

Article

Digitalization's Effect on Chinese Employment Mechanism Study

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Abstract: The influence of the digital revolution on the labor market is undeniably profound. While much of the existing research has concentrated on the role of digitalization in boosting employment rates, its impact on the long-term sustainability of employment remains largely unexplored. In the context of prevailing uncertainties, the imperative to bolster employment resilience through digitalization becomes increasingly apparent. This study aims to bridge the existing gap by introducing an innovative analytical framework that integrates digitalization, enterprise resilience (ER), and sustainable employment (SE). Focusing on publicly listed companies within China's manufacturing sector, the research employs fixed effects models and mediation analysis to intricately explore the interactions among these variables. The investigation yields several pivotal insights: (1) digitalization has a significantly positive impact on sustainable employment; (2) enterprise resilience acts as a positive mediator in the relationship between digitalization and sustainable employment; (3) through heterogeneity analysis, it is demonstrated that digitalization plays a more pronounced role in bolstering employment stability in non-high-tech industries and companies exhibiting superior financial health in the eastern region. These findings offer critical perspectives for informing government policy and devising corporate strategies that capitalize on digitalization and enhance enterprise resilience, thereby promoting more sustainable employment trajectories.

Keywords: digitalization; sustainable employment; enterprise resilience



Citation: Zhao, P.; Tang, F. Digitalization's Effect on Chinese Employment Mechanism Study. *Sustainability* **2024**, *16*, 1436. <https://doi.org/10.3390/su16041436>

Academic Editor: Davide Settembre-Blundo

Received: 31 December 2023

Revised: 6 February 2024

Accepted: 6 February 2024

Published: 8 February 2024



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1. Introduction

With the swift advancement of mobile internet, technologies including artificial intelligence, cloud computing, big data, and blockchain are at the forefront of the digitization wave. This trend significantly escalates market competition among enterprises, subjecting them to pressure not only from their respective industries but also from externally linked internet-based businesses [1]. Digitization has become an effective path for enterprises to maintain their competitive advantages [2]. Companies actively exploit the disruptive capabilities of digitization to reformulate business operations, models, and processes via digital technologies. This strategic engagement facilitates the creation of value, the fundamental reconstitution of traditional industry practices, the transcendence of conventional sector boundaries, and the adept response to evolving trends and challenges [3].

Throughout modern global history, humanity has experienced several major industrial technological revolutions, each profoundly impacting production methods and daily life [4]. Undoubtedly, the digital economy, as a fusion of technological innovations, is no exception [5]. The digital transformation, underpinned by groundbreaking digital technologies, has catalyzed the emergence of novel technologies, business models, and industries, exerting a profound impact on employment levels and structures. Amidst this digital surge, the manufacturing industry—a cornerstone of the real economy—is experiencing significant alterations in its employment landscape [6]. Quantitatively, labor-intensive manufacturing sectors, impacted by the successful implementation of digitization, confront the potential for automation and the substitution of numerous conventional manufacturing roles [7,8].

Structurally, digital transformation increases the demand for professional knowledge in areas such as data analysis, system maintenance, and cybersecurity while decreasing the demand for traditional manufacturing operational skills [9]. This transformation has the potential to modify the employment architecture of the entire manufacturing sector fundamentally. Regarding the scope of impact, digitization for manufacturing entities entails the redistribution of certain positions, alongside modifications to supply chains and industry networks, thereby influencing the employment framework and regional competitiveness.

A report from the International Labour Organization indicated that prior to the advent of COVID-19, the stability of the youth labor force was already precarious. Moreover, the onset of COVID-19 intensified the economic crisis, leading to an escalation in unemployment rates [10,11]. In the context of the global economy's tepid recovery and the inconsistent fluctuations in labor market supply and demand, the employment landscape is confronting grave challenges, necessitating the immediate establishment of stable and sustainable employment trajectories. Against this backdrop, sustainable employment models have surfaced, designed to augment employee well-being and innovation, consequently elevating job performance, enterprise productivity, and efficiency, thereby generating increased value for corporations [12]. Simultaneously, digital transformation also offers new possibilities for the sustainable development of businesses and employment. It is widely believed that digitization has both employment substitution and creation effects [13]. On the one hand, digitalization frequently entails the incorporation of automation and intelligent technologies, resulting in the substitution of repetitive, standardized tasks with machine or software execution. This shift exerts pressure on low-skilled workers, who may confront unemployment, wage reductions, or the necessity of transitioning to new job roles [14]. On the other hand, digitization not only brings opportunities in emerging technology fields, such as data analysis, artificial intelligence, and the Internet of Things, but also stimulates innovation and promotes the emergence of new business models, thereby creating more job opportunities.

Currently, academic research on the impact of digitization on employment is mainly focused on the macro level, primarily from the perspectives of industrial structure upgrading and technological progress, with limited research on the micro level [15–17]. Meanwhile, there is still controversy over the relationship between digitization and employment, and there is a research gap regarding digitization and sustainable employment. So, what is the actual situation? Is digitization conducive to sustainable employment? How does digitization affect sustainable employment? These are a series of urgent questions that need answers. Manufacturing companies are not only microcosms of the macro digital economy but also creators of employment. Therefore, studying the impact of the digital transformation of manufacturing companies on sustainable employment helps elucidate the relationship between the digital economy and employment from a micro perspective [18,19].

The research objectives of this article are delineated as follows: (i) to conduct comprehensive research on the influence of digitalization on the sustainability of employment, encompassing its effects on digital technology, job stability, and employee welfare; (ii) to examine the intermediary function of enterprise resilience between digitalization and sustainable employment, aiming to elucidate how enterprises can augment employment sustainability by bolstering their resilience during the digital transformation process; (iii) to investigate, specifically for non-high-tech industries and enterprises with robust financial health in the eastern region, the strategies through which they can more effectively enhance employment sustainability in the course of digital transformation.

On the basis of this, this paper selected Chinese manufacturing listed companies from 2013 to 2022 as research samples, explored the impact of digitization on sustainable employment, and further studied its underlying mechanisms. The contributions of this research are articulated as follows. (i) This paper augments the body of knowledge on the economic repercussions of digital transformation. By concentrating on the micro-level, it scrutinizes the nexus between the digitization of Chinese manufacturing enterprises and sustainable

employment, accentuating the beneficial ramifications of digitization on employment sustainability. (ii) This paper advances a more nuanced theoretical framework for probing the interplay between digitization and sustainable employment. By integrating enterprise resilience as an intermediary variable, it formulates a conceptual model of “Digitization–Enterprise Resilience–Sustainable Employment,” thereby enriching the examination of the mechanisms through which digitization impacts employment sustainability. (iii) This paper broadens the conceptualization of employment from a sustainability viewpoint. By innovatively proposing a methodology for measuring sustainable employment indicators, it synergizes employment with the paradigm of sustainable development, offering insights and stimulation for subsequent research endeavors. The remaining content of this study is constructed as follows. Section 2 introduces the literature review on digitization, enterprise resilience, and sustainable employment. Section 3 explains the methods and data applied in this study. Section 4 provides results based on data analysis. Section 5 discusses the research findings and insights. The final section discusses conclusions and limitations.

2. Literature Review

2.1. Digitalization

The ascent of the digital economy showcases its formidable developmental momentum and extensive applicability, not merely effectuating a transformation in business operational paradigms but also exerting a significant influence on consumer behavior and the overarching structure of the global economy [14,20]. However, there is still no unified consensus on the definition of the essence of enterprise digitization. The mainstream view suggests that digitization relies on the application of digital technologies, such as the Internet of Things, 5G, and artificial intelligence (AI), closely associated with Industry 4.0. The transformation and disruption of innovative business models, products, services, technologies, and concepts are all outcomes of digitization [21].

Subsequently, a multitude of scholars have engaged in rigorous research concerning methodologies for assessing enterprise digitization. Within the ambit of quantifying enterprise digitization, a prevalent approach entails the utilization of questionnaire surveys [22]. However, the limitations of using questionnaire surveys for measuring digitization are also apparent. On one hand, the questionnaire survey method relies mainly on rigid response results to measure enterprise digitization, meaning that respondents typically need to make choices from predetermined options [21,23]. This methodology, in isolation, fails to encapsulate the comprehensive scope of digitization within an enterprise. Conversely, questionnaire surveys frequently encounter challenges, such as an inadequate sample size or sample selection bias, which may compromise the results’ extrapolation and thereby affect the precise evaluation of digitization’s overall magnitude. To surmount the constraints inherent in questionnaire surveys for gauging digital transformation, numerous scholars have pivoted toward employing text analysis. This involves tallying the frequency of terms related to digitalization in each company’s annual reports, offering a more nuanced and thorough gauge of enterprise digitization levels [24].

Regarding the economic outcomes of digital transformation, prior literature has predominantly investigated the positive effects of digitization on the sustainability, performance, and evolution of business models within enterprises [20,25]. On the one hand, digitization has transformed the business models of enterprises, driving the development of new, more efficient processes and the creation of innovative products, contributing to sustainable competitive advantages for organizations [26]. On the other hand, both internal and external digitization within organizations helps reduce operational costs, leading to improved corporate performance.

