THE PSYCHOLOGICAL AND SOCIAL IMPACTS OF WORKER-MACHINE INTERACTIONS IN THE MANUFACTURING INDUSTRY: A SYSTEMATIC LITERATURE REVIEW

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(Received: January 9, 2023/ Accepted: August 22, 2023)

Abstract

Accidents and occupational diseases occur frequently, especially in the manufacturing industry. Workers also have psychological burdens in the industrial era 4.0 as indicated by the increase in cases of stress experienced when interacting with machines. These concerns led this study to reduce the psychological and social negative impacts on workers interacting with machines. This was achieved through a systematic literature review using the PRISMA stages to comprehensively determine the burden experienced by workers and their impact. It was discovered from the 14 articles that meet the search criteria that the psychological and social conditions of workers are very bad mainly due to the application of technology in the Industry 4.0 era. This was caused by eight factors which include (1) workload exceeding capacity, (2) high concentration and cognitive activity demanded at work, (3) increased cognitive load, (4) anxiety about their ability to use technology, (5) work becoming increasingly complex, (6) worried that their position will be replaced by technology, (7) inability to operate technology, and (8) reduced social interaction. It was recommended that the impact be reduced by managing the causative burdens using two main approaches which include the company and the individual worker affected.

Keywords: *workload; mental burden; workers; technology; manufacturing*

1. Introduction

Accidents and occupational diseases are highly avoided by all industries but happen unexpectedly sometimes. However, some companies often fail to develop and consistently implement prevention strategies, thereby leading to moral and material losses which subsequently reduce productivity. The occurrence of these diseases is very high in Indonesia. This was confirmed by the Social Security Administration (BPJS) that the cases increased from 182,000 in 2019 to 225,000 in 2020 with 63.6% recorded in the manufacturing and construction sectors (Disnakertrans, 2022). Moreover, the world is currently entering the industrial era 4.0 where all areas of life are integrated into systems, the internet, and digitization. This era indirectly has a significant impact on human work, both at the macro and micro levels (Ejsmont, 2021). This is since digitization has increased interactions between humans and machines and even though it is a solution to some problems, it has also created new problems (Bakos et al, 2019). The implementation of these technologies led to major changes in the production process of manufacturing industries.

Mental workload is one of the challenges faced by workers due to technological advancement and this is associated with the pressures and conditions experienced through the demand for cognitive and intellectual loads (Giawa, 2018). The increase in cases of stress and burnout at work is leading several companies to identify mental workloads in the form of psychological and social burdens (Emerman, 2022). According to Malomane et al. (2022), technology can basically assist in reducing accidents, injuries, and deaths to improve worker performance, but Lindholm et al. (2020) showed that it has some negative impacts such as the new risks broadly affecting occupational health and safety. This implies the existence of technology has both positive and negative impacts on every field of work. Furthermore, Leesakul et al. (2022) explained that when there is a growth in technology in work, the workload of workers increases, and this can affect performance when ignored (Rolos et al., 2018).

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Table 1. Keywords Used to Select Proper Literature

Database	Keywords
Proquest, Emerald, Google Scholar	(Manufacture OR Manufacturer OR Manufacturing OR Factories OR Factory OR Industries OR Industry) AND ("Human Machine Interaction" OR "Human Computer Interaction" OR "Man Machine Interaction") AND ("Mental Stress" OR "Mental Workload" OR "Mental Load" OR "Cognitive Load" OR "Cognitive Workload" OR "Social Affect")
Science Direct	(Manufacture OR Factory OR Industry) AND ("Human Machine Interaction" OR "Human Computer Interaction") AND ("Mental Workload" OR "Mental Load" OR "Cognitive Load" OR "Social Affect")

