysis on the data related to Economic

Effectiveness factor. In this regard, Principal Component Analysis (Pearson, 1901) was applied as an estimation method, and the Varimax Rotation Method (Kaiser, 1958) was adopted.

Table 26. Results of the exploratory factor analysis related to economic effectiveness

Corresponding items	*Economic effectiveness*
Resource allocation effectiveness	**0.865**
Technological effectiveness	**0.809**
Management effectiveness	**0.845**
Total variance explained	***70.55%***

Source: own prepared

A total of 3 expressions related to the one-dimensional construction in the study were subjected to factor analysis. The analysis revealed the existence of one dimension with an eigenvalue exceeding 1. This dimension accounts for a total variance of 70.55%. The reliability of the research instruments used in the surveys is assessed using Cronbach's alpha scores, presented below.

Reliability of research instruments: Cronbach's alpha assesses reliability by comparing the amount of shared variance, or covariance, among the items making up an instrument to the amount of overall variance. If the instrument is reliable, there should be much covariance among the items relative to the variance. Cronbach's alpha is equivalent to taking the average of all possible split-half reliabilities (Collins, 2007). According to Rószkiewicz (2020) and Yıldız and Uzunsakal (2018), an instrument is deemed reliable when its Cronbach's alpha value exceeds 0.60.

Table 27. Cronbach's alpha scores of research instruments

Variables	Cronbach's alpha value
Resource allocation effectiveness	***0.700***
Knowledge sharing and equipment needs	*0.665*
Budget allocation for infrastructure, training and employee support	0.605
Remote work participation and time allocation	0.837
Employer support for home office costs	0.637
Technological effectiveness	***0.637***
Management effectiveness	***0.863***
Purposeful approach	0.846
Plan-do-check-act (PDCA) Deming cycle	0.912
Monitoring remote work performance	0.695
System approach	***0.655***
Research and development activities	0.864
Relational capital	0.616
Multi-criteria approach	***0.800***
Teams management approach	***0.709***
Economic effectiveness	***0.777***

Source: own prepared

When reviewing the Cronbach alpha values provided for the study's instruments, it is clear that each dimension demonstrates reliable internal consistency. Additionally, Pearson's correlation has been utilized to reinforce reliability and illustrate the relationships between the components of economic effectiveness.

Table 28. Correlation analysis results regarding economic effectiveness components

Variables	1.	2.	3.	4.
1. *Economic effectiveness*	**1**	**-**	**-**	**-**
2. *Resource allocation effectiveness*	**0.84****	**1**	**-**	**-**
3. *Technological effectiveness*	**0.85****	**0.55****	**1**	**-**
4. *Management effectiveness*	**0.83****	**0.62****	**0.51****	**1**

Note: Pearson's correlation has adopted **p<.01, source: own prepared

The findings show that a strong, significant and positive relationship exists between economic effectiveness and resource allocation effectiveness ($r=0.84$, $p < 0.01$), technological effectiveness ($r=0.85$, $p < 0.01$), and management effectiveness ($r=0.83$, $p < 0.01$). Additionally, a significant and positive relationship exists between resource allocation effectiveness and technological effectiveness ($r=0.55$, $p < 0.01$) and management effectiveness ($r=0.62$, $p < 0.01$). Lastly, a significant and positive relationship exists between technological effectiveness and management effectiveness ($r=0.51$, $p < 0.01$). This correlation analysis also confirms the relationship between economic effectiveness components: resource allocation, technological effectiveness, and management effectiveness.

6. Economic Effectiveness Assessments in the Public Utility Sector

6.1. Effectiveness from a Resource Allocation Perspective

This part will evaluate the main research questions and hypothesis regarding the resource allocation effectiveness perspective. Whether the employer proactively ensures employees' equipment needs and knowledge-sharing platforms during remote work (*RQ1*) is evaluated within the *knowledge sharing and equipment needs* factor. It consists of three components: *employer facilitation of knowledge-sharing meetings for remote employees*, e*mployer documentation of informal knowledge exchange in remote work,* and *remote work equipment needs: employer survey*.

Table 29. Evaluation of knowledge sharing and equipment needs in public utility services

Corresponding items	Mean	Median	Std dev.
Employer facilitation of knowledge-sharing meetings for remote employees	1.56	1.00	1.68
Employer documentation of informal knowledge exchange in remote work	0.98	0.00	1.44
Remote work equipment needs: Employer survey	1.67	1.00	1.80
Knowledge sharing and equipment needs	**1.40**	**1.00**	**1.24**

Source: own prepared, n=165

The study findings indicate the employer's infrequent organization of knowledge-sharing meetings, which may lead to a deficiency in innovation and clarity regarding the remote work process. Additionally, the employer lacks a systematic recording or storage mechanism for shared knowledge, thus failing to establish a database or source for future improvements. Furthermore, there is a notable absence of surveys by employers to assess the equipment needs of remote workers. In summary, public utility services' management of knowledge sharing and equipment needs appears ineffective. These findings lead us to evaluate research question RQ1 negatively, which indicates that employers do not proactively ensure employees' equipment needs and knowledge-sharing platforms during remote work.

The *budget allocation for infrastructure, training, and employee support* factor evaluation follows, aiming to address research questions *RQ2* and *RQ3* within three components. These are *the allocation of the annual team budget for ICT infrastructure and software access*, *allocation of the annual team budget for skill training*, and *workplace adaptations and professional consultations.*

Table 30. Evaluation of budget allocation for infrastructure, training, and employee support in public utility services

Corresponding items	Mean	Median	Std dev.
Allocation of annual team budget for ICT infrastructure and software access	0.73	1.00	0.88
Allocation of annual team budget for skill training	0.29	0.00	0.65
Workplace adaptations and professional consultations	0.27	0.00	0.78
Budget allocation for infrastructure, training and employee support	**0.43**	**0.33**	**0.54**

Source: own prepared, n=165

The result exhibits that public utility services are the most significant portion of the annual budget filled by ICT infrastructure and software access. However, it reveals that public utility services have a small annual budget assigned to pay for their remote work requirements. Requirements for remote work do not occupy a significant portion of annual budgets for services. In other words, remote work is a cost-effective working method for employers. Thus, *RQ2* and *RQ3* have been negatively evaluated, indicating that a small portion of the annual budget is allocated to financing remote work requirements. Most employers do not finance employees' psychological and physiological needs adapting to remote work.

In the following, the *employer support for home office costs* factor evaluates whether the employer finances home office maintenance costs during remote work (*RQ4*). It comprises two components: *employer support for home office maintenance costs* and *remote work internet cost coverage by employers*.

Table 31. Evaluation of employer support for home office costs in public utility services

Corresponding items	Mean	Median	Std dev.
Employer support for home office maintenance costs	0.09	0.00	0.61
Remote work internet cost coverage by employers	0.29	0.00	0.96
Employer support for home office costs	**0.19**	**0.00**	**0.68**

Source: own prepared, n=165

As per the findings, neither home office maintenance costs (including electricity, water, CO, and garbage) nor internet costs are financed by public utility services. Consequently, a

deficiency in *employer support for home office costs* within public utility services implies that employees are responsible for financing their home office expenses during remote work. These findings lead us to evaluate research question RQ4 negatively, which indicates that employers do not finance home office maintenance costs during remote work.

The remote work participation and time allocation factor is evaluated to address research question RQ5 through two components. These components involve the *proportion of team employees engaging in remote work* and the *extent of monthly time devoted to remote work by team employees.*

Table 32. Evaluation of remote work participation and time allocation in public utility services

Corresponding items	Mean	Median	Std dev.
Proportion of team employees engaging in remote work	2.63	3.00	1.83
Extent of monthly time devoted to remote work by team employees	1.95	2.00	1.36
Remote work participation and time allocation	**2.28**	**2.00**	**1.48**

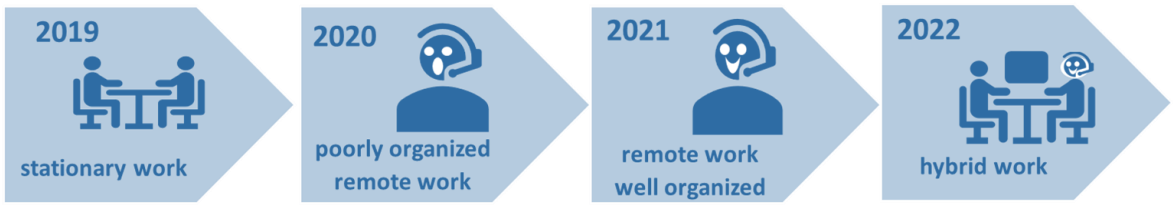
Source: own prepared, n=165

The study's findings suggest that over 50% of employees in public utility services are involved in remote work. Additionally, 40% of employees dedicate their monthly working hours to remote activities. The results further indicate that remote work nearly supplants more than 40% of the work conducted at the institution's headquarters (RQ5). The following research question, RQ6, is evaluated using data on utility expenses.

Analyzing the gathered data is instrumental in addressing research question RQ6, focusing on whether remote work contributes to resource savings for public utility services. Data was collected in public utility services using a separate questionnaire (appendix 2) on the costs or the amount of consumption of raw materials: electricity, cold and warm water, heating buildings, maintaining order and cleanliness, including cleaning products, building protection and monitoring, and waste collection for 2019-2022. All collected data has been translated into monetary values, with adjustments made for inflation when comparing data between different years. The energy crisis was a significant price differentiator during this period. The data has been standardized based on the number of employees in organizations, distinguishing between technical and office workers (scientists and officials). Notably, the number of employees in individual

organizations did not impact the differentiation of results between the studied years. The research incorporated gross prices, except for raw materials benefiting from government-issued privileges in 2022, where net prices were considered to avoid distorting year-to-year comparisons. On the other hand, data collected for 2019-2022, assuming that individual years, due to the COVID-19 pandemic, have different characteristics regarding the use of remote work in public sector organizations. These characteristics are presented in Figure 17 below.

Figure 17. The dominant form of work in the public utility sector in the period 2019-2022 in Poland



Source: (Kam, Przygodzki and Trippner-Hrabi, 2023)

Table 33 below displays annual resource consumption of raw materials: electricity, cold and warm water, heating buildings, maintaining order and cleanliness, including cleaning products, building protection and monitoring, and waste collection for 2019-2022 in the public utility services in Poland (PLN/per capita; fixed prices).