2.2. Sustainable Employment

The ascent of technology does not merely constitute a technological revolution but also signifies an evolution within the labor market characterized by intricate modifications on both the supply and demand fronts. In recent years, a surge of scholarly interest has

been directed toward elucidating the factors driving changes in labor employment [17,26]. Some scholars point out that technological development is the main factor contributing to changes in labor employment. On the one hand, with the widespread application of high technology, repetitive, manual labor, and some daily tasks are gradually being automated, leading to a downward trend in labor demand. In his research, he assessed the susceptibility of 702 distinct occupations in the United States to automation risks and discovered that over 40% of the current occupations within the country were deemed vulnerable to the impacts of automation. This includes work involving repetitive daily tasks, such as production line work and certain administrative functions [27].

On the other hand, this conclusion should not be construed to suggest that technological development harbors negative implications, given that technological advancements frequently entail expansion of scale, enhancements in efficiency, and the genesis of new employment prospects. Fernando et al. (2001) observed that, predicated on theories of biased technological progress, technological advancements diminish the relative cost of labor input. In pursuit of cost reduction, firms are incentivized to augment their investment in labor [28]. Technological progress can improve the total factor productivity of enterprises, accelerate the accumulation of capital, further expand the scale of enterprises, and thus increase the demand for labor. Simultaneously, although the advancement of automation and robotics technology may result in the substitution effect on low-skilled labor, the integration of digital technology within enterprises necessitates an increased demand for high-skilled labor, including research and development personnel [29].

With the concept of sustainability permeating people's production and life, the sustainability of employment has also received attention [1,5]. In response to technological advancements and the trajectory of automation, it is imperative to thoroughly comprehend and adjust to these transformations to guarantee the labor market's adaptability and sustainability. This approach is vital for fostering a more inclusive and dynamic work environment for the future, with the aim of realizing sustainable, inclusive, and prosperous development [16]. Therefore, sustainable employment has become a key task. Sustainable employment is a further extension of the employment concept, which integrates employment, human well-being, and environmental and resource protection as a comprehensive concept. This analysis extends beyond merely accounting for the employment of residents; it also scrutinizes the dynamic uncertainties of the employment market and the interplay between employment and the ecological environment. It delineates an employment paradigm that supports the sustainable development of enterprises and aligns with anticipated future societal demands.

2.3. Relationship between Digitalization and Sustainable Employment

In the existing literature, there has been sufficient discussion at the macro level on the impact of digitization on the total and structure of employment [30]. However, research on the micro impact of digitalization on employment is relatively limited, mainly focusing on the impact of artificial intelligence and robot usage on business operations [31]. It is widely acknowledged that enterprise digitization, embodying the integration of technological innovation, harbors dual effects on employment: substitution and creation. For instance, the adoption of digital technology may supplant certain roles within the agricultural sector, precipitating unemployment. Similarly, the deployment of robots is likely to diminish the demand for low-skilled labor [32]. However, on the contrary, some researchers believe that digitization can promote employment. The popularization of the Internet has provided more employment opportunities for women. In addition, the widespread use of the Internet has increased opportunities for remote and part-time work [33]. The overarching impact of digitalization on employment suggests a positive correlation between digitalization and the employment of high-skilled workers while exerting an adverse effect on employment opportunities for low-skilled workers. However, the positive effects predominate [34].

The relationship between digitization and employment has not yet formed a unified consensus [35]. Considering the deepening of digitization, the transformation of indus-

tries and society toward sustainable development is also an inevitable trend. Currently, research on sustainable employment is limited [36]. Although the concept of sustainable employment has been mentioned in previous literature, research is isolated, and there is little systematic discussion from a digital perspective [21,24,37]. Hence, exploring the economic implications of digitalization within enterprises through the lens of sustainable employment possesses substantial practical significance.

From the perspective of environmental sustainability, digitalization brings optimization of production processes and more efficient utilization of resources. For example, intelligent manufacturing and IoT technology can reduce energy consumption, reduce waste generation, and improve production efficiency [36,38,39]. The adoption of environmental protection strategies via digital technology is pivotal to the notion of sustainable employment, encompassing the judicious management of environmental resources. This approach not only impacts economic growth but also tackles environmental and resource-related challenges. From the standpoint of employee well-being, digitalization has the potential to enhance the work experience and elevate the quality of life for employees [39,40]. On the one hand, innovation in digital technologies, such as remote work, flexible working hours, and intelligent office environments, can improve employee satisfaction and happiness. On the other hand, the training and development opportunities provided through digitization contribute to the career development of employees and enhance their sustainable employability [24,41]. From the standpoint of digital inclusivity and corporate social responsibility, enterprises committed to digital responsibility can implement measures to guarantee the accessibility of their digital tools and opportunities across all societal strata. This encompasses concentrating on employee training and development, engaging in community initiatives, and championing environmental stewardship. Such actions collectively exert a positive influence on employees, society, and the environment, thereby fostering sustainable employment [42].

Digitization exerts the following impacts on sustainable employment within the manufacturing sector. (i) Digitization enhances production efficiency, helping enterprises manufacture products more effectively through automated and intelligent production methodologies. This augmentation in production efficiency not only directly sustains employment but also offers enterprises expanded development opportunities, thereby indirectly generating additional employment prospects. (ii) The implementation of digital technology has transformed the working conditions and responsibilities of employees, alleviated the monotony of repetitive tasks, and heightened job satisfaction. By fostering a more adaptable and intelligent working environment, digitization has enticed a broader spectrum of talents into the manufacturing sector, bolstering support for sustainable employment. (iii) Digital technology empowers enterprises to swiftly adapt to market dynamics, adjust production schedules, and supply chains with greater flexibility, thereby stabilizing employment levels. Under the impetus of digitization, enterprises are enabled to refine their strategies more rapidly, align with shifts in market demand, and maintain stable employment for their workforce [43,44].

On the basis of the above analysis, we propose the first hypothesis:

H1. *Digitalization significantly promotes sustainable employment.*

2.4. Manufacturing Sector in the Chinese Economy

As one of the world's largest manufacturing powers, China's manufacturing industry has always played a crucial role in the Chinese economy [45]. The advancement of this industry not only assumes a critical role in fostering domestic economic growth but also holds a significant stance in the realm of international trade [46]. The extensive deployment of digital technology empowers manufacturing enterprises to realize intelligent and automated production workflows, substantially enhancing production efficiency. This digital transformation transcends the production line, encompassing numerous facets of internal management and collaborative endeavors within the enterprise. The holistic adoption of

digital technology has infused new dynamism into the manufacturing sector, concurrently offering robust support for enterprises to sustain competitive edges in the global arena [47].

In the uncertain period of COVID-19, the impact of digitalization on China's manufacturing industry is more prominent. Faced with the tension of global supply chains and the uncertainty of market demand, the application of digital technology enables manufacturing enterprises to adjust production plans more flexibly and quickly adapt to market changes [48]. This flexibility not only aids businesses in mitigating the impacts of the epidemic but also furnishes more sustainable employment opportunities. Digitization serves as a potent instrument for the manufacturing sector to contend with external shocks by augmenting production efficiency and enterprise management, thereby bolstering the sustainability of employment [49]. Overall, China's manufacturing industry is facing new opportunities and challenges in the digital age. Digitization is not only a means to improve production efficiency but also an engine to promote sustainable development in the manufacturing industry [50]. By undertaking rigorous research into the digital transformation of the manufacturing industry, we can more accurately discern the trajectory of future development and make substantial contributions to the sustainable expansion of the Chinese economy.

2.5. Mediating Effect of Enterprise Resilience

2.5.1. Digitization and Enterprise Resilience

Corporate resilience is defined as the capacity of an enterprise to swiftly adapt, adjust, and restore its normal operations amid internal and external disruptions, uncertainties, and changes, exhibiting principally low volatility and consistent growth. Prior research has corroborated that digitization can bolster enterprise resilience (ER), empowering companies to more effectively adapt to alterations and respond to uncertainties [11]. Regarding the reduction in corporate volatility through digitization, firstly, digitization can enhance the visibility and transparency of the supply chain [10]. Through a digital supply chain management system, companies can better monitor and optimize supply chain processes, reducing risks caused by supply chain issues. Furthermore, digitization enables companies to collect, analyze, and utilize data in real time [51]. Through the application of real-time data analytics, companies are able to rapidly comprehend market dynamics, consumer preferences, supply chain statuses, and additional pertinent information, thereby facilitating immediate decision-making in response to fluctuations. Furthermore, digital technology affords real-time, comprehensive monitoring capabilities, enhancing managerial effectiveness. This contributes to minimizing the risk of agent misconduct, elevating management transparency, and thus preventing market resource misallocation issues that arise from management's short-term focus on economic gains, while also augmenting the firm's capacity to absorb risks. Additionally, digitization enables companies to disclose financial conditions, performance reports, and other essential information in a more prompt and timely manner. Investors can obtain the latest market insights on a real-time or near real-time basis, assisting in a more precise evaluation of the company's valuation [51]. In other words, digitization can reduce the degree of information asymmetry, stabilizing stock price volatility by lowering investor uncertainty and market speculation. Regarding stable growth, firstly, digitization helps companies improve efficiency and reduce operating costs through the automation and optimization of business processes [52]. This frees up resources, allowing companies to focus more on innovation and value-added activities, creating conditions for long-term growth; secondly, digitization encourages companies to adopt new technologies and business models, driving innovation [52,53]. This encompasses the adoption of technologies such as artificial intelligence, big data, the Internet of Things, and the development of innovative digital products and services, thereby unlocking new markets and revenue streams for companies. Furthermore, through digitization, companies are capable of establishing their digital ecosystems, integrating internal and external resources, fostering innovative collaborations, and expediting the iteration of products and services, consequently facilitating sustained ecosystem growth [54].

