Perceived Effect of Factors on Workers' Task Performance in a Cold Storage Warehouse Facility

Cynthara B. Leonardo and Marvin I. Noroña
School of Industrial Engineering and Service Engineering Management
Mapúa University, Intramuros, 1002 Metro Manila, Philippines
cynthara28@yahoo.com, minorona@mapua.edu.ph

Abstract

Cold exposure has implications to worker's health, safety, and occupational performance for the reason that it can cause injuries. Interestingly, an extension of the Protection Motivation Theory was used to evaluate the factors that affect the ergonomic risk behaviour of the employees and their task performance in a cold storage warehouse facility. Structural Equation Modeling was then utilized to analyze the interrelationship among threat appraisal, coping appraisal, ergonomic risk behaviour, and cold storage task performance. An online questionnaire was distributed and a total of 255 data samples were collected. The results of the SEM indicated that threat appraisal and coping appraisal had significant direct effects on the task performance of the employees in a cold storage facility. However, the results also showed that PMT had a significant indirect effect on the cold storage employees regardless of having the latent ergonomic risk behaviour as not significant. In addition, ergonomic risk behaviour was also found to have no significant direct effect on the task performance of the employees in a cold storage facility. Hence, a risk assessment was conducted to identify the cold storage hazards and risk factors and to formulate cold storage operations improvements incorporating these influencing factors on task performance.

Keywords
Cold Storage Warehouse, Protection Motivation Theory (PMT), Structural Equation Modeling (SEM), Ergonomic Risk Behavior, Risk Assessment

1. Introduction
The cold chain is a process that is used to store and preserve chilled and frozen foods in cold storage warehouses to ensure food safety, quality, and shelf life for consumers (Beasley, 1998; Hongxia Zhao et al., 2018; James & James, 2010). Some foods, whether they are frozen or refrigerated, have variable temperature requirements. Ice cream, for example, should be kept at a lower temperature than frozen vegetables (Salin & Nayga, 2003). The cold chain's integrity must be maintained from the point of manufacturing or processing, through all transport phases (e.g., loading, unloading, handling, and storage), and into storage at the consumer's home or restaurant.

Cold storage capacity grew by 66 million cubic meters in 2018, to 616 million, which is 2.67% over 2016. According to Salin (2018), India was the largest at 150 million cubic, then the United States, and China accounted for the rest at 105 million cubic meters, which accounted for 60% of the refrigerated space. While the earlier cold storages were concentrated more in the rural areas and near the site of food production in the Philippines, modern-day facilities have begun founding themselves in the heart of the country, including densely populated areas of Metro Manila, Metro Cebu, and Central Luzon.

The fast-growing cold chain industries in the Philippines have been driven by the contribution of both government and private sectors. The formation of the Cold Chain Association of the Philippines (CCAP) with over 100 captive and non-captive companies as members and the Philippine National Cold Chain Program launched in 2004 by the United States Department of Agriculture (USDA) Food for Progress has been one of the keys defining moments for cold chain industry. With the rise in competitiveness in the market, there has been a need for more efficient supply and storage, and an expansion of innovative technologies. One of the trends in cold storage warehouses is to espouse an intelligent system, as well as the automatic control of refrigeration systems, automatic safety monitor and protection system, automatic information retrieval system, and automatic transportation system (Zhao et al. 2018; Fan, 2013). Researchers investigate alternatives for preserving manual performance in the cold, including protective equipment,

external heating, and exercise (Ray et al. 2019). While gloves can assist save heat and protect hands from any possible injury (Ray et al. 2019), external heating may be more effective due to gloves' inability to maintain a warm hand temperature (Ray et al. 2019; Imamura et al. 1998, Wiggen et al. 2011). Aside from cold exposure, the challenging part of warehousing is the unique demands of customers (Mickleson et al. 2019) and the competition between the cold storage warehouses. Numerous tasks in the workplace, such as material handling tasks, require an individual to perform in poor working conditions to meet task demands (Basahel, 2015). Plenty of research has found out that heavy physical demand and improper posture while performing a task such as lifting activity and pulling or pushing tasks can cause musculoskeletal disorders (Basahel, 2015; Lei et al. 2005). In addition, during order picking, employees often develop musculoskeletal disorders because of weight-intensive and physical jobs (Daria et al., 2015; Grosse et al., 2014; Weisner & Deuse, 2014).

Perhaps one of the most challenging aspects is to incorporate ergonomic concerns to safeguard their workers' health and avoid potential risks that come within manual activities at work (Mengoni, 2017; Goggin et al., 2008; Beevis, 2003). The risk exposure of a worker to accidents and injuries is directly related to a series of improper movements made by the worker when doing jobs such as material handling of heavy loads, transitioning between different activities at irregular intervals, executing only one function or movement for an extended duration, and sudden lifting of loads (Mengoni, 2017). While human factors can determine the performance of the system to large extent, still there are human factors related to issues such as the risk of developing musculoskeletal disorders (MSD) in labor-intensive environments (Grosse et al. 2017). Moreover, cold exposure has implications to worker's health, safety, and occupational performance for the reason that it can cause injuries (Ray, 2019; Mäkinen & Hassi, 2009) which varies in terms of age, gender, body composition, exercise, and adaptation state with longer periods of cold exposure (Khanday & Hussain, 2015). Being exposed in a cold environment can also affect the workers heart rate because the longer the time spent inside the cold storage warehouse, the greater the change in the blood pressure (Morioka, 2005). Furthermore, long cold exposure can lead to hypothermia, incapacitation, frostbite, and even death (Khanday & Hussain, 2015). Hence, this research study seeks to assess the ergonomics factors related to a cold storage warehouse. Specifically, this research aims to:

