

# The Influences of 5S Implementation on Occupational Safety and Health and Work Productivity

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**Abstract:-** This research aims to study and analyze the influence of 5S implementation on occupational safety and health and work productivity at PT. XYZ, a hydraulic excavator manufacturer company in Indonesia. The data used is the primary data that gets the results of a closed questionnaire. The scale used is semantic differential. This research is research with a quantitative approach with a sample number of 220 samples. The method is structural equation modeling (SEM) using AMOS 24 software. Results showed that the implementation of 5S has a positive effect on occupational safety and health and work productivity as well as occupational safety and health has positive effect on work productivity. The implementation of 5S and occupational safety and health, especially the discipline (*shitsuke*) and safety environment should be improved to increase work productivity.

**Keywords:-** 5S Implementation, Occupational Safety And Health, Work Productivity.

## I. INTRODUCTION

PT XYZ is a manufacturer of heavy equipment (hydraulic excavators) in Indonesia. Its products are marketed domestically and exported to Southeast Asian and African countries. Heavy equipment manufacturing companies are currently dealing with very tight competition and also sales fluctuations. To overcome these problems, high work productivity is needed to ensure work efficiency and effectiveness. The average work productivity at PT XYZ in fiscal year 2018 is 78% below the set target of 83%.

The implementation of 5S at PT XYZ is not running optimally. Based on Monday facility inspection data conducted every week by management from January to October 2019, it found that 73% (105 cases) were caused by the implementation of 5S which was not well controlled. Meanwhile, during the 2018 fiscal year there were 4 accident cases and 5 near miss cases which were mostly caused by unsafe conditions (63%).

In previous research studies it was found that 5S implementation has an effect on work productivity (Lucky, 2015). While 5S implementation also affects occupational safety and health (Widianti, 2015). Whereas occupational safety and health influences work productivity (Njihia, 2017; Maulana, 2020). Based on previous research studies,

according to the authors, the research gap is because no one is doing research on three variables in one study. Therefore, the authors conducted a research entitled "The Influences of 5S Implementation on Occupational Safety and Health and Work Productivity".

## II. THEORITICAL REVIEW

### A. 5S Implementation

In mass production, without the 5S implementation, many wastes are accumulated over the years, covering up problems, and becoming an accepted dysfunctional way of doing business. The 5S creates a continuous process for improving the work environment. Start with sorting (*seiri*), separating part or tool which are needed every day to perform value-added work from which are seldom or never used. Mark the rarely used items with red tags and move them outside of the work area. Then straighten (*seiton*), creating permanent locations for each part or tool in the order of how much it is needed to support the operator. The operator should be able to immediately reach for each commonly used part or tool. Then shine (*seiso*), making sure everything stays clean every day. Standardize (*seiketsu*), maintaining the first three pillars. Sustain (*shitsuke*), keeping the benefits of 5S working by making a habit of properly maintaining the correct procedures. Sustain is a team-oriented continuous improvement technique that managers play a critical role in implementing to support 5S (Liker, 2004).

### B. Occupational Safety and Health

The term occupational safety and health refers to the physical and psychological conditions of workers which are the result of the environment provided by the company. If companies make effective safety and health measures, fewer employees will experience the effects of short-term or long-term illness due to working at the company. The advantages of a safe and healthy workplace include (1) higher productivity due to reduced lost work days, (2) increased efficiency and healthier workforce, (3) reduced medical and insurance spending, (4) decreased payment levels employees and direct payments due to the lack of demands filed, (5) increasing the company's reputation (Jackson & Schuler, 2011).

### C. Work Productivity

Employee work productivity for a company is very important in measuring the success of running a business. Because the higher employee productivity, the company's

profits will increase. Productivity is a scientific comparison between the amount produced and the amount of each source used during the production process. These sources can be: (1) land, (2) raw and auxiliary materials, (3) factories, machinery and equipment, (4) labor. While the work productivity referred to in this research is for labor productivity (Affandi, 2016).

