Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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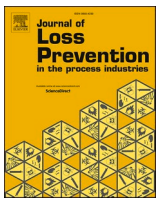

Human resource risk control through COVID-19 risk assessment in Indonesian manufacturing

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ABSTRACT

The COVID-19 outbreak that began at the end of 2019 brought a crisis impact on the health sector and other sectors such as the economy, social and politics. Human resource problems that emerged as a result of the pandemic made every company strive to protect employee safety. The food and beverage sector is one of the industries maintained to continue operating despite the large-scale social restrictions imposed in several regions, including an instant food company in East Java. This study aims to identify and determine human resource risk control to support employee productivity during the COVID-19 pandemic. This research used qualitative data based obtained through interviews, observation, and documentation. The method in this study used a combination of Failure Mode Effect Analysis (FMEA) and Bow Tie to identify, measure, and anticipate the risk of COVID-19 transmission in the company. The output result of the Failure Mode Effect Analysis (FMEA) method is the Risk Priority Number (RPN) score. The three activities with the highest RPN value were health services at the polyclinic, employee meal activities in the canteen, and activities inside and outside the factory. This analysis's results were continued by using the Bow Tie method to identify the causes, prevention, impact, and recovery of these risks. Bow Tie analysis results formed the basis for the preparation of Corrective Action and Preventive Action (CAPA). The risk control of human resources is focused on increasing employee productivity by reducing days lost due to labor shortages. In the end, the study results are expected to become recommendations in the evaluation of risk control and preventive measures for COVID-19 in manufacturing companies.

1. Introduction

The COVID-19 pandemic has caused a disastrous impact on health, economic, social, and political sectors. The virus, which allegedly emerged in Wuhan, China, has spread to almost all countries with the number of infected continue to rise. Industries around the world receive a heavy blow in terms of resources, productivity, and profit. Every company tries hard to initiate multiple efforts to prevent the COVID-19-related issues become worsen. This contingency plan is made to maintain the safety of employees to keep the company's operations running so that they can avoid economic problems and more losses (Iavicoli et al., 2021; Jian et al., 2021). I term of economic, government policies to limit activities, such as lockdowns in many countries, provide another challenge for industries. Several suppliers tried to supply to customers, but unstable market demand and oversupply remain a problem in all sectors (Krausz et al., 2020) (Pascarella et al., 2020) (Purwanto et al., 2020).

The pandemic in Indonesia requires government health agencies to take a central role. At the sub-district level, the community health center is the main actor to carry out socialization in their area. They coordinate with companies to monitor and supervise the development of the COVID-19 case and implement the health protocol in the companies' environment (Everard et al., 2020) (Shammi et al., 2020). Periodically, the health agency office guides companies in health socialization, the latest government policies related to COVID-19, referrals to confirmed cases, and others. Companies are required to report their employee condition regarding COVID-19 such as close contact, suspect, probable, and confirmed to the local community health center. This step is crucial to cut off transmission to other employees or families. The health agency office expects no infected cluster in the company because workers in companies work in groups and are prone to health protocol violations.

Meanwhile, the government chose to apply Large-Scale Social

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Restrictions and massive vaccinations to deal with the increasing transmission of COVID-19. However, there are exceptions to the vital industrial sectors such as the food and beverage industries, health services, fuel stations, financial institutions, and other primary needs. One of them is the food and beverage product industry, which is the most critical and immediate need for many people during a pandemic or normal conditions. This study discusses a multinational instant food manufacturing company located in East Java with more than 1000 employees and operates in three shifts with 20 billion packs/year production capacity. The food and beverage industry will still grow 4%–5% in 2020 due to the COVID-19 pandemic. As of March 2020, food and beverage exports are always increasing, such as agricultural products and processed food (Purwanto et al., 2020).

The COVID-19 pandemic has led many companies to close their efforts to prevent transmission of the Virus in the work environment, including transmission between employees. But some continue to open their businesses by carrying out health protocol procedures to minimize transmission of COVID-19 in the workplace (Purwanto et al., 2020). Management is not the only party responsible for preventing the spread of COVID-19. The primary key to prevention consists of breaking the transmission chain with isolation, early detection, and carrying out essential protection (Gurses et al., 2020) (Maggiulli et al., 2020) (Wang et al., 2020a). All stakeholders play a crucial role in efforts to prevent the spread of COVID-19. Management as policymakers and facilitators prepare facilities, infrastructure, formulate rules and mechanisms, and require a very active role from employees as policy implementers and facilities (Handiwibowo et al., 2020). Employees are significant assets for the company, so that their productivity determines the company's overall performance (Ambarwati et al., 2019).

The company is committed to ensuring Occupational Safety and Health in the operational aspects of work. The OHS policy has been socialized to all employees in the company. All workers actively participate in all efforts to increase productivity in the company following the Collective Labour Agreement. The mitigation carried out by the company related to the prevention and control of Covid 19 in the workplace is in line with the Decree of the Minister of Health No. HK. 01.07/Menkes/328/2020 regarding Guidelines for the Prevention and Control of Corona Virus Disease 2019 (Covid 19) in office and industrial workplaces in supporting business continuity in a pandemic situation. The prevention efforts taken by the company are not only to maintain business continuity but also to minimize the transmission of Covid 19 in the workplace. The provision of personal protective equipment to prevent transmission is also the company's commitment, as stated in the Collective Labour Agreement, which is one of the official rules in the company. However, outsiders such as vendors, suppliers, and guests who come to the company also have important role to prevent the spread of the virus. External parties, especially those working in the company, such as canteen officers, cleaning workers, project workers, loading and unloading workers, also contact and interact with company employees. They also use some of the public facilities available in the company, such as toilets, prayer rooms, lobbies, etc. Apart from management, employees, external parties who work within the company, parties that also play a huge role are government agencies, the public health center, hospitals, and the Health agency office. During the pandemic, intense communication and coordination with the health agency are very important, especially to obtain the latest policy dissemination materials, handling methods, tracking mechanisms, and quarantine measures if there are confirmed positive cases. Health agencies also have an interest in coordinating with the company to prevent clusters within the company. Dissemination is useful because it integrates directly with the company's rules that bind all parties in the company, rather than visiting employees in their respective homes (Maggiulli et al., 2020).

