COSH 2024
24th CONFERENCE AND EXHIBITION ON OCCUPATIONAL SAFETY AND HEALTH

SCICOSH
6TH SCIENTIFIC CONFERENCE ON OCCUPATIONAL SAFETY AND HEALTH

Jabatan Keselamatan dan Kesihatan Pekerjaan
KEMENTERIAN SUMBER MANUSIA

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

STUDY ON BENCHMARKING OF OCCUPATIONAL SAFETY AND HEALTH (OSH) CULTURE LEVELS AMONG EMPLOYERS AND EMPLOYEES IN MALAYSIA

ENGLISH VERSION

MALAY VERSION

MALAYSIA MADANI

COSH 2024
24th CONFERENCE AND EXHIBITION ON OCCUPATIONAL SAFETY AND HEALTH

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6th SCIENTIFIC CONFERENCE ON OCCUPATIONAL SAFETY AND HEALTH

MINISTRY OF HUMAN RESOURCES

NIOSH

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Title: Hierarchical Safety Culture Model for Malaysia: A Confirmatory Study

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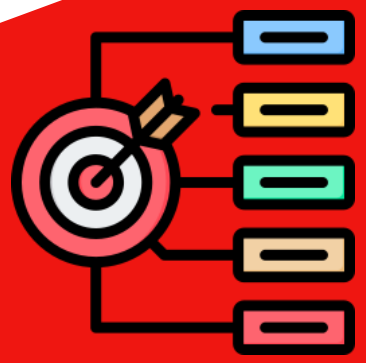
UTM UNIVERSITI TEKNOLOGI MALAYSIA

Hierarchical Safety Culture Model for Malaysia:

A Confirmatory Study

Abstract

The study investigates safety culture in Malaysia, defined by the Health and Safety Laboratory as the blend of attitudes, values, and perceptions impacting workplace behavior. Aim of this study was development of a national Occupational Safety and Health (OSH) culture model. This endeavor aligns with the OSH Master Plan 2021–2025 (OSHMP25), Vision Zero initiatives, and the UN sustainable development goals (SDGs). Confirmatory Factor Analysis (CFA) was used to investigate hierarchical nature of safety culture and its low order factors within organizations in Malaysia. The data was collected at two OSH events: KeJaRI 4.0, and APOSHO. Out of 1500 distributed surveys across these programs, 625 were returned, and upon data screening 536 cleaned data was used for CFA. IBM® SPSS was used for data screening and basic statistical analysis, while SmartPLS 4.0 was used for CFA to identify critical safety culture factors in Malaysia context. Six key factors were identified accounting for 37 items: "Leadership and Communication", "Monitoring Behaviour, Reporting, and Analysis of Accidents or Incidents", "Attitudes towards OSH Improvements", "Education on OSH", "Rewards and Recognition", and "Employees' Competences". The study emphasized the need for Malaysian organizations to enhance these aspects of safety culture, which could lead to better OSH performance, increased productivity, and profitability. These insights are significant for policymakers and OSH professionals, offering a roadmap for cultivating a stronger safety culture in the workplace.



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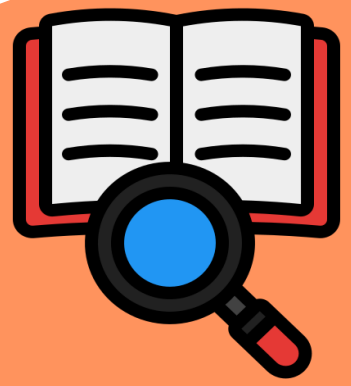

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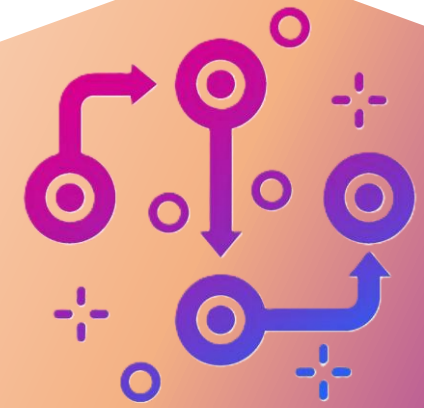

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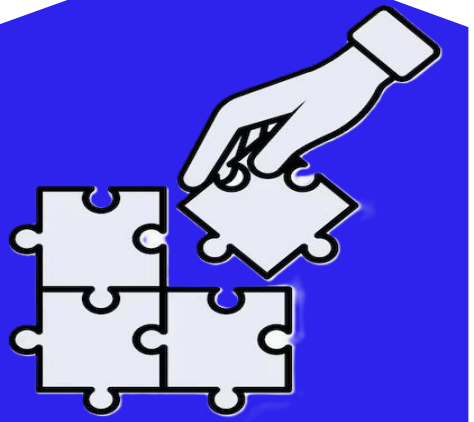

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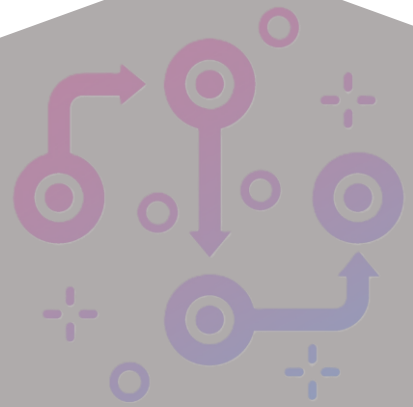

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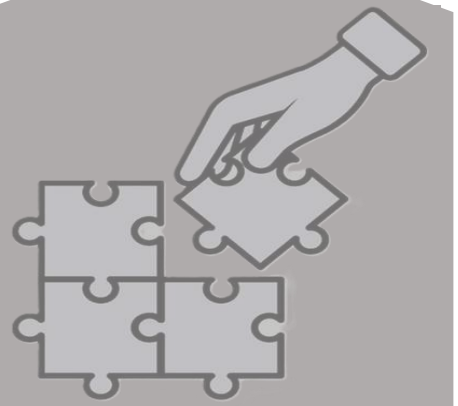

