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Effect of Characteristics and Fatigue of Labor Performance in Shipbuilding Production Room

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ABSTRACT This shipbuilding company is a pioneer company in Indonesia that produces various types of ships supported by technology from Australia (Computer Design Marine). Risky company activities can work fatigue, so companies need to pay attention to the health and safety of workers. In general, work fatigue is a condition that can occur in workers, where workers experience problems both physically and spiritually after work. Work fatigue is a factor that affects the work where fatigue can directly affect the performance of workers. The purpose of this research is to analyze the effect of characteristics and fatigue on the performance of workers. This study used an analytic research method with a p-type approach cross-sectional. Data was collected using interviews. Sampling is using the Simple Random Sampling method with 64 samples which are conducted to the workers in the shipbuilding production room. To determine the effect between two variables, this research used Chi-Square test analysis. The results showed that age ($P=0.038$), years of service ($P=0.041$), and fatigue ($P=0.000$) affected the performance of workers in the shipbuilding production room, while education level ($P=1.000$) didn't affect labor performance in the shipbuilding production room. It is recommended for shipbuilding companies to provide training and rewards (for example by giving compensation) to workers so that they will be more enthusiastic in their work activities and it is necessary to provide light sports coaching activities so that the functioning of body organs is helped them to become stronger and not easily tired.

INDEX TERMS Fatigue, performance, shipbuilding production, labor performance.

INTRODUCTION

In general work, fatigue is a condition that can occur in workers, where workers experience problems both physically and spiritually. Fatigue itself consists of physiological and psychological fatigue. Physiological fatigue is physical exhaustion while psychological fatigue is mental or spiritual exhaustion. Work fatigue is a factor that can directly affect the performance of workers [1]. Fatigue of each person has a different condition, but all of them lead to a loss of efficiency and power endure, as well reduced working capacity [2].

Fatigue is a problem that needs attention. Work fatigue can be caused by various types of work, both formal and informal. Fatigue can increase errors at work that can reduce performance, performance decreases mean productivity at work will decrease too. If the productivity of workers is

disturbed due to mental and physical fatigue, it will be felt by the company with the decrease of company productivity [3]. Another possible consequence is dropping physiological, motoric, and neural functions, it can also improve the possibility of accidents at work. So it will be detrimental to the company as well as the workers themselves [4].

Data from the *International Labor Organization* 2018 explained that almost every year as many as 2 million workers die due to work accidents caused by fatigue [5]. In this study, it was explained that from 58.115 samples, 18.828 (32.8%) of them experienced work fatigue, which will have a direct impact on the level of employee performance. So the man factor has a big effect on level worker performance. For example, in terms of workers' sleep, their biological needs, even labor fatigue too. Most of the drop in employee

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performance is caused by work fatigue [3]. In Indonesia, the problem of work fatigue is also a serious problem in the industrial sector. In Indonesia, work fatigue gets 50% of the occurrence of work accidents. According to data from BPJS in 2018, the number of work accidents also increased by 28% from the previous year [6].

The ability to work is influenced by several factors, one example is age. Age can also affect the use of energy per hour because each person uses different energy muscles in working conditions [7]. When the worker was getting older, his commitment to the company also be higher. On the other hand, these limitations have a different view positive about top so performance to the company will increase [8].

Productive age is between 15-64 years old. Age between 20 years to 40 years old is considered very productive to work because the average worker less than 20 years old is still in the process of education so they do not have sufficient *skill* maturity. Meanwhile, each individual will begin to decrease in physical abilities at over 40 years old [9]. In the mid-twenties, most physical performance reaches its peak and will begin to decrease along with the increasing age. The spiritual and physical abilities of workers will gradually begin to decrease along with the increasing age. Activity life also begins to decrease which has an impact increase the inability of the body to do various things [8].

The level of education can affect the ability and quality of workers to improve their performance because education is the ability to take advantage of all existing facilities and the basis for self-development so that workers are fluent in their works. In fulfilling responsibilities and obligations, education will change a person's way of thinking and attitude for the better and increase his level of awareness [10].

