

# **Implementing ABC Tools to Increase Behavior Based Safety at Bolon House Construction in Ulos Village North Sumatra**

**Sartika Rini**

Faculty Member, Department of Industrial Engineering  
Binus University, Jakarta, Indonesia  
sartika.rini@binus.ac.id

## **Abstract**

Today, many organizations worldwide from manufacturers to construction building, to governments are still struggling to achieve their safety performance by increasing people's behavior and mind sets to achieve zero accident. There's a tools that can be used as an approach to reduce the accidents called Behavior Based Safety (BBS). The value of this tool is obvious. In business, including building construction need an improvement, especially in safety, they generally result in better safety, quality, and productivity. Through this paper we will discuss how to provide the latest state-of-the-art Behavioral Safety Process and ABC Tools for the involvement of workers and contractors and building a positive safety culture in the company. By doing the ABC method, we will learn how the problem can be solved by measuring the Antecedent, Behavior, and Consequences of the unsafe condition and unsafe action to prevent the accident of workers and also to increase safety performance, safety awareness, and productivity.

## **Keywords**

Zero Accident, Behavior Based Safety (BBS), ABC Method, Company Culture, Productivity.

## **1. Introduction**

Bolon house is a traditional Toba Batak house in West Sumatra. The Bolon Toba house, called Jabu Bolon, is square in shape and is sometimes inhabited by 5 to 6 nuclear families. House floor height approximately 1.75 meters above the ground, so given stairs to climb it. The elements that make up Ruma Bolon Toba divided into three parts vertically. Tarup / tayub, namely the roof as a building protection, at the top there is also space as a warehouse and where the parmuscians play music to accompany the tor-tors in the front yard. The middle part is a place to live, where the main activity of the house is as a place to liveresting place happens here. And lastly Bara, the bottom that functioned as a warehouse, usually used to store wood as well as a cage for livestock. The roof of the Toba Bolon House is in the form of a shield, the basic idea of this roof shape is from the back of the buffalo, the curved top of the shape adds to the aerodynamic value against strong lake winds. Roof construction consists of truss, roof truss, and roof covering. The roof covering uses palm fiber material, which is easily available local area. The roof of the Bolon Toba house is shaped like a shield, the basic shape of this roof is from the back of the buffalo, the height of the roof itself is around 4-5 m.

Industrial development in the world causes changes from simple or traditional technology becomes advanced technology. Technology progressively progressing could present great danger, so necessitated control techniques to reduce the negative impact on the workforce, community, as well as the environment (Syahifudin, 2013). Safety culture is a concept that concerns humans which have internal aspects invisible (mind), and visible external aspects (behavior) its existence is present in a social context (Tarwaka, 2015). Work accidents not only cause casualties and material losses for workers and employers, but can disrupt the overall production process, damage the environment, and have an impact on the wider community. Losses that occur are in the form of economic losses (such as: damage to tools / machines; materials and buildings; medical and maintenance costs; accident benefits; reduced production and quality; accident compensation and labor replacement), non-economic losses (such as: suffering of victims and their families. , work activities have stopped temporarily, and the loss of working time) (Anizar, 2009). Based on data from the International Labor Organization (ILO), in 2012 the number of work accident cases in the world reaches 6,000 people each the year. In 2013, the world's death toll due to the work is reaching 2.3 million each year.

From the number of events 2 work accidents that occur at the world level have increased significantly very significant. This can be said that the lack of a management system a company that plays a role in occupational safety and health (Amirrudin, 2012).

According to PT. Jamsostek, the number of work accidents in Indonesia in the year 2012, there were 103,074 cases where every day there were no less than 6 workers died due to a work accident. According to data from the Ministry of Manpower and Transmigration in Indra M, et al (2014), states that until 2013 in Indonesia every day no less than 7 workers die as a result work accident. Indonesia is a country with a high level of work safety relatively low. This figure is relatively high compared to European countries where only 2 people die per day due to work accidents (Indra et al. 2014).

Based on data from the Ministry of Manpower and Transmigration, the number of accidents at work in Indonesia Quarter IV 2014 was 14,519 cases, for the number of victims there were 14,257 cases (Depnakertrans, 2014). In the first quarter of 2015 compared to in 2013 and 2014, the number of work accidents nationally was still very high that is 103,000 per year. Among these, 2,400 cases were causing workers to die, so that an average of 8 people died the world every day (Rahmatika, 2015).

Based on the Iranian Social Security Organization (2015), the rate of work accidents in Iran has increased by 65% from the previous year. This shows that 80-90% of work accidents are related to unsafe behavior of workers. According to research by Abbasi and et al 2015, unsafe acts of manufacturing industry workers accounted for 59.2% of accidents in Kermanshah, while the oil and gas industry contributed 24.5% and 26.7%.