2.5.2. Enterprise Resilience and Sustainable Employment

On the one hand, strategies emphasizing enterprise resilience often include measures to continuously improve employee skills. By providing relevant digital skills training and development opportunities for employees, companies can better adapt to rapidly changing market demands, thereby promoting sustainable employment [55]. On the other hand, resilient companies typically prefer to establish diverse and inclusive work environments. This includes adopting inclusive strategies in recruitment and promotion, ensuring that all employees can participate and benefit, helping achieve sustainable employment and eliminating inequality in employment [2,56,57]. Moreover, resilient enterprises typically place a high priority on social responsibility and sustainable development. By implementing environmental initiatives, engaging in social participation programs, and adopting practices centered on social justice, companies contribute to fostering a sustainable social environment. This, in turn, establishes conducive conditions for sustainable employment [58]. In addition, resilient companies emphasize crisis management and business continuity planning to deal with unexpected events. This not only helps protect the stable operation of companies but also contributes to maintaining the stability of employees' employment [59]. It is imperative to underscore the significance of resilience in contemporary corporate structures. Companies that exhibit robust resilience tend to place a high premium on innovation and adaptability. This implies a greater propensity toward embracing novel technologies and business paradigms. Such an innovative ethos is instrumental in catalyzing the creation of new employment avenues, concurrently propelling the development of the entire industrial value chain. This, in turn, fosters the attainment of sustainable employment, thereby contributing to the overarching economic health.

Therefore, we propose the second hypothesis:

H2. *Enterprise resilience mediates the relationship between digitization and sustainable employment.*

3. Methodology

3.1. Variables

3.1.1. Independent Variable: Digital

The independent variable used in this study was the level of digitization. This paper established a thesaurus of 99 digital-related terms from four dimensions, including the application of digital technology. Python was used to extract the annual report text of China's listed manufacturing enterprises, and the keyword frequency of the thesaurus was counted through text analysis to measure the degree of digitalization.

3.1.2. Dependent Variable: Sustainable Employment

The dependent variable in this study is sustainable employment (Sus). After the introduction of the concept of sustainability, it is not appropriate to measure employment in a single dimension [15]. In the context of the digital era, the conceptualization of employment sustainability necessitates a reconceptualization, particularly through the lenses of "flexible employment" and "sustainability." Initially, it is imperative to acknowledge that flexible employment, as facilitated by digital platforms, is prevalent and characterized by low entry barriers as well as the flexibility of time and spatial arrangements. These attributes distinctly offer workers the liberty to transition seamlessly among diverse occupations, thereby potentially mitigating frictional unemployment. Secondly, the proliferation of new job roles within the digital economy is intrinsically linked to the expansion of urban areas and the enhancement of residents' income levels. In light of these dynamics, this study proposes to evaluate sustainable employment through an integrative approach. This entails employing three key indicators: the number of employees, per capita wages, and carbon emissions. The significance of each indicator is quantified utilizing the entropy method, thereby enabling a more nuanced and comprehensive measurement of sustainable employment (Sus).

The concept of entropy, derived from information theory, serves to quantify the uncertainty associated with a random event and the extent of information it conveys. In the realm of the entropy method, the computation of entropy is anchored in the principles of information entropy. This process entails segmenting the spectrum of indicator values into multiple equal divisions, followed by the calculation of the probability associated with each division. Subsequently, these probabilities are integrated into the information entropy formula to derive the entropy value for each respective indicator. The role of entropy in this context is to measure the degree of fluctuation and uncertainty inherent in the indicators. An elevated entropy value is indicative of heightened fluctuation and uncertainty within an indicator, suggesting its amplified influence on the outcomes of decision-making processes.

The entropy method is predicated on the inherent variability present within the dataset and is characterized by its objectivity, rendering it particularly apt for this study. The methodology encompasses the following specific steps:

Assuming the original data matrix for m samples and n indicators is represented as $R_{ij} = (R_{ij})_{m \times n}$:

Step 1: Normalization.

Normalize all indicators after ensuring they have the same direction, resulting in the normalized matrix $(R_{ij})_{m \times n}$:

$$R_{ij} = \frac{x'_{ij} - \min(x_j)}{\max(x'_j) - \min(x'_j)} \quad (1)$$

Step 2: Calculate the entropy value for each indicator.

Compute the weight matrix for each indicator:

$$P_{ij} = \frac{R_{ij}}{\sum_{j=1}^n R_{ij}} \quad (2)$$

Calculate the entropy value for each indicator:

$$E_j = -\frac{1}{\ln(m)} \times \sum_{j=1}^m P_{ij} \times \ln(P_{ij}) \quad (3)$$

If the entropy of an indicator is smaller, it indicates greater variability in the indicator values and provides more information. This suggests that the indicator has a more significant role in the comprehensive evaluation.

Step 3: Calculate the weights for each indicator.

$$w_{ij} = \frac{1 - E_j}{\sum_{j=1}^n (1 - E_j)} \quad (4)$$

Step 4: Calculate the weighted sum to obtain the sustainable employment (Sus) composite score index:

$$S_i = \sum_{j=1}^n w_{ij} * R_{ij} \quad (5)$$

3.1.3. Mediating Variable: Enterprise Resilience

The concept of organizational resilience embodies the proactive adaptability and recuperative capabilities of enterprises in confronting crises or external shocks. This characteristic is inherently intrinsic to the enterprises themselves. Digitalization plays a pivotal role in augmenting this resilience by enhancing organizational efficiency, optimizing resource allocation, and fostering improved social collaboration. These advancements facilitate an enterprise's ability to respond proactively, adapt comprehensively, and recover swiftly in the face of crises or shocks. Consequently, digitalization significantly bolsters organizational resilience and tension, thereby reinforcing the enterprise's capacity to withstand and

adapt to adverse conditions [60]. Therefore, we adopted earnings before interest and taxes (EBIT) as an indicator to measure ER.

3.1.4. Control Variables

In order to avoid the bias caused by missing variables, which may lead to endogenous problems, and to enhance the explanatory ability of the model, this paper, combined with relevant theories, regarded a group of variables that may have an impact on SE as control variables, including the company's return on equity (ROE), ratio of total liabilities to total assets of the company (Lev), corporate liquidity ratio, return on assets (ROA), and total assets turnover (TAT).

3.2. Data Source

Drawing upon the database of publicly listed enterprises and the publicly accessible data provided by the Securities Association of China, this study focuses on China's publicly listed manufacturing enterprises during the period from 2013 to 2022 as its sample. To enhance the accuracy and reliability of parameter estimation, a preliminary preprocessing of the original dataset was conducted. This preprocessing involved a specific measure to mitigate the potential distortions caused by outliers. Consequently, all variables were subjected to winsorization at the 1% level at both tails. This technique aims to reduce the influence of extreme values, thereby ensuring a more robust and reliable estimation of the parameters in question [43,51]. The data applied in this study were collected from listed manufacturing companies in the Wind and Mark databases. Among them, the Wind database encompasses various fields, such as stocks, bonds, funds, foreign exchange, financial derivatives, commodities, macroeconomics, and financial news. The Mark Data Network comprises a range of specialized databases, including national annual databases, provincial databases, and thematic databases on digital transformation, the digital economy, technology, the environment, energy, and other subjects.

To be specific, the indicators within Sus, namely employee count, average salary, and carbon emissions, were sourced from the Wind database. Additionally, metrics such as return on equity (ROE), leverage level (Lev), current ratio (CR), and return on assets (ROA), as well as total asset turnover (Turnover), were all obtained from the Wind database. The digitalization level (Dt) was sourced from the Mark database. The variable summary table is presented in Table 1.

Table 1. Variable summary.

Variable Type	Variable	Variable Names	Specific Content
Dependent Variable	Sus	Sustainable Employment	Using annual report textual data to measure the frequency of relevant terms.
Independent Variable	Dt	Digital Level	Employing three indicators, namely employee count, average salary, and carbon emissions. The weights for each indicator are calculated using the entropy method.
Mediating Variable	ER	Enterprise Resilience	Utilizing Earnings Before Interest and Taxes (EBIT) as a measure.
Control Variables	CR	Current Ratio	Current Ratio = Current Assets/Current Liabilities
	TOV	Total Asset Turnover	Total Asset Turnover = Net Sales/Average Total Assets
	Lev	Leverage Level	Leverage Level = Total Liabilities/Total Assets
	ROA	Return on Assets	Return on Assets (ROA) = (Net Profit + Interest Expense)/Average Total Assets
	ROE	Return on Equity	Return on Equity (ROE) = Net Profit Margin × Total Asset Turnover × Equity Multiplier

However, the dataset employed in this study is subject to certain limitations. (i) The primary limitation stems from the reliance on data from publicly listed enterprises. While

these entities provide comprehensive financial and operational information, this focus may introduce sample bias. The omission of unlisted or privately owned manufacturing companies could result in an incomplete portrayal of the research findings, particularly impacting the holistic comprehension of China's manufacturing sector. (ii) The temporal coverage of the data, extending from 2013 to 2022, coincides with significant phenomena, such as the digital transformation wave and the COVID-19 pandemic. Nevertheless, due to the dataset's temporal boundary, it may not fully encompass the latest advancements in digital technology or the continued effects of the pandemic. This constraint might affect the immediacy of the research outcomes, diminishing their pertinence to the prevailing socioeconomic milieu. (iii) The analytical framework employs fixed effects models and mediation analysis to dissect the interrelations among variables. Although this approach sheds light on the relationship between digitalization and sustainable employment, it concurrently raises concerns regarding model simplification and the neglect of other plausible influential factors. In conclusion, while this study furnishes valuable insights into the influence of digitalization on sustainable employment via an examination of listed Chinese manufacturing firms from 2013 to 2022, the interpretation of the findings necessitates a cautious consideration of data and methodological limitations. This circumspection is crucial for ensuring a precise grasp of the study's implications. Future research will delve deeper into the effects of digitalization on sustainable employment, aiming to address these limitations.