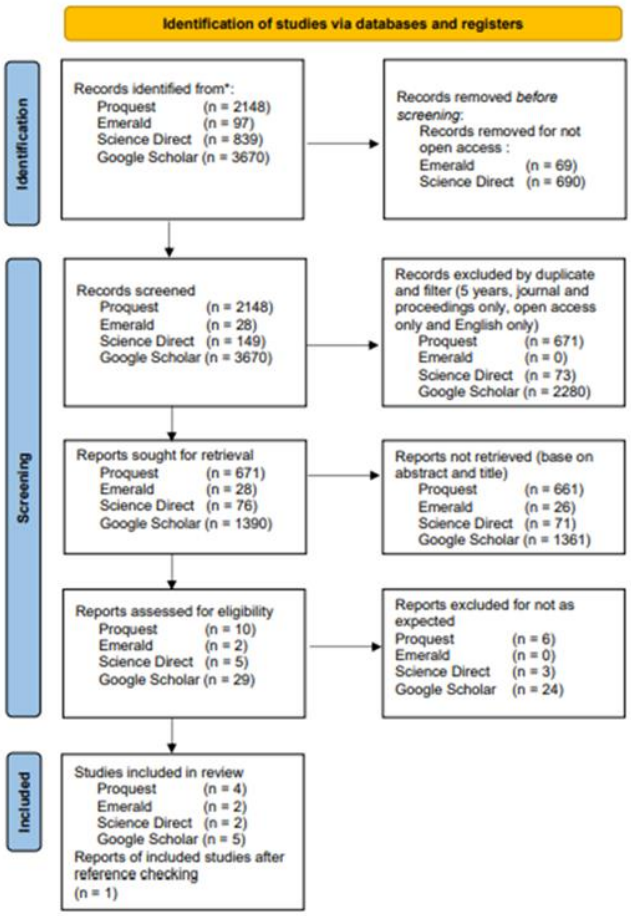

Figure 1. PRISMA Stages in Selecting Literature Process

The empirical and factual findings from observations and literature studies encourage the need for an in-depth study of the mental workload of workers due to their interaction with machines in the manufacturing industry and to identify the psychological and social impacts. This is considered necessary to reduce these impacts and this is the main objective of this study.

2. Methodology

This study uses a Systematic Literature Review (SLR) approach with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) stages which systematically formulates, collects, evaluates, and analyzes data from existing studies to obtain relevant results. The articles used were selected based on certain eligibility criteria which include those written in English, published in the period 2017-2022, produced from scientific research which focuses on the psychological and social impacts in the manufacturing industry, published online, and open accessed in the form of journals or proceedings. A total of four databases were used to source these articles and they include Proquest, Emerald, Science Direct, and Google Scholar using the keywords presented in **Table 1**.

There are five stages involved in the PRISMA method and at the identification stage, a total of 6,754 articles were obtained from four databases after which they were reduced to only 14 that meet all the eligibility criteria set after the next four stages. The selection and search process are indicated in detail in **Figure 1**.

3. Results and Discussion

Selected literatures have useful findings and recommendations for further study even though they were conducted using different objects and methods as indicated in the following **Table 2**.

Table 2. Summary of Selected Articles in A Systematic Literature Review

Author(s)	The object of the study	Method	Findings	Recommendations
Mohammadian et al. (2022)	63 control operators in mining and industrial areas	Document reviews, interviews, and NASA-TLX surveys	The mental burden of the operator workers is high due to management activities, cognitive needs, working memory, the need for responsiveness, and detection of product defects that exceed their capacity.	The addition of a computer system to reduce memory requirements and errors due to excessive working memory.
Scafà et al. (2019)	3 different industries in Italy	Observation and review of workers' duties	Workers in the industry experience a high psychological burden due to large work demands, the complexity of production operations experienced, the need for high concentration at work, and pollution in the workspace.	Improvement in the welfare of workers by filling the gaps between social, economic, and productivity.
Indrawati et al. (2018)	30 workers in the Indonesian mining industry	Observations, interviews, and NASA-TLX surveys	Workers experienced a high psychological workload because of the obligation to immediately respond to dangerous sudden occurrences such as damage to goods, gas or fire leaks, and others.	Implementation of work productivity improvement programs such as 5S (Seiri, Seiton, Seiso, Seiketsu, and Shitsuke), improved communication, stress management, and other informal activities.
Khandan et al. (2018)	107 workers in the operations department of automotive companies	Demographic questionnaire, body map, and the NASA-TLX survey	The psychological workload on workers is very high due to their work activities and this manifests in the form of frustration and pain in certain body parts such as the neck.	Workload control, making correction programs with macro and micro approaches.
Junaedi et al. (2020)	20 production workers in the Indonesian chemical industry	NASA-TLX Survey	Workers experienced a high mental workload because the workload exceeds their capacity.	Optimize the number of workers.
Azizah et al. (2019)	Workers in the packaging section of a peanut factory	NASA-TLX Survey	The mental workload of workers is quite high because the demands of work are very high and exceed their capacity.	Increase the number of workers at several workstations, ensure personal protective equipment are available, and establish a reward program.
Malik et al. (2022)	32 professional workers from different industries	Semi-structured interview	Implementation of technology in the workplace creates a psychological burden, increases workload, creates work insecurity, increases work complexity, reduces the time for personal life, and creates uncertainty, role ambiguity, and dependence on technology.	The company needs to provide support to enhance and expand the soft skills possessed by the workers.

