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Job Stress, Burnout, and Work Ability in Tire Manufacturing: The Role of Age and Experience

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Abstract: This study examined the challenges of the predominantly male, aging workforce in South Korea's tire manufacturing industry, focusing on physical demands, job stress, and burnout. The present study surveyed 400 workers employed on the production line at a tire manufacturing company in the Republic of Korea. This study revealed a predominantly male workforce, a majority of married employees, an older age demographic, a diverse range of employment tenures with a significant portion of long-term staff, and variability in rest period durations and frequencies. An analysis of data from tire manufacturing workers revealed that high job autonomy and relationship conflict contributed to lower job satisfaction and increased stress. Generational conflicts between older, experienced workers and younger employees further exacerbated dissatisfaction. Despite the physically demanding nature of the job, no significant difference in physical ability across age groups was observed. This study also found a high burnout index, characterized by cynicism, emotional exhaustion, and decreased professional efficacy, particularly among those performing repetitive tasks. The findings suggest a need for interventions to address burnout and improve job conditions for the aging workforce.

Keywords: job satisfaction; physical demands; job autonomy; burnout index; generational conflict

Academic Editor: Raphael Grzebieta

Received: 19 November 2024
Revised: 2 January 2025
Accepted: 15 January 2025
Published: 17 January 2025

Citation: Lee, J.; Lee, K.-S.; Ha, J.; Hwang, J. Job Stress, Burnout, and Work Ability in Tire Manufacturing: The Role of Age and Experience. *Safety* **2025**, *11*, 8. https://doi.org/10.3390/safety11010008

1. Introduction

Job stress is being investigated as a measure to understand personal and organizational stress in the workplace. Research in various occupations indicates the correlation between job stress and musculoskeletal issues, or identifies risk factors of job stress, highlighting the need for efforts to reduce it [1]. A recent systematic review and meta-analysis revealed that degenerative lumbar spine diseases had a prevalence of 21% (497 out of 2547 physicians and dentists) with a 95% confidence interval of 17–26%. Additionally, osteoarthritis of the hand was found to have a prevalence of 37% (382 out of 1013 dentists) with a 95% confidence interval of 23–51% within the healthcare sector [2]. Particularly, in human-related professions such as healthcare and education, where stress levels are reported to be high, extensive research is being conducted [3]. Burnout is closely related to job stress and, like job stress, is extensively studied in professions such as healthcare and education. Additionally, since job stress and burnout negatively impact the health of workers and the quality of services, it is important to investigate and address these issues [4].

Job stress and burnout are significant concerns in the manufacturing industry [5,6]. The Work Ability Index (WAI) is a tool used to evaluate work ability, with workers assessing their own capabilities. It plays a key role in understanding changes in work ability, as it takes into account personal characteristics, medical history, and external factors [7]. As the workforce ages, there is an increasing need to study the health, safety, reliability, and productivity of older workers in manufacturing. Research shows that functional capacity begins to decline after the age of 30, and older workers are more likely to experience illnesses, depression, and dementia compared to younger workers. Additionally, older workers often take longer to learn new skills, require more training time, and may have lower productivity [8]. However, some studies suggest that in tasks requiring sustained attention, the decline in work ability among older workers is minimal, and in some cases, their experience can lead to better performance than that of younger workers [9].

Overall, the work ability of older workers is generally rated as 'fair' or 'good', with younger workers scoring slightly higher, though the difference is not statistically significant. While older workers may have lower functional performance compared to younger workers, these differences are often subtle and not statistically significant. These findings suggest that despite physical limitations, older workers' higher levels of education, income, and experience can contribute to better performance and have positive effects on cognitive ability and overall health [10].