According to data from the U.S. Bureau of Labor Statistics, U.S. The Department of Labor in 2013 obtained work accident data in 2010 with a total of 4,690 work accidents in Iran. Of the 4,690 cases of work accidents, 329 cases (7%) occurred in the manufacturing industry, cases in other industries (construction, etc.) amounted to 93%. In 2011, total accidents at work reached 4,693 cases, work accidents in the manufacturing industry were 327 cases (6.9%). In 2012, the total number of work accident cases reached 4,383 cases, with 314 cases (7.2%) occurring in the manufacturing industry. Based on data on work accident cases 4 in the last three years, it can be seen that the average work accident cases contributed by work accidents in the manufacturing industry are equivalent to 7% (Alvan, 2015). Prevention of work accidents is carried out with a focus on reducing worker's unsafe actions by identifying which is done through the Behavior Based Safety (BBS) approach. According to Cooper (2009), Behavior Based Safety (BBS) is a collaborative process related to safety between management and labor that is sustainable with the attention and actions of one person and others as well as safety behavior. BBS encourages individuals to consider the potential hazards that result in incidents and accidents, and to assess behavior whether it is safe behavior or unsafe behavior. BBS emphasizes the aspects of human behavior towards accidents in the workplace (Health and Safety Authority, 2013).

According to DuPont STOP (Safety Training Observation Program), the accident ratio is 1: 30: 300: 3000: 30000, which means for every 30000 hazards or unsafe acts or conditions unsafe, there will be 1 fatal accident, 30 serious accidents, 300 times serious accidents, and 3000 minor accidents.

In implementing this Behavior Based Safety (BBS), all workers are required to observe other workers by filling out an observation sheet at least once a month. The observational data becomes the benchmark and material for the consideration of the Health Safety Environment (HSE) department in continue or improve existing Safety programs. This Behavior Based Safety (BBS) application describes all activities existing in the company, both normal activities carried out by each worker day or abnormal activities performed by workers. Normal activity among others, doing work in accordance with SAFETY regulations and company's procedures. Abnormal activities include workers doing unsafe actions at work areas, workers carry out activities to rescue an event that can detrimental to both workers and companies.

The Safety culture is a unity of three aspects, namely of the safety aspects values and the perception of Safety for each worker, aspects of Safety behavior at work and aspects of the organization and management of Saety in the company. These three aspects these interact and are related and cannot stand alone separate (Tarwaka, 2015).

Based on journals that examine safety culture, there are several factors that support the creation of a safety culture in the company / industry. These factors are management commitment, worker involvement, safety leadership, worker

communication, OSH regulations and procedures, worker competence, work environment, influence of colleagues, knowledge of Saety, safe behavior, motivation, and safety management practice. Worker involvement is important components to create safety behavior and safety conditions in workplace. The involvement of workers in implementing the safety culture can be increase productivity and reduce the incidence of work accidents (Wieke Yuni et al 2012; Andi et al 2005; Erzin Hani et al 2012; Herbert Charles et al 2004; Rozlina et al 2012).

According to Heinrich in the book "Accident Prevention" suggests a theory of cause and effect of accidents is known as the "Domino Theory" that the occurrence of an accident or injury is caused by five factors successive causes, namely habits, mistakes, actions and conditions not safe, accident, injury (Tarwaka, 2014).

To prevent accidents, it is enough to throw the wrong one domino card or break the chain of the dominoes. Based on Heinrich's theory, Bird and Germain (1986) modified it domino theory by reflecting into relationship management directly with the cause of the accidental loss. Loss-causing model involving five causative factors in sequence are (Tarwaka, 2014):

#### 1. Lack of supervision

According to Bird and Germain, there is a lack of supervision is the first sequence to an event that results in losses. Supervision in this case is one of the four management functions, viz planning (planning), organizing (organizing), leading (leadership), and controlling (controlling) (Tarwaka, 2014).

#### 2. Source of Basic Cause

The underlying cause is the general underlying factor against The incident or accident includes (Tarwaka, 2014):

- 1) Personal factors, including lack of knowledge, skills, physical and mental abilities, Motivation, physical stress, or mental.
- 2) Job Factor, including leadership and supervision inadequate, inadequate engineering, lack of maintenance adequate, inadequate tools and equipment, insufficient purchase of goods adequate, inadequate work standards, wear and tear due to use, abuse of power

#### 3. Cause of Contact

These factors include actions and conditions that are inherently unsafe directly causing accidents that can normally be seen and felt.

##### 1) Unsafe Act

Namely a violation of safe working procedures, so that it can raises the chance of an accident or dangerous action from the workers who may have various backgrounds (Tarwaka, 2014:13):

- a. Lack of knowledge and skills (lack of knowledge and skills).
- b. Fatigue and burnout (fatigue and boredom).
- c. Unsafe attitude and habits.
- d. Not mastering / not yet skilled with new equipment or machines.
- e. Decrease in concentration (difficulty in concentrating) while working.
- f. Ignorance of labor.
- g. Lack of improper motivation from the workforce.
- h. Lack of job satisfaction (low job satisfaction).
- i. Attitude to self-harm.