The descriptive statistics of the variables are shown in Table 2.

Table 2. Descriptive statistics.

Variable	Max	Min	Mean	p50	SD	N
Sus	0.16468	0.0042706	0.0302786	0.008977	0.030549	20,698
Dt	0.021	0	0.007231	0.0288	0.004469	21,387
ER	20.65348	13.9425	17.77186	17.2276	1.32769	27,603
TOV	2.7843	0.1327	0.94218	0.79413	0.55643	27,665
Lev	95.7714	6.0476	41.3327	39.4675	13.77641	29,378
CR	13.9785	0.4375	2.64481	1.81705	1.95973	29,549
ROA	33.698	−20.9974	7.27162	6.44395	7.03648	34,736
ROE	64.2762	−63.7609	11.04771	11.32963	12.17466	27,609

On the basis of the data presented in Table 2, a comprehensive statistical analysis reveals significant variability in the degree of digitalization concerning sustainable employment in the observed sample. The sustainable employment index (Sus) exhibits a minimum value of 0.004 and a maximum of 0.165, with an average of 0.03. This disparity underscores the highly uneven nature of sustainable employment across different enterprises. The digitalization index (Dt) further corroborates this finding, with its values ranging from a minimum of 0 to a maximum of 0.021 (an average of 0.007). This suggests a generally low level of digitalization among the surveyed Chinese manufacturing enterprises coupled with considerable variation.

Furthermore, the intermediary variable of enterprise resilience (ER) displays a maximum value of 20.65, a minimum of 13.94, and an average of 17.77. This indicates a relatively narrow range of variation, suggesting a more balanced state of enterprise resilience among these manufacturing companies. In addition, the control variable, the ratio of total liabilities to total assets (Lev), ranges from a minimum of 6.0476 to a maximum of 95.77, with an average value of 41.3327. The wide range in this ratio reflects not only the significant variability in the financial structures of these enterprises but also underscores the robust and comprehensive nature of the sample for this research.

3.3. Model Construction

We established the following model to analyze the impact of digitalization on sustainable employment in China's manufacturing enterprises.

$$Sus_{it} = \alpha_0 + \alpha_1 Dt_{it} + \alpha_2 Controls_{it} + \delta_i + \mu_i + \varepsilon_{it} \quad (6)$$

$$ER_{it} = \beta_0 + \beta_1 Dt_{it} + \beta_3 Controls_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (7)$$

$$Sus_{it} = \theta_0 + \theta_1 Dt_{it} + \theta_2 Controls_{it} + \theta_3 ER_{it} + \delta_i + \mu_t + \varepsilon_{it} \quad (8)$$

where i represents the year, t represents the manufacturing listed company individual, Sus_{it} represents the sustainable employment situation of t company in year i , Dt_{it} represents the digitization level of company t in year i , ER_{it} is expressed as the enterprise resilience of t company in year i , $Controls$ represents the group of control variables, expressed as a firm individual and fixed, expressed as a fixed year, and is a random disturbance term.

These three steps correspond to models (6), (7), and (8) in this study. Specifically, model (6) is a fixed effects model established for the maximum influence of digitalization on Sus to test hypothesis H1. If coefficient α_1 is significantly positive, it indicates that digitalization has a significant positive impact on Sus ; otherwise, it is considered that digitalization has a negative impact on Sus . Model (7) and model (8) were set up to further explore the impact mechanism of digitalization on sustainable employment, that is, the intermediary effect of digitalization on sustainable employment. If the coefficients β_1 , θ_1 , and θ_3 are significant, it indicates that the mediating effect of digitalization on sustainable employment is significant, and it is part of the mediating effect. If the coefficients β_1 and θ_3 are significant and θ_1 is not significant, it indicates that there is a complete mediating effect.

The three-step mediation analysis represents a statistical methodology predicated on causal inference. This approach is an extension of multiple regression analysis, structured around three sequential stages. Initially, aligning with the causal model, a singular regression analysis is executed to scrutinize the interactions among the independent variable, the mediating variable, and the dependent variable, specifically assessing the link between the mediating variable and the independent variable. Subsequently, both the independent and mediating variables are concurrently incorporated into a regression analysis to evaluate the connection between the independent variable and the dependent variable. In the final stage, the mediating variable, as derived from the outcomes of the preceding step, is reintegrated into a regression analysis to investigate its influence on the relationship between the independent variable and the dependent variable, thus affirming the existence of a mediating effect. Leveraging insights from extant research across pertinent domains, this three-step methodology has been extensively applied in exploring issues concerning mediating effects.

4. Results

4.1. Benchmarking: The Impact of Digitization on Sustainable Employment

The results of the fixed effects regression test on the influence of digitalization on SE are shown in columns (1)–(6) of Table 3.

Column 1 shows that the effect of Dt on Sus is significantly positive at the 1% level when no control variables are added. In order to reduce the influence of the endogenous problem, when the control variables TOV , Lev , CR , ROA , and ROE are added successively, the influence of digitalization on Sus is still significant at the level of 5% on the basis of fixed years and enterprises, and the coefficient is 0.54, which means that with every 1% increase in digitalization level, sustainable employment will increase by 0.54%, indicating that digitization has a significant positive impact on increasing sustainable employment, verifying H1.

Table 3. Results of the effect of digitalization on SE.

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	Sus	Sus	Sus	Sus	Sus	Sus
Dt	0.266 *** (0.0373)	0.659 *** (0.0233)	0.449 ** (0.04749)	0.1768 * (0.0422)	0.324 *** (0.0772)	0.535 ** (0.0663)
ROE		4.0438 * (6.37642)	3.02265 (4.57725)	2.9258 *** (4.66827)	4.0776 ** (2.4832)	2.1765 (2.5696)
CR			−0.001437 *** (3.06647)	−0.0013432 *** (2.69376)	−0.00105 *** (2.6973)	0.001078 * (3.6649)
ROA				−5.9637 *** (4.07874)	−8.7754 * (3.6973)	−3.8876 (4.7638)
TOV					0.04428 ** (0.001325)	0.00528 * (0.000663)
Lev						0.000332 ** (9.0737)
Constant	0.0677 * (6.9894)	0.0348 ** (0.006937)	0.0587 *** (0.000696)	0.0732 ** (0.000334)	0.0798 ** (0.001436)	0.00672 ** (0.000442)
Individual fixed	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18.844	17.944	18.165	17.296	17.377	17.824
R-squared	0.772	0.785	0.742	0.766	0.793	0.795

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Mediating Mechanism Verification

To further investigate how digitalization affects SE through enterprise resilience, we estimated the regression models based on Equations (1)–(3). The results of the mediation effect are reported in Table 4.

Table 4. The results of the mediating effect.

	(1)	(2)	(3)
Variables	Sus	ER	Sus
Dt	0.443 *** (0.0954)	19.47 *** (3.147)	0.177 *** (0.0441)
ER			0.01023 *** (8.91366)
ROE	0.00339 *** (4.17469)	0.00704 *** (0.03186)	−7.13147 *** (3.8698)
CR	0.004251 ** (8.67337)	−0.0634 *** (0.00337)	0.000326 ** (6.85794)
ROA	0.000698 *** (6.34879)	0.186 *** (0.00474)	−0.000903 *** (8.0156)
TOV	0.00897 *** (0.002977)	0.403 *** (0.0476)	0.00411 ** (0.000378)
Lev	0.0003638 ** (1.06687)	0.5012 *** (0.000687)	0.003358 *** (9.6649)
Constant	−0.00772 ** (0.000813)	14.147 * (0.0879)	−0.341 ** (0.00893)
Observations	18.117	18.524	18.875
R-squared	0.713	0.503	0.776

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The analysis of the results, as depicted in column (1), reveals that the coefficient of the digitization level (Dt) is 0.4, which is statistically significant at the 1% level. This finding robustly supports the assertion that an enhancement in the digitization level exerts a significant promotional effect on sustainable employment (SE). Moving to the findings presented in column (2), the coefficient of Dt is observed to be 19.47, again significant at the

1% level. This outcome emphatically demonstrates that an improvement in the digitization level has a considerable positive influence on enterprise resilience (ER).

Further scrutiny of the data in column (3) indicates that the coefficient of Dt is 0.177, significant at the 1% level, and the coefficient of ER is 0.01023, also significant at the same level. These results collectively allow for a nuanced conclusion: the positive impact of digitalization on the enhancement of sustainable employment is partly mediated through the improvement of enterprise resilience. Specifically, enterprise resilience acts as a partial intermediary in this process. This empirical evidence lends substantial support to hypothesis H2, affirmatively confirming its validity. The implications of these findings underscore the integral role of digitalization in fostering sustainable employment, particularly through its influence on enhancing enterprise resilience.