Tire manufacturing industries remain prominent among major heavy industries, employing labor-intensive production methods [11]. The working environment in tire manufacturing plants is often dusty, noisy, and physically demanding, with workers exposed to challenging conditions such as repetitive tasks and heavy manual handling. These factors contribute to a high prevalence of musculoskeletal disorders, including lower back pain, shoulder discomfort, and repetitive strain injuries such as trigger finger. Furthermore, the rate of pay in the tire manufacturing industry is generally slightly above minimum wage but remains significantly lower than average wages in other vehicle manufacturing sectors. This economic disparity highlights the financial challenges faced by workers and contributes to the dissatisfaction and turnover rates in the industry. Within a tire manufacturing plant, there has been a notable rise in complaints, reports, and sickness rates related to musculoskeletal symptoms, particularly manifesting as pain and discomfort in various body regions [12]. There is little research focusing on musculoskeletal disease symptoms and complaints within the tire manufacturing industry [13].

Workers in the tire building section have reported experiencing health issues, including lower back pain, trigger finger, shoulder pain, and other ergonomics-related illnesses after several years on the job [14]. These health concerns warrant thorough investigation to discern their root causes [15]. The escalating reports and medical treatments, especially concerning lower back pain, among tire-building machine employees raise significant concerns [16].

Theoretically, this study was grounded in the Work Ability Theory developed by Ilmarinen (2001) [17], which emphasizes the multidimensional nature of work ability including physical, psychological, social dimensions, etc. This study was grounded in the Job Demands–Resources model by Demerouti et al. (2001) [18] and Zacher and Schmitt (2016) [19] and the Organizational Implications by Truxillo et al. (2015) [20], which emphasize the multidimensional nature of job stress including relationship conflict, organizational system, and inadequate compensation. Additionally, we incorporated the Age Management Theory to examine how age-related changes affect workers' job stress, work capabilities, and burnout. The objective of this study was to examine the prevalence of job stress, WAI, and burnout among tire manufacturing workers. Furthermore, this study investigated the potential relationships between these measures and various demographic

characteristics. The research questions were as follows: (1) What are the prevalence rates of job stress, WAI, and burnout among workers in the tire manufacturing industry? (2) How are age and job experience associated with job stress, WAI, and burnout in this occupational context? This study surveyed job stress, WAI, and burnout among tire manufacturing plant workers, analyzing these factors across different demographic variables. It specifically explored the physical and mental health status of workers, focusing on age and work experience within the tire manufacturing industry and the broader domestic labor market.

2. Materials and Methods

2.1. Data Collection

The present study surveyed tire manufacturing employees on the production line in the Republic of Korea. This study comprised a cross-sectional survey, and a random sampling strategy was employed within the tire manufacturing plant for participant selection. Workers who expressed reluctance or hesitation to participate were excluded from the study. The survey was conducted between March and May 2022, targeting a total of 400 workers. After excluding insincere or incomplete responses, data from 366 respondents were included in the analysis, yielding a response rate of 91.5%. The survey questionnaire took approximately 20–25 min to complete, and each of the workers who participated in the survey was compensated with USD 15.

2.2. Measures

2.2.1. Job Stress

Job stress was chosen as a key measure because it impacts employee well-being, job performance, and the likelihood of burnout, making it a vital indicator for understanding occupational health and workplace dynamics [21]. Job stress was measured with the Korean Occupational Stress Scale Short Form (KOSS-SF), which is a standardized and simplified version of the scale developed by a previous study [22]. The scale consists of 24 items across the following seven subscales: Lack of Job Autonomy (5 items), Job Demands (8 items), Interpersonal Conflicts (4 items), Job Insecurity (6 items), Organizational Structure (7 items), Inadequate Compensation (6 items), and Workplace Culture (4 items). The scale's internal consistency reliability was demonstrated with a Cronbach's alpha value of 0.924. The value for each sub-factor was 0.602 for the four items in Lack of Job Autonomy (on elimination of one item with a low reliability), 0.837 for Job Demands, 0.869 for Interpersonal Conflicts, 0.624 for the four items in Job Insecurity (on elimination of one item with a low reliability), 0.904 for Organizational Structure, 0.828 for Inadequate Compensation, and 0.772 for Workplace Culture.