1. To assess how the workers perceive threats in a cold storage warehouse and how does management respond to avert this threat.
2. To determine the mediating effect of workers' ergonomic risk behavior on their task performance in the cold storage warehouse.
3. To recommend a solution to increase the workers' productivity and efficiency in the cold storage warehouse.

This research undertaking will be beneficial to the cold storage sector in the Philippines to understand how the workers perceived threats and their ergonomic risk behavior influence their task performance. The scope of this study covers the cold storage warehouse in the Philippines and will only focus on the ergonomic factors that can affect workers' task performance.

2. Methods

A cold storage warehouse is used to store frozen and chilled to prevent the growth of bacteria in a temperature danger zone of 40 °F to -140 °F. However, too much cold exposure could affect the health of the workers. Additionally, repetitive tasks and wrong movements of workers during task execution might have the risk of developing a musculoskeletal disorder, which later on can affect their task performance. Hence, the main objective of this study is to identify how workers perceived threat in a cold storage setting by integrating protection motivation theory (PMT) and how does it affect their task performance. Thus, this study will be guided by the conceptual framework as shown in Figure 1. On the other hand, Figure 2 illustrates this study's operational framework, a more detailed analysis infused with the determining factors identified affecting the workers' cold storage task performance.

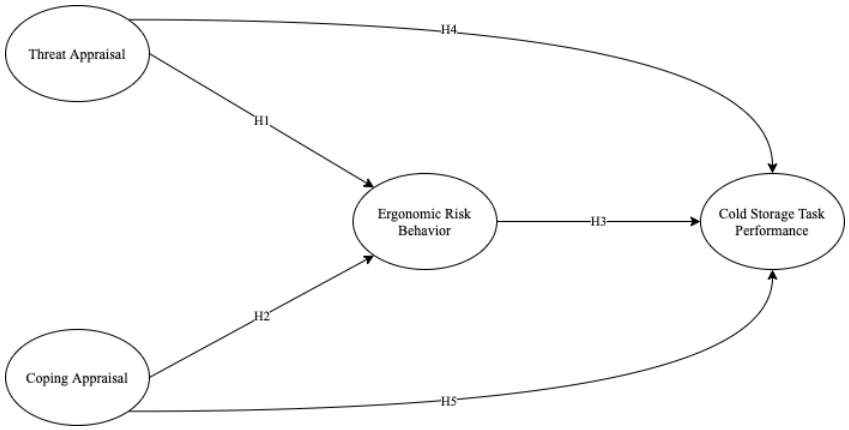

Figure 1. Conceptual Framework

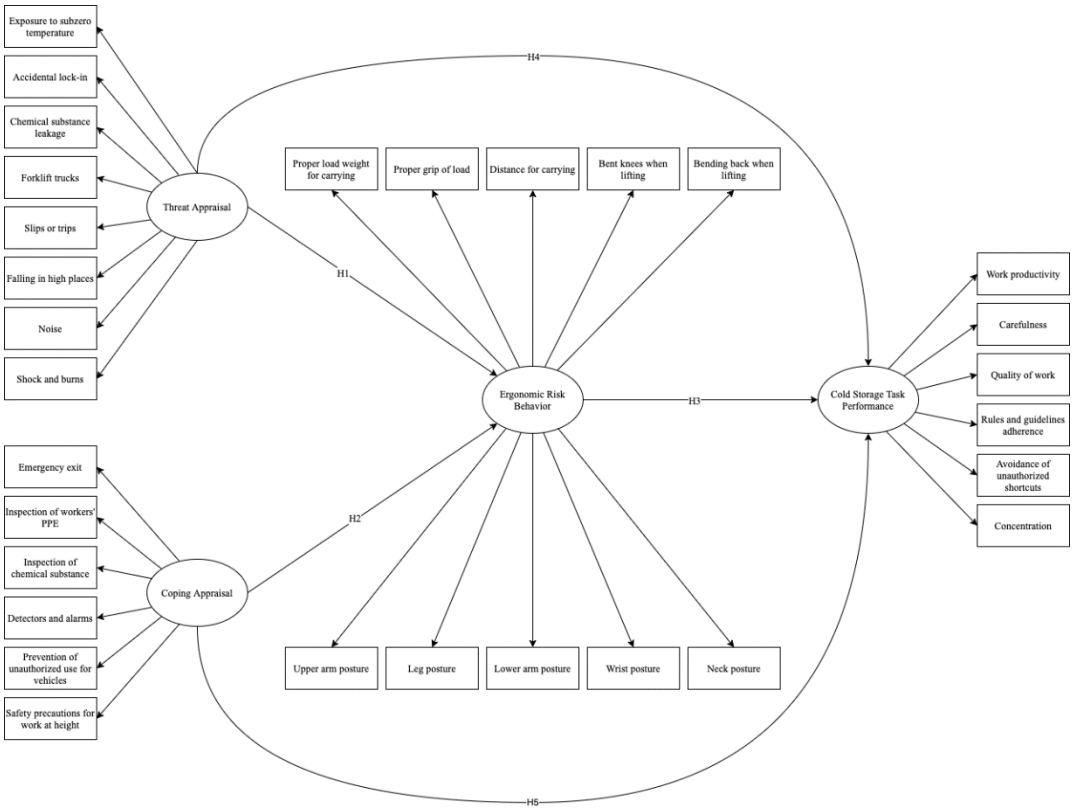

Figure 2. Operational Framework

3. Data Gathering

A survey questionnaire through Google Form will be adopted as the primary instrument for this study. The online questionnaire will be distributed and a total of 255 data samples will be collected. As latent constructs are unobservable, they will be derived from the operational framework's variables of interest, which will then be measured using a 5-point Likert scale.

The survey questionnaire of this study will be created based on the operational framework and will be distributed to workers of a cold storage warehouse in the Philippines. The survey questionnaire will consist of five (5) sections with 35 questions: (1) Socio-demographic profile of the workers, (2) Threat Appraisal, (3) Coping Appraisal, (4) Ergonomic Risk Behavior, and (5) Cold Storage Task Performance.

4. Data Analysis