Every operating company needs to prevent COVID-19 from spreading to employees and the surrounding community through various activities and completing the necessary facilities and infrastructure, such as providing masks, hand washing facilities, hand sanitizer, thermogenic, gloves, and face shield. This COVID-19 prevention program needs to be implemented in various work programs and action plans for employees who work and other surrounding communities (Shammi et al., 2020) (McAleer, 2020). One of the efforts to prevent the transmission of COVID-19 is by identifying potential risks arising from operational activities at the company.

At the initial stage, each potential failure is qualified based on the priority scale of treatment. The priority scale is according to the conditions of the risk of failure effects on the company's operating systems and processes. The parameters used in the prioritization are the extent of the damage caused by the risk (severity), how often the risk occurs (occurrence), and the area to which the risk can be detected (detection) (Stamatis, 2014) (Yousefi et al., 2018). In addition to using FMEA, risk assessment is carried out using the Bow Tie method to describe the causes and consequences of risks and actions to prevent and recover from hazards (Voicu et al., 2018) (Mulcahy et al., 2017).

Research related to risk assessment in the COVID-19 pandemic has been carried out previously. The study conducted by (Wang et al., 2020a, 2020b) is related to the response of universities in China in dealing with the COVID-19 pandemic, starting from empowering alumni to help the worst affected areas, conducting research in the health sector, providing psychological services, and holding online education. This study also explains the obstacles experienced such as high transmission rates, the need for more valid research results, stalled economic activity, and network constraints on online education. This research provides several suggestions for universities in China to deal with the COVID-19 pandemic to survive the challenges (Wang et al., 2020a, 2020b). Many public places that become the gates of people's mobility, both regional and international, have handwashing facilities. Those places, such as airports, requires people to wash their hands before entering the gates. It is believed that the handwashing habits in public places, especially those that connect people from many places, can decrease the global spread of infection. Such policies can provide input into implemented public health policies related to the overall objective of mitigating potential crises (Benzell et al., 2020). Other research has resulted in experimental work, the development of computational tools, the analysis of evolutionary pathways, and the refinement of influenza surveillance, the ability to assess the emerging risks to humans by influenza viruses, and lead to improved preparedness and response pandemics (Zwanka and Buff, 2021). However, research on COVID-19 risk assessment on risk control of human resources in manufacturing can hardly be found, so that it is necessary to conduct this research.

At the initial stage, each potential failure is qualified based on the priority scale of treatment. The priority scale is according to the conditions of the risk of failure effects on the company's operating systems and processes. The parameters used in the prioritization are the extent of the damage caused by the risk (severity), how often the risk occurs (occurrence), and the area to which the risk can be detected (detection) (Chen, 2007; Jiang et al., 2015; Liu et al., 2015; Stamatis, 2014; Yousefi et al., 2018). In addition to using FMEA, risk assessment is carried out using the Bow Tie method to describe the causes and consequences of risks and actions to prevent and recover from hazards (Voicu et al., 2018) (Mulcahy et al., 2017). The research related to risk assessment using FMEA identifies and collects information about risk management and evaluates product and process design failures. This research was conducted on companies that have used FMEA to select suppliers in their supply chain. This FMEA analysis minimizes risks in the supply chain, such as unexpected costs, waiting time, and quality (Curkovic et al., 2013).

Previous studies such as (Afefy, 2015; Chen, 2007; Curkovic et al., 2013; Wang et al., 2012, 2020bbib_Wang_et_al_2020bbib_Wang_et_al_2012; Yousefi et al., 2018) used quantitative approaches value of the risk of failure and its probability. This kind of approach provides quantitative data as a basis for decision-making without considering qualitative aspects that can produce input to management

comprehensively. In addition, qualitative descriptive studies about the risk of the spread of COVID-19 and risk control activities in many industries and countries have been conducted by (Abdo et al., 2018; Aguinis et al., 2020; Alauddin et al., 2020; Aqlan and Mustafa Ali, 2014; Astles and Cormier, 2018; Becker and Smidt, 2016; Mulcahy et al., 2017).

On the other hand, this study aims to identify human resource risk control activities to support productivity during the COVID-19 pandemic. The focus is on risk assessment with risk control by combining the two methods of FMEA and BowTie. FMEA analysis produces RPN values by setting the highest priority problems that need to be resolved immediately. BowTie analysis generates CAPA as input for management based on priority issues derived from FMEA analysis. The risk assessment results with a more comprehensive approach under priority and urgency will produce problem solutions that are right on target for the manufacturing industry.

2. Method

The research problem was limited to COVID-19 mitigation related to human resources and infrastructure to support employee productivity. To ensure the completeness of the data, the researcher collected using three techniques, which were, first, the interview, second, the observation, and third, the documentation. The researcher used an interview with vital informants who could provide information and data needed for analysis. The interview conducted was an unstructured interview technique where the questions were only in the form of essential points. This interview technique ran more flexibly and revealed a lot of information beyond what was needed to support analysis. For informants who were sources in data collection (especially interviews), the following criteria were determined: employees with permanent status; a minimum working period of 5 years, assuming the employee already knows the work process in the area; Position structurally in the company at least Supervisor level; a member of the COVID-19 task force at the company. These informants were Industrial Relations Supervisors, Safety Health & Environment Supervisors, Production Shift Supervisors (3 people), General Affairs & Services Supervisors, Branch HR Managers, and paramedics (3 company doctors). This observation used a participatory method, which involved the researcher directly in the object's activity. Observations were made on the spot what was happening, not simulated or conditioned by the division of observation time that could represent all conditions (3 shifts). The observation locations were the company entrance, security post, polyclinic, employee canteen, employee union shop, employee locker, toilet, meeting room, company prayer room, lobby/receptionist, and HR room. Field data documentation could be in the form of Standard Operating Procedures, Implementation Guidelines (operational guidelines), Directors Decree Internal Memorandum. Work Instruction. etc.

