International Journal on Advanced Science Engineering Information Technology

Vol.14 (2024) No. 2
ISSN: 2088-5334

Ergonomic Factors Which Affect the Work Productivity of Clove Flower Harvesters

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Abstract—**The height of the cloves at which they begin to flower, which is about 20 meters, is a factor that affects the clove harvesting procedure. This means that collecting cloves at height necessitates using tools that ensure worker safety. The agricultural industry is susceptible to ergonomic work risks resulting from several elements, such as worker characteristics, job demands and procedures, work organization, and environmental conditions. It is necessary to prioritize people as the critical consideration in defining work or human-centered design to manage ergonomic risks. This research analyzes the risk facts for clove flower pickers with a comprehensive method covering task, organization, and environment. This study was conducted during the clove flower harvest season from July to September 2023 at the plantation in Munduk Village-Bali, with 107 participants. Data on ergonomic hazards from internal and external factors before and after work were collected from MSDs and predicted using the Nordic Body Map questionnaire; fatigue was measured using the Core questionnaire Quality of Life (EORTC QLQ- C30), rating pulses were measured using a pulse meter. The data obtained were analyzed using SEM (Structural Equation Model). Significant differences were $p < 0.05$. The results of the research show that internal factors, particularly age, exert a negative influence on productivity. External factors, including body posture, time conditions, social conditions, information conditions, and human-tool interactions, significantly influenced productivity. This highlighted the importance of optimizing the "human-machine-environment" system to enhance safety, efficiency, and overall well-being.**

Keywords—**Ergonomic factors; work productivity; musculoskeletal disorders; clove flower harvester.**

Manuscript received 12 Dec. 2023; revised 23 Mar. 2024; accepted 16 Apr. 2024. Date of publication 30 Apr. 2024.

I. INTRODUCTION

Clove (Syzygium aromaticum) is a spice plantation widely cultivated in tropical and subtropical countries [1]. This plant is used for food preservatives and various medicinal purposes. Local species can grow to heights above 15 m and occasionally reach about 20 m [2], with some surpassing 100 years in age. The clove plant is harvested when the whole flower head is visible but unopened. This is achieved by climbing a bamboo ladder and picking each flower stem without breaking the twigs. Clove flower bunches are picked above the last leaf node to avoid being damaged. Furthermore, the flowers are evenly distributed throughout the tree branches, making harvesting difficult. The methods used in this process greatly influence the quality of the fruit or seeds picked and their work productivity [2]. The clove flowers are harvested by selecting from the outside of the tree using a ladder made from a single bamboo stem, designed explicitly with steps for footholds. While harvesting the clove flowers, the farmer works at a height of roughly 20 meters while standing on this ladder. Work postures that are not ergonomic, such as twisted arms, bent knees, and a tilted body to one side or the other, are frequently associated with this procedure [3]. When such practices are accompanied by additional challenges, namely insufficient work equipment, the psychological strain of working at heights, unergonomic footrests, and adopting unnatural work postures, can significantly elevate the risk of injury, illness, and various musculoskeletal complaints (MSDs) [4], [5], [6]. Harvesting on one side of the tree can take approximately 2 to 2.5 hours and increase oxygen demand for the body's metabolism, resulting in an increased pulse rate [7]. This further leads to fatigue in muscles, joints, and nerves, culminating in musculoskeletal complaints (MSDs) [4], which can manifest as mild to severe pain due to certain activities. Prolonged periods of static work can lead to muscles, nerves, joints, ligaments, and tendons damage, resulting in complaints commonly referred to as MSDs [5], [6].

Various factors that influence the clove harvesting process are the height of the cloves that begin to flower productively, around 20 meters, making it dangerous and difficult to reach [8]. Soewardi and Sujono [9] research state that harvesting cloves at height requires tools that guarantee work safety. Ergonomic aspects of work hazards in the agricultural sector can be caused by worker characteristics, job demands, work methods [10], work organization factors, and environmental factors [11]. One solution for managing ergonomic risks is prioritizing humans as the primary factor in shaping work or human-centered design (HCD) [12]. Inefficient work tools can lead to exposure to physical and ergonomic hazards [13], resulting in accelerated fatigue, complaints, pain, and injuries to workers' limbs. The design of work facilities plays a significant role in MSDs. In some cases, manual workers may benefit from stretching exercises to alleviate these complaints, enhancing productivity and overall work health [14]. The application of ergonomics, as evidenced in numerous studies, shows its effectiveness in curbing absenteeism from work-related accidents and MSDs [15]. This significantly reduces work-related musculoskeletal disorders (WMSD) and other ergonomics-related incidents in the workplace, yielding substantial cost savings, mitigating litigation risks, and bolstering overall productivity [16].