Table 33. Annual resource consumption in the public utility services in Poland (PLN/per capita; fixed prices)

The dominant form of work							
Years	**2019**	**2020**	**2019=100**	**2021**	**2019=100**	**2022**	**2019=100**
Electricity	13 547 998	12 457 054	92	14 525 918	107	27 809 334	205
Cold and warm water	6 172	4 713	76	5 062	82	7 117	115
Heating buildings	1 226	1 220	100	1 429	117	1 319	108
Maintaining order and cleanliness, including cleaning products	24 585	28 627	116	28 145	114	28 656	117
Building protection and monitoring	19 645	21 571	110	21 429	109	19 738	100
Waste collection	3 765	3 921	104	3 417	91	4 163	111
Total annual resource consumption	13 603 390	12 517 106	92	14 585 400	107	27 870 327	205
Total annual resource consumption without electricity	55393	60052	108	59482	107	60993	110

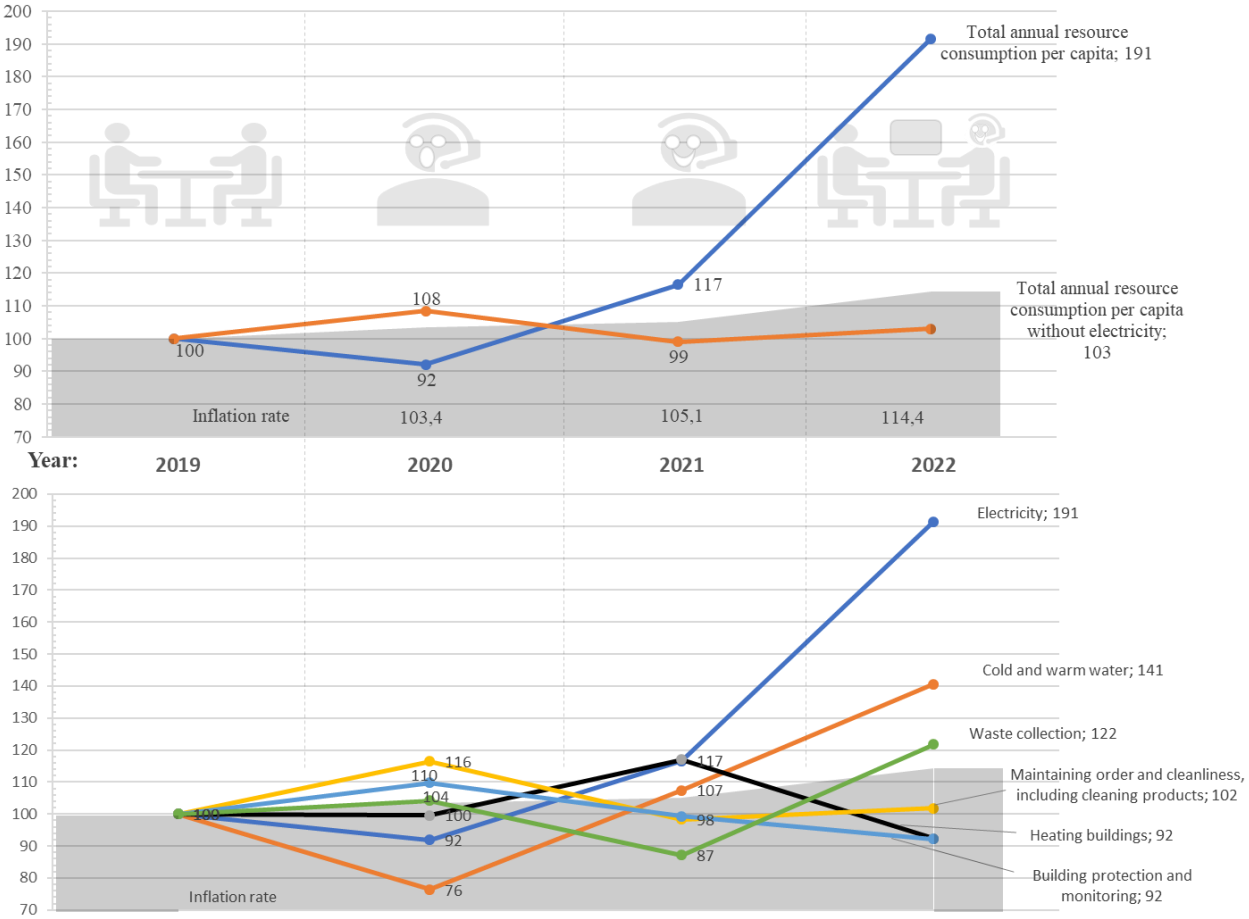
Source: (Kam, Przygodzki and Trippner-Hrabi, 2023)

According to the analysis results, electricity emerges as the most crucial category in the operational costs of the utility sector, with an abnormal value in 2022 due to the global energy crisis. For most resources, the mandated transition to remote work in 2020 yielded savings, notably in electricity, water, and heating for buildings. Increased expenses were observed only in using cleaning products, which is understandable in the context of the COVID-19 pandemic. Building security and monitoring costs increased slightly during this period, only to decrease in 2022, almost reverting to the base year's value. The increase in 2020-21 can be attributed to long-term contracts, often associated with public institutions. The decrease in costs due to the shift to remote work is also evident in the total annual resource consumption indicator.

However, a more pivotal year for observing the costs of organizing remote work was 2021. In this period, public institutions prepared for remote work at both the technical and procedural levels. In 2021, the total annual resource consumption increased by seven percentage points compared to the base year of 2019. Savings were observed solely in water management and waste collection during this period. In contrast, in 2022, the implementation of hybrid remote work failed

to offset the costs, resulting in one hundred-five-percentage-point increase in total annual resource consumption, excluding electricity, which increased by ten percentage points compared to the base year of 2019.

Figure 18. Dynamics of annual resource consumption in public utility services



Source: (Kam, Przygodzki and Trippner-Hrabi, 2023).

Examining the dynamics of changes in the annual consumption value of resources expressed in constant values about the fluctuation in the inflation rate (Figure 18) reveals dissimilar trends between these indicators. None of the resource costs demonstrated a correlation with fluctuations in the inflation rate. Notably, in 2021, characterized by well-organized remote work in contrast to the poorly organized remote work in 2020, total annual resource consumption was reduced, excluding electricity. This observation provides a positive assessment of research question *RQ6*, suggesting that remote work contributes to resource savings in public utility services.

Lastly, it is concluded that public utility services do not finance home office maintenance costs (including electricity, internet, water and garbage) for remote workers. In addition, according to financial utility expense reports, remote work contributes to resource savings in public utility services. As a result, hypothesis 1 has been confirmed (*H1*: *If public utility services work remotely, they lower indirect employee costs).*

6.2. Effectiveness from a Technological Perspective

This part will evaluate the main research questions and hypothesis regarding the technological effectiveness perspective for public utility services. The technological effectiveness factor consists of five components: *equipment provision, ownership of remote work equipment, access to network infrastructure, technical support,* and *internal training percentage: employee-to-employee*.

Table 34. Evaluation of technological effectiveness in public utility services

Corresponding items	Mean	Median	Std dev.
Equipment provision	3.93	5.00	1.57
Ownership of remote work equipment	2.22	2.00	1.67
Access to network infrastructure	4.02	5.00	1.53
Technical support	3.09	4.00	1.76
Internal training percentage: employee-to-employee	1.95	1.00	1.75
Technological effectiveness	**3.04**	**3.20**	**1.02**

Source: own prepared, n=165

Research results indicate that public utility services are equipped with office devices for remote work. However, in many cases, the employees provide their own devices rather than the employer. These findings negatively evaluate the research question *RQ7*. That indicates that the employer does not effectively provide the technological infrastructure to meet the needs of employees working remotely. Employers are only partially meeting the technological needs of their remote employees. However, there is room for improvement in providing adequate technological infrastructure, particularly in providing organizations' devices to remote workers.

Public utility services provide remote employees access to the network infrastructure, which is essential for performing work duties. This finding positively answers research question *RQ8*. That indicates public utility services proactively used ICT infrastructure at the premises during remote work. However, access to help desk services, an essential support component, was not rated satisfactory for public utility services. In this regard, research question *RQ9* has been negatively evaluated. That suggested the employer's technical help desk is ineffective during remote work in public utility services. This is an aspect where employers must focus on providing remote employees with better technological support. Enhancing the availability and effectiveness of help desk services could further encourage and facilitate remote employees to effectively utilize the ICT infrastructure during remote work. On the other hand, if training does take place, it is usually delivered by external training providers. This finding positively answers research question *RQ10*. That indicates that public utility services use innovative outsourcing to train their employees remotely. In other words, public utility services do not significantly apply internal training possibilities or need more human capacity to cover such a scope.

Finally, the technological effectiveness of public utility services is evaluated with corresponding items. The mean score for technological effectiveness is 3.04 out of 5.00, and the median score is 3.20 out of 5.00 for public utility services. These results stress that remote work effectiveness, in other words, the technological readiness of employees, is not yet at the desired level to implement remote work in public utility services effectively. While some progress has been made, there is a need for further investment in equipment and infrastructure, technical support, and training and skill development to ensure that remote employees have the tools and knowledge they need to work productively and efficiently. As a result, hypothesis 2 has been confirmed (*H2: The technological readiness of employees is determined by employers' involvement in the infrastructure support of remote work*).

6.3.Effectiveness from a Management Perspective

This part will evaluate the main research questions and hypothesis regarding the Management effectiveness perspective for public utility services. The management effectiveness perspective is complex and is examined using four approaches: purposeful approach, system approach, multi-criteria approach, and team management approach.

Purposeful approach: Whether organizations achieve their operational goals (*RQ11*) is evaluated through the Plan-do-check-act (PDCA) Deming cycle implementation during remote work. The PDCA Deming cycle factor consists of six components: *decision-making in team*, *team activity proportion*, *execution of strategic and ongoing activities*, *task and project control*, *team communication*, and *goal achievement*.

Table 35. Evaluation of the PDCA Deming cycle in public utility services

Corresponding items	Mean	Median	Std dev.
Decision-making in team	1.58	1.00	1.43
Team activity proportion	1.67	1.00	1.17
Execution of strategic and ongoing activities	1.73	1.00	1.34
Task and project control	1.65	1.00	1.41
Team communication	2.29	2.00	1.55
Goal achievement	2.51	3.00	1.65
PDCA Deming cycle	**1.91**	**1.83**	**1.12**

Source: own prepared, n=165

Results indicate that individual assessments of each component within the PDCA Deming cycle reveal a notable lack of effectiveness. *Team communication* and *goal achievement* notably differ significantly, though they fall short of optimal effectiveness. Nonetheless, these components still demonstrate inefficacy, suggesting areas for enhancement. The data reveals that nearly half (approximately 50%) of all team decisions are communicated to employees remotely. Furthermore, achieving goals in public utility services slightly surpasses 50%. In essence, public utility services struggle to execute all planned goals successfully during periods of remote work. In conclusion, implementing the PDCA Deming cycle proves ineffective within the context of public utility services, emphasizing the need for improvement in the operational process. These findings

negatively evaluate the research question *RQ11*. That indicates that public utility service has not effectively achieved its operational goals during remote work.

The following part evaluates the effectiveness of groups of motivational tools, from the most to the least effective, regarding leaders'/managers' application (*RQ12*). The related scores are given in Table 36.