##### 2) Unsafe Condition

Unsafe conditions in machines, equipment, aircraft, materials, environment, workplace, work processes, nature of work, and work systems. Inner environment in broad terms not only the physical environment, but the factors related to it provision of facilities, past human experience as well as shortly before duty, work organization arrangements, relations among workers, economic conditions and politics that can interfere with concentration (Tarwaka, 2014).

#### 3. Incidents

Incidents occur due to contact with energy, or hazardous materials. Accidents in the form of collisions, being hit by moving objects / tools, being pinched, and in contact with electricity, heat, cold, radiation, and toxic materials (Tarwaka, 2014).

#### 4. Losses

Losses are the series of previous factors resulting in losses to human, property or property, and the production process (Tarwaka, 2014).

Hazard is anything including a situation / action that has the potential cause accidents/ injuries to humans, damage or other disturbances. Hazard is inherent and a part of something substances, systems, conditions / equipment. It's not a danger, it's a factor contributes to the occurrence of accidents or the severity of the incident. Hazard is also referred to as the risk of a "potential" (Ramli, 2010). See Figure 1 and Figure 2.

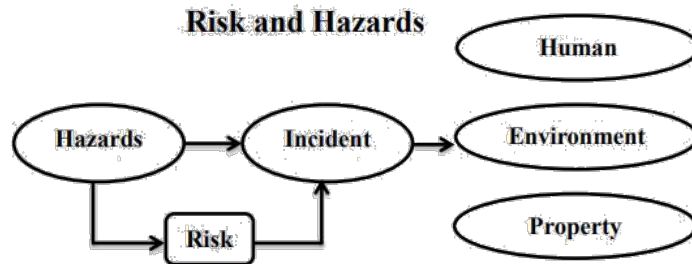


Figure 1. Risk and Hazard (Ramli, 2010)

According to Ramli (2010), risk control is a step determines the overall risk management. See Figure 2.

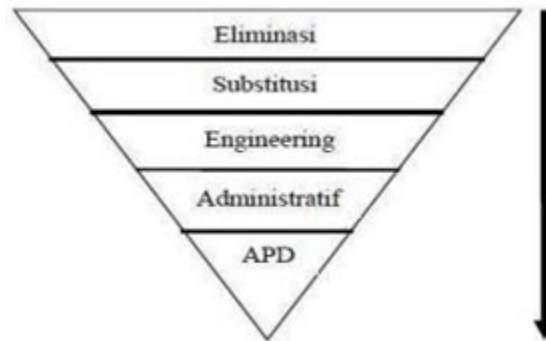


Figure 2. Risk Control (Ramli 2010)

Strategy in control risk is carried out in several ways :

a. Elimination

Elimination is risk control that is permanent, must be tried to be implemented as the first priority. Risk can be avoided by removes the source. If the source of the hazard is eliminated, there is a risk that will arise can be avoided (Ramli 2010)

b. Substitution

Substitution is a hazard control technique by changing tools, hazardous materials, systems or procedures with safer ones or more low danger (Ramli 2010).

c. Engineering Control

Sources of danger come from technical equipment / facilities in the environment work, so that hazard control can be carried out through improved design, addition of equipment, and installation of safety equipment (Ramli 2010).

d. Administrative

Hazard control can also be carried out administratively, that is by reducing contact between the recipient and the source of the hazard, for example by arranging a work schedule, rest, work methods or safe work procedures, rotation, or health checks (Ramli, 2010: 104).

e. Personal Protective Equipment

Personal protective equipment is used to control risk, reducing consequence or severity.

According to Tarwaka (2014) types of Personal Protective Equipment or PPE :

a. Headwear

Headwear is used to protect hair that gets tangled in the machine rotating and to protect the head from the danger of being hit by sharp objects or hard, danger of falling objects or being hit by floating objects, splashes corrosive chemicals, hot sunshine, etc. (Tarwaka, 2014). Examples : Safety Helmets, Hats or Cap.

b. Eyes Protection

Eye protection or eyes protection is a tool that works for protects the eyes from splashing corrosive chemicals, dust, and particles air, gas, or vapor that can cause eye irritation, electromagnetic wave radiation, solar radiation heat, blow to objects hard, and so on (Tarwaka, 2014). Examples : Spectacles, Goggles, Safety Glass.