Author(s)	The object of the study	Method	Findings	Recommendations
Krutova et al. (2022)	3,800-7,000 workers in Finland	Data collection through the Web Labor Force Survey Interview	Workers with high work skills experienced a psychological burden due to the threat of layoffs, dismissals, unemployment, changes, increased workload, and relocation. Workers with low job skills experienced a psychological burden due to the threat of losing their jobs because they are replaced by technology because of the demands for efficiency from managers.	Open communication between top management and workers regarding the adaptation of technology will have an impact on the entire work process
Gregori et al. (2018)	Workers at a shoe sole factory in Italy	EOG, Camera, Smart Glasses, Heart Sensor, Pollution Sensor, Motion Monitor	Workers experienced a high mental workload because high concentration is required when processing very small foils, calculating processes, and checking the quality of finished products before packaging.	Implement structured planning to make the workers productive, including the further process in other factories.
Meyer & Hünefeld (2018)	18,554 workers in Germany	Cross-sectional survey	Technology in work added to the psychological burden due to new and unstudied work activities that cause fatigue, stress, and reduced job satisfaction under certain conditions.	Companies need to employ workers that fit their needs.
Glimne et al. (2020)	18 production operators	CISS questionnaire, eye movement detection, lighting calculation, and observation of working environment conditions	Production operators experienced a high psychological burden on cognitive activities such as when selecting, calculating, remembering, searching, and making decisions. Psychological burden also arises due to the need for high concentration, use of working memory, readiness, and eye movements with focus on the entire monitor screen which causes neck and shoulder pain as well as eye fatigue.	Provide an optimal visual environment with consideration for ergonomic principles as a guide to designing and managing work in the control room.
Maisiri & Dyk (2021)	Professional workers in the South African manufacturing industry	Semi-structured interview	The implementation of technology in the manufacturing industry causes changes in employment. Workers are required to be agile and multitask. The cognitive load of workers also increases due to the implementation of technology because activities require high abilities, and this led to job transitions and job losses.	Develop strategies to deal with technological developments by developing worker skills as needed.

Author(s)	The object of the study	Method	Findings	Recommendations
Leesakul et al. (2022)	15 professionals and 184 workers in the manufacturing industry	Professional interviews and surveys	The presence of technology causes companies to lack suitable and capable workers. This condition makes workers experience a mental burden due to changes in work, tight supervision, and reduced social interaction.	Provide training to develop worker skills, a special time to learn, and design an employee strategic planning.
Jerman et al. (2020)	14 professional workers from various industries	Semi-structured interview	Technology is influential in the manufacturing industry because of the increasing need for highly technically competent workers with teamwork, conflict management, leadership, motivation, and emotion management skills.	The company needs to establish a program to develop workers' skills through intensive training.

These findings generally showed that there are differences in how workers interact with machines in the manufacturing industry. It was observed that highly skilled workers interact more with computers and use technology to make decisions, process data, and do other complex jobs while those with low skills interact more with heavy machines and conduct repetitive and monotonous work.

Psychological and Social Conditions of Workers in the Manufacturing Industry

The findings of all the 14 selected articles indicate high psychological and social burdens experienced by workers in the manufacturing industry due to several factors which were observed to be different before and after the emergence of the industry 4.0 era. It was discovered that manufacturing industries were using machines such as conveyors to assist their workers before the industry 4.0 era, but these machines only act as a tool while the workers conduct real activities. The psychological burden experienced was due to the need for high concentration in searching for defects, engaging in cognitive activities such as choosing, calculating, searching, deciding, solving problems, and others as well as in relation to workloads that exceed capacity or monotonous activities.

