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ASSEMBLY -

Designing a Circular Rental
System for Remote Working
Furniture

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INDEX

ABSTRACT	4
Chapter 0. Introduction	5
0.1 Research objectives	6
0.1.1 COVID-19	6
0.1.2 Circular economy	7
0.2 Structure of the thesis	9
0.3 Purpose of the thesis	11
Chapter 1. Research background	12
1.1 Challenge of remote working	13
1.1.1 Research of remote working	13
1.1.1.1 Type of remote working	13
1.1.1.2 The report from Lenovo	16
1.1.2 Analysis of remote working	18
1.1.2.1 What kinds of jobs are suitable for telecommuting	18
1.1.2.2 What kinds of jobs are unsuitable for telecommuting	21
1.1.2.3 Influence factor	24
1.2 Challenge of daily life	25
1.2.1 change from Living habit	25
1.2.2 Various industries	27
1.2.3 Necessities	30
1.3 Remote working in the world	31
1.3.1 Impact of economy	31
1.3.2 Impact of social	34
1.4 Conclusion of research	38
1.4.1 Value and advantage	38
1.4.2 Risk and disadvantage	41
1.4.3 How to improve telecommuting experience	42

INDEX

Chapter 2. Context analysis	44
2.1 Conditions of remote workers	45
2.1.1 Office furniture	45
2.1.1.1 Need of office furniture	50
2.1.1.2 Type of office furniture	51
2.1.2 Life furniture	53
2.1.2.1 Secondhand furniture	53
2.1.2.2 Need of life furniture	56
2.1.3 Challenges and opportunities	58
2.2 Future trends	61
2.2.1 circular economy with furniture	61
2.2.2 how circular economy change the effects	62
Chapter 3 Case study of furniture	65
3.1 Technology-based	66
3.2 Environment	69
3.3 Products	71
3.4 Service	73
Chapter 4. Synthesis of design research	74
4.1 User research	75
4.1.1 Interview with different age group	75
4.1.2 The collection of information on the questionnaire	83
4.2 Persona	87
4.3 Conclusion	89
4.3.1 Win-win cooperation	90
4.3.2 Market scenario	91
Chapter 5. Concept Generation	92
5.1 Idea generation	93

INDEX

5.2 Material	95
5.3 Journey map	96
5.4 Service system overview	98
5.4.1 The framework	98
5.4.2 The wireframe	100
5.5 Service structure	102
Chapter 6. Concept Implementation	104
6.1 Brand	105
6.1.1 Logo	105
6.1.2 Mood board	106
6.2 Furniture	108
6.2.1 KIT	108
6.2.2 Desk and tools	109
6.2.3 Wall design	110
6.2.4 Cabinet design	112
6.2.5 Joint	114
6.2.6 Storyboard – product	116
6.3 Application	117
6.3.1 User Experience	117
6.3.2 Scene preset	118
6.3.3 Storyboard – service	121
6.4 How to use	122
6.5 Final outcomes	129
6.5.1 Advantages	129
6.5.2 Product list	130
6.6 Future development	132
Chapter 7. Bibliography	134

ABSTRACT

The COVID-19 pandemic has prompted a surge in remote work, posing new challenges to the work environment. Information workers in many tech companies are increasingly shifting towards full-time telecommuting. It is evident that telecommuting will continue to revolutionize the work and life pace of many employees. However, most furniture is unsuitable for remote workspaces due to size constraints, inefficient office arrangements, and other challenges. This has made it challenging for employees to adapt to this new normal. Conventional furniture cannot handle the pandemic or the trend towards telecommuting. Employees now desire more time with their team while enjoying the flexibility of telecommuting. In this context, telecommuting-based cycle design presents a viable solution to address these challenges. The goal of this paper is to design a circular design system to alleviate the problem. This study analyzes the current telecommuting situation, identifies the challenges faced by remote workers from the perspective of service and furniture design, and examines the relationship between these challenges and furniture design with respect to factors such as age, gender, and occupation. Finally, through user group analysis, user characteristics, and needs, coupled with existing telecommuting software and furniture products, this paper proposes an office furniture cycle rental system that provides guidance for employees and enterprises. This study contributes to the growing research on the challenges and opportunities of telecommuting and underscores the potential of design-based solutions to support remote work.

Key words:

Pandemic; furniture; telecommuting; circular; rental platform; remote working

Chapter 0. Introduction

Chapter 0. Introduction

0.1 Research objectives

0.1.1 COVID-19

The COVID-19 pandemic has significantly impacted workplaces and work environments worldwide, leading many companies to adopt remote working policies to ensure employee safety. Although telecommuting has been gaining popularity in recent years, the pandemic has undoubtedly accelerated its widespread adoption. However, the sudden shift to remote work has highlighted the unpreparedness of many organizations for this mode of work.

The concept of telecommuting was introduced by Jack Nilles in 1973. Telecommuting refers to the practice of completing work-related tasks from a remote location, typically outside of a traditional office environment. As the digital economy continues to grow and technological advancements are made, telecommuting is becoming increasingly prevalent in many industries and organizations.

Realistic conditions of the “home office” model:

- Changes in what and how work is done offer the possibility of “working from home”
- The development and popularization of the Internet and communication technology provides the technical conditions
- Social development creates economic and environmental conditions

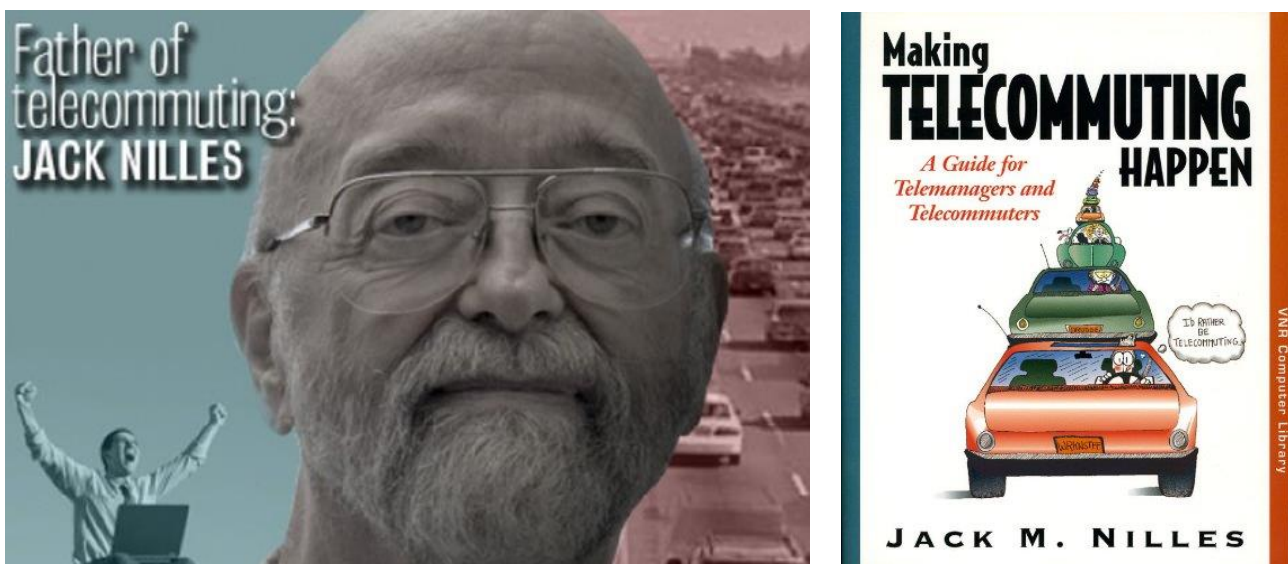


Fig.1 Father of telecommuting: Jack Nilles

While remote work offers various advantages, including flexibility and autonomy, it also presents potential drawbacks such as social isolation for remote workers. Additionally, managing time can be more challenging in remote settings, and opportunities for collaboration and mentorship may be limited. It is also important to acknowledge that not all employees have equal access to the necessary resources and support needed for remote work, such as reliable high-speed Internet and a proper workspace, which can hinder their ability to perform their job duties effectively.

0.1.2 Circular economy

The circular economy represents a regenerative system where the material and energy cycles are slowed, closed, and shrunk, resulting in a reduction of resource input, waste, and emissions. In contrast, the linear economic model of "acquisition, manufacture, and treatment" has contributed to significant environmental and social challenges, such as resource depletion, waste generation, and social inequality. As a result, the concept of circular economy has gained increasing attention as a more sustainable and renewable mode of economic development, providing a solution to these challenges.

Understand – Understand the user and the system.

Define – Put into words the design challenge and your intentions as a designer.

Create – Conceive, design, and create as many iterations and version prototypes as possible.

Launch – putting your design out into the wild and building your narrative.

By building loyalty among customers and deepens stakeholder investment by telling a compelling story.

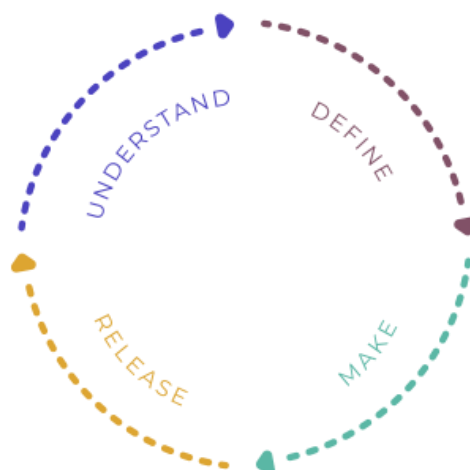


Fig .2 Solutions of circular economy

Moving from product to service: Ownership is not necessary

The concept of circular economy centers around the transition from a linear model of ownership to one based on the right to use. This implies that users only need to utilize a product for a specific duration, and then either return it to the service provider or transfer it to another user. Several innovative businesses have emerged in recent years, offering customers access to diverse products through subscription, sharing, or leasing, rather than permanent ownership.

Dematerializing: Reducing resource requirements for design

The main objective of this strategy is to minimize the material inputs required to achieve an effective solution. This can involve different approaches, such as virtualizing the product or creating a digital version instead of a physical one. Additionally, it may require designing the product or service with a minimal use of materials, to optimize resource efficiency and reduce environmental impact.

Modular: Designed to be upgradeable and easy to repair

Modular design is a highly effective strategy that can facilitate the repair, remanufacture, and upgrading of products. By allowing for disassembly through the removal or updating of only certain parts, the cost and effort of replacing damaged components is significantly reduced. Furthermore, modular systems offer greater flexibility in customization, enabling them to easily adapt to the evolving needs of users and preventing products from becoming obsolete, thereby ensuring their longevity.

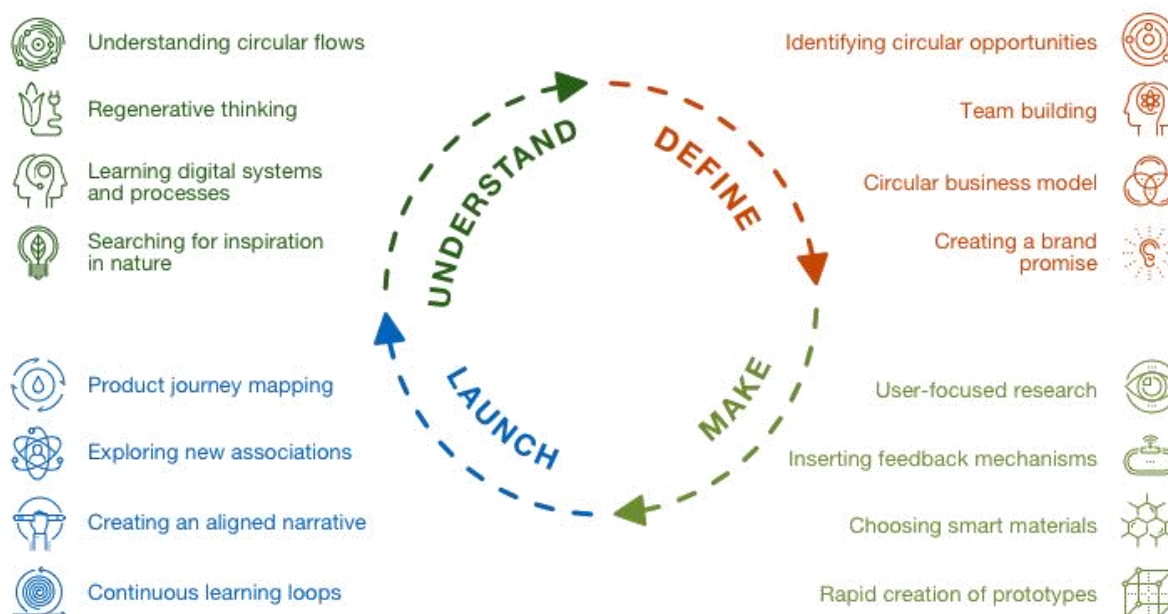


Fig .3 Way of circular economy

The design industry is a crucial player in advancing the circular economy. Designers have the potential to drive the transition from a linear economic model to a circular one by producing durable, reusable, and recyclable products and services.

0.2 Structure of the thesis

This paper aims to investigate and analyze the background of telecommuting and circular economy, and to apply the findings in the development of design solutions. The key topics explored in each chapter are summarized as follows:

Chapter 1. Research background

–Research

Chapter 1 examines the trends and challenges of telecommuting before and after the COVID–19 pandemic, focusing on social, economic, and technological aspects. This chapter also explores how circular design principles can be applied to address these challenges and provide more sustainable solutions.

Chapter 2. Context analysis

–Analysis problem

Chapter 2 conducts an analysis of the current office furniture problems that require addressing. The first section covers systemic issues, such as office conditions and living conditions. The second section delves into the details of specific requirements, including health concerns, productivity, dietary needs, and social interaction.

Chapter 3. Case study of remote working

–Analysis specific product

Chapter 3 provides an in–depth analysis of existing cases of telecommuting and remote working. The first section discusses office demands, covering technology, furniture, and services. The second section focuses on spiritual needs, including environmental and mental health. The chapter then summarizes all the problems and opportunities gathered during the analysis. The aim is to evaluate the environmental, social, and economic impacts of implementing a circular rental system and rental business model for remote office furniture in selected companies.

Chapter 4. Synthesis of design research

–Solve the problem

Chapter 4 delves into the design considerations and challenges associated with telecommuting. This chapter takes a more detailed approach, examining remote office interaction design, product design, and service design. A comprehensive list of limitations, needs, and desires is compiled to better understand the motivations, goals, and behaviors of telecommuters. Using this information, a telecommuting scenario is developed and designed to address these needs and desires.

Chapter 5. Generation of design

–Create design system

Chapter 5 presents the proposed circular design system for telecommuting based on the insights and analyses from the previous chapters. The design process and specific features of the system are outlined, which include identifying user needs and characteristics, analyzing existing telecommuting software and furniture products, and addressing the challenges identified in the previous sections. A circular system is created to guide the final design concept, and the implications of the results for the design industry and remote working practices are discussed.

Chapter 6. Final design concept

–Product design and interactive design

Chapter 6 presents the final design concept based on the research and guidelines presented in the previous chapters. The chapter is divided into six parts, starting with a detailed description of each ecosystem component, followed by an analysis of the user experience, and concluding with a presentation of the product system diagram, which outlines future product development.

Chapter 7. Bibliographic

Chapter 7 summarizes the main research and findings of the design and discusses the conclusions of the research work. And a proposal for the development and implementation of a remote office furniture cycle rental system.

0.3 Purpose of the thesis

This research aims to investigate the working environment of remote workers during and post-pandemic, identify solutions to address the challenges of remote working, and support remote worker productivity. It focuses on exploring the implementation of circular design systems in the office industry or product category, addressing challenges and opportunities and contributing to the transition to a sustainable and renewable economy. Ultimately, it seeks to create a more equitable and sustainable society by developing practical and effective strategies to integrate circular design principles into the design process by employees, platforms, and enterprises.

Based on the aforementioned background, obstacles, and challenges, the objective of this paper is to design a furniture rental platform that caters to the needs of telecommuting employees. The platform targets users who work remotely and provides guidance for future office trends as a complement to the design. Therefore, the specific objectives of this design are:

1. Analyze the telecommuting environment.
2. Design a circulation system for telecommuting employees.
3. Improve employee productivity and address health issues.

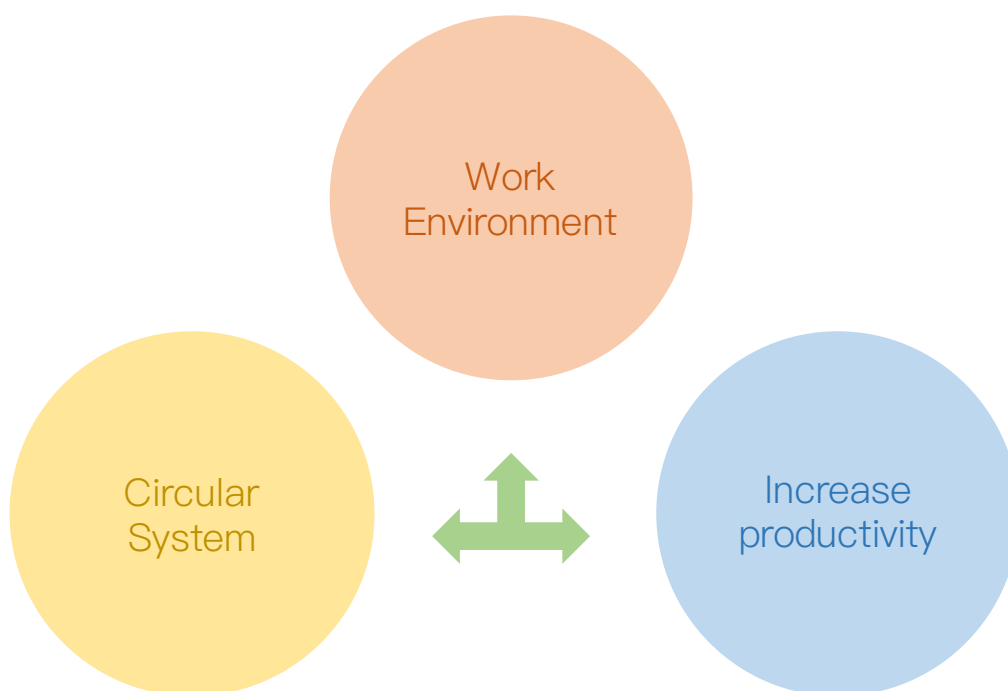


Fig 4 Specific objectives of design

Chapter 1 .

Research background

Chapter I . Research background

1.1 Challenge of remote working

1.1.1 Research of remote working

Remote work is the practice of employees doing their jobs from a location other than a central office operated by the employer. Such locations could include an employee's home, a co-working or other shared space, a private office, or any other place outside of the traditional corporate office building or campus.

1.1.1.1 Type of remote working

Home-based telecommuting.

Home-based telecommuting is a type of work arrangement where employees work from home or another remote location but remain employed by the company. This approach eliminates the need for employees to travel to a physical office and instead allows them to work in the comfort of their own homes. Home-based telecommuting can occur on a regular basis, but not necessarily every day, depending on the specific job requirements. Typically, employees who work from home are self-employed or have relatively independent work responsibilities that can be completed outside of a traditional office setting. Effective communication is essential to the success of home-based telecommuting, and video conferencing is often used to facilitate collaboration with colleagues and supervisors. Additionally, employees working from home often rely on various communication tools, such as email and other online platforms, to support virtual communication and teamwork.

Public Office Spaces as an Alternative to Traditional Workplaces

Public office spaces are an increasingly popular option for employees seeking convenience and reduced commuting time. They serve as auxiliary institutions, providing temporary office work solutions to individuals who need a workspace close to home. In recent times, many young professionals such as photographers, cartoonists, writers, and entrepreneurs prefer to work in public office spaces, often located in coffee shops. Public office spaces offer an undisturbed realm where individuals can maintain their independence while still being connected to the outside world.

Public office spaces come equipped with office furniture, providing employees with a comfortable and productive workspace. Moreover, employees can carry the necessary equipment required by the company to these spaces. Overall, public office spaces offer an alternative to traditional office spaces, providing employees with a flexible, convenient, and efficient workspace that promotes collaboration and creativity.

Mobile office

The term "mobile workers" refers to employees who work remotely without a fixed office location. This type of telework allows for maximum flexibility, as employees are able to work from anywhere, be it at home or on the go. Mobile workers are commonly associated with sales professionals, as their work often requires frequent travel outside of the office. Given their on-the-go nature, mobile workers rely heavily on communication tools to stay connected with their colleagues and maintain productivity. These tools may include video conferencing software, instant messaging, and email, among others.



Fig 5 Three different types of telecommuting

1.1.1.2 The report from Lenovo

Lenovo Group has recently released a global research report examining the impact of the COVID-19 pandemic on the trend of home-working, as well as the challenges and opportunities it presents for companies and their IT departments in promoting remote work in the future. The report reveals that over half of the surveyed employees worldwide expect working from home to become more prevalent in the future.

The report analyzes how employees across the globe have adapted to the "new normal", with 72% of respondents reporting that their daily work practices have changed significantly in the past three months. The majority of employees feel more productive and connected when working from home. However, the report also highlights the financial, physical, and emotional burdens that telecommuting imposes on employees.

Dilip Bhatia, Vice President of User and Customer Experience Business at Lenovo Group, points out that "as working from home becomes more common, and the boundary between work and personal life becomes blurred, this report provides valuable insights into the complex relationship between employees and technology."

The report finds that 85% of respondents rely more on their computers (laptops/desktops) while working from home than when working in the office. Moreover, 63% of employees worldwide believe that working from home is more effective than working in the office. Over half of the respondents expect to spend more time working from home even after social distancing is lifted. This confidence in remote work has increased the demand for modern IT solutions that can be customized and deployed at scale.

However, 79% of respondents reported having to act as IT staff while working from home, highlighting the need for technical training to facilitate telecommuting in the future. The majority of respondents believe that companies should invest more in technical training to support telecommuting. Employees also reported purchasing new technology to cope with telecommuting, with 70% of global respondents indicating that they had spent money on upgrading or improving their technology. U.S. respondents spent an average of \$348, about \$70 more than the global average of \$273, and the second highest among the ten markets surveyed, to improve their technology for remote work due to COVID-19.

Technology and the Evolving World of Work

Global Research Study | July 2020



1
BENEFITS OF
WORKING FROM
HOME IN THE
COVID-19 ERA



2
CHALLENGES OF
WORKING FROM
HOME IN THE
COVID-19 ERA



3
FINDING
SUCCESS IN
THE NEW
WORKPLACE
"NORMAL"



Fig 6 Technology and the Evolving World of Work

1.1.2 Analysis of remote working

1.1.2.1 What kinds of jobs are suitable for telecommuting

Telecommuting can pose various challenges, which vary by individual and industry. For those who are new to remote working, the most common obstacles are feelings of isolation from colleagues and managers, and the constant distractions of home life. However, telecommuting is not universally disliked. Many employees appreciate the convenience and flexibility it offers. Conversely, some workers prefer the traditional separation of home and work life. Ultimately, the challenge of telecommuting lies in the temporary spatial disconnect between home and work roles.

IT enterprises are suitable for telecommuting

Telecommuting can be an ideal working arrangement for pure IT companies. With a plethora of unified communication tools available, teams can easily collaborate remotely and have access to platforms for development and testing. In fact, most IT tasks can be accomplished using these tools alone. Only a few operations, such as large-scale software integration releases, integration testing, and hardware operations, require onsite presence.

Telecommuting has several advantages and advantages for the IT industry:

Don't worry about time spent in transit,

Complete self-completed tasks relatively efficiently

It's easier to interact with your family.

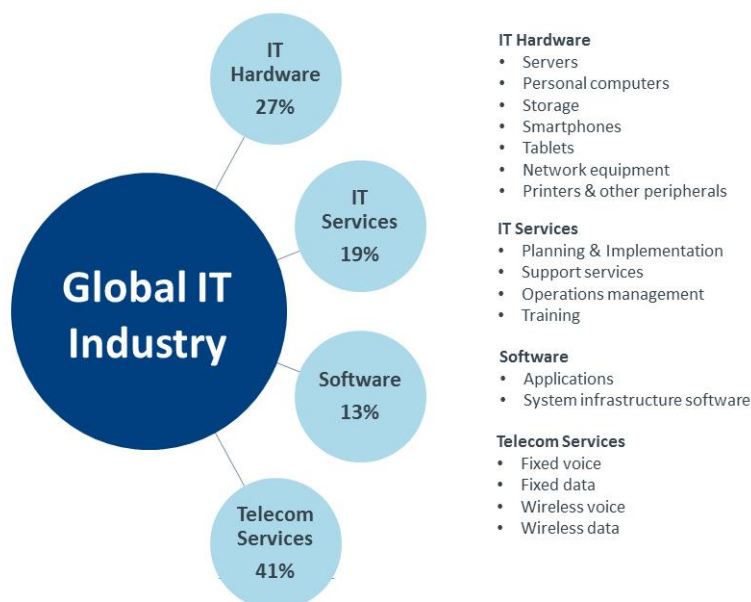


Fig 7 Global IT market

Non-IT jobs also require automated collaborative solutions

While telecommuting is already a feasible option for IT-related roles such as administration, management, and finance, the majority of non-IT work is still heavily reliant on physical labor, whether through automated tools or human workers. Although the trend towards factory automation is on the rise, the current level of technological intelligence is still insufficient for most advanced processing companies, such as Foxconn, to achieve fully unmanned and remote production. As such, human labor remains a vital component of physical production. This underscores the importance of Industry 4.0, which integrates automation, communication, and computing to continuously replace human participation in manual labor and move towards automated intelligent production. Ultimately, the goal is to reach a point where telecommuting becomes a near-universal possibility.

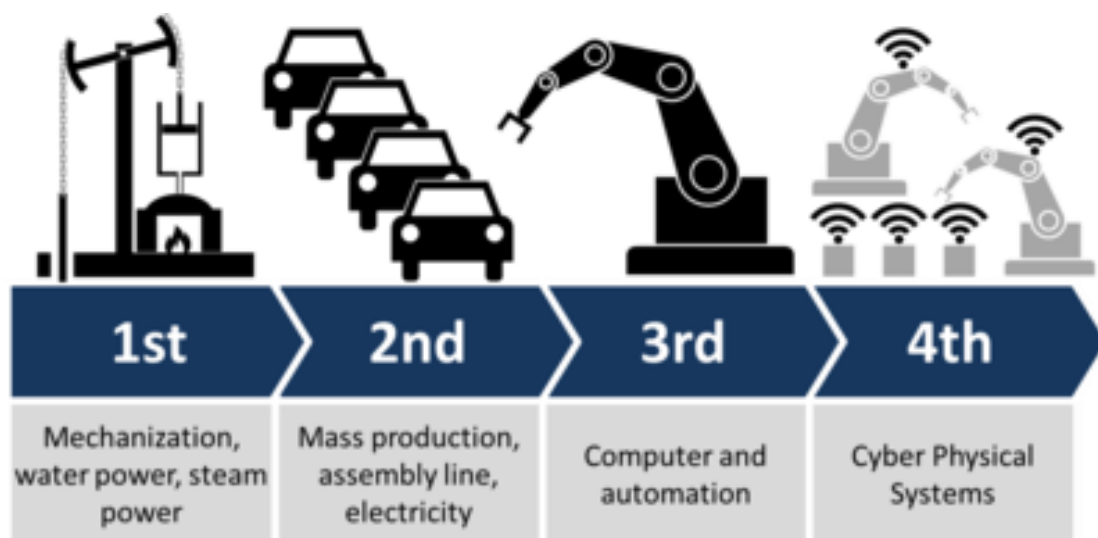


Fig 8 Industry 4.0

The suitability of a job for telecommuting depends on several factors, including job requirements, organizational policies, and individual work preferences and skills. For industries where telecommuting is expected to become more prevalent, certain characteristics may be present, such as:

1. Monomer
2. Repeatability
3. Low growth
4. Rigid demand

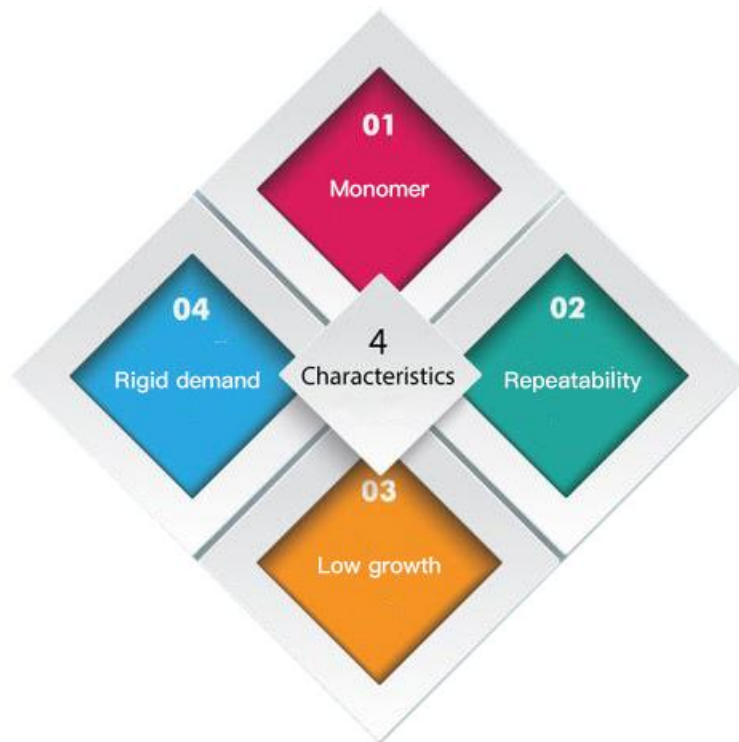


Fig 9 4 characteristics of job which suitable for working remotely

1.1.2.2 What kinds of jobs are unsuitable for telecommuting

Not simple and repetitive work

The suitability of a job for telecommuting depends on various factors such as job requirements, organizational policies, and individual work preferences and skills. In some industries, however, telecommuting may become increasingly common. For instance, in the field of engineering design, multiple professionals need to collaborate to discuss complex concepts, which may be difficult to express in simple terms. To effectively communicate such information, professionals often rely on charts, animations, and specialized software along with professional explanations. Although telecommuting software may enable remote multimedia display, "face-to-face" interaction during discussions may still be limited. Moreover, even in in-person discussions, the information exchanged may not always be clear.

Medium to high growth jobs

Professionals such as designers, engineers, and project managers require continuous learning and adaptive working strategies. This type of work often necessitates the so-called "intellectual spark" as many problems and solutions arise in the physical realm. Working remotely can lead to getting stuck on certain issues, which can decrease work efficiency and ultimately make telecommuting an unwise choice. Furthermore, remote work can limit the opportunities for face-to-face interactions and spontaneous brainstorming sessions, which are crucial to stimulating creativity and problem-solving.