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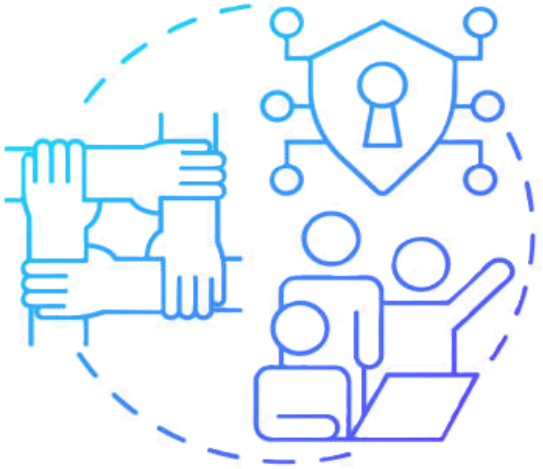
Introduction

❖ Occupational Safety Health (OSH)

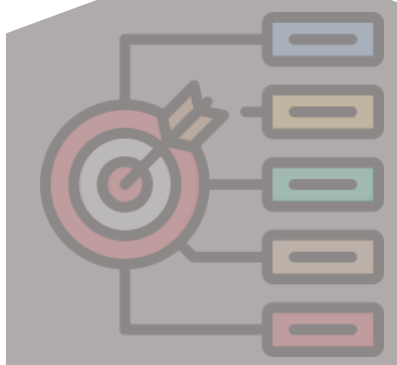
= Optimal Level worker's (physical + mental + social wellbeing)

(ILO, Forastieri, 2014)

❖ Problem and Objectives



- Building a positive OSH culture and accident-free workplace environment still **remains a biggest challenge**.
- To develop a safety culture model that aligns with Malaysia's OSH culture
- To identify key factors to achieve high level of OSH culture among organization in Malaysia.



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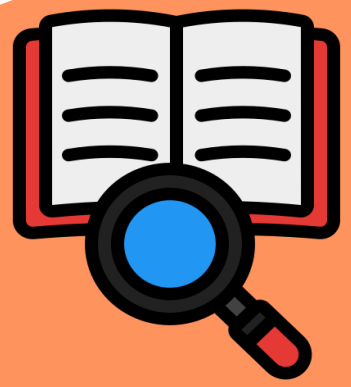

SAFETY CULTURE MODEL

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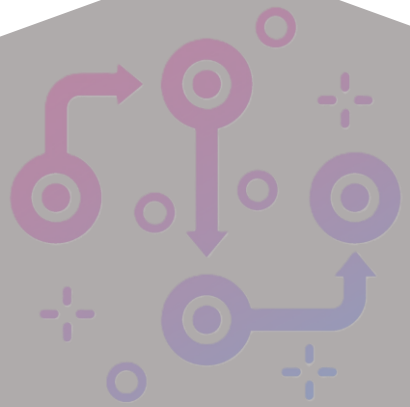

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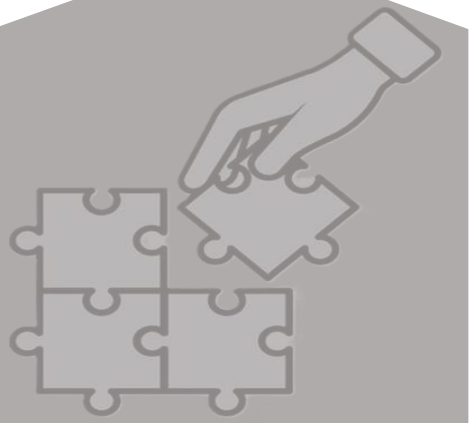

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Safety Culture Model

❖ Safety Culture

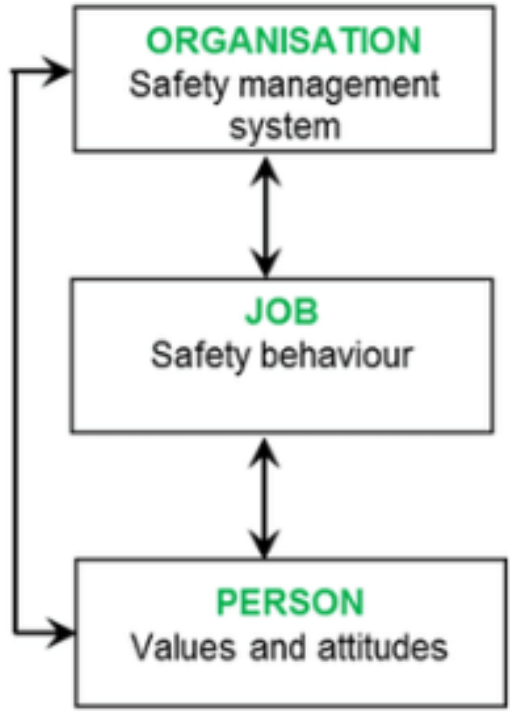
- There is no global agreement on its definition or content.
- 51 distinct definitions of safety culture and 30 distinct definitions of safety climate. *(Cooper, 2016)*

❖ *Cooper (2016), Bisbey et al. (2019), and van Nunen et al. (2022)*

Safety culture model incorporates:

Leadership commitment,
Employee involvement,
Communication,
Training, and education,
Hazard detection and reporting,
Safety performance measurement,
Continuous improvement, **and**
Organizational learning.

Reciprocal SC model
(Cooper 2001, p. 16)



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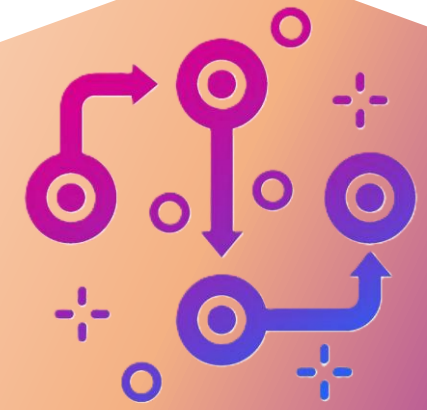

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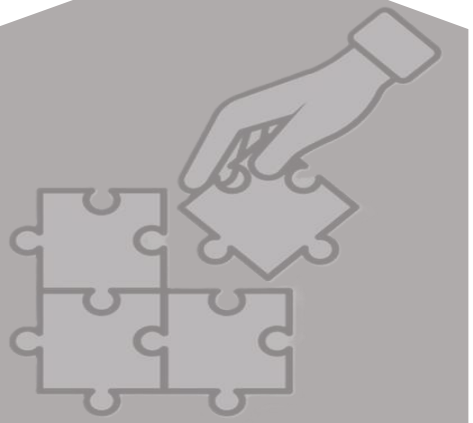

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Methodology

❖ Hafizah et al. (2023)

- Survey after exploratory factor analysis (EFA) with 42 items was administered.
- Data collected at:

(i) ***National Occupational Safety and Health Seminar and Exhibition*** (KeJaRI 4.0) held on 26th -27th September 2023 (DOSH)

(ii) ***37th Asia-Pacific Occupational Safety and Health Organization*** (APOSHO) Conference held on 24th -25th October 2023

❖ Survey Response

- 1,500 surveys were distributed, with 625 returns (41.7% response).
- **n= 536 as useable for analysis after data screening & cleaning**.
- Softwares:

(i) **IBM® Statistical Package for Social Science (SPSS) 27** software: data screening, data coding, data imputation and descriptive statistical analysis for demographics.