The emergence of industry 4.0 makes workers' lives to be inseparable from technology and they are also required to continue adapting to the developments made by their company. The monotonous work activities have been replaced by technology but there is a need for higher skills and knowledge. The workers are required to continue learning and this further caused an increase in their cognitive load. Moreover, they are experiencing technostress due to the need to continue working in real-time, techno-complexity which is associated with the use of complex technology without adequate skills, and techno-insecurity due to fear of having their roles replaced by technology. These changes have a continuous effect on their psychology, thereby, leading to anxiety and stress. Furthermore, technology has reduced the interaction between workers, and this is believed by Handayani (2021) to have the ability to cause stress.

It was discovered from 10 out of the 14 selected articles that the high psychological and social burden of workers is due to having a workload that exceeds their capacity and ability. This was observed before Industry 4.0 era as indicated by 8 articles and during the era as stated by the remaining 2 articles. Moreover, before the application of technology in work, 6 articles explained that the psychological burden occurred due to the high concentration and cognitive activity while 6 other articles found an increase in cognitive load after the application. It was also observed from 1 article that the presence of technology in work causes techno-overload which implies workers are required to work more and faster as indicated in **Table 3**.

Bad Psychological and Social Impacts

The findings from 10 out of the 14 articles reviewed showed that work stress and burnout are the biggest adverse effects of high psychological burdens and poor social conditions experienced by workers in the manufacturing industry. This is reinforced by Suci (2018) that the magnitude of the psychological burden experienced by workers is closely related to the occurrence of work stress. It was discovered from 6 articles that these conditions led to psychosomatic occurrence in the form of a decrease in physical condition due to poor psychological conditions. Kennel (2021) also comprehensively stated that the burdens cause a reduction in worker welfare, increment in turnover of workers, the emergence of anxiety, decreased physical conditions such as muscle tension, faster heartbeats, and

Table 3. Psychological and Social Conditions of Workers in The Manufacturing Industry

Author(s)	Before Industry 4.0		During Industry 4.0					
	Overload-ed working capacity	High demand for concentrate-on and cognitive activities	Increas-ed cognitiv-e deman-d	Anxiety on self-performan-ce	Techno/job-complexit-y	Techno/job-insecurity	Techno-overloa-d	Low social interactio-n
Mohammadian et al. (2022)	×	×						
Scafà et al. (2019)	×	×						
Indrawati et al. (2018)	×	×						
Khandan et al. (2018)	×	×						
Junaedi et al. (2020)	×							
Azizah et al. (2019)	×							
Malik et al. (2022)	×		×	×	×	×	×	×
Krutova et al. (2022)	×		×	×		×		
Gregori et al. (2018)	×	×						
Meyer & Hünefeld (2018)			×	×				
Glimne et al. (2020)	×	×						
Maisiri & Dyk (2021)			×					
Leesakul et al. (2022)			×		×	×		×
Jerman et al. (2020)			×					
Total	**10**	**6**	**6**	**3**	**2**	**3**	**1**	**2**

Table 4. Bad Psychological and Social Impacts

Articles	Reduced Productivity	Psychosomatic	Burn Out
Mohammadian et al. (2022)			×
Scafà et al. (2019)	×		
Indrawati et al. (2018)		×	×
Khandan et al. (2018)		×	
Junaedi et al. (2020)			×
Azizah et al. (2019)			×
Malik et al. (2022)	×	×	
Krutova et al. (2022)		×	×
Gregori et al. (2018)		×	×
Meyer & Hünefeld (2018)		×	×
Total	**2**	**6**	**7**

easy fatigue. Moreover, two articles showed that high psychological and social burdens can reduce productivity, and this is in line with the opinion of Widananto and Nugraheni (2019) that companies are encouraged to reduce excessive workloads to increase worker productivity and health. **Table 4** summarizes the bad impacts on the psychological and social of workers.