Human interaction work

Industries such as sales, marketing, and branding, especially for big-ticket items, may not be the most suitable for telecommuting. While one can certainly develop work strategies from home and communicate with colleagues remotely to create a plan, the final execution of the work often necessitates completing tasks offline, within the physical business premises.



Fig 10 Jobs are unsuitable for telecommuting

In summary, there are certain industries that are not conducive to telecommuting. These industries can be characterized by:

1. Jobs that require physical presence or on-site work. Examples include construction workers, healthcare professionals, hotel employees, and retail workers.
2. Work involving the handling of sensitive or confidential information. Such as legal or financial work
3. Work that requires close cooperation and communication with others. Examples include sports coaches, performing arts professionals and event planners.

1.1.2.3 influence factor

Network influence

Remote work heavily depends on technology, including computers, smartphones, video conferencing tools, and reliable Internet access. The availability and quality of technology can significantly affect the efficiency and success of remote work. For instance, the existing telecommuting software may crash when many users are online, making it difficult for users to log in or causing disruptions in voice communication. In addition, effective communication is crucial for remote work, and technology plays a key role in facilitating communication. Poor network connection can adversely impact communication, leading to misunderstandings and delays. Conversely, effective communication can boost productivity and foster trust among team members. Therefore, ensuring high-quality technology infrastructure and reliable communication channels is essential for successful remote work.

Working environment

Working from home may lack the social aspect of working in an office. While adults can maintain self-discipline to complete their work according to their contracts, the lack of a quiet and professional workplace can impact work efficiency. Even with a designated workspace at home, there may be distractions such as a child interrupting a conference call or an email that requires attention. These interruptions can disrupt the flow and focus of work. Remote work requires an appropriate work environment, which includes a quiet and distraction-free space and the necessary equipment. The availability of a suitable work environment can affect the effectiveness of remote work.



Fig 11 Competitiveness Factors in Telecommunication Markets

1.2 Challenge of daily life

The COVID-19 pandemic has had a significant impact on people's lives worldwide. To combat the spread of the virus, many businesses have extended their office scenes, and over 100 million employees have opted to work from home. However, telecommuting presents significant challenges, not only in the workplace but also in personal life.

1.2.1 change from Living habit

Remote working brings about significant changes in an individual's lifestyle habits since traditional work schedules and environments are replaced by more flexible and self-managed work structures. Some of the changes that individuals may experience while working remotely include:

Balancing challenges:

The advent of remote working has made it increasingly challenging to differentiate between work and personal life, thus making it more difficult to draw clear boundaries between the two. This often leads to excessive workload, job burnout, and a detrimental impact on mental health. As work is no longer confined to a specific physical location, the concept of "clocking out" is becoming more and more obsolete, and individuals may find it hard to switch off from work and unwind.

Social Challenges:

Human beings are inherently social animals, and remote workers may experience a sense of loneliness and isolation due to the absence of social interaction in a physical office. This feeling of disconnection can negatively impact their mental health. Additionally, remote workers may miss out on the opportunity for professional communication and career development that often occurs in a traditional office setting.

Health challenges:

Remote working can lead to prolonged sitting. This sedentary behavior can result in a lack of physical activity, which can have a negative impact on physical health. Research has shown that prolonged sitting is associated with increased risk of obesity, type 2 diabetes, cardiovascular disease, and some types of cancer. Therefore, it is important for remote workers to incorporate physical activity into their daily routine to maintain their physical health.

Focus on the challenge:

Working remotely can be challenging due to the potential for distractions at home, such as family members, pets, or household chores, which can adversely affect productivity. Remote workers need to stay focused and motivated to complete their tasks on time. This requires discipline, self-management skills, and the ability to work independently, which can be a significant challenge for those who are used to the structure and accountability of a traditional office environment.



Fig 12 Biggest challenges facing remote employees

1.2.2 Various industries

The coronavirus pandemic has upended the cultural and technological barriers that previously impeded the growth of telecommuting. As a result, the workplace is undergoing a structural transformation for some segments of the workforce. According to a study by the McKinsey Global Institute (MGI), which examined more than 2,000 jobs in 800 occupations across nine countries (China, France, Germany, India, Japan, Mexico, Spain, the United Kingdom, and the United States), only a small number of highly skilled and educated individuals in select industries, occupations, and locations have the potential to telecommute effectively.

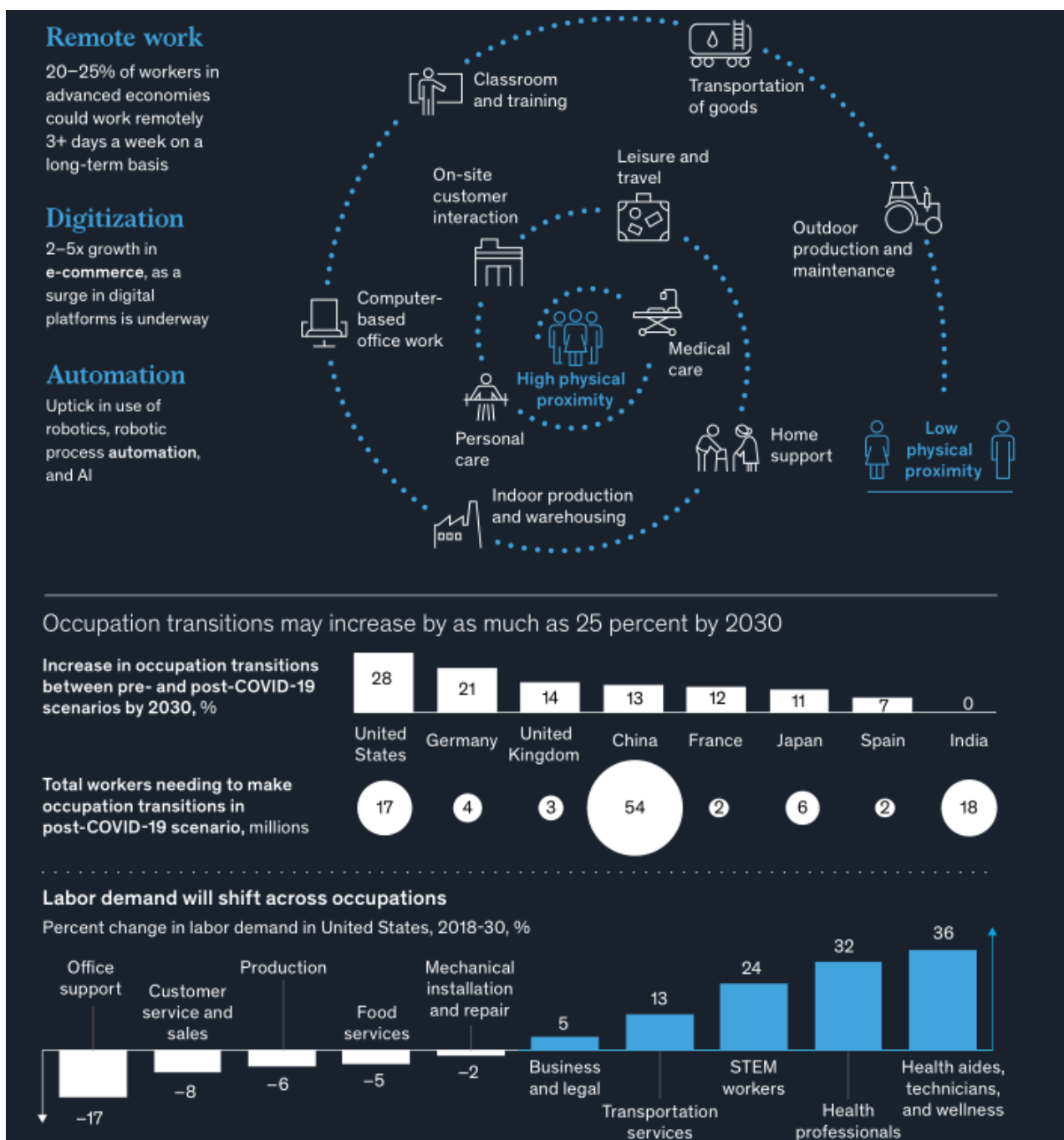


Fig 13 The future of work after COVID-19

1. Information Technology industry

Remote working is particularly feasible in the IT industry, given that a large number of IT professionals can work effectively from anywhere with a stable Internet connection. The nature of work in this sector is such that a significant portion of tasks can be performed digitally and remotely.

Apart from the convenience and flexibility it provides, remote working in the IT industry can lead to a range of benefits. For instance, it allows for greater flexibility in client engagement, reduces overhead costs associated with office space, and enables work to be carried out in a variety of locations. Moreover, it reduces commuting times and provides employees with a better work–life balance, leading to improved productivity.

2. Hotel tourism industry

The feasibility of remote working in the hospitality and travel industries may be limited, as these industries often require on–site customer service, operations, and other tasks. However, administrative and managerial roles in these industries may be suitable for remote working arrangements.

During the pandemic, the hotel industry experienced a sharp decline in orders, with the figure dropping by more than 90 percent. For hotels, the two main costs are manpower and rent, and the biggest burden is bank loans. Given that the hotel industry involves heavy asset investments, such as in the early stages of store decoration and construction, it may take five or six years to recover these costs. This means that for hotels that have not passed the investment period, a zero income scenario would make it difficult to continue repaying their loans. The COVID–19 pandemic has affected all companies within the travel industry, both upstream and downstream.

3. Real estate industry

In industries that rely on on–site work, such as manufacturing and construction, remote working can present greater difficulties. Similarly, in the real estate industry, which is known for its capital–intensive nature, the suspension of sales caused by the COVID–19 pandemic has accelerated the elimination of some traditional real estate businesses. As a result, industry experts believe that the pandemic has hastened the shift towards new business models in real estate. Despite these challenges, certain roles in these industries, such as project management and procurement, have proven to be feasible for remote work.

4. Manufacturing industry

The feasibility of remote working in industries that involve physical labor or the operation of large machinery is limited. This is particularly true for manufacturing companies that require workers to be present on-site. However, in some small businesses, remote work may be possible with the provision of appropriate furniture and tools to enable employees to carry out their work from home. During the pandemic, storage boxes have become a popular solution for craftsmen looking to organize their work materials in a home office setting.

Remote Work Status by Occupation

	Total working remotely	Exclusively (100%)	Sometimes (10%-99%)	Never/Rarely (less than 10%)
	%	%	%	%
Total	52	33	19	48
Majority working from home				
Computer, Mathematical	86	73	13	14
Life, Physical or Social sciences	86	51	35	14
Arts, Design, Entertainment, Media	81	64	17	18
Financial, Insurance, Real estate, Consulting	80	66	14	20
Legal	74	46	28	27
Education, Training, Library	69	37	32	31
Architecture, Engineering	67	32	35	33
Community or Social services	60	27	33	39
Clerical or Office	56	37	19	44
Less than majority working from home				
Sales	36	20	16	64
Healthcare	33	15	18	68
Construction, Mining	16	8	8	84
Installation, Maintenance, Repair	15	3	12	85
Transportation	14	9	5	86
Service	9	3	6	91
Manufacturing, Production	8	4	4	92

Based on full-time employees who work for an employer; industries with fewer than 130 respondents not reported due to low sample size. "Total" figures may not match the sum of "Exclusively" and "Sometimes" responses due to rounding.

GALLUP PANEL, OCTOBER 2020-APRIL 2021

Fig 14 Remote Work Status by Occupation

1.2.3 Necessities

The relationship between telecommuting and consumer staples is weak, with more sustained and stable growth. On the other hand, consumer choices are strongly correlated with telecommuting.

Small appliances are less affected by the outbreak

The COVID-19 pandemic has had a considerable adverse effect on most consumer goods, except for essential items such as protective gear (e.g., masks and disinfection products) and daily necessities. Although small household appliances fall under optional consumer goods, their installation is not a necessity. Due to their already high online market share (typically exceeding 50% among leading enterprises), the pandemic's impact on them has been relatively small. Furthermore, during the pandemic, offline demand has shifted online, further mitigating the impact on small household appliances.

The service system will become more and more important

In the coming years, brands will no longer be focused on selling just products, but instead selling a complete service system that will enable them to retain customers. This service system will go beyond the traditional notion of "after-sales service" and will be geared towards addressing customer pain points, even if these pain points are not directly related to the products being sold. Brands will not just be "selling" to customers, but will be managing long-term relationships with them through a systematic approach to service.

Customization will do well

To better cater to the individualized needs of customers, customized services have emerged as a prominent trend in the age of telecommuting. Customization in this context may entail adapting work arrangements, policies, and practices to facilitate effective remote work for employees. Organizations that embrace remote work often tailor their policies and practices to suit the needs of remote workers. For instance, they may offer flexible working hours to accommodate different time zones or enable employees to create personalized schedules that are conducive to their remote work setup. Customization may also involve providing remote workers with the necessary tools and resources to carry out their tasks efficiently, such as customized office setups, tailored training and support for remote work technologies, and so on.

1.3 Remote working in the world

1.3.1 Impact of economy

The First Wave of the epidemic: Its impact on China's economy

In early December 2019, the outbreak of COVID-19 began to rapidly spread across China, leading to a lockdown in Wuhan on January 23, 2020. While the epidemic peaked in mid-February, it took three months to bring it under control. The impact of the epidemic on industrial and supply chains exceeded expectations. Although enterprises resumed work and the rate of employees returning gradually picked up, the return to work for upstream and downstream enterprises is still uneven due to factors such as goods transportation and other reasons, causing the labor chain, industrial chain, and supply chain to remain in a state of recovery. The economic cycle is not yet smooth, and the phenomenon of return to work is still relatively common. Additionally, the decline in international air passenger traffic has led to a sharp decrease in passenger cargo in the belly space, which has negatively affected China's exports and the normal operation of the international supply chain. The outbreak subsequently spread globally, and developed countries in Europe and the United States were hit the hardest. As the main sources of China's imports of intermediate goods and capital goods, the disruption of the production process or industrial chain of these products will cause new impacts on China's manufacturing industry and economy. It is crucial to closely monitor the subsequent impact of the epidemic on other areas.

The epidemic has had several effects on China's economy. Firstly, employment pressure has increased significantly, with enterprises facing mounting pressure to reduce staff and small and micro enterprises at a higher risk of suspending production or closing down. As a result, the employment situation has become more severe. The nationwide surveyed urban unemployment rate rose to 6.2 percent in February 2020, up one percentage point from December 2019. Secondly, the gap between local government revenue and expenditure has widened, as enterprises' production and business activities have shrunk, leading to a significant increase in expenditure to deal with the epidemic. The gap between revenues and expenditures will widen rapidly, and it will be difficult to close quickly even after the epidemic ends. Thirdly, risks are rising in the financial system, including an increase in debt defaults, a rise in the non-performing rate of the banking system, and the intensification of risks for small and

medium-sized banks. The decline in the stock market may also trigger the risk of stock pledge financing, and capital outflow pressure is expected to increase.

The second wave of COVID-19: The world economy is likely to fall into recession

Currently, the COVID-19 pandemic is rapidly spreading worldwide, and developed economies in Europe and the United States are implementing stricter management and control measures, including strict quarantine and city or country-wide lockdowns. These measures have resulted in the shutdown of production systems, leading to systemic consequences for the global economy.

Despite ongoing debates, there is no doubt that the pandemic has caused significant short-term shock to the world economy. While some view it as a natural disaster, others predict that its impact will be greater than that of the 2008 global financial crisis. Given the already low growth, high debt, and high risk of the global economy, coupled with the spread of the pandemic, financial market turmoil is likely to deepen, resulting in a rapid recession of sovereign and non-financial corporate debt. This could ultimately lead to a comprehensive balance sheet recession of households and financial institutions, creating a global transmission chain that reinforces both the financial crisis and the economic recession. It is therefore crucial to closely monitor the situation and develop effective policies to mitigate the economic impact of the pandemic.

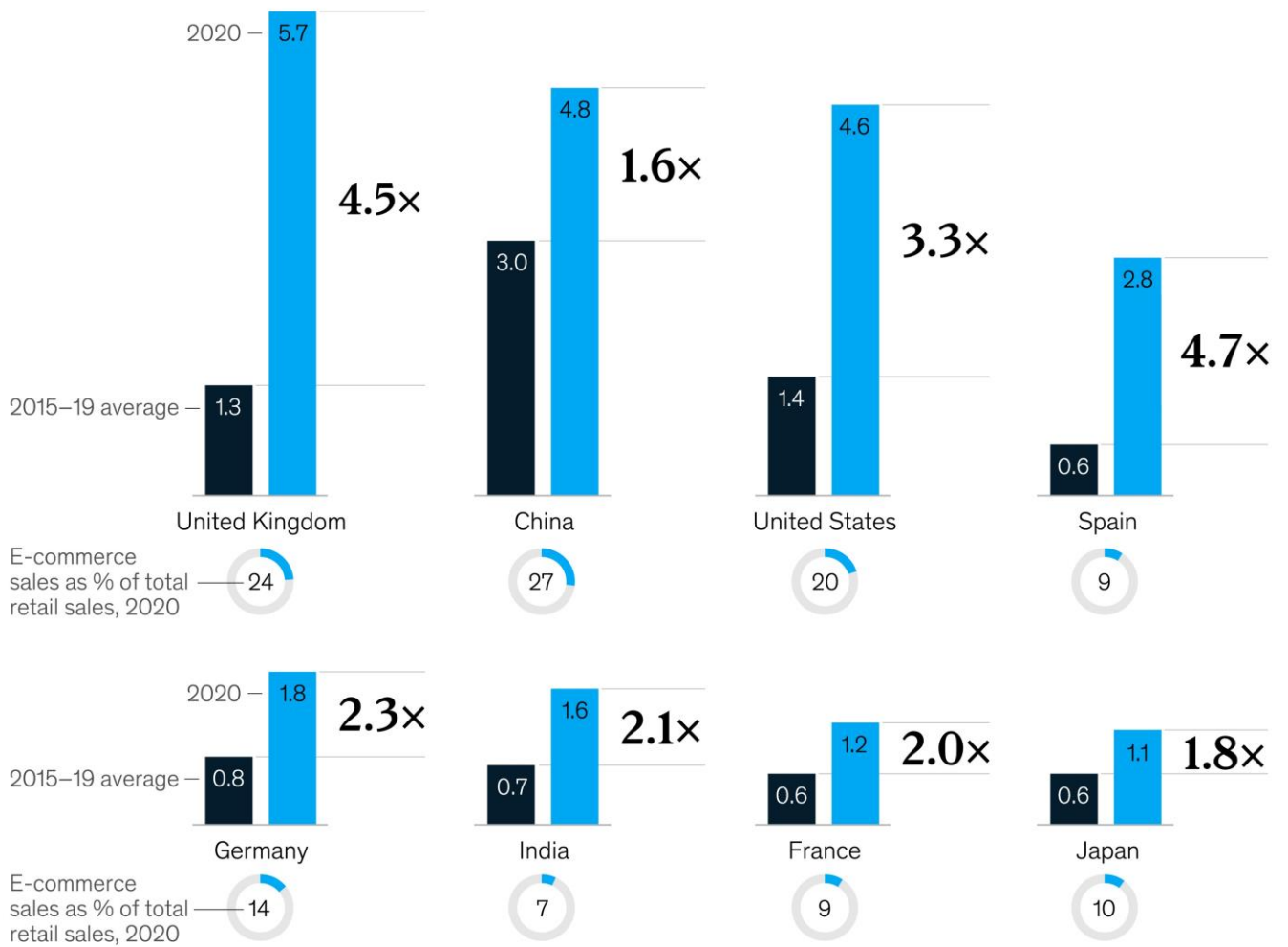


Fig 15 E-commerce changing compare with time before pandemic

1.3.2 Impact of social

White-collar worker

The COVID-19 pandemic has transformed the landscape of urban business districts across the United States as companies delay or cancel plans to reopen offices. Previously bustling business centers are now deserted, with empty skyscrapers and upscale office buildings. This has led to the complete paralysis of the business ecosystem centered on white-collar workers. Moreover, the trend of telecommuting shows no signs of abating, as many companies, including JPMorgan Chase, Ford Motor, Twitter, and REI, have announced long-term or permanent work from home policies for their employees. The trend has gained further momentum as Pinterest recently announced its willingness to pay \$89.5 million in contractual penalties to cancel its planned lease of a 490,000 square foot office building in San Francisco, as it has decided to move to permanent telecommuting. Through the pandemic, many large companies have come to believe that their employees can perform their work from home and achieve higher productivity, thereby reducing their dependence on corporate physical offices in the United States.

Changes at home and work

In traditional family relationships, our roles require us to care for and be involved in the actions of our children, spouses, and extended family members, while our work roles require us to maintain relationships with our bosses and colleagues. In remote work, the former role is intensified, while the latter is weakened due to the lack of in-person communication. As these two roles can conflict with one another, promoting family responsibilities may lead to what is commonly referred to as "family interference," while a decline in work responsibilities can result in "workplace alienation." This can make it challenging for those new to remote work to integrate their home and office responsibilities.

Preference for Remote Work by Gender Within Job Type/Occupation

	Would continue to work remotely because prefer it	Would continue to work remotely because of coronavirus	Would return to working in office	Not working remotely now
	%	%	%	%
White collar				
Total	40	11	21	29
Men	41	10	25	25
Women	39	12	17	32
Blue collar				
Total	7	2	6	86
Men	5	2	6	86
Women	15	1	4	80
Education				
Total	19	15	32	33
Men	15	16	40	28
Women	21	15	29	36
Healthcare				
Total	17	6	9	68
Men	8	3	13	76
Women	21	7	7	65
Sales				
Total	26	7	14	53
Men	21	5	13	60
Women	33	11	16	40

Based on full-time employees who work for an employer

GALLUP PANEL, OCTOBER 2020-APRIL 2021

Fig 16 Preference for Remote Work by Gender Within Job Type/Occupation

Ctrip, a leading travel service provider, conducted a large-scale social experiment in Shanghai, aimed at examining the effects of remote work on productivity and employee satisfaction. Of the 994 employees in the air ticket and hotel reservation department, 503 (51%) volunteered to participate, and 249 were finally selected to take part in the experiment. Participants were randomly divided into a control group (working in the office) and an experimental group (working from home) based on their odd/even birthdays.

The experiment found that working from home resulted in a 13% increase in productivity among participants, with 9% attributed to longer hours worked (due to fewer sick days and coffee breaks) and 4% to a quieter work environment. However, nearly half of those who had chosen to work from home decided to return to the office, citing poor performance at home and difficulty in solving social issues.

Moreover, while employee personal happiness generally increased, performance-based promotion rates fell by 50%, meaning that family circumstances discouraged many from advancing in their careers. Therefore, the results of the experiment suggest that while remote work can improve productivity, it may not be suitable for all industries and departments.

In general, departments that require less communication with colleagues are more suited for remote work, while departments that require more communication are better suited for in-person work. Moreover, students who are ambitious about their career may benefit more from working in the company, while those who value freedom may find working from home more suitable. However, it should be noted that the results of this experiment have limited generalizability and may vary across industries and job types.



Support for Hybrid Working Model

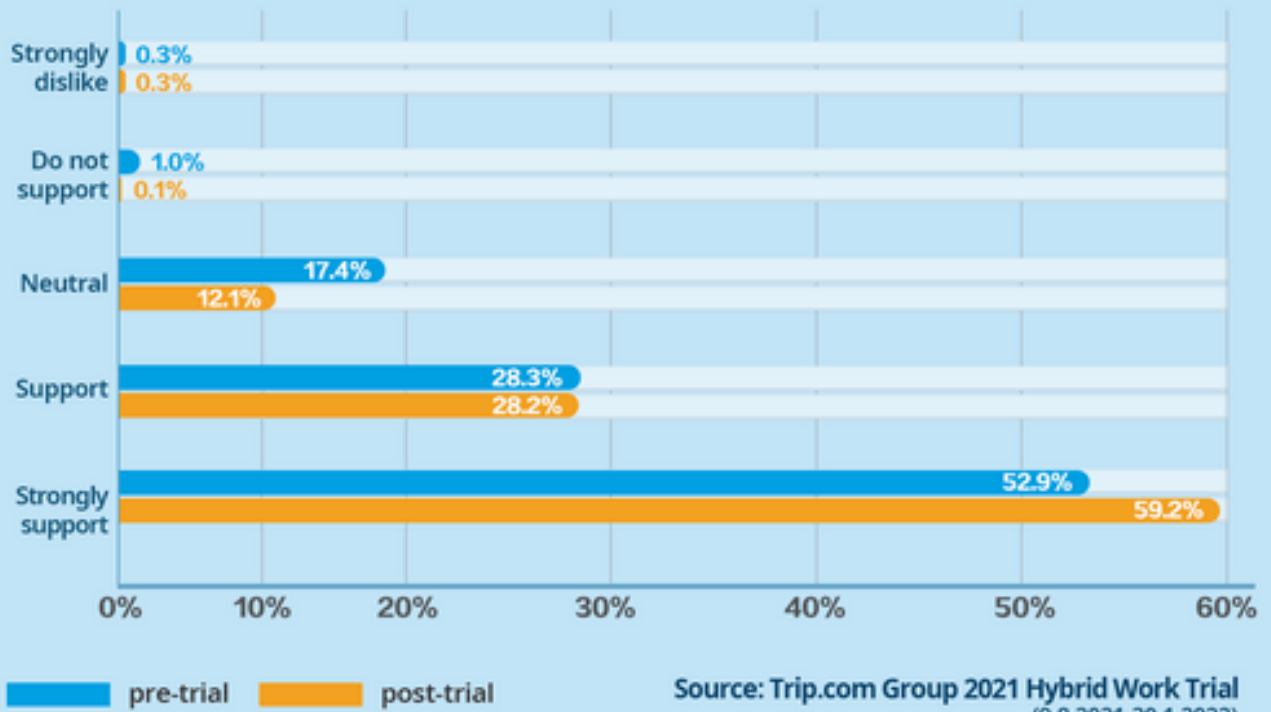


Fig 17 Chinese largest online travel company report

1.4 Conclusion of research

1.4.1 Value and advantage

From the enterprise perspective

"Home office" is a flexible approach to employment that can provide benefits to both employers and employees, such as cost savings and increased recruitment opportunities. During public health emergencies, the "working from home" model allows companies to maintain normal operations while responding to crises. For example, during the current pandemic, many companies across different industries have implemented remote work arrangements to ensure business continuity while preventing the spread of the virus.

One of the key advantages of "working from home" is the flexibility it offers in terms of location, allowing companies to recruit talented employees from all over the world without being restricted by geographic boundaries. Additionally, existing employees may appreciate the flexibility of working from home, which can help to increase job satisfaction and retention rates.

Furthermore, "working from home" can result in cost savings for companies by reducing expenses such as office space, supplies, and utilities. This reduction in operating costs can be particularly beneficial for smaller businesses or those facing financial challenges.

Overall, the "working from home" approach is a viable option for companies to adapt to changing circumstances, while also providing benefits to both employers and employees.

From the employee perspective

"Telecommuting" offers a range of benefits, including the reduction of employee commuting stress and improved work–family balance, which can ultimately lead to higher work performance. Firstly, from the perspective of commuting factors, "working from home" eliminates the need for employees to waste time and energy on their daily commute, which in turn reduces commuting pressure and allows them to focus more time and energy on work, ultimately enhancing their work efficiency. Secondly, "telecommuting" breaks down the traditional office mode, leading to a weakened sense of boundary between different organizations and functions, which is beneficial for employees who can use the internet platform to access knowledge sharing and utilize more resources in the office process.

From the social perspective

”Working from home” is a sustainable practice that promotes energy conservation and reduces environmental pollution. In the traditional office mode, employees often use various means of transportation during their daily commute, resulting in high levels of air pollution. The modern society is facing challenges such as resource depletion, air pollution, and climate change. ”Home office” mode can alleviate the traffic congestion during peak commuting hours, thus contributing to energy conservation. Furthermore, ”home office” leverages the utility of the internet and computer, and as an office mode with less pollution and energy consumption, it reduces the consumption of office supplies, as compared to traditional office mode. This novel office model aligns with the future development trend and promotes green development by reducing energy consumption through a change in the way we work.

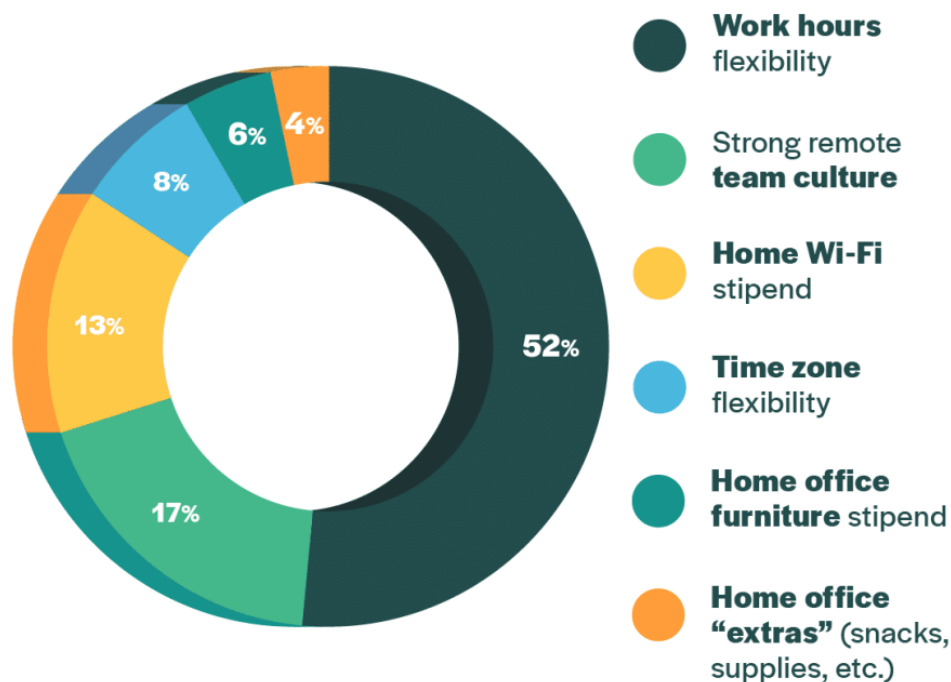


Fig 18 Value and advantage of telecommuting

1.4.2 Risks and disadvantage

The interference of family and other distractions can pose a challenge to the supervision and control of employees' work processes and performance, thereby negatively affecting employee productivity.

While some companies like Google and Facebook allow employees to work from home during "inconvenient times", few have fully embraced remote work even during the pandemic. Employee performance is greatly influenced by their work environment, and an environment with fewer distractions can lead to higher work efficiency. The family environment is one such source of potential distractions. When employees achieve a healthy work–family balance, the family can positively impact employee performance. However, when family interference cannot be eliminated, conflicts between work and family can significantly reduce employee productivity.