All previous data collection techniques could provide the information needed by researchers and complement each other as much as possible. The raw data obtained during the data collection phase using various methods were processed and sorted into the specified data analysis methods. This phase classified which data was primary, secondary, or maybe not even needed in this research. All data from this data collection method would complement each other and serve as the next process's primary data source, namely data analysis. Data validity testing was carried out through triangulation, including triangulation of sources by validating data from various sources involving the person in charge and the COVID-19 task force team; triangulation of data collection techniques with an interview, observation, and documentation techniques; and time triangulation by testing work time variations covering the first, second, and third shifts.

Efforts to control risk on the human resources of manufacturing companies, especially during the COVID-19 pandemic, need a systematic and efficient method to ensure the company's reliability in overcoming critical conditions. The potential for failure must be eliminated from the root of the problem. The parameters for calculating the priority scale of activities that have a Risk Priority Number (RPN) value are the extent of the damage caused by the risk (severity), how often the risk occurs (occurrence), and the extent to which the risk can be detected (detection) (Chen, 2007) (Jiang et al., 2015).

The next step was to analyze (all the data obtained from the data collection technique and put it into a risk assessment using the FMEA and Bow Tie methods (Fig. 1). The first step in data processing through the FMEA method is activities risks identification in each work area (Afefy, 2015). Furthermore, scoring the likelihood, impact, and risk detection values for each activity in each work area based on discussions with the COVID-19 Task Force team and the person in charge of the work area involves as many as 23 participants. The scoring step from interviews and observations resulted in 22 activities related to human resources with the risk of COVID-19 transmission. The experts and researchers conducted meetings through virtual media to discuss and determine the scoring criteria for Severity (S), Occurrence (O), and Detection (D) using a scale of 1–10 with the provisions in Table 1. The score was calculated on the average geometric weight, and the calculation of the RPN score was obtained by multiplying the values of Severity (S), Occurrence (O), and Detection (D). The stages of determining priorities with the RPN value of each field and the work process are based on these criteria. The highest RPN value indicates that the urgency of problems in the work area is very high, so these problems need to be resolved immediately to reduce the impact of the risks that occur. This study uses three priorities based on the highest RPN value (see Fig. 2).

After analyzing the data using FMEA, the researcher also analyzed the data using Bow Tie analysis. Analysis of the causes and impacts of hazards and prevention and recovery measures were carried out using the Bow Tie method. Selection based on historical data, interviews, and the provision of corrective actions allows the actual estimation of RPN value to produce evaluation materials and suggestions for management. (Afefy, 2015) (Yousefi et al., 2018) (Streimelweger et al., 2015). Bow Tie analysis was carried out based on three problem-solving priorities according to the RPN score. The steps to perform a Bow Tie analysis were as follows: determine the center of the Bow Tie by looking at the risk that has the highest RPN value from the previous FMEA; analyze the causes and impacts of possible risks; develop and determine Corrective Actions and Preventive Actions (CAPA) (Chen, 2007) (Jiang et al., 2015). The conclusions and findings of this study include the final results of data analysis and research recommendations.

3. Results and discussion

Data processing results were obtained from qualitative data collection within the scope of human resources through interviews, observation, and risk analysis documentation. The next is a risk analysis of protection activities and supporting productivity using the FMEA method. Supporting productivity activities include employee candidate selection, receipt of employee salary slips, and employee attendance. Apart from that, there are also protection activities in employee meal activities in the canteen, provision of drinking water for employees, prayer services, employee changing rooms and lockers, employee toilets, employee pick-up facilities, and employee health services in the polyclinic, and also shopping activities at the employee union store. There were also employees going in and out of the factory area. Activities in the office include distributing documents, photocopying documents, receiving guests, handling customer complaints, training, outreach/briefings, and releasing employees and retirees. The calculation of the RPN value of the 22 activities (Table 2) shows the level of risk priority.

The RPN calculation results show the respondent's scoring on the level of severity, occurrence, and detection. Fig. 1 shows that the largest RPN scores are health services in the polyclinics 241.24, eating in the canteen 174.26, and exit and enter the factory 165.54. The polyclinic