Table 36. Evaluation of the groups of motivational tools, from the most effective (1) to the least effective (8), for remote workers

Groups of motivational tools	*1 - Most effective* *8 - Least effective*
Flexible working time and independence	**1**
Motivational interviews, advice	**2**
Material rewards, including money	**3**
Assessment systems, opinion polls	**4**
Regulations, instructions, penalties	**5**
Praise, distinctions	**6**
Good rapport at work; strong, positive, informal relationships	**7**
Other	**8**

Source: own prepared, n=165

Findings exhibit that *flexible working time and independence* were the most rated effective motivational tools by leaders/managers during remote work in public utility services. The second most rated effective tool was *motivational interviews and advice*; the third effective was *material rewards, including money*; the fourth effective was *assessment systems opinion polls*; the fifth effective was r*egulations, instructions, and penalties*; the sixth effective was *praise and distinctions*, seventh effective; *good rapport at work- strong, positive, informal relationships*.

These findings evaluate the research question *RQ12*. The study sheds light on several key strategies and tools employed by leaders/managers in public utility services to motivate remote employees. Results indicate a recognition of the importance of providing employees with autonomy and a flexible work schedule. In addition, it emphasizes the role of personalized guidance and support in fostering motivation among remote employees. Moreover, it highlights the significance of recognizing and rewarding employees for their efforts. The following part evaluates

monitoring remote work performance (*RQ13*). Monitoring remote work performance factor consists of two components: *primary remote control method* and *task control frequency*.

Table 37. Evaluation of monitoring remote work performance in public utility services

Corresponding items	Mean	Median	Std dev.
Primary remote control method	1.93	2.00	1.51
Task control frequency	2.38	2.00	1.65
Monitoring remote work performance	**2.16**	**2.00**	**1.38**

Source: own prepared, n=165

In order to assess *primary remote control method* in public utility services, a specific scale has been adopted. Evaluation was as listed: 0 (no control), 1 (informal interview), 2 (scheduled meetings and reporting), 3 (unannounced on-the-job controls), 4 (remote access of the manager to employees computers) and 5 (written reports). The scores for the primary remote control method reveal a mean of 1.93 and a median of 2.00. On the other hand, it concluded that 21 public utility services do not have any control (12.70%), 52 of them apply informal interview (31.50%), 62 of them scheduled meetings and reporting (37.60%), only 2 of them apply unannounced on-the-job controls (1.20%), only 3 of them apply remote access of the manager to employees computers (1.80%), and 25 of them apply written reports (15.20%). Based on the research findings, it is evident that the predominant primary remote control method involves either scheduled meetings and reporting or informal interviews conducted by leaders/managers.

A specific scale has been implemented to appraise the task control frequency within public utility services. Evaluation was as listed: 0 (we do not audit tasks), 1 (annual or less frequent reports), 2 (semi-annual), 3 (quarterly), 4 (weekly) and 5 (daily). Task control frequency scores are mean= 2.38 and median=2.00. On the other hand, it concluded that 30 public utility services do not have any task control system at all (18.20%), 26 of them apply annual or less frequent reports (15.80%), 29 of them adopt semi-annual reporting (17.60%), 31 of them apply quarterly reporting (18.80%), 29 of them apply weekly reporting (17.60%), and only 20 of them apply daily reporting (12.10%). According to the findings, the dominant task control frequency was semi-annual or quarterly by the leaders/managers. In summary, the research outcomes enable us to address research question *RQ13*, indicating that the prevailing primary remote control method, conducted semi-annually or quarterly, entails either scheduled meetings and reporting or informal interviews

facilitated by leaders/managers. In light of these findings, research hypothesis 3 *(H3: If public utility service works remotely, the dominant form of goal control is task control)* has been confirmed.

System approach: This part will evaluate the main research questions and hypothesis regarding the system approach for public utility services. The system approach factor consists of *research and development activities* and *relational capital.*

Table 38. Evaluation of research and development activities in public utility services

Corresponding items	Mean	Median	Std dev.
Customer satisfaction measurement	2.87	3.00	2.14
Research on customer needs	2.36	2.00	2.11
Research and development activities	**2.61**	**2.50**	**1.99**

Source: own prepared, n=165

The study's findings reveal that, during remote work, nearly 60% of public utility services measure customer satisfaction as part of their operational activities. On the other hand, it is concluded that more than 40% of public utility services employed research on their customer needs/preferences during remote work. According to these findings, the implementation of *research and development activities* has been evaluated. As a result, public utility services partially conduct *research and development activities*. In other words, research question *RQ14* has been answered that public utility services partially apply research and development activities to enhance remote work effectiveness. There is room for improvement to enhance remote work effectiveness, and a more proactive management perspective is needed. The following part evaluates *relational capital* (*RQ15*).

Table 39. Evaluation of relational capital in public utility services

Corresponding items	Mean	Median	Std dev.
Dominant employee-management relationship	2.78	2.00	1.58
Predominant cross-team employee relationships	2.57	2.00	1.17
Formal remote work procedures: existence	1.65	1.00	1.81
Relational capital	**2.33**	**2.33**	**1.10**

Source: own prepared, n=165

A specific scale has been implemented to appraise the *dominant employee-management relationship* within public utility services. The evaluation was as listed: 0 (no relations between employees), 1 (individual relations between employees and manager dominate), 2 (individual relations between employees dominate), 3 (relationships during formal online team meetings dominate), 4 (relationships during formal team meetings in the office dominate) and 5 (we usually work together in a team using common communication platforms). The average score for dominant employee-management relationship is 2.78, with a median score of 2.00. On the other hand, it concluded that only 4 public utility services do not have any relations between employees dominant (2.40%), 43 of them have individual relations between employees and manager dominate (26.10%), 37 of them have individual relations between employees dominate (22.40%), 22 of them have relationships during formal online team meetings dominate (13.30%), 20 of them have relationships during formal team meetings in the office dominate (12.10%), and 30 of them usually work together in a team using common communication platforms (23.60%). According to the findings, the most *dominant employee-management relationship* is individual relations.

In order to evaluate *predominant cross-team employee relationships* in public utility services, a specific scale has been adopted. The evaluation was as listed: 0 (no relations between employees), 1 (communication is machine-based - stages of process implementation), 2 (individual relations between employees dominate), 3 (relationships during formal online team meetings dominate), 4 (relationships during formal team meetings in the office dominate) and 5 (we most often work in interdisciplinary teams on common communication platforms). On the other hand, it concluded that 94 public utility services have individual relations between employees (57.00%). Based on the research findings, it is evident that the *predominant cross-team employee relationship* (between the team's employees and employees of other teams) is individual relations.

Lastly, *formal remote work procedures: existence* has been evaluated. It concluded that 60 public utility services (41.20%) do not have any procedures/instructions that remote workers must follow. The *formal remote work procedures: existence* scores reveal a mean of 1.65 and a median of 1.00. In other words, there are no strict procedures that need to be followed by remote workers. As a result, the research outcomes enable us to address research question *RQ15*, indicating that public utility services have mostly individual relationships between employees and between employees and managers. In other words, remote work in public utility services has relational capital, primarily as individual relationships. These results confirm hypothesis 4 *(H4: If a public utility service works remotely, its organizational structure is flat and flexible).*

Multi-criteria approach: This part will focus on the main research questions and hypothesis regarding the multi-criteria approach that evaluates *work-life balance* for public utility services. the multi-criteria approach factor consists of *work-life balance achievement, personal time* and *time management efficiency.*

Table 40. Evaluation of multi-criteria approach in public utility services

Corresponding items	Mean	Median	Std dev.
Work-life balance achievement	2.38	2.00	1.71
Personal time	2.50	2.00	1.79
Time management efficiency	1.93	2.00	1.66
Work-life balance	**2.27**	**2.33**	**1.43**

Source: own prepared, n=165

According to findings, remote work does not positively impact work-life balance achievement, personal time, or time management efficiency. These findings answer research question *RQ16* that remote work implementation in public utility services does not lead to improved time management efficiency for operational activities. Finally, the results show that remote work neither negatively impacts public utility service leaders/managers' work-life balance nor positively contributes to it. In other words, regarding mean and median values evaluation, research question *RQ17* has been answered that remote work does not positively contribute to *work-life balance* in public utility services.

Tabachnick and Fidell (2013) and George (2011) indicate that if skewness and kurtosis's results are between +1.5 and -1.5, it can be concluded that data has normally been distributed. Findings indicate that work-life balance achievement has skewness 0.10, kurtosis -1.18; personal time has skewness 0.06, kurtosis -1.36; time management efficiency has skewness 0.43, kurtosis -0.96; work-life balance has skewness 0.08, kurtosis -0.90; goal achievement has skewness -0.02, kurtosis -1.18. in this regard, related variables skewness and kurtosis's scores are between +1.5 and -1.5. Therefore, parametric analysis will be adopted.

The relationships between *work-life balance* and the characteristics of Generation Y, X, and Baby Boomers were subsequently examined with a one-way ANOVA test. The results are displayed in Table 41 below.

Table 41. The relationships between work-life balance and generations Y, X and Baby Boomers characteristics-one way ANOVA test analysis results

Generation type	*N*	*Mean*	*SD*	*Source of variance*	*Sum of squares*	*df*	*Mean square*	*F*	*p*
Generation Y	5	2.06	2.01	Between groups	3.27	2	1.63	0.80	0.45
Generation X	85	2.14	1.40	Within groups	332.04	162	2.05		
Baby Boomers	75	2.42	1.42	-	-	-	-		
Total	165	2.27	1.43	-	-	-	-		

Source: own prepared

When the data obtained were examined, it was concluded that there was no significant difference in *Work-Life Balance* levels regarding Generations Y, X and Baby Boomers' Characteristics ($F=0.80$, $p>0.05$). In the following, correlation and regression analyses regarding the *work-life balance achievement, personal time, time management efficiency* and *goal achievement* will be implemented to evaluate research hypothesis 5.

Table 42. Correlation analysis results

Variables	Mean	Median	Sd	1.	2.	3.	4.
1.*Work-life balance achievement*	2.38	2.00	1.71	**1**	-	-	-
2.*Personal time*	2.50	2.00	1.80	**0.74****	**1**	-	-
3.*Time management efficiency*	1.93	2.00	1.66	**0.47****	**0.39****	**1**	-
4.*Goal achievement*	2.51	3.00	1.65	**0.41****	**0.33****	**0.57****	**1**

Note: Pearson's correlation has adopted **p<.01, n=165, Source: own prepared

The findings show that a significant and positive relationship exists between *work-life balance achievement* and personal time (r=0.74, p < 0.01), time management efficiency (r=0.47, p < 0.01), and *goal achievement* (r=0.41, p < 0.01). A significant and positive relationship exists between personal time and *time management efficiency* (r=0.39, p < 0.01) and *goal achievement* (r=0.33, p < 0.01). A significant and positive relationship exists between *time management efficiency* and *goal achievement* (r=0.57, p < 0.01).

After the relationships between the variables were revealed through the correlation analysis, multiple regression analysis was performed to determine the cause-and-effect relationships between the variables. The relationship is shown in Table 43.