c. Ear Protection

Ear protection or ear protection, which is the tool used to reduce the intensity of the sound that enters the ear (Tarwaka,2014: 290). Examples : Ear Plugs, Ear Muff

d. Respiratory Protection

Respiratory protection is an appropriate tool which is used to protect inhalation from the risk of exposure to gases, vapors, dust, contaminated or toxic air, corrosion, or stimulation (Tarwaka, 2014). Example : Mask, Respirator

e. Hand Protection

Hand protection is a tool that is used used to protect hands and other parts from sharp objects or scratches, chemicals, hot and cold objects, and contact with electrical items (Tarwaka, 2014). Example : Gloves, Mitten, Hand pad, Sleeves.

f. Feet Protection

According to Tarwaka (2014), foot protection equipment is a tool that serves to protect the feet and other parts from hard, sharp, metal or glass objects, chemical solutions, hot objects, and contact with electrical items. Example : Safety Shoes

g. Body Protection

Body protective clothing or body protection is a useful tool used to protect all or part of the body from sparks, temperature hot or cold, chemical liquids, and so on. Protective clothes can be in the form of an apron that covers part of the wearer's body from the chest area to the knees or overalls, namely covering all parts of the body (Tarwaka, 2014).

h. Safety Body Harness

Safety body harness or safety belt is a protective device serves to protect the body from the possibility of falling from a height, as in climbing, and in work buildings construction (Tarwaka, 2014).

The purpose of this research is that every company must be able to pay attention and protect all its employees at work by complying with the applicable rules and regulations in order to avoid work accidents. In addition, to assess the maturity level of the OHS culture and the implementation of the OHS management system in the workplace, provide recommendations for corrective and preventive actions to improve the OHS culture that has a significant impact on reducing the accident rate and improving the company's OHS performance, as well as providing recommendations for corrective and preventive actions to improve the safety and health of the company. Safety and Health culture which has a significant effect on reducing accident rates and increasing company OHS performance. By implementing this BBS, the company will be able to decrease in the number of reports of work accidents, creating a safe work environment by creating a strong and well-rooted safety culture in the work environment, reducing the accident rate and losses due to work accidents, long term investment (lasts for a long time), and proactive efforts to minimize the potential for accidents caused by human factors.

## **1.1 Objectives**

By doing the ABC method, we will learn how the problem can be solved by measuring the Antecedent, Behavior, and Consequences of the unsafe condition and unsafe action to prevent the accident of workers and also to increase

safety performance, safety awareness, and productivity. Based on research from the project area, there are still many unsafe conditions and unsafe behavior where this will have the potential to cause work accidents. The limited and minimal personal protective equipment provided by the company illustrates how the company still does not care about the health and safety of its employees. Only some of the workers are equipped with personal protective equipment while others do not use personal protective equipment in carrying out their work. There are still many workers who work at heights without using a safety body harness, safety shoes, helmet, gloves in doing their job. From this it can be seen that there is a lack of awareness about safety at work. If this situation is ignored, the possibility of work accidents due to falling, slipping will occur, which will harm the employees and also the company have to pay the medical costs for the workers.

## **2. Literature Review**

Based on work accident statistics that more than 85% of accidents are caused by unsafe action or dangerous behavior and with this BBS, unsafe action as the cause of accidents can be reduced which ultimately achieves zero accidents. Occupational Health and Safety (OHS) is a continuous process involving all parties in the organization, so that if each member has behaved in a Safety-based manner or Behavior Based Safety(BBS), it is hoped that an OHS culture will be achieved in the company.

Behavior based safety is a system that companies use for changing unsafe employees behavior and attitudes. According to Straub (2005: 32) in Saodah (2015: 28), behavior based safety educates employees to find the root causes of accident-prone behavior. This is awakening the tendency of employee behavior which causes a high risk of accidents work. The observed behavior is documented and discussed in meetings, so that everyone can have a safer environment.

According to Rahardjo (2010) in Tarwaka (2015), behavior based safety is human safety behavior in the work area in identifying hazards as well as assessing the potential risks that may arise so that they are acceptable in doing so work that interacts with the activities, products, and services performed.

According to Geller (2001) in Saodah (2015), behavior based safety is process approaches to improve occupational health and safety environment by helping a group of workers to identify OHS-related behavior:

1. Collecting data on groups of workers
2. Provide two-way feedback on safety behavior and occupational health
3. Reduce or remove system barriers to further development continue.

The most important elements in a process can also have an impact on successful implementation of safe behaviors. Several experiments were conducted with designing a process to see the effectiveness of positive changes against safe behavior and reduce the number of work accidents in order cost effectiveness. The components that exist in the application effort safe behavior, including:

1. Identification of at-risk behavior.
2. Development of an appropriate observation checklist.
3. Train everyone and observers in making observations.
4. Continuous assessment of safe behavior.
5. Feedback the feedback.
6. Raising the spirit of involvement in BBS activities, it is necessary given awards for individuals and teams.