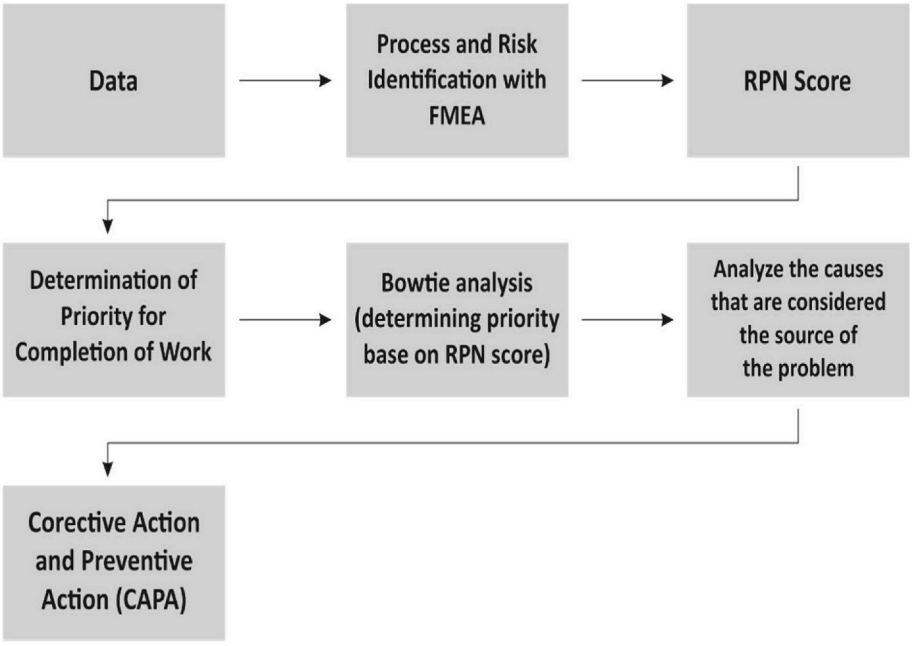

Fig. 1. The process of analysis risks FMEA and Bow Tie.

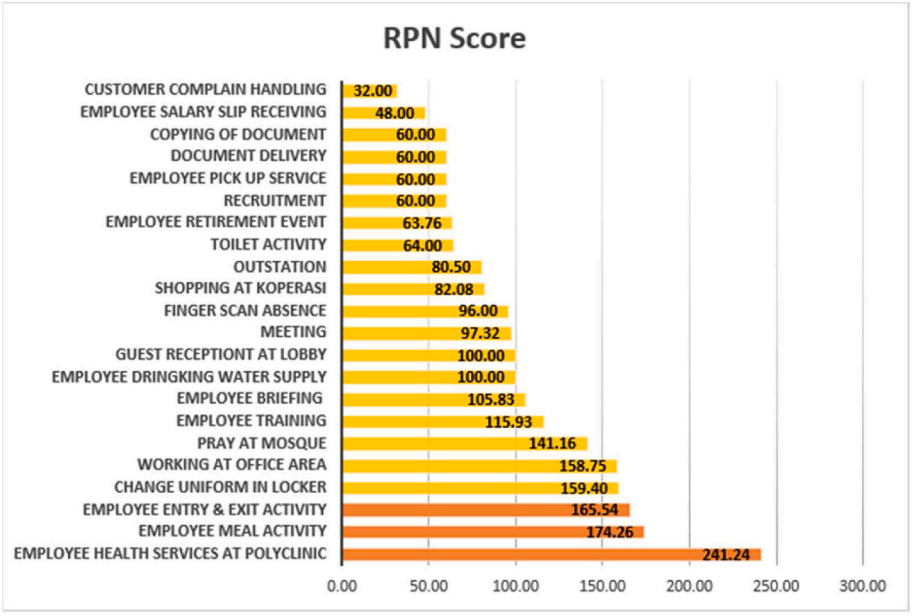

Fig. 2. The RPN scoring.

score of health services explains that the polyclinic health service activities have the most urgent risks and urgency for mitigation. The potential for the transmission of the COVID-19 Virus is most significant in this activity. The process of testing health service activities at the company polyclinic, including paramedics (nurses and doctors), are not sick, and patients who are safe are at risk of COVID-19. The seriousness of this activity's risk for employees and company operations received a relatively high score of 7.20. The event probability score (event) and risk detection ability (detection) were 6.70 and 5.00. Changes in conditions in the polyclinic are implementing health protocol procedures and the refusal of employee patients to come. If the polyclinic previously provided face-to-face treatment, consultation, and physical examination by paramedics, consultation during a pandemic must be carried out with strict health protocols. For example, consultations should take place using acrylic screens or online. Paramedics and patients have a high risk of being exposed to the COVID-19 Virus, transmitting and becoming infected.

The second priority is to provide dining facilities in the employee canteen. Company management prepares this activity to offer dining facilities to employees who have worked for 3 h continuously or are still working during meal times (11.59 a.m., 06.00 p.m., and 02.00 a.m.). The meal activity was conducted in a closed room with up to 300 people attended. Activities in the canteen involve employees who eat and catering staff who serve employees' meals. The people working on the machines that make the process possible are divided into different shifts considering machine location and job availability. This activity takes an average of 30 min/shift according to employee break hours with a total duration of 2 h. The canteen's eating activity obtained a severity score of

Table 1
The scale of severity-occurrence-detection.

Severity		
Score		Description
1–2		Very unlikely chance of occurrence
3–4		Low chance of occurring
5–6		Equal likelihood of occurring or not occurring
7–8		Most likely, it can happen
9–10		Indeed. it will very likely happen
Occurrence		
Score	Criteria	Description
1–2	Cost	No increase in cost
	Manpower	There is no reduction in manpower in that area
	Operational	No disrupted operations
3–4	Cost	There is an increase in the cost of <5%
	Manpower	There is a reduction in manpower of <1%
	Operational	Operational interruption occurred <8 h
5–6	Cost	There is an increase in cost of <6–10%
	Manpower	There is a reduction in manpower of 2–3%
	Operational	Operational interruption occurred 9–24 Hours
7–8	Cost	There is an increase in cost of <11–15%
	Manpower	There is a reduction of manpower by 4–5%
	Operational	Operational interruptions occur 24–48 h
9–10	Cost	An increase in cost of <15%
	Manpower	There is a reduction in manpower by > 5%
	Operational	Operational interruption occurred >48 h
Detection		
Score	Level	Description
1–2	Very High	Able to control the causes of failure by 80–100%
3–4	High	Able to control the causes of failure by 60–79%
5–6	Medium	Able to control the causes of failure by 40–59%
7–8	Low	Able to control the causes of failure by 20–39%
9–10	Very low	Able to control the causes of failure by 1–19%

Table 2
Risk Priority Number (RPN) score.