Besides age factor and level education, which suspected causing. The low performance of workers is due to work period. Labor can be affected by the work period in a negative or positive direction. The negative effect is the longer a person works, the more causes boredom. On the other hand, the positive effect is if the longer person works the more experiences they get. The work period is related to performance, so far where workers can reach satisfactory results in their work. It depends on skills, abilities, and his skills. So that the worker can do his job according to the specified target [10].

Performance is basically what it does and it doesn't do by workers in their work. The continuity of the company to achieve the goals of employee performance can affect it. Employee performance can provide benefits for the company, while poor performance could generate losses for the company, both material and financial losses nonmaterial. Decreased enthusiasm for work can be due to performance which is the bad, thing this could see when workers can not complete their work according to the target and time set by the company [11].

Based on the results of a preliminary study carried out by the author in the shipbuilding production room, information

was obtained from the person in charge of the HSE section that in the shipbuilding company there were several incidents of work accidents. Shipbuilding companies also have implemented ISO 45001:2018 since 2020. From the results of direct observations in the production room of 20 randomly selected workers, the aim is to assess the level of worker fatigue and worker performance. The instrument used to measure work fatigue is a questionnaire based on indicators according to the *Industrial Fatigue Research Committee (IFRC)* in Tarwaka (2015). The method used in assessing the level of work fatigue and worker performance is in the form of interviews using questionnaires to workers. The results of the preliminary study showed that 3 workers experienced low fatigue, 6 workers experienced moderate fatigue, 11 workers experienced high fatigue, and no workers experienced very high fatigue. The assessment of the performance of workers, shows that 1 worker has poor performance, 8 workers have adequate performance and 11 workers have good performance. From the results of measuring the performance of these workers, there are no respondents who fall into the category of very good performance.

The purpose of this study is to analyze the effect of characteristics and fatigue on the performance of workers in the shipbuilding production space.

II. METHOD

This research uses analytic research, with a *cross-sectional approach*. The sample is the workers in the production room with 64 samples. Researchers use the technique of taking samples as *Simple Random Sampling*. The independent variables in this study were age, education level, years of service, and work fatigue. The dependent variable is the performance of the workforce in the shipbuilding production room.

In this study, the instrument used was a *subjective feelings* questionnaire and a performance questionnaire addressed to workers in the shipbuilding production unit. The *subjective feelings questionnaire* has 30 indicators consisting of 10 indicators about weakening activities, 10 indicators about weakening motivation, and 10 indicators about physical fatigue. The scale used is a Likert scale, this scale has an iteration of 1–4. While the performance questionnaire contains statements about the main task of the production room workers which later can describe the performance of the production room workers. Employee performance indicators here are divided into 5 indicators, namely quantity, quality, timeliness, effectiveness, and independence.

The method of data collection in this study was observation and interviews to obtain a description of the characteristics, fatigue of workers, and labor performance in the shipbuilding production room. Analysis of the data used to analyze the effect of characteristics and fatigue on performance by using test analysis *Chi-Square*.

III. RESULTS

A. LABOR CHARACTERISTICS

1) Age

Based on the graphs above, it is known that 64 workers (100%) showed workers who have good performance with age less than 40 years, namely 42.2% (27 workers). While the results of the *Chi-Square* statistical analysis test between the age variable and the performance of the workforce in the shipbuilding production room obtained a value of $P = 0.038 \leq \alpha (0.05)$ then H_0 is rejected, meaning that there is an influence between age on the performance of the workforce in the space production shipbuilding.