This research aims to identify ergonomic factors in clove flower harvesting, including the interaction of aspects of task demands-work environment-organization [17], which aims to reduce injuries directly related to the workplace [18] and improve human performance includes various main elements: (1) balanced nutrition [19], (2) considering muscle strength and biomechanics, (3) evaluating body posture and workplace physiological design [20], (4) social and sociological conditions [21], (5) working environment conditions [22], (6) work and rest time and related conditions [23], (7) information conditions and interaction between individuals and visual performances [24], as well as (8) human-machine interaction as a means of exchanging information between workers and equipment [25].

The novelty in research on ergonomic factors in the clove flower harvesting process includes identifying potential hazards, mental and physical workload, and work processes in terms of eight ergonomic aspects related to worker characteristics: (1). calorie consumption; (2) muscle power during work; (3) body posture when working; (4) work environment; (5) time conditions; (6) social conditions; (7) information conditions and (8) human interaction with tools/machines on work productivity.

II. Materials and Method

A. Research Sites

This study was conducted during the clove flower harvest season from July to September 2023 at the plantation in Munduk Village, Banjar District, Buleleng Regency, Bali Province, Indonesia. The plantation covers 542 hectares and is owned by 586 families.

B. Research Subject

The study subjects were selected based on specific inclusion criteria. The inclusion criteria were as follows: (a) individuals aged between 20 and 56 years, verified by their Resident Identity Card; (b) a BMI range of 18-22; (c) a minimum of one year of experience in harvesting clove flowers; (d) absence of any physical abnormalities that could hinder work activities, determined through both physical assessments and self-reported by the participants; and (e) a willingness to participate as study subjects. Subsequently, individuals from the eligible population meeting these criteria were chosen to participate in the study. The sample size was determined using the Slovin [26] formula:

Number of samples (n):

$$n = \frac{N}{1+(Nxe^2)} \tag{1}$$

The total population is 145 people; the confidence level is 95%, the z-score value is 1.96, and the margin of error (e) is 0.05 [27].

$$n = \frac{145}{1+145(0.05)^2} = 107$$

Number of samples (n) = 107 peoples

The sampling technique is simple random sampling. A random sample is taken from the existing population using a lottery.

C. Research Design

This research was a pre-experimental design with a one-group pretest-posttest design according to the following chart:

$$\mathbf{R} \longrightarrow \mathbf{O}_1 \xrightarrow{\mathbf{P}} \mathbf{O}_2$$

Fig. 1 Research Design [28]

where R is a randomly selected sample, P is the treatment, O1 is the result from the experimental unit's pretest before work, and O2 is the result from the experimental unit's posttest after work.

D. Tasks and Assessment

Ergonomic risk factors were assessed using a comprehensive method covering Task, Organization, and Environment, considering human factors extensively in designing safe and efficient systems [12]. Human factors include psychological, social, physical, and biological traits, as well as environmental factors. It includes optimizing human performance, safety, and well-being by designing products and systems that align with human needs, capabilities, and limitations [29]. Studies of ergonomic factors in agriculture emphasize ergonomic interventions to reduce risk factors related to the demands of agricultural tasks such as harvesting and ergonomic analysis of the entire influencing system [30]. Based on these considerations, in this study, the hypotheses that will be tested are as shown in Figure 1.2, namely: (1) Internal factors (F1), which include worker characteristics, calorie intake, skeletal muscle complaints before work and work posture have an impact on work productivity (Y); (2) External factors (F2) which include the work environment, working time conditions, social conditions, information conditions, and human-tool interactions have an impact on work productivity (Y).