**D. Thinking Framework and Hypothesis**

The authors formulated the thinking framework based on theory as follows:

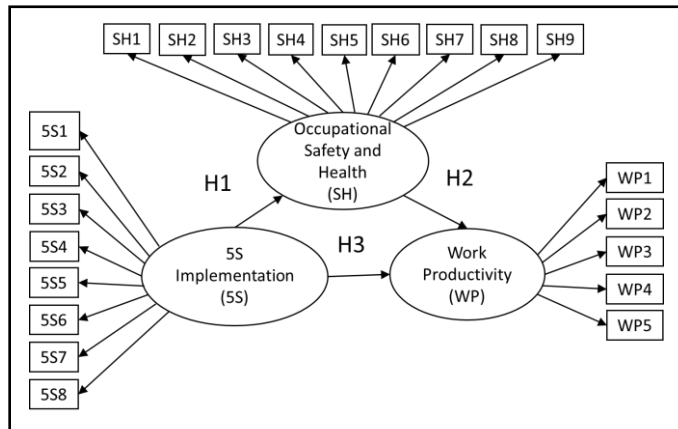


Fig. 1:- Thinking Framework

Figure 1 explains that the 5S implementation has 8 indicators namely storing only used goods (5S1), disposing of goods and tools that are not used (5S2), storing goods at predetermined locations (5S3), cleaning work areas according to schedule (5S4), check the condition of the equipment by cleaning it (5S5), available weekly work schedules that are clearly visible (5S6), labeling and or color coding for work areas and goods so that they are easily recognized (5S7), discipline in following the 5S schedule that has been set (5S8).

Occupational safety and health has 9 indicators namely the company analyzes accident data (SH1), safe environment and work tools (SH2), the company provides personal protective equipment according to risk (SH3), employees are involved in improving working conditions and environment (SH4), the company conducts medical check-up for all employees (SH5), the company provides adequate health facilities (SH6), the company conducts training on introducing work environment for new / transfer employees (SH7), organizes gathering events for all employees in reducing work boredom (SH8), the company provides health insurance (SH9).

Work productivity has 5 indicators namely employees can achieve the targets set by the company (WP1), employees have knowledge and skills that are in accordance with the work (WP2), employees are able to produce goods according to company quality standards (WP3), employees optimize work ability in completing work (WP4), the employee completes work in accordance with the allotted time (WP5).

Based on the thinking framework, the following research hypotheses can be drawn:

- H1: 5S implementation (5S) has a positive effect on occupational safety and health (SH).
- H2: Occupational safety and health (SH) has a positive effect on work productivity (WP).
- H3: 5S implementation (5S) has a positive effect on work productivity (WP).

**III. METHODOLOGY**

Based on the results to be achieved, this research is applied research. According to the level of exploration is a casual associative research that is to get a causal relationship between several variable situations which then drawn a general conclusion. This research uses a quantitative approach.

The population of PT. XYZ numbered 1,120 people. In this research 220 samples were used. Sampling in this study included in the category of non-probability sampling with purposive sampling technique. Where the sample selection is based on employees who are directly related to 5S.

In this research the measurement scale of the data is the semantic differential scale. This scale uses in range of 1 – 10, where the number 1 is the most nonconformity with actual conditions while the number 10 is the most conformity to actual conditions. Data analysis techniques using structural equation modeling (SEM) with AMOS software applications.

**IV. RESEARCH RESULT**

**A. Confirmatory Factor Analysis (CFA) and Reliability Test**

The CFA test aims to determine whether all indicators (manifest variables) can explain latent variables (constructs). This test is performed on each model of exogenous (independent) and endogenous (dependent) variables. If the p value  $\leq 0.05$  then it is declared significant, then if the value of the standard loading factor  $\geq 0.5$  then it is declared valid. Measurement of reliability in SEM uses composite reliability measure (CR) and variance extracted (VE) with the condition value of  $CR \geq 0.70$  and  $VE \text{ value} \geq 0.50$ .

Variable	Indicator	Std	P	CR	VE
5S	5S1	0.822	***	0.918	0.586
	5S2	0.758	***		
	5S3	0.708	***		
	5S4	0.765	***		
	5S5	0.711	***		
	5S6	0.862	***		
	5S7	0.786	***		
	5S8	0.696	***		
SH	SH1	0.667	***	0.900	0.502
	SH2	0.627	***		
	SH3	0.821	***		
	SH4	0.658	***		
	SH5	0.735	***		
	SH6	0.728	***		
	SH7	0.716	***		
	SH8	0.695	***		
	SH9	0.713	***		
WP	WP1	0.858	***	0.926	0.715
	WP2	0.889	***		
	WP3	0.854	***		
	WP4	0.821	***		
	WP5	0.803	***		

Table 1:- CFA and Reliability Test Result

Based on the results of each indicator (table 1) the construct has  $p \leq 0.05$  so that it is declared significant. Meanwhile standardized loading estimate  $\geq 0.5$ , it can be concluded that each indicator in the construct is valid. The CR value obtained is greater than 0.7 and the VE value is greater than 0.5 indicates that the constructs is reliable.