2.2.2. Work Ability Index (WAI)

The Work Ability Index (WAI) was chosen as a key measure because it provides a comprehensive assessment of a worker's capacity to meet job demands while maintaining their physical and mental health, making it essential for evaluating occupational health and predicting productivity. In this study, Finland's National Institute of Occupational Health (FIOH; Finnish Institute of Occupational Health) evaluated the work ability of workers working on the assembly line. The WAI developed by Finland's National Institute of Occupational Health was used [23]. This work ability evaluation tool is based on the year, and a total of 7 items are evaluated, including current work ability, illness, number of sick days, self-diagnosis, and mental qualities. The WAI classifies work ability into 4 grades: very good, good, average, and bad. Very good denotes the highest level of work ability, with minimal limitations in performing work activities and the potential for achieving high performance. Good indicates a satisfactory level of work ability, where

minor limitations may exist, but most tasks can be effectively completed. Average reflects a moderate level of work ability, with some tasks potentially requiring additional support or posing challenges. Bad represents a poor level of work ability, characterized by significant difficulties in fulfilling job demands. This is a method of classifying work ability into four grades.

2.2.3. Burnout

Burnout was chosen as a key measure because it is a critical indicator of chronic workplace stress that can negatively affect employee well-being, job performance, and overall organizational productivity, making it essential for understanding long-term occupational health outcomes. To measure subjects' job burnout, we used the Maslach Burnout Inventory—General Survey (MBI-GS), which was developed by Maslach [24] and validated in Korean [25]. The MBI-GS comprises a total of 16 items, including 5 each for assessing exhaustion and cynicism and 6 for assessing professional efficacy. Following a reliability analysis, we removed 1 item assessing professional efficacy; thus, a total of 15 items were administered. Example questions of each subscale are as follows: "I feel emotionally drained from my work" (exhaustion); "My interest in my work has decreased since I started my current job" (cynicism); and "I can effectively manage problems that arise at work" (professional efficacy). The Cronbach's α value for the whole scale was 870, while those for the exhaustion, cynicism, and professional efficacy subscales were 862, 738, and 827, respectively.

2.3. Data Analysis

The data collected from the 366 participants were analyzed using a range of statistical methods (SPSS version 23.0) to explore the relationships between demographic characteristics, job stress, the WAI, and burnout. Specifically, one-way analysis of variance (ANOVA) was employed to examine differences in job stress, WAI, and burnout across demographic variables such as age, gender, and work experience (Figure 1). The statistical significance was set as 0.05. Additionally, a Pearson correlation analysis was conducted to assess the strength and direction of the relationships among the components within job stress, WAI, and burnout. These statistical approaches provided a comprehensive understanding of how demographic factors and inter-variable relationships influence workplace outcomes.

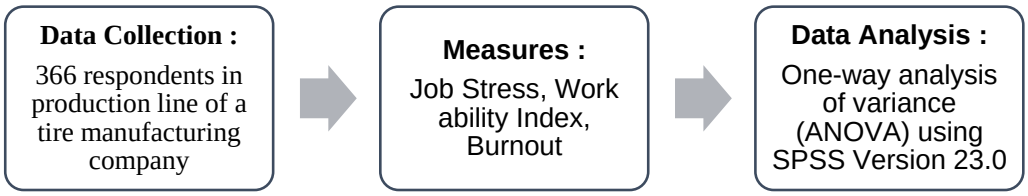

Figure 1. Flow chart of research process.

3. Results

3.1. Demographic Characteristics

The employee gender distribution highlighted a notable imbalance, with 360 men (98.4%) and only 6 women (1.6%), demonstrating a predominance of male employees. Regarding marital status, 277 employees (75.7%) were married, while 89 (24.3%) were single. The age breakdown revealed that 23 employees (6.3%) were in their 20s, 75 (20.5%) were in their 30s, 102 (27.9%) were in their 40s, and 166 (45.4%) were aged 50 or older, with the 20s being the least-represented age group and the 50s and above being the most.