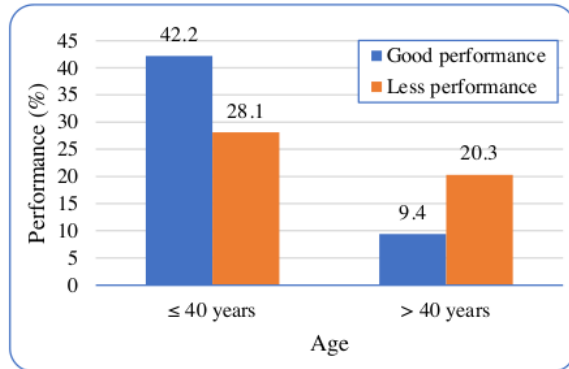


FIGURE 1. Graph of Age With Workforce Performance

2) Level of Education

Based on the graph above, it is known that out of 64 workers (100%) it shows workers who have good performance with a high school education level of 48.4% (31 workers). While the results of the *Chi-Square* statistical analysis test between the variable level of education and labor performance in the shipbuilding production room obtained a value of $P = 1,000 > \alpha (0.05)$ then H_0 is accepted, meaning that there is no influence between the level of education on the performance of the workforce in the space production shipbuilding.

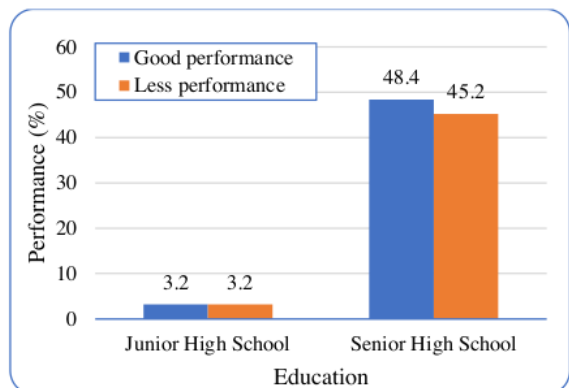


FIGURE 2. Graph of Education Level With Labor Performance

3) Work Period

Based on the graph above, it is known that 64 workers (100%) showed workers who have good performance with a long service period that is equal to 46.9% (30 workers). While the results of the *Chi-Square* statistical analysis test between the variable period of service and labor performance in the shipbuilding production room obtained a value of $P = 0.041 \leq \alpha (0.05)$ then H_0 is rejected, meaning that there is an influence between the service period on the performance of the workforce in the space production shipbuilding.

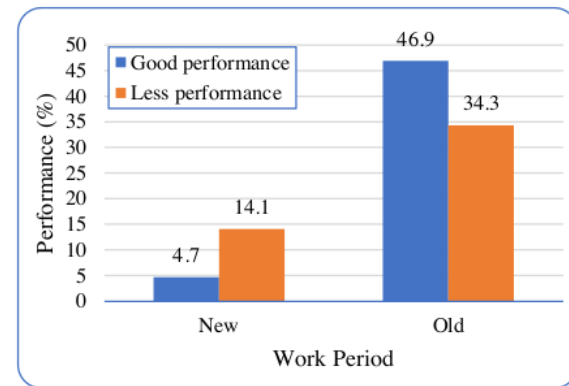


FIGURE 3. Graph of Work Period With Labor Performance

B. FATIGUE

Based on the graph, it can be seen that 64 workers (100%) showed workers who had good performance with low fatigue, namely 42.2% (27 workers). While the results of the *Chi-Square* statistical analysis test between the fatigue variable and labor performance in the shipbuilding production room obtained a value of $P = 0.000 \leq \alpha (0.05)$ then H_0 is rejected, meaning that there is an influence between the working period on the performance of the workforce in the production room shipbuilding.

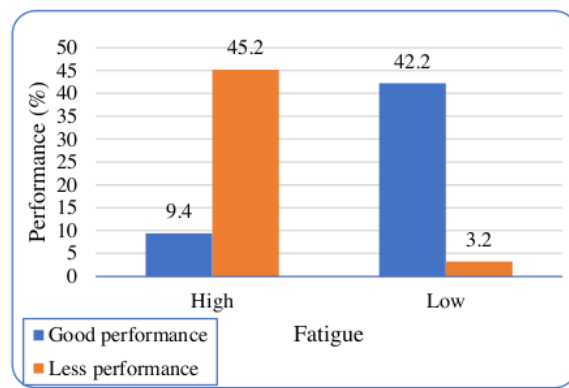


FIGURE 4. Graph of Fatigue Chart With Workforce Performance

IV. DISCUSSION

A. LABOR CHARACTERISTICS

1) Age

Based on the research results, it can be seen that of the 64 workers in the shipbuilding production room, the workers who have good performance with age less than 40 years are 42.2% (27 workers). While the results of the *Chi-Square* statistical analysis test between the age variable and the performance of the workforce in the shipbuilding production room obtained a value of $P = 0.038 \leq 0.05$ then H_0 is rejected, meaning that there is an influence between age on the performance of the workforce in the shipbuilding production room.