There are many variations of approaches that can be used in implementation BBS, but it all depends on the objectives in implementation. In the beginning the implementation of this program must have been agreed upon by the internal management achievement targets, and determine the reference per period, so as to achieve the target of worker safety behavior becomes the practice implementation safety observation program.

Recent research data indicate that at-risk behavior is the root cause of 85 to 90% of all workplace injuries (Krause, 1999). Because of this revelation, many large and respected organizations are now looking at adding behavioral based safety (BBS) to their arsenal of tools to prevent workplace injuries. BBS can best be described as workers looking after each other. BBS is a method of sampling behavior (through observation) in the workplace, and comparing what was observed against a specification of safe performance. After an observation, feedback is used to reinforce all observed safe behaviors, encouraging them to continue. Constructive feedback then takes the form of

structured two-way discussions in which the observer and the performer identify and understand the root cause of any observed at-risk behavior and to provide corrective actions to promote safe behavior. As with other quality control processes, BBS requires behavior sampling, data review, and control strategies to be effective. In the world of Behavioral Based Safety, behaviors are seen as either “safe” or “at-risk.”

The big question is, why do workers take risks? This question is asked repeatedly, especially after an incident. Research indicates that the reason people continue unsafe behavior, regardless of knowledge, is because of the “positive, immediate and certain consequences associated with the unsafe behavior” (ShamRao, 1999).

Consequences can either increase behavior or decrease behavior. The manner in which consequences compete for control of behavior is based on three factors; significance, timing and probability.

The tool that we can use as a BBS approach is ABC Analysis that consists of **Antecedents, Behavior and Consequences**.

**Antecedents** - According to Thomas Krause, antecedents are preexisting sensory or intellectual input that trigger behaviors and influence decision-making. Antecedents include triggers of behaviors that prompt action as well as constraints that shape action, indicating what is and what is not behavior

**Behavior** - According to E. Scott Geller, behavior refers to acts or actions by individuals that can be observed by others. In other words, behavior is what a person does or says, as opposed to what he or she thinks, feels, or believes. Behaviors consider the behaviors that are required to complete the objectives. Behaviors lead to consequences, which may be positive, negative or sometimes a combination of both.

**Consequence** - According to Aubrey Daniels, a consequence is simply what happens to the performer as a result of the behavior. Consider the example of a worker not wearing hearing protection in a high noise area. Before beginning a behavioral based safety process, many practitioners recommend first understanding how the employees perceive the current safety efforts. This understanding allows the organization to assure that any perceived shortcomings in the traditional focus on conditions are addressed before attention is turned to behavior.

The most common tool to accomplish this is the comprehensive safety culture assessment (HSE, 1999). Safety culture is defined as values and mutual trust that interacts with organizational structures and systems control to generate norms of behavior. Every member the organization behaves in harmony with its goals to avoid it happening injury to humans, improve management commitment, enhance job satisfaction, and reduce physical complaints (Somad, 2013). Based on the evolution of OH&S performance, OSH has evolved over time and changes in behavior. Even though the engineering control has been carried out and OSH procedures, the behavior of managers, supervisors, and workers is not supportive realization of working safely, so that the incidence rate remains high. For this reason, the world's safety experts have begun to focus their efforts on improving performance with a safety behavior change program that can ultimately improve safety culture so that the incidence rate can decrease (Somad, 2013).

### **3. Methods**

In this study, there are five indicators of safety behavior to assess behavior based on safety for workers in the construction building of Bolon House:

1. Top management commitment consists of: Safety equipment, Safety training, OHS supervision, employee dismissal policies that do not comply with regulations and Safety procedures, improving Safety performance.
2. OHS regulations and procedures include: the importance of OHS rules and procedures, consistency of application of OHS regulations and procedures, socialization of regulations and OHS procedures, review / update of OHS regulations and procedures, sanctions for violations OHS regulations and procedures.
3. Worker communication consists of: providing OSH information, information work accidents, communication with managerial parties, and communication with workers.
4. Worker competencies consist of: worker requirements and scope, workers' knowledge of hazard risks, the ability of workers to fulfill OHS regulations and procedures, enhancing worker competence regarding Safety.
5. Worker involvement consists of worker involvement in delivery OHS information, OHS programming, accident or condition reporting

The focus of research is the subject matter of a general nature, obtained after the researcher did the grand tour observation and the grand tour question (general exploration) (Sugiyono, 2010: 288). The focus in this research is overview of behavior based safety as an effort to reduce unsafe action and unsafe condition in building of Bolon houses the traditional village in North Sumatra.