Activities	Severity	Occurrence	Detection	RPN
Employee Health Services At Polyclinic	7.20	6.70	5.00	241.24
Employee Meal Activity	5.81	6.00	5.00	174.26
Employee Entrance & Exit Activity	6.32	4.93	5.31	165.54
Change Uniform In Locker	6.00	5.31	5.00	159.40
Working At Office Area	6.48	4.90	5.00	158.75
Pray At Mosque	5.00	5.65	5.00	141.16
Employee Training	5.92	4.90	4.00	115.93
Employee Briefing	5.92	4.47	4.00	105.83
Employee Drinking Water Supply	5.00	5.00	4.00	100.00
Guest Reception At Lobby	5.00	5.00	4.00	100.00
Meeting	5.24	4.64	4.00	97.32
Finger Scan Absence	6.00	4.00	4.00	96.00
Shopping At Koperasi	5.65	3.63	4.00	82.08
Outstation	4.47	3.00	6.00	80.50
Toilet Activity	4.00	4.00	4.00	64.00
Employee Retirement Event	5.24	2.62	4.64	63.76
Recruitment	5.00	3.00	4.00	60.00
Employee Pick Up Service	5.00	3.00	4.00	60.00
Document Delivery	4.00	3.00	5.00	60.00
Copying Of Document	4.00	3.00	5.00	60.00
Employee Salary Slip Receiving	4.00	3.00	4.00	48.00
Customer Complain Handling	4.00	2.00	4.00	32.00

5.81, an occurrence score of 6.00, and a detection score of 5.00. The third priority is employee activities in and out of the factory. Testing this activity is at the company's main entrance by involving employees and guests who will enter or leave the office and security guards. This activity includes checking the condition of the body and luggage of all employees and guests. This activity involves a lot of physical contact between employees and guests and security guards who carry out checks. The action received a severity score of 6.32 and 4.93 and a detection score of 5.31.

The factors that most determine the transmission of COVID-19 are discipline and compliance to health protocols (Benzell et al., 2020) (McAleer, 2020). Employees work at least 8 h a day spent in the company environment and met with coworkers. The shift work system and the number of public facilities in the company simultaneously add to the transmission risk. Nearly 70% of the work's nature is done in groups with closed workspaces in a food factory. The food safety management system requires closing access from outside because of contamination of food products. On the contrary, one of the preventions of COVID-19 must be done by creating an open workspace with adequate air circulation. The spread of COVID-19 between humans is the primary source of transmission of the Virus, so workers' distance must be calculated carefully (Aguinis et al., 2020).

The nature of work that requires employees to work in teams and close together requires arrangements both in working hours and technical in the room so that the factory can meet food safety and health aspects. Several factory activities require employees to do activities in groups simultaneously, such as changing uniforms, using the toilet, wearing the polyclinic, and eating in the canteen. Employees must change uniforms in the locker because uniforms cannot be worn outside the factory premises. The limit for using the toilet is for 25 people but the risk is still high because it can be used simultaneously. The polyclinic becomes the place for employees to drink vitamins, medicines, and other health needs. Eating in the employee canteen is the most prominent thing seen by employees who cluster together because the break time does not last long. Employees cannot avoid all these activities, so the company always tries to remind employees to keep their distance, wear masks and not linger in these locations. Regulating rest hours and creating barriers/boundaries can also minimize the risk of transmission between employees. A study found that the sticking Virus is the indoor

door handles, toilet seats, light switches, windows, cupboards, and ventilation fans. The research was conducted in a room for a COVID-19 patient with mild symptoms in Singapore (Pung et al., 2020).

The three priority activities from the RPN scoring results used the Bow Tie method analysis. The first highest RPN score level is health service activities at the polyclinic. The study results on the Bow Tie analysis at the Health Polyclinic (Fig. 3) showed six possible causes of risk. However, company managers can take 15 precautions. Then there are six consequences if the risk of this activity occurs and 17 corrective actions.

The Bow Tie analysis emerged from the consequences of brainstorming and interviews with informants and the implications of clinical observations. The polyclinic visit rate reached a significant increase during the pandemic by around 120% (March–December 2020) compared to the previous year. Doctor visits for treatment, consultation and also help monitor the healthy progress of employee patients. There are three nurses for three shifts and one midwife (Tuesday and Friday), and one doctor on Monday - Friday (02.00 p.m.–04.00 p.m.). Various infrastructure engineering, making warning signs/banners/posters, and disseminating health protocols can be preventive and recovery measures if the consequences of risks occur. Apart from the polyclinic function's curative aspect, there is also promotional aspect prevention and rehabilitation, which is part of risk and control. The mitigation activities affect employee work efficiency, smooth factory operations such as absenteeism, and employee health. Changes in procedures while undergoing treatment at the polyclinic are also essential in preventing COVID-19. All systems adapt to the conditions that occur during a pandemic (Carnevale and Hatak, 2020). Patient consultations with doctors are still carried out in the polyclinic room, as before the pandemic. However, services have been moved to an outdoor area with limited service hours and patient waiting room capacity. Another procedural change that was carried out was the adjustment of the employee rest mechanism to the diagnosis of the company doctor.

The second highest RPN score level is in the activity of eating and taking-breaks for employees in the canteen. The results of Bow Tie's analysis show nine causes of the risk in employee meal activities. Then there are 23 preventive measures, five possible consequences, and 16 steps for recovery. Eating activities in the canteen are also at risk of contracting COVID-19 (Fig. 4). Employees will group to eat and take off their masks while eating and also talk to other employees.