Table 43. Regression analysis results

Variables	***Goal achievement*** (β)
Work-life balance achievement	0.17
Personal time	0.02
Time management efficiency	0.48**
F	28.65**
R^2	0.35
Adjusted R^2	0.34

Note: ** p < 0.01, standard beta values are used, n = 165, Source: own prepared.

The regression analysis results show a statistically significant relationship between time management efficiency and goal achievement ($\beta = 0.48$, $p < 0.01$). However, no statistically significant relationships were found between work-life balance and goal achievement or between personal time and goal achievement. In other words, work-life balance does not significantly predict achieving goals in public utility services. As a result, there is no basis to confirm research hypothesis 5 *(H5: If the employee has a good work-life balance during remote work, the public utility service effectively achieves its goals)*.

Team management approach: This part will focus on the main research question and hypothesis regarding the Team management approach that evaluates *empowerment* for public utility services. Team management approach factor consists of *remote work commitment level, remote decision-making capacity, task modification autonomy, assessing employee competence, power-sharing in the team* and *final task executor.*

Table 44. Evaluation of empowerment in public utility services

Corresponding items	Mean	Median	Std dev.
Remote work commitment level	3.32	4.00	1.55
Remote decision-making capacity	2.92	3.00	1.61
Task modification autonomy	3.48	4.00	1.55
Assessing employee competence	4.38	5.00	0.91
Power-sharing in the team	2.95	3.00	1.89
Final task executor	2.42	3.00	1.95
Empowerment	**3.25**	**3.50**	**1.03**

Source: own prepared, n=165

The assessment of employees' decision-making within the organization encompassed evaluations in empowerment (scoring 5 and 4) and delegation stages (scoring 0-3). The scores indicate a delegation stage between employees and department leaders across public utility services. In other words, research question *RQ18* answered that leaders assign tasks and responsibilities to individuals or teams in organizations, granting them the authority to make decisions and act within their work scope. However, the leader is a decision-making body;

therefore, they are not self-management teams. Hence, hypothesis 6 (*H6*: *If public utility service works remotely, they are not self-management teams)* has been confirmed.

6.4. Evaluating Economic Effectiveness of Remote Work in Public Utility Services: Holistic Overall Assessment

The assessment of the economic effectiveness of remote work comprises three categories: resource allocation, technological effectiveness, and management effectiveness. Each category is weighted equally in this evaluation. The mean, median, and standard deviations for each category are presented in Table 45 below. The final economic effectiveness scores were calculated by averaging the values from the three categories.

Table 45. The evaluation of economic effectiveness of remote work

Corresponding items	Mean	Median	Std dev.
Resource allocation effectiveness	1.13	1.11	0.62
Technological effectiveness	3.04	3.20	1.02
Management effectiveness	2.43	2.47	0.76
Economic effectiveness	**2.20**	**2.22**	**0.63**

Source: own prepared, n=165

According to the findings, resource allocation in public utility services is ineffective, necessitating significant improvements. Employers do not proactively ensure employees' equipment needs and knowledge-sharing platforms during remote work. Most employers do not finance employees' home office maintenance costs and do not finance employees' psychological and physiological needs adapting to remote work. Specifically, the decision-making process for distributing limited and scarce resources needs to be re-evaluated in public utility services.

Conversely, technological effectiveness scores highest among the evaluated categories in public utility services, yet further enhancements are required to ensure the effectiveness of remote work. Study findings indicate that employers do not effectively provide the technological infrastructure to meet the needs of employees working remotely. The technical help desk is also ineffective during remote work in public utility services. While currently inefficient, management effectiveness shows promise, indicating potential for substantial improvement. Study findings indicate that public utility services partially apply research and development activities to enhance

remote work effectiveness. However, they have not effectively achieved their operational goals during remote work. Finally, the results indicate that the economic effectiveness of remote work in public utility services is inadequate. Remote work has not yet been successfully integrated into these services effectively.

6.5. Comparative Analysis - Economic Effectiveness of Remote Work in Public Utility Services Versus Transnational Companies

In this part, transnational companies and public utility services will be compared regarding the context of economic effectiveness to indicate the differences in the application of remote work and emerge suggestions for improvement of public utility services. The following parts will evaluate the comparison questions in the order presented in Tables within the mean, median, and Mann-Whitney test results. The skewness and kurtosis results for comparative variables fall within the range of +1.5 to -1.5. However, given a substantial difference in sample sizes (transnational companies, n=15; public utility services, n=165), non-parametric tests become more suitable for comparison. Hence, the Mann-Whitney test has been employed.

Effectiveness comparison from resource allocation perspective

In Table 46, resource allocation effectiveness is evaluated separately for public utility services and transformational companies, and results are compared.

Table 46. Evaluation of resource allocation effectiveness

Corresponding items	*Type*	*Mean*	*Median*	*Skewness*	*Kurtosis*	*Std dev.*	*P*
Resource allocation effectiveness	**US**	1.13	1.11	0.43	0.24	0.62	**<0.001**
	TC	***2.90***	***2.89***	***0.02***	***-1.31***	***0.43***	

Description: Mann-Whitney's test statistic; p – significance level- US: utility services, TC: transnational companies, Source: own prepared

It is revealed that resource allocation is ineffective in public utility services. On the other hand, it is effective in transnational companies; however, there is room for improvement for both organizations to strengthen their resource allocation strategies. In addition, Mann-Whitney's test shows a significant difference between utility services and transnational companies regarding the resource allocation effectiveness in favor of transnational companies. These scores lead us to answer comparison question CQ1 positively, which is that there is a significant difference in the

effectiveness levels of allocation of resources within organizations in favor of transnational companies.

Effectiveness comparison from technological perspective

The technological effectiveness is evaluated separately for public utility services and transformational companies, and the results are compared. The related scores are represented in Table 47.

Table 47. Evaluation of technological effectiveness

Corresponding items	*Type*	*Mean*	*Median*	*Skewness*	*Kurtosis*	*Std dev.*	*P*
Technological effectiveness	US	3.04	3.20	-0.87	0.69	1.02	**<0.001**
	TC	***4.51***	***4.40***	***-0.09***	***-0.66***	***0.38***	

Description: Mann-Whitney's test statistic; p – significance level- US: utility services, TC: transnational companies, Source: own prepared

According to the findings, technological effectiveness is high in transnational companies. It is decent regarding public utility services; however, there is room for improvement to ensure remote work quality. Mann-Whitney's test shows a significant difference between public utility services and transnational companies regarding the *technological effectiveness* in favor of transnational companies. These scores lead us to evaluate comparison question *CQ2* positively: There is a difference regarding technological effectiveness within organizations in favor of transnational companies.

Effectiveness comparison from management perspective

The management effectiveness is evaluated from the point of purposeful approach, system approach, multi-criteria approach and team management approach separately for public utility services and transformational companies, and the results are compared. The related scores are represented in Table 48.

Table 48. Evaluation of management effectiveness

Corresponding items	Type	Mean	Median	Skewness	Kurtosis	Std dev.	P
Purposeful approach	**US**	1.97	2.00	0.10	-0.55	0.92	**<0.001**
	TC	4.21	4.37	-0.81	-0.47	0.52	
System approach	**US**	2.32	2.33	-0.21	-0.64	1.06	**<0.001**
	TC	3.78	3.67	0.41	-0.79	0.69	
Multi-criteria approach	**US**	2.27	2.33	0.09	-0.90	1.42	**<0.001**
	TC	4.24	4.33	-0.87	-0.18	0.75	
Team management approach	**US**	3.24	3.50	-0.80	0.61	1.03	0.66
	TC	3.41	3.50	-0.68	1.49	0.85	
Management effectiveness	**US**	**2.43**	**2.48**	**-0.44**	**0.64**	**0.76**	**<0.001**
	TC	**3.89**	**3.78**	**0.12**	**-0.91**	**0.36**	

Description: Mann-Whitney's test statistic; p – significance level- US: utility services, TC: transnational companies, Source: own prepared

The purposeful approach score exhibits inefficient application for public utility services but shows an excellent application for transnational companies. Mann-Whitney's test shows a significant difference between public utility services and transnational companies regarding the purposeful approach favouring transnational companies. In this regard, *CQ3a* positively evaluated that there is a difference in purposeful approach evaluation within organizations. The system approach score is greater than the purposeful approach for public utility services. However, it is ineffective, and there is room need for improvement.

On the other hand, transnational companies have a decent score regarding the system approach. Mann-Whitney's test shows a significant difference between public utility services and transnational companies regarding the system approach favouring transnational companies. In this regard, *CQ3b* positively evaluated that there is a difference in system approach evaluation within organizations.

The evaluation of *the multi-criteria approach* shows that public utility services are inefficient in this category but efficient for transnational companies. Mann-Whitney's test shows a significant difference between public utility services and transnational companies regarding the

multi-criteria approach favoring transnational companies. In this regard, *CQ3c* positively evaluated that there is a difference in multi-criteria approach evaluation within organizations.

According to the findings, the *team management approach* is decent in public utility services and transnational companies. However, there is room for improvement to better team adherence. Mann-Whitney's test shows no significant difference between utility services and transnational companies regarding the team management approach. These scores lead us to evaluate CQ3d negatively, meaning there is no difference in evaluating multi-criteria approaches within organizations.

Lastly, the *management effectiveness* score exhibits inefficient application for public utility services but shows a decent application for transnational companies. Mann-Whitney's test shows a significant difference between public utility services and transnational companies regarding the *management effectiveness* favoring transnational companies. Hence, this result positively answers *CQ3,* stating that there is a difference in overall management effectiveness within organizations. However, there is room for improvement to achieve better outcomes for transnational companies.

A holistic perspective on comparing economic effectiveness

According to the findings, resource allocation is ineffective in public utility services. On the other hand, it is decent in transnational companies; however, there is room for improvement for both organizations to strengthen their resource allocation strategies. Additionally, technological effectiveness is high in transnational companies. It is decent regarding public utility services; however, there is room for improvement to ensure remote work quality. Moreover, the management effectiveness score exhibits inefficient application for public utility services but shows a decent application for transnational companies.

The assessment of the economic effectiveness of remote work comprises three categories: resource allocation, technological effectiveness, and management effectiveness. Each category is weighted equally in this evaluation. The economic effectiveness of remote work is evaluated separately for public utility services and transformational companies, and the results are compared—the final economic effectiveness mean scores were determined by averaging the values from the three categories. The median score was similarly calculated by finding the median values from the three categories. The related scores are represented in Table 49.

