Chapter 3

Research Methodology

This research is quantitative research. The details about the research method are as follows:

1. Research Design
2. Population and Sample
3. Variables, Operational Definitions, and Measurements
4. Research Instruments
5. Measurement of Validity and Reliability
6. Data Collection
7. Data Analysis
8. Ethical Decision
9. Conclusion

Research Design

In this research, a quantitative research design is adopted to obtain the relationship between the relevant factors in the remote, including Teleworker Characteristics, Job Characteristics, Communication, Management, Organizational Culture, Environment, Asynchronous work, Technology, and impact on remote work output.

A questionnaire was developed based on relevant concepts to obtain reliable and effective relationship evidence for example, which can be applied to employees, managers, and upstream and downstream industry chains involved in remote work.

This study is based on the X-efficiency theory, scientific management principle, and lean production theory, combined with the findings of previous investigations and studies on telecommuting. The 7-level Likert scale method was adopted, After the guidance of the tutor and the review of relevant professionals, the questionnaire was finally obtained.

After summarizing and screening the data collected from the questionnaire, the reliability test, correlation test, and multiple linear regression analysis were conducted for each item to obtain the correlation between the elements of the process, and finally the most widely affected aspects of remote work and the most cost-effective solutions to the problems.

Population and Sample

1. Population

The target population of this study is information technology practitioners in Beijing, Shanghai, Shenzhen, and Qingdao. These include middle and senior management, R&D, testing, operations, project managers, and sales.

2. Sample

Random sampling was used in this study. A total of 12 information technology-related companies, which employ about 3,000 people, will be surveyed.

560 people were selected from the population as samples, and an equivalent number of samples were randomly selected from 6 job types. The reason for selecting this sample is that it is expected to represent the characteristics of the entire IT industry.

The number of samples is calculated according to the following formula.

N is the population size. e is the acceptable sampling error.

$$n = \frac{N}{1+N*(e)^2}$$

Based on the 95% confidence, 3000/(1+3000*0.05*0.05)=352, so at least 352 valid samples are needed, and finally 500 valid samples are obtained after collecting samples from 560 people.

Since there are many job types for information technology workers, there are certain differences. In order to have wider representativeness, questionnaires are distributed to different types of workers through stratified sampling. Then random sampling was used to select participants from each level.

Variables, Operational Definitions, and Measurements

1. Dependent Variable

In this study, the output of telecommuting is mainly expressed using the following three dependent variables. These three factors are important indicators to evaluate employees' overall feelings at work and in their personal lives and have a profound impact on employees' performance, job satisfaction, and life quality. Often, productivity and work-life balance have a direct impact on employee happiness, which in turn affects productivity and work-life balance. Therefore, understanding the

relationship between these three dependent variables can help us better understand the overall work experience and personal life status of employees in the mode of remote work, and provide important guiding significance for improving employee happiness and work efficiency.

1) Job effectiveness refers to an employee's ability to achieve expected objectives in his work and whether he can accomplish tasks effectively in the course of his work. It is usually measured by job performance appraisal, including work quality, work efficiency, and work attitude. By referring to Laschinger, et al., (1999), Kahya (2009), Werbel (2000), and Platis, et al. (2015) formulated relevant issues.

2) Work-life balance refers to the degree of balance between Work and life, that is, whether an employee can achieve a state of balance between work and personal life. It can be measured by factors such as working hours, work intensity, and personal quality of life. By referring to Hayman (2005), Bell, et al. (2012), and Le, et al. (2020) formulated relevant questions.

3) Well-being refers to the overall feeling of an individual's physical, emotional, psychological, and states. As a comprehensive concept, it is related to physical health, positive emotions, self-actualization, interpersonal relationships, and self-mastery. It can be measured by factors such as life satisfaction, happiness, anxiety, and depression. By referring to Besika, et al. (2021), Harding (1982), Devins, et al. (1997), and McDowell (2010) formulated relevant questions.

2. Independent Variable

1) Teleworker Characteristics refer to the personal characteristics and characteristics of remote workers, which may have an impact on the working style and efficiency of remote workers. For example, remote workers may be adept at using new technological tools; Experienced remote workers may be more familiar with their work patterns, but they may also be stubborn and reluctant to try new approaches. By referring to Maruyama, et al. (2009), Nakrošienė, et al. (2019), and O'Neill, et al. (2009) formulated relevant questions.

2) Job Characteristics refer to the characteristics and attributes of a job, including the type of work, the content of work, the difficulty of work, the pressure of work, and the working environment. These characteristics and attributes may have an impact on remote workers' productivity and well-being. By referring to Sims et al. (1976), Karasek, et al. (1998), Dunham (1976), and Fried (1991) formulated relevant questions.