Dining and resting activities often involve outsiders and catering staff who interact directly with employees in the canteen. Providing meal facilities for employees by the company is one activity to meet employees' calorie and nutritional needs while working. Provision of vitamins and additional supplements is a particular priority in close contact with people with COVID-19 without symptoms. Those who are already showing signs receive treatment under the supervision of company doctors. The quality of nutrition provided follows the health adequacy rate set by the Health agency office. This company's efforts and actions help employees maintain their immunity against the COVID-19 Virus and other diseases. Thus, companies need to control the risk of employees being in one room and violating the 2-m social barrier when interacting with each other. Infrastructure engineering in the canteen and routine inspection of employee health conditions are measures of control and recovery of risks inside the canteen.

The third highest RPN score level is employees' activities entering and leaving the factory area under security guards. Bow Tie's analysis showed seven causes of the risk in employees' activities entering and leaving in security post. There are also 16 preventive measures, six possible consequences, and 20 steps for recovery action (Fig. 5). Activities in and out of the factory apply to employees and company guests (including vendors). The Security Unit and employees/guests who enter and exit the factory area have a high risk of contracting COVID-19.

Provision of supporting facilities/infrastructure and socialization of maintaining health protocols are possible risk control measures. Personal protective equipment is also an important facility to minimize both sides' risks (Askari et al., 2017) (Streimelweger et al., 2015). The main gate is the access of all people who will enter the factory area, both healthy and sick, including the sterilization of vehicles that will enter the factory area. Automation in the operation of sterilizers is currently the most appropriate choice to reduce contact (Aguinis et al., 2020) (McAleer, 2020). The risk of exposure to the Virus has been reduced by raising awareness about hygiene and healthy lifestyle protocols, conducting room engineering by maximizing air circulation, equipping all personnel with PPE according to their risk level, equipping disinfection and sanitation facilities for both rooms and employees, and preparing sanctions as well as standard mechanisms. Operation procedure, providing adequate nutrition and nutritional intake for employees,

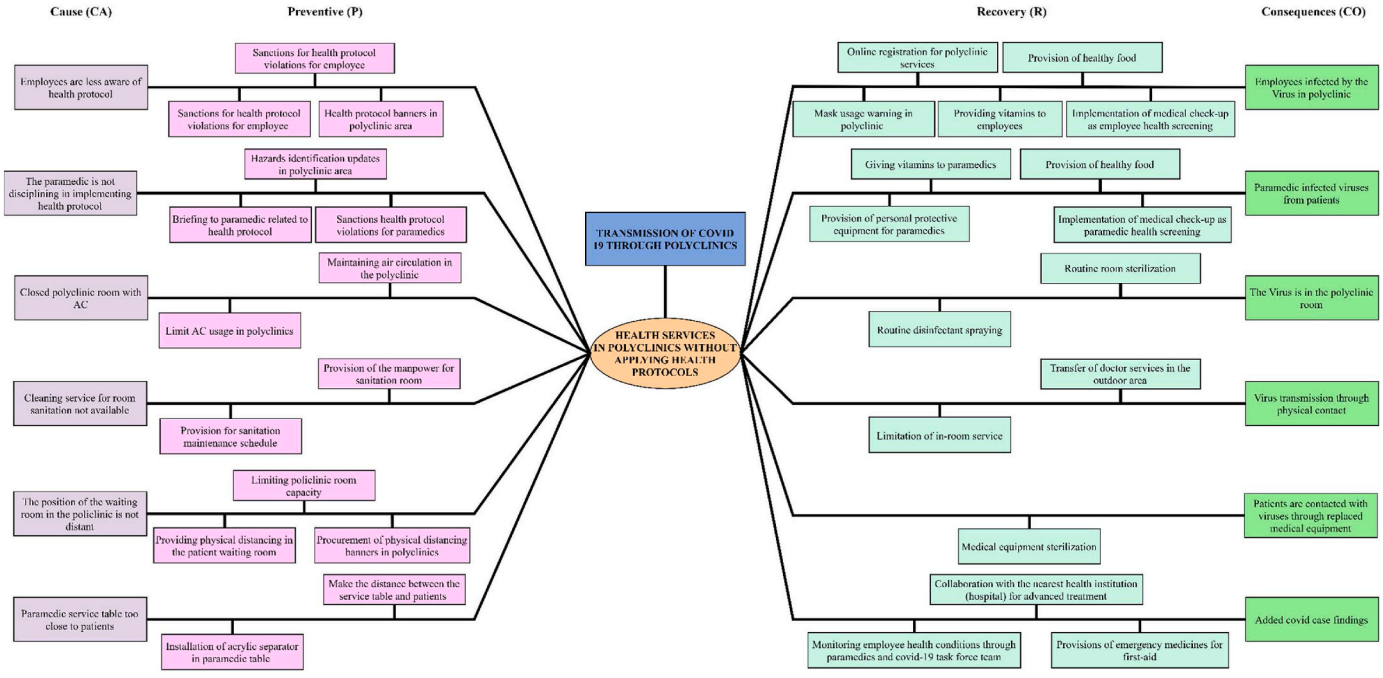

Fig. 3. The Bow Tie analysis of health services in polyclinics.

