

# ***Spatial and Temporal Distribution, Hotspot Distribution and Evolution Path of Flexible Working Arrangements Research: A Visual Analysis Based on the CiteSpace Knowledge Map***

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**Abstract:** In the post-epidemic era, flexible working arrangements have received more and more attention from scholars, but no scholars have yet analyzed the research in the field of flexible working arrangements using visual measurement methods. In order to understand the progress of flexible working arrangements research more scientifically and intuitively, based on the literature on flexible working arrangements in the database of “Web of Science Core Collection”, CiteSpace software was used to visualize and analyze important scholars, countries and research institutions, research hotspots, and trends in the research field. The study found that: the research development in the field of flexible working arrangements shows a gradual upward trend, and the research has been more active after 2010; the existing research in the field of flexible working arrangements can be divided into five theme groups, and the research content mainly focuses on the dimensions of flexible working arrangements, employee behavior, and leader factors, and so on. Finally, future research directions are proposed based on the analysis of the flexible working arrangements knowledge map.

**Keywords:** Flexible Working Arrangements, Visual Analysis, CiteSpace, Knowledge Map.

## **1. Introduction**

In order to cope with the changing external environment, enterprises need to constantly seek innovative development and meet the individual needs of diversified employees. In the process of meeting the individual needs of employees, the collaboration between enterprises and employees has become more flexible. In particular, during COVID-19, in order to reduce the number of people gathering and control high-risk groups, many enterprises and social organizations implemented unconventional measures such as flexible work, telecommuting, and shift work. Even in the current post-epidemic era, in the face of the recurring challenges of the epidemic, flexible working arrangements continue to play a role in some enterprises and social organizations. Focusing on the development of work patterns and work systems, in the era of rapid Internet development, traditional working systems have increased operating costs and reduced the ability to respond flexibly to crises. Flexible working arrangements, which originated in the 1960s, have attracted widespread attention as they focus more on the autonomy of employees' working hours, increase work flexibility, and are more adaptable to today's changing social and organizational environments. The concept of “flexible working hours” was first proposed by economist Halle, who advocated that enterprises change the

original fixed-time commuting pattern and adopt staggered commuting measures, which is considered to be the origin of flexible working arrangements[1]. After entering the 1990s, flexible working arrangements began to be widely used in some Western countries, gradually evolving into flexibility in terms of working hours (fixing only the total number of working hours per day and the core working hours for which attendance is mandatory) and flexibility in terms of working days (allowing a week's work to be compressed into a few days)[2][3]. With the development of science and technology, flexible working arrangements are no longer limited to temporal flexibility arrangements, and gradually extended to flexible space. Rau and Hyland proposed a two-dimensional time-space structure for flexible working arrangements in 2002, using telecommuting and flexible working hours as the main manifestations of the structure[4]. Greenberg and Landry in 2011 further argued that flexible working hours specifically refers to the institutional arrangement that allows the employees to adjust the starting point of their working hours as well as the total amount of time, while spatial flexibility specifically refers to the institutional arrangement that allows employees to work outside of their designated workplace[5]. Barbieri argues that elasticity is a multifaceted concept in the labor market and classifies elasticity in the labor market into four dimensions: quantity elasticity, time elasticity, functional elasticity, and wage elasticity[6]. With the growing richness of the concept and theory of flexible working arrangements, scholars gradually turn to explore the impact of flexible working arrangements on work effects and its practical application in various fields.

The positive role that flexible working arrangements can play in today's changing economic environment is getting more and more attention from all parties, but most of the review articles on flexible working arrangements are qualitative studies based on the summary and analysis of a large amount of past literature, and no scholars have yet to make use of the visual measurement method to carry out an intuitive descriptive analysis of the literature related to flexible working arrangements. Therefore, it is of great theoretical and practical significance to analyze the literature on flexible working arrangements visually. Based on this, this paper uses CiteSpace software to visualize and interpret the current research status of flexible working arrangements as a whole, in order to understand the important scholars, countries and institutions, research hotspots and future trends in this field, and to provide a reference for researchers on this topic.

## **2. Data Sources and Research Methods**

### **2.1. Data Sources**

The data in this paper was taken from the "Web of Science Core Collection" database, and the search was conducted under the title of "flexible work" or "flexible working". The initial search yielded 980 articles, and 285 articles were left after excluding articles that were not related to the field of this research and eliminating non-research articles and duplicates. The time span of the literature data is 1979-2024.