3) Communication refers to the way people exchange information and communicate with each other in a remote working environment. Good, positive communication may have a positive impact on work efficiency and happiness. Referring to Rubin, et al. (1994), Hecht (1978), McCroskey (1992), and Mundy, et al. (2003) formulated relevant issues.

4) Management refers to how leaders manage and oversee the work of their teams in a remote working environment. Managers need to set clear work plans and goals and monitor the progress and results of remote workers. For remote work environments, managers need to focus more on communication and trust and need to manage work more flexibly and openly. Good management can promote work coordination and cooperation, and improve work efficiency and quality. By referring to Grant, et al. (2019), Barsness, et al. (2005), Tramontano, et al. (2021), and Martin, et al. (2010) formulated relevant issues.

5) Organizational culture refers to the common beliefs, values, and norms of behavior of an organization. In a remote working environment, organizational culture can influence employees' attitudes and behaviors at work, as well as how they understand and adapt to the organization's working style. Good organizational culture can promote employees' job satisfaction and happiness, and improve their work efficiency and quality. Referring to Gregory, et al. (2009), Jung, et al. (2009), Seren, et al. (2007), and Petty, et al. (1995) formulated relevant issues.

6) The Environment includes the environmental factors of the family, the community, the city, and the country. These factors can have an impact on remote workers' productivity, satisfaction, and health, among other things. For example, noise, light, and air quality in the workplace may affect productivity and physical health, safety and amenities in the community may affect job stability and productivity, and traffic conditions and the cost of living in a city may affect work-life balance and satisfaction. Therefore, environmental factors need to be considered in studies of remote work efficiency, quality, and well-being. By referring to Moos and Insel (1974), Mabile, et al. (1989), Amabile, et al. (1996), Schepers and Van Den Berg (2007), and Kristensen, et. al (2005) formulated relevant issues.

7) Asynchronous work means completing work tasks at different times, places, and speeds. This way of working has become a common form of remote working. Asynchronous working improves flexibility, productivity, and work-life balance. Therefore, the relationship between asynchronous work and remote work efficiency, quality, and happiness needs to be studied. By referring to Dittus, et al. (2017), Barber, et al. (2015), McDaniels, et al. (2016), and Günes and Alagözlü (2020) formulated relevant issues.

8) Technology is one of the most important factors in remote working. Not only does it provide the infrastructure and platform needed to work remotely, but it also affects the productivity, satisfaction, and happiness of remote workers. However, technical failures, instability, and inadaptability can lead to communication and collaboration problems, which in turn affect productivity and quality. Therefore, the relationship between technology and remote work efficiency, quality, and well-being needs to be studied. By referring to Molino, et al. (2021), Wu (2011), Liu (2010), and Jaradat and Smadi (2013) formulated relevant issues.

Table 3.1 Operational definitions and a list of measurements are presented in following

Variables	Operational Definitions	Measurements
Job effectiveness	Job effectiveness refers to an employee's ability to achieve expected objectives in his work and whether he can accomplish tasks effectively in the course of his work.	I get more done in less time. I always correctly estimate how long a task will take to complete. I automate common tasks to reduce repetitive work. I will take the initiative to find new working methods and tools to improve my efficiency.
Work-life balance	Work-life balance refers to the degree of balance between Work and life, that is, whether an employee can achieve a state of balance between work and personal life	I have enough time to take care of my family and personal needs. Working remotely has had a positive impact on my life. I have plenty of time to rest and relax. I feel the pressure of work has been effectively relieved.
Well-being	Well-being refers to the overall feeling of an individual's physical, emotional, psychological, and states.	I never feel helpless. I can get enough feedback and recognition. I feel my personal growth has increased. I am more free and flexible.

Environment	The Environment includes the environmental factors of the family, the community, the city and the country. These factors can have an impact on remote workers' productivity, satisfaction and health, among other things.	I have a satisfactory work area. I can work as conveniently as in a company. My clients and partners support me in telecommuting. My company or the local government provides adequate policy and legal support for telecommuting.

Table 3.1 Operational definitions and a list of measurements are presented in following (Cont.)

Variables	Operational Definitions	Measurements
Job Characteristics	Job Characteristics refer to the characteristics and attributes of a job, including the type of work, the content of work, the difficulty of work, the pressure of work and the working environment.	I'm used to using various digital tools to coordinate my work. Working remotely does come with a certain amount of loneliness and stress. There are often different tasks going on at the same time. My work is important to the rest of the team.
Teleworker Characteristics	Teleworker Characteristics refer to the personal characteristics and characteristics of remote workers, which may have an impact on the working style and efficiency of remote workers.	I tend to work in an independent, autonomous and self-motivated environment. I have enough self-discipline to complete the task without supervision. I'm good at multitasking. I tend to take the initiative to communicate and cooperate with colleagues to complete the work better.
Communication	Communication refers to the way people exchange information and communicate with each other in a remote working environment.	I am able to express my views and ideas clearly and avoid ambiguity and misunderstanding. I like to take the initiative to communicate and give feedback one-on-one with team members. I am fully aware of the progress of my team members.