**B. Data Normality and Outlier Test**

Data used in this research using SEM applications, should have a normal distribution. The normality can be seen

through the comparison of the value of the critical ratio (c.r) and the z score (the result of reducing the average value which is then divided by the standard deviation) of the data obtained. The level of significance in the accuracy of the results that have been processed by SEM around 99% is equal to 0.1, where the results obtained z from the table are  $\pm 2.58$  and the data are normally distributed when the value of c.r ranges from -2.58 to +2.58.

Variable	min	max	skew	c.r.	kurtosis	c.r.
SH9	5	10	-0.259	-1.567	-0.421	-1.271
SH8	5	10	-0.384	-2.322	-0.762	-2.300
SH7	5	10	-0.257	-1.555	-0.641	-1.936
SH6	5	10	-0.305	-1.841	-0.371	-1.121
SH5	5	10	-0.139	-0.838	-0.658	-1.987
SH4	6	10	-0.369	-2.228	-0.772	-2.331
SH3	5	10	-0.367	-2.220	-0.797	-2.408
SH2	5	10	-0.385	-2.323	-0.797	-2.407
SH1	5	10	-0.348	-2.103	-0.715	-2.160
WP5	5	10	-0.309	-1.868	-0.159	-0.480
WP4	6	10	-0.233	-1.408	-0.700	-2.116
WP3	6	10	-0.383	-2.313	-0.806	-2.435
WP2	6	10	-0.143	-0.862	-0.697	-2.105
WP1	5	10	0.001	0.006	-0.701	-2.117
5S8	5	10	-0.231	-1.394	-0.604	-1.825
5S7	6	10	-0.175	-1.056	-0.632	-1.908
5S6	6	10	-0.343	-2.074	-0.607	-1.835
5S5	5	10	-0.110	-0.663	-0.315	-0.951
5S4	5	10	-0.129	-0.782	-0.790	-2.388
5S3	5	10	-0.402	-2.431	-0.735	-2.219
5S2	4	10	-0.334	-2.020	0.197	0.595
5S1	5	10	-0.194	-1.172	-0.313	-0.946
Multivariate					11.265	2.565

Table 2:- Normality test result

After the outlier data processing is performed, for the skewness and kurtosis cr values obtained for each indicator are in the range of -2.58 and +2.58, it is concluded that the data meets the normal univariate assumptions. While the value of cr for multivariate is 2.565. Because the values are in the range of -2.58 and +2.58, it is concluded that the data meets multivariate normal assumptions.

Outliers are observations that arise with extreme values both univariate and multivariate. By comparing the value of mahalanobis distance with the chi square table, if the value of mahalanobis distance d-squared is more than the chi square table will be declared outlier. Based on the table 3 the highest mahalanobis distance value is 47.338. Because the value is lower than chi square table (48.268), it means there is no outlier data.

Observation number	Mahalanobis d-squared	p1	p2
58	47.338	0.001	0.252
54	43.485	0.004	0.228
218	43.301	0.004	0.071
78	40.334	0.010	0.173
219	39.712	0.012	0.116
...	...	...	...
...	...	...	...

Table 3:- Outlier test result

C. Goodness of Fit Test

Model structure test results and data modification obtained goodness of fit results:

Goodness of fit indices	Cut off value	Output	Information
CMIN/DF	≤ 2.00	1.791	Good fit
TLI	≥ 0.9	0.939	Good fit
IFI	≥ 0.9	0.946	Good fit
CFI	≥ 0.9	0.946	Good fit
RMSEA	≤ 0.08	0.060	Good fit
AIC	default < saturated and independent	462.855 < 506.000 and 3277.781	Good fit
ECVI	default < saturated and independent	2.123 < 2.321 and 15.036	Good fit

Table 4:- Goodness of fit test result

Overall goodness of fit can be assessed based on a minimum of 5 (five) criteria that are met (Ghozali, 2014). So it can be concluded that in the results of this research the entire model is considered feasible and meets the goodness of fit criteria so that it can be proceed to the hypothesis testing stage.