Therefore, it is crucial for companies to provide employees with a suitable work environment that minimizes distractions and promotes optimal work performance, whether it is in a traditional office or a remote work setting. Companies should also consider implementing policies that facilitate a healthy work–life balance for their employees to promote optimal performance and job satisfaction.

The decline in face–to–face communication among employees poses a challenge to fostering a sense of unity within an organization. As social beings, humans thrive on interpersonal interaction that transcends the limitations of virtual communication. Although technological advancements have enabled seamless online collaboration, it cannot replace the richness and depth of in–person communication. This dearth of face–to–face interaction can dampen employees' enthusiasm, weaken their commitment to the organization, and impair loyalty. It also limits the potential for developing personal relationships between colleagues and superiors, ultimately impeding mutual understanding and solidarity. The dearth of interpersonal communication also contributes to an uninviting and uninspiring work atmosphere, leaving employees feeling disconnected and lonely, which is detrimental to the long–term health of the company.

	Benefits (probable)	Limitations (potential)
Individual	<ul style="list-style-type: none"> • Higher job satisfaction • Higher organizational commitment • Less pressure • Better time management • Reduced travel time • Balance work and home life • Distraction free environment • Less involvement in office politics • Suitable for homebound employees 	<ul style="list-style-type: none"> • Feelings of isolation from the work culture • Lack of promotional opportunities • Lose out on the assignment of good projects • Dissatisfaction with peer relationships • Less influence over the people and events at work • Work/family conflict • Harder to take a sick day
Organizational	<ul style="list-style-type: none"> • Increase productivity • Lower costs • Less office space needed • Reduced absenteeism • Lower turnover • Do not have to have all employees in one location (a terrorist consideration) • Increased recruitment options • Able to adapt to the virtual organization 	<ul style="list-style-type: none"> • More difficult to supervise • Assessment concerns • Special logistics requirements • Sensitive information could be compromised • Goes against the concept of teamwork • Control over health and safety • Lack of infrastructure support (secretary, etc.).
Society	<ul style="list-style-type: none"> • Less traffic • Less pollution • Conserve oil • Supports the local and rural communities 	<ul style="list-style-type: none"> • Individualistic mentality • Fewer face-to-face relationships

Adapted from:

Baruch, Y. (2001). The status of research on teleworking and an agenda for future research. *International Journal of Management Reviews*, 3(2), 113-129.

Daniels, K., Lamond, D., and Standen, P. (2001). Teleworking: Frameworks for organizational research. *Journal of Management Studies*, 38(8), 1151-1185.

Fig 19 benefits and limitations of telecommuting

1.4.3 How to improve telecommuting experience

Establish a blended office environment that combines “working from home” with traditional office spaces.

Creating a unified workspace can help employees improve their focus and concentration during work hours while still communicating remotely. According to survey data, only about 11% of employees are willing to work completely from home, as most feel that working from home exclusively could lead to decreased productivity. To ensure the long-term viability of the “working from home” model, it is important to establish a unified or similar workspace that helps employees distinguish between work and leisure time. This not only allows employees to manage their time flexibly and create a relaxed working atmosphere, but also enables enterprises to monitor employee performance and promote communication among employees.

Customizing an Appropriate Office Environment for Different Work Positions

Implementing the “home office” mode can be challenging for many companies due to the lack of prior experience. Therefore, before introducing this office mode to enterprises, it is crucial to identify the suitable job positions and work content, and develop the necessary supporting workflows. First and foremost, it is necessary to identify which job positions are compatible with “home working” and then customize the office environment accordingly. Secondly, the work content and process should be re-evaluated to suit the requirements of remote work. As “home office” is a novel office system that differs from the traditional office mode, the original office content and process need to be adapted to make it more suitable for remote work conditions.



Over Communicate

With teams spread out and using digital tools to communicate, it's easier for messages to get lost and overlooked. Update your manager frequently on everything you're doing. Regularly check in with employees you manage to ensure they are on target and have clear objectives.



Check Equipment and Software

Teleworking requires a lot of conference calls and video conferencing. Promote one platform for teleworking. Employees should be able to work seamlessly with other groups in your organization without having to download a new program every time they are asked to join a call.



Have a Plan for the Kids

Teleworking, social distancing and home isolation is a significant disruption. It is helpful for the whole family to understand the new expectations for the day. Let the children know when a parent will be available and when they need to work.



Don't Forget About "Non-Employees"

Craft a plan to communicate with workers who might not automatically receive official work communications. These workers might include volunteers, independent contractors, vendors and interns. Think about the people who are part of your team but are not official employees.



Forward Your Phone

In the sudden need to work from home it's easy to forget one of the most important steps—forwarding your desk phone to your mobile or home phone. Customers and clients are still expecting you to pick up when they call.

Fig 20 Tips to better telecommuting

Chapter 2.

Context analysis

Chapter 2. Context analysis

2.1 Conditions of remote workers

2.1.1 Office furniture

The global pandemic has spurred a widespread reevaluation of office distance, space openness, and collaboration. In the last century, it was believed that the office would become obsolete with the advent of the internet, as the internet could instantaneously connect any two locations, rendering physical space irrelevant and offices unnecessary. However, despite advanced technology enabling global instant communication and allowing people to work from home, most people still commute to an office every day. In fact, more and more companies are recognizing the importance of the office environment, resulting in a more diverse and open design of office spaces. This shift reflects the understanding that work is not just a means of making a living but a crucial part of life. Hence, new office spaces are being created rather than offices disappearing altogether.

The importance of the office environment lies in the fact that it not only represents a window to display the corporate image and culture but also serves as the space in which employees spend eight hours of their day. In some cases, the significance of the office environment may even surpass that of the home environment for employees. A conducive office environment can enhance employees' sense of comfort, belonging, and work efficiency. Furthermore, an office environment that emphasizes creativity and collaboration can further improve employee performance.

Freestanding tables and chairs from the 1920s and 1930s



The 'cubicle' of the 1980s and 1990s



Now there is no partition



Fig 21 The changing history of office furniture

Traditional office furniture

Reception area

Reception desk, reception sofa, table and chair, end table, display rack. Used in the reception area to provide a comfortable and welcoming environment for customers.



Management office

File cabinet, office chair, sofa, coffee table, small meeting table and chair. Used to provide work space



Fig 22 Office furniture types

Staff office area

Desk, chair lift, file cabinet, partition cabinet, combination sofa end table, writing board. Make a point of storing files and office supplies, and help keep your workspace organized.



Conference room

Meeting table and chair, tea cabinet, folding table and chair. Designed for meetings and discussions, it usually has a larger surface area than a standard table.



Fig 22 Office furniture types

Other accessories

Folding bed, bed, wardrobe, nightstand, desk, monitor table. Ergonomic accessories can help employees work more comfortably and avoid strain and injury.



Fig 22 Office furniture types

To summarize, the ideal working conditions for remote workers include:

Sufficient workspace: Remote workers require a workspace that is spacious, comfortable, and devoid of distractions. This space can be in the form of a home office or a co-working facility.

Appropriate equipment: Remote workers need access to appropriate equipment such as computers, phones, and tools, which enable them to carry out their job responsibilities efficiently. Additionally, ergonomic office furniture is essential for remote workers to ensure their comfort and minimize the risk of injury.

Incorporating these elements into a remote worker's work environment can improve their productivity, job satisfaction, and overall well-being.

2.1.1.1 Need of office furniture

Demand of man-machine relationship

Based on market research analysis, 90% of people who work at desks for extended periods experience neck and shoulder muscle strain due to an inadequate man-machine relationship over time. While the common height difference between office desks and chairs on the market is around 300mm, the actual optimal height may vary based on gender and specific needs, potentially exceeding the height limit. Furthermore, due to the dynamic nature of people's postures while working, the man-machine relationship can easily cause harm to the human body. Despite various telescopic chairs available on the market that can adjust the height, the most reasonable height for each individual worker remains a problem yet to be solved. Therefore, the design of office furniture must address this issue by incorporating reasonable dynamic design elements to tables and chairs and adapting to changes in people's postures.

Demand of office automation

In contemporary office spaces, a variety of office furniture is utilized, including benches, chairs, partitions, filing cabinets, archives, and a plethora of books and documents, along with essential office equipment such as computers, fax machines, projectors, printers, and shredders. Thus, office furniture serves not only to create a suitable and comfortable work environment but also to cater to the structure of office equipment and enhance space utilization. A crucial aspect of adapting to office automation is designing adjustable furniture space through reasonable scale planning. This enables the efficient use of space while accommodating the changing needs of modern offices.

Demand of leisure and office integration

Modern office furniture serves multiple functions, including providing space for work, communication, and relaxation. The design of office furniture places emphasis on expanding humanized leisure space, as seen in some large enterprises that provide leisure areas for their employees to rest, play games, or have small meetings. However, many office buildings cannot offer such activities due to space constraints. To achieve the functional conversion between office and leisure using the same furniture, it is necessary to rely on dynamic design and research of furniture structure to facilitate conversion by adjusting the structure, combination, and movement of furniture.

2.1.1.2 Type of office furniture

Office furniture is a broad term that encompasses a wide range of items used to facilitate work activities and create a comfortable and efficient workspace. Some of the most common types of office furniture include:

Folding type

To optimize unfolding, furniture designers often incorporate folding mechanisms into office furniture to enhance space-saving capabilities and ease of movement. Two common forms of folding office furniture include the planar connecting rod mechanism and overlapping arrangement. The former utilizes external stretching to achieve folding in either vertical or horizontal directions, as seen in folding tables, chairs, and sofas. The latter involves arranging objects to maximize space and concealment, as in the case of hidden cabinets.

Combined type

Combination is a widely-used design method in which multiple parts or units are brought together to form a unified whole. In the realm of office furniture, modular combination is frequently utilized, featuring standardized interfaces or connectors that connect various modules to create a variety of furniture forms. This approach offers numerous benefits, including simple yet elegant designs, high flexibility, and a wide range of functions, making it well-suited for use in various office spaces.

Regulating type

Adjustable office furniture is designed based on ergonomic principles, taking into consideration the various proportions and postural changes of the human body. By incorporating motion structures and adjusting the size and angles of furniture, it can meet the diverse needs of different users. There are various adjustment modes, such as screw-fixed position adjustment, spiral adjustment, pressure rod type adjustment, hydraulic type adjustment, and electric adjustment, as seen in features like chair lifts.

Rotary type

Rotary office furniture typically features a pulley or bearing structure added to the bottom of the furniture to facilitate movement. Examples of such furniture include swivel chairs, computer desks, and file cabinets.

Sliding type

Sliding office furniture refers to furniture equipped with sliding devices, which enable the active surface and fixed surface of the furniture to move effortlessly. This type of furniture typically employs roller or ball-type devices, allowing for easy and smooth movement. Sliding office furniture is commonly used for drawers, cabinet doors, and other furniture that requires mobility.



Fig 23 Type of office furniture

2.1.2 Life furniture

The coronavirus pandemic has upended the cultural and technological barriers that previously impeded the growth of telecommuting. As a result, the workplace is undergoing a structural transformation for some segments of the workforce. According to a study by the McKinsey Global Institute (MGI), which examined more than 2,000 jobs in 800 occupations across nine countries (China, France, Germany, India, Japan, Mexico, Spain, the United Kingdom, and the United States), only a small number of highly skilled and educated individuals in select industries, occupations, and locations have the potential to telecommute effectively.

2.1.2.1 Secondhand furniture

Second-hand furniture refers to used furniture that has been sold or exchanged. It includes a variety of items such as chairs, tables, filing cabinets, and bookcases. Used furniture is often sold for less than new furniture, making it an attractive option for those on a budget or looking for sustainable alternatives. Some businesses also opt to buy used furniture as a cost-saving measure.

However, it is essential to inspect the furniture thoroughly before purchasing it to ensure that it is in good condition and safe to use. With the advent of the internet, people have become more aware of the benefits of second-hand office furniture. While it may seem like an individual choice, in the long run, it is an inevitable aspect of the changing times.

Benefits of Second-hand Office Furniture

Cost-effectiveness, Time-efficiency and Money-saving

Second-hand office furniture offers a range of benefits over new furniture in terms of cost-effectiveness, time-efficiency and money-saving. With regards to pricing, high-quality used furniture from well-known brands are available at a fraction of the cost of new furniture, thus reducing capital expenditure for businesses by 40–60%. Furthermore, purchasing used furniture is a cost-effective option for businesses looking to furnish their office spaces.

In addition, second-hand office furniture can also save time during the decoration phase. Brands that offer second-hand office furniture usually have items in stock, so customers can purchase and receive their orders promptly, without the need for customization or shipping. This eliminates the time-consuming processes associated with new furniture, such as cargo transfer, customization, and shipping.

Therefore, the cost-effectiveness, time-efficiency, and money-saving benefits of second-hand office furniture make it an attractive option for businesses looking for sustainable alternatives and budget-friendly solutions.

The use of second-hand office furniture has multiple benefits beyond cost savings. One key benefit is the use of healthier materials and reduced health risks associated with off-gassing of chemicals such as formaldehyde. Second-hand office furniture typically comes from top-tier companies with high standards for material and production processes. After 2–5 years of use, harmful substances have already been released, making it a safer option. Additionally, second-hand furniture rental programs are becoming increasingly popular among medium and large enterprises, allowing them to achieve sustainability goals while maintaining product quality comparable to new furniture. By embracing second-hand furniture, companies can achieve a win-win situation of cost savings, sustainability, and a healthier work environment for their employees.

Reducing Resource Consumption and Carbon Emissions

Apart from the cost-effectiveness and health benefits of second-hand office furniture, another advantage is its contribution to reducing waste and carbon emissions. With the increasing emphasis on circular economy and carbon neutrality, many renowned enterprises have incorporated the procurement of used office furniture into their carbon-neutral action plans and reports.

In response to the call of the "double carbon" era, Second Tree Recycling Furniture aims to promote environmental, social, and governance (ESG) growth and create a low-carbon sustainable future by partnering with thousands of small and medium-sized enterprises. Through our joint efforts, we help enterprises reduce their resource consumption and carbon emissions while lowering their procurement costs. Moreover, we aim to establish eco-friendly practices by reusing furniture to reduce the need for new furniture production, thus saving natural resources and reducing waste emissions.

Overall, choosing second-hand office furniture not only benefits the enterprise financially and in terms of employee health but also aligns with the global trend of reducing carbon emissions and promoting sustainable development.

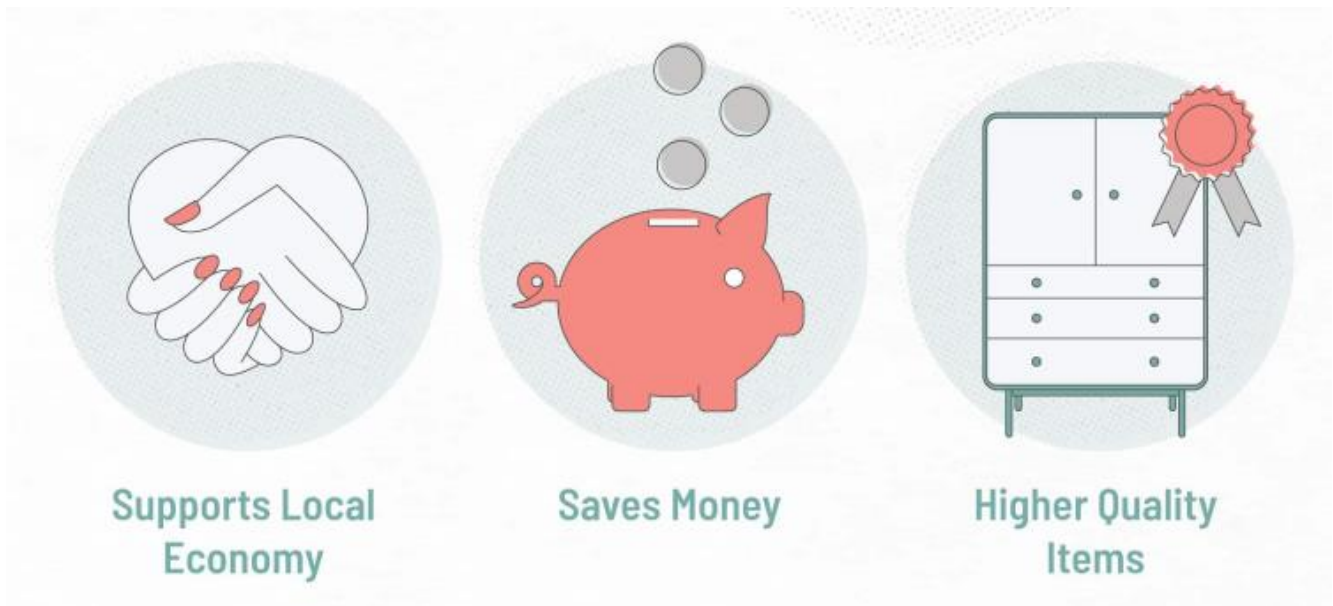


Fig 24 Benefits of used furniture

Challenges Associated with Purchasing Used Furniture:

Limited Options: One of the challenges associated with buying used furniture is the limited availability of options. Sourcing specific types of furniture that meet specific requirements can be more difficult than buying new furniture.

Condition: Used furniture is likely to show signs of wear and tear, which may require additional repairs or maintenance. Buyers must be prepared to inspect the furniture thoroughly to ensure that it is in good condition and safe to use.

Compatibility: Another challenge of used furniture is compatibility with modern technology. For instance, older furniture may not be compatible with modern technology, such as computer desks that do not have built-in cable management solutions.

In conclusion, while buying used furniture can offer several advantages, such as cost-effectiveness and sustainability, businesses need to be aware of the challenges associated with it. Finding the right pieces in good condition, and ensuring compatibility with modern technology, may require extra effort and attention.

2.1.2.2 Need of life furniture

Office and lifestyle furniture are two important categories of furniture. Office furniture is intended to create a professional and efficient workspace while lifestyle furniture is designed to provide comfort and relaxation in the home. In the context of office furniture, it is crucial to establish a fully functional and ergonomic workspace, comprising of tables, chairs, lockers, and other accessories. High-quality office furniture can improve posture, reduce discomfort and fatigue, and enhance productivity. As remote working becomes increasingly popular, there is a growing demand for ergonomic and adaptable office furniture that supports the health and well-being of remote workers. Although there may be some overlap in design and functionality between office and lifestyle furniture, they serve distinct purposes and are tailored to different user needs and preferences. Ultimately, both types of furniture strive to offer users comfort, functionality, and style.

The table is the main thing

When choosing a desk for your home office, it is recommended to select one with a length of at least 1.2m. This length allows ample space to accommodate a computer, some books, and a cup of tea without feeling cramped. Moreover, a width of at least 53cm is ideal, which perfectly fits a laptop with an external keyboard. It is also important to consider a desk that allows for both sitting and standing positions, as this can help alleviate body tension and reduce the monotony and stress that come with working from home.

Flexible folding office furniture

When both spouses need a study or when children occupy the only available desk in the house, people working from home require a more flexible space layout, especially those with limited space in their homes.

Accessories

When setting up your home office, it's important to consider your desk setup, including nearby accessories such as a switchboard for easy access to power. A storage box socket is recommended for maintaining a clean and tidy workspace. Additionally, desktop storage options like bookshelves and pencil holders can enhance organization, and using items from the same series or material (e.g. iron art or concrete) can create

a cohesive look. To ensure proper lighting, a desk lamp can be added. Other optional items to personalize the workspace may include a trash can, humidifier, desk calendar, or decorative items like photos or ornaments.

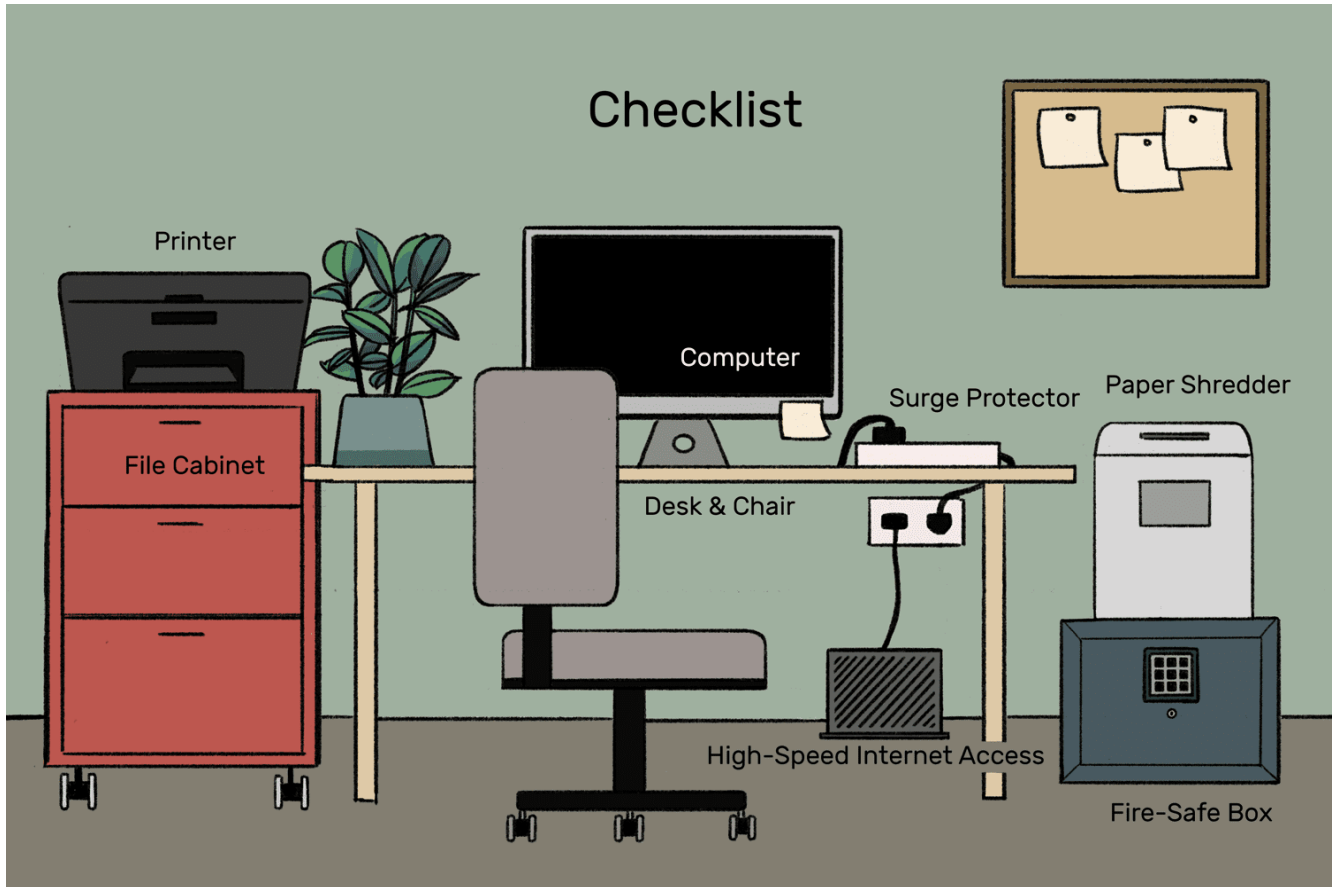


Fig 25 Checklist of home office furniture

2.1.3 Challenges and opportunities

We are witnessing a shift in office environments from compartmentalized spaces to closed spaces, and now to open spaces. The transformation of office spaces is evident as cubicles, once extremely popular, have become more humanized and have given way to open, intelligent, healthy, dynamic, and flexible office spaces. The primary goal is to maximize the value of the workspace and provide employees with high-quality and highly satisfying work environments.

The challenges and opportunities facing office furniture include:

1. **Challenges:** Unergonomic office furniture can lead to health problems such as back pain, carpal tunnel syndrome and eye strain.
2. **Cost:** Office furniture can be expensive, especially if a company is buying it for a large number of employees.
3. **Sustainability:** The manufacture and disposal of office furniture can have a significant impact on the environment, so sustainability is an important consideration.
4. **Flexibility:** With the trend toward more employees working remotely and collaboratively, the need for flexibility in office Spaces poses challenges for office furniture designers and manufacturers.
5. **Aesthetic:** The appearance of office furniture is an important consideration, as it can affect the overall image of a company.

Mobile office environment allows more freedom in working mode

Currently, we are witnessing the rise of desktop computers replacing laptops, and tablets becoming an essential office tool in the near future. Moreover, factors such as meetings, business trips, and remote work are driving the development of mobile office equipment. This, in turn, is shaping people's mobile work styles, which necessitates a mobile office environment. In the future, individuals may not have their own designated workspace but rather be able to work from anywhere.

Intelligent office environment makes work simple and efficient

Due to the rapid advancement of science and technology, we can expect the office environment to become increasingly intelligent. For example, iris recognition access control, intelligent cleaning machines, automatic watering systems, and smart air conditioning systems will become common. Moreover, augmented reality (AR)

technology is also expected to enter the field of office equipment. Notably, traditional projectors, whiteboards, and markers will soon be replaced by smart conference tablets with a range of functions, such as computers, projectors, screens, whiteboards, audio systems, and remote video conferencing capabilities.

Customized office environment can relieve boredom and stimulate creativity

In the coming years, there will be a growing focus on promoting "creativity" and "individuality" in the workplace, leading to a flourishing cultural and creative industry. With the emergence of younger generations who place a greater emphasis on freedom and individuality, these individuals will become the driving force behind enterprise growth. Consequently, it has become necessary to create an office environment that meets individual needs and stimulates creativity. Personalized office spaces can accommodate individual needs and preferences, such as providing maternal and infant rooms to assist female employees. In addition to personal workspaces, customized team areas are also available to meet the diverse needs of employees. By providing employees with the freedom to showcase their unique personalities and creativity, businesses can promote internal diversity, cultivate employee creativity, and achieve greater success.

Modular office space

The trend of office space is shifting from closed to open, from indoor to outdoor, and from centralized to decentralized. As companies place more emphasis on collaboration in the workplace, furniture that fosters teamwork and communication is becoming increasingly popular. Furthermore, in the future, there will be more combined office spaces that accommodate small teams of large enterprises and industrial alliances of small and micro enterprises. Additionally, modular office spaces will become more prevalent due to the diverse working environments and job requirements.

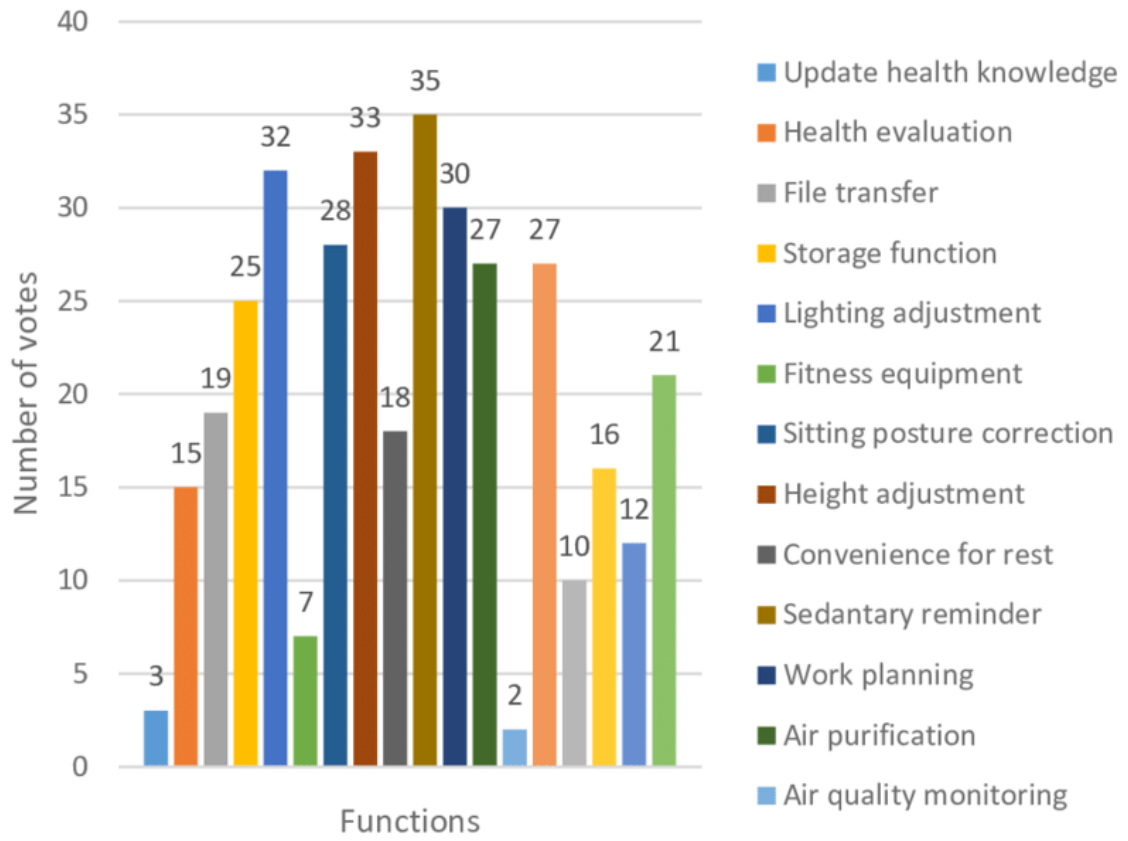


Fig 26 Functions vote of furniture

2.2 Future trends

2.2.1 circular

A circular economy is a restorative system that focuses on the reuse, refurbishment, and recycling of resources to maximize their value and minimize waste. The furniture industry has a significant environmental impact, from the extraction of raw materials to the disposal of furniture at the end of its life cycle. Therefore, the industry is increasingly exploring the potential of a circular economy model to reduce waste and carbon emissions.

The circular economy model for furniture involves renting, refurbishing, and reusing furniture instead of buying new. A rental system that revolves furniture can offer businesses and individuals quality office furniture, reducing the need for purchasing and disposing of new furniture. Additionally, refurbishing or repurposing existing furniture can prolong its life cycle and minimize the requirement for new resources.

Adopting a circular economy model can also open up new revenue streams for businesses by offering additional services such as repair and maintenance. By prolonging the life of furniture, businesses can enhance customer loyalty, reduce waste, save costs, and positively impact the environment.

However, implementing a circular economy model in the furniture industry necessitates significant changes in production and supply chain management. Some challenges include sourcing high-quality used furniture, establishing an efficient renovation and repair process, and creating a market for used furniture.

Overall, the circular economy model offers crucial opportunities for the furniture industry to decrease waste and carbon emissions, boost revenue, and develop sustainable and equitable practices.