### **2.2. Research Methods**

CiteSpace is an information visualization software developed by Prof. Chaomei Chen. With its powerful functions, CiteSpace software can deeply mine and visualize the literature information of specific research fields in authoritative databases such as "Web of Science", "CSSCI" and "CNKI", present the collaboration networks among authors, countries and institutions, and reveal the dynamics of research hotspots as well as the knowledge base of the field. In this paper, an in-depth visualization and analysis of the sample data was conducted using CiteSpace software. The analysis dimensions broadly cover author collaboration networks, country and institution collaboration networks, and co-occurrence analysis of keywords to explore the current research hotspots as well as future research trends in flexible working.

### 3. Spatial and Temporal Distribution of Research on Flexible Working Arrangements

#### 3.1. Temporal Distribution

The year-volume of publications folding graph is based on data retrieved and filtered from the Web of Science Core Collection database. The folding graph can reflect the development trend of flexible working arrangements and the hotspots in the research field more intuitively. Through reading the literature related to flexible working arrangements, it is found that flexible working arrangements began to popularize rapidly in the 1970s, and in the late 1970s, nearly half of the public sector in the U.S. implemented flexible working arrangements for employees [7]. As can be seen from Figure 1, overall, the number of literature publications is roughly on an upward trend. before 2000, the folding graph is flat, and the number of publications is relatively small. 2000-2009, the folding graph fluctuates but overall is relatively flat, and the number of publications shows a slower development; 2010-2024, although there are always substantial fluctuations in the number of publications per year, the overall trend is upward. 2021 and 2023 reached the highest number of publications, up to 28. Due to the data statistics as of June 2024, the data of 2024 in the statistics of the annual number of publications only includes the annual number of publications in the first half of 2024, and the number of publications in the first half of 2024 is already as high as 17 publications. From the perspective of the overall trend of change in the number of publications, the annual number of publications in the field of flexible working arrangements research reached a high level (25) for the first time in 2019 and then showed a more regular fluctuation. This may be due to the fact that the outbreak of COVID-19 and the recurrence of the epidemic in the post-epidemic era have aroused the demand and concern of society for flexible working arrangements, which shows that the development of flexible working arrangements is closely related to the general trend of social development.

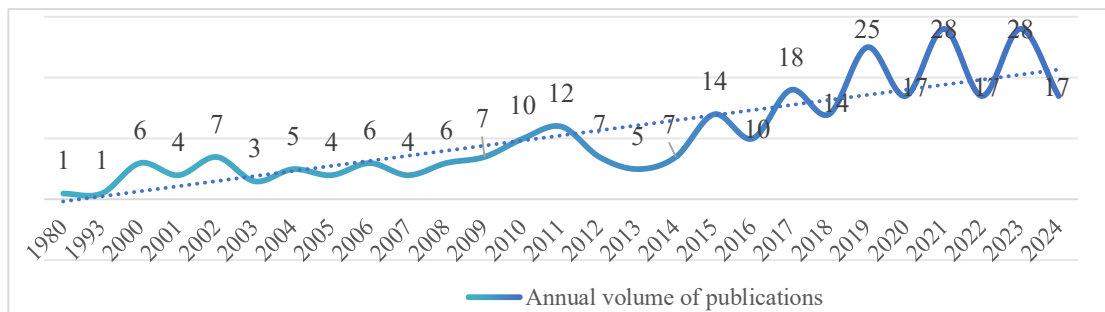


Figure 1: Year-volume of publications graph.

#### 3.2. Spatial Distribution

##### 3.2.1. Collaborative Analysis of Authors

In the field of flexible working arrangements, author collaboration network analysis provides an intuitive perspective to explore the degree of collaboration among scholars in the field. In this paper, we use CiteSpace software to construct and analyze the author collaboration network by selecting “author” as the node type. In this network, authors with cooperative relationships are shown through the lines between the nodes, in which the size of the nodes and the size of the letters labeled on the nodes directly reflect the authors’ contributions to the field, and the larger the nodes and the letters labeled on the nodes, the greater the number of articles published by the authors. The color and thickness of the connecting line are used as an indicator to measure the degree of connection between the authors, the thicker the connecting line is, the higher the frequency and intensity of collaboration between the two authors. As shown in Figure 2, the largest number of publications is by Chung (6),

followed by Kelliher (4), Anderson, Atiku, Atkinson, Cathcart, McDonald, and Stavrou, etc(3), and the rest of the scholars have either two or one. In terms of connectivity, there are four larger collaborative clusters of authors, the largest of which consists of Cooklin, Crawford, Giallo, Hokke, Strazdin, Banwell, Bennetts, and Dixon, who work closely with each other. The other three collaborative clusters are centered on Stavrou, Pitt-catsoupes, Garavan, and Clarke, respectively. Taken as a whole, there is a lack of strong links between authors in the field of flexible working arrangements research, with single authors as well as two authors still conducting a large proportion of research.