The following steps show how a ABC tool is applied:

- Describe the behavior (Pin Point)
- List all antecedents and consequences and describe strength of consequence
- Determine which consequences are motivating behavior
- Solution to problem behavior—make weak consequences strong
- Observation checklist (Table 1)
- Define ABC tool : Antecedents, Behavior, and Consequences
- Spot check behaviors
- If it is safe behavior, mark ‘safe’
- If it is unsafe behavior, mark ‘unsafe (Table 2)’

Table 1. Observation Check List

**OBSERVATION CHECK LIST**

Day/Date :  
Completed by :  
Approved by :

Area/Location : Bolon Traditional Houses - North Sumatra

No.	Picture	ABC Tool								Observation		Feedback		Comments
		Antecedents (A)	Behavior (B)		Consequences (C)					Safe	Unsafe	Positive	Corrective	
		Punishment	Extinction	I	F	C	U	•	-					
1		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact											<input checked="" type="checkbox"/> Using Complete PPE	
2		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact											<input checked="" type="checkbox"/> Using Complete PPE	
3		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact											<input checked="" type="checkbox"/> Using Complete PPE	

Measurement

- Records observations and analyses
- Uses objective measurement
- Measures safety process, not just results
- Gives feedback to employees and captures small improvements
- Is specific about performance and becomes positive reinforcement Positive Verbal Feedback
- Be specific
- Be sincere
- Deliver immediately
- Be personal
- Do not use ‘but’ or ‘however’
- Do not ignore unsafe behavior
- Acknowledge small improvements
- Be objective
- Be specific
- Use a questioning approach



### 4. Data Collection






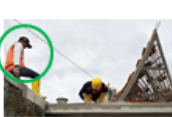



Table 2. Result










#### OBSERVATION CHECK LIST



Day/Date :  
Completed by :  
Approved by :

Area/Location : Bolon Traditional Houses - North Sumatra

No.	Picture	ABC Tool										Observation		Feedback		Comments
		Antecedents (A)	Behavior (B)		Consequences (C)						Safe	Unsafe	Positive	Corrective		
			Punishment	Extinction	I	F	C	U	*	-						
1		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact														<input checked="" type="checkbox"/> Using Complete PPE - Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
2		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact														<input checked="" type="checkbox"/> Using Complete PPE - Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
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No.	Picture	Antecedents (A)	ABC Tool							Observation		Feedback		Comments	
			Behavior (B)		Consequences (C)					Safe	Unsafe	Positive	Corrective		
			Punishment	Extinction	I	F	C	U	+						-
8		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)	
9		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)	
10		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)	
11		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
12		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
13		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
14		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
15		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
16		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input type="checkbox"/> Caught between <input type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)

No.	Picture	ABC Tool										Observation		Feedback		Comments
		Antecedents (A)	Behavior (B)		Consequences (C)						Safe	Unsafe	Positive	Corrective		
			Punishment	Extinction	I	F	C	U	+	-						
17		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X						X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)	
18		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
19		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
20		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
21		<input checked="" type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
22		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact		X	X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
23		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
24		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		
25		<input type="checkbox"/> Over Exertion <input checked="" type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input checked="" type="checkbox"/> Welding Flash <input checked="" type="checkbox"/> Heat Contact <input checked="" type="checkbox"/> Toxic Contact	X		X	X					X		<input checked="" type="checkbox"/> Using Complete PPE	- Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)		

No.	Picture	ABC Tool										Observation		Feedback		Comments	
		Antecedents (A)	Behavior (B)		Consequences (C)						Safe	Unsafe	Positive	Corrective			
			Punishment	Extinction	I	F	C	U	+	-							
26		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact	X			X		X							X		<input checked="" type="checkbox"/> Using Complete PPE - Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)
27		<input type="checkbox"/> Over Exertion <input type="checkbox"/> Struck by <input checked="" type="checkbox"/> Caught between <input checked="" type="checkbox"/> Fall(s) <input checked="" type="checkbox"/> Struck against <input checked="" type="checkbox"/> Slip <input type="checkbox"/> Welding Flash <input type="checkbox"/> Heat Contact <input type="checkbox"/> Toxic Contact		X		X		X							X		<input checked="" type="checkbox"/> Using Complete PPE - Need to educate people about safety at work place - Need to train people to think safety and work safely - Coach them to be more aware about safety - Ask them what their family do if something happen to them (Accident and Incident)

## 5. Results and Discussion

The unsafe condition and unsafe action/behavior are found on the building construction of Bolon house in Ulos Villages in North Sumatra. The problem had been showed in the pictures below. By using the ABC tool, we can prevent the problem occur within a solid team which have same goal to improving the safety awareness and increasing safety culture. The middle level managers tried to define the problem and involve the supervisor, operator, to identify and solve the problem. With the ABC tools approach we had discussed with the operator to ensure that they understand about safety awareness to protect themselves. Also to encourage them to be more safe while they doing their job and look after each other. In detail the personal protective equipment that must be used for this project work is divided into 5, namely safety shoes, helmets, safety body harnesses, gloves, and vests. Based on observations in the field, from total 120 worker, can be seen that only 25% or 30 of workers who use personal protective equipment but are not complete, and 75% or 90 of workers do not use personal protective equipment at all. If it is described, workers who use incomplete personal protective equipment are only 10 people who wear safety shoes, only 30 people who use helmets, only 3 people who use safety body harnesses, only 4 people who use gloves, and only 36 people who use vests. person. And workers who do not use personal protective equipment at all there are 110 people who do not wear safety shoes, 90 people use helmets, 117 people do not use safety body harnesses because they don't work at heights, 116 people don't use gloves, and 84 people don't use vests. See Figure 2 and 3.