Table 49. Comparison of economic effectiveness of remote work

Corresponding item	*Type*	*Mean*	*Median*	*Skewness*	*Kurtosis*	*Std dev.*	*P*
Economic effectiveness of remote work	**US**	2.20	2.22	-0.76	1.78	0.63	**<0.001**
	TC	***3.77***	***3.80***	***-0.13***	***-0.82***	***0.27***	

Description: Mann-Whitney's test statistic; p – significance level- US: utility services, TC: transnational companies, Source: own prepared

The findings show that the economic effectiveness of remote work is high in transnational companies but low in public utility services. The Mann-Whitney test indicates a significant difference favoring transnational companies. Public utility services must reassess their remote work strategies, regulations, and practices to improve economic effectiveness. Using transnational companies as benchmarks can help enhance remote work operations. Public utility services need to examine the remote work processes used by transnational companies. Implementing outsourcing strategies to engage professionals from transnational companies is a commendable initial step for improving remote work in public utility services.

Conclusions

As a result, the study's theoretical background determines the significance of remote work. Justifications for the effectiveness of remote work were made in two categories: economic justification by the knowledge-based economy (KBE) and the flexible-firm model and social justification by feminization of the workplace concept, social exchange theory, and generational theory. According to the theories, using remote work may give public utility services opportunities and advantages to having a more skilled labor force.

The KBE refers to the value of knowledge and human capital that has increased daily in the global economy. Also, the KBE states that with the development of communication technologies, work no longer depends on location. It is widely acknowledged that we have transitioned to a knowledge-based economy, defined by at least two key characteristics: knowledge is a significant factor in economic growth, and the innovation process is systemic (Llerena, 2005). From this point of view, public utility services must generate their working systems for remote work, considering the dynamics of knowledge-based innovation. If they want to provide high-quality services to their citizens, it is critical to have skilled labor forces. When it considers that the roots of the KBE are spreading worldwide dramatically and have become a significant trend (Hines and Carbone, 2013), if the international laws/regulations are okay with such employment in related countries (on both employer and employee sides), talent can be sourced worldwide. From this perspective, organizations should stay caught up in significant trends in the knowledge-based economy and apply remote work to achieve economic effectiveness.

The flexible firm model claims that public utility services may achieve a flatter and faster communication structure and a more proactive workplace with flexible working methods such as remote work. Flexible working refers to employees' flexibility over how long, where, when, and what times they work (CIPD, 2021). If companies are flexible, they can gain significant long-term competitive benefits. Firstly, a flexible business can deploy its employees and utilize their talents more effectively and efficiently than one that is not. Secondly, the more adaptable an organization is, the better it will adjust to change. Finally, employee flexibility, particularly regarding working hours, is highly valued by employees and can thus aid in recruiting and retaining top performers (Taylor, 2018). Naqshbandi et al. (2024) findings reveal that flexible work significantly and positively affects job performance.

According to the Office of National Statistics (ONS), two-thirds of individuals working at least half of their time from home are self-employed, while a third work part-time. Remote work goes hand in hand with other forms of flexible work, and trends in these fields of work may explain at least some of the growth of remote work (Felstead and Henseke, 2017). Remote work is one of the flexible working methods which is significantly popular worldwide. The flexible firms model refers to the fact that when public utility services use flexible working methods such as remote work, they will have functional, numerical, and financial flexibility to make organizations more dynamic. That is why public utility services need to apply remote work, which provides flexibility to employees and makes their work attractive.

The feminization of the workplace concept claims that the women's labor force has increased in the labor market. On this point, public utility services have to apply the proper working methods to be attractive to women. Taking into consideration that working women contribute considerably to household, national, and global economic development, failing to create women-friendly work practices such as fair remuneration may eventually reverse all of the gains made as a result of increased female engagement in the workplace (Stamarski and Song Hing, 2015; Munongo and Pooe, 2021). Therefore, public utility services shall adjust their employment practices in response to the feminization of the labor force and the rising participation of mothers in the job market to meet the demands.

Laß, Vera-Toscano, and Wooden's (2023) study findings suggest the main benefit of remote work for workers arises from the improved ability to combine work and family responsibilities, something that matters more to women given they continue to shoulder most of the responsibility for house and care work. In this regard, organizations providing remote work possibilities may be attractive centers for the women's labor force.

The feminization of the workplace and remote work are two parts of a big puzzle. The workplace is feminizing, with women entering the labor market. If organizations apply for remote work, they can be attractive centers for qualified women in the labor force. After working remotely in organizations and providing employees with flexible and comfortable workplaces, women would enter the labor market more intensely. With women entering the labor market intensely, the competition in the labor market may be more challenging as well. After all, positively evaluated

candidates may be recruited, and a more qualified workforce can provide better outputs, higher employee performance, and customer satisfaction with organizations.

Generational theory argues that members of the generation born and growing at different times and periods, affected by the historical, social, cultural, and political events of the period in which they grew up, have different values, beliefs, attitudes, and expectations and that all these differences have an effect on employee behavior (Kupperschmidt, 2000; Howe and Strauss, 2007; Lepeyko and Blyznyuk, 2016). Over the years, new generations have joined the workforce, so the generation profiles of public utility services have been changing and diversifying. Significantly, new generations, such as Generation Z, inhabit an environment rich in new technological developments, advanced communication systems, and efficient transportation facilities. In this regard, new generation members can use technology well and work remotely successfully; they tend to be physically alone and prefer to avoid geographical limitations. Remote work is a proper system that allows employees to work anywhere and anytime; hence, it meets their expectations.

Finally, social exchange theory claims that there is a social exchange between employees and organizations. A successful relationship may be possible by meeting common expectations between them. Not only should organizations pay attention to employee expectations, but employees should also pay attention to institutions' requests. In other words, if an employer treats an employee well and gives him or her a pleasant working environment, proper working methods, numerous social rights, reasonable compensation, and other benefits, the employee may return to practical work, high performance, and positive outcomes. When considering social exchange theory's basic assumptions and previous studies about remote work, it reveals that if public utility services apply for remote work fully or partially as their working method, employees may provide practical work and better performance. Effective working methods in public utility services can bring positive outcomes; however, ineffective methods may negatively impact employee performance and results.

Regarding empirical outcomes of the study, the economic effectiveness of remote work in public utility sector organizations is evaluated separately from the perspectives of allocation resources and technological and management effectiveness. As a result of the resource allocation effectiveness perspective, it is concluded that public utility services must proactively ensure employees' equipment needs and knowledge-sharing platforms to enhance remote operations'

achievements during remote work. Although there has been some progress in implementing remote work practices, there are still significant gaps in providing enough support regarding knowledge sharing and equipment needs for remote workers and maximizing their productivity.

ICT infrastructure and software access fill the most significant portion of the annual budget in public utility services. However, public utility services have a small annual budget assigned to pay for their remote work requirements. Requirements for remote work do not occupy a significant portion of annual budgets for services. Most employers do not finance employees' psychological and physiological needs adapting to remote work. In other words, remote work is a cost-effective working method for employers. On the other hand, public utility services do not finance home office maintenance costs (including electricity, internet, water, and garbage) for remote workers. According to the results of the analysis, electricity emerged as the most crucial category in the operational costs of the utility sector due to the global energy crisis. However, according to overall financial utility expense reports, remote work contributes to resource savings in public utility services. As a result, hypothesis 1 has been confirmed (*H1*: *If public utility services work remotely, they lower indirect employee costs).* In addition, the findings of a study that systematically reviewed the research methods and results of predominantly quantitative studies conducted by O'Brien and Aliabadi (2020) support this evaluation and conclude that remote work reduces energy consumption.

Regarding the technological effectiveness perspective, it is concluded that most employees have office devices; however, there are cases in which some employees must use their own devices to cover their daily tasks. This finding shows that employers do not fully secure essential equipment for their employees. When it is in account that technological devices play a pivotal role in securing remote work effectiveness, this situation can decrease employee productivity and satisfaction and cause limitations in incorporating remote work effectively.

On the other hand, with the widespread use of the digital environment, traditional crimes have also shifted to the digital space. Due to new-generation attacks and evasion techniques, traditional protection systems such as firewalls, intrusion detection systems, antivirus software, and access control lists are no longer effective in detecting these sophisticated attacks (Aslan et al., 2023). In this context, when employees need to use their office devices while working remotely, it can be challenging to secure remote connections and may cause significant risks. Using personal

devices causes sustainable cybersecurity risks to organizational portals because of potential disparities in security controls and patching compared to corporate-issued devices. This vulnerability can cause leaks to organizational systems and data by unauthorized users.

Organizations that operate an IT infrastructure that provides the fundamental technical framework for remote work, such as VPN and flexible firewall rule sets, can create beneficial groundwork for the successful development of teams (Koehne et al., 2012). It is concluded that the ICT infrastructure at the institution's headquarters is mainly used during remote work in public utility services. In addition, most employees have access to the required network infrastructure, such as common databases, electronic documents, and integrated management systems. However, access to help desk services is a crucial support component of remote work effectiveness. When technical support is accounted for as essential to facilitate seamless remote work, it could have been rated more satisfactory. Service quality and speed during technical issues directly affect remote work productivity and effectiveness. Thus, employers must provide technical support to ensure remote work effectiveness.

Outsourcing services is another reality for public utility services. As every coin has two sides, it has also advantages and disadvantages. Advantages include expertise, the ability and time to concentrate on core process, risk-sharing, and cost reduction such as recruitment and operating costs. On the contrary, disadvantages include the risk of exposing confidential data and technology, wrong partners, lack of customer focus, and many hidden costs (Somjai, 2017). Our research concludes that the dominant group of the annual training was external in public utility services. This finding shows that services mainly apply to outsourcing to cover their employees' training needs during remote work. The internal training system is fundamental, but access to external knowledge through outsourcing ensures innovative knowledge. However, public utility services must gain the knowledge and practices to be proactive and independently secure their training needs. In that case, it is vital to build and maintain an internal capacity to ensure training needs to prepare their workforce for the challenges and opportunities of the future.

Finally, these results stress that remote work effectiveness, in other words, the technological readiness of employees, is not yet at the desired level to effectively implement remote work in public utility services. While some progress has been made, there is a need for further investment in equipment and infrastructure, technical support, and training and skill development to ensure

that remote employees have the tools and knowledge they need to work productively and efficiently. As a result, hypothesis 2 has been confirmed (*H2: The technological readiness of employees is determined by employers' involvement in the infrastructure support of remote work*).

Regarding the management effectiveness perspective, it is concluded that managers rated achieving operational goals as 50% overall. This score reveals that remote work causes operational slowdowns and obstacles to cover daily activities. The PDCA Deming cycle evaluation shows an ineffective cycle deployment in public utility services for remote work. In this context, procedures and methods require enhancement to achieve better work outcomes. The literature review by Isniah, Purba, and Debora (2020) reveals that the PDCA method can increase productivity, eliminate workplace waste, and reduce waiting time, energy consumption, loss, and defects. Hence, the PDCA Deming cycle can be a valuable tool to enhance service delivery quality and customer satisfaction in public utility services.