(ii) **SmartPLS 4**: Confirmatory Factor Analysis (CFA). (Ringle et al., 2022)

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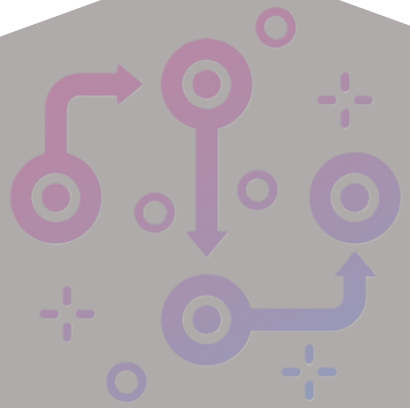

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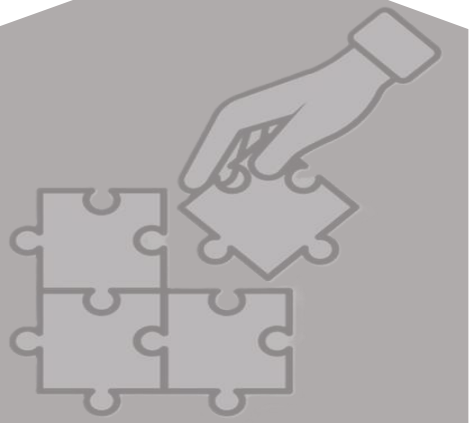

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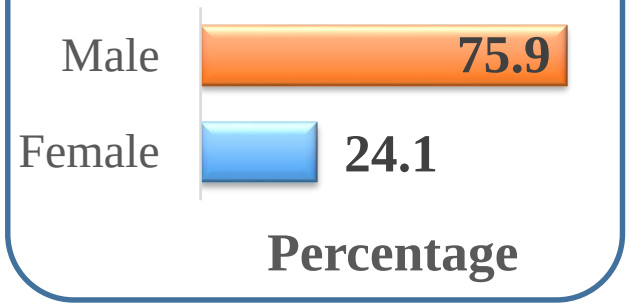
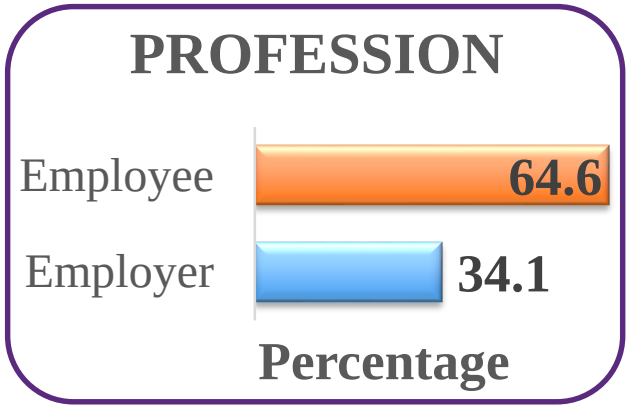
Results & Discussions (Respondents Demographic Profile, n=536)