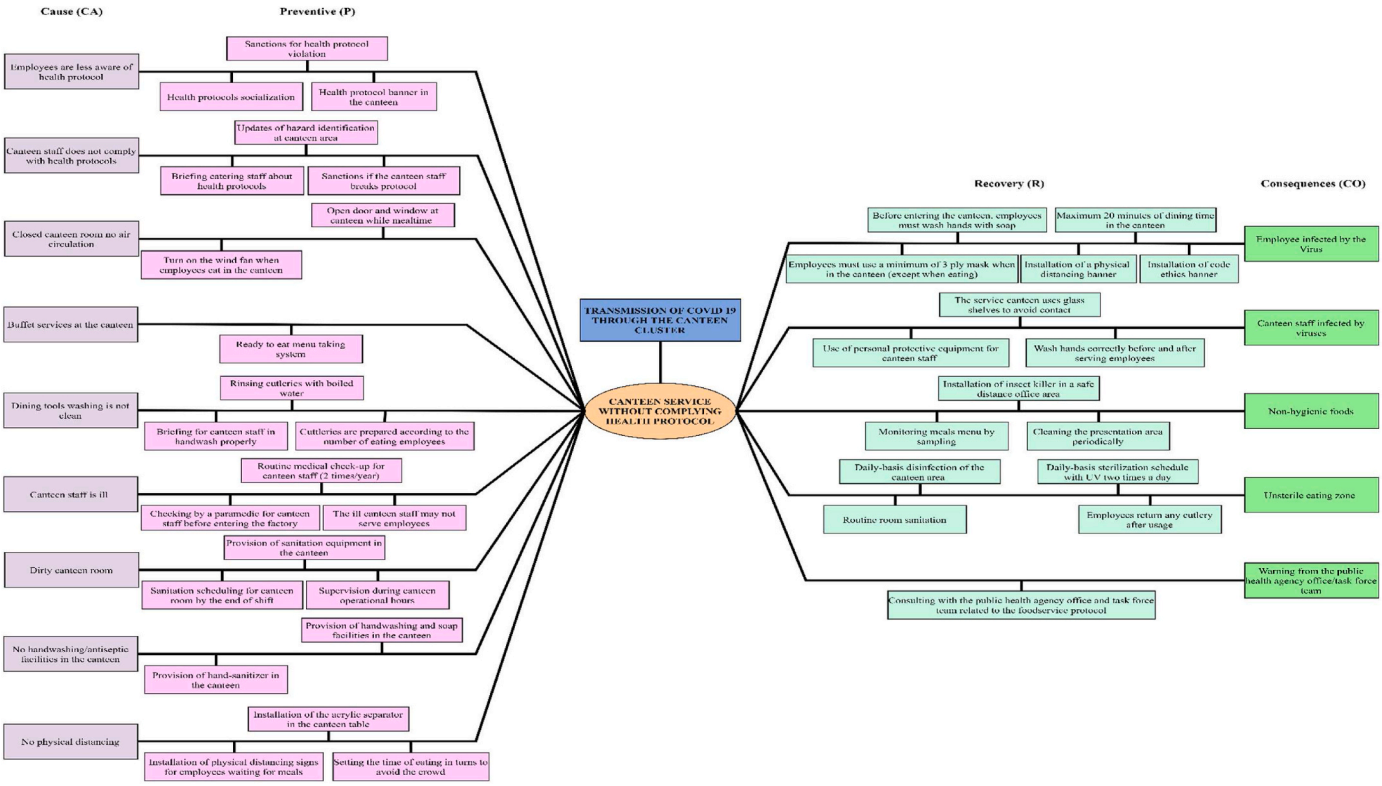

Fig. 4. The Bow Tie's analysis for employee meal activities in the canteen.

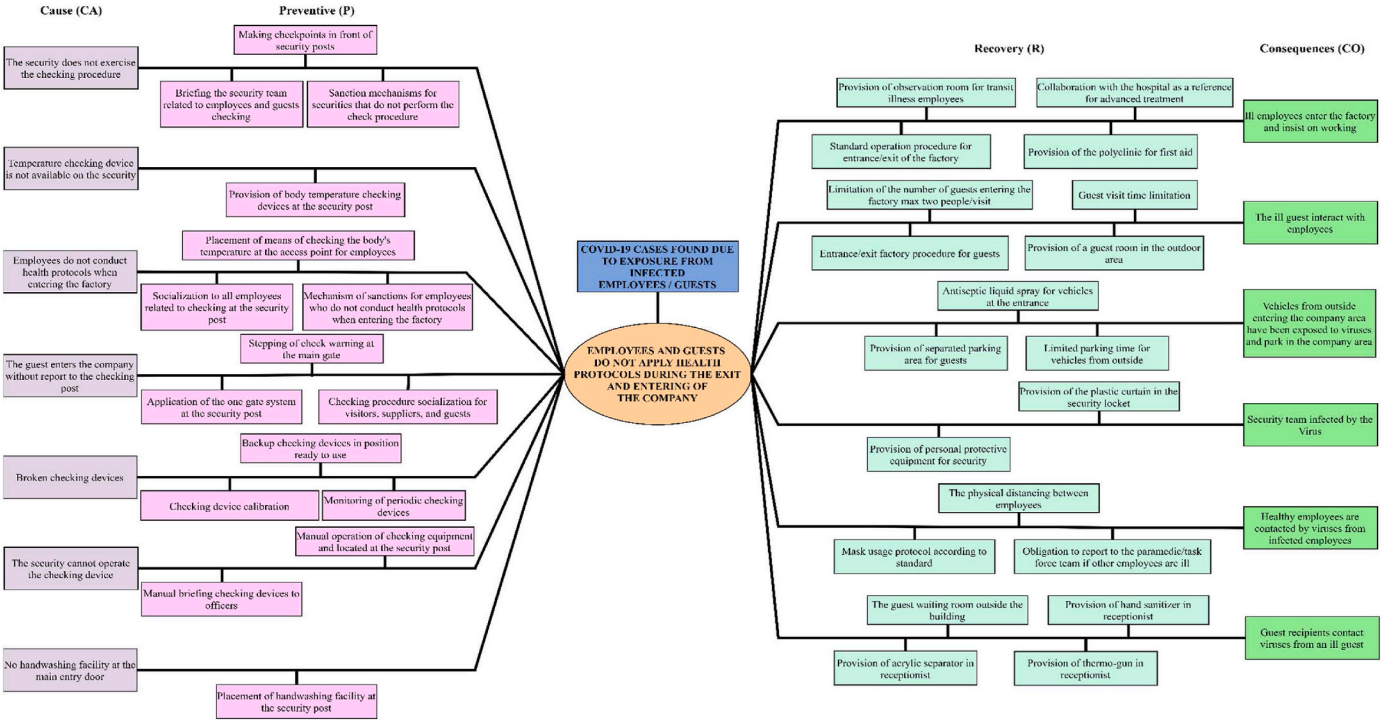

Fig. 5. The Bow Tie's analysis for factory entrance and exit activities.