On the other hand, the control mechanism is another topic to be highlighted, as it is critical to ensure operational activities. It includes various strategies and tools aimed at monitoring and managing the activities of remote employees, ensuring productivity and accountability. A study conducted on civil servants by Dos Santos, Sallaberry, and Mendes (2022) reveals that elevated levels of employee control in remote work can decrease the alignment of individual objectives with those of the organization. Our research findings underscore that the primary remote control method involves either scheduled meetings and reporting or informal interviews conducted by leaders. In addition, the predominant task control frequency is semi-annual or quarterly, facilitated by leaders. Consequently, public utility services have a task-control mechanism to monitor whether their employees fulfil their duties. In this regard, hypothesis 3 has been confirmed *(H3: If public utility service works remotely, the dominant form of goal control is task control).*

As motivation levels relate to both the productivity and well-being of individuals, organizations must know how motivation can be facilitated in a remote work context to keep the productivity and well-being of their employees safe (Dryselius and Pettersson, 2021). In this regard, the study assessed the strategies and tools applied to motivate remote employees. Our research findings reveal that leaders in public utility services consider flexible working time and independence as the most effective motivational tools during remote work. Motivational interviews and advice rank second in effectiveness, followed by material rewards (including money) in the

third position. In summary, findings underscore the importance of providing employees with autonomy and a flexible work schedule, recognizing the role of personalized guidance and support in fostering motivation and acknowledging and rewarding employees for their efforts.

In the era of remote work, it is more important than ever to thoroughly understand relational capital and how it plays a crucial role in promoting organizational performance and successful virtual cooperation. Relational capital pertains to cultivating interconnected associations among enterprises, institutions, and individuals, resulting in a robust sense of affiliation and interdependence for all participating entities (Johnston and Lane, 2018). According to Ramírez-Solis, Llonch-Andreu, and Malpica-Romero (2022), relational capital strongly impacts organizational technology orientation. Hence, our study focuses on the characteristics of relational capital during remote work. Based on the research outcomes, the distinctive nature of relational capital in remote work within public utility services is characterized by relationships that transcend the conventional hierarchical structure and encompass informal connections. In substance, it is concluded that the organizational structure of public utility services is flat and flexible during remote work. As a result, hypothesis 4 has been confirmed *(H4: If a public utility service works remotely, its organizational structure is flat and flexible).*

Another essential subject is the work-life balance while working remotely. Work-life balance is fundamental to improving remote workers' physical health, mental well-being, and productivity (Como, Hambley, and Domene, 2021). The study finding reveals that remote work neither adversely nor positively contributes to the work-life balance of leaders in public utility services. In other words, remote work does not contribute positively to work-life balance in public utility services. The reason for this finding can be reduced socialization during remote work. In this case, a proactive approach to enhance socialization activities is needed for remote workers. Management strategies must reconsidered, and public utility services must emphasize socialization opportunities. On the other hand, the research outcome concludes that work-life balance does not significantly predict achieving goals in public utility services. As a result, there is no basis to confirm research hypothesis 5 *(H5: If the employee has a good work-life balance during remote work, the public utility service effectively achieves its goals).*

A literature review shows empowerment makes employees happier and more productive by giving them resources, authority, opportunities, and motivation to do the job and holding them

accountable for their actions (Staniulienė and Zaveckis, 2022). An examination was conducted to assess the extent of employee autonomy in decision-making while engaged in remote work. The results illuminate a distinct delegation framework operating within public utility services, where employees primarily manage tasks entrusted to them by their department heads. In public utility services, empowerment is contingent upon obtaining prior approval from their superiors, reflecting the enduring bureaucratic nature inherent. This finding underscores that, during remote work, organizations do not function as self-managing teams. As a result, research hypothesis 6 has been confirmed *(H6: If public utility service works remotely, they are not self-management teams).*

To summarize, resource allocation in public utility services is ineffective, necessitating significant improvements. Specifically, the decision-making process for distributing limited and scarce resources needs to be re-evaluated in public utility services. Conversely, technological effectiveness is most effective among the evaluated categories in public utility services, yet further enhancements are required to ensure the effectiveness of remote work. While currently inefficient, management effectiveness shows promise, indicating potential for substantial improvement.

In conclusion, even if remote work is a cost-effective method for public utility services and decreases indirect employee costs, it has yet to be incorporated successfully. The results indicate that the economic effectiveness of remote work falls short of the desired level. Therefore, public utility services need to strengthen infrastructure, innovate their remote systems, invest human capital and reorganize their strategies regarding allocating resources, technology and management categories to enhance economic effectiveness when operating remotely.

Public utility services and transnational companies were compared in terms of economic effectiveness in allocating resources, technology, and management categories. It is revealed that there are significant differences regarding each category in favor of transnational companies. Consequently, transnational companies have successfully employed remote work. In other words, the economic effectiveness of remote work is high in transnational companies. However, there is room for improvement.

On the contrary, public utility services unsuccessfully applied for remote work, and they must reevaluate their remote work strategies and procedures to achieve better economic effectiveness. That is why assessing transnational companies' remote work operations is critical to boosting the economic effectiveness of remote work in public utility services. On this point, public

utility services can apply benchmarking with transnational companies to improve the effectiveness of remote work operations. Finally, future studies should be conducted to evaluate challenges regarding remote work in the public utility sector. Also, applying a comprehensive study with a similar research methodology to private and public sector organizations is advisable.

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Appendix 1. Survey Form for Public Utility Sector Institutions

1. Proszę wpisać nazwę swojego wydziału lub biura.* (dalej w ankiecie używane jest pojęcie wydziału, prosimy traktować je wymiennie z pojęciem biura)	**2.** Jaka część pracowników wydziału pracuje zdalnie (niezależnie od zakresu tej pracy, biorąc pod uwagę ostatnie 12 miesięcy)? **0**- Nikt nie pracuje zdalnie **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%)Wszyscy pracują zdalnie	**3.** Jaką część miesięcznego czasu pracowników wydziału zajmuje praca zdalna? **0** – Brak pracy zdalnej **1** (20%) 2 (40%) 3 (60%) **4** (80%) **5** (100%) – Wyłącznie praca w trybie zdalnym	**4.** Uogólniając w jakim zakresie pracownicy pracujący zdalnie wyposażeni są w urządzenia biurowe (komputer, monitor, kamera,mikrofon, drukarka)? **0** - Nie, nikt nie jest w Pełni wyposażony **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - cały zespół ma pełny dostęp do takich urządzeń w domu
5. Uogólniając w jakim zakresie pracodawca jest właścicielem urządzań biurowych pracowników pracujących zdalnie (komputer,monitor,kamera, mikrofon, drukarka)? **0** – Pracownicy pracują w Domu używając prywatnych urządzeń **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) – Pracodawca zapłacił za sprzęt wykorzystyw any w domu do pracy zdalnej	**6.** Uogólniając w jakim zakresie pracownicy pracujący zdalnie mają dostęp do wymaganej na ich stanowisku infrastruktury sieciowej (wspólne bazy danych, dokumenty elektroniczne, zintegrowane systemy zarządzania)? **0** - Nikt nie ma dostępu **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) – Cały zespół ma pełen dostęp	**7.** W jakim zakresie pracodawca ponosi koszty dostępu do Internetu pracowników pracujących zdalnie? **0** – Pracownicy w pełni płaca za Internet pracując w domu **1** (20%) **2** (40%) **3**(60%) **4** (80%) **5** (100%) - Pełne koszty pokrywa pracodawca	**8.** Czy pracodawca prowadzi badania wśród pracowników pracujących zdalnie, w celu określenia ich potrzeb w wyposażeniu sprzętowym? **0** - Nie, nigdy **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - Tak, regularnie w zakresie wszystkich pracowników
9. Czy pracownicy mogą bezpośrednio korzystać z pomocy technicznej (tzw. help desk) jeśli mają problemy techniczne podczas w pracy zdalnej? **0** - Nie, nie mamy takiego wsparcia **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - Tak, takie wsparcie zapewnione jest przynajmniej 12 godzin na dobę	**10.** Jaka część rocznego budżetu wydziału (biorąc pod uwagę budżet z roku 2021) przeznaczana jest na finansowanie infrastruktury ICT lub/ i dostępów do oprogramowania umożliwiającego realizację pracy zdalnej? **0** – Nie przewidujemy takich wydatków **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - Wszystkie wydatki kierowane są na te cele	**11.** Czy pracodawca finansuje pracownikom pracującym zdalnie pomoc w dostosowaniu się do pracy zdalnej, dotyczącą na przykład: dostosowania ergonomii miejsca pracy, konsultacji z fizjoterapeutą, psychologiem? **0** - Nie **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - Tak	**12.** Jaki odsetek pracowników wydziału szkoli się przynajmniej raz w roku, aby doskonalić umiejętności pracy w trybie zdalnym? **0** - Nikt **1** (20%) **2** (40%) **3** (60%) **4** (80%) **5** (100%) - Wszyscy pracownicy
13. Według Państwa szacunków, jaka część rocznego budżetu wydziału (biorąc pod uwagę budżet	**14.** Według Państwa szacunków, jaka część szkoleń w skali roku ma wewnętrzny	**15.** Czy pracownicy pracujący zdalnie zgłaszają potrzeby w zakresie dokształcania	**16.** Czy pracodawca pokrywa koszty utrzymania home office np. poprzez ryczałt, bonifikatę (prąd,