		I believe that documents and emails should be clear and concise so that team members can quickly understand them.

Table 3.1 Operational definitions and a list of measurements are presented in following (Cont.)

Variables	Operational Definitions	Measurements
Management	Management refers to how leaders manage and oversee the work of their teams in a remote working environment.	I think communication should respect different cultures and backgrounds to avoid cultural conflicts and misunderstandings. My supervisor is always active and helpful to the members. I have enough trust in my supervisor. My supervisor tried to avoid adding extra stress to my work. My supervisor is very supportive and encourages collaboration and mutual help among team members. My supervisor clearly sets team goals and expectations.
Organizational culture	Organizational culture refers to the common beliefs, values and norms of behavior of an organization. In a remote working environment, organizational culture can influence employees' attitudes and behaviors at work, as well as how they understand and adapt to the organization's working style.	The organization has sufficient support and emphasis on remote work. Organize regular activities to promote communication and cooperation among team members. The organization attaches great importance to the career development and training programs of its employees. The organization has a good working atmosphere, which can stimulate my working motivation. The organization encourages me to innovate in my work and life.

Table 3.1 Operational definitions and a list of measurements are presented in following (Cont.)

Variables	Operational Definitions	Measurements
Technology	Technology is one of the most important factors in remote working. Not only does it provide the infrastructure and platform needed to work remotely, but it also affects the productivity, satisfaction, and happiness of remote workers.	My company has strict information security management to protect company secrets. I have easy access to technical support and help. I have several solutions to guarantee the stability and bandwidth of the network (fiber,4G,5G, and different network operators). I have arbitrary access to work-related data. I use the equipment and software compatible with the company or team members.
Asynchronous work	Asynchronous work means completing work tasks at different times, places, and speeds.	I think working asynchronously allows me to better collaborate with more people, especially partners in different time zones or regions. I think asynchronous work allows me to do my planning better and be less influenced by others. I think asynchronous work can avoid a lot of pointless meetings or wait times. In asynchronous work mode, I design redundant plans to avoid having nothing to do if something goes wrong with the front work.

Research Instruments

A Questionnaire survey is adopted as a research tool in this study. The questionnaire is designated according to relevant theories, conceptual framework, and operational definition, which mainly consists of three parts

The first section provides basic personal information, including age, gender, education level, type of work, marital status, partner's work status, whether telecommuting is active or passive, the number of hours in a day, and the number of days in a week.

The second part consists of 8 parts: Teleworker Characteristics, Job Characteristics, Communication, Management, Organizational culture, Environment, Asynchronous work, and Technology. A 7-level scale was used and the measurement results are explained as follows:

6.51-7.00	means	that the behavior, situations, or operations match the reality at the highest level.
5.51-6.50	means	that the behavior, situations, or operations match the reality at a high level.
4.51-5.5	means	that the behavior, situations, or operations match the reality at a somewhat level.
3.51-4.51	means	that the behavior, situations, or operations match the reality at a medium level.
2.51-3.51	means	that the behavior, situations, or operations match the reality at a somewhat level.
1.51-2.51	means	that the behavior, situations, or operations match the reality at a low level.
1.00-1.50	means	that the behavior, situations, or operations match the reality at the lowest level.

The third part consists of three parts: Job effectiveness, Work-life balance, and Well-being. A 7-level scale was used and the measurement results are explained as follows:

6.51-7	means	that the Telework performance was at the highest level.
5.51-6.50	means	that the Telework performance was at the highest level.
4.51-5.50	means	that the Telework performance was at a high level.
3.51-4.50	means	that the Telework performance was at a medium level.
2.51-3.50	means	that the Telework performance was at a low level.
1.51-2.50	means	that the Telework performance was at a low level.
1.00-1.50	means	that the Telework performance was at the lowest level.

Measurement of Validity and Reliability

In order to ensure that the research questionnaire can accurately and reliably measure the variables to be studied and ensure the effectiveness and reliability of the research results, the following reliability checks were made on the questionnaire:

1. Reliability Test

Based on the analysis of past literature, relevant theoretical models were derived. Corresponding independent and dependent variables were obtained, and a comprehensive reliability test was conducted on 8 independent variables and 3 dependent variables in the questionnaire.

1) After the relevant theoretical model is obtained based on the analysis of past literature, the corresponding independent variables and dependent variables are obtained, and then the past literature and scale design are obtained based on these variables.

2) Factor analysis was performed on a sample of 500 people, and Cronbach's alpha coefficient was used to test its reliability.