2.2.2 how circular change the effects

The implementation of a circular economy can significantly enhance the efficiency of office furniture usage. Under a linear economy, office furniture is frequently discarded after use, resulting in environmental waste and pollution. In contrast, the circular economy aims to reuse, repair, or recycle office furniture, thereby reducing waste and conserving resources. By adopting circular economy practices, the way we work remotely can be transformed, leading to sustainability and waste reduction across the value chain, from product design and production to end-of-life disposal.

Through the adoption of circular economy practices, office furniture can be designed, produced, used, and disposed of in a more sustainable manner. The circular economy model promotes the use of renewable resources, extends the lifespan of office furniture, and encourages the creation of new products from recycled materials. By reducing waste and carbon emissions, the circular economy can promote a more environmentally responsible approach to office furniture usage. Moreover, the adoption of circular economy practices can also lead to the creation of new jobs and the development of innovative technologies, driving economic growth and social progress.

Materials innovation: Circular economy principles are becoming increasingly important in the selection of materials for office furniture. In order to reduce the environmental impact of production, transportation and disposal, manufacturers are expected to use more sustainable materials such as recycled plastics, bamboo and recycled wood. These materials not only help to minimize waste and save resources, but also produce durable, environmentally friendly and cost-effective products. As the circular economy gains more traction, it is likely that sustainable material selection will become a key consideration for office furniture manufacturers looking to meet the demands of environmentally conscious consumers.

Closed loop supply chain: To achieve a circular economy for office furniture, it is crucial for companies to adopt circular business models such as recycling programs, rental or leasing services, and remanufacturing. To make this possible, companies must collaborate with their suppliers, customers, and partners to create a closed-loop system that minimizes waste and maximizes resource efficiency. By doing so,

companies can create a sustainable supply chain that facilitates the repurposing and reuse of materials and products, thereby reducing waste and maximizing the value of resources.

Digital: Incorporating digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain can enable the tracking and monitoring of the entire life cycle of office furniture products, thus reducing waste and optimizing resource allocation.

Circular design thinking: To achieve a circular economy for office furniture, designers need to adopt a circular design thinking approach, which involves considering the end-of-life of products at the beginning of the design process. This approach can lead to innovative design solutions that enable materials to be dismantled, repaired, and reused, thus extending the life of products. In addition, the principles of the circular economy can be applied to remote work by considering the impact and life cycle of digital tools, telecommunications infrastructure, and other services that make remote work possible. For instance, remote workers can reduce waste and extend the life of existing products by using refurbished or recycled equipment instead of purchasing new equipment every few years. Similarly, companies can develop circular business models that promote the reuse and sharing of resources, such as co-working spaces, meeting rooms, and other office equipment, to minimize waste and promote sustainability.

Consumer awareness and Behavior change: As environmental awareness among consumers grows, there will likely be an increasing demand for office furniture that is sustainable and environmentally friendly. Meeting this demand will require a shift in consumer behavior and preferences, placing greater emphasis on factors such as durability, maintainability, and recyclability. In response, office furniture manufacturers will need to prioritize sustainable design and production practices, and work towards meeting the expectations of eco-conscious consumers. By doing so, they can not only promote environmental sustainability, but also differentiate themselves in the market and gain a competitive advantage.

The future trends in the circular economy of office furniture are likely to be shaped by a growing demand for sustainable, resource-efficient, and environmentally friendly products, as well as an increasing awareness of the importance of recycling in business practices. In conclusion, circular economy principles offer an avenue for promoting sustainability in remote working by enabling the reuse, sharing, and recycling of resources while minimizing waste and reducing the environmental footprint.

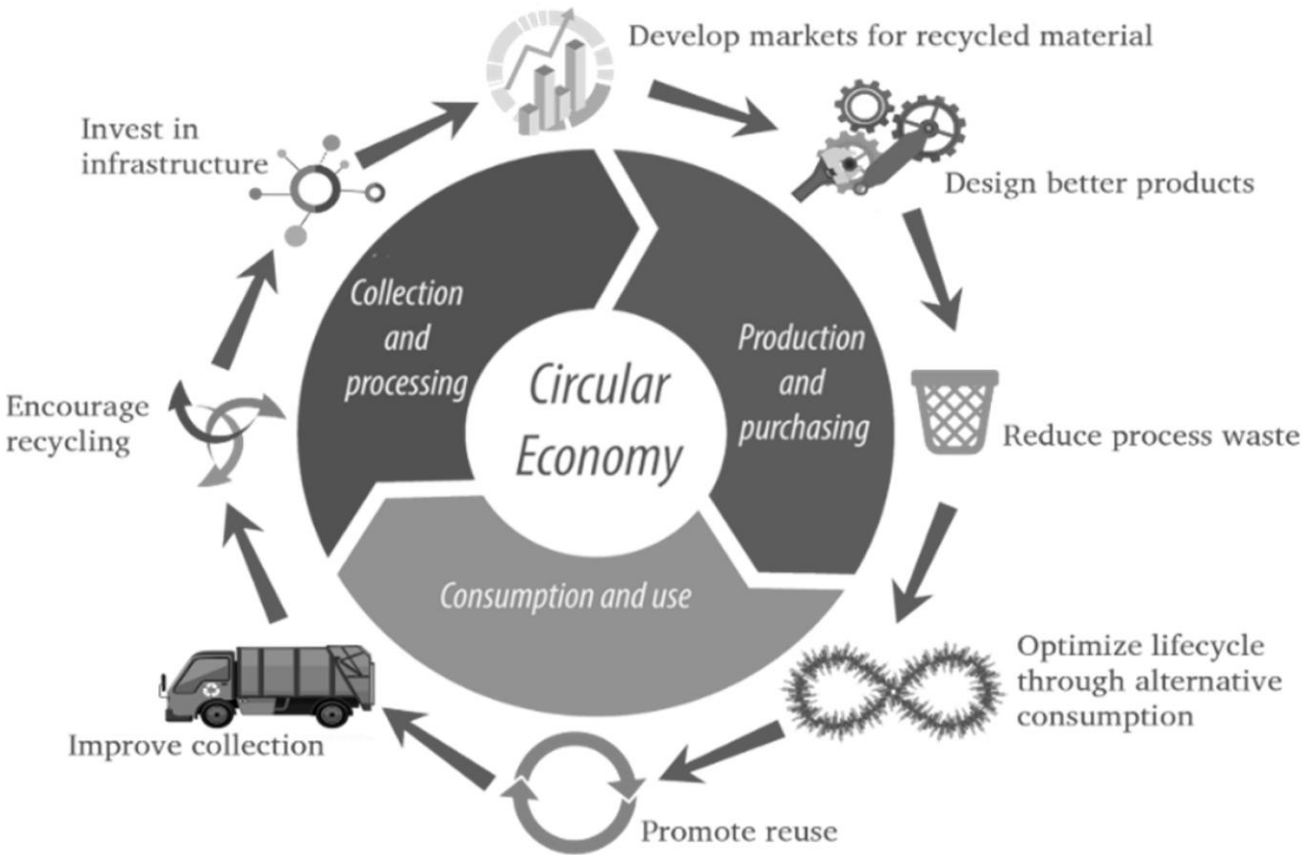


Fig 26 How circular economy achieve sustainability

Chapter 3.

Case study of furniture

Chapter 3. Case study of furniture

Case studies are a crucial tool in the design field as they offer tangible and practical examples of design problems and solutions. They provide an in-depth and comprehensive description of the design process, starting from the research phase, concept development, prototyping, and testing stages. By analyzing these real-world examples, designers can gain a better understanding of the context in which their designs will be used and the challenges they may face.

Through examining both successful and unsuccessful design solutions in case studies, designers can learn from the experiences of others and acquire valuable insights into best practices and strategies for tackling design challenges. Case studies offer a unique opportunity for designers to understand the decision-making process and how they can apply successful strategies to their own work.

Furthermore, case studies can help designers anticipate potential problems and develop strategies to avoid them, leading to a more efficient and effective design process. By taking the time to analyze and learn from case studies, designers can improve their design skills and develop a better understanding of how to create designs that are not only aesthetically pleasing but also functional, effective, and meet the needs of users.

3.1 Technology-based



IKEA Place and AR Kit

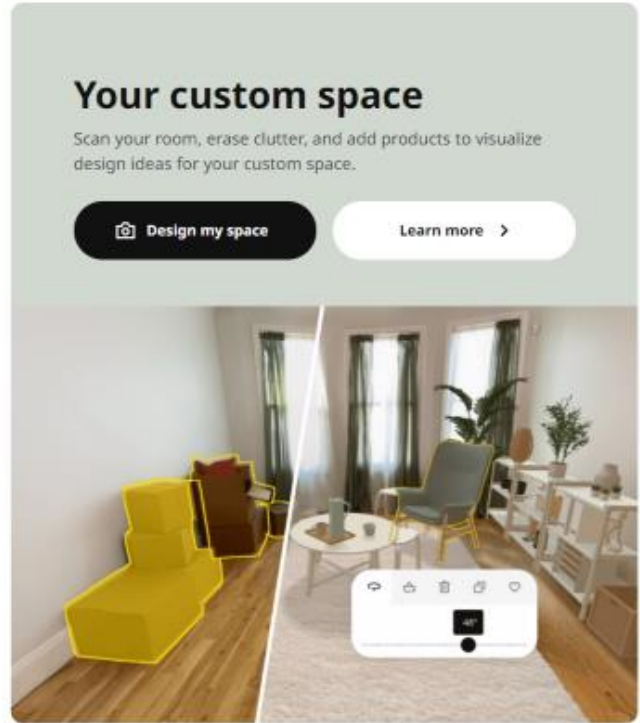
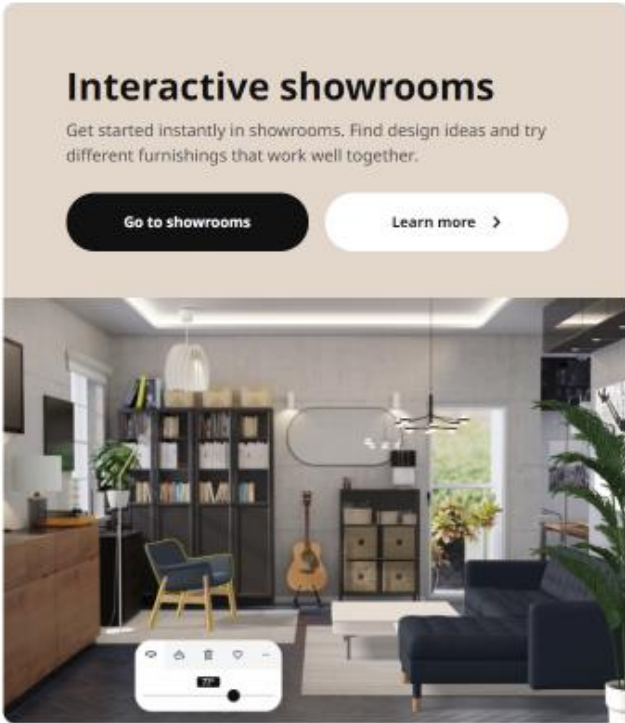
The furniture industry has been at the forefront of applying AR technology. In 2017, Apple launched the AR Kit platform, and IKEA became its first partner. Together, they created IKEA Place, an AR application that allows users to project 3D models of products into real-life settings. This helps consumers visualize the effect of selected furniture in their homes, offices, or apartments, without the need for measurements or color matching. AR technology can estimate the scale and track motion, streamlining the furniture selection process in the household industry.



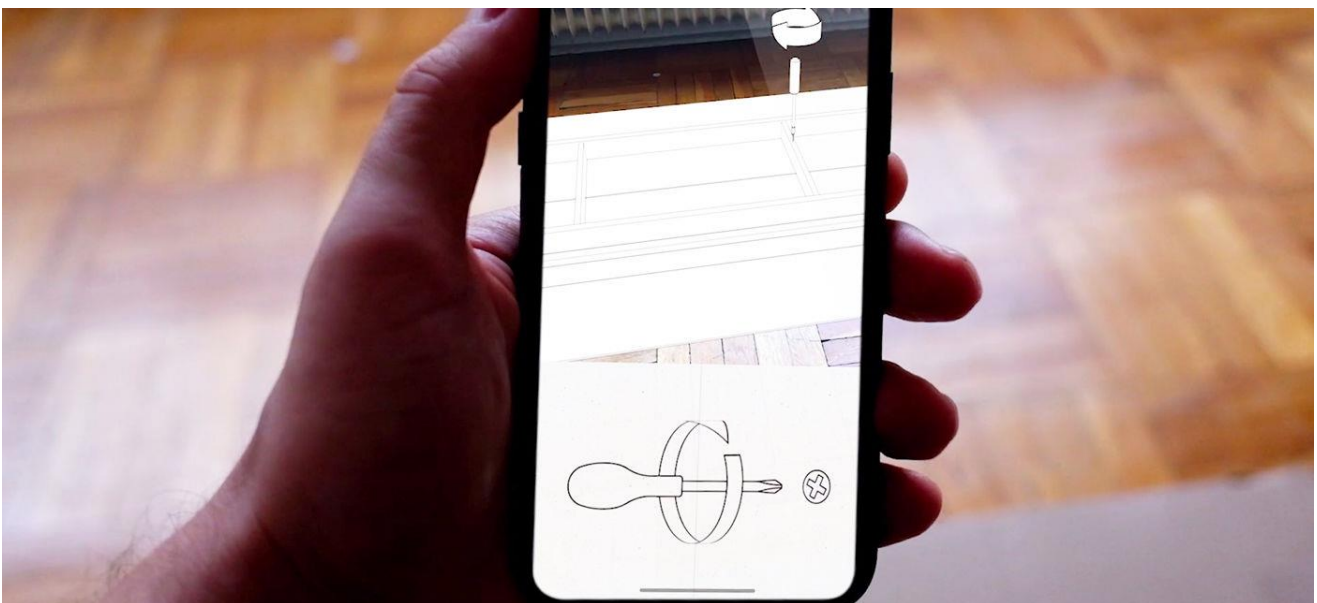
Case in point, when people buy new furniture, they often face the challenge of determining whether the size is appropriate and whether the style matches their existing decor. IKEA Place, a furniture app that uses AR, allows consumers to simulate different furniture arrangements before making a purchase. This empowers consumers to determine whether new furniture is suitable for their homes.

IKEA Place boasts over 2,000 digitally rendered pieces of furniture, including sofas, coffee tables, and armchairs, allowing users to explore and design their own unique spaces. AR Kit-enabled apps automatically scan the environment and adjust the size of the 3D model to match the room size. Moreover, virtual furniture brings realistic lighting and shadows, making the experience more realistic and meeting users' needs.

The app also allows users to take photos of their designed spaces and share them with friends and family for feedback. While IKEA Place currently focuses on large furniture for living rooms, such as sofas, tables, and storage solutions, AR applications will play an essential role in future product lines. Additionally, if consumers don't like their current rooms, IKEA creative offers 50 3D virtual rooms for them to experiment with and decorate.



Traditionally, furniture installation manuals are paper-based, and while IKEA's products are minimalist and detailed, they're not visually intuitive. To help home consumers, Assemble AR takes an extra step by digitizing complex installation steps and displaying them in AR form. Users can follow the app's prompts to assemble the furniture correctly. The app displays the furniture's components and their placement, the arrangement of planks, and the direction to rotate screws, as well as providing detailed installation demonstrations by scanning the QR code on the app's scanning box.



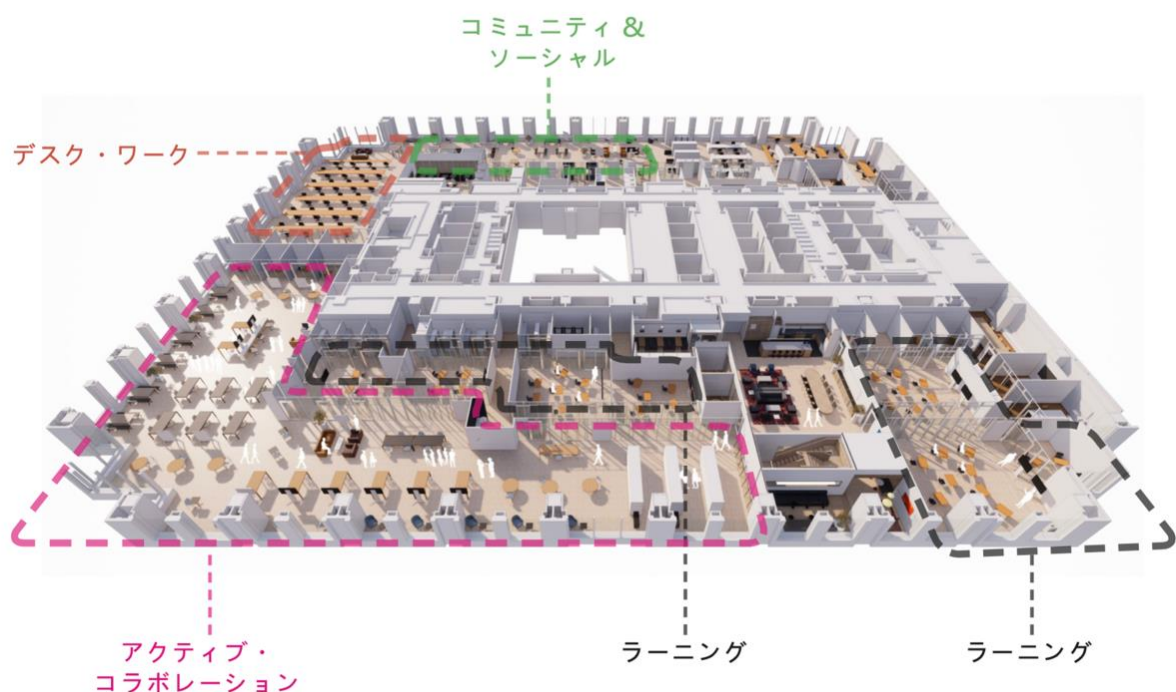
In conclusion, AR technology has transformed the furniture industry by allowing consumers to visualize furniture placement and streamline the installation process. IKEA's AR-enabled apps have demonstrated that AR technology can enhance user experience, boost sales, and provide consumers with more creative control.

3.2 Environment

PayPay

The progress and development of design are driven by advancements in technology and changing societal needs. In the wake of the COVID-19 pandemic, people's perceptions of the office environment have shifted, prompting designers to reconsider the traditional approach to office design. While design has historically focused on practical problem-solving, the rise of experience design has emphasized the importance of creating joyful and valuable experiences for users. One way designers are meeting this challenge is through the integration of modular and DIY furniture design, resulting in multifunctional and flexible furniture solutions that improve user experience.

PayPay Co., Ltd. is an example of a company that has redefined the office environment through innovative design. By reducing the number of traditional desk workstations by 75 percent and creating spaces for employees to interact, PayPay's new office maximizes the benefits of having a physical workspace. The modular design of the furniture allows for a family-style approach to workplace design, enabling employees to choose from a range of furniture options such as bookcases, dining tables, sofas, chairs, and stools that can be combined into different work scenes. By offering employees the ability to choose their own furniture and set up four corporate zones, PayPay has created a customized office that reflects the new normal of work.



Modular furniture design emphasizes the characteristics of modularity, sustainability, and freedom. By allowing for different combinations of each module, users can create different product use environments according to their needs. Modular furniture can be versatile and multifunctional, breaking down into different furniture pieces such as tables, chairs, and sofas, depending on the desired placement and style. This approach provides a lot of combination possibilities, making space change more flexible and casual.



In summary, the integration of modular and DIY furniture design with experience design principles is reshaping the way designers approach workplace design, resulting in multifunctional and flexible furniture solutions that improve user experience and support changing societal needs.



3.3 Products

Bauhütte

Bauhütte, a Japanese gaming furniture brand, specializes in creating products designed to meet the unique needs of esports players. Their products are known for their practicality and functionality. One of their most notable offerings is the Gaming Bed, which is specifically designed for those who spend long hours playing video games.



The bed features a high-quality mattress made in collaboration with Nishikawa, a reputable 455-year-old Japanese manufacturer, and an electric system that connects to dual motors for adjustments in the back and leg areas. This allows users to adjust the back angle up to 60° and the leg angle up to 35°, enabling them to easily switch between sleeping and playing with the press of a button. The Gaming Bed is also compatible with Bauhütte's modular home gaming system, which includes various modular options such as tables, wardrobes, and kitchen cutlery areas. This system provides gamers with everything they need without having to leave their gaming area.



Bauhutte offers a range of modular furniture systems, including beds, tables, wardrobes, and bookshelves. With over 150 furniture pieces and accessories to choose from, users can customize and combine them to build their ideal gaming table. Additionally, there are 12 available modes as presets for those who are unsure of what type of desk they want.



The modular nature of Bauhutte’s products allows for multi-functional use. For example, users can convert their hangers to beds, providing a convenient storage solution for their clothes. This feature is particularly useful for people who go to school or work on a daily basis, allowing them to quickly switch between different activities throughout the day. Bauhutte’s products also provide comfort and convenience for non-gaming activities such as eating, reading, and relaxing.

Overall, Bauhutte’s practical and modular designs make them a leading brand in the gaming furniture market, providing gamers with the comfort and functionality they need to optimize their gaming experience.

3.4 Service

HERMAN MILLER

The prevalence of disposable products in modern society is a disheartening trend, which is largely fueled by globalization and consumerism. Despite this, there are still companies that prioritize sustainable design and aim to extend the lifespan of their products. One such approach is through the implementation of modular design, which enables products to be disassembled and repaired rather than discarded.

Herman Miller is a company that creates innovative designs that empower individuals to accomplish great things. With a focus on durability, Herman Miller's products are built to withstand daily use both in the workplace and at home. Modular design is a key aspect of Herman Miller's approach, which includes a range of replaceable parts such as electrical components, casters, cylinders, and tilt mechanisms. In fact, almost any part of the iconic Herman Miller Aeron chair can be purchased as a replacement.

Should a user encounter any issues with their Herman Miller product, they can easily reach out to the company's dealer, retailer, or online store where the product was purchased for assistance. These authorized dealers can determine whether the issue is covered under warranty and whether a replacement or repair is necessary. With a global network of dealers, users can easily locate the nearest dealer via GPS technology. Additionally, replacement parts are readily available through Herman Miller's partner dealers, ensuring that users can prolong the lifespan of their products with ease.



Chapter 4.

Synthesis of design research

Chapter 4. Synthesis of design research

4.1 User research

An interview is a commonly used qualitative research method for data collection. It involves a researcher asking open-ended questions to the respondent to collect data on a specific topic. Prior to conducting an interview, it is necessary to create a comprehensive research plan and formulate relevant questions that help elucidate the opinions of the target audience on the topic of interest. By analyzing and summarizing the obtained information, we can identify user pain points and use them to guide our own design process.

Based on the collected basic information, this paper explores the goal of this paper: to improve the experience of telecommuting through systematic home product design.

Data Target:

1. The most relevant needs of telecommuting;
2. The most important product or part of telecommuting;
3. How to use design to solve these problems.

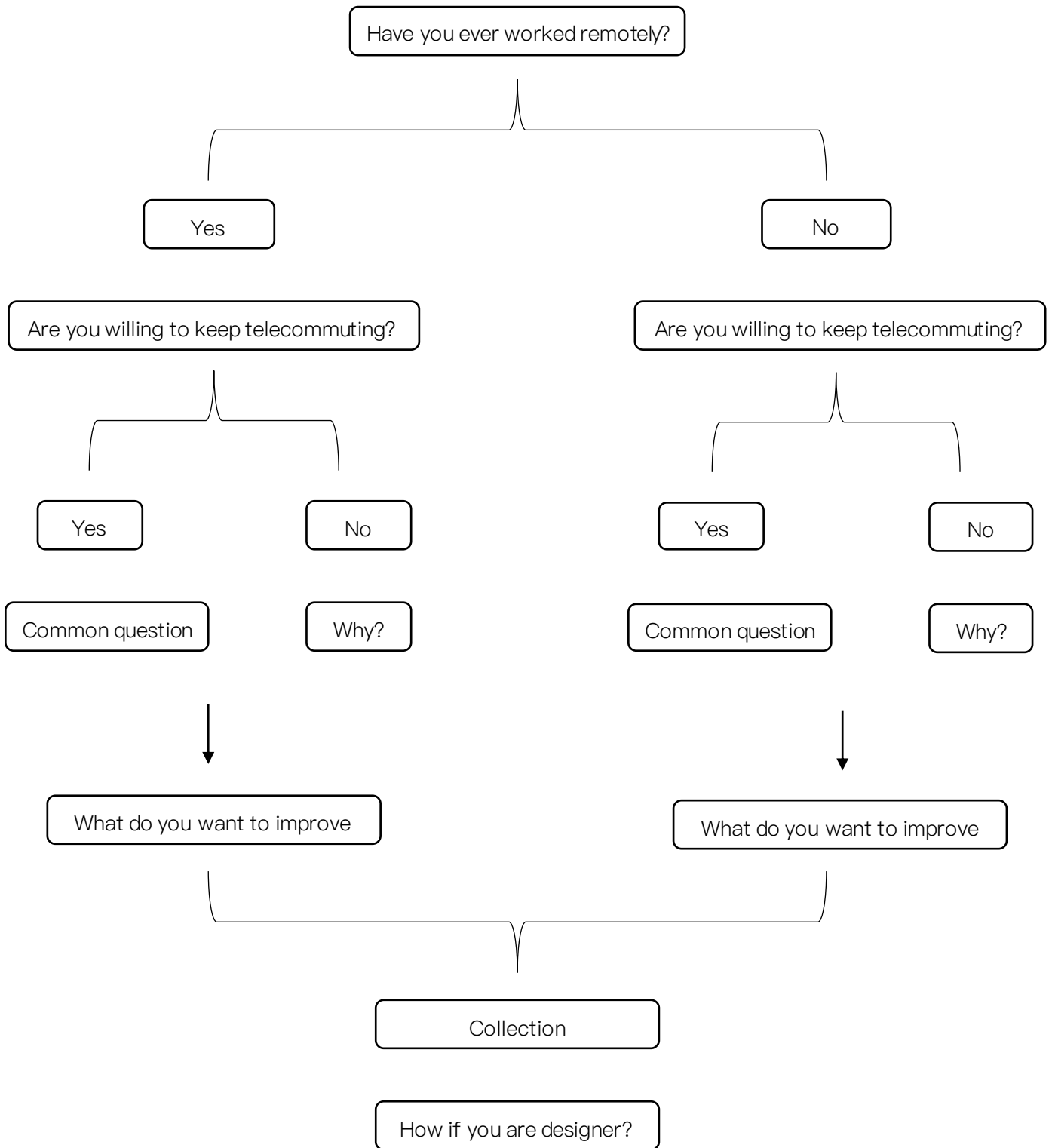
4.1.1 Interview with different age group

In the previous chapters, thesis explored the background of telecommuting in the context of the pandemic, examined its impact, needs, and opportunities. In this chapter, thesis will use a questionnaire to delve into the role of telecommuters.

1. Gain a comprehensive understanding of all aspects of telecommuting through data collection.
2. Conduct a questionnaire survey among users to understand their daily work.
3. Interview individuals from diverse backgrounds to gain an in-depth understanding of the psychology of telecommuting and to discover the real interactions and needs of office staff.
4. Explore the main role of designers in this field by studying the target population and designing a system of home products.
5. Use personas to summarize pain points and opportunities for later design.



The interview structure



Question list

1. What is your current job?

Learning

Preliminary work

Management

Freelance work

Other

2. Do you have a separate working environment during telecommuting?

Yes

No

3. Which work mode do you prefer?

Telecommuting, Reason

On-site office, Reason

4. How often do you telecommute?

Less than 1 a week

1-3 days a week

4 to 7 days a week

No fixed time

5. What are the main effects of working from home today? (multi-select)

Office facilities

Communication

Family

Health

Other

6. What do you think of the working atmosphere?

Be positive, make progress together

Each doing his own job, more harmonious

Lethargy, less communication

Others

7. What do you think of the work efficiency?

Same

More efficient

Low efficiency

Others

Very smooth

Relatively smooth

Basically smooth

Not smooth

8. How well do you communicate and collaborate with others while telecommuting?

Very smooth

Relatively smooth

Basically smooth

Not smooth

9. What are the steps you take when telecommuting and getting no feedback?

Contact the other party

Seek assistance from leaders

Contact relevant colleagues

Wait until the on-site

Wait for feedback

10. What common products do you use most when telecommuting?

Please type

11. What common tools do you use most when telecommuting?

Please type

12. What are your most relevant needs for telecommuting?

Please type

13. What process do you think have enhanced the telecommuting experience?

Please type

14. What furniture do you think will change in the future of telecommuting?

Please type

15. If you were a designer, what do you want to design for telecommuting?

Please type

Questionnaire

Thesis conducted some questionnaire to get more quantitative and qualitative data and get specific answers by separating the different data into categories.

1. Age: Use age group to find the main consumer to design the product.
2. Gender: Different genders have different thinking. This design aim is to enhance the experience. So we must understand this gender thinking differences.
3. Type of work: The work content of telecommuting is different. This group is used to obtain the frequency and work tendency of telecommuting.
4. Family situation: Through the marriage situation to understand the different family division of labor and consider possible impression factors.



1. Age: 25
2. Gender: male
3. Type of work: student (master)
4. Family situation: unmarried

Current job: learning
Have separate working environment
Prefer telecommuting, because can improve efficiency
No foxed time
Office related facilities
Each doing his own job, more harmonious
More efficient
Relatively smooth
Contact the other party
Telecommuting tools: zoom, teams

I am a graduate student and I have some work experience. I think the current experience is good, but I feel slack during this time. I need something or somebody to push me. I think the most important product is Chat APP. If I were a designer, I would design products that reinforce reminders.



1. Age: 22
2. Gender: female
3. Type of work: student (bachelor)
4. Family situation: unmarried

Current job: learning
Have separate working environment
Prefer telecommuting, because environment is quiet
No foxed time
Communication influences
Be positive, make progress together
Same
Very smooth
Contact the other party
Telecommuting tools: zoom, teams

I am a university student, mainly using distance learning. Since I often go to the library to study by myself, distance learning doesn't make any difference to me. I think the most important product is the bookcase. I don't have many books and management tools in my home. If I were a designer, I would design an APP to improve online reading experience.



1. Age: 23
2. Gender: female
3. Type of work: The intern
4. Family situation: unmarried

Current job: Preliminary work
 Don't have separate working environment
 Prefer on-site office, because can learn more from leader
 1-3 days a week
 Communication influences
 Lethargy, less communication
 Low efficiency
 Not smooth
 Seek assistance from leaders
 Telecommuting tools: skype, slack

I am a graduate who is working as an intern. Telecommuting has had a huge impact on me. I struggle with the demands of the company. My most relevant need is how skilled employees guide me. The most useful product for me these days is the company's software.