4.3. Robustness Tests

Robustness tests were run to check the robustness of the estimated results. All of the estimated results of the robustness tests are displayed in Table 5.

Table 5. Robustness check.

	(1)	(2)	(3)
Variables	Sus	Sus	Sus
R.Dt	0.723 *** (0.1135)		
ROE	2.86753 (2.77843)	0.00326 *** (4.46875)	6.47859 *** (2.39325)
CR	0.000518 ** (3.86357)	0.007424 ** (6.37994)	0.00264 *** (4.46708)
ROA	−5.20394 (3.73345)	0.000267 (7.04714)	−7.799 *** (4.45964)
TOV	0.00136 ** (0.01356)	0.00782 *** (0.007153)	0.006874 (0.005463)
Lev	0.002543 *** (8.8559)	0.004353 ** (1.12145)	0.00958 *** (1.04162)
Dt		0.424 * (0.0480)	
L.Dt			0.172*** (0.04257)
Constant	0.007224 *** (0.00745)	−0.00761 ** (0.000866)	0.0274 *** (0.00224)
Observations	17.889	18.597	14.959
R-squared	0.863	0.412	0.848

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In order to ensure the robustness of regression results, this paper adopted four methods—replacing explanatory variables, replacing regression methods, solving endogenous problems, and the instrumental variable method—to carry out robustness testing.

(1) Replace variables

To enhance the explanatory robustness of our findings, we conducted robustness tests employing surrogate variables. This methodological approach is premised on the assumption that if results remain consistent across different variable sets, the universality of the findings and the reliability of the model settings are substantiated. In alignment with the methodologies employed, this study undertook a comprehensive statistical and textual analysis of 76 digital-related terms. These terms are methodically selected from five distinct dimensions to serve as proxies for the crude oil lexemes, thereby enabling a refined measurement of the degree of digitalization. This revised metric is denoted as R.Dt.

The empirical analysis, as highlighted in column (1), reveals that the coefficient of R.Dt stands at 0.723, which is statistically significant at the 1% level. This significantly

positive coefficient robustly indicates that the initial conclusions derived from our study are indeed resilient to variations in variable selection. Such a finding not only reinforces the validity of the original results but also affirms the robustness and reliability of the model configurations employed in our analysis. Consequently, this lends greater credence to our research findings, underscoring their applicability and relevance in the broader context of digitalization studies.

(2) Alternative estimation techniques

In this study, we acknowledged the potential impact of estimation methodologies on regression results. To address this, we employed cross-verification using diverse estimation techniques, thereby enhancing the reliability of our findings. Consequently, we introduced the hybrid ordinary least squares (OLS) method as an alternative estimation method to further validate our results.

The analysis, as detailed in column (2), reveals that the coefficient of the digitization level (Dt) is 0.424, exhibiting statistical significance at the 1% level. This significantly positive coefficient substantiates the hypothesis that an enhancement in the digitization level exerts a notable positive influence on sustainable employment (Sus). The consistency of this result with our initial findings not only reinforces the robustness of our original conclusion but also underscores the efficacy of hybrid OLS as a viable alternative estimation technique. This methodological rigor ensures a higher degree of confidence in the validity of the observed relationships, thus solidifying the foundational premises of our research.

(3) Lag variable method

Because enterprises with a high digitalization level are more competitive and some scholars believe that the improvement of digitalization level can bring more jobs, which is conducive to the improvement of sustainable competitiveness, we believe that there may be a two-way causal relationship between digitalization and Sus. In order to solve the problem of digitization and Sus's endogeneity, we adopted a one-stage lag method to improve the accuracy of the model. As shown in column (3), the coefficient of L.Dt is 0.172 and is significant at the 1% level, which proves that the original result is robust.

(4) Instrumental variable method

In addressing the limitations inherent in employing lagged variables for regressing, which may not fully resolve endogeneity concerns, this study adopted the instrumental variable (IV) method to conduct a more rigorous endogeneity test. Drawing from existing literature, the industry-average level of digitization was selected as the instrumental variable. The selection of this particular variable was predicated on its strong correlation with the digitization level of individual enterprises within the same industry. Simultaneously, it exhibits a relatively weaker connection with the sustainability of employment at the individual enterprise level, thereby satisfying the criteria for exogeneity.

Table 6 delineates the regression outcomes derived from the application of the instrumental variable method. The first-stage regression is marked by a Wald test F-statistic of 1769.53, which substantiates the validity of the instrumental variable through the weak instrument test, affirming its appropriateness in this context. Furthermore, as shown in the second column of Table 5, the coefficient of digitization level (Dt) remains significantly positive at the 1% level. This persistence of significance indicates that the positive impact of digitization on sustainable employment is not merely an artifact of endogeneity. Instead, it retains its statistical significance even after accounting for potential endogeneity biases. Such findings not only validate the original hypothesis but also reinforce the robustness and reliability of the baseline regression results, thereby solidifying the study's contributions to understanding the dynamics between digitization and sustainable employment.

Table 6. Instrumental variable regression results.

	(1) First Stage	(2) Second Stage
Variables	Dt	Sus
Dt_IV	0.8800 *** (0.02421)	
Dt		0.4851 *** (0.34754)
ROE	2.74962 (2.24875)	4.34812 *** (2.50121)
CR	0.001283 ** (3.29044)	0.00178 *** (5.19284)
ROA	−5.57419 *** (4.43944)	−4.37742 (3.18198)
TOV	0.00452 ** (0.01174)	0.008927 (0.005291)
Lev	0.00294 *** (6.75482)	0.00402 *** (3.02774)
Constant	0.008742 *** (0.00693)	0.0202 *** (0.00774)
Observations	17.875	17.875
R-squared	0.769	

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

4.4. Heterogeneity Effect Analysis

Taking into account various factors at the enterprise level, including regional characteristics and the technological level of enterprises, which may influence sustainable employment, this study conducted a heterogeneity analysis. To ascertain the effects of regional characteristics and technological levels on sustainable employment, this paper categorizes manufacturing enterprises into two distinct groups on the basis of region and enterprise type: (1) enterprises located in the eastern region versus those in non-eastern regions and (2) high-tech versus non-high-tech enterprises. The findings of this classification are presented in Table 7.

Table 7. Results of the heterogeneity test.

	Eastern	Non-Eastern	High-Tech	Non-High-Tech
Variables	(1) Sus	(2) Sus	(3) Sus	(4) Sus
Dt	0.399 *** (0.0463)	0.753 *** (0.0569)	0.549 ** (0.05691)	0.431 ** (0.2899)
ROE	6.14296 *** (1.83984)	−1.27129 * (2.27134)	2.33948 (2.6926)	8.45367 (5.22956)
CR	7.137886 (5.93814)	−2.76816 (9.37377)	0.002846 *** (4.06674)	4.872798 (7.93757)
ROA	−0.003143 *** (3.45964)	8.2716 *** (4.74815)	−2.59945 (4.4965)	5.473145 (0.000732)
TOV	0.075224 *** (0.002985)	−0.00746 ** (0.002924)	0.00719 *** (0.00976)	−0.00129 (0.00364)
Lev	0.000376 *** (8.13676)	9.72144 *** (1.13772)	0.000741 *** (9.3191)	9.94351 *** (1.804382)
Constant	0.00392 *** (0.00368)	0.0684 *** (0.00735)	0.00783 *** (0.0007262)	0.01419 ** (0.00172)
Observations	13.112	5.845	11.776	7.138
R-squared	0.782	0.689	0.812	0.673

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.4.1. Regional Heterogeneity Test (Level of Economic Development)

Columns (1) and (2) of Table 7 display the regression outcomes for listed manufacturing companies in the eastern and non-eastern regions of the study area, respectively. The coefficient of digitization level (Dt) in column (1), pertaining to the eastern region, is 0.399 and exhibits statistical significance at the 1% level. By contrast, column (2), representing the non-eastern region, shows a Dt coefficient of 0.753, which is also significant at the 1% level.

A comparative analysis of these results reveals a more pronounced effect of digitization enhancement on sustainable employment (Sus) in the manufacturing enterprises of the eastern region. This disparity can be attributed to several factors. Firstly, the manufacturing industry structure in the eastern region is relatively more advanced, characterized by a higher prevalence of high-tech industries and intelligent manufacturing. These sectors have an inherently stronger reliance on digital technology, leading to a more significant impact of digital technology adoption on their sustainable development.

By contrast, the manufacturing industry in the non-eastern regions tends to be more traditional, with a comparatively lower urgency and application of digital technologies. Furthermore, the eastern region benefits from a higher concentration of tertiary education and research institutions, bolstering its capabilities in technological innovation. This advantage facilitates more effective research, development, and application of digital technologies in the eastern region, enabling a quicker translation of new technologies into productive capacity. Consequently, this accelerates the sustainable development of the labor market in these areas.

In summary, the differential impact of digitalization on sustainable employment in the eastern and non-eastern regions can be linked to variations in industrial structure, technological demand, and innovation capacity. These factors collectively contribute to the distinct dynamics observed in the regional labor markets concerning digital technology adoption and application.