Based on the established operational framework, the SEM construct has four (4) latent variables with one (1) mediating variable, which is the ergonomic risk behavior, and three (3) endogenous variable which is the cold storage task performance. In this regard, structural equation modeling (SEM) will be used to test the formulated hypotheses of this study. AMOS 22, a statistical software used for the analysis of moment structures, will be utilized with a maximum likelihood approach to obtain a model fit of causal relationships between observed and latent constructs. To determine the model's fit of the SEM construct, six measurements will be taken into accounts such as Incremental Fit Index (IFI), Tucker Lewis Index (TLI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AFGI), and Root Mean Square Error of Approximation (RMSEA).

The result of this study will be divided into two parts subjected for interpretation. Once the SEM results have assessed the significant factors, a path analysis for the established structural model will indicate the direct and indirect effects of the significant factors and their relationships. Next, the said results will then serve as an insight on how to reinforce the significant factors affecting ergonomic risk behavior to impact the workers' cold storage performance.

5. Results and Discussion

A total of 255 respondents with an average age of 31 years old answered the online questionnaire, which contained 35 questions. Table 1 presents the workers' demographic profile.

Table 1. Demographic Profile of the 255 Respondents

Category	Item	Frequency	Percentage
Gender	Male	95	37.2
	Female	160	62.8
Highest Level of Education	Gradeschool	1	0.4
	Highschool	37	14.6
	Technical Vocational	45	17.7
	Bachelor	165	64.6
	Masters	7	2.7
	PhD	0	0
Working Experience	<1	58	22.6
	1 - 2	116	45.6
	3 - 4	40	15.5
	> 5	42	16.4
Accident Experience	Yes	108	42.5
	No	147	57.5

Structural equation modeling (SEM) has been widely used in the past to assess various aspects of ergonomics and safety at work (Wu et al., 2015; Salvendy, 2012; Jaworek et al., 2010). Figure 3 illustrates the initial SEM result by integrating protection motivation theory (PMT) to determine the factors influencing the employees' ergonomic risk behavior and task performance in a cold storage industry setting. According to Hair et al. (2010), an ideal standardized factor loading value should be greater than 0.5 to be considered as important (Arifin & Muhamad, 2016) while some researchers use much more stringent criteria such as a cut-off of 0.7 (Barrett, 2007). As seen in Figure 3, few factor loadings are below the suggested cut-off such as ER1, TP4, and TP5. These values greatly affect the model fit of the initial SEM, which results in not meeting the suggested cut-off as presented in Table 2. Therefore, a revised SEM

model was constructed as shown in Figure 4, by omitting these variables to improve the fitness of this study's initial model. Subsequently, the final model for the SEM and model fit test is presented in Figure 5 and Table 3.