Figure 2. Strategies to Control the Psychological and Social Impact of Workers

Formulation of Psychological and Social Impact Control Strategies

The systematic literature review conducted showed the poor psychological and social conditions experienced by workers in the manufacturing industry and these were observed to be leading to a decline in productivity, psychosomatic situation, and stress for workers. It is, however, important to note that workers are the determinants of a smooth production process, and this indicates the impact of these burdens needs to be controlled. Therefore, the strategies to be applied were based on the findings and facts from the literature review with the focus on two approaches including the efforts made by the company and those related to the individual workers concerned as indicated in **Figure 2**. Both approaches intend to increase productivity, streamline work processes, reduce stress, burnout, and work fatigue, improve worker welfare, minimize cognitive overload, support self-development, and obtain information on worker capacities.

Company-approached Strategies

Companies, as the place for workers to conduct their work activities, need to make several efforts towards effective control of psychological and social impacts. This is important because the presence of technology is too complicated and this is making the workers feel threatened, thereby, losing their potential. There is a need for early detection of these symptoms and the recent agile and fast technology in the Industry 4.0 era needs to be adapted using the right strategies. Seven strategies have been outlined for companies to reduce the psychological and social impact of workers as observed from the articles reviewed and these include (1) applying user-friendly and easy-to-use technology, (2) conducting periodic fun training, (3) organizing interactive activities and sharing knowledge in an informal atmosphere, (4) conducting mental load surveys, (5) facilitating health-related programs, (6) designing ergonomic workplaces, equipment, and facilities, and (7) constantly encouraging improvement efforts.

The findings showed that the workers feel burdened when they must deal with technology, and this signifies companies need to pay more attention to the characteristics and scope of the technology to be applied. This is important because the psychological and social burden of workers is logically expected to be reduced when the technology applied is user-friendly and easy to use. Moreover, there are several types and functions of technology, but they are all basically designed to make work easier. This is projected to be useful in reducing the burden on workers due to the ability of technology to decrease the usage of working memory, and work concentration, as well as monotonous and repetitive manual work. This is in line with the findings of Krutova et al. (2022) that technology assists work efficiency, workers' development, and flexibility. Furthermore, the use of friendly technology can indirectly increase productivity as mentioned by Nurfiat and Rustariyuni (2018).

Technology has a great contribution, but companies need to realize that its complex application has the tendency to cause mental and cognitive burdens which can subsequently lead to techno-complexity. Therefore, there is a need for a thorough and detailed application process that involves an Automatic Man-Machine System to allow the workers to only supervise and control its operations. This is expected to minimize the occurrence of errors in repetitive or monotonous activities of the manufacturing industry. It is also important to consider the lifespan of the technology to ensure it is available for a long time. The changes and

adjustments should also not be dramatic and sudden to avoid an increase in the cognitive load of workers required to learn and adapt to the new technology. Moreover, the use of technology should be accompanied by an increase in the capacity of human resources, effectiveness in the flow of material and work processes, and improvement of policies and regulations.

The psychological and social burden caused by increased cognitive activity and reduced social interaction needs to be balanced with learning activities to avoid creating further problems for the employees. Companies are, therefore, encouraged to hold fun training using materials tailored to their needs and the capabilities of their employees. This is necessary because the right training can improve abilities and performance, thereby leading to better productivity as indicated by Rudhaliawan et al. (2013). The training facilitated by companies can also positively reduce the stress and anxiety experienced by workers. It is also expected to reduce the fear of losing a job or job insecurity because workers are allowed to improve their knowledge and ability to operate technology which subsequently leads to having control over the existing technology. In addition to this technical training, companies are also encouraged to conduct non-technical training to achieve self-development, especially for workers lacking confidence in their potential. The training should be focused on work-life balance, growth mindset, time management, and several others.

Training has several advantages for companies but there is a need to ensure it does not cause fatigue among some workers. This agrees with the observation of Mohammadian et al. (2022) that the workers required to learn new things or engage in more tasks usually experience additional cognitive load. This risk needs to be avoided by delivering training materials appropriately and not excessively in line with the abilities of each worker. It was also observed that training organized through games, role-playing, case studies, simulation practices, and others can reduce the tension and cognitive load experienced by workers.