4.4.2. Heterogeneity Analysis of Technological Factor Input

Columns (3) and (4) in Table 7 delineate the regression outcomes for listed high-technology and non-high-technology manufacturing firms, respectively. The Dt coefficient in column (3) registers at 0.549, attaining significance at the 1% threshold, whereas the Dt coefficient in column (4) is noted at 0.431, similarly significant at the 1% level. The comparative analysis between high-technology and non-high-technology sectors reveals a pronounced impact of digitalization on the advancement of sustainability measures within high-technology manufacturing enterprises. This observation may stem from the propensity of high-technology firms to prioritize technological innovation and research and development endeavors. The adoption of digital technologies facilitates these enterprises in achieving more efficient and precise production methodologies, thereby enhancing the quality of products and services. Such a focus on technological innovation propels productivity enhancements and value addition, concurrently fostering the creation of skilled employment opportunities. Furthermore, the digital transformation journey necessitates continuous employee training and skills enhancement to align with novel production techniques and evolving market requirements. This paradigm of ongoing skill development serves to elevate the workforce's proficiency, augmenting their competitive edge in the employment market and bolstering sustainable employment initiatives.

5. Discussion and Implications

5.1. Discussion

The impact of digitization on sustainable employment in Chinese manufacturing companies is multifaceted. These dimensions are interwoven, collectively constructing a complex and rich mechanism through which digitization influences sustainable employment. Therefore, it is essential to delve into the empirical results of this study regarding the impact of digitization on sustainable employment in Chinese manufacturing companies.

- (1) There is a significant positive correlation between digitization and sustainable employment.

The research findings indicate a significant positive impact of digitization on sustainable employment in Chinese manufacturing companies. This assertion is congruent with digitization significantly contributes to employment expansion, thereby exerting a positive influence on the augmentation of employment rates. The pervasive deployment of digitization markedly elevates production efficiency, thereby helping companies scale their production capacities to align with market demands. Through the utilization of digital technologies, firms are enabled to orchestrate and administer production processes with heightened efficiency, culminating in an enhanced output and a consequent surge in labor demand. Moreover, the extensive application of digital technology empowers companies to access and scrutinize voluminous datasets, thereby catalyzing innovation. Enhanced digital proficiencies permit companies to more adeptly adapt to market fluctuations, expedite the launch of novel products and services, and engender new employment opportunities. This digitization-induced expansion of employment furnishes substantial support to the Chinese manufacturing sector and proffers innovative solutions to counteract the gradual diminution of the demographic dividend, thereby presenting a pivotal strategy in sustaining the industry's growth and competitiveness in an era of digital transformation.

- (2) Enterprise resilience plays an intermediary role between digitization and sustainable employment.

Digitization transcends the mere enhancement of sustainable employment; it also serves as a pivotal intermediary by bolstering enterprise resilience, which, in turn, exerts a profound influence on sustainable employment outcomes. Enterprise resilience manifests through more adaptable production and organizational frameworks, facilitating superior adjustment capabilities in response to market dynamics. Digital technologies endow companies with enhanced decision-making support and agility, enabling them to modify production and employment strategies with greater flexibility. This resilience augments corporate competitiveness, thereby creating more conducive conditions for the attainment of sustainable employment.

Hence, enterprise resilience emerges as a critical intermediary mechanism bridging digitization and sustainable employment. It is not only integral to the evolution of enterprises in the digital era but also a fundamental catalyst for fostering sustainable growth in employment. This underscores the multifaceted role of digitization in promoting enterprise adaptability and long-term employment sustainability, positioning it as an essential element in the strategic development of organizations navigating the complexities of the digital age.

- (3) Heterogeneity in Region and Technological Investment

The research delves into the nuanced effects of digitization on sustainable employment, distinguishing between enterprises located in the eastern region and non-high-tech enterprises. Due to its advanced economic development, the eastern region boasts a more extensive infrastructure and application of digitization. This affords enterprises within this region access to a superior digital milieu, which, in turn, engenders a more pronounced positive impact on employment. Conversely, non-high-tech enterprises exhibit a more substantial capacity for digital transformation, underscoring the imperative for augmented focus and support from both governmental and corporate sectors. Such support is crucial for facilitating the digital transition of these entities, thereby ensuring sustained growth in employment sustainability.

In summary, the study highlights that the influence of digitization on sustainable employment is not solely contingent on the digital prowess of enterprises but also significantly linked to governmental investment in digital infrastructure and the propagation of technology. In regions with a high level of economic development, escalated government investment is anticipated to expedite the digitization trajectory, furthering the advancement of sustainable employment. Governmental assistance is pivotal not only in enhancing the technological capabilities of enterprises but also in executing a strategic role in fostering balanced regional development. This approach ensures that the dividends of digitization

are disseminated more equitably among various regions and enterprise types, thereby harmonizing the distribution of digital transformation benefits.

5.2. Theoretical Implications

Research has found that digitization is a necessary driving force for enhancing sustainable employment. The research findings enrich the perspective of organizational capability, indicating that digitalization can be seen as an organizational capability that can help achieve sustainable employment. Our research uncovered that digitalization exerts a significant positive influence on the enhancement of sustainable employment. Crucially, we investigated the correlational mechanism between digitalization and the capacity of enterprises to resume operations, discovering that sustainable employment can be facilitated through the bolstering of enterprise resilience. We introduce a novel model that amalgamates digitalization, enterprise resilience, and sustainable employment, thereby establishing a comprehensive theoretical framework that elucidates the primary effects of digitalization on employment. This framework not only underscores the direct impact of digitalization on creating job opportunities but also highlights the pivotal role of enterprise resilience as a mediator that enables organizations to adapt and thrive in a digitalized economy, thus contributing to the sustainability of employment. This provides a new theoretical perspective and research approach for research in related fields. Other scholars can further delve into the relationship between digitalization and employment within this framework, expanding the scope of application of relevant theories.

5.3. Practical Significance and Influence

The empirical findings of this study demonstrate that digitalization holds considerable practical significance and exerts a substantial influence on enhancing sustainable employment within manufacturing enterprises, detailed as follows. (i) The extensive adoption of digital technology enables manufacturing enterprises to augment production efficiency and respond adaptively to market fluctuations. This, in turn, leads to the creation of more stable and sustainable employment opportunities. Such insights offer pragmatic guidance for enterprise management, indicating that during digital transformation, a focal point should be the enhancement of digital application levels within the organization. Concurrently, there should be an emphasis on reinforcing the digital skills training of employees. This dual approach is essential for maximizing the benefits of digitalization, ensuring that enterprises are equipped to navigate the challenges and opportunities presented in a digitally evolving landscape and contributing to the broader objective of achieving sustainable employment growth.

To enhance the stability of employment in the digital era, it is imperative for enterprises to recognize the multifaceted role of digitalization. Digitalization serves not only as a conduit for enhancing productivity but also as a crucial element in generating higher-quality jobs, bearing significant implications for the attainment of sustainable employment. Specifically, the study elucidates that:

- (i) Digitalization acts as a catalyst for creating more quality employment opportunities, underpinning the crucial linkage between technological advancement and sustainable employment. This revelation advises that management should prioritize elevating the level of digital application within the organization and intensify efforts in digital skills training for employees. Such strategic focus is pivotal in fostering an environment in which enterprises are better positioned to maintain employment stability amidst the digital transformation.
- (ii) The investigation into the positive mediating role of firm resilience between digitalization and sustainable employment highlights that flexibility and adaptability are indispensable for a firm's success in the digital age. In practical terms, management's focus on bolstering enterprise resilience is paramount. This includes refining production processes, enhancing the flexibility of organizational structures, and fostering a diverse employee base. Flexibility not only facilitates rapid strategic adjustments

in response to market dynamics—thereby ensuring the sustainable employment of enterprises—but also amplifies employees’ adaptability to changes, ultimately elevating their job satisfaction. Consequently, management is encouraged to pursue and execute flexible strategic planning, leverage digital technology to augment production process flexibility, and fortify the enterprise’s adaptability to external environmental uncertainties.

- (iii) Consensus analysis reveals that digitalization exerts a more pronounced effect on employment sustainability in the eastern region, notably within non-high-tech industries and financially robust firms. This observation offers practical insights for enterprises, suggesting the necessity for digital strategies to be contextually tailored to regional and industrial specificities. The pronounced impact of digitalization in the eastern region on employment sustainability may stem from the unique industrial structure and market environment of the area. Thus, in practice, management must thoroughly consider local variances and devise targeted digital strategies to ensure the precise and effective application of digital technologies. To sum up, the promotion of digitalization is important not only to improve production efficiency but also to create more stable and sustainable employment opportunities for enterprises. In practice, management needs to pay attention to the level of digital application, enterprise resilience, and regional characteristics in order to formulate more accurate digital strategies to promote the development of China’s manufacturing industry toward a more sustainable employment direction.

5.4. Future Application

In future applications, digital technology will be more deeply integrated into all aspects of manufacturing enterprises. From production automation to intelligent supply chain management to talent development and management innovation, digitalization will provide enterprises with more opportunities and challenges. In the future, enterprises need to focus on the comprehensive application of digital technology, especially in improving product quality, innovative management methods, and improving employee skills. The future application of digitalization is not only about the renewal of technology but also about the transformation of corporate culture and the innovation of management mode.

In the evolving landscape of digital applications, it is imperative for business management to adopt a proactive stance in orchestrating change. This necessitates a robust enhancement of the training of digital leadership to elevate management’s comprehension and competency in digital strategy execution, ensuring its seamless integration into the enterprise’s long-term strategic planning. Management is obliged to stay abreast of the rapid advancements in digital technology, focusing not only on the technological application per se but also on its harmonious amalgamation with corporate strategy. In the forthcoming digital epoch, the role of management will be increasingly pivotal, demanding a broader strategic outlook and an augmented innovation acumen to guide enterprises toward the realization of sustainable growth.