preparing an emergency response mechanism if an employee is exposed to the COVID-19 Virus. Each element in the company, from management, employees, to the third parties (guests. vendors. government agencies. etc.), must have the same enthusiasm in carrying out mitigation activities during the COVID-19 pandemic (Benzell et al., 2020) (Pascarella et al., 2020). The priority now is to maintain health and break the chain of transmission of the COVID-19 Virus with all the company's efforts.

The most avoided risk impact from non-compliance on health protocols is the confirmed case of COVID-19. If there is a confirmed case of

COVID-19, the mechanism is to do 3T (testing, tracing, and treatment). The first is to test the suspect or probable COVID-19- at the health agency that is the reference. After the test results are positive, what must isolate the patient with the option of self-isolation at home if there are no symptoms or mild symptoms or need to be treated in a hospital, mostly a COVID-19 referral, is severe worrying. This consideration is with the approval of the Company Doctor and the company task force team. The company polyclinic has a significant role when there is a confirmed COVID-19 in the company. The company collaborates with the local community health center as the most accessible government agency that traces established patients' close contact. People who have been in contact with COVID-19 patients will be assessed for the last 14 days. This assessment is to determine the extent to which frequent contact occurs and whether the person implements health protocols when in contact with patients. The task force team will later consider the assessment and company doctors' results to test and treat the patient's close connection. Risk control efforts can utilize restrictive measures such as social restrictions, case detection, isolation, close contact tracing, and case-based quarantine to avoid COVID-19 transmission. Control mechanisms like washing hands, wearing a mask, and keeping a distance are also needed to minimize the COVID-19 impact (Alauddin et al., 2020). The company identifies possible mitigation steps for each risk and activity and determines mitigation steps considering cost and risk reduction (Aqlan and Mustafa Ali, 2014).

Preventive identification is critical for extraordinary conditions to avoid catastrophic losses. Early detection optimizes control risk to minimize risk and potential loss because prevention is more effective than corrective action. Controlling risks to humans is different from managing risks to machines. Dynamic humans tend to act and behave according to their beliefs and values. There needs to be a clear, detailed, and binding mechanism to change human behavior (Gurses et al., 2020) (Everard et al., 2020). The sanctioning mechanism is a means of controlling employee behavior. During the pandemic, the health protocol has become one of the company's main rules, so any violations of these rules will receive sanctions determined by management. Company rules and procedures can be in collective labor agreements, internal memoranda, Directors' decrees, implementation guidelines, etc. The sanctioning mechanism includes conditions of sanctions ranging from verbal warnings, written warnings in warning letters phase 1, 2, 3 to suspension and dismissal if the violation is severe. Determining the level of sanctions involves considerations such as the level of loss/severity, the modus operandi, the chronology of the incident, whether there was a violation or not. After the violation, the security guard/HR department makes an inspection report to determine sanctions. This sanction mechanism has also received approval from employees represented by the union. This sanction mechanism integrates with the management system that is currently running (Krausz et al., 2020). This research is a development of previous risk identification research (Liu et al., 2015) (Afefy, 2015). In addition to using two risk identification methods, the novelty in research is also recommended for priority mitigation activities in a manufacturing company. The importance of this mitigation activity focuses on human activities with the highest risk of COVID-19.

4. Conclusions

The results of risk analysis using the FMEA and Bow Tie methods resulted in 22 COVID-19 mitigation activities at Company X with a significant risk of COVID-19 transmission. There are three priorities from the highest RPN results: completing health service activities at the community health center, eating activities in the canteen, and mobility activities in and out of the company area. The Bow Tie analysis results show several causes, controls, consequences, and risk recovery from the three priority activities, then formulate Corrective Action and Preventive Action (CAPA). The CAPA results can serve as a guideline for making Standard Operating Procedures (SOP), Implementation Guideline, and Work Instructions (WI) for COVID-19 mitigation activities. Mitigation activities are focused on increasing employee productivity by reducing lost days due to a lack of labor. This lack of workforce results in every movement in the company and has a risk level of COVID-19 transmission. This research's implications are generated from an in-depth analysis based on the risks that arise while maintaining a balance between health and employee productivity. This study recommends solving company management problems to control risk in human resource activities in company operations to achieve company targets. Changes in employee behavior and company culture regarding risk control against COVID-19 are visible. During the pre-pandemic period, employees only wore masks during the production process, but they were required to wear masks all the time, starting from home during the pandemic. According to Good Manufacturing Practice (GMP), employees must also wash their hands frequently or use hand sanitizer and other health protocols. The use of technology and engineering is also an effort by company management to reduce physical contact, avoid crowds, and keep company operations running according to plan. This research focuses on human resource activities that risk COVID-19 transmission in manufacturing companies without considering and measuring external factors from social interaction and internal factors of workers' physical-mental health. Thus, further research is recommended to focus on risk analysis based on the risk value of the company's assets and the intrinsic factor of human resources by calculating other measurement methods.

Author contributions

Rita Ambarwati: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Diah Yuliastri: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. Wiwik Sulistiyowati: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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