Before initiating the study, participants provided details about their characteristics, completed questionnaires regarding calorie consumption, social circumstances, and information conditions, and underwent measurements of their interaction with work tools. Body weight, resting pulse, and any subjective complaints were recorded at the start of work. The working pulse was monitored in the process, and aspects such as work duration, breaks, and pauses were documented. Muscle power was calculated based on the working pulse, and work posture was noted. Additionally, the weight of the harvested clove flowers was measured. Following work, participants recorded their recovery pulse and post-work body weight. Potential ergonomic hazards were evaluated through analyses of MSDs, fatigue, and Ergonomic Risk Factors (ERF) using a Structural Equation Model. This model helped identify internal and external factors influencing work productivity, as well as potential ergonomic risk factors associated with upper extremity cumulative trauma disorders. The risk levels of environmental hazards and work posture were also assessed [31]. MSDs were predicted using the Nordic questionnaire Body Map [32], fatigue was measured using the EORTC Core questionnaire Quality of Life (EORTC QLQ-C30) [33], and work posture risk levels were assessed using survey analysis tailored to investigations of workplace ergonomics related to upper extremity disorders [34]. Potential hazard control was established via a comprehensive ergonomic analysis with the SHIP (Systemic, Holistic, Interdisciplinary, and Participatory) methods [35].

E. Research Procedures

Before the commencement of the study, the accessible population (N) was asked to provide a signed letter of consent, along with personal information such as name, gender, place/date of birth, and address. Sample selection was then conducted using random numbers, resulting in the chosen sample (n). These participants underwent anthropometric measurements while standing to assess their suitability for handling work tools and maintaining proper postures during clove harvesting activities. Before the study began, participants completed questionnaires about work motivation and ergonomic risk factors for independent work. Additionally, each subject was given a 15-minute rest period to record body weight and resting pulse rate and to complete a 30-item fatigue questionnaire, along with the Nordic body map to document their baseline condition. Subsequently, a pulse meter was applied to the wrist, and participants were instructed to initiate the clove flower harvesting activity. The results concerning ergonomic risk factors during work were classified into internal (F1) and external factors (F2), both of which have an impact on work productivity (Y). The working conditions of each subject were documented over three consecutive workdays. In total, the sample size consisted of 107 individuals. The interrelationship between the study variables is visually presented in Figure 2.