Cronbach's alpha coefficient of each variable was calculated to test the reliability of the research. The results are shown in the following table: Environment (0.753), Job Characteristics (0.754), Teleworker Characteristics (0.824), Communication (0.887), Management (0.772), Organizational Culture (0.939), Technology (0.826), Asynchronous work (0.807), Job effectiveness (0.938), work-life balance (0.933) and well-being (0.932). They are all above acceptable scores.

Table 3.2 Reliability Statistics of Variables

Variables	Cronbach's Alpha	N of Itimes
Environment	0.753	4
Job_characteristics	0.754	4
Teleworker_characteristics	0.824	4
Communication	0.887	4
Management	0.872	5
Organizational_culture	0.939	5
Technology	0.826	3
Asynchronous_work	0.807	4
job_effectiveness	0.938	4
Work-life_blance	0.933	4
Well-being	0.932	4
All	0.967	45

Table 3.3 Reliability Statistics of Items

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
environment1	148.54	679.476	0.966
environment2	148.38	680.820	0.966
environment3	148.48	680.703	0.966
environment4	148.58	668.384	0.966
Job_Characteristics1	148.97	685.677	0.966
Job_Characteristics2	149.11	729.306	0.970
Job_Characteristics3	148.69	679.882	0.966
Job_Characteristics4	148.92	686.419	0.967
Teleworker_Characteristics1	148.99	679.517	0.966
Teleworker_Characteristics2	148.69	690.876	0.967
Teleworker_Characteristics3	148.72	686.067	0.966
Teleworker_Characteristics4	148.81	672.705	0.966

Table 3.3 Reliability Statistics of Items (Cont.)

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
communication2	148.52	684.619	0.966
communication3	148.26	685.073	0.966
communication4	148.26	685.610	0.967
communication5	148.30	678.021	0.966
Management1	148.92	675.059	0.966
Management2	148.76	678.364	0.966
Management3	148.52	683.994	0.967
Management4	148.71	663.406	0.966
Management5	148.67	673.457	0.966
Organizational_culture1	148.29	660.672	0.966
Organizational_culture2	148.87	649.56	0.966
Organizational_culture3	148.41	662.407	0.967
Organizational_culture4	148.27	658.875	0.966
Organizational_culture5	148.09	666.426	0.966
Technology1	149.14	666.505	0.966
Technology2	148.58	673.567	0.966

Technology5	148.50	688.519	0.967
Asynchronous_work1	148.98	693.150	0.968
Asynchronous_work2	148.64	696.029	0.969
Asynchronous_work3	148.44	701.264	0.968
Asynchronous_work4	147.73	698.641	0.968
job_effectiveness1	148.56	683.201	0.966
job_effectiveness2	148.40	679.443	0.966
job_effectiveness3	148.33	677.198	0.966
job_effectiveness4	148.53	682.470	0.966
work-life_balance1	148.54	686.137	0.966

Table 3.3 Reliability Statistics of Items (Cont.)

Items	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
work-life_balance2	148.57	679.32	0.966
work-life_balance3	148.63	683.339	0.966
work-life_balance4	148.48	681.433	0.966
well-being1	148.68	678.358	0.966
well-being2	148.69	675.891	0.966
well-being3	148.38	664.676	0.965
well-being4	148.39	675.452	0.965

2. Validity Test

Construct validity refers to the extent to which a research tool measures what it intends to measure in terms of theoretical concepts (Locke, 2012, pp. 146-148). By measuring construct validity, researchers can obtain results to improve survey questionnaires. In addition, confirmatory factor analysis can help researchers determine which variables should be included in a questionnaire that contains multiple variables based on theoretical concepts or operational definitions. This technique can prevent researchers from relying solely on personal feelings or opinions to determine factor loading when creating new variables. The results of factor analysis can display the factor loading of each variable and each item (Kim & Mueller, 1978, p. 13). Typically, an acceptable factor loading should not be lower than 0.4 (Budaev, 2010, pp. 472-480).

Principal component extraction and variance rotation factor analysis were conducted for Teleworker Characteristics, Job Characteristics, Communication, Management, Organizational Culture, Environment, Asynchronous work, and Technology. The factor loading results are presented in the table below. The factor loading was divided into 8 dimensions for separate analysis.

Calculate the Kaiser-Meyer-Olkin Measure of Sampling Adequacy for each variable. The results are shown in the following table: Environment (0.678), Job Characteristics (0.673), Teleworker Characteristics (0.778), Communication (0.802), Management (0.748), Organizational Culture (0.833), Technology (0.695), Asynchronous work (0.66), Job effectiveness (0.815), work-life balance (0.858) and well-being (0.846). They are all above acceptable scores.