D. Hypothesis Test

The relationship between constructs in the hypothesis shown by the standardized regression weight value. The

result of the hypothesis test output are explained in figure 2 as follow:

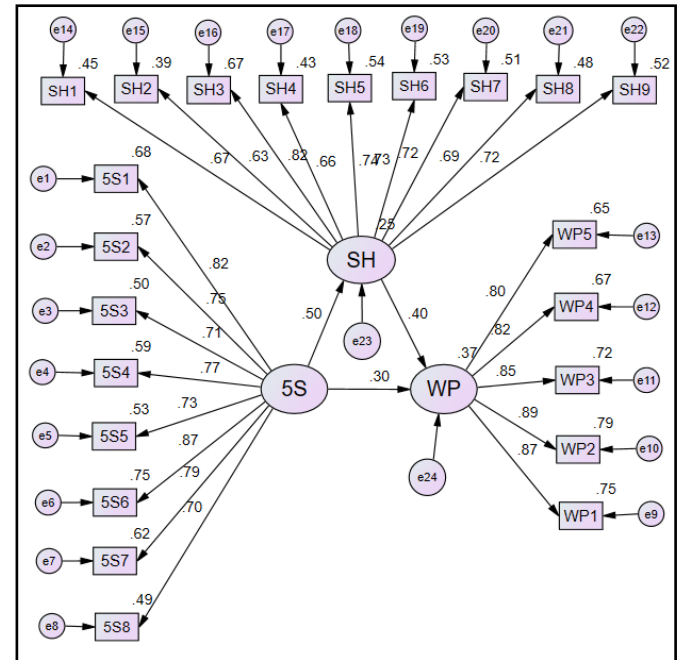


Fig. 2:- AMOS output of research model

Based on the model shown in Figure 2 from the AMOS program, the relationship between the independent variables and the dependent variable can be explained in the following table:

	S.E.	C.R.	P	Label	Std Est
SH <--- 5S	0.078	6.085	***	par_20	0.502
WP <--- SH	0.091	5.037	***	par_21	0.402
WP <--- 5S	0.081	3.980	***	par_22	0.297

Table 5:- Hypothesis test result

In 5S relation to SH. Because p value is lower than 0.05, **H1 is accepted**, it means that the 5S implementation (5S) has a positive effect on occupational safety and health (SH). This is in accordance with research conducted by Ramesh (2016), the results of his research show that 5S is an effective tool for improvement of organisation’s safety performance.

In SH relation to WP. Because p value is lower than 0.05, **H2 is accepted**, it means that occupational safety and health (SH) has a positive effect on work productivity (WP). This is in accordance with research conducted by Delia Pansiang (2017) in a shell cultivation company that simultaneously occupational safety and health has a significant effect on employee work productivity. Prayitno's (2015) research about field workers in telecommunications company shows the same conclusion.

In 5S relation to WP. Because p value is lower than 0.05, **H3 is accepted**, it means that the application of 5S (5S) has a positive effect on work productivity. (WP). Lucky Radi

(2015) researched that 5S influences employee work productivity at a shopping center in Indonesia.

The standardized regression weight of the 5S implementation (5S) variable is 0.502 with a positive direction meaning that there is a direct relationship ie if the 5S implementation (5S) increases by 1 unit the occupational safety and health (SH) will increase by 0.502. Tri Widiandi (2015) study in a research group where the 5S implementation has a positive impact on the safety of researchers with the creation of a work environment that is organized, safe and protected from potential hazards.

The standardized regression weight for the occupational safety and health (SH) variable is 0.406 with a positive direction meaning that there is a direct relationship ie if the occupational safety and health (SH) increases by 1 unit the work productivity (WP) will increase by 0.402. The standardized regression weight of the 5S implementation (5S) variable is 0.297 with a positive direction meaning that there is a direct relationship ie if the 5S implementation (5S) increases by 1 unit the work productivity (WP) will increase by 0.297. Based on Ramesh (2016) research conclusion, the integration of 5S concept with the safety management system (OHSAS 18001: 2007) has improved knowledge levels leads to the process improvements to eliminate the unsafe and hazards through continuous improvements. The enhanced safety in the work place has effect on the employee satisfaction and lower absenteeism the most important observation in the organisations that have obtained the best team working culture and results has a very strong system for training, motivation methods and good working atmosphere.