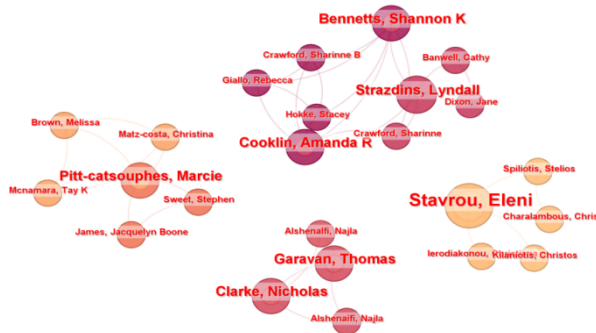


Figure 2: Author collaboration network analysis diagram.



Figure 3: Countries and institutions collaboration network analysis diagram.

### 3.2.2. Collaborative Analysis of Countries and Research Institutions

The Countries and institutions collaboration network analysis diagram provides an accurate picture of the strength of scientific collaboration internationally and between different research institutions. In this diagram, the size of the annual wheel is used as a visual indicator of the number of publications by each subject, the thicker the wheel, the more publications the country or institution has in the field. As shown in Figure 3, England has the highest number of publications, as high as 58, followed by 12 countries such as the United States (52), Australia (35), Germany (16), etc. The number of publications in England and the United States is much higher than that of other countries, which is at the forefront of research in the field of flexible working arrangements. Moreover, the high degree of centrality of England, the United States and Australia indicates that the countries with the highest number of articles occupy an important position in the field of flexible working arrangements and are closely connected. As for research institutions, flexible working arrangements research is more active at Cranfield University (6), Queensland University of Technology (6), Edinburgh Napier University (6), and Lundby University (6), Queensland University of Technology (Australia) (6), Edinburgh Napier University (Australia) (6).

## 4. Hotspots and Trends of Research on Flexible Working Arrangements

### 4.1. Analysis of Research Hotspots

In order to accurately grasp the research hotspots and trends in the field of flexible work arrangements, this paper analyzes the keyword co-occurrence with the help of CiteSpace software. As can be seen from Table 1, the top 10 high-frequency words are “flexibility”, “flexible work arrangements”, “impact”, “family conflict”, “arrangements”, “performance”, “life balance”, “gender”, “policy”, and “job satisfaction”.

Table 1: High frequency keyword statistics table.

No.	Keywords	Frequency	Centrality	No.	Keywords	Frequency	Centrality
1	flexibility	61	0.13	16	family	18	0.2
2	Flexible work arrangements	43	0.1	17	workplace	16	0.02
3	impact	42	0.16	18	meta analysis	16	0.05
4	family conflict	41	0.16	19	flexible working arrangements	15	0.02
5	arrangements	32	0.13	20	balance	15	0.02
6	performance	30	0.05	21	life	14	0.01
7	life balance	29	0.14	22	flexible work	14	0.02
8	gender	29	0.05	23	work-life balance	14	0.02
9	policy	28	0.07	24	health	13	0.01
10	job satisfaction	25	0.02	25	employment	13	0.07
11	conflict	22	0.09	26	schedule control	12	0.03
12	workplace flexibility	22	0.06	27	satisfaction	12	0.01
13	management	21	0.12	28	women	11	0.01
14	human resource management	21	0.06	29	antecedents	11	0.12
15	flexible working	19	0.11	30	job	11	0.03

The keyword co-occurrence map of flexible working arrangements is shown in Figure 4. Based on the analysis of the keyword co-occurrence map (Figure 4) and the research hotspots network map (Figure 5), the research in the field of flexible working arrangements can be divided into five themes.

Theme 1: Dimensions of flexible working arrangements and research methods. The key word involved in this area is “qualitative”. At present, there is no clear expression in academic circles to explain the connotation of flexible working arrangements, and the definition of flexible working arrangements is rather vague. Jianmin Sun et al. summarize the existing management practice research, and divide the research on flexible work into four types: time-based flexible work, space-based flexible work, employment-based flexible work, and content-based flexible work[8]. Early academic research on flexible working arrangements was mainly based on field experiments. Kim and Campagna adopted the field experiment method to study the impact of flexible working hours on employees’ attendance and performance[9]. Hicks and Klimoski use a combination of experimental methods and questionnaire surveys to explore the impact of flexible working hours on employees’ attitudes towards work[10]. With the advancement of science and technology and the rapid development of the Internet, in recent years, the research on flexible working arrangements has changed into a questionnaire survey research as the main body, supplemented by experimental method and secondary data method. Scholars such as Stavrou and Leslie have included questionnaire survey research in the research process[11]. Hornung et al. have developed a more standardized scale for researching flexible working arrangements, and research on flexible working arrangements is gradually being improved. Hornung et al. have developed a more standardized scale for studying flexible working arrangements, and the research in the field of flexible working arrangements is being gradually improved.