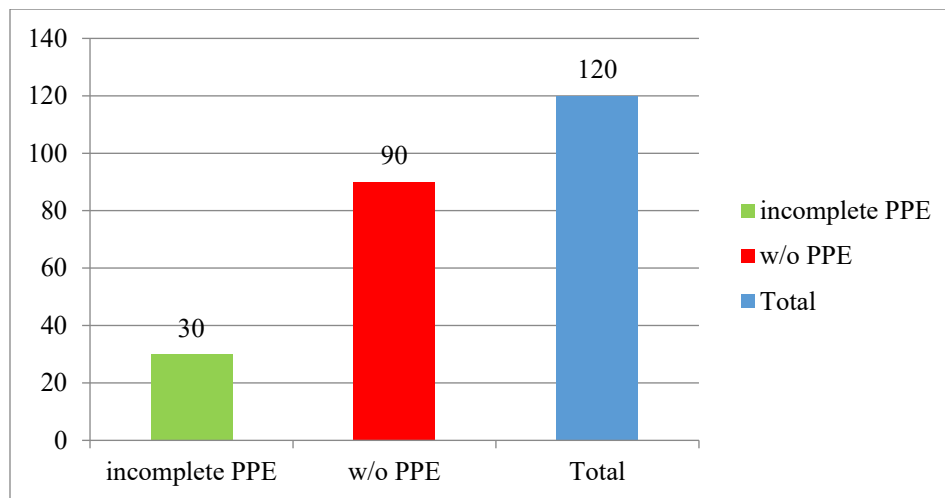


Figure 2. Total Worker items

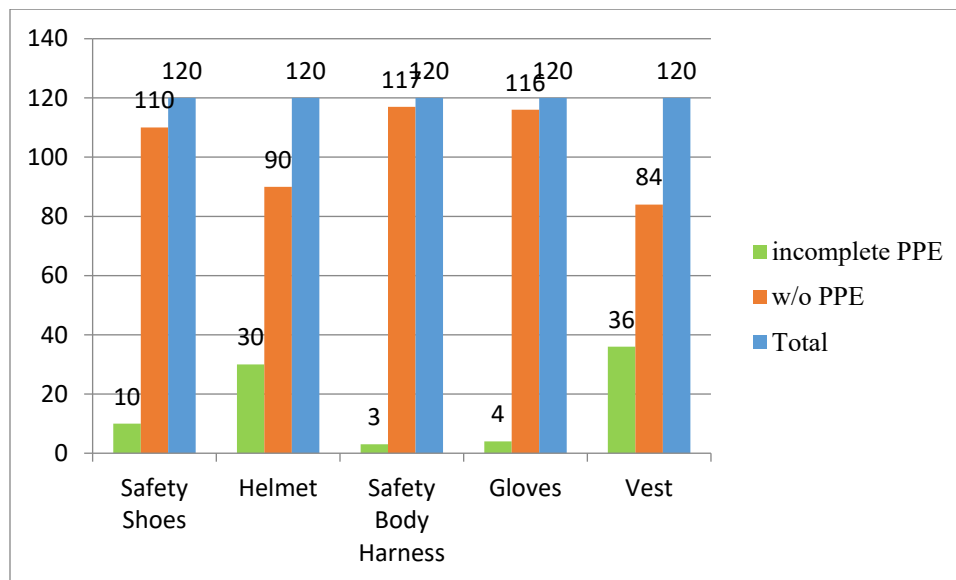


Figure 3. Data worker based on PPE items

## 6. Conclusion

Company could encourage their workers to improve their workplace by increasing safety performance to achieve company goals with zero accidents. The company has responsibility to provide workplaces are safe and productive. BBS can be applied when the worker adopts a positive attitude toward changing and improving the way they work and puts the attitude into action. By following safety standard, the workers will have a better workplace with small risks. BBS is the fundamental of the company safety culture, as a business practice, a tool, the way of learning, thinking, and improving. Within a gradual process that has been an accumulation from many decades of effort. People learned how to identify and understood the unsafe condition and unsafe action and solve the problem. Company's safety performance metrics are increasing again within a better observation and it will become stronger in the future utilizing ABC concept as a tool in the organization, business practices and culture. Company need to develop the safety culture to continue the thinking process of people which involves individuals thinking outside of themselves. To ensure the problem solving is proper implement and well addressed, the authors recommend that a company need to ensure that employees in problem solving situations not to jump to conclusions that may become an obvious solutions. Those solutions normally have a component of emotional attachment which may not address the true issue. The company safety culture must engage other team members who can contribute to the deeper and better solution. Missing the optimum opportunities will affect to company safety performance and it will accumulate throughout the year. The organizations that implementing the ABC and BBS concept should drive, by management and good leadership thought processes. With proper training and mentoring, more employees should become champions of safety improvement. ABC and BBS must be attached in people's mind set and in everything that being done in the organization to help the employees constantly learn how to be more safe, effective through following the safety standard. ABC tools leads to improved Productivity, increased safety, and better morale. When ABC is first introduced, many companies see safety and productivity increase by 30 to 100 percent ABC tool helps and lets management become more attentive to people's need because it creates a good environment and morale. The ABC tool strategy strives to improve the safety performance while paying attention to results. The ABC method is good for many companies to solve the unsafe condition and unsafe action/behavior. The case study proved that it also represents a suitable tool for the searching and effective implementing good improvement at the Ulos Villages, especially on Bolon traditional house. Method that encourages people to be more creative, explore the critical thinking and communicate as a team, especially the improvement team. Innovation needs interdisciplinary team approach. Systematic and well-structure approach with the proper steps, which allows to study all aspects of the unsafe condition and unsafe action problems with all the consequences.