The findings of this study also showed that the presence of technology led to a reduction in the social interaction of workers. This can be remedied by holding interactive activities not related to work between workers such as sports according to the hobbies of the workers, joint worship activities, social donations, and others. This can be used to develop togetherness and bonding activity required to facilitate elaboration between workers and ensure positive knowledge-sharing attributes. Culture can be transferred into their daily work through the provision of solid support and cooperation which can reduce the psychological and social burden. Widuri (2018) further suggested that the development of a knowledge-sharing culture requires that companies map out who, what, and where knowledge currently resides in detail by employing Knowledge and Talent Mapping strategies.

It was also discovered that psychological and social burdens occurred when the workload exceeds the capacity of the workers. Therefore, companies need to conduct a workload demand survey and measure the capacity of their workers. It is important to note that objective workload can be determined by measuring heart rate, blinking frequency, and muscle tension while subjective workload can be evaluated spontaneously or experimentally using the SWAT (Subjective Workload Assessment Technique), NASA-TLX, Harper Qooper Rating (HQR), and other similar methods. A workload survey allows the company to have a better understanding of the needs and capacities of each person to overcome work stress associated with the imbalance (Blaug et al., 2007). It can also assist companies to reconfigure the optimal number of workers and reconsider their placement to ensure it matches their interests and abilities to avoid psychological burdens (Meyer & Hünefeld, 2018).

Psychological and social burdens also affect physical health, and this is the reason companies are encouraged to organize sports activities consistently and regularly as part of their health program. Engagement in these physical activities such as sports can reduce stress hormones during the process of exercise (Asih et al., 2018). Moreover, the desire of workers to exercise independently needs to be stimulated by giving awards to employees that excel in sports, providing interest-free installments for the purchase of sports equipment, and several others.

Companies also need to provide media for workers to obtain psychological assistance or a forum to discuss personal problems. Moreover, counseling programs can be made available to maintain and improve the mental health of the workers. The understanding of the complaints or responses of employees can also be used to identify the aspects of the system to be improved. It is also important to note that consulting services are useful for the enhancement of quality and productivity.

The psychological and social burden of workers in the manufacturing industry was observed to be caused by the monotonous and repetitive nature of their work. This is associated with the dominance of human and machine interactions which have isolated workers from their personal lives and caused despair (Timotius & Octavius, 2022). Furthermore, the principles of "Work-Life Balance" and "Growth Mindset" are required to be applied in companies to focus on the welfare of their workers and their families. This is expected to provide opportunities for workers to explore some of their rights such as taking time off, enjoying easy transportation, accommodation, consumption, worship, and others. There is also the need to stimulate their self-confidence through internal competition such as an appreciation for

innovative ideas that can increase efficiency. This does not necessarily need to be monetary because workers also need recognition as well as emotional, social, financial, and physical comfort when they work (Malomane et al., 2022).

It is also possible to use the workplace layout to reduce the psychological and social burden on the workers in the manufacturing industry. This can be achieved through the application of ergonomic workplace design and assistive devices to assist workers to complete their jobs effectively, thereby reducing their mental workload. All the elements of work need to be formed in accordance with the maximum limits of human capabilities, supporting facilities, and tools to ensure a smooth work process. Moreover, ergonomic design involves considering the duration, posture, frequency, and workload of workers as well as the shape, dimensions, patterns, and placement of equipment affecting the position or posture of the workers while performing their duties. It has been reported that ergonomically designed workplaces, jobs, and equipment can increase productivity and reduce work stress and cognitive load because the workers do not get tired easily (Yassierli et al., 2020). Furthermore, this design such as the inclusion of non-workplace spaces such as prayer rooms, toilets, canteens, parking lots, lockers, and others also allows workers to be more comfortable and avoid the risks of accidents and occupational diseases.

Several efforts have been made by companies to reduce the psychological and social burden but there is a need for improvements. This can be achieved through the continuous application of the Kaizen principle with iterative cycles of Plan-Do-Check-Action to maximize the results. Moreover, the top management of companies needs to be consistently committed to improvement efforts, including the suggestions made by workers at the lowest level.