Theme 2: The effect of flexible working arrangements on employee productivity and satisfaction. The keywords involved in this area are “flexible work”, “working condition” and “family policy”.

Early researchers focused on the effects of flexible working arrangements on employees' behaviors such as leave, absenteeism, and procrastination. Rubin argues that flexible working arrangements allow employees to control their time more freely, which leads to more efficient labor and less leave and absenteeism[12]. In contrast, flexible working hours can reduce work-life conflicts, employee fatigue and psychological symptoms, and increase employee satisfaction with their jobs[13]. Kelliher et al. found that the work intensity of employees under flexible working arrangements increased, but their job satisfaction and organizational commitment rose instead. Social exchange theory can be used to explain this phenomenon as employees respond to the ability to work flexibly by putting in extra effort, which pays off for the employer[14]. However, it has also been shown that flexible working arrangements reduce employees' career-related self-esteem and identity and that employees' satisfaction with their employment status decreases[15].

Theme 3: The influence of leadership factors in flexible work arrangements. The keywords involved in this area are "flexible work arrangements" "Germany" "human resource management". Leadership, as an important variable at the organizational level, plays an important role in the implementation of flexible working arrangements in terms of leadership styles, attitudes, and perceptions of leaders[16]. Leslie et al. found that leaders attribute employees' behaviors to the practice of flexible working arrangements for two main reasons: to improve productivity or for personal life attributions. When leaders attribute employee behaviors to increased productivity, flexible working arrangements can bring benefits to employees' career success; on the contrary, when leaders attribute employee behaviors to personal life attributions, the implementation of flexible working arrangements can impede employees' career development[17]. Wood argues that the ambiguity and flexibility of flexible working arrangements provide leaders with a powerful and unaccountable control mechanism, forcing employees to need to continually strive to maintain leaders' favor[18]. This view is supported by the research of Prowse et al. Full-time midwives and those without caring commitments feel disadvantaged by flexible working arrangements because flexible working hours make leaders expect them to cover extra work[19].

Theme 4: The impact of flexible working arrangements on turnover. This area covers the keywords "career change" and "turn over". Stavrou explores the impact of flexible working arrangements on turnover rates in terms of flexible working hours and telecommuting respectively. In the private sector, non-standard work hours are associated with a decrease in turnover, while in the public sector, both non-standard work hours and work outsourced are associated with a decrease in turnover[20]. Timms et al. found that when the organizational culture is supportive of flexible working, employees show low turnover and low levels of psychological strain, as well as higher levels of work engagement[21].

Theme 5: Impact of flexible working arrangements on work-family balance. The keywords covered in this area are "work-life balance", "flexible working arrangements", and "shift work". The impact of flexible working arrangements on employees' work-life balance and work-family conflict has been an important direction of research by scholars in this area. Hornung et al. found that flexible working arrangements can reduce work-family conflict[22]. Allen et al. used meta-analysis to sort out the relationship between flexible working arrangements and work-family conflict. The study found that the impact of flextime on work-family conflict was significantly stronger than flexplace[23]. Wheatley found through the British Household Panel Survey and Understanding Society (2001-2011) that flexible working hours were more common among men and had a positive impact on men's ability to maintain a full-time job while taking care of their household responsibilities[24].



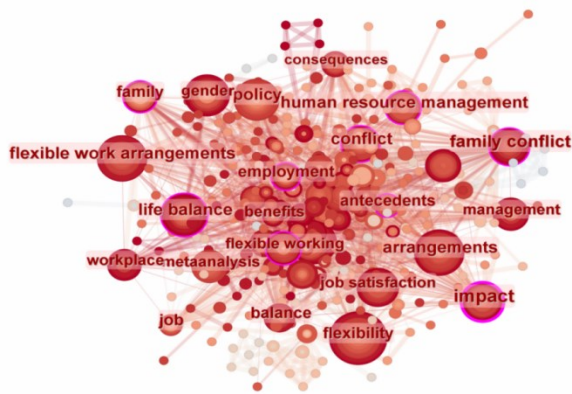


Figure 4: Keyword co-occurrence map



Figure 5: Research hotspots network map.