Table 3.4 KMO and Bartlett's Test for All Variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.963
Bartlett's Test of Sphericity	Approx. Chi-Square	29309.66
	df	990
	Sig.	0

Table 3.5 Construct Validity Test of Variables

Variables	**Communalities**	**Factor loading**	**Cumulative%**
environment			58.679
environment1	0.653	0.808	
environment2	0.595	0.772	
environment3	0.573	0.757	
environment4	0.526	0.725	

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.678
Bartlett's Test of Sphericity	Approx. Chi-Square	563.424
	df	6
	Sig.	0

Variables	**Communalities**	**Factor loading**	**Cumulative%**
Job Characteristics			57.697
Job_Characteristics1	0.497	0.705	
Job_Characteristics2	0.531	-0.729	

Job_Characteristics3	0.684	0.827
Job_Characteristics4	0.596	0.772

Table 3.5 Construct Validity Test of Variables (Cont.)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.673
Bartlett's Test of Sphericity	Approx. Chi-Square	514.624
	df	6
	Sig.	0

Variables	Communalities	Factor loading	Cumulative%
Teleworker Characteristics			65.633
Teleworker_Characteristics1	0.644	0.802	
Teleworker_Characteristics2	0.572	0.756	
Teleworker_Characteristics3	0.64	0.8	
Teleworker_Characteristics4	0.769	0.877	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.778
Bartlett's Test of Sphericity	Approx. Chi-Square		737.929
	df		6
	Sig.		0

Variables	Communalities	Factor loading	Cumulative%
communication			75.253
communication2	0.668	0.818	
communication3	0.814	0.902	
communication4	0.779	0.882	
communication5	0.749	0.866	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.802
Bartlett's Test of Sphericity	Approx. Chi-Square		1181.693
	df		6
	Sig.		0

Table 3.5 Construct Validity Test of Variables (Cont.)

Variables	Communalities	Factor loading	Cumulative%

Management			66.37
Management1	0.602	0.776	
Management2	0.57	0.755	
Management3	0.471	0.686	
Management4	0.854	0.924	
Management5	0.821	0.906	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.748
Bartlett's Test of Sphericity	Approx. Chi-Square		1563.523
	df		10
	Sig.		0

Variables	**Communalities**	**Factor loading**	**Cumulative%**
Organizational culture			80.86
Organisational_culture1	0.887	0.942	
Organisational_culture2	0.811	0.9	
Organisational_culture3	0.807	0.898	
Organisational_culture4	0.853	0.924	
Organisational_culture5	0.686	0.828	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.833
Bartlett's Test of Sphericity	Approx. Chi-Square		2517.047
	df		10
	Sig.		0

Variables	**Communalities**	**Factor loading**	**Cumulative%**
Technology			74.188
Technology1	0.804	0.897	
Technology2	0.759	0.871	
Technology5	0.663	0.814	

Table 3.5 Construct Validity Test of Variables (Cont.)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.695
Bartlett's Test of Sphericity	Approx. Chi-Square	580.294
	df	3
	Sig.	0

Variables	Communalities	Factor loading	Cumulative%
Asynchronous work			66.81
Asynchronous_work1	0.74	0.86	
Asynchronous_work2	0.427	0.654	
Asynchronous_work3	0.676	0.822	
Asynchronous_work4	0.829	0.911	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.66
Bartlett's Test of Sphericity	Approx. Chi-Square		1130.898
	df		6
	Sig.		0

Variables	Communalities	Factor loading	Cumulative%
Job effectiveness			84.592
job_effectiveness1	0.853	0.923	
job_effectiveness2	0.851	0.923	
job_effectiveness3	0.883	0.939	
job_effectiveness4	0.797	0.893	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.815
Bartlett's Test of Sphericity	Approx. Chi-Square		1854.005
	df		6
	Sig.		0

Table 3.5 Construct Validity Test of Variables (Cont.)

Variables	Communalities	Factor loading	Cumulative%
work-life balance			83.552
work-life_balance1	0.849	0.922	
work-life_balance2	0.85	0.922	
work-life_balance3	0.833	0.913	
work-life_balance4	0.81	0.9	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.858
Bartlett's Test of Sphericity	Approx. Chi-Square		1683.421
	df		6
	Sig.		0

Variables	Communalities	Factor loading	Cumulative%
well-being			84.403
well-being1	0.869	0.932	
well-being2	0.859	0.927	
well-being3	0.86	0.927	
well-being4	0.789	0.888	
KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			0.846
Bartlett's Test of Sphericity	Approx. Chi-Square		1807.335
	df		6
	Sig.		0

In the data testing stage, because the validity test failed, the researcher excluded three questions in the actual data analysis, including The first question in the communication part: "I am able to express my views and ideas clearly and avoid ambiguity and misunderstanding." and question 3 of the technical section "I have several solutions to guarantee the stability and bandwidth of the network (fiber, 4G, 5G, and different network operators)." and number 4." I have arbitrary access to work-related data." Questions with low validity mean that these questions do not measure the content of the study well. The validity of the measurement tool was increased by deleting questions with low validity. Cronbach (1951, pp. 297-334). The following table shows the validity analysis of these three questions.