z roku 2021) przeznaczana jest na finansowanie szkoleń wzmacniających kompetencje pracowników z zakresie umiejętności pracy w trybie zdalnym? 0 – Nie przewidujemy takich wydatków 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) –Wszystkie wydatki kierowane są na te cele	charakter tj. szkolenie pracowników przez pracowników (biorąc pod uwagę rok 2021 w Państwa wydziale)? 0 – Nie realizujemy wewnętrznych szkoleń 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Wszystkie szkolenia są wewnętrzne	się determinowane innowacjami i modernizacją infrastruktury ICT oraz oprogramowania? 0 - Nie, nikt 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) -Tak, wszyscy	woda, CO, śmieci)? 0 - Nie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak, w pełni
17. Czy organizacja pracy w trybie zdalnym poprawia efektywność zarządzania czasem? 0 - Nie, ten tryb pracy jest bardziej czasochłonny, realizujemy mniej zadań w określonym czasie pracy 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak, realizujemy więcej zadań w określonym czasiepracy lub dokładniej realizujemy dotychczaso we	**18.** Czy pracodawca organizuje dla pracowników pracujących zdalnie spotkania formalne i nieformalne w celu wymiany wiedzy cichej (nieskodyfikowanej w procedurach i regulaminach)? 0 - Nie, nigdy 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak, regularnie	**19.** Czy pracodawca rejestruje wymianę wiedzy nieformalnej i spostrzeżenia pracowników pracujących zdalnie (np w formie grup dyskusyjnych, chatów, nagrań, bazy pomysłów,itp)? 0 - Nie, nigdy 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak, regularnie	**20.** Oszacuj liczbę pracowników w wydziale włącznie z kadrą kierowniczą, których najlepiej opisują następujące cechy (mają przewagę takich cech): osoby, które w swoim życiu lubią mieć wszystko poukładane, wszystko planują, lubią stabilne otoczenie i procedury (proszę wpisać liczbę) ……..
21. Oszacuj liczbę pracowników w wydziale włącznie z kadra kierowniczą, których najlepiej opisują cechy (mają przewagę takich cech): osoby zasadnicze, szybkie w podejmowaniu decyzji, praktyczne, odpowiedzialne, odważne, zasadniczo nastawione do pracy (proszę wpisać liczbę)	**22.** Oszacuj liczbę pracowników w wydziale włącznie z kadrą kierowniczą, których najlepiej opisują następujące cechy (mają przewagę takich cech): osoby spokojne,ceniące harmonię, nie lubiące zmian, o wysokim poziomie empatii i jednocześnie mało asertywne (proszę wpisać liczbę)	**23.** Oszacuj liczbę pracowników w wydziale włącznie z kadrą kierowniczą, których najlepiej opisują następujące cechy (mają przewagę takich cech): osoby spontaniczne, komunikatywne, radosne, pewne siebie, czerpiące satysfakcję z kontaktów społecznych (proszę wpisać liczbę)	**24.** Wskaż, czy w wydziale są pracownicy, którzy pełnią następujące role (jeden pracownik może pełnić kilka ról) • Praktyczny organizator • Koordynator – naturalny lider • Innowator – Kreator • Analityk – Sędzia • Poszukiwacz źródeł – człowiek od kontaktów • Perfekcjonista – skrupulatny wykonawca • Człowiek grupy – dusza zespołu – gracz grupowy • Realizator-implementator • Specjalista
25. Jaką część wszystkich aktywności w wydziale planujecie wyłącznie w trybie zdalnym? 0 – Plany przygotowujemy wyłącznie w biurze 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) –	**26.** Jaką część wszystkich ważnych decyzji w wydziale podejmujecie wyłącznie w trybie zdalnym? 0 – Żadnej ważnej decyzji nie podejmujemy w trybie zdalnym 1 (20%) 2	**27.** Jaką część wszystkich decyzji w wydziale komunikujecie pracownikom wyłącznie w trybie zdalnym? 0 – Żadnej ważnej decyzji nie	**28.** Jaką cześć wszystkich zaplanowanych aktywności o charakterze strategicznym i bieżącym realizujecie w wydziale w trybie zdalnym? 0 – Żadnej aktywności nie realizujemy w trybie zdalnym 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) -

Wszystko planujemy w kontakcie zdalnym	(40%) 3 (60%) 4 (80%) 5 (100%) – O wszystkim decydujemy w trybie zdalnym	komunikuje my pracownikom zdalnie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – O wszystkim informujemy się od początku do końca trybie zdalnym	Wszystkie aktywności realizujemy w trybie zdalnym
29. W jakim stopniu praca w formie zdalnej pozwala osiągać wszystkie zaplanowane cele (realizować projekty badawcze, publikacje, i przygotowanie do zajęć)? 0 – Nie osiągamy celów pracując zdalnie, to tylko tymczasowa forma 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Osiągamy wszystkie cele	**30.** Jaką część zadań i projektów kontrolujecie wyłącznie w trybie zdalnym? 0 – Żadnego zadania i projektu nie kontrolujemy wyłącznie w trybie zdalnym 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Wszystkie zadania i projekty kontrolujemy wyłącznie w trybie zdalnym	**31.** Z jaką częstotliwością podczas pracy zdalnej kontrolowane są zadania stawiane przed pracownikami wydziału? 0 (nie kontrolujemy zadań) 1 (raporty roczne lub rzadsze) 2 (półroczne) 3 (kwartalne) 4 (tygodniowe) 5 (dzienne)	**32.** Jaki jest podstawowy/ dominujący sposób kontroli podczas pracy zdalnej pracowników wydziału? 0 (brak kontroli) 1 (niesformaliz owana rozmowa) 2 (zaplanowane spotkania i raportowanie) 3 (nie zapowie dziane kontrole podczas pracy) 4 (dostęp zdalny kierownika na komputery pracowników) 5 (raporty pisemne)
33. Czy używasz takich samych narzędzi motywacji w odniesieniu do pracowników pracujących zdalnie, jak i pracujących w biurze (jeśli aktualnie wszyscy pracują zdalnie, to w porównaniu do pracy wykonywanej w biurze w ostatnich trzech latach)? 0- Zupełnie innych narzędzi lub w innej formie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Dokładnie takich samych narzędzi	**34.** Uszereguj grupy narzędzi motywacyjnych od najskuteczniejszego (1) do najmniej skutecznego (8) w odniesieniu do pracowników pracujących zdalnie: • Pochwały, wyróżnienia • Rozmowy motywacyjne, porady • Nagrody materialne w tym pieniężne • Regulaminy, instrukcje,kary • Systemy ocen, badanie opinii • Elastyczny czas pracy i samodzielność • Komfort pracy, silnepozytywne związki nieformalne • Inne	**35.** Czy masz formalną listę procedur/ instrukcji, której muszą przestrzegać pracownicy pracujący zdalnie? 0 - Nie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak, dla wszystkich procesów	**36.** W jakim zakresie pracownicy uczestniczą w tworzeniu standardów i procedur dotyczących pracy zdalnej? 0 – Nie uczestniczą w ogóle 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Są w pełni zaangażowa ni w tworzenie standardów i procedur
37. Czy podczas pracy zdalnej mierzony jest poziom zadowolenia klientów z kontaktu z pracownikiem?	**38.** Czy prowadzicie badania dotyczące potrzeb, preferencji lub wymagań klientów w zakresie usług	**39.** Jaki jest sposób relacji w wydziale pomiędzy pracownikami i kierownictwem	**40.** Jaki jest dominujący zakres relacji pracowników wydziału z pracownikami innych wydziałów? 0 – Brak relacji pomiędzy

0 - Nie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak	świadczonych w formie zdalnej? 0 - Nie 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Tak	pracującymi w trybie zdalnym? 0 – Brak relacji pomiędzy pracownikami 1 Dominują relacje indywidualne pracownika z kierownikiem 2 Dominują relacje indywidualne pomiędzy pracownikami 3 -Dominują relacje podczas formalnych spotkań zespołu online 4 Dominują relacje podczas formalnych spotkań zespołu w biurze 5 – Pracujemy najczęściej wspólnie w zespole używając wspólnych platform komunikacji	pracownikami 1 – Komunikacja ma charakter maszynowy – etapy realizacji procesów np. w systemie EOD 2 – Relacje indywidualne pomiędzy pracownikami 3 – Relacje podczas formalnych spotkań online 4 – Relacje podczas formalnych spotkań w biurze 5 – Pracujemy najczęściej w zespołach interdyscyplinarnych na wspólnych platformach komunikacji
41. Czy pracując w systemie zdalnym, masz wystarczająco dużo czasu na prywatne życie? 0 - Nie, mam zbyt mało czasu na życie prywatne 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Tak, ten typ pracy pozwala mi realizować moje prywatne plany	**42.** Czy praca w trybie zdalnym ułatwia osiąganie równowagi pomiędzy życiem zawodowym a prywatnym? 0 – Praca zdalna przeszkadza mi w życiu prywatnym 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Praca zdalna ułatwia mi osiąganie równowagi pomiędzy życiem zawodowym i prywatnym	**43.** W jaki sposób praca zdalna wpływa na kreatywność i innowacyjność? 0 – Pozbawia kreatywności i działań innowacyjnych 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Pozwala na dużą kreatywność i zachowania innowacyjne w pracy	**44.** Czy w trybie zdalnym wspólnie a pracownikami dyskutujecie nad nowymi rozwiązaniami, ideami, strategiami? 0 - Nie, nigdy 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Tak, regularnie organizujemy spotkania w zespole zdalnie w tym celu
45. Jaki jest zakres możliwości podejmowania decyzji przez pracowników pracujących zdalnie? 0- Minimalny, wszystko jest zdefiniowane w procedurach 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- Szeroki, pracownicy dokonują wyborów narzędzi i sposobów realizacji celów	**46.** Jaki jest poziom zaangażowania pracownika w pracę podczas pracy zdalnej? 0 – Praca polega na rutynowej aktywności 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- Wysoki, praca wymaga kreatywności i indywidualnego podejścia do zadań	**47.** Czy pracownicy qwydziału mają możliwość samodzielnej modyfikacji zadań? 0 - Nie 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Tak	**48.** Jak ogólnie można ocenić kompetencje pracowników w wydziale? 0 - Niskie 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Wysokie
49. Kto jest wykonawcą finalnych zdań? 0-Indywidualny pracownik	**50.** Czy w wydziale występuje proces dzielenia się władzą?	**51.** W jakim wieku jest kierownik wydziału?	**52.** Jaki jest staż pracy kierownika na aktualnym stanowisku?

1 -(20%) 2 (40%) 3 (60%) 4 (80%) 5 Zespół	0 - Nie 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Tak	• w wieku 18-25 lat (Generacja Z) • w wieku 26-40 lat (Generacja Y) • w wieku 41-56 lat (Generacja X) • w wieku powyżej 57 lat (Generacja Baby Boomers)	
53. Jaki jest stan cywilny kierownika? • Wolny, rozwiedziony, wdowa, wdowiec • Partnerstwo, mężatka, żonaty	**54.** Liczba kobiet w wydziale (niezależnie od wymiaru zatrudnienia):	**55.** Liczba mężczyzn w wydziale (niezależnie od wymiaru zatrudnienia):	**56.** Liczba pracowników włącznie z kadrą kierowniczą pochodzących z Polski:
57. Liczba pracowników włącznie z kadrą kierowniczą pochodzących z innych krajów niż Polska:	**58.** Liczba pracowników włącznie z kadrą kierowniczą w wieku powyżej 57 lat (Generacja Baby Boomers):	**59.** Liczba pracowników włącznie z kadrą kierowniczą w wieku 41-56 lat (Generacja X):	**60.** Liczba pracowników włącznie z kadrą kierowniczą w wieku 26-40 lat (Generacja Y):
61. Liczba pracowników włącznie z kadrą kierowniczą w wieku 18-25 lat (Generacja Z):			

Appendix 2. Survey Form for Utility Expenses Data in Public Utility Sector Institutions

Categories of infrastructure maintenance costs:	**Measurement units**	**Period**			
Media:	**Annual consumption in:**	**2019 (I-XII)**	**2020 (I-XII)**	**2021 (I-XII)**	**2022 (I-XII)**
Electricity	kWh				
Cold water	m^3				
Warm water	m^3				
Heating buildings: gas consumption	m^3				
Heating buildings: the cost of water from the municipal network	PLN/year				
comments:					
Type of expenses:	**Total expenses for 1 year**	**2019 (I-XII)**	**2020 (I-XII)**	**2021 (I-XII)**	**2022 (I-XII)**
Cleaning products (soap, toilet paper, towels, disinfectants, etc..)	PLN/year				
Maintaining order and cleanliness	PLN/year				
alternatively: Maintaining order and cleanliness, including cleaning products	PLN/year				
Building protection and monitoring	PLN/year				
Waste collection	PLN/year				
comments:					
Information about users:	**Amount**	**XII.2019**	**XII.2020**	**XII.2021**	**XII.2022**
Total number of FTEs for maintenance staff	number of persons				
Total number of FTEs of office workers at all levels	number of persons				
Total number of students	number of persons				
comments:					