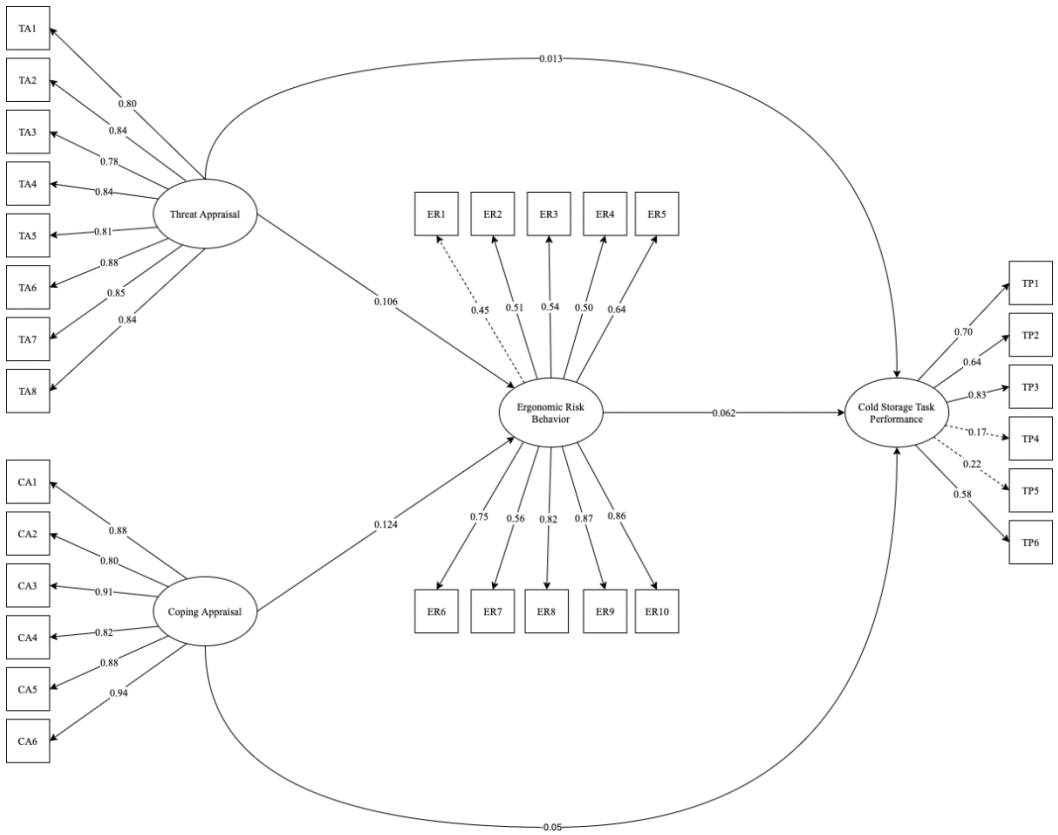

Figure 3. Initial Result of SEM

Table 2. Model Fit Test Result for the Initial SEM

Measure	Parameter Estimates	Suggested Cut-Off	Suggested By
Incremental Fit Index (IFI)	0.720	> 0.90	Hair et al. (2010)
Tucker Lewis Index (TLI)	0.694	> 0.80	Hooper et al. (2008)
Comparative Fit Index (CFI)	0.719	> 0.90	
The goodness of Fit Index (GFI)	0.657	> 0.80	Gefen et al. (2000)
Adjusted Goodness of Fit Index (AGFI)	0.602	> 0.80	Gefen et al. (2000)
Root Mean Square Error of Approximation (RMSEA)	0.131	≤ 0.08	Hooper et al. (2008)