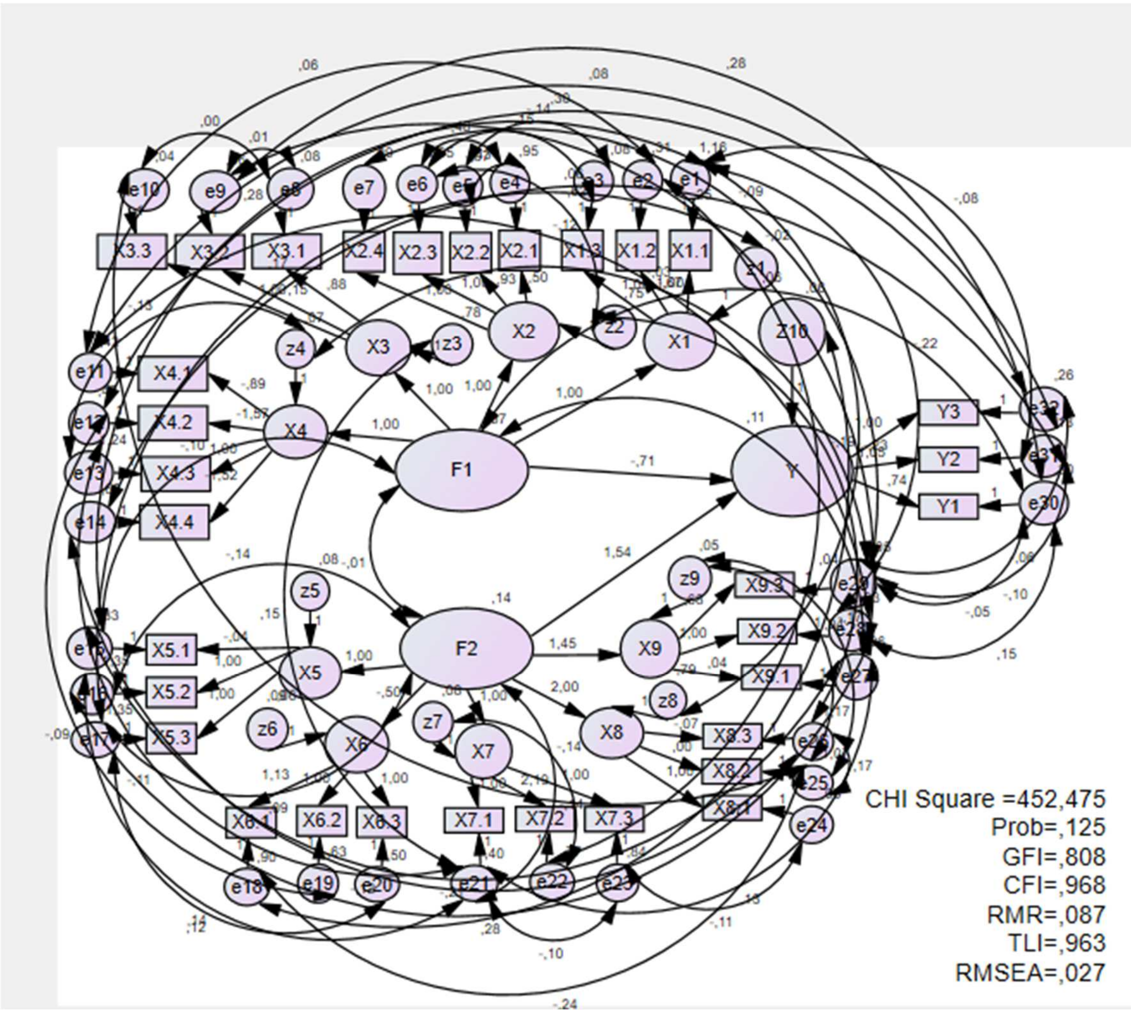

Fig. 2 Internal and External Factors That Influence Work Productivity

Notes:

F1	Internal factors	X31	Working Pulse
F2	External Factors	X32	Pulse of Work
X1	Worker Characteristics	X33	Calories expended during work
X2	Calorie consumption	X41	Muscle Complaints Before Work
X3	Muscle power during work	X42	Muscle Complaints After Work
X4	Work Posture	X43	Tired before work
X5	Work environment	X44	Fatigue After Work
X6	Time conditions	X51	Air temperature
X7	Social Conditions	X52	Humidity
X8	Information Conditions	X53	Wind velocity
X9	Human -Machine Interaction	X61	Length of working
Y	Work productivity	X62	Long rest
Y1	Productivity based on work pulse	X63	Long stolen break
Y2	Productivity based on fatigue score	X71	Working relationships with superiors and co-workers
Y3	Productivity based on Skeletal Muscle Complaint Score	X72	Work motivation
X11	Worker Age	X73	Wages
X12	Work experience	X81	Ease of distinguishing harvested clove flowers
X13	Technical Knowledge	X82	Ease of seeing clove flowers
X21	Calorie Intake per day	X83	Ease of reach
X22	Drinking water intake during work	X91	High up the stairs
X23	Urine volume during work	X92	Step distance
X24	Losing Weight After Work	X93	Width of step steps

F. Data Analysis

Data from measurements of ergonomic risk factors were tabulated and then analyzed for ergonomic risk control based on score values and risk categories. Ergonomic risk factors that influence internal and external sources were analyzed using SEM (Structural Equation Modeling). Data on workload and subjective complaints before and after work were analyzed using the t-test to obtain significant differences. The difference in statistical test significance is $p \leq 0.05$.

G. Research Hypotheses

The hypotheses in this research are as follows:

- Internal worker factors have a negative influence on productivity.
- External factors (including body posture, time conditions, social conditions, information conditions, and human interaction with tools) influence productivity.

III. Results and Discussion

A. Normality Test Results

Variables X (ergonomic factors) and Y (work productivity) were assessed for normality using a critical criterion ratio skewness of ± 2.58 at a significance level of 0.01. The results showed that both variables exhibit a normal distribution because the critical ratio skewness falls below the absolute value 2.58. The effect of the test on the data for these variables signifies that the structural equation model used in this study is indeed a good fit. According to the Confirmatory Factor Analysis (CFA) calculation, assessing the goodness of fit and model modification, the constructs under examination—X1 (worker characteristics), X2 (calorie consumption), X3 (muscle power during work), X4 (work posture), X5 (work environment), X6 (time conditions), X7 (social conditions), X8 (information conditions), X9 (human-machine interaction), F1 (internal factors), F2 (external factors), and Y (work productivity)—all possess a GFI index of ≥ 0.90. This shows that these indicators were valid and effectively represent the unidimensionality of the tested constructs, rendering them well-suited for examining the hypotheses posited. Additionally, the results of the sample's validity and reliability tests indicate that the Construct Coefficient Reliability exceeds 0.70, further affirming the robustness of the model's outcomes