The employment period of participants showed a diverse distribution across various tenure categories. Among the employees, 63 individuals (17.5%) had been with

the company for less than 5 years, while 59 (16.3%) had an employment history of 5 to 10 years. Employees with 10 to 15 years of service accounted for 55 of the participants (15.2%), and those with 15 to 20 years totaled 32 (8.9%). In the next tenure category, 26 employees (7.2%) were employed for 20 to 25 years, while 75 individuals (20.8%) fell within the 25 to 30 years range, representing the largest group. Finally, 51 employees (14.1%) had been with the company for over 30 years, reflecting a significant portion of their long-term staff. This distribution illustrated a balanced representation of employees with varying levels of experience and tenure within the organization.

A majority of participants (65.7%) reported rest periods lasting under 30 min, followed by 31.4% who took rest periods between 30 and 60 min, and a smaller proportion (2.8%) who reported rest periods exceeding 60 min. Regarding the frequency of rest periods, most participants (62.3%) took one to three rest breaks, while 25.7% reported taking four or more. A small percentage indicated having no rest periods (7.1%), and an even smaller group (2.5%) described their rest periods as unpredictable. This distribution underscores the variability in rest practices among the participants.

3.2. Job Stress

Job autonomy had the highest value, scoring 57.22 for men and 56.76 for women. When comparing men and women, men had more than half of the items ranked in the top 50% (corresponding to category B). These items included job autonomy, relationship conflict, job instability, and the organizational system (Table 1).

Table 1. Job stress responses of subjects by each gender.

						(N = 360)
Component	**Male**					
	Mean	**Median Score of Korean Workers**	**A**		**B**	**C**
			Bottom 25%	**Bottom 50%**	**Top 50%**	**Top 25%**
Job demand	49.09	50.1	41.6 (below)	41.7–50.0	50.1–58.3	58.4 (above)
Job autonomy	57.22	53.4	41.6 (below)	41.7–50.0	50.1–66.6	66.7 (above)
Relationship conflict	39.30	33.4	-	33.3 (below)	33.4–44.4	44.5 (above)
Job instability	50.18	50.1	33.3 (below)	33.4–50.0	50.1–66.6	66.7 (above)
Organizational system	50.75	52.4	41.6 (below)	41.7–50.0	50.1–66.6	66.7 (above)
Inadequate compensation	51.85	66.7	33.3 (below)	33.4–55.5	55.6–66.6	66.7 (above)
Workplace culture	32.92	41.7	33.3 (below)	33.4–41.6	41.7–50.0	50.1 (above)
Job stress (Total)	47.57	-	42.4 (below)	42.5–48.4	48.5–54.7	54.8 (above)
						(N = 6)
Component	**Female**					
	Mean	**Median Score of Korean Workers**	**A**		**B**	**C**
			Bottom 25%	**Bottom 50%**	**Top 50%**	**Top 25%**
Job demand	49.66	54.2	50.0 (below)	50.1–58.3	58.4–66.6	66.7 (above)
Job autonomy	56.76	60.1	50.0 (below)	50.1–58.3	58.4–66.6	66.7 (above)
Relationship conflict	39.29	33.4	-	33.3 (below)	33.4–44.4	44.5 (above)
Job instability	48.64	50.1	-	33.3 (below)	33.4–50.0	50.1 (above)
Organizational system	50.00	52.4	41.6 (below)	41.7–50.0	50.1–66.6	66.7 (above)
Inadequate compensation	51.42	66.7	44.4 (below)	44.5–55.5	55.6–66.6	66.7 (above)
Workplace culture	32.27	41.7	33.3 (below)	33.4–41.6	41.7–50.0	50.1 (above)
Job stress (Total)	47.10	-	44.4 (below)	44.5–50.0	50.1–55.6	55.7 (above)

The results of an ANOVA indicated significant differences between age groups in three factors, relationship conflict (F = 13.884, p = 0.000), organizational system (F = 3.709, p = 0.012), and inadequate compensation (F = 3.700, p = 0.012), as well as in overall job stress (Table 2). Additionally, there was a statistically significant difference in total job stress (F = 5.683, p = 0.001).