In order to show more clearly the research hotspots and evolution process of different stages in the field of flexible working arrangements, this paper draws a keyword time zone diagram with the help of CiteSpace software. As shown in Figure 6, the literature on flexible working arrangements can be traced back to 1979, and it has maintained a steady development until now. 1979-2000, there were few studies on flexible working arrangements, and flexible working practices began to be popularized in western countries such as the U.S. During the period of 2000-2005, scholars initially explored the research in the field of flexible working arrangements, focusing more on the dimension of “flexibility” in practice and the research method of flexible work arrangements, and initially categorized flexible work into spatial flexibility and temporal flexibility. At the same time, scholars have also begun to focus on the impact of flexible work arrangements on employees’ work behavior, such as separation, absenteeism, leave and so on. Scholars have also focused on the effects of flexible work arrangements on the work satisfaction of employees and the performance of the organization. During the period of 2006-2010, based on the previous studies, scholars added the different preferences of individual factors for flexible work arrangements (gender, age, marital status, etc.) and individual cognitive factors (the perceived value of flexible working system and the use of flexible working system by people around them) as moderating variables to investigate the effects of flexible work arrangements on the work behaviors of employees, such as turnover, leave, etc. In addition, scholars have conducted more in-depth research and analysis on the impact of flexible working arrangements on employees’ physical and mental conditions, and after 2010, the research in this field has entered a relatively active development stage. Scholars have paid more attention to the mechanisms through which flexible working arrangements work in different cultural contexts and situations. At the same time, scholars have shifted their perspectives from employees to leaders and explored the role of leader factors in flexible working arrangements. In addition, scholars have begun to consider the impact of flexible working arrangements on employees’ work-life balance and work-family conflict as an important research direction.





hot topic and a trend for future research. Chen and Fulmer pointed out that although the positive relationship between flexible working arrangements and employee attitudes, behaviors, work-family relationships, organizational performance and other variables has been verified by many studies, the mediating mechanism of flexible working arrangements and its boundary conditions have not been sufficiently studied. However, the research on the mediating mechanism of flexible working arrangements and the boundary conditions of its functioning is still insufficient[27].

#### 4. Quadrant 4: Fringe area (high frequency, low centrality)

Keywords such as “flexible work arrangements” have high frequency and low centrality. Although these themes are relatively mature in their development, other themes have low relevance and are gradually being marginalized.

### 5. Conclusion and Enlightenment

This paper takes the literature of the research in the field of flexible working arrangements within the “Web of Science Core Collection” database as the research object and uses CiteSpace software to draw the knowledge map of the research in the field of flexible working arrangements, which visualizes the development of the research in this field since 1979. Deeply analyzes the hotspots and development trends of the research in the field of flexible working arrangements. By analyzing the knowledge map in the field of flexible working arrangements, this paper draws the following conclusions.

First, with the continuous popularization and development of the practice of flexible working arrangements, coupled with the impetus of COVID-19 on the research and practice of the field, the publication volume of literature in the field of flexible working arrangements continues to rise. There are four larger clusters of author collaborations in the author collaboration network diagram, the largest of which is centered on Cooklin. In terms of research institutions, the more active ones are universities such as Cranfield University.

Secondly, research in the field of flexible working arrangements is mainly divided into five themes: (1) Dimensions of flexible working arrangements and research methods. (2) The effect of flexible working arrangements on employee productivity and satisfaction. (3) The influence of leadership factors in flexible work arrangements. (4) The impact of flexible working on turnover. (5) Impact of flexible working arrangements on work-family balance.

Third, based on the analysis of the knowledge map of flexible working arrangements, the future research directions are mainly divided into the following aspects: (1) Enriching the variables to measure the effect of flexible working arrangements. In the future, more attention can be paid to the effects of flexible working arrangements on the organizational level, such as organizational competitiveness, cohesion, and other outcome variables. (2) Explore the potential factors affecting flexible working arrangements from different perspectives. For example, Lambert et al. found that the use of flexible working arrangements by people around them affects employees’ attitudes and use of flexible working arrangements[28]. (3) Research on the role mechanism of flexible work arrangements under different boundary conditions. Many of the current studies remain at the level of validation of the correlation relationship, but in the future, we can deeply explore the inner mechanism of its action. (4) Enrich the research on the negative effects of flexible working arrangements. The past research results are more inclined to the positive effects of flexible working arrangements, and the studies on the negative effects account for a minority, and most of them are focused on specific occupations and situations. In the future, it is possible to explore whether flexible working arrangements will trigger negative behaviors of employees, such as procrastination and poor attitude, under different boundary conditions.

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