B. Direct and Indirect Effect Test Results

The analysis of the direct influence of F1 (internal factors) on Y (work productivity) was conducted at a significant level (α) of 5% (0.05). The Structural Equation Modeling (SEM) results yielded a t-statistic value of -3.311, with a corresponding statistical probability of 0.000. The obtained statistical probability value of 0.000 was lower than the Level of Significance (0.05), leading to the conclusion that there exists a negative influence of -0.712 between F1 (Internal Factors) and Y (work productivity). This negative influence stems from the internal factor of age, which harms task performance [36]. Consequently, older workers tend to exhibit reduced strength, adaptability, technological proficiency, and overall performance compared to their younger counterparts.

The test results examining the direct influence of F2 (external factors) on Y (work productivity) were conducted at a significant level (α) of 5% (0.05). The SEM computations yielded a t-statistic value of 4.846, alongside a statistical probability of 0.000. Upon analyzing the processed data, the obtained statistical probability value of 0.000 was lower than the Level of Significance (0.05). This leads to the conclusion that a positive and direct influence exists between F2 (External Factors) and Y (Work Productivity) of 1.543. These results align with the definition provided by the International

Labour Organization (ILO), which characterizes productivity as measuring how efficiently resources are utilized. This can be assessed through total factor productivity, which encompasses all production factors, or labor productivity, specifically output generation [37].

The test results for the direct influence of various variables, including X1 (worker characteristics), X4 (work posture), X5 (work environment), X7 (social conditions), X8 (information conditions), and α (significance level) set at 5% (0.05), were subjected to the SEM. The obtained t-statistical values for these variables were 3.875, 3.905, 2.632, 2.733, 4.333, and 3.657, respectively. The associated probability statistics for X1, X4, X8, and X9 were all 0.000, while for X5 and X7, they were 0.008 and 0.006, respectively. After meticulous data processing, it was observed that the obtained statistical probability values were all less than the designated Level of Significance (0.05). Consequently, it was deduced that there exists a positive direct influence between X1 (worker characteristics), X4 (work posture), X5 (time conditions), X7 (social conditions), X8 (information conditions), and human-machine interaction (X9) on Y (work productivity) with coefficients of 0.124, 1.496, 0.173, 0.705, 0.065, and 0.128, respectively. When testing the direct influence of X2 (calorie consumption) on Y (work productivity) with α set at 0.05, the SEM yielded a t-statistic value of 0.652, with a corresponding statistical probability of 0.515. Following data analysis, the statistical probability value of 0.515 exceeds the designated Level of Significance (0.05), leading to the conclusion that there is no direct influence between X2 (calorie consumption) and Y (work productivity). Furthermore, when assessing the direct impact of X3 (muscle energy during work), the SEM produced t-statistical values of -3.388 and -4.046, with corresponding probability statistics for X3 and X6 (time conditions). Both were recorded as 0.000.

Upon analyzing the processed data, the obtained statistical probability value of 0.000 was lower than the designated Level of Significance (0.05). This leads to the conclusion that there exists a direct negative influence between X3 (muscle energy during work) and X6 (time conditions) on Y (work productivity) with coefficients of -0.227 and -2.836, respectively. Considering the cumulative influence, the direct effect of F1 (internal factors) and F2 (external factors) on Y (work productivity) accounts for 28.2% and 85.3%, respectively. The indirect effect of F1 (internal factors) on Y (work productivity) was registered at 0.00%.

C. Factor Analysis Test Results

The results of the ergonomic factor analysis, assessing the impact of F1 (internal factors) and F2 (external factors) on Y (work productivity), showed insightful patterns. The influence of internal factors (F1) can be delineated as follows: X1 (worker characteristics) had the most substantial effect at 1.195, followed by calorie consumption (X2) at 0.294, muscle power during work (X3) at 0.289, and work posture (X4) at 0.710. In contrast, external factors (F2) exhibited distinct contributions, namely the work environment (X5) wields an impact of 0.796, time conditions (X6) show an effect at -0.606, social conditions (X7) play a significant role at 0.796, and information conditions (X8) was the most influential factor with a value of 0.923. The "human-machine-environment" system comprises the comprehensive structure and attributes essential for optimizing the synergy between humans, machinery, and the environment. This optimization ensures the overall system's safety, efficiency, and comfort, thereby enhancing its capacity to support human life functions.