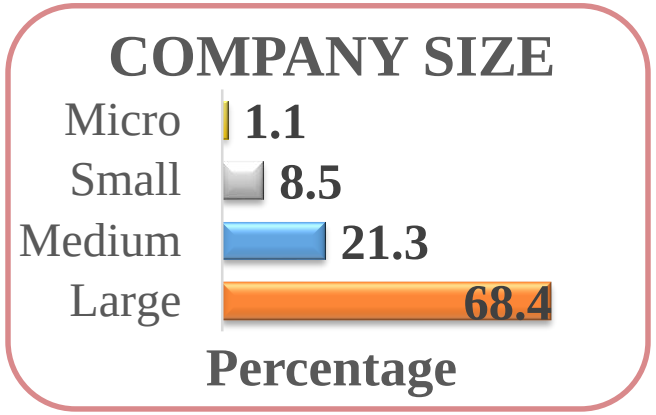
GENDER



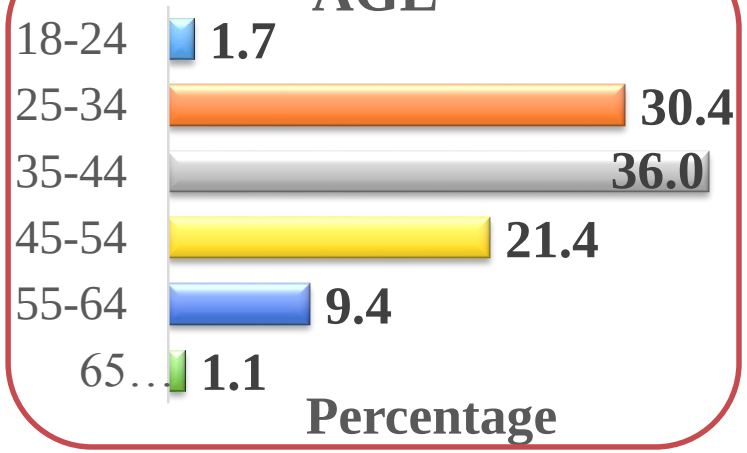
PROFESSION



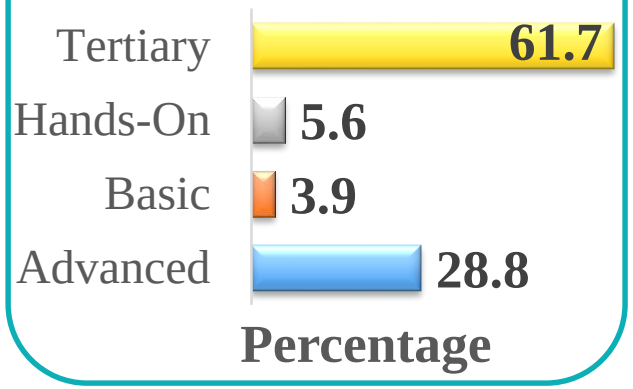
COMPANY SIZE



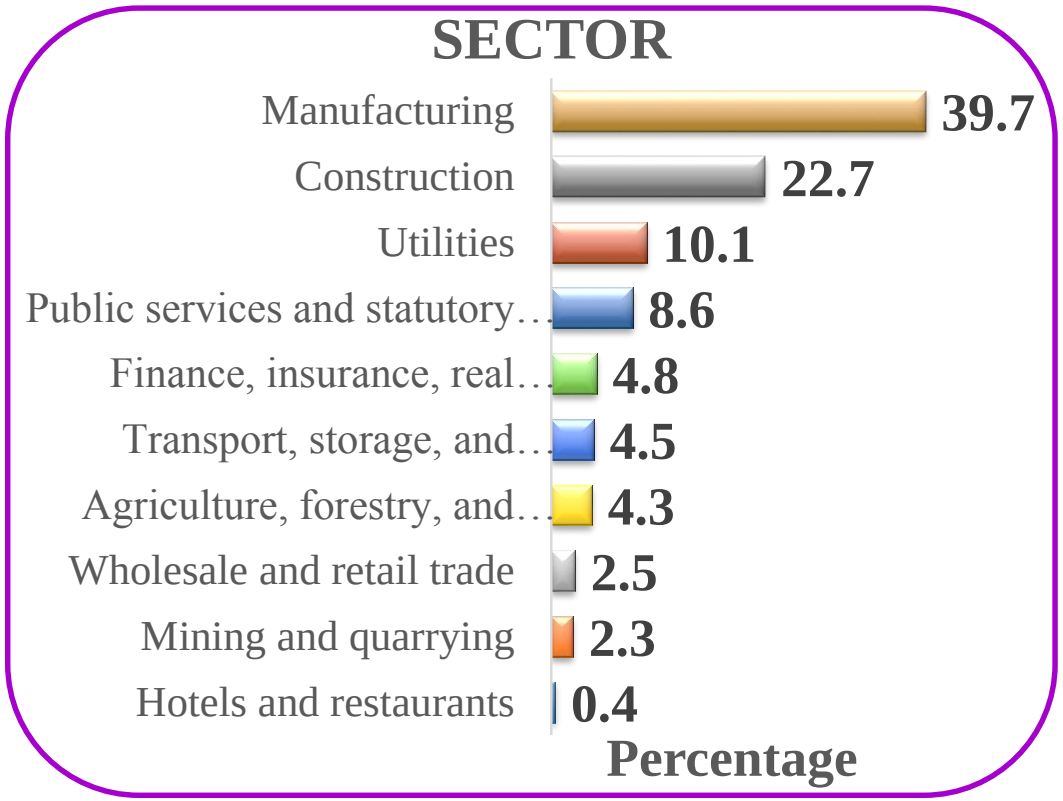
AGE



EDUCATION



SECTOR



Results & Discussions – Bias

❖ Full Collinearity Test as per *Kock and Lynn (2012), Kock (2015)*

- Common Method Bias/Variance due to single source data

Leadership and Communication	Monitoring Behaviour, Reporting and Analysis of Accidents or Incidents	Attitudes towards OSH Improvements	Education on OSH	Rewards and Recognition	Employees' Competences
2.569	2.256	2.525	3.079	1.499	1.096

❖ Result: Variance Inflation Factors (VIF) less than 3.3

→ model **free from common method bias.** *Kock (2015)*

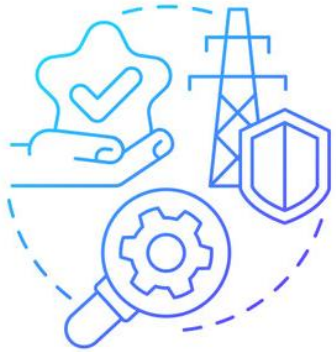
Common method bias in PLS-SEM: A full collinearity assessment approach

Ned Kock

Full reference:

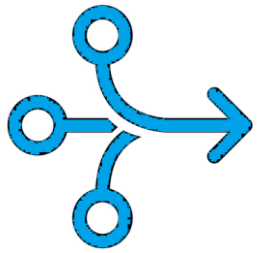
Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1-10.

QUALITY OF MEASUREMENT SCALES



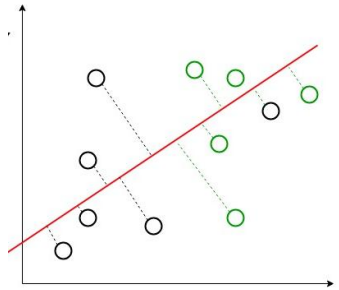
Reliability
-A substantial amount of the factor variance is due to true score variance

Cheung et al. (2023)



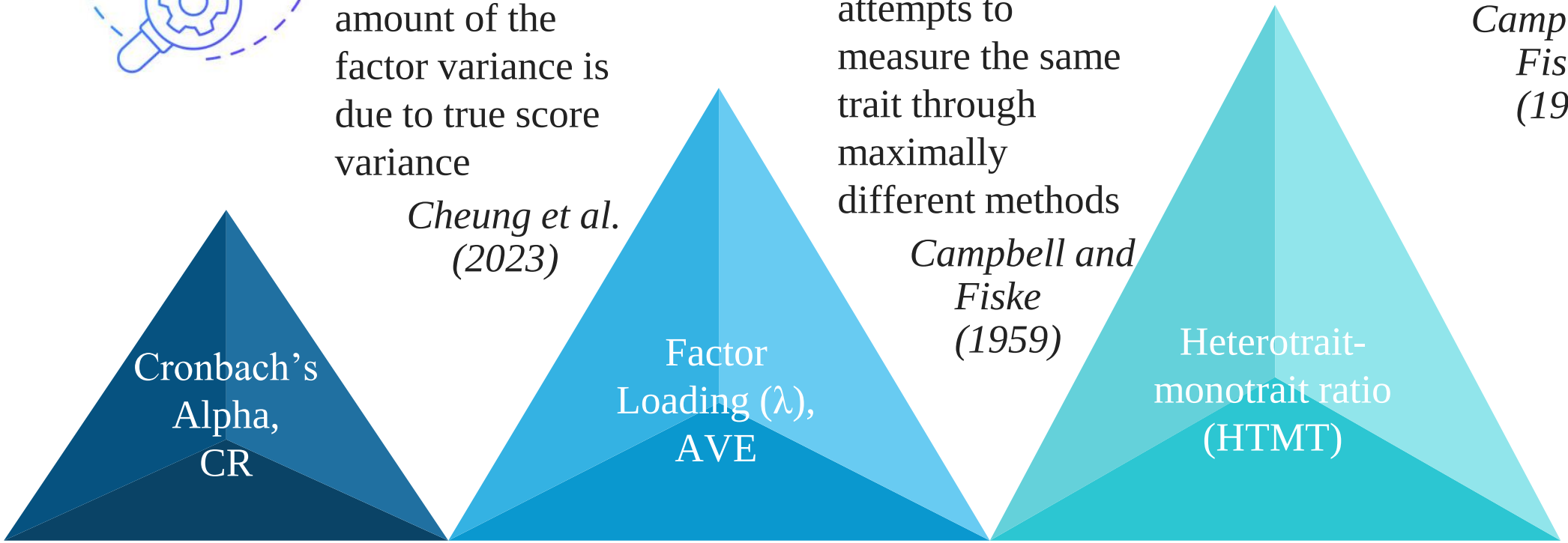
Convergent Validity
-the agreement between two attempts to measure the same trait through maximally different methods