The 5S implementation (5S) has a direct and indirect effect on work productivity (WP). The direct effect of 5S implementation is greater than the indirect effect. Where the direct estimation parameter is 0.297, while the indirect effect is 0.202 as a result of the multiplication of the indirect estimation parameter (0.502 x 0.402) or it can be seen in the standardized indirect effect table of AMOS output results that show the same number. From this it follows that occupational safety and health is not a mediating variable.

In this research, respondents perceptions are based on conformity with the actual conditions. For 5S implementation by looking at the highest standardized regression weight is in 5S6, namely the availability of a clear weekly work schedule. Weekly work schedules are equipment checks, cleaning checks and others. Because this company has implemented 5S before and some of these schedules are SOPs before running the machine, in general the schedule is available. Next is 5S1, which is to store only the items needed. The implementation of this section is mostly carried out for the scope of work of the operator, so that there are not many items that make the movement become narrow. Operators realize that too much stuff is in their work area, making their movements less flexible. The next relationship is 5S7, namely giving a name code or color code. Just like in 5S6 the name code or color code has been implemented in the previous 5S. In some areas code names or color codes have

been provided to facilitate the placement of items and their quantities.

			S.E	C.R.	P	Label	Std Est
5S1	<-- -	5S					0. 824
5S2	<-- -	5S	0.0 79	12.69 5	***	par _1	0. 755
5S3	<-- -	5S	0.0 95	11.61 8	***	par _2	0. 707
5S4	<-- -	5S	0.0 73	13.04 7	***	par _3	0. 77
5S5	<-- -	5S	0.0 79	12.04 4	***	par _4	0. 726
5S6	<-- -	5S	0.0 71	15.56 5	***	par _5	0. 868
5S7	<-- -	5S	0.0 69	13.42 5	***	par _6	0. 785
5S8	<-- -	5S	0.0 81	11.52 1	***	par _7	0. 703
WP 1	<-- -	W P					0. 868
WP 2	<-- -	W P	0.0 54	17.98 7	***	par _8	0. 89
WP 3	<-- -	W P	0.0 55	16.47 9	***	par _9	0. 848
WP 4	<-- -	W P	0.0 57	15.41 1	***	par _10	0. 817
WP 5	<-- -	W P	0.0 58	15.02 8	***	par _11	0. 805
SH1	<-- -	SH					0. 67
SH2	<-- -	SH	0.1 17	8.408	***	par _12	0. 628
SH3	<-- -	SH	0.1 18	10.57 4	***	par _13	0. 818
SH4	<-- -	SH	0.0 99	8.739	***	par _14	0. 655
SH5	<-- -	SH	0.1	9.698	***	par _15	0. 738
SH6	<-- -	SH	0.1 12	9.576	***	par _16	0. 727
SH7	<-- -	SH	0.1 07	9.455	***	par _17	0. 717
SH8	<-- -	SH	0.1 09	9.174	***	par _18	0. 692
SH9	<-- -	SH	0.1 07	9.471	***	par _19	0. 718

Table 6:- Indicators and variables relationship

The low standardized regression weight is 5S3 or storing goods in the specified location. Even though there is already a name code or color code for the item, operators often don't put the item in its place. The condition seems to be untidy. Then the lowest and the source of the problem is the lack of discipline in running 5S schedules / rules, namely in 5S8. Discipline or sustain is the most difficult factor in implementing 5S. Sustain is a team-oriented continuous improvement technique where managers play a very critical

role to support the implementation of 5S. The best practice for sustain is to do regular (eg monthly) audits by managers (Liker, 2004). Audits are an essential management tool to be used for verifying objective evidence of processes, to assess how successfully processes have been implemented, for judging the effectiveness of achieving any defined target levels, to provide evidence concerning reduction and elimination of problem areas (Nurmazilah, 2015). In fact managers rarely conduct internal audits while audits from 5S secretariat will only be carried out if there are already submissions from managers. That caused PT. XYZ cannot run 5S optimally.