The test results showed the direct influence of various factors on work productivity (Y). Specifically, the influence of ergonomic factor X1 (worker characteristics) on Y was 0.124, while X2 (calorie consumption) exhibited a correlation of 0.118. On the other hand, X3 (muscle power during work) showed a considerable negative influence of -0.227. Factor X4 (work posture) exhibited the most substantial impact with a coefficient of 1.496. Furthermore, X5 (work environment) showed a positive effect of 0.173, while X6 (time condition) indicated the most negligible influence with a coefficient of -2.836. Factor X7 (social conditions) contributed positively, with a coefficient of 0.705, and X8 (information conditions) showed a minor impact of 0.065. Finally, X9 (human-machine interaction) showed a moderate influence with a coefficient of 0.128. A clove flower harvester's 'working posture' refers to the specific body position adopted during the activity. A proper, or 'good,' working posture is crucial, as it helps mitigate the risk of musculoskeletal disorders [38], bolstering work productivity.

Internal Factor X1 (worker characteristics) comprises X11 (worker age) at 0.203 (the smallest) and X13 (technical knowledge) at 0.209. Internal Factor X2 (calorie consumption) includes X21 (calorie intake per day), X22 (drinking water intake), X23 (BMI), and X24 at 0.422, 0.789, 1.142, and 0.949, respectively. The most influential aspect was the Body Mass Index (BMI), reflecting nutritional status as an essential element of safe and productive work, including physical and mental health and the long-term well-being of workers [29]. Interventions such as providing better nutrition enhanced workers' health, enabling them to work safely for extended periods [28]. Internal Factor X3 (muscle power during work) is shaped by X31 (work pulse), X32 (working pulse) (the smallest), and X33 (energy released during work in kcal/minute) at 0.944, 0. 185, and 0.977, respectively.

Additionally, X42 (muscle strength before work) and X43 (fatigue before work) were at 0.651 and -0.355. These factors contribute to muscle fatigue due to decreased strength, exertion, and discomfort [39]. Cumulative physical stress also heightened the risk of skeletal muscle complaints [40]. External Factor X5 (work environment) was influenced by X51 (air temperature), X52 (humidity), and X53 (wind speed) at -0.022, 0.413, and 0.397. Study results by [41], [42], [43] have established a correlation between workplace ergonomics (including temperature, furniture arrangement, facilities, lighting, noise, and equipment) and staff performance. External Factor X6 (time conditions) is determined by X61 (length of work) at 0.344 (the smallest), X62 (rest duration) at 0.362, and X63 (stolen rest length) at 0.399 (the largest). A study by [31] emphasized that data on work/rest patterns were crucial for preventing muscle fatigue in the workplace. The presence of stolen breaks during work indicated heightened fatigue. Work/rest cycle time was vital in assessing the risk of musculoskeletal disorders arising from repetitive, monotonous work [44]. X7 (social conditions) was determined by X71 (work relations) at 0.797, X72 (work motivation) at 0.930 (the greatest), and X73 (wages) at 0.454

(the smallest). These outcomes were consistent with the research by [45], where it was concluded that job satisfaction, work environment, and work motivation significantly impact employee performance. External Factor X8 (information condition) was affected by X81 (ease of distinguishing harvested clove flowers) at 0.982 (the greatest), X82 (ease of seeing clove flowers) at 0.004, and X83 (ease of reach) at -0.079.

The highest factor for information conditions lay in the ease of distinguishing which clove flowers are ready to be harvested. This supports the notion that well-designed information conditions can profoundly influence the efficiency and safety of workers [46]. X9 (human-machine interaction) was determined by X91 (stair climb height) at 0.026 (the smallest), X92 (comfortable distance between steps) at 0.517 (the greatest), and X93 (comfortable step width) at 0.361. The most influential aspect of human-tool interaction was the step distance factor. Standard stair designs, by the American National Standards Institute, use a step pitch of 30.5 cm or 12 inches, while European Standards provided a range of 25.0 to 30.0 cm or 9.8 to 11.8 inches [47]. Work at heights necessitates attention to safety measures, including protection from falling, use of standard equipment, supervision of procedures, methods, work stages, workplace security, and preparedness for emergencies and response [48].