Campbell and Fiske (1959)



Discriminant Validity
-can be meaningfully differentiated from other traits

Campbell and Fiske (1959)



Results & Discussions – CFA Measurement Model

❖ Tested as per *Hair et al. (2022) and Ramayah et al. (2018)*

- Composite Reliability (CR), **should be ≥ 0.7**
- Factor Loadings, **should be ≥ 0.708**
- Average Variance Extracted (AVE), **should be ≥ 0.5**

❖ Result:

- All AVEs > 0.5, & CR > 0.7

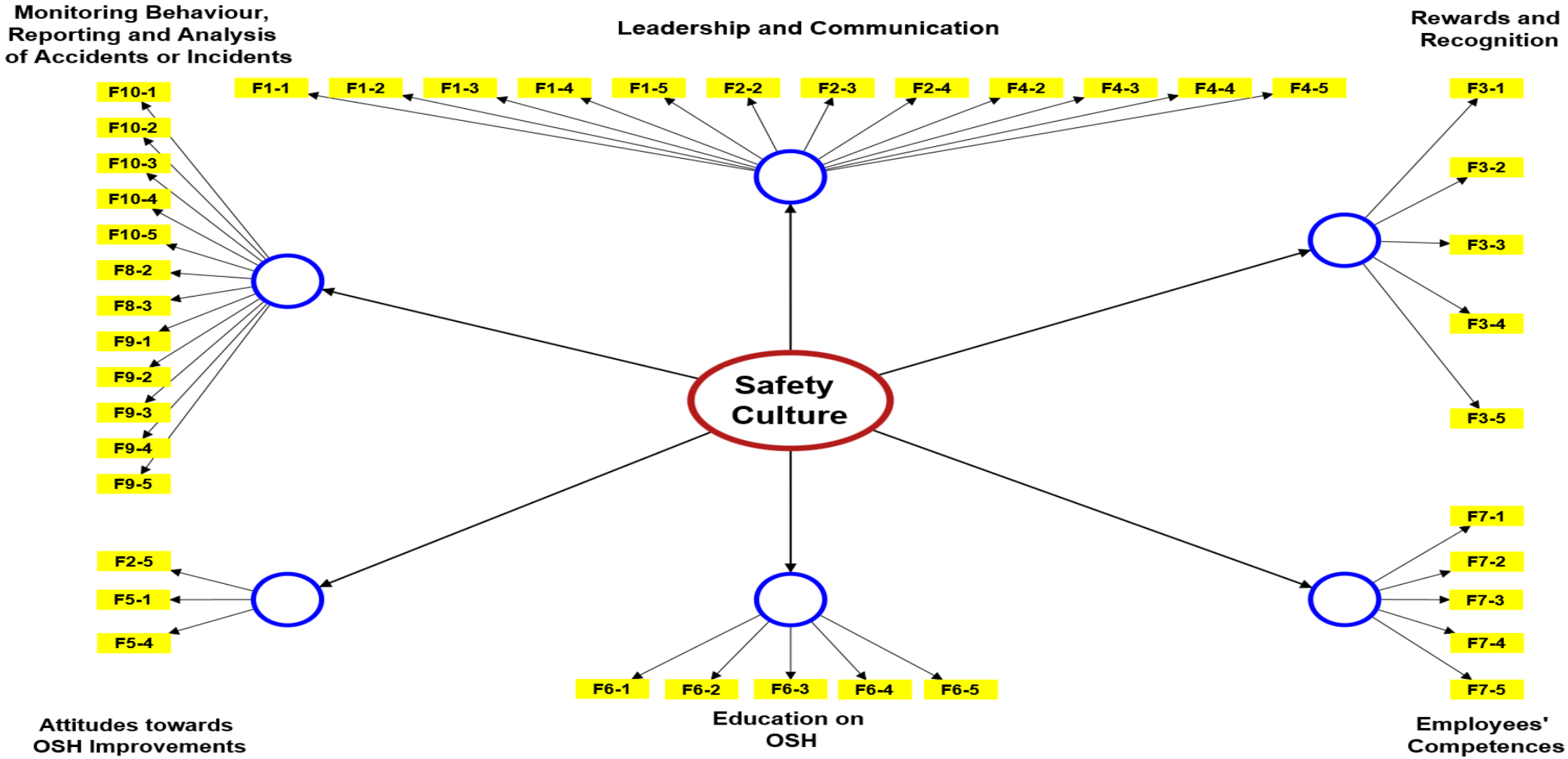
→ All lower order constructs (subdimensions) were reliable and valid.

- Five items loadings < 0.708, **hence removed**.