To summarize, digital applications are poised to exert a more profound influence on Chinese manufacturing enterprises in the future. Digital technology heralds new horizons for innovation and development for businesses, albeit accompanied by a spectrum of challenges. Henceforth, it is vital for management to prioritize the extensive adoption of digital technology, foster enterprise agility and adaptability, and tailor digital strategies to the unique demands of diverse regions and industries. By delving deeper into the essence of digitalization, Chinese manufacturing entities are well-positioned to attain sustainable growth in the digital era, thereby making significant contributions to the economy’s enduring development.

6. Conclusions and Limitations

This study employed panel data from Chinese manufacturing companies listed from 2013 to 2022, utilizing fixed effects and mediation effects models to empirically investi-

gate the influence of digitalization on sustainable employment. Three principal findings emerged from the analysis: (i) digitalization exerts a significant positive impact on sustainable employment; (ii) enterprise resilience acts as a positive mediator in the nexus between digitalization and sustainable employment; (iii) the beneficial effects of digitalization on sustainable employment are more pronounced for enterprises, including non-high-tech firms, in the eastern region. These insights underscore the importance for companies to leverage digital technology to bolster their risk resilience and foster sustainable employment.

Nonetheless, the study is subject to certain limitations. Primarily, it analyzes data from Chinese manufacturing firms, which may introduce sample limitations and contextual biases. Furthermore, the focus is predominantly on the ramifications of digitalization for sustainable employment, sidelining other potential influences, such as the policy milieu and market demands, which could also bear upon employment dynamics but were not accounted for in this study.

Future research endeavors could broaden the sample scope, incorporate a wider array of influencing factors, and delve into the mechanisms through which digitalization impacts employment across different sectors and regions more thoroughly. Additionally, integrating qualitative research methodologies could enrich the understanding of the tangible effects of digital transformation on employees and organizations. This would facilitate a more nuanced exploration of how digitalization can be optimized to achieve the objectives of sustainable employment.

Author Contributions: Conceptualization, P.Z.; methodology, P.Z.; software, P.Z.; validation, P.Z. and F.T.; formal analysis, P.Z.; investigation, P.Z.; resources, P.Z.; data curation, P.Z.; writing—original draft preparation, P.Z.; writing—review and editing, P.Z. and F.T.; visualization, P.Z.; supervision, P.Z. and F.T.; project administration, F.T.; funding acquisition, P.Z. and F.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the following funding: the National Natural Science Fund of China (NSFC), grant number 71532003, and the National Natural Science Fund of China (NSFC), grant number 72072008.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data are available upon request.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Abou-foul, M.; Ruiz-Alba, J.L.; Soares, A. The impact of digitalization and servitization on the financial performance of a firm: An empirical analysis. *Prod. Plan. Control* **2020**, *32*, 975–989. [\[CrossRef\]](#)
2. Zoubek, M.; Simon, M.; Poor, P. Overall Readiness of Logistics 4.0: A Comparative Study of Automotive, Manufacturing, and Electronics Industries in the West Bohemian Region (Czech Republic). *Appl. Sci.* **2022**, *12*, 77–89. [\[CrossRef\]](#)
3. Zhu, P.; Song, J. The Role of Internal Control in Firms' Coping with the Impact of the COVID-19 Pandemic: Evidence from China. *Sustainability* **2021**, *13*, 62–94. [\[CrossRef\]](#)
4. Zhou, J. Digitalization and intelligentization of manufacturing industry. *Adv. Manuf.* **2013**, *1*, 1–7. [\[CrossRef\]](#)
5. Ayu Purnamawati, I.G.; Yuniarta, G.A.; Jie, F. Strengthening the role of corporate social responsibility in the dimensions of sustainable village economic development. *Heliyon* **2023**, *9*, 15115. [\[CrossRef\]](#)
6. Vuković, M.; Jorg, O.; Hosseinifard, M.; Fantoni, G. Low-Cost Digitalization Solution through Scalable IIoT Prototypes. *Appl. Sci.* **2022**, *12*, 8571. [\[CrossRef\]](#)
7. Barbosa, C.R.H.; Sousa, M.C.; Almeida MF, L.; Calili, R.F. Smart Manufacturing and Digitalization of Metrology: A Systematic Literature Review and a Research Agenda. *Sensors* **2022**, *22*, 6114. [\[CrossRef\]](#)
8. Berge, T.; Schwaneberg, U.; Barth, S.; Hermann, L.; Grunwald, T.; Mayer, S.; Biermann, F.; Sözer, N. Application cases of biological transformation in manufacturing technology. *CIRP J. Manuf. Sci. Technol.* **2020**, *31*, 68–77. [\[CrossRef\]](#)
9. Vrabcová, P.; Urbancová, H. Use of human resources information system in agricultural companies in the Czech Republic. *Agric. Econ.* **2021**, *67*, 173–180. [\[CrossRef\]](#)
10. Tisch, A.; Meyer, S.C. Risks and opportunities of digitisation in the professional fields of nursing, care and healing. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* **2020**, *63*, 690–697. [\[CrossRef\]](#)

11. Sundstrup, E.; Meng, A.; Ajslev, J.Z.N.; Albertsen, K.; Pedersen, F.; Andersen, L.L. New Technology and Loss of Paid Employment among Older Workers: Prospective Cohort Study. *Int. J. Environ. Res. Public Health* **2022**, *19*, 7168. [\[CrossRef\]](#)
12. Sangmeister, H.; Villhauer, B. Digitalization and Global Responsibility. In *Handbook Industry 4.0: Law, Technology, Society*; Springer: Berlin/Heidelberg, Germany, 2022; pp. 1161–1170.
13. Neugebauer, R.; Hippmann, S.; Leis, M.; Landherr, M. Industrie 4.0—From the Perspective of Applied Research. *Procedia CIRP* **2016**, *57*, 2–7. [\[CrossRef\]](#)
14. Chen, J.; Zhang, S.; Ma, X.; Zhao, X.; Song, Y.; Fan, Y.; Yu, Y. Global Value Chains Embedding and Carbon Productivity of China's Manufacturing Industry: Direct Influence, Adjustment Effect, and Heterogeneity Analysis. *Sustainability* **2023**, *15*, 13272. [\[CrossRef\]](#)
15. Mesa, D. Digital divide, e-government and trust in public service: The key role of education. *Front. Sociol.* **2023**, *8*, 1140416. [\[CrossRef\]](#) [\[PubMed\]](#)
16. Letmathe, P.; Rößler, M. Should firms use digital work instructions?—Individual learning in an agile manufacturing setting. *J. Oper. Manag.* **2021**, *68*, 94–109. [\[CrossRef\]](#)
17. Helmann, A.; Deschamps, F.; Loures, E.D.F.R. Reference Architectures for Industry 4.0: Literature Review. In *Transdisciplinary Engineering for Complex Socio-Technical Systems—Real-Life Applications*; IOS Press: Amsterdam, The Netherlands, 2020; p. 74.
18. Grishchenko, N. An inverted digital divide during COVID-19 pandemic? Evidence from a panel of EU countries. *Telemat. Inform.* **2022**, *72*, 101856. [\[CrossRef\]](#)
19. Freire, Y.; Gonzalo, E.; Lopez-Suarez, C.; Pelaez, J.; Suarez, M.J. Evaluation of the marginal fit of monolithic crowns fabricated by direct and indirect digitization. *J. Prosthodont. Res.* **2021**, *65*, 291–297. [\[CrossRef\]](#) [\[PubMed\]](#)
20. Chen, X.; Despeisse, M.; Johansson, B. Environmental Sustainability of Digitalization in Manufacturing: A Review. *Sustainability* **2020**, *12*, 10298. [\[CrossRef\]](#)
21. El Hamdi, S.; Abouabdellah, A. Logistics: Impact of Industry 4.0. *Appl. Sci.* **2022**, *12*, 4209. [\[CrossRef\]](#)
22. Eriksson, K.M.; Carlsson, L.; Olsson, A.K. To digitalize or not? Navigating and merging human- and technology perspectives in production planning and control. *Int. J. Adv. Manuf. Technol.* **2022**, *122*, 4365–4373. [\[CrossRef\]](#)
23. Antràs, P.; Chor, D. Global value chains. In *Handbook of International Economics*; Elsevier: Amsterdam, The Netherlands, 2022; Volume 5, pp. 297–376.
24. Faraj, M.; Bein, M. Sustainability of Local Labour Market in South Africa: The Implications of Imports Competition from China. *Sustainability* **2022**, *14*, 7168. [\[CrossRef\]](#)
25. Adrita, M.M.; Brem, A.; O'Sullivan, D.; Allen, E.; Bruton, K. Methodology for Data-Informed Process Improvement to Enable Automated Manufacturing in Current Manual Processes. *Appl. Sci.* **2021**, *11*, 3889. [\[CrossRef\]](#)
26. Hardik, N. Digitalisation promotes adoption of soft information in SME credit evaluation: The case of Indian banks. *Digit. Financ.* **2023**, 1–32. [\[CrossRef\]](#)
27. Jagusch, K.; Sender, J.; Flügge, W. Transparency in the Design-Accompanying Production on Shipyards. *Procedia CIRP* **2019**, *81*, 791–796. [\[CrossRef\]](#)
28. Kim, H.K.; Lee, C.W. Relationships among Healthcare Digitalization, Social Capital, and Supply Chain Performance in the Healthcare Manufacturing Industry. *Int. J. Environ. Res. Public Health* **2021**, *18*, 1417. [\[CrossRef\]](#)
29. Kulahci, M.; Frumosu, F.D.; Khan, A.R.; Rønsch, G.Ø.; Spooner, M.P. Experiences with big data: Accounts from a data scientist's perspective. *Qual. Eng.* **2020**, *32*, 529–542. [\[CrossRef\]](#)
30. Lafuente, E.; Vaillant, Y.; Vendrell-Herrero, F. Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *Int. J. Prod. Econ.* **2017**, *192*, 19–28. [\[CrossRef\]](#)
31. Zhao, X.; Sun, X.; Zhao, L.; Xing, J. Can the digital transformation of manufacturing enterprises promote enterprise innovation? *Bus. Process Manag. J.* **2022**, *28*, 960–982. [\[CrossRef\]](#)
32. Lin, B.; Xie, Y. Impact assessment of digital transformation on the green innovation efficiency of China's manufacturing enterprises. *Environ. Impact Assess. Rev.* **2024**, *105*, 107373. [\[CrossRef\]](#)
33. Martínez-Gutiérrez, A.; Díez-González, J.; Verde, P.; Ferrero-Guillén, R.; Perez, H. Hyperconnectivity Proposal for Smart Manufacturing. *IEEE Access* **2023**, *11*, 70947–70959. [\[CrossRef\]](#)
34. Matthess, M.; Kunkel, S.; Dachrodt, M.F.; Beier, G. The impact of digitalization on energy intensity in manufacturing sectors—A panel data analysis for Europe. *J. Clean. Prod.* **2023**, *397*, 136598. [\[CrossRef\]](#)
35. Liu, S.; Zhu, S.; Hou, Z.; Li, C. Digital village construction, human capital and the development of the rural older adult care service industry. *Front Public Health.* **2023**, *11*, 1190757. [\[CrossRef\]](#) [\[PubMed\]](#)
36. Milichovský, F.; Kuba, K. Expected Impact of Industry 4.0 on Employment in Selected Professions in the Czech Republic and Germany. *Processes* **2023**, *11*, 516. [\[CrossRef\]](#)
37. Hole, G.; Hole, A.S.; McFalone-Shaw, I. Digitalization in pharmaceutical industry: What to focus on under the digital implementation process? *Int. J. Pharm. X* **2021**, *3*, 100095. [\[CrossRef\]](#)
38. Ning, G. The impact of energy industry structure adjustment on digital media application technology. *Energy Rep.* **2022**, *8*, 1463–1471. [\[CrossRef\]](#)
39. Leal Filho, W.; Tripathi, S.K.; Andrade Guerra, J.; Giné-Garriga, R.; Orlovic Lovren, V.; Willats, J. Using the sustainable development goals towards a better understanding of sustainability challenges. *Int. J. Sustain. Dev. World Ecol.* **2019**, *26*, 179–190. [\[CrossRef\]](#)