Open and simply understandable approach that allows to integrate already known and in the company used thinking methods by giving a positive feedback for safe performance and corrective feedback for unsafe behavior. Transparent process of the searching and implementing the improvement through visual management to measure results objectively.

Encouraging efforts is important when process improvement is the concern. A system should be developed that rewards the efforts of workers and managers, rather than simply giving recognition based on an end result. The desired result is to have an ongoing effort to improve. ABC is tools of Behavior Based Safety that can improve safety awareness and safety performance when we do it together, it build a better, stronger, more profitable company. Good Safety means Good Company.

## **References**

- Agnew, J., & Ashworth, C, Behavior-based safety: Setting the record straight. Aubrey Daniels International Inc, 2012. <http://aubreydaniels.com/pmezine/behavior-based-safety-setting-record-straight>
- Braksick, L.W., Unlock Behaviour, Unleash Profits. McGraw-Hill: New York, 2007.
- Daniels, A.C., Bringing out the Best in People. McGraw-Hill: New York, 2000.
- McSween, T.E., The Values-Based Safety Process. John Wiley & Sons: New Jersey, 2003..
- Myers, W.V. , McSween, T.E., Medina, R.E., Rost, K., and Alvero, A.M., The implementation and maintenance of a behavioral safety process in a petroleum refinery. Journal of Organizational Behavior Management, 30, 285-307, 2010.
- Raharjo, D, P., Exceclent Safety Behavior Reducing Cause Of Accident Significantly, 2010.
- Ramli, Soehatman.,Sistem Manajemen Keselamatan Dan Kesehatan Kerja :OHS 18001. Jakarta. Pt Dian Rakyat, 2010.
- Saadah, Penerapan Program Behavior Based Safety (Bbs) Dan Kecelakaan Kerja, 2014.
- Syahifudin, Analisis Sistem Manajemen Keselamatan Dan Kesehatan Kerja (SMK3) Terhadap Kepuasan Kerja Karyawan. Studi Pada PT. PJB. UP Brantas, 2013.
- Tarwaka, Textbook Keselamatan, Kesehatan Kerja dan Ergonomi (K3E) dalam Perspektif Bisnis Penerbit Harapan Press Surakarta, 2008. ISBN 978-979-18144-3-0
- Ir. Ismet Somad, Msc. Eng, Textbook “Teknik efektif dalam Membudayakan Keselamatan dan Kesehatan Kerja” Dian Rakyat, 2015.

## **Biography**

**Sartika Rini** joined Bina Nusantara University in July 2017 as a Faculty Member of Industrial Engineering Faculty. She served as the Subject Matter Expert for Production and Operation Analysis, Industrial Feasibility Analysis, Managerial Economic and Accounting. She was working as Senior Industrial Engineer and World Class Manufacturing Manager at Multinational companies from 2004 – 2016. She expert in productivity improvements, implementing lean manufacturing, optimizing process design, and Health, Safety, and Environment. Her teaching areas of expertise include Supply Chain Logistic, Economic Engineering, System Engineering Analysis, Leadership Organization and Behavior. Recently, she published several articles on the adaptation of 5S or housekeeping in Swedish company, Process Improvement in Plastic Injection Company and most recently in areas of Health, Safety, and Environment for Ergonomic and Psychosocial Assignments, also Fire Risk Assessment.