Appendix 3. Survey Form for Transnational Companies

1. Please, enter the name of your team or area of activity:	**2.** What part of the team's employees work remotely (regardless of the extent of this work, considering the last 12 months)? 0 – Nobody 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5- (100%) Everyone works remotely	**3.** How much of the team's employees' monthly time is taken up by remote work? 0 - No remote operation 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) -Remote operation only	**4.** Generalizing, to what extent are remote workers equipped with office equipment (computer, monitor, camera,microphone, printer)? 0 - No, no one have full set 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Yes, the whole team has full access to such devices in the home
5. Generalizing to what extent does the employer own the office equipment of employees working remotely (computer,monitor, camera, microphone, printer)? 0 - Employees work from home using private devices 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – The employer paid for the equipment used at home for remote work	**6.** Generalizing to what extent do employees working remotely have access to the network infrastructure required for their position (shared databases, electronic documents, integrated management systems)? 0 - No one have the access 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Whole team have full access	**7.** To what extent does the employer bear the cost of Internet access for employees working remotely? 0 - Employees fully pay for the Internet when they work from home 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – The employer covers the full costs	**8.** Does the employer survey employees working remotely to determine their needs in equipment? 0 - No, never 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Yes, regularly for all employees
9. Can employees directly use the help desk if they have technical problems while working remotely? 0 - No, we do not have such support 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Yes, such support is provided at least 12 hours a day	**10.** What part of the team's annual budget (taking into account the 2022 budget) is used to fund ICT infrastructure and/or access to software to enable remote work? 0 – Nothing 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) -Whole budget	**11.** Does the employer fund employees working remotely to help them adapt to remote work, concerning, for example: adjusting the ergonomics of the workplace, consulting a physiotherapist, psychologist? 0 - No 1 (20%) 2 (40%)3 (60%) 4 (80%) 5 (100%) - Yes	**12.** What percentage of team members receive training at least once a year to improve their remote working skills? 0 - No one 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Whole team
13. According to your estimates, what part of the team's annual budget (taking into account the 2022 budget) is spent on funding training to strengthen employees' remote working skills? If the team leader does not manage a dedicated budget, estimate the share of training expenses of the team's	**14.** According to your estimate, what part of the training per year is internal, i.e., training of employees by employees (considering 2022 in your team)? 0 - No one internal 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Every internal	**15.** Do employees who work remotely report needs for further training determined by innovations and upgrades in ICT infrastructure and software? 0 - No one 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) –Yes, everybody	**16.** Does the employer cover the cost of maintaining the home office, e.g. through a lump sum, a rebate (electricity, water, CO, garbage)? 0 - No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes, fully

employees in relation to their salaries on an annual basis. 0 – Nothing 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%)			
17. Does organizing work remotely improve time management efficiency? 0 - No, this mode of operation is more time consuming, we complete fewer tasks within a given working time 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Yes, we carry out more tasks within a certain working time or more precisely we carry out the existing ones	**18.** Does the employer hold formal and informal meetings for employees working remotely to share tacit knowledge (not codified in procedures and regulations)? 0 – No, never 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes, regularly	**19.** Does the employer record the exchange of informal knowledge and insights of employees working remotely (e.g., in the form of discussion groups, chat rooms, recordings, idea database, etc.)? 0 – No, never 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes, regularly	**20.** Estimate the number of employees in the team including managers who are best described by the following characteristics (have a preponderance of such characteristics): persons who in their lives like to have everything arranged, plan everything, like a stable environment and procedures (please enter a number) …….
21. Estimate the number of employees in the team including managers who are best described by the qualities (have a preponderance of such qualities): persons who are principled, quick to make decisions, practical, responsible, courageous, fundamentally-minded (please enter a number)	**22.** Estimate the number of employees in the team including managers who are best described by the following traits (have a preponderance of such traits): persons who are calm,value harmony, do not like change, with a high level of empathy and at the same time not very assertive (please enter a number)	**23.** Estimate the number of employees in the team, including managers, who are best described by the following characteristics (they have the advantage of such characteristics): spontaneous, communicative, joyful, self-confident, enjoying social contact (please enter the number)	**24.** Indicate whether there are employees in the team who perform the following roles (one employee can perform several roles) • Practical organizer • Coordinator - the natural leader • Innovator - Creator • Analyst - Judge • Source-seeker - a man of contacts. • Perfectionist - meticulous performer • Group man - team soul - group player • Executor - implementer • Expert
25. How much of all team activity do you plan to do exclusively remotely? 0 - We prepare plans only in the office 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – We plan everything in remote contact	**26.** What part of all important decisions in the team do you make exclusively remotely? 0 - We do not make any important decisions remotely 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - We decide everything remotely	**27.** How much of all team decisions do you communicate to employees exclusively remotely? 0 - We do not communicate any important decisions to employees remotely 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5(100%) – We inform ourselves about everything from start to finish in remote mode	**28.** What part of all planned activities of a strategic and ongoing nature do you carry out in the team remotely? 0 - We do not carry out any activities in remote mode 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – All activities are carried out remotely

29. To what extent does working remotely allow you to achieve all your planned goals? 0 - We don't achieve goals only remote working, it's just a temporary form 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - We realize all the goals	**30.** What part of the tasks and projects do you control exclusively remotely? 0 - We do not control any task or project only in remote mode 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – All tasks and We control projects only remotely	**31.** During remote work, with what frequency are the tasks given to team members controlled? 0 (we do not audit tasks) 1 (annual or less frequent reports) 2 (semi-annual) 3 (quarterly) 4 (weekly) 5 (daily)	**32.** What is the primary/dominant method of control when team members work remotely? 0 (no control) 1 (informal interview) 2 (scheduled meetings and reporting) 3 (unannounced on-the-job controls) 4 (remote access of the manager to employees' computers) 5 (written reports)
33. Do you use the same motivation tools for employees working remotely as you do for those working in the office (if everyone is currently working remotely, compared to work done in the office in the last three years)? 0 - Completely different tools or in a different form 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Exactly the same tools	**34.** Rank groups of motivational tools from most effective (1) to least effective (8) for remote workers: • Motivational interviews, advice • Regulations, instructions, penalties • Material rewards, including money • Assessment systems, opinion polls • Praise, distinctions • Comfort at work, strong positive informal relationships • Flexible working time and independence • Other	**35.** Do you have a formal list of procedures/instructions that employees working remotely must follow? 0 - No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) - Yes, for all processes	**36.** To what extent do employees participate in the development of standards and procedures for remote work? 0 - Do not participate at all 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Are fully involved in the development of standards and procedures
37. When working remotely, is customer satisfaction with the employee contact measured(such as client satisfaction survey)? 0 – No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes	**38.** Do you conduct research on customer needs, preferences or requirements for remote services? 0 – No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes	**39.** What is the dominant way of relationship between employees and management working remotely? 0 – No relations between employees 1- Individual relations between employees and manager dominate 2- Individual relations between employees dominate 3- Relationships during formal on-line team meetings dominate 4- Relationships during formal team meetings in the office dominate 5- We usually work together in a team using common communication n platforms	**40.** What is the predominant extent of the relationship of the team's employees with employees of other teams? 0 – No relations between employees 1 -Communication is machine- based - stages of process implementation , e.g. in the Electronic Document Circulation system 2 - (Individual relations between employees dominate 3 - Relationships during formal on-line team meetings dominate 4 -Relationships during formal team meetings in the office dominate 5 - We most often work in interdisciplinary teams on common communication platforms

41. When working remotely, do you have enough time for your private life? (Team leader's own opinion) 0 - No, I have too little time for my private life 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Yes, this type work allows me to pursue my private plans	**42.** Does working remotely make it easier to achieve work-life balance? (Team leader's own opinion) 0 - Remote work disturbs my private life 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5-Remote work helps me achieve balance between work and private life	**43.** How does remote work affect creativity and innovation? 0 - It deprives creativity and innovative activities 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5 Yes, it allows to be very creative and behave innovative at work	**44.** Do you and your employees discuss new solutions, ideas, strategies together remotely? 0 - No never 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- Yes, we regularly organize remote team meetings for this purpose
45. What is the extent of the decision-making capacity of employees working remotely? 0 - Minimal, everything is defined in procedures 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- Wide, workers make tool selections and ways to achieve goals	**46.** What is an employee's level of commitment to work when working remotely? 0 - The work involves routine activity 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- High, work requires creativity and individual approach to tasks	**47.** Do team members have the ability to modify tasks on their own? 0 – No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes	**48.** In general, how can you assess the competence of the employees on your team? 0 – Low 1 - (20%) 2 (40%) 3 (60%) 4 (80%) 5- High
49. Who is the final executor of the tasks? 0 - Individual employee 1-(20%) 2 (40%) 3 (60%) 4 (80%) 5- Team	**50.** Is there a power-sharing process in the team? 0 – No 1 (20%) 2 (40%) 3 (60%) 4 (80%) 5 (100%) – Yes	**51.** How old are you? • aged 18-25 (Generation Z) • aged 26-40 (Generation Y) • aged 41-56 (Generation X) • aged over 57 (Baby Boomers Generation)	**52.** What is your seniority in the current position(experience in current position)?
53. What is your marital status? • Single, divorced, widowed, widower • Partnership, married	**54.** Number of women in the team (regardless of the dimension of employment):	**55.** The number of men in the team (regardless of the dimension of employment):	**56.** Number of employees in the team including management from Poland:
57. Number of employees in the team including management coming from countries other than Poland:	**58.** Number of employees in the team including executives over the age of 57 (Baby Boomers Generation):	**59.** Number of employees in the team including executives aged 41-56 (Generation X):	**60.** Number of employees on the team including executives aged 26-40 (Generation Y):
61. Number of employees in the team including executives aged 18-25 (Generation Z):			

Table 50. Matrix of survey questions (surveys 1 and 3) that are used to identify perspectives on the economic effectiveness of remote work

Perspective of the economic effectiveness of remote work	Components of perspective	Number of survey questions
Resource allocation effectiveness	*Knowledge sharing and equipment needs*	**8,18,19**
	Budget allocation for infrastructure, training and employee support	**10,11,13**
	Remote work participation and time allocation	**2,3**
	Employer support for home office costs	**7,16**
Technological effectiveness		**4,5,6,9,14**
Management effectiveness	**Purposeful approach**	
	Plan-do-check-act (PDCA) Deming cycle	**25,26,27,28,29,30**
	Monitoring remote work performance	**31,32**
	System approach	
	Research and Development Activities	**37,38**
	Relational Capital	**35,39,40**
	Multi-criteria approach	**17,41,42**
	Team management approach	**45,46,47,48,49,50**

Source: own prepared