Age is present (since birth) or the length of life. The older worker is the higher his commitment to the company because getting other job opportunities are becoming more limited and this is also in line with the increasing age of workers. On the other hand, these limitations have a positive view of superiors so that their performance towards the company will improve [8]. The ability to work is influenced by several factors, one of which is age. Age can also affect, one of which is the use of energy per hour, because each person uses energy per hour in different muscle working conditions [7]. This causes age to be one of the indicators for companies to recruit workers. Workers who will be recruited are workers who are of productive age, so they will fill positions that are currently needed by the company [12].

The shipbuilding production area is dominated by men, where the workers are more than 40 years old less than workers with less age than 40 years. This is because workers work for needs family economy and the type of work they do also have a heavy burden with a high enough risk. Most of the age of workers who work in the shipbuilding production room is less than 40 years old, this age is still included in the productive age. Although some of the age there are still in the productive age category, workers who have entered the age of 40 years and over will begin to experience physical decline and feel bored with the work they do so that it can affect the performance of the workforce. This is by the explanation according to Priyono and Yasin, workers aged between 20 years to 40 years are considered very productive to work because the average worker less than 20 years of age is still in the process of education so they do not have sufficient *skill* maturity. Meanwhile, each individual will begin to experience a decrease in physical abilities at the age of over 40 years [13]. The spiritual and physical abilities of workers will gradually begin to decline with age. Life activities also begin to decrease which will increase the body's inability to do various things [8].

According to Karadag, 2017 found that there is an influence between age on performance. In this study, there was a significant difference between ages [14]. This result is

also by the research done by Kooij et al., 2013 shows that the performance of workers will get stronger with age. Younger workers may think more about their interests than the interests of the company and have not had much experience thereby reducing their level of performance. Another explanation may be that younger employees who attend formal training are still struggling to apply what they have learned. Meanwhile, as an employee who is getting old more motivated to do a better job, as they may be more appreciative of the work they are doing, helping others, for example serving as a mentor, and their performance level will be even higher because of the experience they already have. This research indicate that there is an influence between age on worker performance [15]. Many workers fall into the age category of fewer than 40 years, which means that many workers are of productive age. With increasing age, workers will gain a lot of experience, so that their performance towards the company will be able to increase.

Efforts that can be made to improve the performance of workers who have decreased productivity due to aging are by giving *rewards* (awards or appreciations) for example in the form of compensation or others to workers so that they will be more enthusiastic in doing work and will improve their performance, this can be prioritized at an age that begins to experience physical decline because it can affect how they work in the shipbuilding production room. The workers also have a lifestyle healthy by eating nutritious and healthy food, getting enough sleep, and exercising regularly so that the body remains in prime condition to be able to complete its work according to work targets.

2) Level of education

Based on the results of the research, it can be seen that of the 64 workers in the shipbuilding production room, the workers who have good performance with a high school education level are 48.4% (31 workers). While the results of the *Chi-Square* statistical analysis test between the variable level of education and the performance of the workforce in the shipbuilding production room obtained a value of $P = 1.000 > 0.05$ then H_0 is accepted, meaning that there is no influence between the level of education on the performance of the workforce in the shipbuilding production room.

The level of education can affect the ability and quality of workers to improve their performance because education is the ability to take advantage of all existing facilities and the basis for self-development so that workers are smooth in carrying out tasks [10]. Education is one of the activities for mastering theory and skills so that it will increase the knowledge of workers, it is hoped that workers will be more independent to take bigger decisions on problems related to activities to achieve goals [16].