1. Age: 28
2. Gender: male
3. Type of work: programmer
4. Family situation: married (no baby)

Current job: Preliminary work
 Don't have separate working environment
 Prefer telecommuting, because save more time
 4 to 7 days a week
 Office related facilities
 Be positive, make progress together
 Same
 Very smooth
 Contact relevant colleagues
 Telecommuting tools: zoom, Google drive, We transfer

I've been working for two years. For me, telecommuting is pretty much the same as it used to be, but I prefer it. I think the most relevant requirement for this experience is office comfort. The chairs at home are not as comfortable as those at work. I think the most important thing is the office furniture. If I were a designer, I would design ergonomic office furniture.



1. Age: 27
2. Gender: male
3. Type of work: the host
4. Family situation: unmarried

Current job: Freelance work
 Don't have separate working environment
 Prefer on-site office, because of salary
 Less than 1 a week
 Health influence
 Lethargy, less communication
 Low efficiency
 Very smooth
 Wait for feedback
 Telecommuting tools: mail

My job is to communicate with people, and telecommuting has a big impact on my productivity. I've been on the verge of losing my job, I'm anxious, I can't sleep well. My most relevant need for telecommuting is how to use the time efficiency. I think the most important product is the desk, and I'm often so tired that I sleep on it. I want to design products that focus on my health.



1. Age: 31
2. Gender: female
3. Type of work: designer
4. Family situation: married (no baby)

Current job: Freelance work
 Have separate working environment
 Prefer telecommuting, because it's more free
 No fixed time
 Health influence
 Be positive, make progress together
 More efficient
 Relatively smooth
 Contact the other party
 Telecommuting tools: zoom, WhatsApp

I'm a freelance worker, and the pandemic doesn't bother me because I work remotely all the time. I think the most relevant need for telecommuting is organize, because I often make a mess of my desk. I think the most important product is the desk. If I were a designer, I would design a modular desk for easy organizing.



1. Age: 24
2. Gender: female
3. Type of work: engineer
4. Family situation: unmarried

Current job: Preliminary work
 Have separate working environment
 Prefer on-site office, because it's hard to communicating
 1-3 days a week
 Communication influences
 Each doing his own job, more harmonious
 Same
 Relatively smooth
 Contact relevant colleagues
 Telecommuting tools: Google hangouts, Google drive

I'm an engineer. The biggest impact of the pandemic is work efficiency. I can't touch the tool remotely. So I think the future is going to be a combination of telecommuting and traditional work. The most relevant requirement for me is work progress sharing. If I were a designer, I would design a software that could share work progress across multiple platforms.



1. Age: 41
2. Gender: male
3. Type of work: doctor
4. Family situation: married (2 children)

Current job: other
 Don't have separate working environment
 Prefer on-site office, because need to understand symptoms
 No fixed time
 Communication influences
 Each doing his own job, more harmonious
 Low efficiency
 Very smooth
 Wait until the on-site time
 Telecommuting tools: zoom, onedrive, cloud disk

I'm a doctor. After the epidemic, my main job changed from attending physician to consultation. I need to know the patient's temperature, symptoms, and I need to touch the patient with tools. These problems seems impossible to solve by designing.



1. Age: 43
2. Gender: male
3. Type of work: manager
4. Family situation: married (1 child)

Current job: Management
 Have separate working environment
 Prefer telecommuting, because have more time with family
 4 to 7 days a week
 Family influences
 Each doing his own job, more harmonious
 Same
 Basically smooth
 Wait for feedback
 Telecommuting tools: FaceTime

I love telecommuting. It gives me more time to spend with my family. I think the most relevant requirement for telecommuting is to set up an office scene so that only I am on screen during meetings, and my family is not present. I think the most important product is the establishment of office space. I think the needs for telecommuting are different for every occupation. If I were a designer, I would customize office furniture according to the needs of different people.



1. Age: 36
2. Gender: female
3. Type of work: teacher
4. Family situation: married (1 baby)

Current job: other
 Have separate working environment
 Prefer telecommuting, because save travel time
 1–3 days a week
 Family influences
 Be positive, make progress together
 More efficient
 Very smooth
 Contact the other party
 Telecommuting tools: zoom, mail

I have a baby and thus telecommuting makes me anxious. I used to have a babysitter, but now all this noise is really interfering with my work. I think the most relevant need is silence. I think the most important product is the noise reduction product. If I were a designer, I would design an office area that filters out noise.

Keywords and opportunities

Product design

Tool area/library; The office area; Ergonomic furniture; Noise filtering; Customize; Modular; Work area arrangement; Cheap furniture

Software design

Health testing; Colleague communication; Establishment of work environment; Progress sharing;

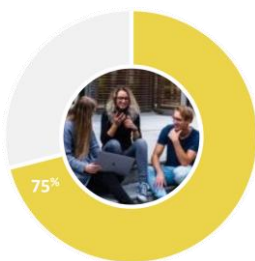
User experience design

Efficiency; Quiet; Communication; Physical/mental health; Family influence; The boundary between life and work; Comfortable; Remind; Guide

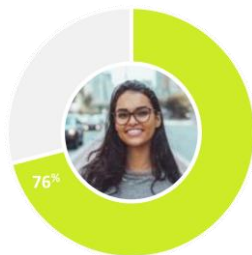
4.1.2 The collection of information

As business leaders, IT departments and tech suppliers grapple with how to power this new era of working remotely, the Technology And The Evolving World Of Work report explores the perspectives of over 20,000 employed adults in 10 markets about their experience with technology in the workplace and the impact of COVID-19 on their preferences, connectivity and work/life balance.

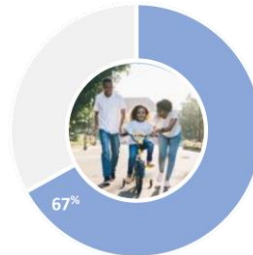
Percentage of employees has been impacted by COVID-19



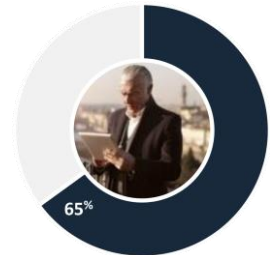
Gen Z



Millennials

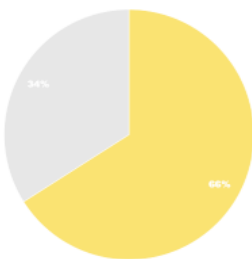


Mid-lifers

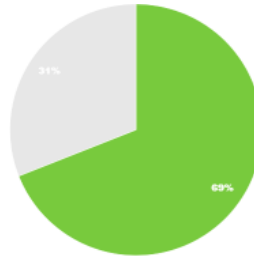


Age 56+

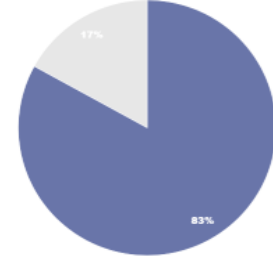
Improve work efficiency: 63%



USA

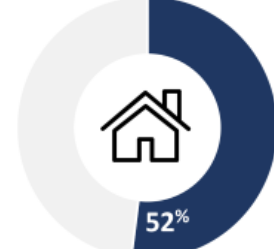
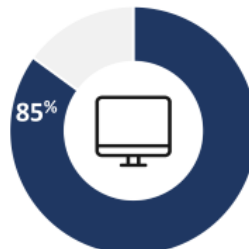
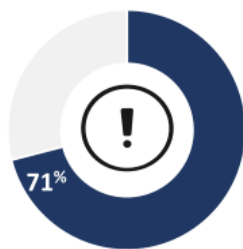


Brazil



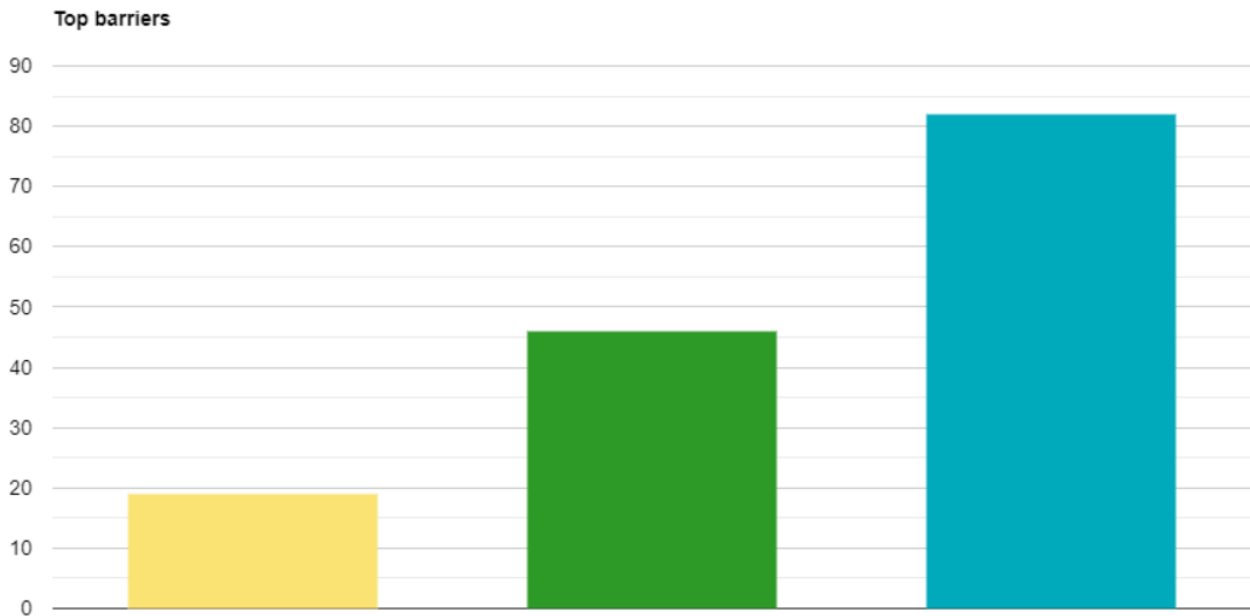
India

INCREASED PHYSICAL PAIN POINTS AND TECH RELIANCE



1. Complain of new or worsening aches and pains while working remotely during COVID-19, including back and neck pain, poor posture, headaches, difficulty sleeping, and eye strain.
2. Feel more reliant on their work PCs (laptops or desktops) than they did when they were working from the office.
3. Believe they will work from home more than in the past even once things start to return to normal post-COVID-19.

Employees feel company tech is not keeping up with needs



1. 19% of global employees believe their companies are leaders in their industries when it comes to adopting new and emerging tech, and are strongly committed to staying up to date.
2. 46% feel their employers are only middle of the pack or falling behind with their tech needs
3. 82% indicate their employers encounter barriers as they endeavor to keep up to date with new and emerging tech.

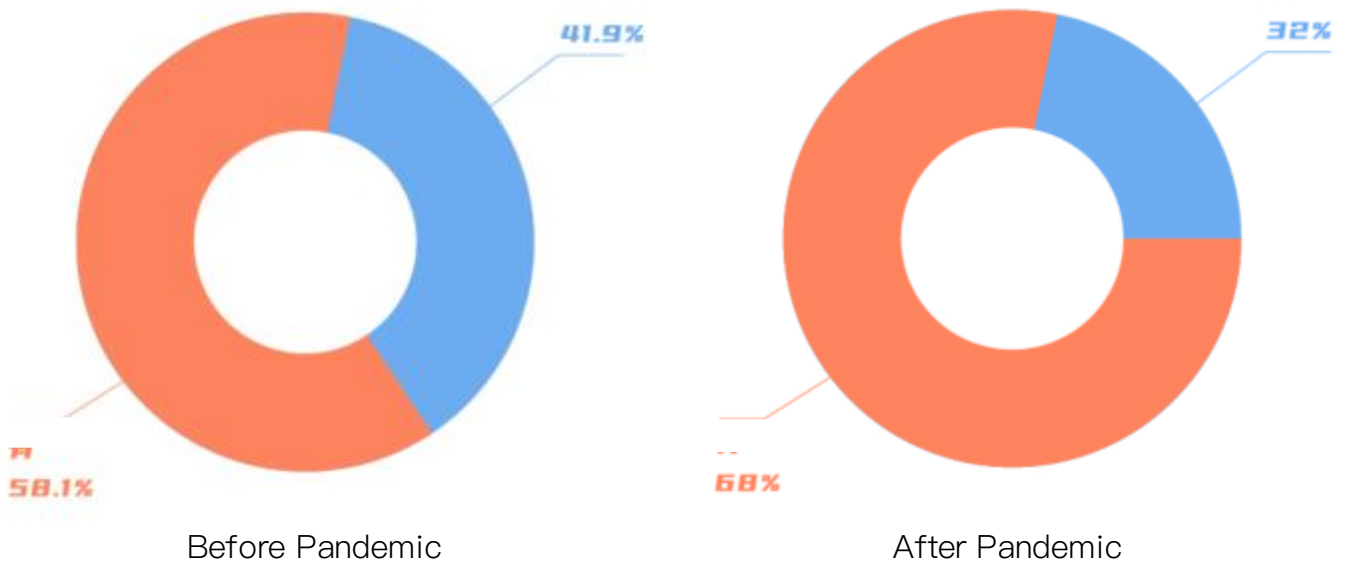
The interview structure

1. Difficulty training employees to use new and emerging tech
2. Prioritization of budgets and overall affordability
3. Lack of understanding by IT Decision Makers of employee needs

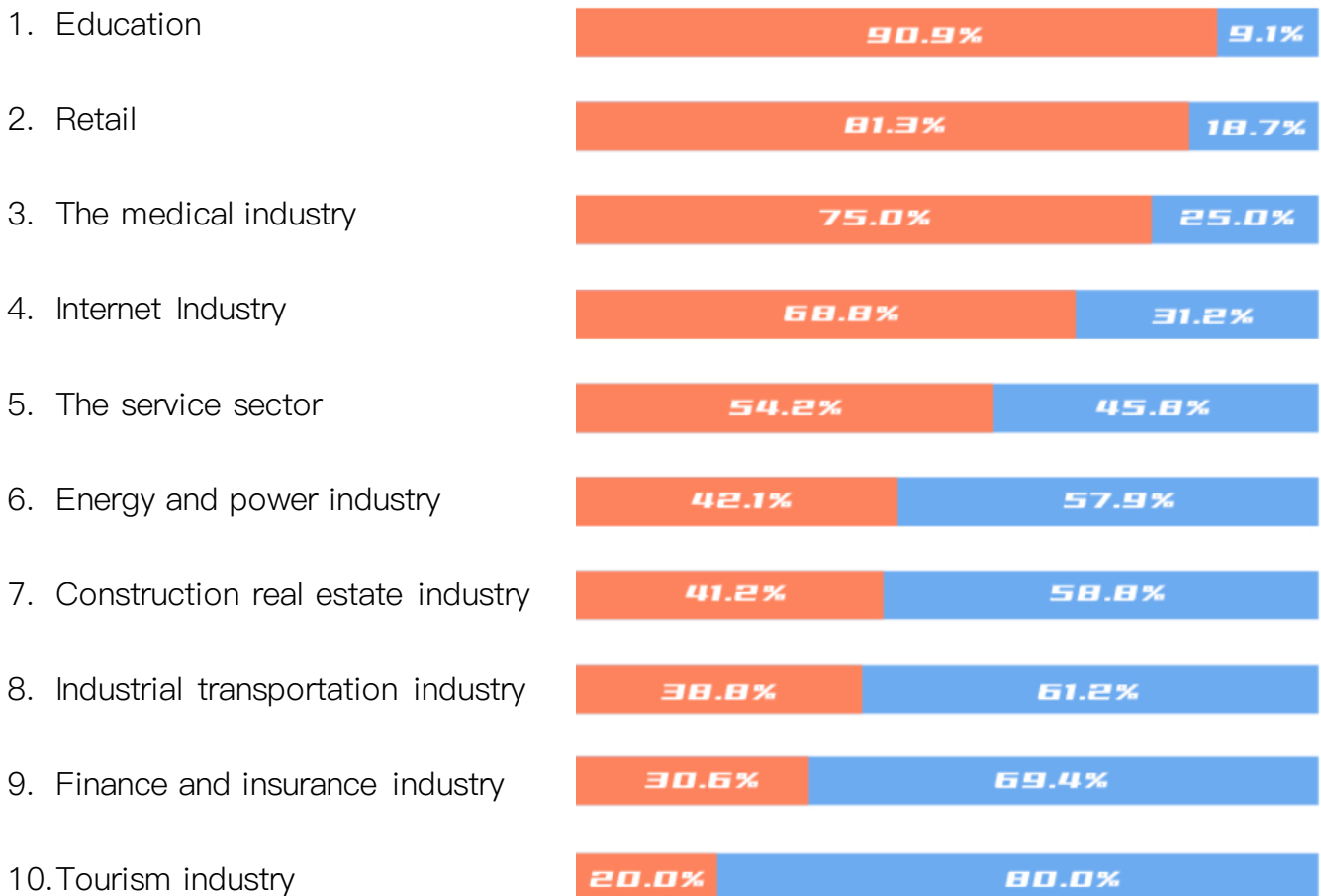
Five ways tech companies could help employees going forward:

1. Focus on training employees not on tech as a tool but how tech folds into their tasks
2. Consider the learning curve employees will face with tech and focus on providing the right tools
3. Ensure tech is not a “one-size-fits-all” for work devices
4. Invest in products with increased usability through predictive AI/Machine Learning
5. Provide software and security updates without getting in the way of employees and underlying their benefits

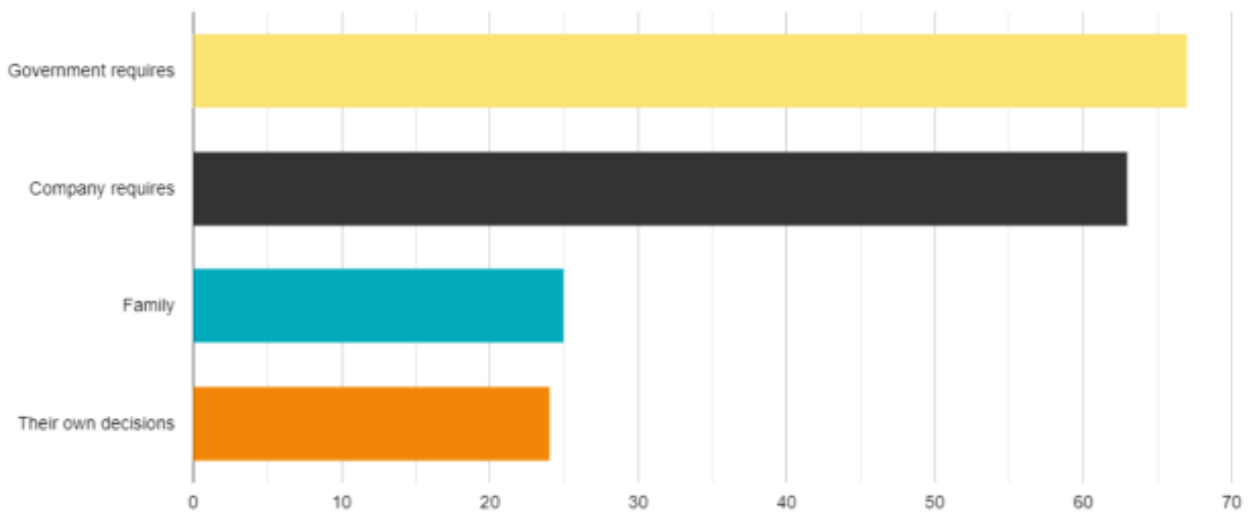
Whether there was telecommuting



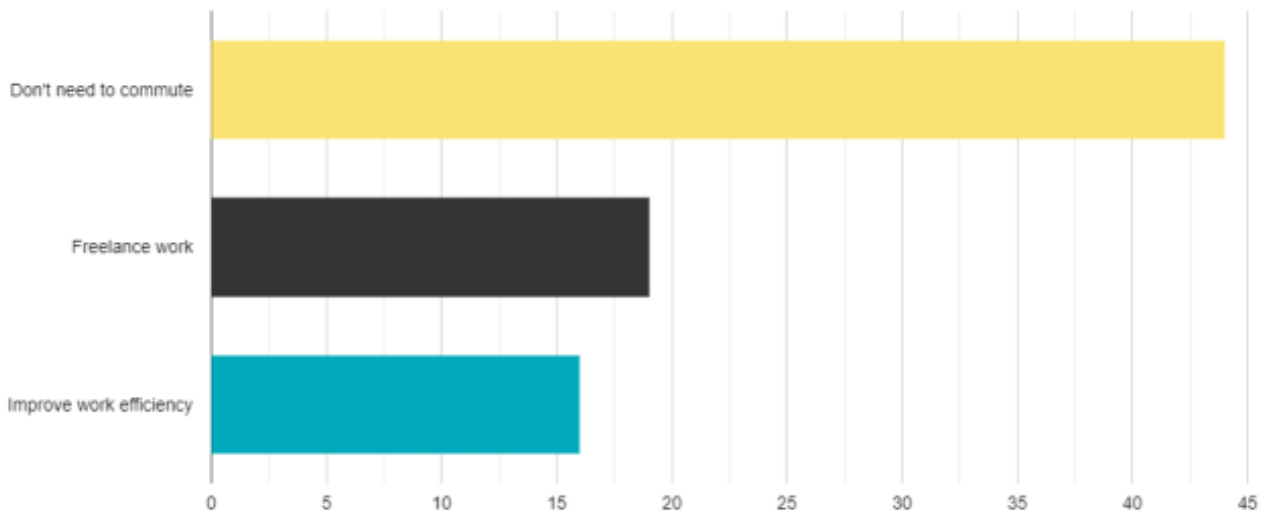
Different Industry Impact



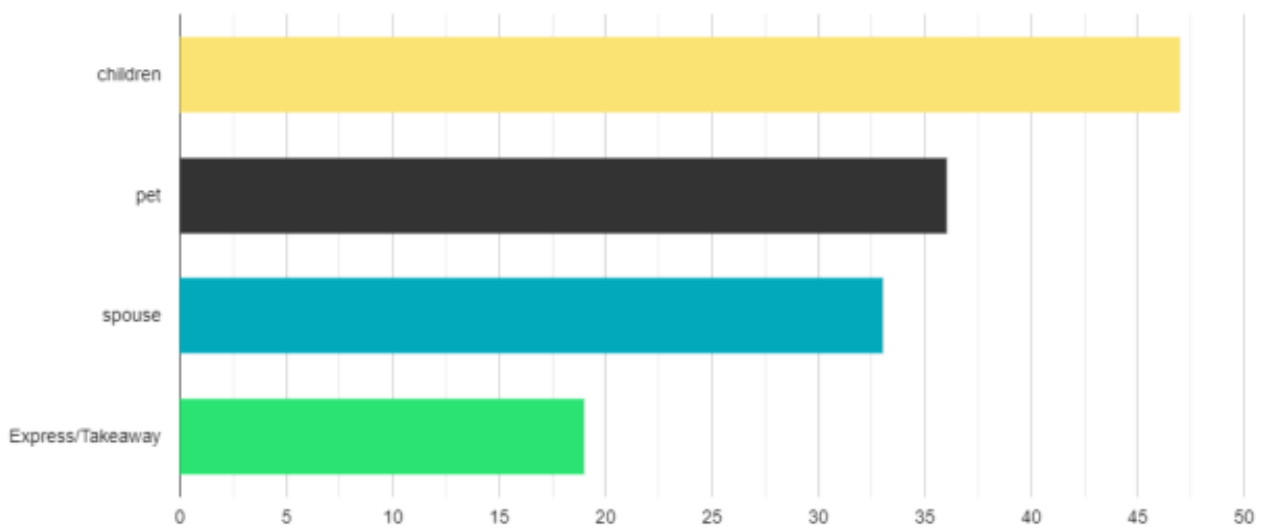
Reason of telecommunicating



Advantages



Interrupt reason



4.2 Persona

Persona 1

Name: Emily

Age: 26

Occupation: Digital Marketing Manager

Living: with parents



Emily is tech-savvy and spends most of her day working on a computer. She loves to entertain friends and family on weekends and is always on the lookout for furniture that is both stylish and functional. She is also environmentally conscious and prefers to buy furniture made from sustainable materials.

Persona 2

Name: David

Age: 32

Occupation: Teacher

Living: with wife and kids



David is a middle-aged parent with two teenage children. He lives in a suburban home with his wife and children. He spend time with his family. David is also an avid reader and likes to have a comfortable reading nook in his home. He prefers classic furniture that is sturdy, easy to maintain, and has ample storage space.

Persona 3

Name: Patricia

Age: 72

Occupation: Retired

Living: with husband



Patricia is a retiree who lives in a cozy cottage by the beach. She spends her days gardening, reading, and hosting her grandchildren. She is a lover of traditional furniture and has many antiques in her home. Patricia is also very interested in interior design and likes to decorate her home with unique pieces that reflect her personality. She prefers furniture that is comfortable, durable, and easy to clean.

4.3 Conclusion

Reason why like telecommuting

Communicate

1. Strengthen communication with global team members
2. You can decide who you connect with
3. You can enter or leave a meeting
4. You can have a quick conversation without much preparation

Comfortable

1. Have more personal time
2. More quiet time
3. It addresses work–life balance
4. Home has a more comfortable environment
5. Reduce stress
6. Spend more time with family
7. Use your own desk and chair
8. You can work in underwear

Personal life

1. Have more private time
2. You can exercise during rest time
3. More time to manage life

Productivity

1. Ability to work outside office hours
2. Interference is less
3. More time to get work done
4. Be more creative at home
5. Use your own equipment and software
6. You can concentrate better when the task requires your full attention

Flexible

1. Have more control over your time
2. Flexible working hours
3. Ability to adjust schedule as needed
4. Since the set time
5. Save time on your commute

4.3 Conclusion

Reason why dislike telecommuting

Communicate

1. It is difficult to assemble many people for the meeting
2. Chat messages can be upsetting
3. There are too many meetings to make up for the lack of face-to-face contact
4. Informal meetings become formal meetings
5. Tracking progress becomes time-consuming
6. You can't simply check what's on someone's screen, you have to take screenshots or schedule screen share time

Comfortable

1. Table and chair screen height does not meet the ergonomic requirements
2. Lack of personal interaction
3. No interesting office chat
4. Less socializing after work
5. Lack of direct support and stress when encountering problems

Personal life

1. Sometimes it's hard to focus and avoid distractions at home
2. It's hard to juggle working hours and taking care of children
3. It is difficult to arrange the separation between work time and personal life

No boundary

1. Work non-stop throughout the day
2. There is no transition time from home life to work
3. Some people don't have a separate room to work

Technology

1. Slow network
2. The process is difficult. For example, color postproduction before delivery date
3. Lack of quick and convenient technical support
4. Communication delay
5. It is difficult to handle large files using remote servers

4.3.1 Win-win cooperation

To achieve sustainable growth and development in the furniture industry, it is crucial to establish win-win cooperation among customers, enterprises, and furniture platforms. Customer satisfaction, profitability, and competitiveness are all essential factors that need to be considered. By focusing on building a bridge between customers and enterprises through design, a win-win cooperation can be established.

Two-way participation is an effective way to achieve win-win cooperation. By allowing companies and customers to communicate directly, companies can better understand the needs and preferences of customers while customers gain a better understanding of the company's products and services. Leveraging technology to create a seamless and convenient shopping experience is also critical. For instance, an online furniture platform can utilize virtual reality technology to allow customers to see how the furniture will look in their homes before making a purchase. This not only improves customer satisfaction but also reduces the likelihood of returns and enhances the overall efficiency of the supply chain. Additionally, partnering with a home furnishing platform can change the sales model and expand the market, leading to long-term gains.

In conclusion, creating a more efficient and sustainable supply chain through design can benefit all parties involved in the furniture industry. Through win-win cooperation among customers, enterprises, and furniture platforms, sustainable growth and development can be achieved.

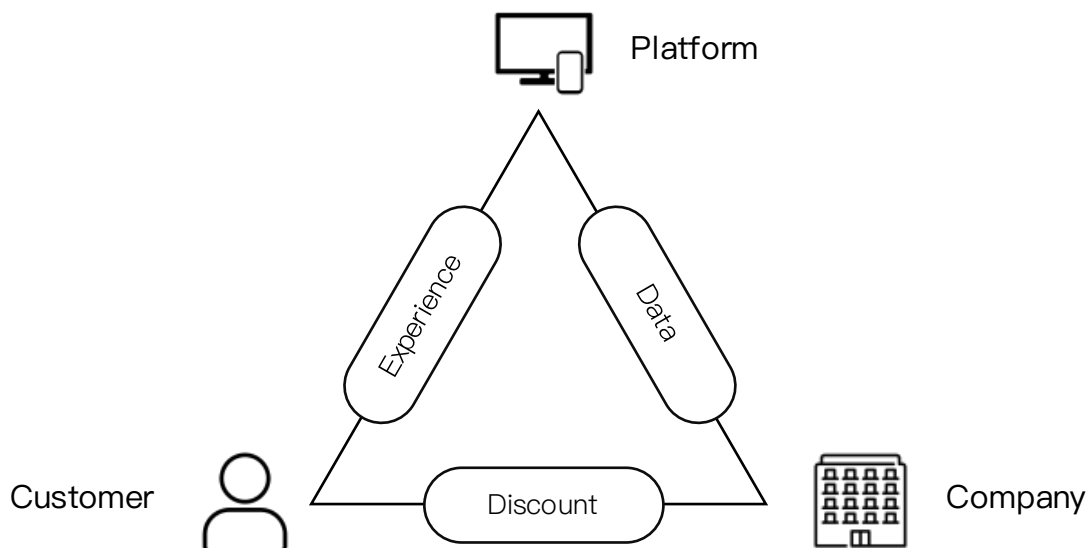


Fig 27 Win-win cooperation

4.3.2 Market scenario

With the rise of telecommuting, there is an increasing need for furniture that supports remote work. The demand for comfortable and efficient home office environments has increased significantly. The furniture market is a competitive and dynamic industry, with the global furniture market expected to grow at a compound annual growth rate (CAGR) of 5.2% between 2021 and 2028. Driven by the COVID-19 pandemic and increasing urbanization, more employees are seeking work-life balance and more companies are looking to reduce the cost of office space. Many businesses continue to adopt remote working policies, and demand for home office furniture is expected to remain strong.

The rise of e-commerce and online furniture platforms has disrupted the traditional physical furniture retail model, providing consumers with a more convenient and diverse shopping experience. The telecommuting furniture market has seen the emergence of various online platforms that offer a wide range of products to meet the growing demand. These platforms allow consumers to compare prices, read reviews, and buy products from the comfort of their own homes, thus making it easier for consumers to find furniture that suits their needs.