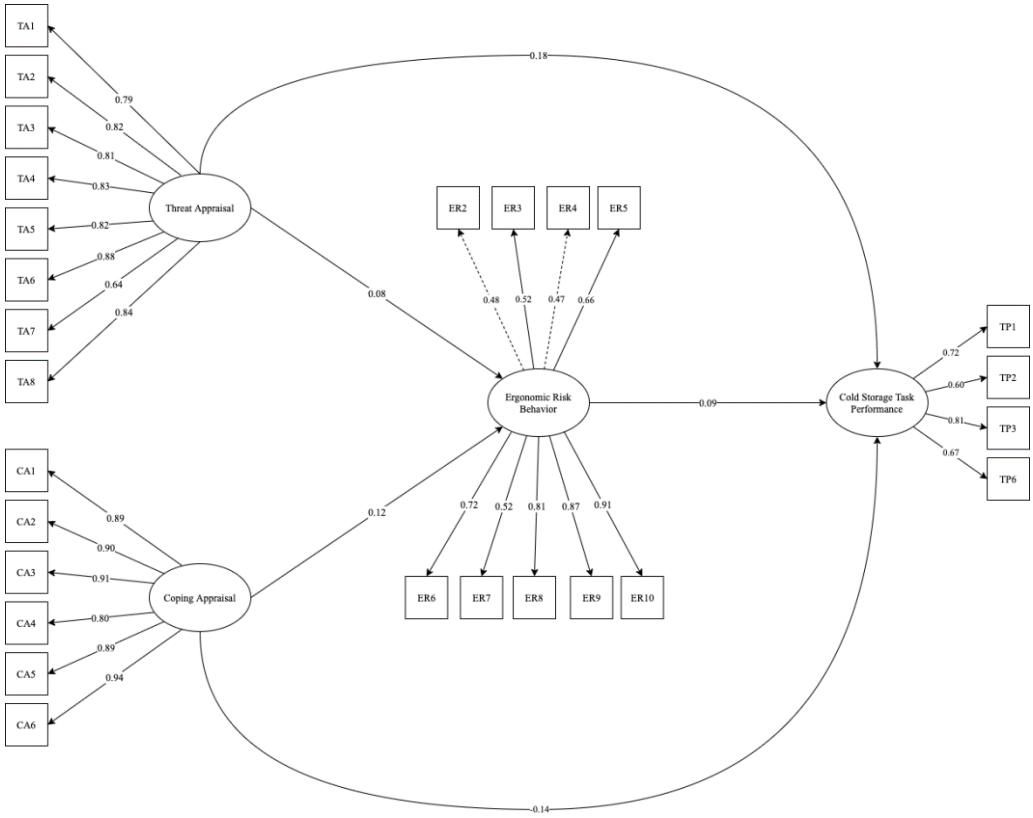

Figure 4. Iteration 2 for SEM

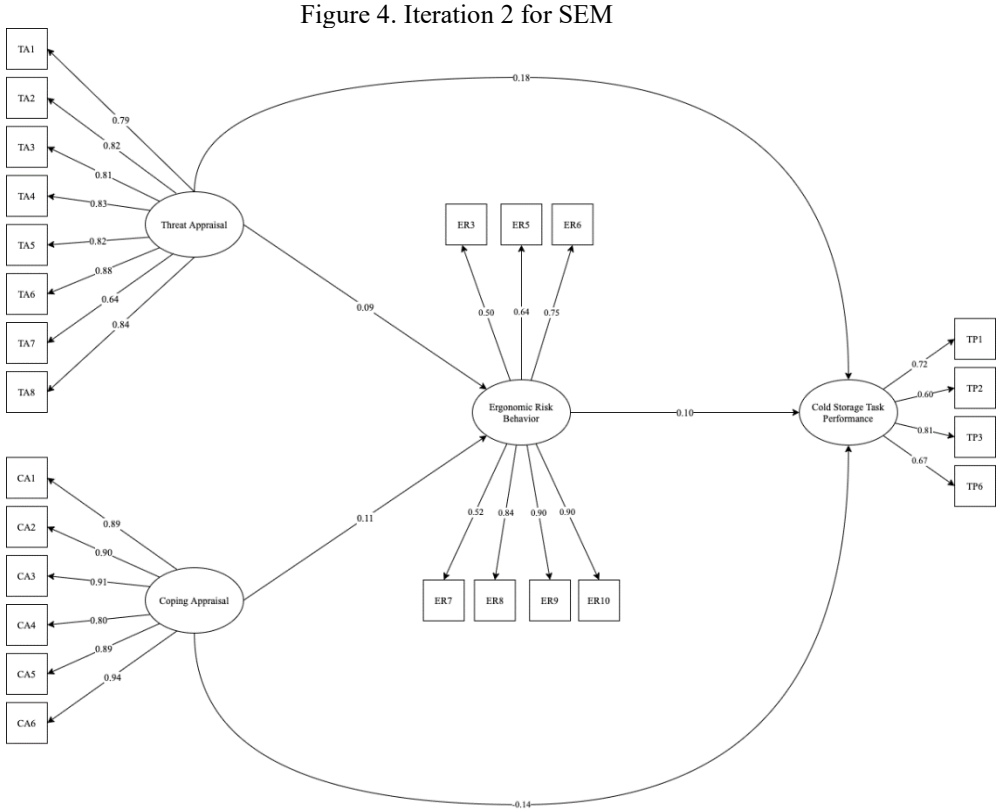

Figure 5. Final Result of SEM

Table 3. Model Fit Test Result for the Final SEM

Measure	Parameter Estimates	Suggested Cut-Off	Suggested By
Incremental Fit Index (IFI)	0.904	> 0.90	Hair (2010)
Tucker Lewis Index (TLI)	0.881	> 0.80	Hooper et al. (2008)
Comparative Fit Index (CFI)	0.903	> 0.90	Hair (2010)
The goodness of Fit Index (GFI)	0.831	> 0.80	Gefen et al. (2000)
Adjusted Goodness of Fit Index (AGFI)	0.775	> 0.80	Gefen et al. (2000)
Root Mean Square Error of Approximation (RMSEA)	0.089	≤ 0.08	Hooper et al. (2008)

The model fit result for the final SEM in Figure 5 has shown a significant improvement compared to the previous calculations. As presented in Table 3, the IFI, TLI, and CFI values were greater than the suggested cutoff of 0.90 and 0.80, indicating that the specified model's hypothesized construct was an excellent representation of the observed data. In addition, the value of GFI for this study has surpassed the suggested cutoff, indicating that the model was also good. However, the AFGI of this study is below the suggested cutoff of 0.80 but appears to agree with the statement that AFGI is always less than the GFI. The RMSEA value was 0.089, indicating that it did not pass the suggested cutoff. But, MacCallum, Browne, and Sugawara (1996) argued that values that range from 0.08 to 0.10 can be considered as a mediocre fit.

Overall, the final model fit test has shown parameters along with the suggested cutoff, which can be accepted to use to analyze the direct, indirect, and total effects of each latent, as presented in Table 4.