Table 3.6 Questions with Low Validity

Variables	Communalities
Communication1	0.294
Technology3	0.181
Technology4	0.018

Data Collection

Since the questionnaire contains personal information, including the image and feelings of colleagues and superiors, in order to protect the privacy and security of the subjects and enable them to fill in the questionnaire more truly, the electronic

questionnaire is planned to be used by disclosing the questionnaire network address of the subjects.

The network address of the electronic questionnaire will be disclosed through the internal communication platform of these enterprises, and it will be explained in the questionnaire. Multiple enterprises will participate in the questionnaire, so they do not have to worry about the negative influence of their opinions on the company.

1. Data Content:

This study will collect data from seven aspects: environment, self, relationship, management, development and guidance, asynchronous work situation, and open proposal.

The data collected in this study are divided into three parts. The first part is personal basic information, including age, gender, education level, job type, work economy, marital clothing, partner's work status, whether telecommuting is active or passive, telecommuting time in a day and telecommuting days in a week. The second part includes 8 parts: Teleworker Characteristics, Job Characteristics, Communication, Management, Organizational culture, Environment, Asynchronous work, and Technology. The third part includes three parts: Job effectiveness, Work-life balance, and Well-being

2. Data Collection Object:

This study is expected to collect a total of 352 information technology industry practitioners from Beijing, Shanghai, Shenzhen, Qingdao, and other four cities, respectively in 8 fields of Internet, automatic driving, graphic recognition, voice recognition, biomedicine, chip design, automated agriculture, food safety.

3. Data Collection Method:

Questionnaires will be made and collected using questionnaire stars. After the questionnaire is made on the questionnaire star, the corresponding network address will be generated. The author will send this network address to the friends of the target group in the company, and they will publicize the address of the questionnaire in the internal communication system. The questionnaire was collected within 5 working days. The questionnaire star will automatically close the questionnaire at the specified time. The questionnaire will be collected anonymously, and the IP addresses and cookies of respondents will not be recorded.

Data Analysis

After data collection, the accuracy and integrity of the data were analyzed and verified. In the factors influencing remote work efficiency, we not only want to know the impact of each factor on productivity but also the interrelationships among these factors. As this study involves multiple dependent and independent variables, we employ multiple linear regression analysis to explore their relationships.

Multiple linear regression has been widely used in other studies in the past. This paper draws on and learns from these studies, such as:

In "International Journal of environmental research and public health. Wilderness & Environmental Medicine" study used multiple regression analysis to explore the impact of telecommuting on employee performance, The mediating roles of motivation, competence, and opportunity in this relationship were investigated using a multi-mediation model. A quantitative research design was used to collect data on telecommuting and multiple regression analysis was used to analyze the data (Longino, 2015, p. 99).

"Work from home during the COVID-19 outbreak: The impact on employees' remote work productivity, engagement, and stress. Journal of occupational and environmental medicine" study used multiple regression analysis to explore the factors that influence job satisfaction and engagement in a remote working environment. They collected data on remote workers and analyzed the relationship between different variables and job satisfaction and job engagement using a multiple regression model. Through multiple regression analysis, the researchers were able to identify which factors had significant effects on job satisfaction and job engagement and quantify the magnitude of these effects. (Galanti, et al, 2021, e426-e432).

"Comparing telework locations and traditional work arrangements: Differences in work-life balance support, job satisfaction, and inclusion. Journal of Managerial psychology" explores the effect of remote work on job satisfaction of different job types by multiple regression analysis. They collected data from employees in different job types and used multiple regression models to analyze the impact of remote working on job satisfaction. Multiple regression analysis enabled the researchers to determine the extent to which remote work affected job satisfaction across job types and to determine the importance of different factors in different job types. (Morganson, et al., 2010, pp. 578-595)

"Telecommute acceptance and work performance: A multiple regression analysis. International Journal of Innovation and Business Strategy (IJIBS)" In this study, multiple regression analysis was used to study the effects of telecommuting on job performance, and the moderating effects of task complexity and job autonomy were

considered. It is found that telecommuting influences job performance through the mediating effects of task complexity and job autonomy, and these relationships are tested by multiple regression analysis. (Zhan Zhang, 2020)

These studies provide examples of the use of multiple regression analysis to explore the relationships between employee performance, satisfaction, and other factors in a telecommuting environment. According to the characteristics of this study and participation in the above literature, the specific data analysis steps of this paper are as follows:

1. Conditions of Multiple Linear Regression Analysis

Multiple linear regression analysis requires the fulfillment of the following conditions (Meyers, et al., 2016, pp. 35-40):

a) The independent variables and the dependent variable have a theoretical causal relationship.

b) The dependent variable is a continuous variable.

c) There exists a linear relationship between each independent variable and the dependent variable.

d) The residuals satisfy the assumptions of normality, independence, and homoscedasticity.

e) There is no multicollinearity among the independent variables.