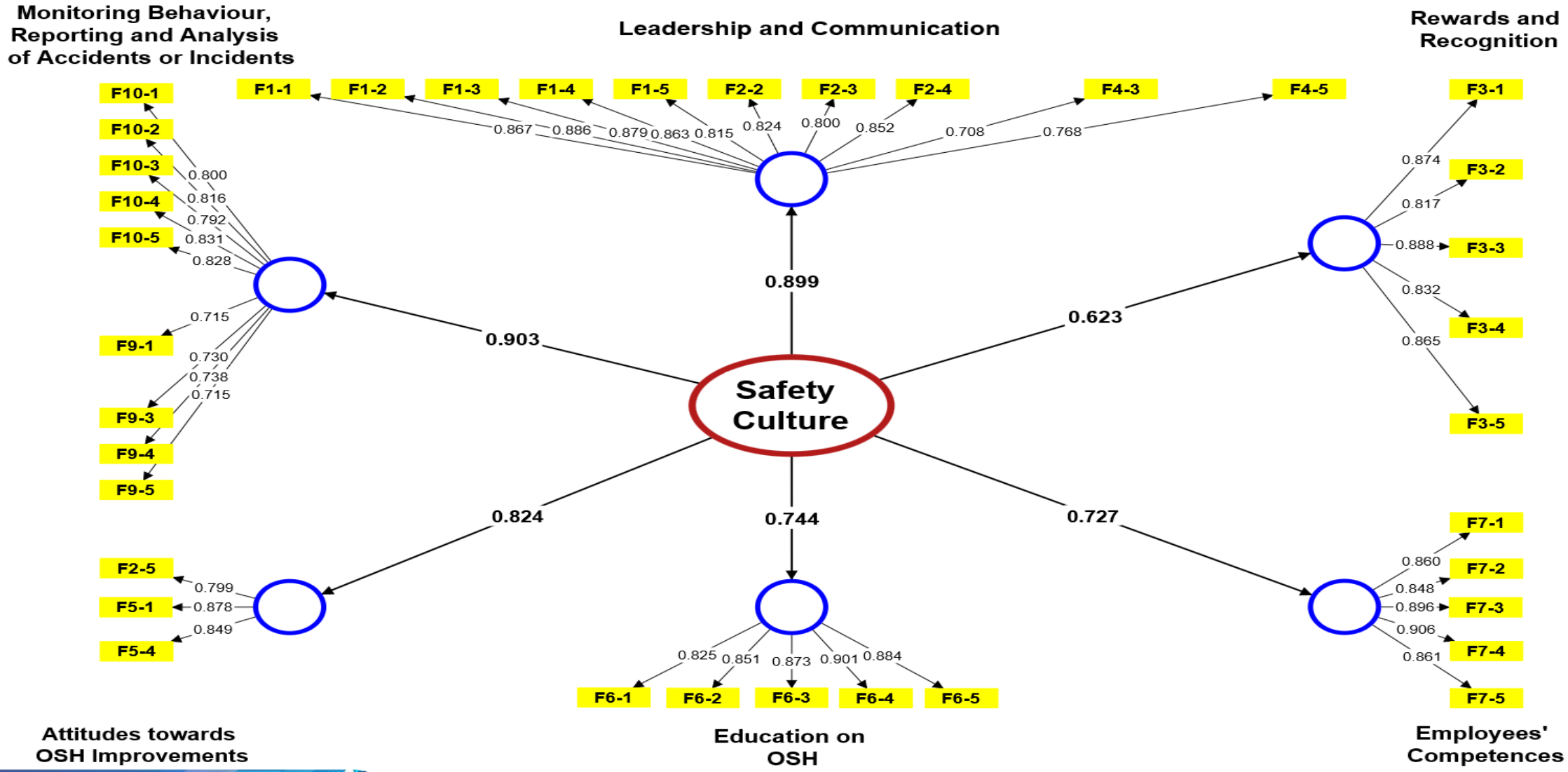
→ Leadership and Communication construct (item **F4-2 & F4-4**),

→ Monitoring Behaviour, Reporting and Analysis of Accidents or Incidents construct (item **F8-2, F8-3 & F9-2**).

Results & Discussions – Initial Model



Results & Discussions – Final Model (2nd Iteration)



Results & Discussions – Lower Order Constructs

Lower order constructs	Indicator	Loadings			α	*CR*	AVE
		(Initial)	(Iteration 1)	(Iteration 2)			
Leadership and Communication	F1-1	0.859	0.861	0.867	0.948	0.956	0.685
	F1-2	0.877	0.882	0.886			
	F1-3	0.867	0.872	0.879			
	F1-4	0.849	0.856	0.863			
	F1-5	0.799	0.805	0.815			
	F2-2	0.803	0.810	0.824			
	F2-3	0.790	0.796	0.800			
	F2-4	0.829	0.841	0.852			
	F4-2	0.703	0.692	**Deleted**			
	F4-3	0.749	0.739	0.708			
	F4-4	0.676	**Deleted**	**Deleted**			
	F4-5	0.790	0.776	0.768			

Results & Discussions – Lower Order Constructs

Lower order constructs	Indicator	Loadings (Initial)	Loadings (Iteration 1)	Loadings (Iteration 2)	α	*CR*	AVE
Monitoring Behaviour, Reporting and Analysis of Accidents or Incidents	F8-2	0.646	**Deleted**	**Deleted**	0.916	0.931	0.601
	F8-3	0.659	**Deleted**	**Deleted**			
	F9-1	0.722	0.722	0.715			
	F9-2	0.695	**Deleted**	**Deleted**			
	F9-3	0.743	0.740	0.730			
	F9-4	0.785	0.752	0.738			
	F9-5	0.749	0.729	0.715			
	F10-1	0.752	0.789	0.800			
	F10-2	0.759	0.808	0.816			
	F10-3	0.728	0.781	0.792			
	F10-4	0.794	0.824	0.831			
	F10-5	0.797	0.822	0.828			

Results & Discussions – Lower Order Constructs

Lower order constructs	Indicator	Loadings			α	*CR*	AVE
		(Initial)	(Iteration 1)	(Iteration 2)			
Attitudes towards OSH Improvements	F2-5	0.797	0.797	0.799	0.794	0.880	0.709
	F5-1	0.877	0.877	0.878			
	F5-4	0.851	0.851	0.849			
Education on OSH	F6-1	0.818	0.818	0.825	0.917	0.938	0.752
	F6-2	0.856	0.856	0.851			
	F6-3	0.874	0.874	0.873			
	F6-4	0.902	0.902	0.901			
	F6-5	0.883	0.883	0.884			
Rewards and Recognition	F3-1	0.878	0.878	0.874	0.909	0.931	0.730
	F3-2	0.805	0.806	0.817			
	F3-3	0.880	0.880	0.888			
	F3-4	0.847	0.847	0.832			
	F3-5	0.860	0.860	0.865			