Table 4. Direct, Indirect, and Total Effects

Variables	Direct	P-value	Indirect	P-value	Total Effect	P-value
TA → ER	0.086	0.193	-	-	0.086	0.193
CA → ER	0.110	0.092	-	-	0.110	0.092
TA → TP	0.183	0.010	0.009	0.010	0.192	0.010
CA → TP	-0.142	0.043	0.011	0.043	-0.131	0.043
ER → TP	0.10	0.156	-	-	0.100	0.156

The current study is an extension of behavioral safety (Cooper et al., 1994) and safety climate work, integrating the Protection Motivation Theory (PMT) to evaluate the factors that affect the ergonomic risk behavior of the employees and their task performance in a cold storage industry in the Philippines. Structural Equation Modeling (SEM) was utilized to analyze the interrelationship among threat appraisal (TA), coping appraisal (CA), ergonomic risk behavior (ER), and cold storage task performance (TP). An online questionnaire was distributed and a total of 255 data samples were collected.

SEM indicated that factors derived from the PMT, threat appraisal (TA), and coping appraisal (CA) had a significant direct effect on employees' cold storage task performance (TP). The result highlights the most common issue of the employees in the workplace, which supported several studies (Guldenmund, 2000; Neal et al., 2000) that safety climate can be used as an antecedent of safety performance through risk perceptions. These are: (1) the possibility of falling in high places, which can cause severe or fatal injuries, (2) the possibility of being struck by forklift trucks or other materials handling equipment and shock and burns from faulty electrical equipment or installation has the same level of degree from an employees' perspective, (3) the accidental lock-in in the cold storage, which may cause death or injury from prolonged exposure to cold temperature, (4) slips or trips over subjects as stock protruding into pathways and, (5) the possibility of leakage for chemical substances such as ammonia and freon, which may cause death or fatal

respiratory irritation or worse death from prolonged inhalation exposure. Since safety awareness is associated with productivity and safety behavior, management should be stringent on their safety activities to enhance the quality of employees' work and, at the same time, reduce accidents due to unauthorized shortcuts on the execution of the job. The management of the organization should also promote good communication within the workplace, as only communicating effectively can result in a thorough understanding of human factors concepts and safety measures. Supervisors and managers who actively express their ideas and expectations to employees must be aware of potential conflicts between production and safety objectives, and senior management must grasp how their attitudes affect employee perceptions.

The result also showed that PMT has no significant direct effect on the ergonomic risk behavior of the employees (ER) in a cold storage workplace as opposed to studies from Al-Refaie (2013) and Lee et al. (2015). On the other hand, Nasab et al. (2009) mentioned that there is no statistically significant relation was reported between attitude and the ergonomic risk behavior of the employees. Ergonomic risk behavior was also found to have no significant effect on the cold storage task performance of the employees. However, the result also showed that PMT has a significant indirect effect on the cold storage employees regardless of having the latent ergonomic risk behavior as not significant. It could be argued that the safety climate associated with PMT factors and safety behavior is dynamic and always in a state of flux. These findings serve as a timely reminder that safety climate scores do not always fully portray actual levels of safety behavior, implying that the use of several performance indicators to justify safety climate measures may be necessary.

5.1 Risk Assessment Matrix

As demonstrated by the study's findings, when workers are content with their working conditions and feel protected from injuries and accidents, they increase their productivity. According to Dekker (2011), insufficient or improper resources, notably knowledge and tools, have a detrimental effect on human and organizational performance and contribute to the migration of businesses into hazardous states, which may result in undesirable consequences such as safety incidents and lower-quality outputs. A risk assessment in cold storage, as shown in Table 6, is designed to help the management minimize the probability of potential risk to optimize employees' task performance. Since not all risks can be eliminated, potential risks should be managed appropriately to minimize the effect of the risk. On the other hand, some risks will be quick to address and, some will take time and preparation, therefore, there is a need to prioritize areas for action. Hence, Table 5 represents the hierarchy of risk control figures to work through the highest level of protection and reliability to the lowest.

Table 5. Risk Classification Matrix

Probability of the Threat	**Probability and Impact Risk Ranking**			
	Negligible	**Minor**	**Serious**	**Critical**
Frequent	Low	Medium	High	High
Probable	low	Medium	Medium	High
Remote	Low	Low	Medium	Medium
Improbable	Low	Low	Low	Low