Variable Y comprises Y1, based on work pulse with the smallest coefficient of 0.716, Y2 derived from fatigue score with the most significant coefficient of 0.893, and Y3 from musculoskeletal complaints score with a coefficient of 0.795. Optimizing these elements, ergonomics enhanced physical and psychological efficiency while mitigating risk factors for work time loss [49]. This method further improved social conditions within the workplace, boosting worker satisfaction and motivation and lowering the likelihood of musculoskeletal complaints [50] and fatigue-related issues [39]. The efficacy of ergonomic initiatives was assessed through enhancements in productivity, efficiency, safety, and the overall quality of life for individuals. Work productivity was determined through performance, workload, musculoskeletal complaints, and fatigue levels [51]. Therefore, ergonomic interventions can potentially enhance occupational health and system productivity [6].

D. Implications of The Findings

Internal factors, worker characteristics, and work posture influence work productivity the most. Unergonomic working postures can increase the potential for skeletal muscle complaints. Exposure to working conditions such as work posture, workload, work methods, work tools, and work pressure will influence musculoskeletal complaints (MSDs) [52]; work efficiency [53], and repetitive work can cause musculoskeletal complaints (MSDs) [54], [55], besides harvesting cloves including overhead manual work on a large scale can increase activities related to local muscle fatigue [56]. Various methods of working at height, such as scaffolding, ladders, gondolas, and access systems using ropes, make this work have a high potential for danger [57]. Working at heights with repetitive movements in unnatural posture positions that expose workers contributes to increased skeletal muscle complaints [58].

Various studies show that ergonomic interventions can reduce work-related upper extremity [59] musculoskeletal disorders (MSDs), so it is essential to address risks by reviewing all aspects that may contribute to the emergence of work-related musculoskeletal complaints (MSDs) and interventions on tool design, tasks, and shifts. Work may be required [54]. Research conducted by [60] aimed to improve the ergonomics of agricultural harvest baskets can reduce the risk of musculoskeletal disorders (MSDs) among farmers in Korea. The design of Korean melon harvesting equipment was made by taking into account the product's physical characteristics and the workers' anthropometry. It also effectively reduced postural loads and increased job satisfaction of farmers in a city in southern Korea [45]. Research [61] from 1995 to 2020 found 221 studies related to musculoskeletal disorders (MSDs) in agricultural work, which were generally reported by developed countries, and only a few countries paid attention. Because ergonomics is a multidisciplinary science that adjusts labor to workers to protect their health and safety, it is crucial to agriculture [62] risks involved in work, machines, vehicles, and work environments, which include tools and materials, work methods, and conditions. Surroundings, physical environment, and work organization [63]. Other methods to reduce musculoskeletal (MSDs) have also been identified, such as training workers in ergonomics, providing rest periods, and alternating body postures [61].

IV. Conclusion

According to the results and discussion of the analysis, ergonomic factors that influence the work productivity of clove flower harvesters were influenced by internal factors in a negative way, which was due to the presence of internal factors. Age has a negative impact on aging on task performance, and older workers are weaker, less able to adapt, less technologically savvy, and overall show lower performance than younger workers. Meanwhile, external factors that influenced the productivity of clove flower harvesters came from the resources used, which directly influence worker characteristics, body posture, time conditions, social conditions, information conditions, and human-machine interactions. Meanwhile, external factors of calorie consumption did not have a direct influence. The negative direct influence was muscle power during work and in different time conditions.

Generally, the direct influence of internal factors on the work productivity of clove flower harvesters is 28.2%, and the direct impact of external factors on the work productivity of clove flower harvesters is 85.3%. The factor that contributed most to forming internal factors was worker characteristics. The factor that contributes most to forming external factors is human-machine-machine interaction because the "human-machine-environment" system includes the entire structure and attributes of the system to make the best use of humans, machines, and the environment to make the whole system safe, efficient, and comfortable for humans and life support functions. The ergonomic factors, internal and external, that influence the work productivity of clove flower harvesters that contribute the most are the worker's body posture and abnormal work posture (awkward work posture). Working in an uncomfortable position can increase the risk of musculoskeletal disorders, ultimately reducing work productivity.

Nomenclature

N number of population
n number of sample
e margin of error
X independent variable
Y dependent variable

Acknowledgment

We thank the Republic of Indonesia's Ministry of Education, Culture, Research and Technology and P3M Bali State Polytechnic for funding this research.

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