As consumers become more environmentally conscious, the demand for eco-friendly and sustainable furniture is on the rise. This has led to the development of new materials and production methods that are more environmentally friendly, such as recycled materials, sustainable wood, and low-emission manufacturing processes. However, telecommuting also brings challenges such as isolation, lack of social interaction, and blurred boundaries between work and life. This creates a need for furniture that balances the functional requirements of a home office with the comfort and aesthetic needs of a living space.

In general, the telecommuting market presents opportunities for various industries, including furniture, technology, and health, as well as challenges that require innovative solutions. As consumer preferences change and new technologies emerge, furniture companies must remain adaptable and responsive to remain competitive in the marketplace. By leveraging online platforms and sustainable production methods, furniture companies can cater to the growing demand for telecommuting furniture while also addressing the social and environmental challenges of remote work.

Chapter 5. Concept Generation

Chapter 5. Concept Generation

5.1 Idea generation

Product

Desk	Sofa	Chair	Shelf	Cabinet	Baby crib
Kit	Board	Mirror	Drawer		

Service

Discount	Repair	Module	Rent	Customization	AR
APP	Health	After-sale	Quiet	System	

Tool

Lamp	Box	Cable	Expand	Accessory	
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Detail

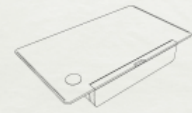
Cost	Material	Sustainability	Foldable	Changeable	Sliding
Second-hand	Movable	Combine	Rotary	Magnet	



Different size



Drawer?



Cable



Leg



Lamp



Quiet



Take a snap



Wall module



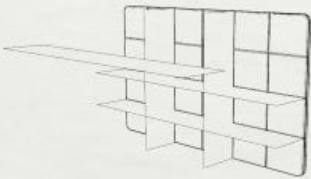
Storage type 1



Storage type 2



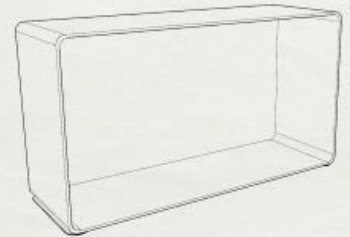
Storage type 3



Shelf 1



Shelf 2



Module cabinet



Luggage



Foldable



Baby crib



Expandable

5.2 Material

MDF Board



Good value: affordable alternative to solid wood.

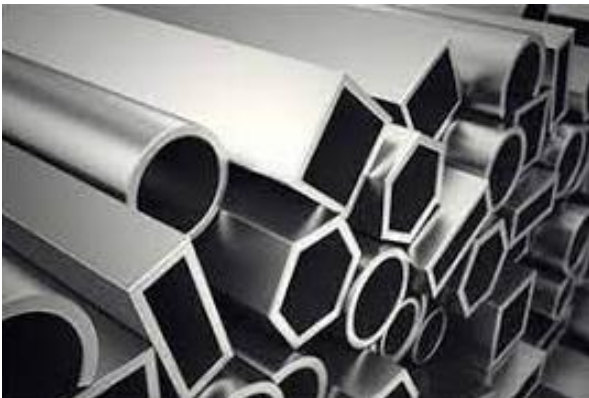
Versatile: can be easily cut and shaped.

Smooth surface: smooth surface and free of knots and grain patterns.

Stable and consistent: less prone to warping, contracting, and expanding than solid wood.

Eco-friendly: from recycled wood fiber and considered an eco-friendly choice.

Aluminum alloy



Lightweight: light compared to other metals.

Durable: highly durable and can withstand wear and tear.

Easy to maintain: does not require special treatments to maintain its appearance.

Recyclable: can be recycled and reused multiple times without losing its strength or durability.

Polypropylene (PP5)



Durability: can withstand exposure to sunlight, moisture, and chemicals. It is resistant to scratches and dents.

Lightweight: a lightweight material, making it easy to move and transport.

Cost-effective: an affordable material, making it an attractive option for mass-produced furniture.

Recyclable: a recyclable material to create new furniture pieces or other plastic products.

5.3 Journey map

1. Why does it happen?

Future trend

With the end of the pandemic, more people choosing to work remotely, furniture rental has become an important part of the service industry.

Large market

Furniture rental has become a large green industry. Many company employees working in different cities and rent furniture. Furniture rental has a great market demand in the city and become important part of GDP.

2. When does it take place?

Flexibility and price:

Furniture rental take place at any time, especially for young people. Young people need to rent, need to work remotely, and is the majority of the working population in society.

To furniture

Analyze user behavior and using information to improve the user experience. Understand how people use the furniture and which features are popular or not. Improve or simplify furniture function to better user needs.

3. Where does it take place?

Online platform:

allows people and businesses to rent furniture directly. The platform offers economical cooperation and more flexible services and pricing.

To service

As furniture rental becomes more popular, more and more companies offering rental services in the future, including large retailers and rent platforms. Service quality can improve customer satisfaction and loyalty

6. Next conclusion

5. Who is it about?

5.3 Journey map

4. What happened?

1. Become VIP

It's a platform for collaboration with companies. If the user is an employee of a company, they can become a VIP.

VIP:

1. KIT is provided for free;
2. 10% subscription fee;
3. 20% discount rent fee;
4. Allow to use 5 tools for free.

4. Assemble furniture

All furniture is modular in design. It can be folded, moved and assembled. All parts are replaceable. Use, storage, assembly, disassembly, upgrade, users can operate on their own. Make the whole system can be recycled.

People

Cheap price: Just pay for the rent.

Variety: Select the most appropriate furniture and functions according to needs.



2. Customized demand

Browse the product list in the APP to select the furniture you need. Furniture is rented rather than bought.

Define different furniture lists from different users' office environments. Provide different functions according to age, occupation and room size.

5. Upgrade furniture

Furniture can be customized according to the needs of users. Upgrade the most suitable furniture for the most comprehensive features. VIP users can use up to five tools for free. Other tools need to be rented for use.

3. Pay a fee

After selecting the desired furniture, the user contacts to confirm the delivery time and address. When the user purchases the system, the furniture list is fully folded and placed into the package for sending. The product sets the lease terms for the user. Determine rent, rental period, delivery and pickup options, and follow-up services.

6. Maintain furniture

VIP can rent furniture on an annual basis. After the minimum rent time is full, you can choose to cancel or extend the lease. At the same time, concept provides furniture repair and furniture recycling and other supporting services.

Company

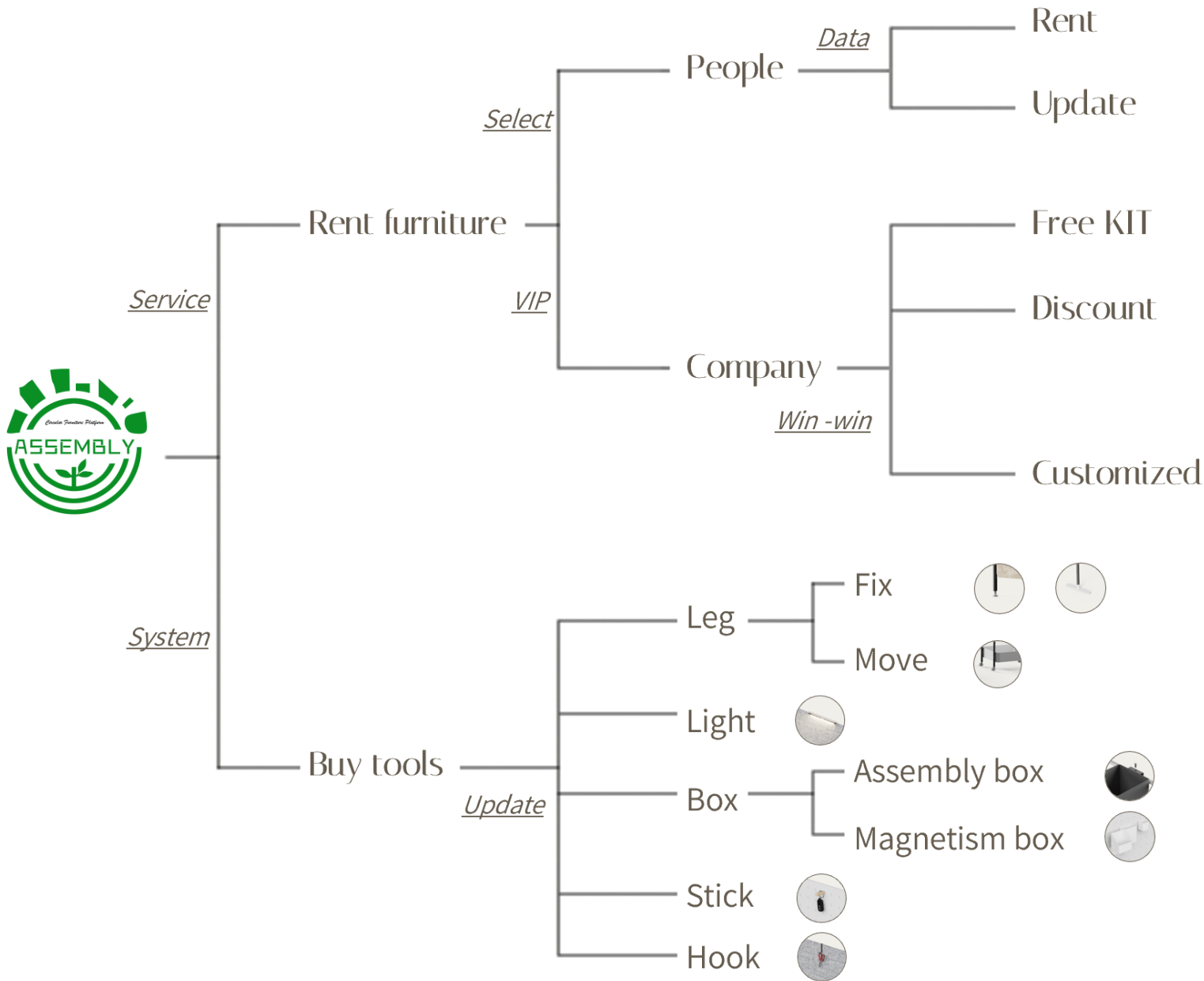
Cheap price: Save high office expenses and furniture costs.

Sustainability: Reduces the amount of furniture that ends up in landfills.

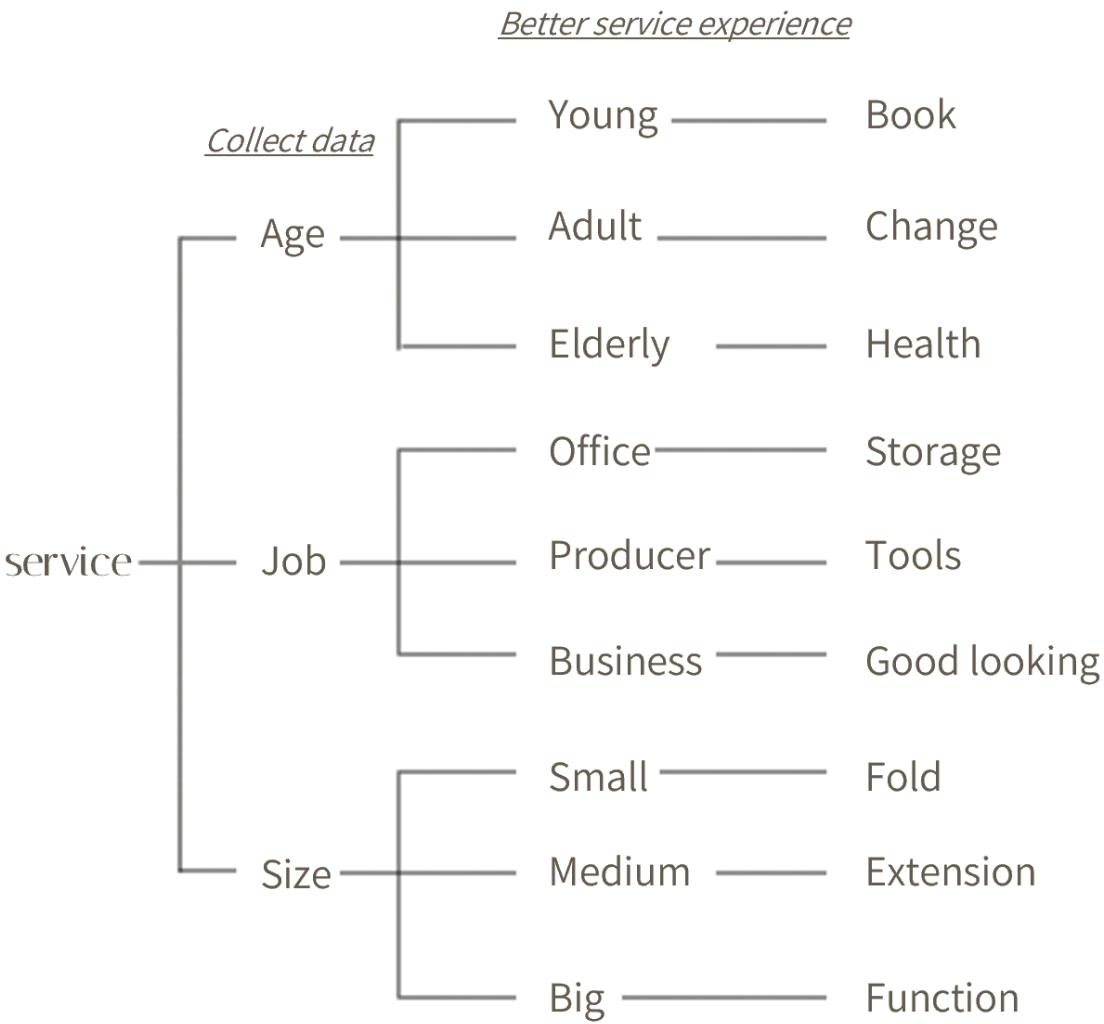


5.4 Service system overview

5.4.1 The framework



5.4.1 The framework



5.4.2 The wireframe

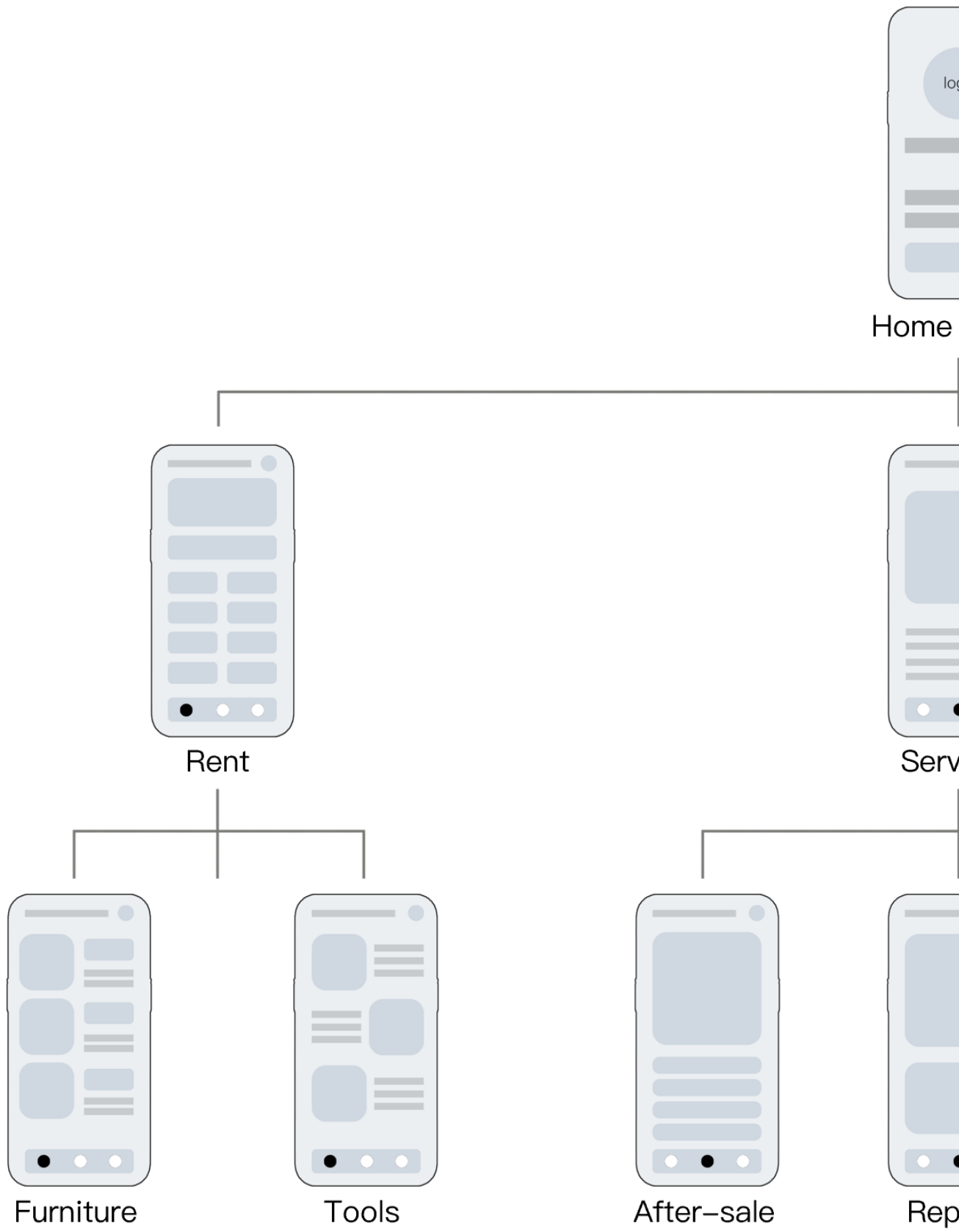


Fig 14

5.4.2 The wireframe

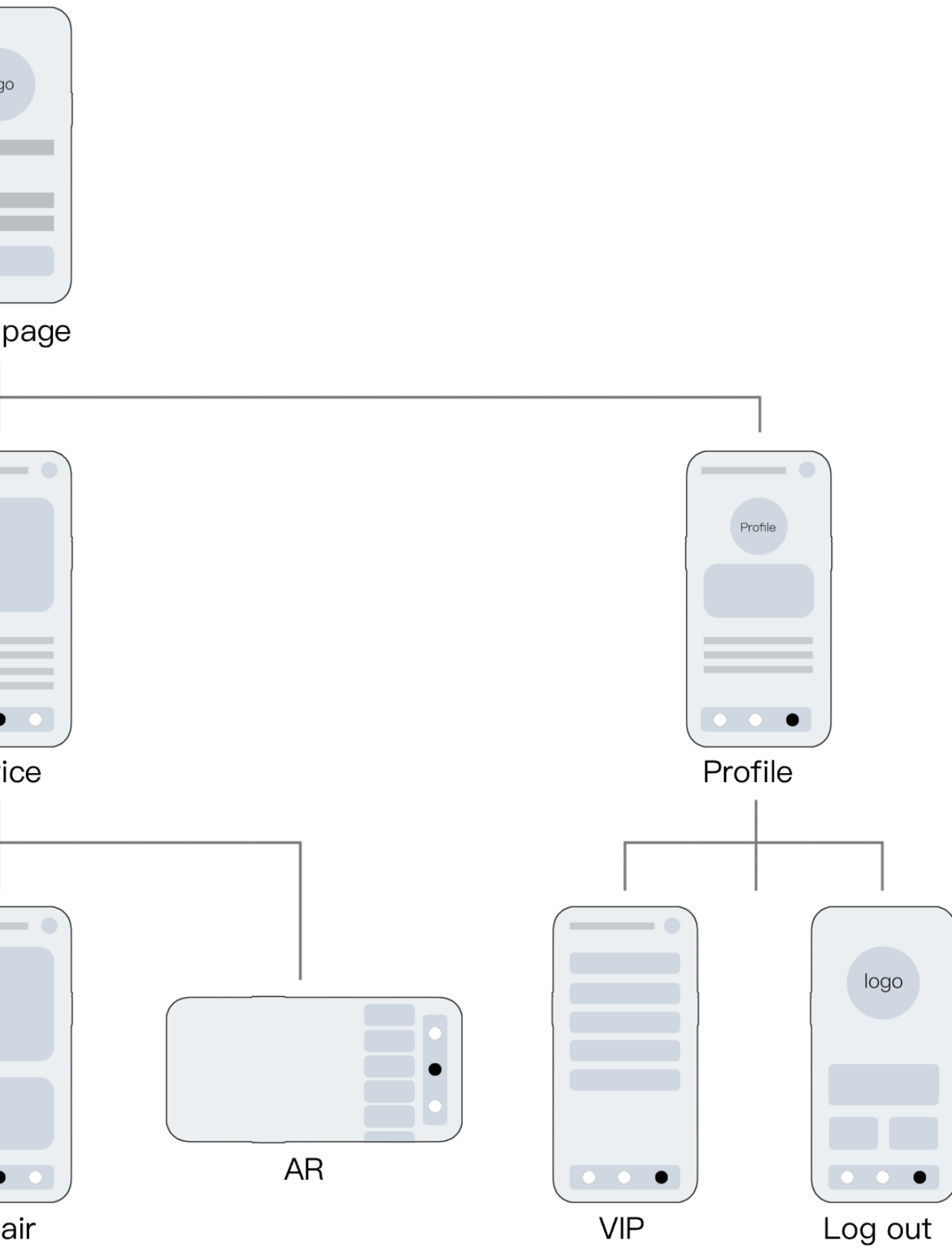
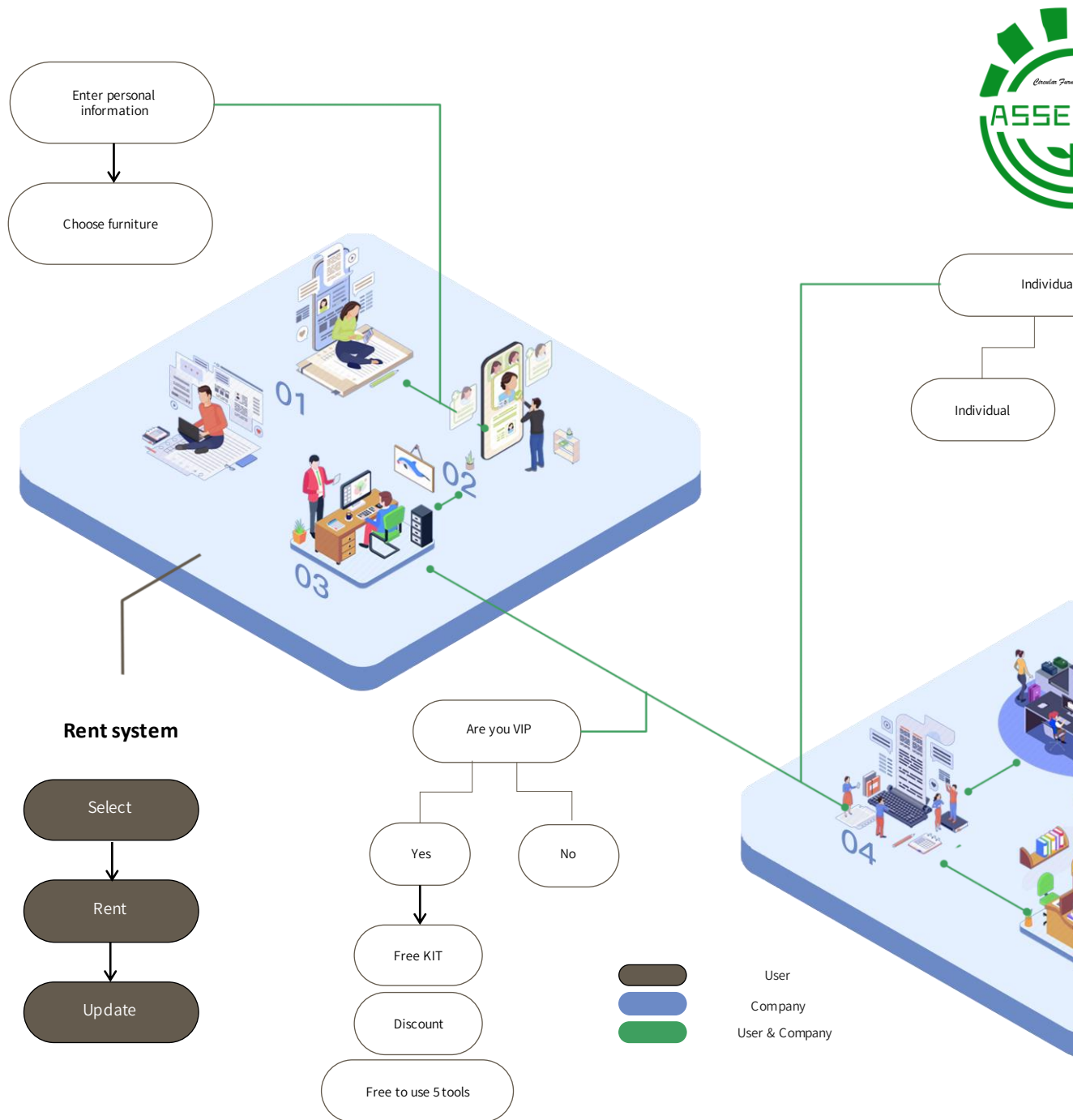
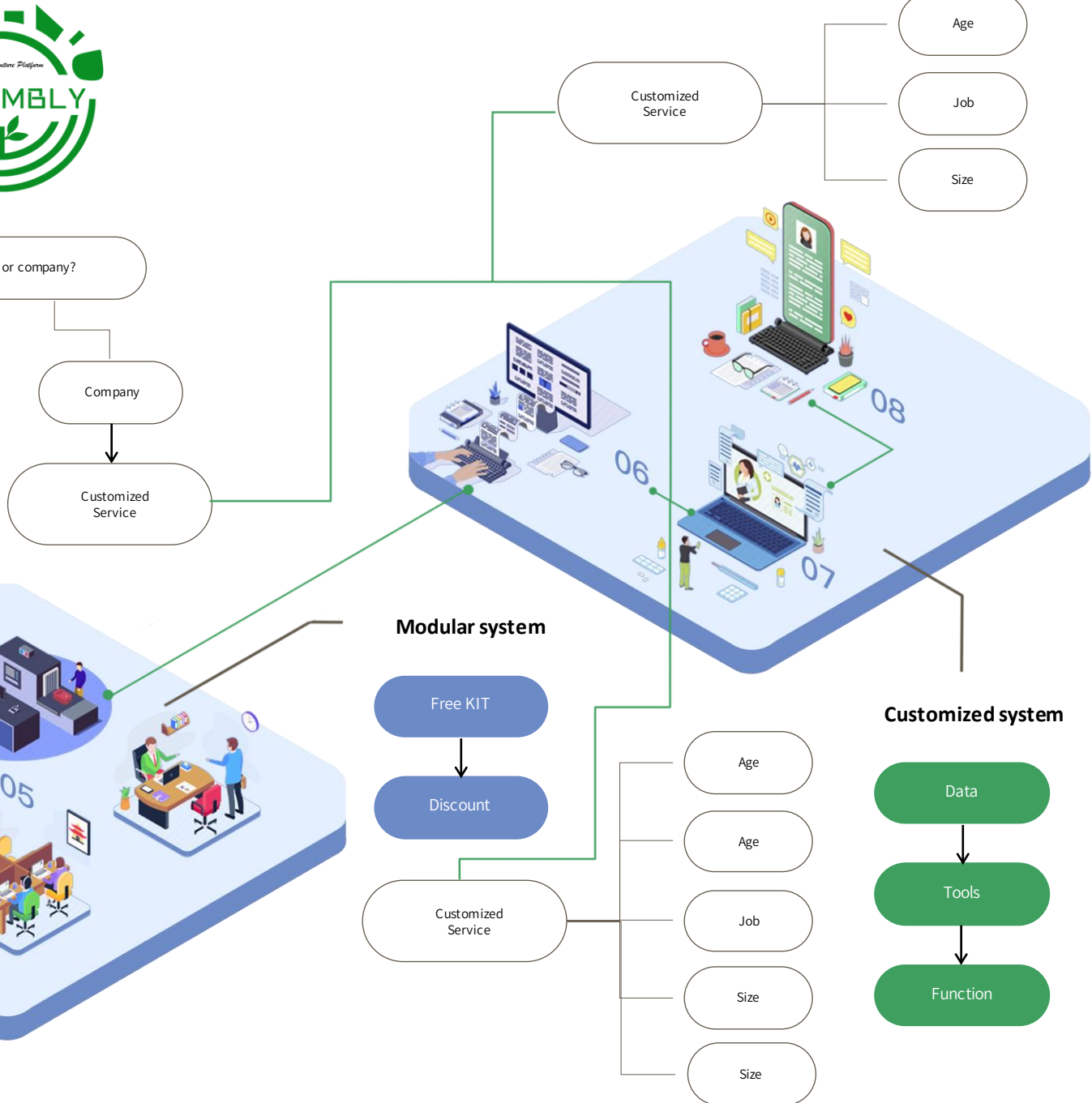


Fig 14

5.5 Service structure



5.5 Service structure



Chapter 6.

Concept Implementation

Chapter 6. Concept Implementation

6.1 Brand

Assembly is a modular furniture rental system that has been designed for the purpose of facilitating companies in providing comfortable and efficient furniture to their employees. This system targets large companies and offers VIP discounts and benefits to their employees. By adopting this system, employees who work remotely can easily rent furniture instead of buying it, thereby saving them the cost of purchasing furniture. This also reduces the cost of office space for companies, creating a win-win situation for both parties.

In addition, Assembly is designed with modularity in mind, which allows for the easy replacement and upgrading of individual components. This promotes the principles of the circular economy, as materials can be reused and repurposed instead of being disposed of as waste. By adopting such a system, companies can lower their costs while providing a better experience for their employees, which can lead to increased productivity and job satisfaction.

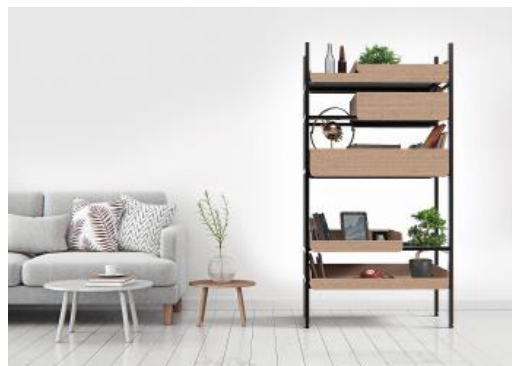
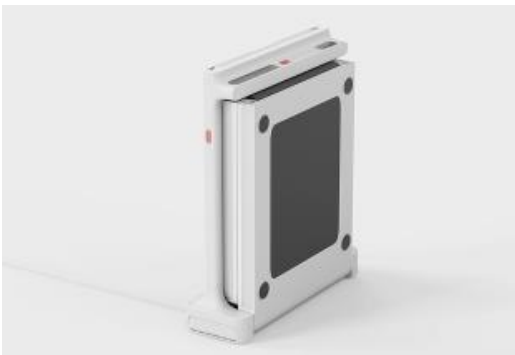
6.1.1 Logo



The name is “Assembly”, which mainly placed expectations that furniture can be assembled by DIY and products can be assembled with services.