Table 6. Risk Assessment for Cold Storage

Hazard Identification	Description of Risk	Potential Harm	Consequence	Likelihood	Risk Level	Control Risks
Manual Tasks	Lifting heavy objects, repetitive movements, awkward posture	Musculoskeletal disorder, damage to joints, muscles, etc.	Minor	Probable	Medium	Ensure operators are properly trained in manual handling
Extreme Cold	Accidental lock-in	Hypothermia, frostbite, death, and gradual loss of risk awareness	Serious	Remote	High	Ensure that there are no obstructions going to the emergency exit and it is operational through periodic checks.
						Ensure alert system on doors for inform outsiders to a trapped operator
	Working in a subzero environment		Serious	Remote	High	Ensure that implementation of Good Operating Practices such as wearing of PPEs is properly followed.
Chemical Substances	Accidental release of chemical substances (i.e., ammonia, freon, etc.)	Severe eye and throat irritation	Minor	Probable	High	Ensure that any work related to potential ammonia release or any work on the system must be done by at least two persons (second person to help in an emergency)
						Monthly checks on vapor detectors and alarms
						Shower to be checked weekly
Workplace Transport	Vehicle activity in the cold storage	Injury to persons, death, collision, damage to property or equipment	Serious	Probable	Medium	Instruct forklift operators or drivers not to leave keys when vehicles are unattended and ensure that only authorized persons can be used the vehicle (e.g., forklift, pallet mover etc.)
						Ensure adequate flooring in the area, non-slip and appropriate for heavy equipment
Poor Workplace Design and Layout	Falls from height	Severe or fatal injuries	Serious	Remote	Medium	Ensure that procedure for working in heights are properly followed. Equipment and PPEs related to this work must also check by Supervisors and Safety Officer.
						Signage must also be posted. This will set as a reminder to all employees not to violate SOPs.
	Inadequately stored product (i.e., in aisles)	The trip, slip hazard, fractures	Minor	Remote	Low	Good housekeeping to ensure the area is clear of debris
Noise	Exposure to loud noise above 85db	Hearing damage	Serious	Improbable	Low	Ensure preventive maintenance is carried out on cold storage equipment
						Give staff access to earbuds and earmuffs
Electricity	Faulty electrical installation or electrical equipment	Shock and burn injuries	Serious	Probable	Medium	Regularly conduct a planned schedule for inspection on electrical installation and equipment

6. Conclusion

Like many hands-on jobs and working environments, working at a cold storage facility poses several potential health and injury risks for employees performing typical daily activities. With regular use of heavy equipment, exposure to extremely cold temperatures, damp, slippery surfaces, workplace injuries, and mishaps in cold storage facilities can be common – employees experience accidents like falls, overexertion, or cold-related adverse health effects. This current study integrated Protection Motivation Theory (PMT) to evaluate ergonomic factors affecting the ergonomic risk behavior and task performance of the employees in a cold storage facility. The results of the Structural Equation Modeling (SEM) indicated that threat appraisal and coping appraisal had significant direct effects on the task performance of the employees in a cold storage facility. However, the results also showed that PMT had a significant indirect effect on the cold storage employees regardless of having the latent ergonomic risk behavior as not significant. In addition, ergonomic risk behavior was also found to have no significant direct effect on the task performance of the employees in a cold storage facility. These findings serve as an opportune reminder that safety climate scores do not always fully portray actual levels of safety behavior, implying that the use of several performance indicators to justify safety climate measures may be necessary.

A risk assessment was also conducted in a cold storage facility to understand the common cold storage health and safety risks identified from the result of the SEM and incorporate strategies and guidelines to avoid personal injuries, ensure a working environment, and have efficient daily operations.

6.1 Recommendations

The findings of this study indicate that safety climate perceptions will not necessarily match actual ergonomic risk behaviour and safety task performance of the employees in a cold storage facility. It is suggested that the cold storage warehouse management should focus its primary safety improvement effort on changing unsafe situations and conditions, and on preventing ergonomic related disorders. The above will help improve people's safety behaviour as well as cold storage employee attitudes and perceptions.
For future research- explore additional factors and relationships such as worker involvement to safety behaviours, safety awareness, and management commitment to ensure a safe environment for all of their employees at work.

References

Ahmad, R. (2014). Researching social sciences and management studies: Practical and a step-by-step guide. RS Publishing House.

Ahmad, R., Ching, C. L., Bandar, N. F. A., Hamidi, H., Shminan, A. S., & Siong, H. C. (2018). Relationship between safety climate factors and safety performance among the workers in cold storage industries. American Journal of Trade and Policy, 5(3), 85-92.

Baumeister, R. F., & Showers, C. J. (1986). A review of paradoxical performance effects: Choking under pressure in sports and mental tests. *European Journal of Social Psychology*, *16*(4), 361-383.

Beasley, S. (1998). The current state of the cold chain in the Philippines. United States Department of Agriculture, Trade and Investment Program of Food Industries Division, Foreign Agricultural Service, 10, 251-256.

Chi, H.K., Yeh, H.R. and Chiou, C.-Y. (2008) The Mediating Effects of Internal Marketing on Transformational Leadership and Job Performance of Insurance Salespersons in Taiwan. The Business Review, 11, 173-180.

Dekker, S. (2016). *Drift into failure: From hunting broken components to understanding complex systems*. CRC Press.

Dode, P., Greig, M., Zolfaghari, S., & Neumann, W. P. (2016). Integrating human factors into discrete-event simulation: a proactive approach to simultaneously design for system performance and employees' well-being. *International Journal of Production Research*, *54*(10), 3105-3117.

Dole, C., & Schroeder, R. G. (2001). The impact of various factors on the personality, job satisfaction, and turnover intentions of professional accountants. Managerial auditing journal.

Fritzsche, L., Wegge, J., Schmauder, M., Kliegel, M., & Schmidt, K. H. (2014). Good ergonomics and team diversity reduce absenteeism and errors in car manufacturing. *Ergonomics*, *57*(2), 148-161.

Glendon, A. I., Clarke, S., & McKenna, E. (2016). Human safety and risk management. CRC Press.

Griffin, M. A., & Curcuruto, M. (2016). Safety climate in organizations. Annual Review of Organizational Psychology and Organizational Behavior, 3, 191-212.