Table 2. Job stress by different personal characteristics of subjects.

	Age Group	N	Mean	SD	F	*p*
Relationship conflict	20s	23	28.99	22.03	13.884	0.000 **
	30s	75	29.56	16.11		
	40s	102	40.69	17.64		
	50s and older	166	44.28	18.96		
Organizational system	20s	23	45.29	21.59	3.709	0.012 **
	30s	75	47.44	15.32		
	40s	102	49.35	18.49		
	50s and older	166	53.87	16.66		
Inadequate compensation	20s	23	46.86	22.71	3.700	0.012 **
	30s	75	46.96	19.89		
	40s	102	51.96	18.31		
	50s and older	166	54.69	16.73		
Job stress (Total)	20s	23	44.86	14.38	5.683	0.001 **
	30s	75	43.44	11.46		
	40s	102	47.78	12.02		
	50s and older	166	49.70	10.45		

p ** < 0.01.

A correlation analysis of the job stress factors revealed no relationship between job demand and job autonomy, while all other factors showed positive correlations. The strongest positive correlations were found with overall job stress, followed by inadequate compensation (0.814), organizational system (0.759), and job instability (0.661).

3.3. Work Ability Index (WAI)

When examining the detailed results of the WAI by age group, statistically significant differences were observed in current work ability, psychological work ability, diseases, and work ability prognosis (Table 3).

Table 3. The WAI results in different age groups.

	Age Group	N	Mean	SD	F	*p*
Current work ability	20s	23	6.57	2.128	10.111	0.000 **
	30s	75	7.23	1.984		
	40s	102	7.67	1.847		
	50s and older	166	8.25	1.539		

Table 3. *Cont.*

	Age Group	N	Mean	SD	F	*p*
Physical work ability	20s	23	4.17	1.571	0.478	0.698
	30s	75	4.02	1.567		
	40s	102	3.94	1.423		
	50s and older	166	3.84	1.507		
Psychological work ability	20s	23	1.91	0.651	8.885	0.000 **
	30s	75	2.59	1.073		
	40s	102	2.35	0.949		
	50s and older	166	2.86	1.122		
Diseases	20s	23	6.26	1.389	11.317	0.000 **
	30s	75	4.99	1.834		
	40s	102	5.08	1.704		
	50s and older	166	4.28	1.794		
Disease impairment	20s	23	5.17	1.586	0.801	0.494
	30s	75	5.39	0.820		
	40s	102	5.38	0.912		
	50s and older	166	5.46	0.684		
Sick leave	20s	23	4.87	0.458	1.833	0.141
	30s	75	4.81	0.512		
	40s	102	4.87	0.460		
	50s and older	166	4.94	0.285		
Work ability prognosis	20s	23	5.83	1.749	4.627	0.003 **
	30s	75	5.52	1.934		
	40s	102	5.88	1.737		
	50s and older	166	6.31	1.307		
Mental resources	20s	23	2.57	1.080	0.765	0.514
	30s	75	2.57	0.975		
	40s	102	2.57	0.873		
	50s and older	166	2.72	0.907		
Total score	20s	23	37.39	5.758	1.741	0.158
	30s	75	37.16	6.072		
	40s	102	37.80	5.293		
	50s and older	166	38.69	4.680		

p ** < 0.01.

The correlation analysis of the WAI items revealed that the factors affecting the total score were current work ability (0.704), work ability prognosis (0.693), and mental resources (0.588), all showing a positive correlation. Conversely, among the WAI items, psychological work ability and physical work ability exhibited a negative correlation, with a coefficient of −0.313.