The main symbols of the LOGO are composed of module and circular economy to represent the core of the concept. The main color of this logo and app are green. Green is an excellent color choice for circular style. In addition, green is an organic color that reminds us of nature. The selected symbols, meanings and colors are intended to make users have the feeling of the circular design.

6.1.2 Mood board



6.2 Furniture

6.2.1 KIT



6.2 Furniture

6.2.1 KIT



The KIT includes a range of basic furniture pieces, such as a table, a cabinet, and a wall unit, that are designed to be foldable and easily assembled. All KIT products can be packed in a compact box, which provides convenient storage and transportation for users. KIT's foldable and movable furniture is particularly suitable for those who frequently move or have limited space.

In addition, KIT offers a subscription service that provides VIP users with a 20% discount and a 10% subscription fee. This subscription model allows users to rent the furniture for a flexible period of time, which helps to reduce costs and waste. By offering a simple and sustainable solution for basic furniture needs, KIT aims to promote a more minimalist and efficient lifestyle.

6.2.2 Desk and tools



Desk is movable, detachable and foldable. The desk can be folded into a piece.

Upgrade location:

The metal tube of the table can be fitted with a storage box, and the feet of the table can be changed to a fixed or wheel.

Rent price

20% subscription

6 euros/month

6.2.3 Wall design



The walls are movable, elevating and detachable. The board in the middle of the wall is its functional area.

Upgrade location:

Each piece is held in place by screws, changing the board to change the function of this wall.

Rent price

20% subscription

6 euros/month

6.2.3 Wall design



W-1: Basic wall

W-2: Hanging wall

W-3 : Rotation wall

W-4: Soundproof wall

W-5: Magnetic absorption wall

W-6: Holes wall

W-7: Mirror wall

6.2.4 Cabinet design



The cabinet is removable, foldable and detachable.

Upgrade location:

Each piece is held in place by screws, changing the function of the cabinet by changing its core.

Rent price

20% subscription

4 euros/month

6.2.4 Cabinet design



C-1: Basic cabinet

C-2: Tea table cabinet

C-3: Drawer cabinet

C-4: DIY cabinet

C-5: Baby crib cabinet

C-6: Shoes cabinet

C-7: Clothes cabinet

C-8: Bookshelf cabinet

6.2.5 Joint



6.2.5 Joint



Assembly by screw is a popular method of furniture assembly because it is relatively simple and requires only basic tools. It is also a strong and durable method of joining materials, ensuring that furniture will remain stable and secure over time.

6.2.6 Storyboard – product

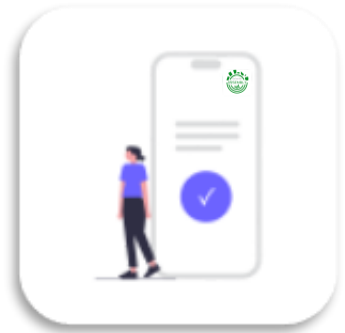
Before use



1. Start live in a new house



2. Prepare to use app to have furniture



3. Browse and order



4. Deliver



5. Get KIT

While using – product



1. DIY



2. Storage



3. Lifting



4. Upgrade



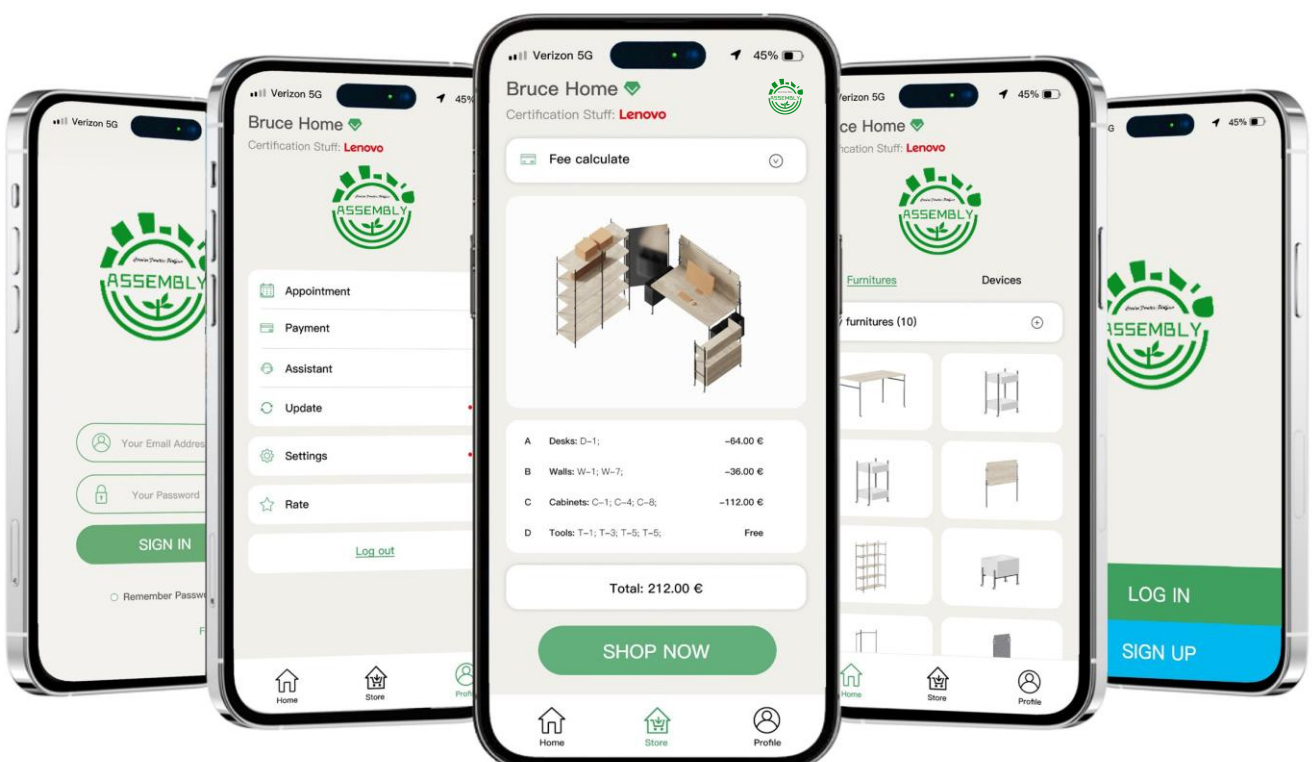
5. Change the size

6.3 Application

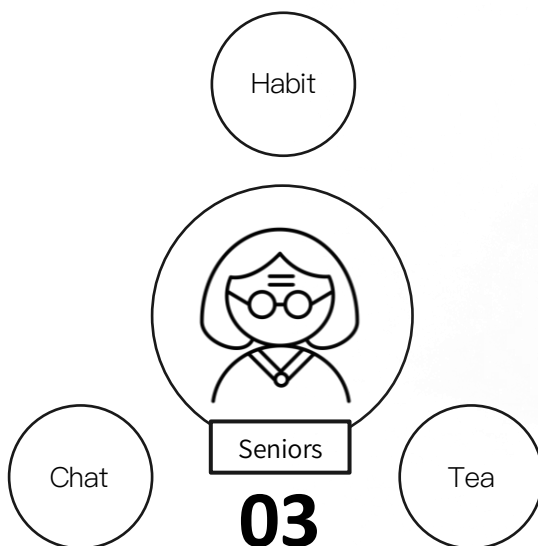
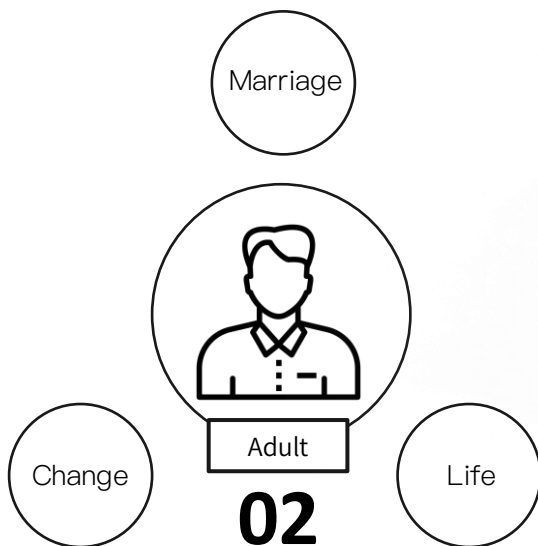
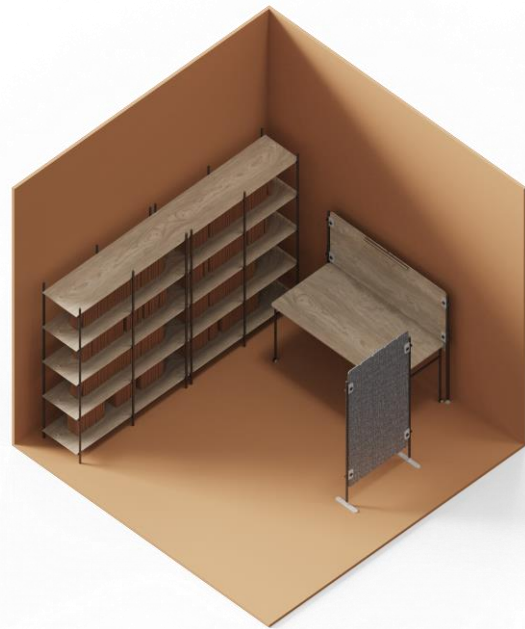
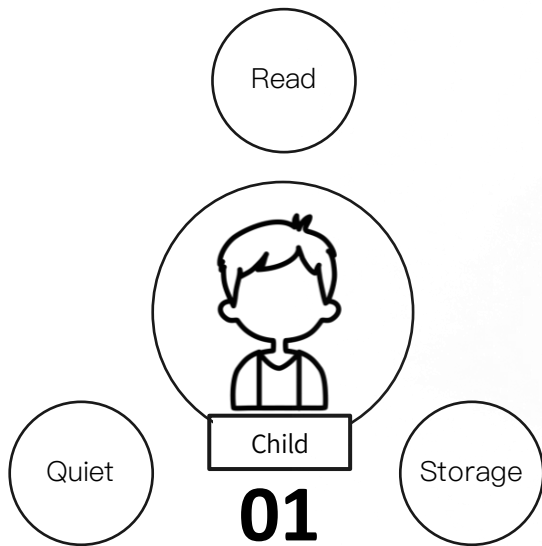
6.3.1 User Interface

It provide users with furniture rent solutions. People could rent furniture and tools in this APP. Besides, it can connect devices and manage them. Which could give users better using experience.

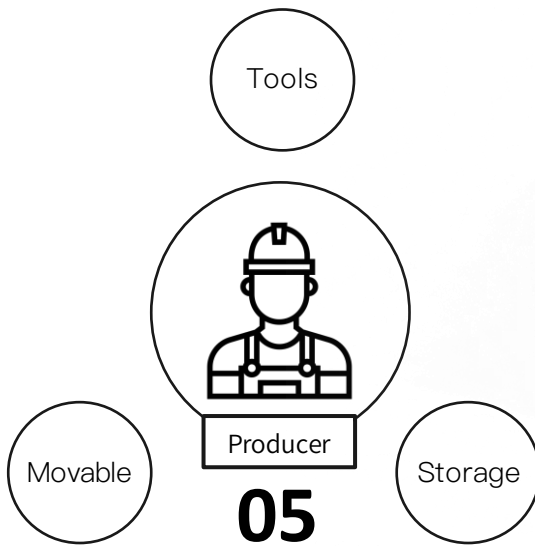
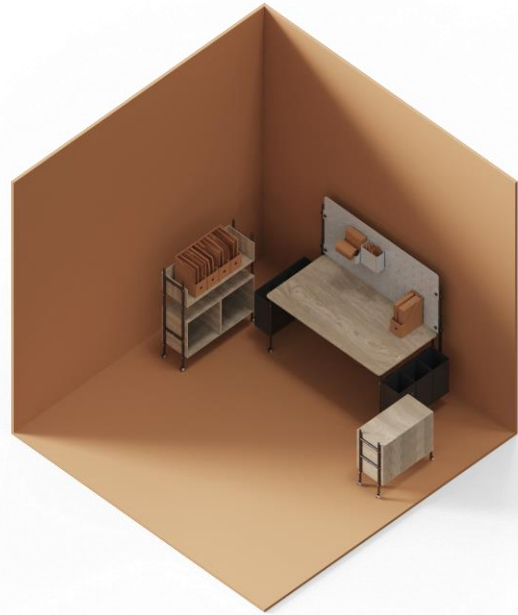
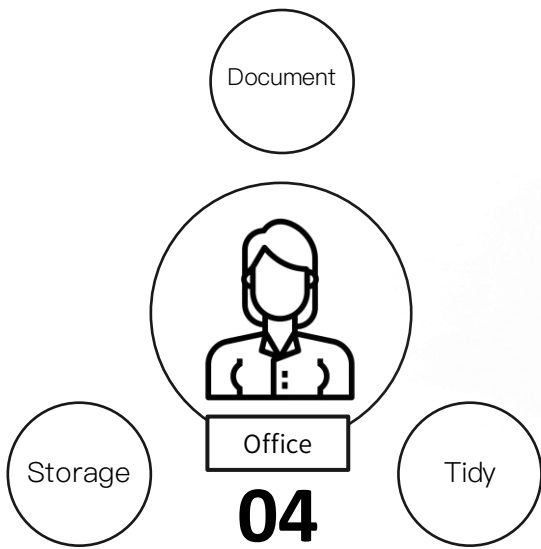
In this APP, we offer the after-sales service for each customers. People could use this APP to contact us to modify rent time, renewal parts and repair furniture.



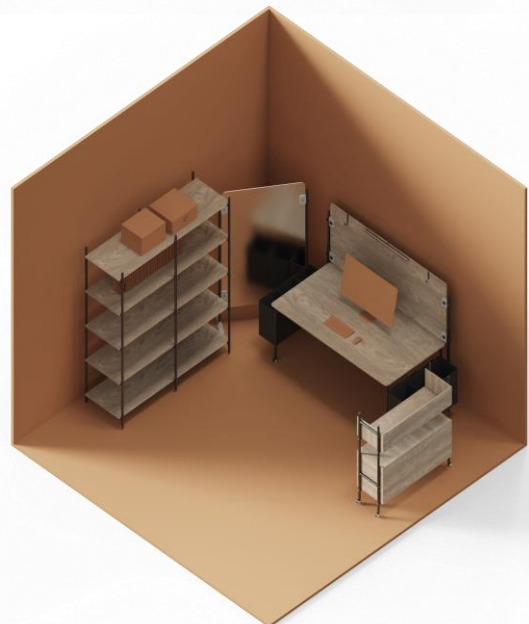
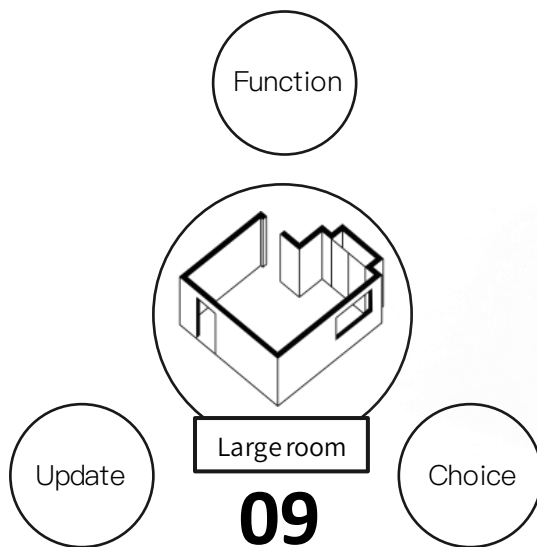
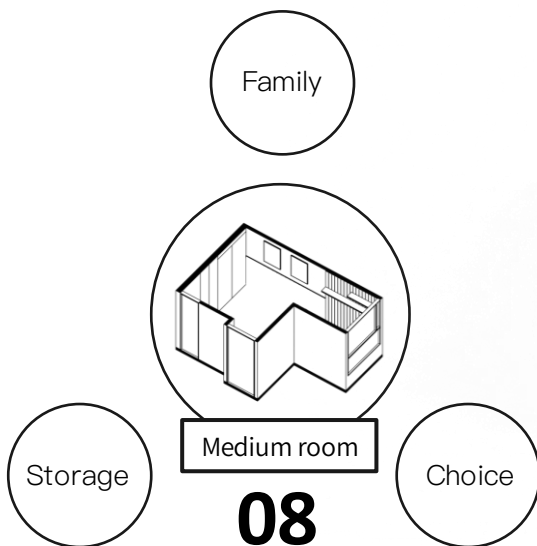
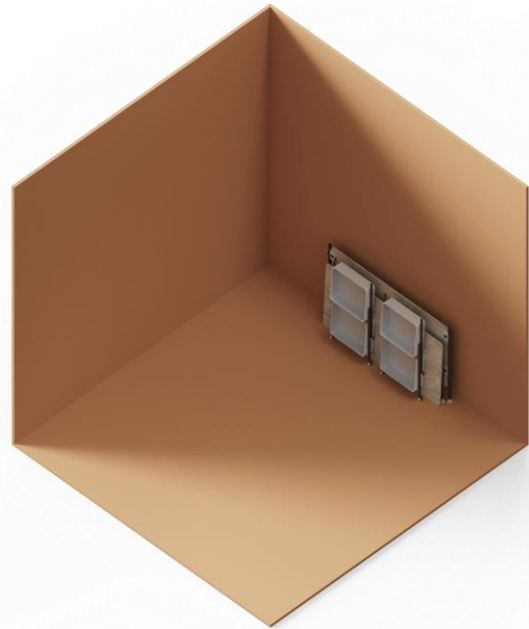
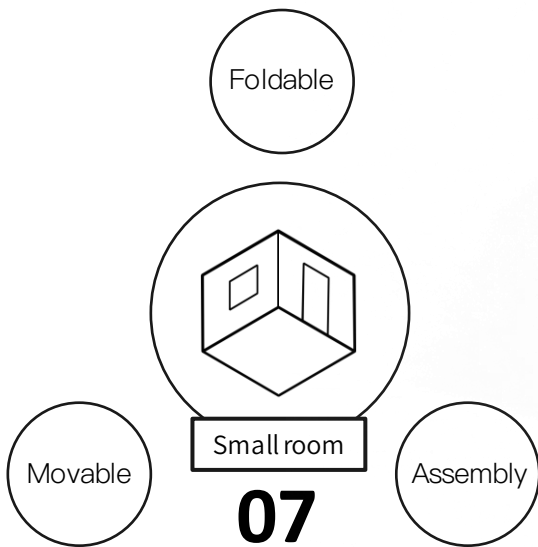
6.3.2 Scene preset



6.3.2 Scene preset



6.3.2 Scene preset



6.3.3 Storyboard – service

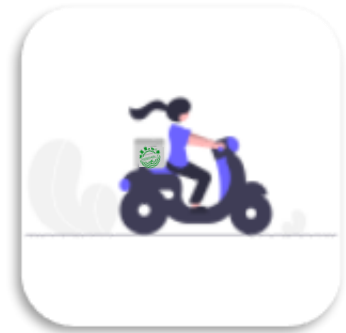
While using – service



1. Upgrade services



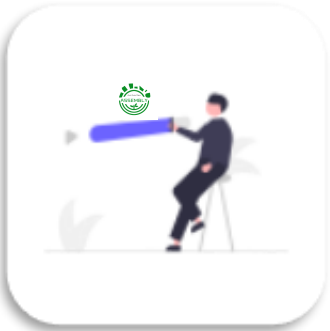
2. Home-moving service



3. Recycle service



4. Repair service



5. Change rental

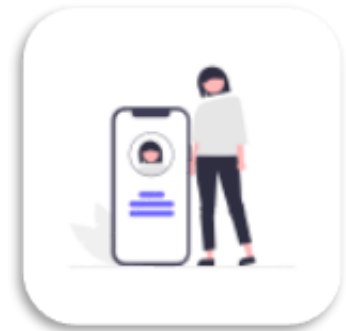
Collaborate with company



1. I am an employee of a business



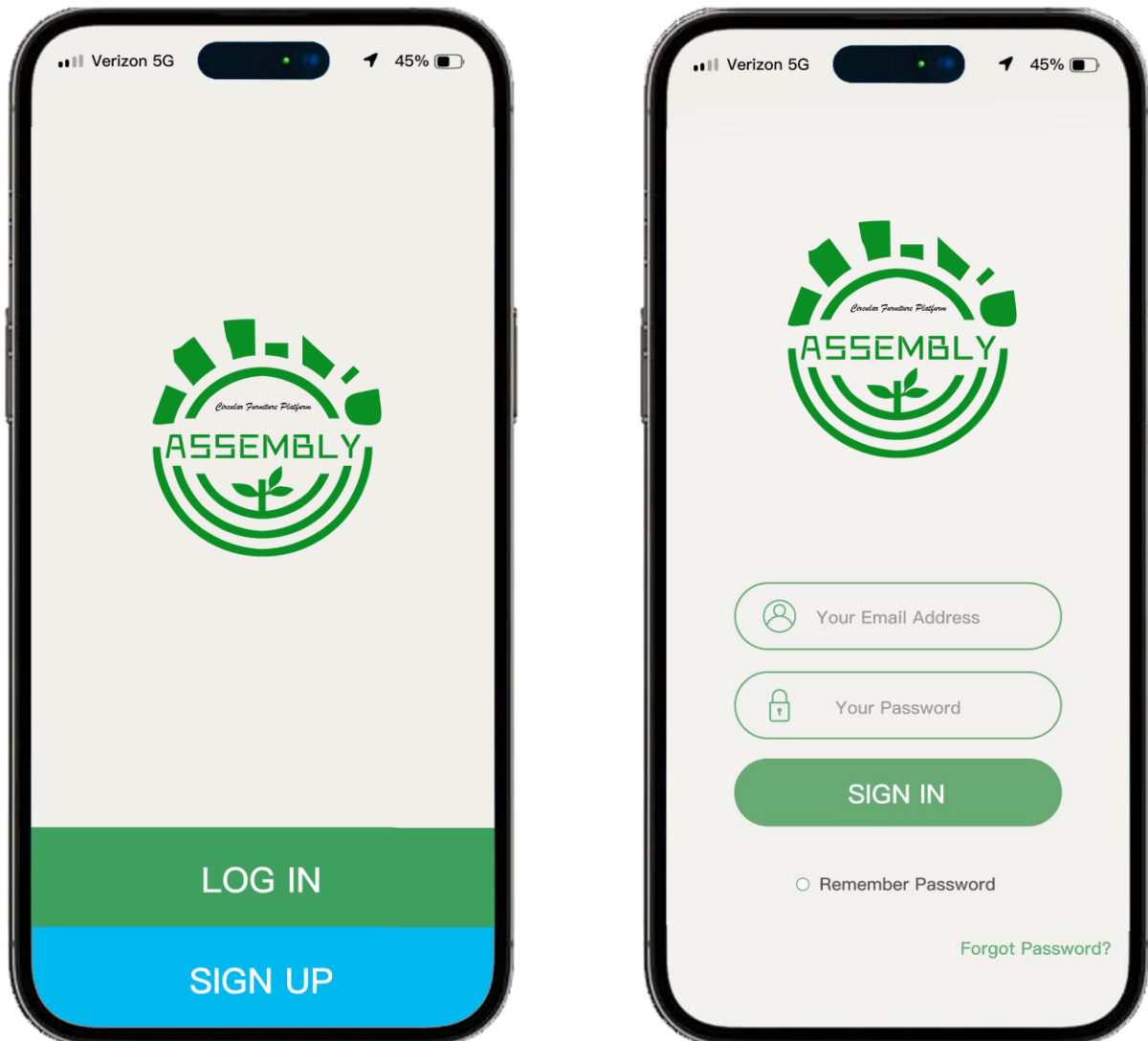
2. Get VIP offers



3. Customized service

6.4 How to use

Step 1. Login



1. Import account and password to log in to Assembly.

You can also link to social media, such as Facebook, Apple account, or Google account.

2. Bind the company to obtain VIP status.

There are plenty of perks to being a VIP. Include:

2.1 10% subscribe fee

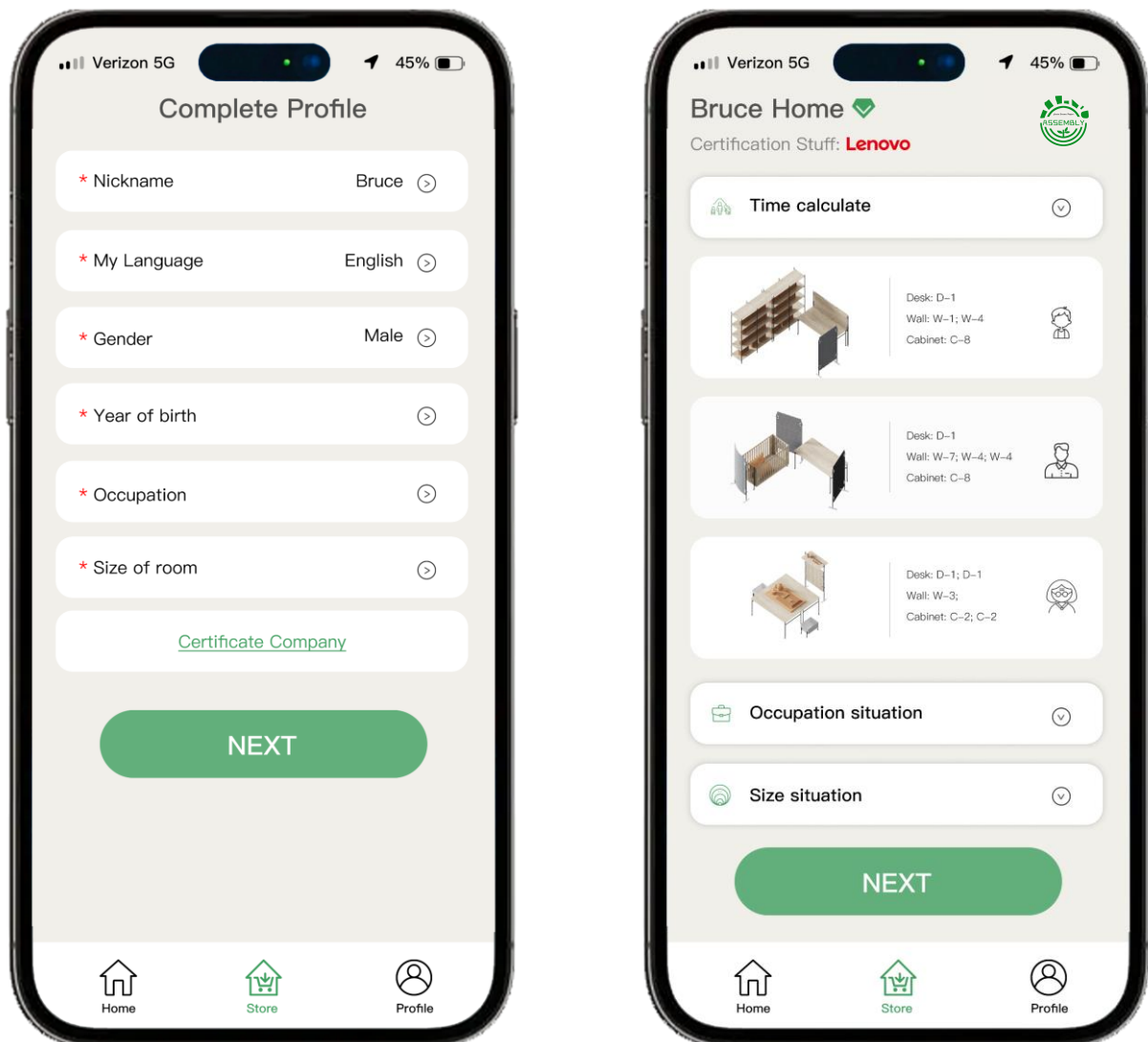
2.2 20% discount monthly rental fee

2.3 5 tools to use for free

2.4 More intimate service

6.4 How to use

Step 2. Rental



1. Demand management

2. Product selection

Through the smart analysis of the system, can also be through AR scanning environment analysis, and then choose their own furniture.