Someone who undergoes education will think more rationally, have a broader perspective and have certain skills so that education can influence as well as change the way of life for somebody. That person will also experience

interaction among attention, awareness, and understanding which are declared in the form of habits and behavior that someone has. The level of education will change attitudes and ways of thinking in a better direction and a high level of awareness will also provide greater awareness in fulfilling responsibilities and obligations [10]. However, the level of education is one of the factors that can be directly or indirectly related to workforce performance [16].

The level of education possessed by the workers in the shipbuilding production room is not directly related to performance because the various kinds of education possessed by the workers do not affect their performance. Workers can still do their jobs well so that the targets set by the company can be achieved with good performance. Education is a way to improve the performance of workers and to motivate workers to work. Basically the level of education possessed and passed by workers is one of the efforts made to obtain good performance [17]. However, the level of education can be related indirectly or directly to the performance of the workforce. Worker performance will be maximized if the level of education applied by the company to workers is appropriate, and vice versa [16].

According to Karadag, 2017 shows that the level of education has a significant effect on worker performance. This research shows that with increasing levels of education Worker performance will also increase [14]. This result is also by the research by Khan et al., 2019 that there is a positive relationship between the level of education with employee performance. This is contrary to research conducted by researchers because the results obtained are that there is no influence between the level of education on the performance of workers [18]. Education is indeed very important because it is one of the basic needs for many companies that will accept workers to work based on their level of education. Many companies will accept job applicants with a higher level of education, if someone's education is high, they will get a job that matches their level of education and vice versa, if a person's education level is low, there will be fewer doors open for a better career. Maybe even level worker education does not affect every time there is an increase in worker performance. This can happen because the level of education of a worker does not guarantee his performance in the company. Workers carry out their duties to the maximum so that their performance will be maintained and improved, even though workers have various educational levels.

3) Work Period

Based on the results of the study, it can be seen that of the 64 workers, the workers who have good performance with a long service period are 46.9% (30 workers). While the results of the *Chi-Square* statistical analysis test between the variable period of service and labor performance in the shipbuilding production room obtained a value of $P = 0.041 \leq 0.05$ then H_0 is rejected, meaning that there is an influence

between years of service on the performance of workers in the shipbuilding production room.

Working period is the term time people who have worked on the environment company (years), starting from when he worked until the research took place [19]. The more long somebody work, then they have more a lot of experience. Otherwise the shorter their tenure, the less experience they gain. Work experience provides many skills and skills in work, otherwise, experience work which limited cause skills and skill which owned more low. New workers usually do not yet know the intricacies of profession and safety by deep. Therefore, workers often prioritize the first finish amount profession certain which given to them, compared to their salvation so that their salvation does not get sufficient attention [20].

A worker who has extensive experience usually also has enough years of service, so that they are faster to face a problem that will arise because they understand what to do. The length of the working period will also shape the performance of workers who are more effective because various obstacles that arise can be resolved according to their experience. Workers can complete their tasks well because they have a lot of experience. In addition, workers no longer need to adapt to the tasks they are carrying out and will work faster because they already have a lot of experience. Workers in finishing work will be faster because of the more experience the ability will also be different. So that the period of work passed by workers should provide a work experience that will ultimately affect the level of professionalism of workers [8].

According to Juwita et al., 2017 shows that tenure has a negative and insignificant effect on performance. Term of service means the length of time a worker has worked in the company. A long working period also requires daily work processes. The longer the work, the better the performance of workers, because they already have experience in working [21]. This means that it has similarities with research conducted by the author regarding the role of tenure on worker performance. The results of the research conducted indicate that many workers are included in the long service category, which means that many workers already understand and are familiar with the work they are doing. This is also in line with research conducted by Ali and Davies, 2010 where the length of service affects the performance of rubber tappers. So that the working period of the worker will have an impact on his performance. Because all tapping workers do the same job, require the same set of skills and abilities, and there is no allocation of different work-related tasks based on years of service. Therefore, workers will be more independent when they have enough years of service and have skills when facing problems in their work [22].

Efforts that can be made by companies to improve the performance of workers who have a new tenure are by holding training, for example regarding the development of

skills or *soft skills development*. to workers so that they can better understand method do Duty by correct and by holding training on *soft development skills* also for build culture work which is more efficient. This is prioritized for new workers because these workers do not have much work experience but are old workers also need to learning sustainable by regular so that always know the latest developments.