3.4. Burnout

The sample adequacy measure (MSA) was 0.904, indicating it was suitable for factor analysis (Table 4). Bartlett's sphericity test confirmed the correlation between burnout scale variables, making factor analysis feasible. The factor analysis resulted in the extraction

of three sub-factors: Factor 1 was labeled emotional exhaustion, Factor 2 was named professional efficacy, and Factor 3 was identified as cynicism.

Table 4. Results of an exploratory factor analysis of 14 burnout survey questions.

KMO Measure of Sampling Adequacy		**0.904**		
Bartlett's Test of Sphericity		Approx x^2		3551.830
		df		91
		p		0.000 ***
Component	**Communalities**	**Factor loading**		
		1	2	3
Burnout2	0.726	0.888	0.228	−0.528
Burnout3	0.794	0.886	0.204	−0.532
Burnout4	0.796	0.874	0.236	−0.558
Burnout1	0.623	0.851	0.122	−0.406
Burnout5	0.780	0.788	0.176	−0.383
Burnout14	0.617	0.138	0.833	−0.478
Burnout11	0.718	0.192	0.773	−0.255
Burnout12	0.593	0.081	0.765	−0.348
Burnout13	0.548	0.323	0.716	−0.385
Burnout10	0.472	0.090	0.680	−0.348
Burnout9	0.597	0.478	0.427	−0.850
Burnout7	0.728	0.526	0.351	−0.835
Burnout8	0.711	0.354	0.388	−0.769
Burnout6	0.645	0.641	0.323	−0.744
Factor group name	Emotional exhaustion	Professional efficacy	Cynicism	
Eigenvalue	6.333	2.782	1.235	
% of variance	45.235	19.873	8.819	
Cumulative %	45.235	65.109	73.928	

*** $p < 0.001$. Extraction Method: CFA(confirmatory factor analysis); Rotation Method: direct oblimin.

The burnout results through the MBI-GS can be classified into upper A, middle B, and lower C using criteria based on factors such as emotional exhaustion, cynicism, and professional efficacy. Looking at the average of all survey respondents, emotional exhaustion was classified at the medium B level, and cynicism and professional efficacy were classified as high-level A (Table 5).

Table 5. Burnout results through MBI-GS.

	Emotional Exhaustion	**Cynicism**	**Professional Efficacy**
N	366	366	366
Mean	3.14	3.73	3.50
SD	0.87	0.76	0.66
MBI-GS Criteria	**B**	**A**	**A**
	$A \geq 3.20$ $2.01 < B < 3.19$ $C \leq 2.00$	$A \geq 2.20$ $2.01 < B < 3.19$ $C \leq 2.00$	$A \leq 4.00$ $4.01 < B < 4.99$ $C \geq 5.00$

Looking at the correlation between the burnout items, burnout items 4 ("Working with people all day is really a strain for me.") and 5 ("I feel burned out from my work.") show the strongest positive correlation. It was found to be 0.823. Next, items 3 ("I feel fatigued when I get up in the morning because I have to face another day on the job.") and 4 ("Working with people all day is really a strain for me.") were strong at 0.800.

4. Discussion

The tire manufacturing factory from which the study data were collected predominantly employs male workers. Many of these workers are over the age of 50 and frequently suffer from musculoskeletal disorders due to their physically demanding tasks such as moving heavy tires. The age and tenure of the workers show similar distributions and characteristics. Workers in Korean tire manufacturing factories engage in physically intensive tasks, which often lead to pain in various body parts, not just limited to musculoskeletal disorders.