Among these, linearity, normality, independence, and equal variance, commonly referred to as LINE, are the four fundamental assumptions of linear regression analysis.

2. Residuals

Residuals in mathematical statistics refer to the differences between the actual observed values and the estimated values (fitted values). Residuals reflect the impact of random factors on the dependent variable y, which cannot be explained by the linear relationship between x and y. In practical cases, it is impossible to achieve a perfect prediction of y that matches the true values, and therefore errors are inevitably introduced. We use ε to represent this unpredictable error. By introducing ε, we can bring the model closer to a perfect state, which represents the theoretical regression model. (Fox, 2015, p. 96)

In general, a successful linear regression model is achieved when:

a) The residuals ε have an expected value of 0, i.e., $E(\varepsilon) = 0$.

b) The variances σ^2 of ε are the same for all predicted values.

c) The residuals ε follow a normal distribution, are independent of each other, i.e., $\varepsilon \sim N(0,\sigma^2)$.

3. Diagnosis of Multicollinearity

Multicollinearity refers to the situation where two or more independent variables are highly correlated. It not only affects the explanatory power of the independent variables for the variation in the dependent variable but also impacts the overall fit of the multiple linear regression model. (Hair, et al., 2010, pp. 26-31)

1) Tolerance: This method treats each independent variable as the dependent variable and builds separate linear regression models with other independent variables. The coefficient of determination, R^2, is calculated for each model. A higher R^2 indicates a stronger linear relationship between the corresponding independent variable and other independent variables. The tolerance, defined as Tolerance = 1 - R^2, is used as a measure. Thus, a higher R^2 corresponds to a smaller tolerance, indicating a stronger collinearity between the independent variable and other variables.

2) Variance Inflation Factor (VIF): The VIF is the reciprocal of the tolerance, i.e., VIF = 1 / (1 - R^2). Essentially, the VIF and tolerance are equivalent measures. Generally, if VIF >= 10 or tolerance <= 0.1, it indicates a severe multicollinearity issue among the independent variables. On the other hand, if VIF < 10 or tolerance > 0.1, it suggests that there is no collinearity among the independent variables in the regression equation.

4. Approaches to Multiple Regression

Stepwise regression is a method based on linear regression. The idea is to introduce variables one by one and, after introducing a new variable, test the previously selected variables one by one. Variables that are deemed insignificant are removed until there are no new variables to introduce or old variables to remove, ensuring that every variable in the regression model is meaningful. (Tabachnick & Fidell, 2007, p. 724)

There are three main approaches to stepwise regression:

1) Forward selection: This method starts by selecting the variable that has the highest correlation with the dependent variable to enter the regression model and test the regression coefficients. Then, from the variables already in the model, it selects the variable with the highest partial correlation coefficient to enter the regression model and tests the regression coefficients. Typically, SPSS allows a probability value of less than 0.05 for the regression coefficient test to be allowed into the model. This selection process is repeated until no more variables can enter the model.

2) Backward elimination: This method initially includes all independent variables in the regression equation, performs t-tests, and removes the variable with the smallest t-value. Then, it refits the equation and tests the regression coefficients, removing variables with a probability value greater than 0.1. This process is repeated until no variables can be removed.

3) Stepwise selection: This method combines forward selection and backward elimination. It considers testing variables when they enter the regression model to select variables that meet the criteria. It also considers the possibility of collinearity between variables after they are introduced into the model and tests the variables again to remove those that do not meet the criteria.

In this study, stepwise selection will be used to address the issue of multicollinearity.

5. Estimating Regression Model Parameters Using Least Squares Method

The regression line is an estimated line that minimizes the sum of squared residuals, also known as the residual sum of squares (RSS). The method of minimizing the RSS is called least squares regression or ordinary least squares (OLS) regression. Performing a least squares linear regression analysis involves using this method to calculate regression coefficients. Using these coefficients, we can make predictions of the dependent variable based on the values of the independent variables, aiming to minimize the errors produced by predictions based on the mean value. The sign of the regression coefficients tells us the direction of the relationship between the two variables, while the magnitude indicates the extent of the change. (Montgomery, et al., 2021, p. 33)

The line drawn by the regression equation obtained through the least squares method can be considered the best-fit line, which is a line that is superior to other fitted lines. All points are closer to this line, minimizing the sum of squared distances between the points and the line. Therefore, the best-fit line is also known as the least squares line.