Hofmann, D. A., Morgeson, F. P., & Gerras, S. J. (2003). Climate as a moderator of the relationship between leader-member exchange and content-specific citizenship: safety climate as an exemplar. *Journal of Applied Psychology*, *88*(1), 170.

Hollnagel, E. (2009). *The ETTO principle: efficiency-thoroughness trade-off: why things that go right sometimes go wrong*. Ashgate Publishing, Ltd.

Hon, C. K., Hinze, J., & Chan, A. P. (2014). Safety climate and injury occurrence of repair, maintenance, minor alteration, and addition works. Facilities.

Jaworek, M., Marek, T., Karwowski, W., Andrzejczak, C., & Genaidy, A. M. (2010). Burnout syndrome as a mediator for the effect of work-related factors on musculoskeletal complaints among hospital nurses. *International Journal of Industrial Ergonomics*, *40*(3), 368-375.

Kahya, E. (2007). The effects of job characteristics and working conditions on job performance. *International journal of industrial ergonomics*, *37*(6), 515-523.

Kamarulzaman, N., Saleh, A. A., Hashim, S. Z., Hashim, H., & Abdul-Ghani, A. A. (2011). An overview of the influence of physical office environments on an employee. Procedia Engineering, 20, 262-268.

Khandan, M., Maghsoudipour, M., Vosoughi, S., & Kavousi, A. (2013). Safety climate and prediction of ergonomic behavior. *International journal of occupational safety and ergonomics*, *19*(4), 523-530.

Kossek, E. E., Kalliath, T., & Kalliath, P. (2012). Achieving employee wellbeing in a changing work environment: An expert commentary on current scholarship. *International Journal of Manpower*.

List of Accredited Cold Storage Warehouse in the Philippines by National Meat Inspection Service. Retrieved from: https://nmis.gov.ph/images/pdf/accredited_list/asofmay2021/CSW.pdf

List of Accredited Cold Storage Warehouse- BFAR. Retrieved from: https://bfar.da.gov.ph/files/img/photos/July2020-LISTOFACRREDITEDCOLDSTORAGEWAREHOUSE.pdf

Luria, G., & Yagil, D. (2010). Safety perception referents of permanent and temporary employees: Safety climate boundaries in the industrial workplace. Accident Analysis & Prevention, 42(5), 1423-1430.

Maslow, A. H. (1981). Motivation and personality. Prabhat Prakashan.

Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice, and safety performance in offshore environments. Safety Science, 41(8), 641-680.

Mossa, G., Boenzi, F., Digiesi, S., Mummolo, G., & Romano, V. A. (2016). Productivity and ergonomic risk in human-based production systems: A job-rotation scheduling model. International Journal of Production Economics, 171, 471-477.

Omogoroye, O. O., & Oke, S. A. (2007). A safety control model for an offshore oil platform. Disaster Prevention and Management: An International Journal.

Reiman, T., & Oedewald, P. (2007). Assessment of Complex Sociotechnical Systems–Theoretical issues concerning the use of organizational culture and organizational core task concepts. Safety Science, 45(7), 745-768.

Salvendy, G. (Ed.). (2012). Handbook of human factors and ergonomics. John Wiley & Sons.

Tharaldsen, J. E., Olsen, E., & Rundmo, T. (2008). A longitudinal study of safety climate on the Norwegian continental shelf. Safety Science, 46(3), 427-439.

Thetkathuek A, Yingratanasuk T, Jaidee W, Ekburanawat W. (2015). Cold exposure and health effects among frozen food processing workers in eastern Thailand. *Saf Health Work*. 2015;6(1):56-61. doi:10.1016/j.shaw.2014.10.004

UK Health and Safety Executive. (2007). Example risk assessment: Cold Storage Warehousing. Retrieved March 21, 2021, from https://www.hse.gov.uk/risk/casestudies/pdf/coldstorage.pdf

Wu, C., Song, X., Wang, T., & Fang, D. (2015). Core dimensions of the construction safety climate for standardized safety-climate measurement. Journal of Construction Engineering and Management, 141(8), 04015018.

Wyatt, R., & Gibson, M. (2002). Integrating Ergonomics into Behavioral Based Safety.

Zohar, D., & Luria, G. (2004). Climate as a social-cognitive construction of supervisory safety practices: scripts as a proxy of behavior patterns. Journal of applied psychology, 89(2), 322.

Biographies

Cynthara B. Leonardo is a Process Engineer/ ISO Compliance at Glacier Pulilan Refrigeration Services Corporation in the Philippines. She earned her Bachelor of Science in Industrial Engineering from Adamson University and a Master of Science in Industrial Engineering from Mapua University. Her research interests include process improvements, quality assurance, ergonomics, and lean six sigma.

Marvin I. Noroña is faculty member of the Mapua University School of Industrial Engineering & Engineering Management and School of Graduate Studies. He earned his BSIE and MBA degrees from University of the Philippines and is completing his dissertation for a Doctor in Business Administration degree at the De La Salle University. Apart from research and teaching, he is into management consulting and training in the areas of sustainability, supply & operations management, production & service systems improvement, strategic planning and management, lean six sigma, and design thinking.