B. FATIGUE

Based on the results of the study, it can be seen that of the 64 workers, the workers who have good performance with low fatigue are 42.2% (27 workers). While the results of the *Chi-Square* statistical analysis test between the fatigue variable and the performance of the workforce in the shipbuilding production room obtained a value of $P = 0.000 \leq 0.05$ then H_0 is rejected, meaning that there is an influence between the working period on the performance of the workforce in the shipbuilding production room.

Generally, work fatigue happens to everyone who is no longer able to carry out activities, this is a pattern that arises in a situation with different physical and mental bodies so that it will result in a decrease in body resistance and decrease workforce to work [19]. Therefore, the problem of fatigue must get attention because fatigue at work is a factor that can determine a person's level of performance [23]. All types of work, both formal and informal, can cause job burnout. With workers experiencing work fatigue, it will cause a decrease in employee performance and increase work errors or problems. If the employee's performance decreases, the company's activities will be disrupted and not run as expected [24].

In the production room of the shipbuilding industry, the level of fatigue must be considered, because everyday work fatigue can continue to occur and will continue to result in severe fatigue. chronic. Not only happen after work in the afternoon, but feelings of fatigue also occur during work even sometimes previously. One of the symptoms of fatigue is feeling lethargic. Psychological symptoms are characterized by feelings of displeasure and antisocial actions towards people around them, lack of energy, loss of initiative, and often feeling depression. Psychic signs this often accompanied also with disorders such as headaches, vertigo, insomnia, digestive disorders, and others. Fatigue can lead to an increase in absenteeism, especially absence in the term short due to increased pain rates or the need for more rest. Clinical fatigue is also known as chronic fatigue, this fatigue occurs in those who are mainly experiencing psychological or mental problems.

This is in line with research conducted by Fang et al., 2015 one of the factors that decrease performance that can increase the error rate at work is fatigue. Workers tend to make more mistakes when the worker was tired, it means it will cause a performance decreases [25]. This result also supports Aulina's statement, that fatigue can occur due to

monotonous working conditions. Monotonous working conditions can cause boredom and make employees feel tired and bored. Feeling bored causes the performance of workers to begin to decline so that it will harm the company's productivity [26]. Based on the results of research that has been conducted by researchers, it shows that work fatigue is in the direction of declining workforce performance and has a significant effect, meaning that the more workers often experience work fatigue, The performance of the workforce will decrease and vice versa if the workers do not experience fatigue, the performance of the workforce will increase.

Efforts that can be made carried out by the company for overcoming fatigue that is by doing coaching activity sport light (doing exercise or muscle stretching (approximately 15 minutes before and after operating the unit) or regular physical exercise because it can help smoothness function organ body so that moment does profession no easy tired and stronger. By doing this, workers can reduce the risk of high fatigue so that their performance will increase. Workers should also better understand simple ways to deal with fatigue experienced during work, for example, to reduce eye fatigue, they can rest their eyes for 20 seconds and massage the temples.

In the work environment, there is high heat pressure due to limited space and hot work activities (machines that continue to operate) so that the room becomes hot, this can cause workers to sweat easily, feel thirsty (dehydration), and fatigue. If the sweat released increases while the sweat contains chloride and sodium, it can cause hyponatremia, namely sodium deficiency [27]. Heat is a burden for workers which causes a lot of fluid in the body to come out through sweat. Along with sweat, the body loses some mineral salts. Lose mineral salts can reduce the concentration of electrolytes in the body and disrupt the fluid balance in the body. Therefore, workers should consume foods and fluids that contain sodium. This is a need for intake for the body in the form of mineral water to restore body fluids lost through excessive sweating at work. The physical recovery of workers can be seen from the sodium electrolyte content in the body after workers consume mineral water [28].