Next is the relationship of indicators with occupational safety and health variable. The relationship with the highest standardized regression weight is at SH3, which is the company providing risk-protective personal equipment (SH3). Personal protective equipment has been provided according to applicable regulations. Working conditions at PT. XYZ really needs it. Standard personal protective equipment such as helmets, safety shoes and protective glasses, and specific personal protective equipment such as welding masks, welding aprons, antistatic clothes and shoes for painting have all been provided by the company.

Furthermore, the company doing medical check-up for all employees (SH5). The company has implemented this to monitor the health conditions of employees. Some employees who have illness are rested or transferred to other parts.

The low relationship of occupational safety and health is in SH4. For SH4 or employee involvement in improving working conditions and environment, there are several accidents or near miss due to dangerous actions due to negligence or not thinking about the danger of what happens if they want to do certain jobs. Before starting work, the operator must hold a tool box meeting, especially to deal with irregular conditions. Besides KYT training (*Kiken Youchi Training*) or training in predicting hazard conditions is very necessary. Management has given a target to managers to carry out the training every month and reported at the safety and health meeting every month to remind managers. Although the manager has informed the safety and health meeting results to his staff, dangerous conditions caused by the environment and dangerous actions are still common.

Then the relationship with the lowest standardized regression weight is SH2, which is a safe environment and a safe working tool. One of the causes of accidents and near miss is unsafe environment and facility failure. Facility planners namely the Production Engineering department must carry out a risk assessment with the user (generally the Production department) before the facility is operated. Since getting the OHSAS 18001 certificate, the hazard assessment activity has been strengthened so that the possibility of work accidents due to environmental factors and facility failures can be minimized. The problem that often occurs is that old facilities that have been operated often escape examination. To overcome this problem Production Engineering has begun to adopt safety standards from the mother company and has begun to conduct a hazard assessment together with suppliers

/ makers before the facility is built. Whereas the Production department continuously strives to raise awareness with KYT activities and other safety activities. The two departments need to work together to create a better working environment and facilities. This is in accordance with Mawih (2019) research conclusion that unsafe conditions/environment are the most important things to improve in improving the occupational safety and health of the company.

Next is the relationship between work productivity (WP) and its indicators. The relationship with the highest standardized regression weight is WP1 or the employee has knowledge and skills according to the job. When compared to similar companies which produce heavy equipment, the ability of PT XYZ employees is above average for welding and machining. The skills of the employee are supported by a good skills training system.

The relationship with low standardized regression weight consists of optimizing work ability in completing work (WP4) and then completing work in accordance with a predetermined time (WP5). Both are related to predetermine deadlines. Even though the production and quality targets are met but the optimization of ability and time that is not good will incur additional costs such as overtime.

## V. CONCLUSIONS AND SUGESTIONS

### A. Conclusions

The implementation of 5S has a positive effect on occupational safety and health and work productivity as well as occupational safety and health has positive effect on work productivity. Implementation of 5S is not running optimally due to lack of employee discipline and inadequate management control. Whereas the findings for occupational safety and health are company inadequate facility planning and low participation of employees in promoting a safe environment. The low optimization of work ability in completing work and the low level of work completion in accordance with the predetermined time are the worst influence on work productivity.

### B. Sugestions

The conclusion states that the 5S implementation and occupational safety and health will increase employee work productivity; the company needs to do the following:

- 5S implementation requires discipline or sustain (*shituke*). Sustain is a team-oriented continuous improvement technique where managers play a very critical role to support the application of 5S. The best practice of sustain is regular audits. In the absence of regular audits by field managers, 5S activities that have been designed with high costs will become activities without control and get unexpected results.
- Company needs to increase employee awareness of safety aspects. Among them are the *tool box meetings* before starting work and by holding a refresh safety training.
- Company needs to improve safety for the environment and working tools. For new facilities, the facility planning department must conduct a risk assessment to ensure the

safety of the facility together with the supplier / maker before the facility is made. Prior to operation, the planning department must conduct a joint risk assessment with the user department. For facilities that are already operating, the relevant department must always conduct hazard prediction training and risk assessment continuously by always updating the changes in safety regulation.

- Company needs to find out the causes of the lack of employee work time optimization. Then the company needs to improve it.

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