The job autonomy and relationship conflict are higher than the Korean average [26]. The tire manufacturing workers experience lower job satisfaction and motivation due to the dusty environment and high-intensity, repetitive tasks. The low job autonomy and high relationship conflict contribute to higher job stress compared to the national average. This finding aligns with research that investigates the relationship between job stress and nicotine dependence among Korean workers, highlighting the significant role of job control and work environment [27]. Additionally, the demographic composition of the workforce shows a significant number of experienced older workers and younger new entrants. Older workers, often serving as supervisors, tend to have conflicts with younger workers. For instance, younger workers often express dissatisfaction with the lack of autonomy in their tasks, feeling constrained by rigid supervisory structures. On the other hand, older workers frequently perceive younger employees as uncommunicative or dismissive of collaborative efforts, leading to misunderstandings. These differences in expectations and communication styles frequently result in workplace conflicts that hinder effective teamwork. This generational conflict and psychological stress have been documented in workplace studies [28]. Such conflicts are not only seen in tire manufacturing plants but also reflect the broader societal tensions between the individualistic and less responsible MZ generation and the older generation.

Workers in tire manufacturing plants typically work independently on individual lines, making pre-task discussions and coordination with supervisors essential. Younger workers tend to perform tasks individually without coordination, leading to ongoing conflicts with veterans. Conversely, supervisors desire task coordination but accumulate dissatisfaction due to potential accountability issues. The tire manufacturing workers face relatively low compensation and organizational system issues. In contrast to office workers, who receive promotions, job changes, and salary increases based on experience, production workers perform similar tasks regardless of tenure, resulting in minimal salary increases. This leads to dissatisfaction with perceived compensation and heightened discontent with the organizational structure.

Following the WAI analysis, individuals with extensive job experience tended to rate their own work abilities more positively. Specifically, when examining current, physical, and psychological work abilities, it was observed that those with prolonged experience tended to rate their mental work ability notably higher. This trend seems to have contributed significantly to everyone acknowledging their high work ability.

Interestingly, in terms of physical ability, there was no discernible statistical difference across age groups. This finding contrasts with the common understanding of physical decline in older individuals, as documented in the existing literature [28]. This discrepancy could be attributed to the nature of tasks within the tire industry, where numerous activities

demand both high intensity and skill. Consequently, younger workers with limited work experience might perceive minimal disparities in their physical abilities compared to their more seasoned counterparts.

Consistent with demographic data, it was observed that a significant number of individuals aged 50 and above had a history of diagnosed diseases. Concerning work ability prognosis, which assesses future work capacity, it appears to be associated with psychological work ability results. Although post hoc analysis did not uncover a statistical distinction among groups, it is plausible that older age groups may exhibit more proactive responses toward increasing future work capacity, possibly driven by economic motives such as securing retirement funds.

The correlation analysis revealed that total and current work ability exhibited the strongest correlation with the WAI outcomes. This suggests that individuals who rated their current work ability highly also demonstrated a greater inclination to continue working in the future. This finding can be linked to the previously mentioned dissatisfaction with compensation associated with job stress. Workers who harbor a strong desire to work and hold their abilities in high regard may perceive their compensation as relatively inadequate.

As a result of factor analysis, a total of three sub-factors were extracted, and Factor 1 was named emotional exhaustion, Factor 2 was named professional efficacy, and Factor 3 was named cynicism. Considering that line workers typically collaborate with colleagues rather than working alone, the stress arising from such collaboration is believed to impact burnout among them. Line workers tend to show a tendency to perceive their job as less important (burnout 9), become cynical about the contribution of their work (burnout 8), exhibit passivity in their tasks (burnout 7), and decrease interest in their job (burnout 6) because they lack the motivation to change anything in their work. A previous study mentioned that the main signs of burnout are apathy and indifference to friends and colleagues [29].

Based on the results of the WAI, workers evaluated their abilities highly, indicating confidence in their skills. However, their high burnout index suggests cynicism and decreased self-efficacy [30]. This is attributed to the nature of line work where there is minimal interest in the job and tasks are repetitive, leading to a negative perception of job importance. Particularly among experienced workers who perform repetitive tasks over long periods, there is a perceived lack of significance in their work and a sense of emptiness, which is considered a significant cause of job burnout. The repetitive tasks cause not only physical problems over time but also produce employee burnout and poor job satisfaction as well.