Results & Discussions – High Order Constructs (Safety Culture)

Measurement Model for the Higher Order Constructs (Safety Culture Dimensions)

Higher order construct (HOCs)	Lower order construct (LOCs)	Std beta, β	α	CR	AVE
Safety Culture	Leadership and Communication	0.899	0.883	0.912	0.637
	Monitoring Behaviour, Reporting and Analysis of Accidents or Incidents	0.903			
	Attitudes towards OSH Improvements	0.824			
	Education on OSH	0.744			
	Rewards and Recognition	0.623			
	Employees' Competences	0.727			

Results & Discussions – Discriminant Validity

Discriminant Validity (HTMT)

Constructs	1	2	3	4	5	6
1. Leadership and Communication						
2. Monitoring Behaviour, Reporting and Analysis of Accidents or Incidents	0.818					
3. Attitudes towards OSH Improvements	0.789	0.736				
4. Education on OSH	0.600	0.595	0.931			
5. Rewards and Recognition	0.559	0.625	0.435	0.291		
6. Employees' Competences	0.537	0.677	0.696	0.594	0.325	

❖ Result: Heterotrait-monotrait ratio (HTMT) criterion

- HTMT < 1, hence respondents well understood that the six latent variables in our survey were distinct and discriminant validity has been achieved. *Henseler et al. (2015), Franke and Sarstedt (2019)*

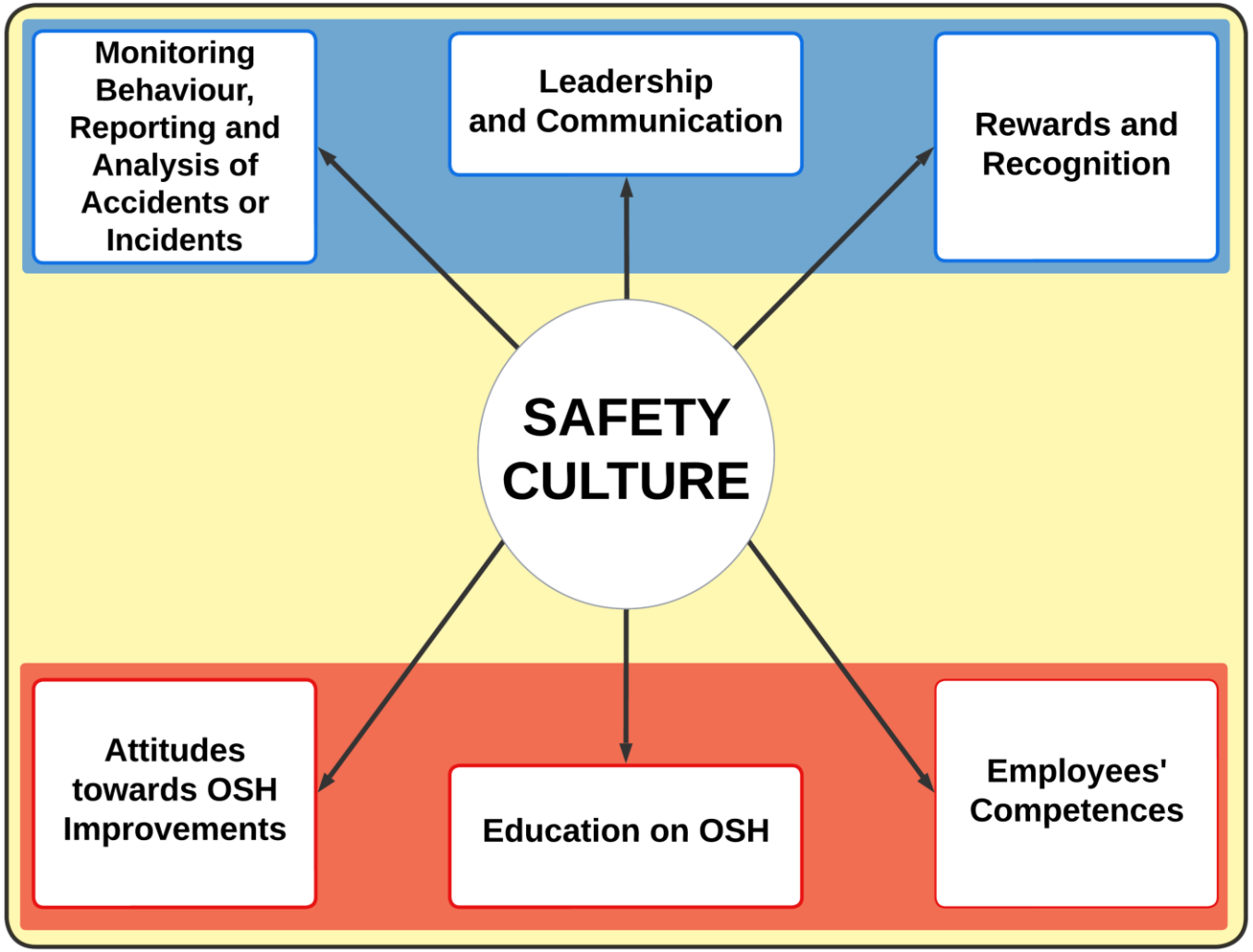
Results & Discussions – Summary EFA & CFA

Summary of EFA (Hafizah et al., 2023) and CFA (our study)

	Exploratory Factor Analysis, EFA (Hafizah et al., 2023) **(n=243)**						Confirmatory Factor Analysis, CFA **(n=536)**					
	1	2	3	4	5	6	1	2	3	4	5	6
Final number of items	12	12	5	5	5	3	9	10	5	5	5	3
Mean	4.08	3.97	4.15	3.24	4.11	4.08	3.98	3.95	4.29	3.54	4.30	4.23
Ranking by Mean	3	4	1	5	2	3	4	5	2	6	1	3
Beta Coefficient, β	-						0.90	0.90	0.73	0.62	0.74	0.82
Ranking by Beta Coefficient	-						1	1	4	5	3	2

Note:
1. Monitoring Behavior, Reporting and Analysis of Accidents or Incidents,
2. Leadership and Communication,
3. Employees' Competences,
4. Rewards and Recognition,
5. Education on OSH,
6. Attitudes towards OSH Improvements