smart analysis

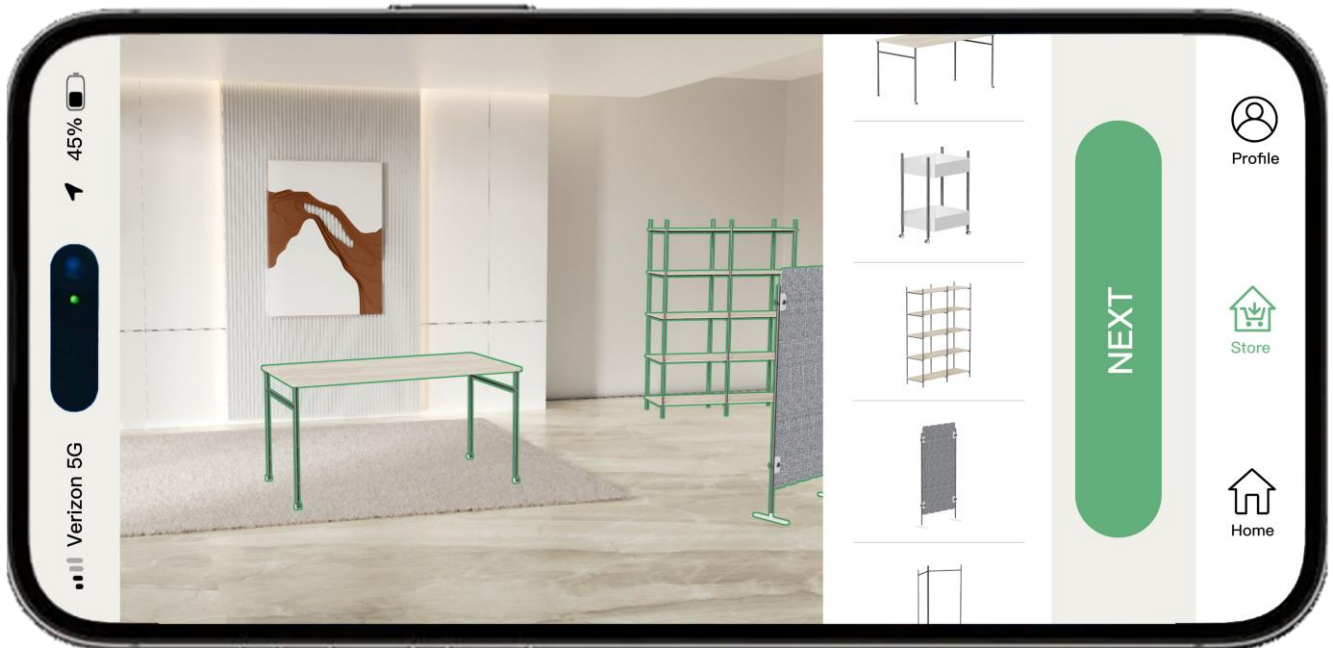
a. Age of people

b. Occupation

c. Size of room

6.4 How to use

Step 2. Rental

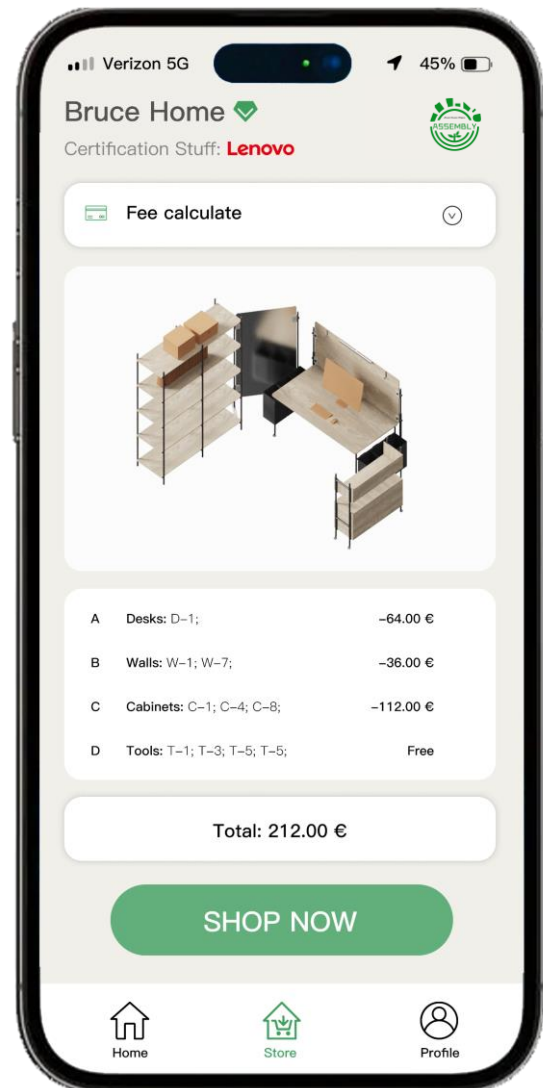
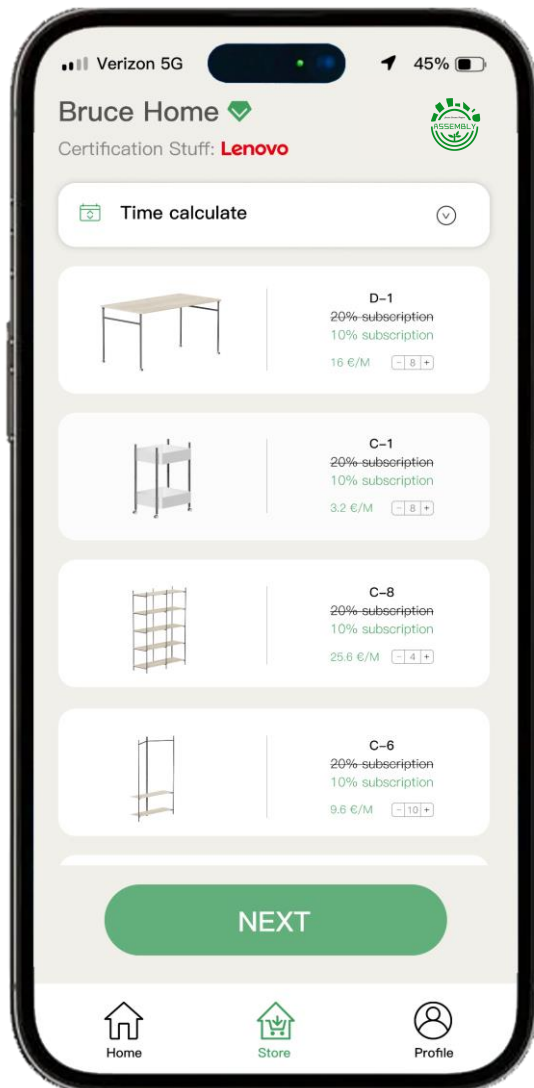


AR technology enables users to view and interact with virtual objects in their real environment using a device such as a smartphone or tablet.

1. After downloading the Assembly app, users can browse through available furniture and select the items they are interested in.
2. The app's camera function is then used to scan the room where the furniture will be placed. Once the virtual space is created, users can select the desired furniture item and drag it to the desired location.
3. The furniture can be viewed in AR mode once it is placed in the virtual space, allowing users to see how the virtual furniture looks in a real-world environment via their device's camera. This feature enables users to make an informed decision before purchasing the furniture item.

6.4 How to use

Step 2. Rental



3. Tools selection

Include table legs, lights, hooks, etc.

4. Time calculate

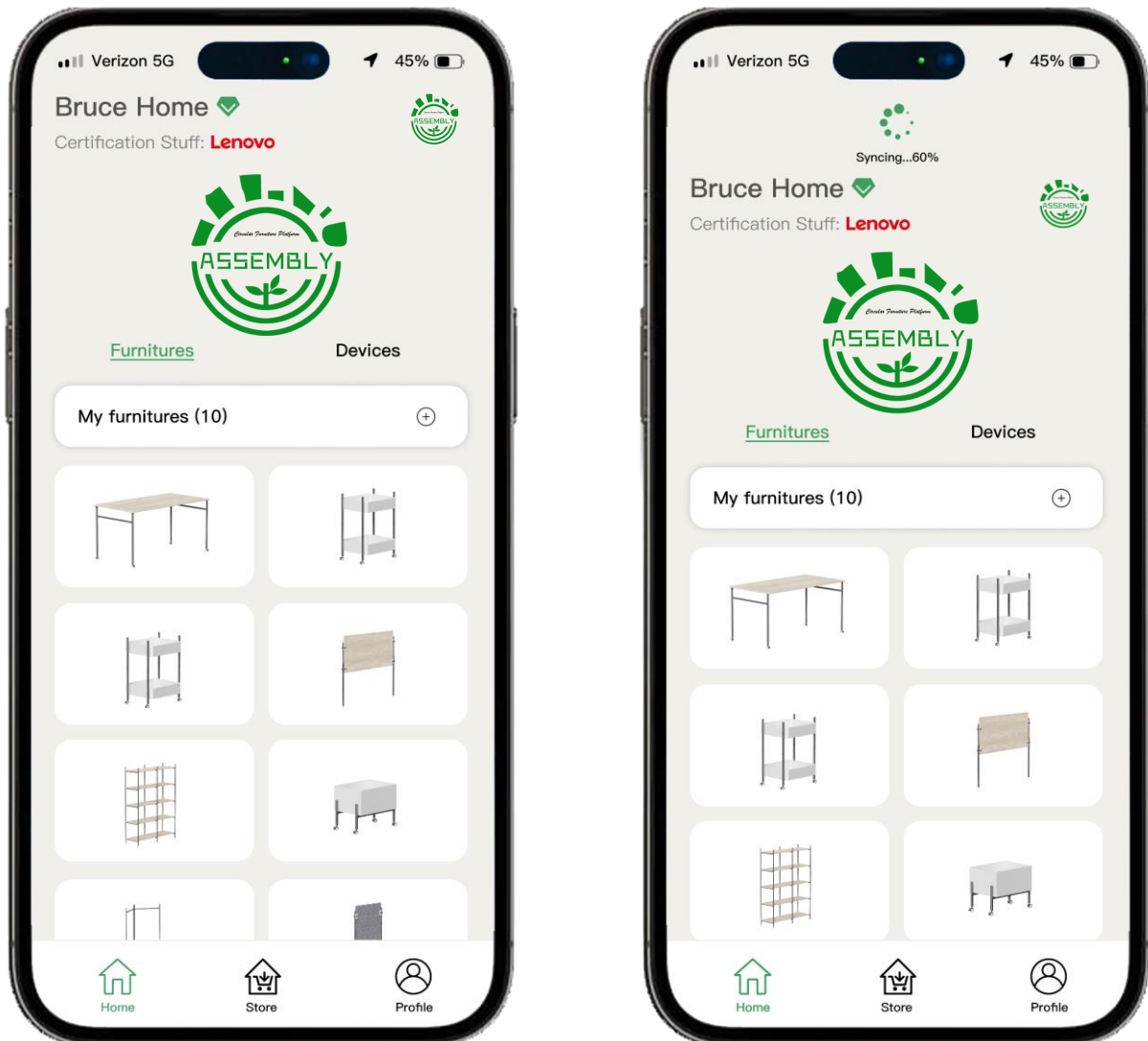
Set the rental time

5. Fee Calculate

Calculate the cost of renting furniture and tools. Assembly began preparing for packing and delivery.

6.4 How to use

Step 3. Service



1. Assembly your furniture

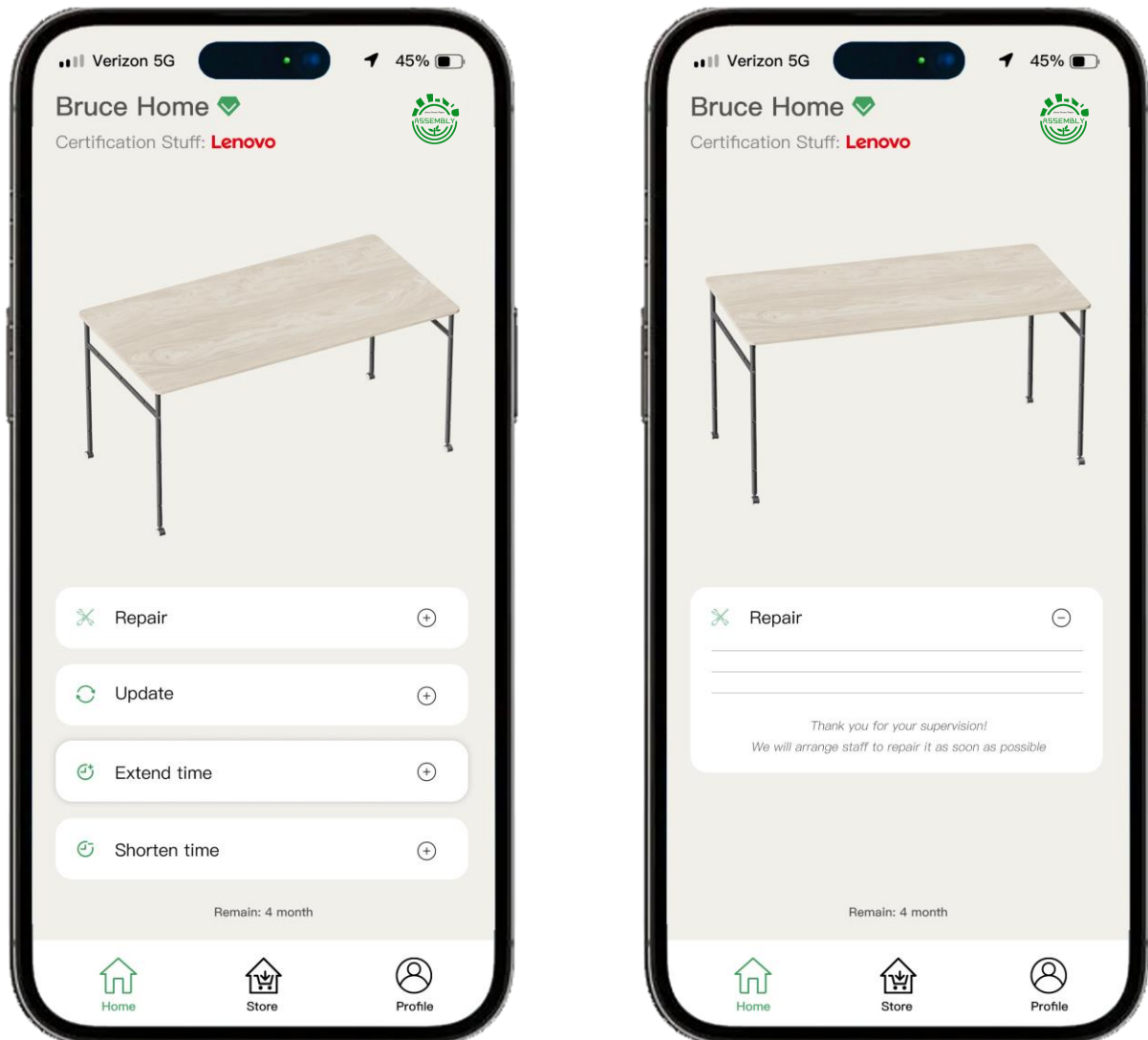
The Assembly sends a package, and each furniture is made from parts. Users can also open the APP to see how to assemble.

2. Thorough after-sales service

The user can explain the situation to the Assembly, and then we adjust the user's service.

6.4 How to use

Step 3. Service



Repair

Every product in the Assembly is assembled. A broken part is immediately replaced.

Update

Users can update subscribed furniture based on their environment. Then create new services.

Change place

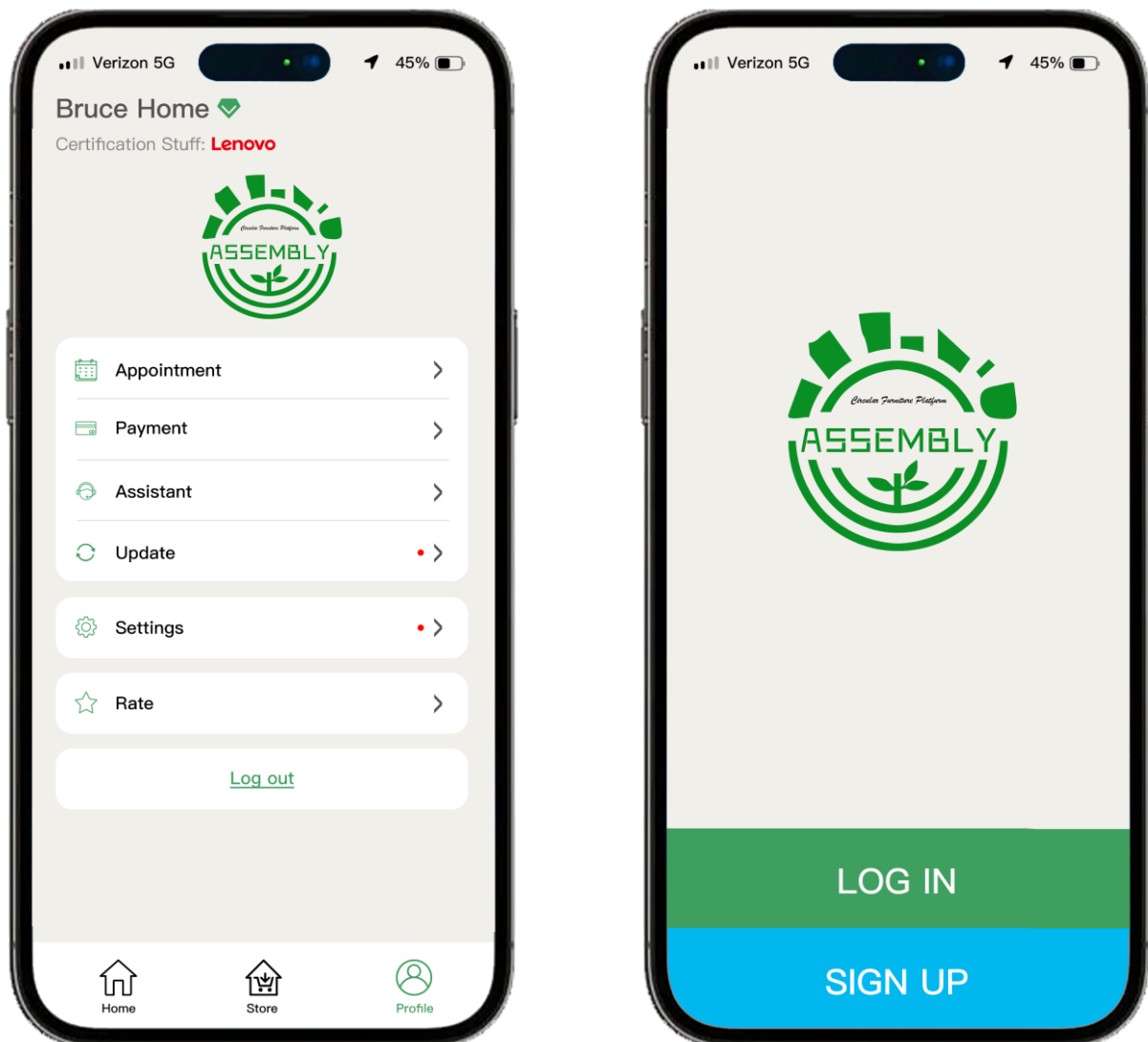
Even if people move to a new house, Assembly still remember the user's habits and help them. Ensure that users can use the same furniture anywhere, thus improve work efficiency.

Change service

Users can contact Assembly to choose to extend or shorten the furniture rental service.

6.4 How to use

Step 4. Profile



1. Appointment with Assembly stuff

Appointment process with the Assembly back office is here, which include all kinds of services, including repairs, upgrades, moves, changes, etc.

2. Payment information

User's subscription information and payment information

3. Assistant request

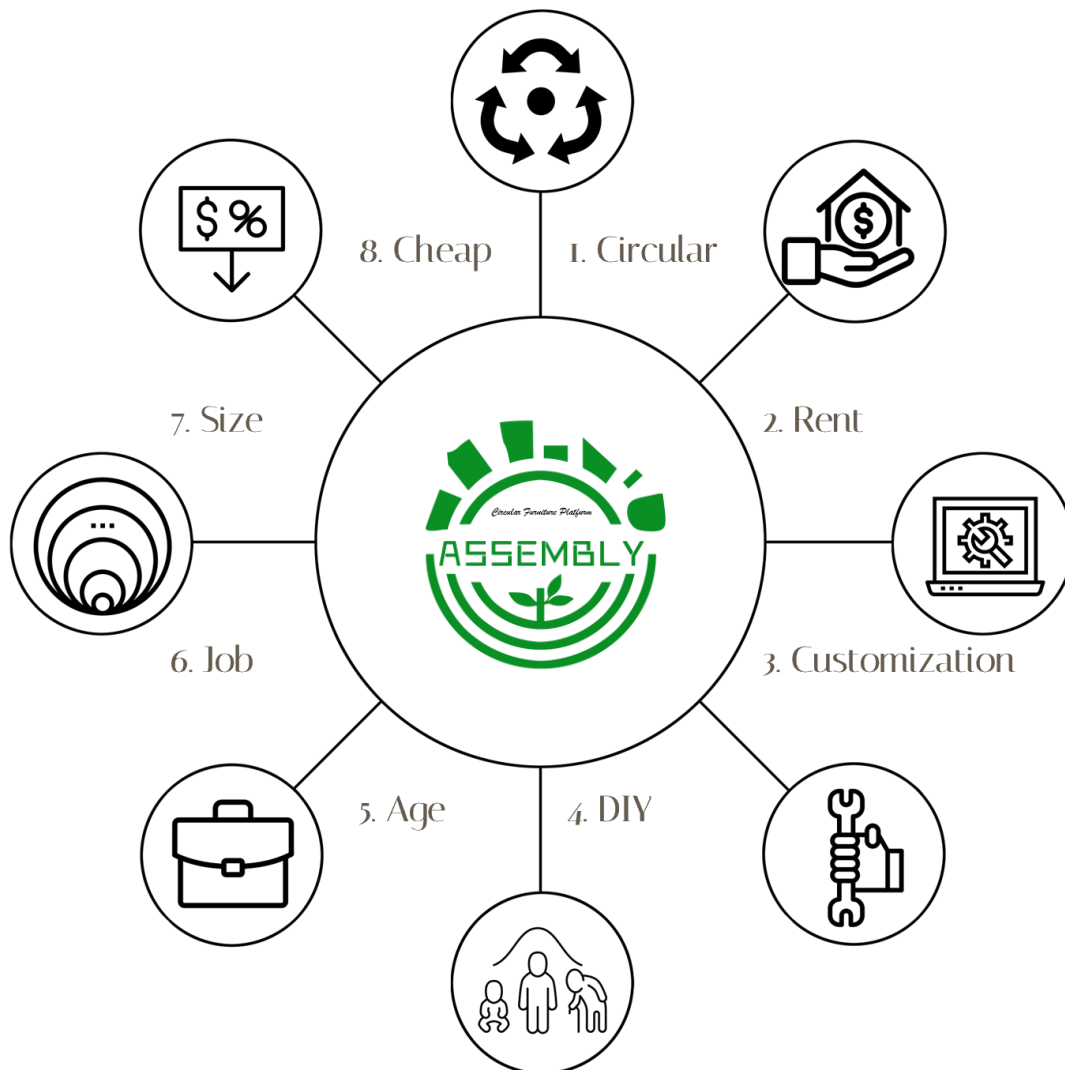
Click here when users need consultation and help

4. Update remind

Assembly is a company that constantly updates its products, reminding users whenever a new product comes online.

6.5 Final outcomes

6.5.1 Advantages



- | | |
|------------------|--|
| 1. Circular | Environmentally friendly materials, all parts can be replaced. Make the whole system circular. |
| 2. Rent | Furniture is rented rather than bought. |
| 3. Customization | Furniture can be customized according to the needs of users. |
| 4. DIY | Use, storage, assembly, disassembly, upgrade, users can operate on their own |
| 5. Age | Provide different functions according to different user ages |
| 6. Occupation | Provide different functions according to different user occupations |
| 7. Size | Provide different functions according to different room sizes |
| 8. Cheap | Companies no longer need to provide lots of offices |

6.5 Final outcomes

6.5.2 Product list

		KIT	Desk
Hardware	Furniture	1 Desk 1 Wall 2 Cabinet	D-1
	Function	A set of foldable, movable, assemble furniture	Fixable, extensible desk
	Size	Changeable	135*70*67 CM
Interaction	Rent price	20% subscription 20 euros/month	20% subscription 6 euros/month
	Membership	10% subscription 20% discount	10% subscription 20% discount

6.5 Final outcomes

6.5.2 Product list

Wall	Cabinet	Tools
W-1; W-2; W-3; W-4; W-5; W-6; W-7.	C-1; C-2; C-3; C-4; C-5; C-6; C-7; C-8	Leg; Light; Box; Stick; Hook
Fixable, extensible, holdable, sound insulation, mirror	baby cot, drawer, shoe cabinet, book shelve	Movable and fixable, lamp, storage
143*24*130 CM	44*36*64 CM	Changeable
20% subscription 6 euros/month	20% subscription 4 euros/month	1~9 euros for sale
10% subscription 20% discount	10% subscription 20% discount	Free to use with 5 items 20% discount

6.6 Future development



KEY PARTNERSHIPS

- Suppliers of sustainable materials.
- Logistics and delivery companies.
- Marketing and advertising agencies.
- Maintenance and repair technicians.



KEY ACTIVITIES

- Sourcing and manufacturing sustainable furniture materials such as recycled plastic, metal, and wood to create high-quality furniture items.
- Designing and prototyping modular and ergonomic furniture that meets the needs of remote workers.
- Marketing and promoting the rental service to potential customers.
- Maintaining and repairing furniture items to ensure they are in excellent condition for re-rental.
- Establishing partnerships with logistics and delivery companies to facilitate easy and efficient transportation of furniture to customers.



COSTS

- Material and production costs.
- Logistics and delivery costs.
- Staff salaries and benefits.
- Marketing and advertising expenses.
- Maintenance and repair costs.

Assembly is a sustainable business model that provides furniture rental services to remote workers who need home office setups. The model aims to promote the principles of the circular economy, which involve reducing waste and extending the life cycle of products. The following is a business model for this system:

6.6 Future development



VALUE PROPOSITION

- Affordable, convenient, and eco-friendly furniture rental service for remote workers.
- Access to high-quality and ergonomic furniture that enhances work productivity and comfort.
- Flexibility to choose furniture items that match personal preferences and design aesthetics.
- Hassle-free maintenance and repairs of furniture items, which saves customers time and money.



KEY RESOURCES:

- Sustainable and high-quality materials for furniture production.
- Skilled designers, manufacturers, and repair technicians.
- Reliable logistics and delivery partners.
- Robust online platform and mobile app for managing rental services and tracking inventory.



CUSTOMER SEGMENTS

- Remote workers who need to set up a home office and require comfortable and functional furniture.
- Companies that want to provide furniture rental services to their remote employees as part of their employee benefits package.



REVENUES

- Rental fees from customers who lease furniture items for a specified period.
- Additional revenue from optional services such as delivery, assembly, and maintenance.
- Fees from corporate customers who subscribe to the rental service for their employees.

Overall, this business model provides a sustainable and affordable solution for remote workers who need home office furniture. By focusing on the principles of the circular economy, the model helps to reduce waste and minimize the environmental impact of furniture production and disposal.

Chapter 7. Bibliography

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Scientific papers

- Golden, T. D. (2006). Avoiding depletion in virtual work: Telework and the intervening impact of work exhaustion. *Journal of Vocational Behavior*, 69(1), 176–187.
- Gajendran, R. S., & Harrison, D. A. (2007). The good, the bad, and the unknown about telecommuting: Meta-analysis of psychological mediators and individual consequences. *Journal of Applied Psychology*, 92(6), 1524–1541.
- Hill, E. J., Ferris, M., & Mårtinson, V. (2003). Does it matter where you work? A comparison of how three work venues (traditional office, virtual office, and home office) influence aspects of work and personal/family life. *Journal of Vocational Behavior*, 63(2), 220–241.
- Sardeshmukh, S. R., Sharma, D., & Golden, T. D. (2012). Impact of telework on exhaustion and job engagement: A job demands and job resources model. *New Technology, Work and Employment*, 27(3), 193–207.
- Sheng, X., & Liu, X. (2014). Telecommuting: Does it improve employee performance? An empirical investigation. *Journal of Business and Psychology*, 29(2), 247–259.
- Bocken, N. M. P., Bakker, C., & Pauw, I. (2018). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 35(7), 494–500.
- Brandi, U., & Talamo, C. (2019). Circular economy and design: a multidimensional approach. *Journal of Cleaner Production*, 213, 595–606.
- Geissdoerfer, M., Savaget, P., Bocken, N. M., & Hultink, E. J. (2017). The Circular Economy—A new sustainability paradigm?. *Journal of Cleaner Production*, 143, 757–768.

Chapter 7. Bibliography

- Hu, M., Wang, Z., Geng, Y., & Sarkis, J. (2019). Circular economy and sustainable development of China's furniture industry. *Journal of Cleaner Production*, 211, 425–436.
- Pizzol, M., Laurenti, R., & Møller, J. (2019). Circular design for a circular economy: An interdisciplinary literature review. *Journal of Cleaner Production*, 221, 839–850.
- Tan, A. R., Chong, W. K., Tan, R. R., & Ho, C. S. (2019). Developing a circular economy framework for furniture industry. *Journal of Cleaner Production*, 229, 382–395.
- Tukker, A., & Tischner, U. (Eds.). (2019). *New business for old Europe: Product-service development, competitiveness and sustainability* (Vol. 50). Routledge.
- Hwang, J. H., Hong, S. G., & Lee, S. W. (2020). An overview of research on indoor furniture design trends. *Journal of Asian Architecture and Building Engineering*, 19(3), 471–478.
- Lee, S., Lee, M., Lee, C., & Kim, M. (2019). Design factors affecting the evaluation of furniture quality in home environments. *Journal of Asian Architecture and Building Engineering*, 18(2), 381–387.
- Hou, Y., Wang, J., & Zhang, L. (2019). Research on furniture design based on emotional experience. *DEStech Transactions on Social Science, Education and Human Science*, (aest), 22–26.
- Kim, Y. S. (2019). A study on the application of furniture design elements for improving the usability of space. *Journal of Asian Architecture and Building Engineering*, 18(2), 297–304.
- Zhang, X., & Zhang, X. (2018). Study on furniture design from the perspective of ergonomics. *DEStech Transactions on Social Science, Education and Human Science*, (aest), 86–91.

Chapter 7. Bibliography

- Widyastuti, N., Wardhana, A., & Basuki, R. S. (2020). The development of eco–design furniture for small scale households in Indonesia. *IOP Conference Series: Materials Science and Engineering*, 778(1), 012098.
- Li, S., Li, J., Li, X., Li, M., & Li, X. (2019). Research on the integration of furniture design and cultural elements. *Advances in Intelligent Systems and Computing*, 900, 759–765.
- Gao, Y., & Sun, X. (2018). An investigation of furniture design based on user experience. *Advances in Computer Science Research*, 68, 385–390.
- Fang, C., & Wang, J. (2021). A study on the interactive design of intelligent furniture. *DEStech Transactions on Social Science, Education and Human Science*, (aest), 55–61.
- Doğan, B., & Ünver, O. (2019). Furniture design principles and environmental sustainability. *Journal of Tekirdag Agricultural Faculty*, 16(2), 178–182.

Web–sources:

- <https://circulardesign.tools/>
- <https://www.circulardesignguide.com/methods/understand>
- <https://www.futureurbanliving.com/design–tools>
- <https://www.proglonet.com/blog/circular–by–design–the–5–principles–to–make–it–happen>
- <https://ellenmacarthurfoundation.org/design–and–the–circular–economy–deep–dive>

Chapter 7. Bibliography

- https://www.researchgate.net/publication/355883100_Remote_Working_Environment_Challenges_in_the_Context_of_the_Covid-19_Pandemic
- https://books.google.de/books/about/Making_Telecommuting_Happen.htm
- <https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-after-covid-19>
- <https://www.statista.com/topics/6565/work-from-home-and-remote-work/>
- <https://www.imf.org/en/Blogs/Articles/2022/03/17/pandemics-e-commerce-surge-proves-less-persistent-more-varied>
- <https://www.shrm.org/hr-today/news/hr-news/pages/viewpoint-on-remote-work-depends-on-gender-ethnicity-industry.aspx>
- <https://dragontrail.com/resources/blog/2021-china-online-travel-industry-report-fastdata>
- <https://www.deel.com/blog/benefits-of-telecommuting>
- <https://content.wisestep.com/telecommuting-advantages-disadvantages-employers/>
- <https://hr.uw.edu/hybridwork/employee-telework-guidance/teleworking-tips-for-employees/>