40. Zaldo Santamaria, J.M.; Rivera, O.; Garcia, J.M. Digitalization, Competitiveness and Employment. A Systemic View through System Dynamics. *Dyna* **2020**, *95*, 355–359. [[CrossRef](#)] [[PubMed](#)]
41. Jurmu, M.; Niskanen, I.; Kinnula, A.; Kaariainen, J.; Ylikerala, M.; Rasanen, P.; Tuikka, T. Exploring the Role of Federated Data Spaces in Implementing Twin Transition within Manufacturing Ecosystems. *Sensors* **2023**, *23*, 4315. [[CrossRef](#)]
42. Pech, M.; Vrchota, J. The Product Customization Process in Relation to Industry 4.0 and Digitalization. *Processes* **2022**, *10*, 539. [[CrossRef](#)]
43. Pena, F.; Rico, J.C.; Valino, G.; Zapico, P.; Meana, V.M. A Procedure to Integrate a CIS Sensor in an Additive Manufacturing Machine for In-Situ Digitizing of Deposited Material Layers. *IEEE/ASME Trans. Mechatron.* **2022**, *27*, 2690–2698. [[CrossRef](#)]
44. Mondejar, M.E.; Avtar, R.; Diaz, H.L.B.; Dubey, R.K.; Esteban, J.; Gómez-Morales, A.; Hallam, B.; Mbungu, N.T.; Okolo, C.C.; Prasad, K.A.; et al. Digitalization to achieve sustainable development goals: Steps towards a Smart Green Planet. *Sci. Total Environ.* **2021**, *794*, 148539. [[CrossRef](#)]
45. Wu, Y.-Q.; Lu, H.-X.; Liao, X.-L.; Zhu, J.-M.; Li, S. Research on the Digitization of Manufacturing Will Enhance the Competitiveness of the Value Chain Based on Advantage Comparison. *Complexity* **2021**, *2021*, 9917772. [[CrossRef](#)]
46. Schuh, G.; Reinhart, G.; Prote, J.-P.; Sauermann, F.; Horsthofer, J.; Oppolzer, F.; Knoll, D. Data Mining Definitions and Applications for the Management of Production Complexity. *Procedia CIRP* **2019**, *81*, 874–879. [[CrossRef](#)]
47. Siedler, C.; Sadaune, S.; Zavareh, M.T.; Eigner, M.; Zink, K.J.; Aurich, J.C. Categorizing and selecting digitization technologies for their implementation within different product lifecycle phases. *Procedia CIRP* **2019**, *79*, 274–279. [[CrossRef](#)]
48. Stan, L.; Nicolescu, A.F.; Pupaza, C.; Jiga, G. Digital Twin and web services for robotic deburring in intelligent manufacturing. *J. Intell. Manuf.* **2023**, *34*, 2765–2781. [[CrossRef](#)] [[PubMed](#)]
49. Wang, C.; Zhang, M. The road to change: Broadband China strategy and enterprise digitization. *PLoS ONE* **2022**, *17*, 0269133. [[CrossRef](#)] [[PubMed](#)]
50. Stark, A.; Ferm, K.; Hanson, R.; Johansson, M.; Khajavi, S.; Medbo, L.; Öhman, M.; Holmström, J. Hybrid digital manufacturing: Capturing the value of digitalization. *J. Oper. Manag.* **2022**, *69*, 890–910. [[CrossRef](#)]
51. Ghobakhloo, M.; Iranmanesh, M. Digital transformation success under Industry 4.0: A strategic guideline for manufacturing SMEs. *J. Manuf. Technol. Manag.* **2021**, *32*, 1533–1556. [[CrossRef](#)]
52. Varis, J.; Ratava, J.; Ollikainen, M.; Penttilä, S.; Bazaz, S.M. Industry 4.0 readiness for the manufacturing sector in the Baltic Sea Region. *Proc. Est. Acad. Sci.* **2021**, *70*, 453–460.
53. Wang, X.; Huang, Y.; Zhao, Y.; Feng, J. Digital Revolution and Employment Choice of Rural Labor Force: Evidence from the Perspective of Digital Skills. *Agriculture* **2023**, *13*, 1260. [[CrossRef](#)]
54. Tang, L.; Lu, B.; Tian, T. The Effect of Input Digitalization on Carbon Emission Intensity: An Empirical Analysis Based on China's Manufacturing. *Int. J. Environ. Res. Public Health* **2023**, *20*, 3174. [[CrossRef](#)]
55. Yuan, S.; Pan, X. Inherent mechanism of digital technology application empowered corporate green innovation: Based on resource allocation perspective. *J. Environ. Manag.* **2023**, *345*, 118841. [[CrossRef](#)]
56. Zhang, Q.; Wang, Q. Digitalization, Electricity Consumption and Carbon Emissions-Evidence from Manufacturing Industries in China. *Int. J. Environ. Res. Public Health* **2023**, *20*, 3938. [[CrossRef](#)] [[PubMed](#)]
57. Deng, H.; Bai, G.; Shen, Z.; Xia, L. Digital economy and its spatial effect on green productivity gains in manufacturing: Evidence from China. *J. Clean. Prod.* **2022**, *378*, 134539. [[CrossRef](#)]
58. Schulte, P.A.; Streit, J.M.K.; Sheriff, F.; Delclos, G.; Felknor, S.A.; Tamers, S.L.; Fendinger, S.; Grosch, J.; Sala, R. Potential Scenarios and Hazards in the Work of the Future: A Systematic Review of the Peer-Reviewed and Gray Literatures. *Ann. Work. Expo. Health.* **2020**, *64*, 786–816. [[CrossRef](#)] [[PubMed](#)]
59. Sharma, M.; Luthra, S.; Joshi, S.; Kumar, A. Analysing the impact of sustainable human resource management practices and industry 4.0 technologies adoption on employability skills. *Int. J. Manpow.* **2022**, *43*, 463–485. [[CrossRef](#)]
60. Fabiani, C.; Longo, S.; Pisello, A.L.; Cellura, M. Sustainable production and consumption in remote working conditions due to COVID-19 lockdown in Italy: An environmental and user acceptance investigation. *Sustain. Prod. Consum.* **2021**, *28*, 1757–1771. [[CrossRef](#)] [[PubMed](#)]

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