Results & Discussions – Model for Malaysia



- Two main non-observable domains: **organizational domain and human domain**.

van Nunen et al. (2022)

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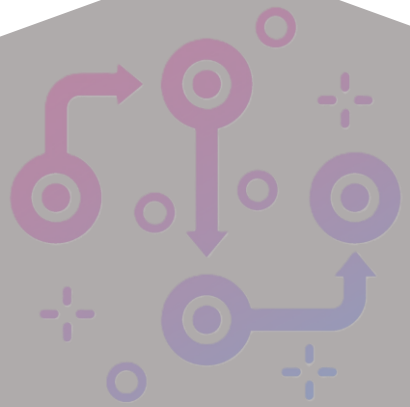

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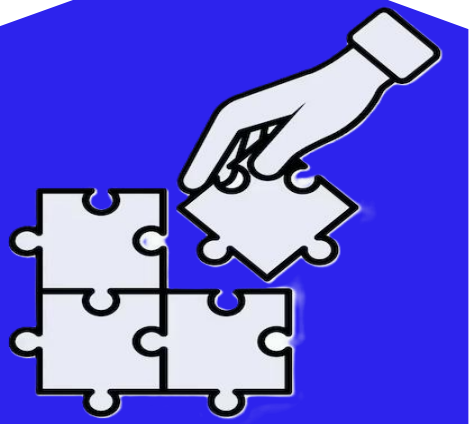

CONCLUSION

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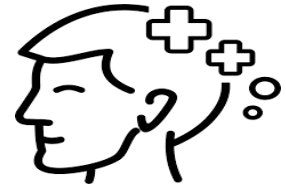
Conclusion

- Hierarchical structure of safety culture model suitable for occupational setting and culture in Malaysia developed with six main factors that CFA confirms as key influencer for safety culture were (**arrange by ascending order of ranking based on factor loading in CFA**), 37 items in total:



(i) Leadership and Communication,

(ii) Monitoring Behaviour, Reporting, and Analysis of Accidents or Incidents,

(iii) Attitudes towards OSH Improvements,

(iv) Education on OSH,

(v) Employees' Competencies, and

(vi) Rewards and Recognition.

Practical implications to "The Future of Work & OSH"

- Reduce accident rates, increased productivity and profitability.
- Adapting to changing work environments.
- Bridging the current gap in safety culture and enhance workplace safety.
- Benchmarking against industrial standard.
- Assist policy and regulations.
- Enable Malaysia to become leader in OSH.

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Jabatan Keselamatan dan Kesihatan Pekerjaan
KEMENTERIAN SUMBER MANUSIA

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

STUDY ON BENCHMARKING OF OCCUPATIONAL SAFETY AND HEALTH (OSH) CULTURE LEVELS AMONG EMPLOYERS AND EMPLOYEES IN MALAYSIA

ENGLISH VERSION

MALAY VERSION

REFERENCES

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin*, *103*(3), 411-423.

Bisbey, T. M., Kilcullen, M. P., Thomas, E. J., Ottosen, M. J., Tsao, K., & Salas, E. (2021). Safety culture: An integration of existing models and a framework for understanding its development. *Human factors*, 63(1), 88-110.

Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: results from a monte carlo simulation study and an electronic-mail emotion adoption study*. Information Systems Research*, 14(2), 189-217.

Cole, K. S., Stevens-Adams, S. M., & Wenner, C. A. (2013). A literature review of safety culture.

Cooper M. D. (2000). Towards a model of safety culture. *Safety Science*, 36, 111–136.

Cooper, M. D. (2016). Navigating the safety culture construct: a review of the evidence. *BSMS: Franklin, IN, USA*.

Elkhweldi, M. A., Elmabrouk, S. K., & Sassi, A. (2018). Safety Culture Assessment in the Air Traffic Control Sector.

Franke, G., & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: a comparison of four procedures. *Internet Research*, 29(3), 430-447.

Friend, M. A., & Kohn, J. P. (2010). *Fundamentals of occupational safety and health* (5th ed.). Government Institutes.

REFERENCES

Hair, J. F., Thomas, G., Hult, M., Ringle, C. M., & Sarstedt, M. (2022). A Primer on Partial Least Squares Structural Equation Modeling (3rd ed.). Thousand Oakes, CA: Sage.

Henseler, J., Ringle, C., & Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-based Structural Equation Modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135.

Guldenmund, F. W. (2000). The nature of safety culture: a review of theory and research. *Safety science*, *34*(1-3), 215-257.

Ismail, F., Ahmad, N., Janipha, N. A. I., & Ismail, R. (2012). Assessing the behavioural factors' of safety culture for the Malaysian construction companies. *Procedia-Social and Behavioral Sciences,* 36, 573-582.

Kim, C. Y., & Song, B. H. (2016). An Empirical Study on Safety Culture in Aviation Maintenance Organization. *International Journal of u-and e-Service, Science and Technology*, *9*(6), 333-344

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration, 11*(4), 1-10.

Kock, N., & Lynn, G. S. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems, 13*(7), 546-580.

REFERENCES

Laporan Tahunan 2021 Jabatan Keselamatan dan Kesihatan Pekerjaan. (2022). Https://www.dosh.gov.My/Index.Php/Publication-Sp-249/Annual-Report. https://www.dosh.gov.my/index.php/publication-sp-249/annual-report/4327-laporan-tahunan-jkkp-malaysia-2021/file

Ramayah, T., Cheah, J., Chuah, F., Ting, H., & Memon, M. A. (2018). *Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3.0: An Updated Guide and Practical Guide to Statistical Analysis* (2nd ed.). Kuala Lumpur, Malaysia: Pearson.

Ringle, C. M., Wende, S., & Becker, J-M. (2022). SmartPLS 4. Oststeinbek: SmartPLS. Retrieved from https://www.smartpls.com

Valentina Forastieri-ILO Senior Specialist on Occupational Health, Health Promotion, & Well-being. (2014). *Improving health in the workplace: ILO's framework for action*. https://www.ilo.org/safework/info/publications/WCMS_329350/lang--en/index.htm

van Nunen, K., Reniers, G., & Ponnet, K. (2022). Measuring safety culture using an integrative approach: the development of a comprehensive conceptual framework and an applied safety culture assessment instrument. *International Journal of Environmental Research and Public Health*, 19(20), 13602.