Burnout is important to the work ability of older adults given that they appear to need more job controls to buffer the effects of job-related stressors, recover from stress less quickly, and are more sensitive to the effects of job-related stress and burnout on self-efficacy and age-related cognitive decline [31]. There appeared to be no difference between groups depending on employment period (total), but overall, the lower the experience (less than 25 years), the lower the professional efficacy. This suggests that under optimal conditions, older workers may be more able to engage cognitive, psychological, and occupational strengths that improve with age.

Some previous studies have shown that physical work ability decreases with increasing age [32]. However, in this study, physical work ability did not show statistically significant differences with age increases. This result can be interpreted as stemming from workers' confidence in their mental health. This is evidenced by our research findings showing that psychological work ability was higher in those aged 50 and above. Furthermore, while job stress increases with age, the results indicated that older workers considered this stress to not affect their work ability [33].

5. Conclusions

In conclusion, this study highlights the multifaceted challenges faced by workers in the tire manufacturing industry, particularly those related to age, job satisfaction, and work ability. The predominantly male workforce, in which many are over 50, frequently suffers from musculoskeletal disorders and other health issues due to the physically demanding nature of its tasks. The data indicate that despite high levels of job autonomy and relationship conflict, the overall job satisfaction and motivation among these workers remain low, largely due to the dusty, high-intensity work environment and the repetitive nature of the tasks. This is compounded by a generational divide where older workers, often in supervisory roles, experience conflicts with younger, less experienced workers who prefer to work independently. This dissatisfaction is further exacerbated by organizational issues, particularly around compensation, as production workers receive minimal salary increases regardless of tenure, leading to heightened discontent. The compensation in the tire manufacturing industry is often regarded as insufficient when considering its physically demanding tasks, long working hours, and exposure to harsh environmental conditions. Workers frequently reported dissatisfaction, noting that their wages did not adequately reflect the intensity and challenges of their labor. Furthermore, systemic differences in compensation methods across manufacturing sectors, such as piece rates, time rates, and gain-sharing systems contribute to wage disparities, placing tire manufacturing workers at an economic disadvantage [34]. This imbalance exacerbates financial stress and increases turnover rates in the industry.

The findings suggest that while older workers may possess strengths in certain areas, such as professional efficacy under optimal conditions, the physical and psychological toll of the job, coupled with organizational and environmental stressors, contribute to a complex and challenging work environment that requires targeted interventions to improve job satisfaction, reduce burnout, and support the aging workforce. To address these challenges, targeted interventions are recommended, including ergonomic designs to prevent musculoskeletal disorders, strategies to improve communication and reduce generational conflicts, and the implementation of transparent compensation systems. Future research should evaluate the long-term impact of these interventions and explore how technologies, such as collaborative robots, can further alleviate physical strain and enhance workplace satisfaction. The practical implications have been expanded to include (1) guidelines for developing age-appropriate workplace interventions, (2) recommendations for occupational health professionals, and (3) strategies for organizations to better support their aging workforce.

Author Contributions: J.L.: Data analysis and drafting the manuscript; J.H. (Jiyeon Ha): data analysis and editing the manuscript; K.-S.L.: directing the project and editing the manuscript; J.H. (Jaejin Hwang): drafting the manuscript and supervising the study. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the Korea Institute of Energy Technology Evaluation and Planning (KETEP) through a grant funded by the Ministry of Trade, Industry, and Energy (MOTIE) of the Republic of Korea (Grant No. 20224000000080); by the Innovative Human Resource Development for Local Intellectualization program through the Institute of Information and Communications Technology Information and Communications (IITP) grant funded by the Korea government (MSIT) (Grant No. IITP-2024-RS-2023-00260267); and by the National Research Foundation of Korea (Grant No. 2022R1F1A1069384).

Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Kangwon National University (KWNUIRB-2024-10-002-001).

Informed Consent Statement: Informed consent was obtained from all subjects involved in this study.

Data Availability Statement: The data will be shared upon request.

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

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