6. Goodness-of-Fit Test for The Equation

How accurate is the prediction of the regression equation obtained from the sample data? This requires a goodness-of-fit test to evaluate the fitting effect of the regression equation. The goodness-of-fit test is primarily conducted by examining the coefficient of determination R^2, which tells us the proportion of the dependent variable's variation explained by the fitted model. A larger value of R^2 indicates a stronger explanatory power of the independent variables. When interpreting the goodness-of-fit test, it is common to look at the adjusted R^2, which helps determine whether the

increase in explanatory power is due to the introduction of new variables or other factors. (Montgomery, et al., 2021, p. 33)

It is important to note that the best-fit line can only provide accurate predictions when there is a perfect correlation (R=1 or -1). When $R^2=1$, it means that 100% of the variable's variation can be explained by the best-fit line. (Dziuban & Shirkey, 1974, pp. 358-361) In this special case, if the sample data accurately represents the population, the predictions will be completely accurate.

7. F-Test - Overall Test of The Regression Model

The analysis of variance (ANOVA) table is primarily used to determine the regression effect of the regression model through an F-test. It tests whether there is a significant linear relationship between the dependent variable and all independent variables and whether the linear model appropriately describes their relationship. If there is no linear relationship, then all partial regression coefficients are zero. In other words, the null hypothesis H states that all partial regression coefficients are equal to zero. If the null hypothesis is accepted, it is concluded that there is no linear relationship. Otherwise, the multiple linear regression is considered significant. (Kutner, et al., 2004, p. 8). When examining the ANOVA table, the main focus is on two indicators: the F-value and the significance (P-value), with particular emphasis on the significance (P-value).

8. T-Test - Test of Regression Coefficients

The regression coefficient table in linear regression analysis is used to test the significance of regression coefficients. It examines whether there is a significant linear relationship between each independent variable and the dependent variable in the regression model, i.e., whether the independent variables can effectively explain the linear variation of the dependent variable. The significance test of regression coefficients primarily considers two indicators: the t-value and the significance (P-value). (Kutner, et al, 2004, p. 8)

9. Utilizing Regression Model for Prediction

After verification, if the regression equation demonstrates a good fit and both the F-test and T-test are significant, indicating statistical inference, the regression equation can be used for prediction. Prediction can be performed through point prediction and interval prediction:

a) Point Prediction: Given a specific value of an independent variable, plugging it into the regression equation yields the point estimate of the dependent variable.

b) Interval Prediction: Given a specific value of an independent variable, predicting the interval estimate of the mean of the corresponding dependent variable

Ethical Decision

This study will adhere to the principle of academic integrity to ensure that all research results and questionnaire content are original and respect the intellectual property rights of others. The research results of others will be cited where appropriate and clearly noted in the references. And eliminate any form of plagiarism.

This study respects the rights of respondents, protects their personal information and privacy, and will not use it for any commercial purposes or disclose it to third parties. Ensure that respondents voluntarily participate in this survey, and provide adequate explanations and options for respondents to choose whether or not to participate.

This study will ensure that all respondents' answers are anonymous and not linked to any personal information. We will only use the data for research purposes and keep it secure and confidential.

This study regards ethical issues as more important than the research itself. And constantly review and evaluate ethical issues in the process of research, and ensure the legality and ethics of research at all times.

For the investigation involving sensitive issues, all data will be encoded and protected in this study to ensure data security and privacy. Ensure that all investigations into sensitive issues are conducted for scientific purposes and not for any other purpose.

Conclusion

In social science research, the scientific nature and importance of research methods cannot be ignored. Scientific data collection and analysis methods can ensure the reliability and validity of the research. In this paper, scale design and testing, data collection, verification, and analysis are carried out in accordance with the corresponding standards and scientific methods.

The scale design and testing used in this study meet scientific standards. It has good reliability and validity. When designing the scale, the strict demonstration was carried out according to the research questions, and the reliability and validity of the scale were tested by pre-experiment and expert evaluation.

In the process of data collection, this study attaches importance to the integrity and accuracy of data and ensures the randomness and representativeness of samples. Random sampling effectively avoids the problem of sample bias and selection bias. At the same time, the research also focuses on data confidentiality and security, to protect the respondents' personal information from disclosure and abuse.

In this study, a variety of data analysis methods, including descriptive statistical analysis, factor analysis, and structural equation model, were selected to compare and combine in the process of validation analysis, to ensure the reliability and validity of the research results. In the validation analysis process, various indicators were used to evaluate the degree of model fitting, such as the Chi-square test, RMSEA, CFI, etc.

To sum up, this study attaches importance to the scientific nature and importance of research methods to ensure the reliability and validity of research results.