Doing some of these ways is expected to prevent the occurrence of high work fatigue when doing work. According to Fajarwaty, Nurmayanti, Hermiyanti the content of chloride (Cl) and electrolyte sodium (Na) in the blood of workers who have been exposed to heat and given intake of artificial isotonic drinks, there is a difference between before and after consuming mineral water, the sodium content in the body of the workforce, where workers whose nutritional status is normal, fat or thin, have an increase in chloride (Cl) and sodium (Na) electrolytes. in blood. Therefore, so that workers do not become dehydrated, workers need to have intake for the body in the form of artificial isotonic drinks with the addition of salt and sugar to keep them healthy. restore body fluids lost through excessive sweating at work [29]. However, giving coconut water has

the effect of increasing the sodium content in the blood of workers, which is higher than the consumption of mineral water. This is because coconut water contains glucose and salt. The sodium in fruit or vegetables is digested faster by the body than the salt contained in beverages [30].

C. LABOR PERFORMANCE

Based on the results of research with a sample of 64 workers, it shows that part large number of respondents who work in the room production shipbuilding have a good performance that is equal to 51.6% (33 workers) this can be seen from the employee performance indicators, namely indicators of quantity, quality, effectiveness, and timeliness of employees.

Performance improvement is something that wanted good from workers and parties employer. Employers want the performance of workers good and maximum for the need to increase company profits and productivity. On the contrary, workers have the interest to develop themselves as well as a form of responsibility for their work. In general, the performance that is done well has the aim of producing by the company's targets because each section and the workers in the company must always make improvements to the work system. To achieve this, a good performance management system is needed [31].

The performance or work performance is the result of work in quantity and quality obtained by workers while carrying out tasks by responsibilities within a predetermined time [32]. The results of the performance of workers are measured by the criteria and standards that have been determined by the company [33]. Performance is said to be good if the work target can be completed before or within a predetermined time limit. The success of a company can be seen from the performance of workers that have been achieved. Therefore, company leaders must pay attention to the level of performance, because the company's performance is strongly influenced by the performance of the workers [32].

Performance is also the main factor in processing raw materials into a product. Where workers are required to be able to do a quality job on time to meet market demand. In this case, good employee performance can affect the continuity of growth development of a company in producing a product. Employee performance is also very important in the company's efforts to achieve its goals because in general companies base planning goals to be achieved in the future with the expected behavior of all workers to achieve these goals [34].

This is in line with Cahyono 's research, one of the most important factors in the company's efforts to increase company productivity is good employee performance. Performance is the work performance displayed by each individual in the form of real behavior by workers by their role in the company. One of the most important things to achieve company goals is employee performance [34].

An effort which can be done to cope with decreased performance is by taking part in training, for example regarding the development of abilities or the development of *soft skills* to workers so they can better understand how to do their job properly and build a more efficient work culture. Giving *rewards* to workers can also improve the performance of the workforce, with these rewards causing workers to be even more enthusiastic about doing their jobs so that the work will be completed according to the targets set by the company. The limitation of this questionnaire is that the answer given by the respondent is not necessarily a real answer or does not describe to the actual situation. In this study, the distribution of education is uneven so the level of work education does not affect performance. Employee performance appraisal is carried out through filling out questionnaires by the employees concerned to allow the emergence of bias due to subjective assessment of the performance of each employee.

V. CONCLUSION

Most of the workers in the shipbuilding production room indicated that the workers were less than 40 years old (70.3%), high school education level (93.6%), long working period (81.2%), high work fatigue as a result. Cesar 54.6% (35 workers), and good performance of 51.6% (33 workers). There is a influence between age, years of service, and fatigue on the performance of workers in the shipbuilding production room, and there is no effect between the level of education on the performance of the workforce in the shipbuilding production room.

Suggestions that can be made by the company are to make efforts to prevent a decrease in performance in the shipbuilding production space including providing training (eg training on the development of skills or *soft skills development*), giving awards (eg in the form of *compensation*) to workers so that they are more enthusiastic in carrying out their work activities and it is necessary to develop light sports activities so that the smooth functioning of the organs of the body is helped so that when doing work they are not easily tired and stronger. For further research, it is necessary to conduct further research related to the performance of the workforce with other variables that have not been studied, including gender, marital status, organizational factors, management factors that can affect the performance of the workforce.

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