Worker-approached Strategies

The selected articles reviewed showed that the biggest obstacle faced by workers is the existence of sophisticated technology to replace some of their work activities. This is considered a challenge for some of the workers while others perceive it as an addition to the burden to learn and adjust. It is important to note that the process is not easy because the shortcomings of the workers need to be corrected immediately if they do not want their position to be replaced by technology, thereby, leading to psychological and social burdens for workers in the manufacturing industry. Meanwhile, according to Amanvermez et al. (2022), stress can be managed by having the right mindset. This implies the efforts to reduce the impact of psychological and social burdens should not be limited to the company alone but extended to the workers concerned. This can be achieved by (1) creating a growth mindset, (2) having coping skills, and (3) sharpening time management skills.

The 14 articles reviewed showed that psychological and social burdens on workers are associated with fear, anxiety, worry, inferiority, insecurity, pessimism, and other negative feelings which are all rooted in the mindset. This denotes that having a good mindset is important because people behave, act, and respond to situations based on their perspective (Timotius et al., 2018). There are two types of mindsets, and these include the Growth and Fixed Mindsets. The growth type believes desires can be achieved by learning from failure and challenging the mind, willing to learn from the success of others, and always trying to do better while the fixed type is vice versa. According to Krutova et al. (2022), workers aged over 35 years are usually not interested and willing to improve their abilities, they tend to dislike change because they think it will interfere with their work and this is an example of a fixed mindset. Meanwhile, psychological, and social burdens are not expected to occur among workers having a growth mindset due to their ability to maintain courage, dare to face challenges, sincerely ask for and accept criticism to learn from their mistakes, and proactively develop themselves to be better.

Coping skills is another strategic recommendation for workers. The concept was defined by Lazarus and Folkman (1984) as the ability to self-manage conditions considered to be tiring and draining energy. It can be used to balance emotions, maintain relationships with others, reduce insecurity, and others. It was also believed by Maryam (2017) to assist workers to overcome problems and pressures. There are two types of coping skills, and these include emotional-focused and problem-focused. The emotional-focused can be used to reduce stress by controlling internal emotions through social support, acceptance, and continuous positive thoughts while the problem-focused centers on problems associated with planning, collaborating, socializing, and taking the risk to change a situation.

Another effort required from the workers is to sharpen their time management skills. This is due to the fact workloads are often associated with poor management of time and the inability to distinguish between important and urgent activities. This usually has a psychological and social burden because workers feel stressed, are always pressured by time limits, and do not have enough time to rest. It is important to note that time management includes planning, scheduling, and organizing the best possible time to complete tasks based on the order of priority. Good time management makes it easier for workers to complete all their work properly and reduces psychological and social impacts. This is in line with the findings of Gea (2014) that good time management is directly related to worker satisfaction, performance, and reduction in mental stresses like

anxiety. Therefore, workers are encouraged to start work by understanding job priorities, scheduling, working, and finishing the job based on these priorities.

4. Conclusion

Changes are bound to happen in the work process of manufacturing industries, especially due to the advancement of technology in the Industry 4.0 era. The companies operating in this industry are engaged in a lot of human-machine interaction and must deal with the psychological and social impact of adopting technology on their workers which occur based on work activities and the mental pressure to adapt and use technology efficiently. The review of the 14 selected articles showed that the human-machine interaction in the manufacturing industry is often associated with a workload that exceeds the capacity of workers, job characteristics that require high concentration and cognitive activity, pressure on workers to continue learning new things, lack of confidence in workers abilities, increasing complexity in technology (techno/job-complexity), the possibility of workers' roles being replaced by technology (techno/job-insecurity), excessive use of technology (techno-overload), and reduced social interaction. These factors have the capacity to cause decreased productivity, psychosomatic condition, and work stress.

The psychological and social burden can be controlled by both the company and the workers to achieve maximum results. It is recommended that further studies focus on measuring the success of the strategy proposed in the scope of the manufacturing industry using different fields, locations, and characteristics. Moreover, there is a need for more attention to the use of digital technology, the work environment, and other factors in the industrial work system in order to have new findings and develop better strategies.

5. Acknowledge

Authors would like to thank to the Universitas Kristen Krida Wacana that has been facilitated and supported this study, particularly to the faculty members of Department of Industrial Enginering.

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