



5th Malaysia Statistics Conference

29 November 2017

Sasana Kijang, Bank Negara Malaysia

2017

From Data to Knowledge : The Journey

Statistical Standard, Methodology and Application

THE INFLUENCE OF QUALITY MANAGEMENT ON SAFETY PERFORMANCE AT WOOD BASED FURNITURE INDUSTRY

Fatin Amrina A Rashid¹, Jafri Mohd Rohani² and Khidzir Zakaria³

^{1,2,3} Department of Materials, Manufacturing & Industrial Engineering,

Faculty of Mechanical Engineering, Universiti Teknologi Malaysia,

81310 Skudai, Johor Bahru, Malaysia



5th Malaysia Statistics Conference

Presentation Outline

- Introduction
- Research Objective
- Research Hypothesis
- Research Methodology
- Result
- Discussion
- Conclusion
- References

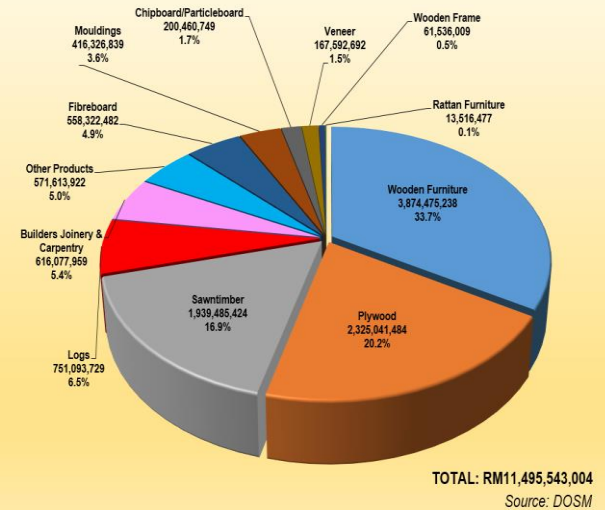
Wood based furniture industry become vital key in driving timber industry in Malaysia

Wooden furniture conquered about 33.7% of the exported timber products with money value of RM 3,874,475,238 from January to June 2017.

The top three country that import wooden furniture from Malaysia are United States of America (USA), Japan and Australia

Introduction

MALAYSIA: EXPORT OF TIMBER & TIMBER PRODUCTS, JAN – JUNE 2017



Source:

Mtib.gov.my. (2017). *Malaysian Timber Industry Board - Malaysia Major Export*. [online] Available at: http://www.mtib.gov.my/index.php?option=com_content&view=article&id=2034&Itemid=65&lang=en [Accessed 12 Oct. 2017].

Introduction

- There is an interest to study wood based furniture industry especially in quality and safety management.
- This is because, quality and safety aspects are two critical issues that should be considered to increase the growth and productivity of wood based furniture industry.
- Provided that quality and safety constructs have significant relationship with each other (Wanberg et al., 2013), this research intend find the relationship between hard and soft aspects of quality management with safety performance.

Wanberg, J., Asce, S. M., Harper, C., Asce, S. M., Hallowell, M. R., Asce, A. M., ... Asce, A. M. (2013). Relationship between Construction Safety and Quality Performance. *Journal of Construction Engineering and Management*, 139(10), 4013003-1-4013003-10. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000732](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000732).

Introduction

Variable	Constructs	
<p>Independent Variable <i>Zeng et al. (2015)</i></p>	Process management	Hard Aspects of Quality Management
	Quality information	
	Small group problem solving	Soft Aspects of Quality Management
	Employee suggestion	
	Task-related training for employees	
<p>Dependent Variable <i>Vinodkumar & Bhasi (2010)</i></p>	Safety performance	

Zeng, J., Phan, C. A., & Matsui, Y. (2015). The impact of hard and soft quality management on quality and innovation performance: An empirical study. *Intern. Journal of Production Economics*, 162(February 2016), 216–226. <https://doi.org/10.1016/j.ijpe.2014.07.006>

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour : Assessing the mediating role of safety knowledge and motivation. *Accident Analysis and Prevention*, 42(6), 2082–2093. <https://doi.org/10.1016/j.aap.2010.06.021>

Research Objective

Objective

- To identify the independent variables of the model.
- To determine the dependent variable of the model.
- To establish relationship between safety performance and hard and soft aspects of quality management simultaneously.

Result

- A measurement model that can reveal the relationship between quality constructs and safety constructs.

Model Framework

Hard Aspects of
Quality Management

Process management

Quality information

Small group problem
solving

Soft Aspects of
Quality Management

Employee suggestion

Task-related training
for employees

Safety performance

Research Hypothesis

- H_0 : Process management will not have an influence on safety performance.
- H_1 : Process management will have an influence on safety performance.

- H_0 : Quality information will not have an influence on safety performance.
- H_2 : Quality information will have an influence on safety performance.

- H_0 : Small group problem solving will not have an influence on safety performance.
- H_3 : Small group problem solving will have an influence on safety performance.

- H_0 : Employee suggestion will not have an influence on safety performance.
- H_4 : Employee suggestion will have an influence on safety performance.

- H_0 : Task-related training for employees will not have an influence on safety performance.
- H_5 : Task-related training for employees will have an influence on safety performance.

Research Methodology

- Sample and Population
- Instrument
- Sample Size
- Rule of Thumb

Sample and Population

Population

✓ Wood based furniture company located in Johor and Melaka.

✓ Involved small, medium and large companies.

Sample

The respondents are management workers of respective company.

Approached more than 60 companies and managed to get 55 respondents from 35 companies.

Located at Melaka, Muar, Ledang, Segamat and Batu Pahat.

Instrumentation

The proposed questionnaire includes 43 questions that are divided into 4 sections.

The following are the sections included:

- Section A: Demographic Information
- Section B: Hard Quality Management
- Section C: Soft Quality Management
- Section D: Safety Performance

Sample Size

Exhibit 1.7 Sample Size Recommendation a in PLS-SEM for a Statistical Power of 80%

Maximum Number of Arrows Pointing at a Construct	Significance Level											
	1%				5%				10%			
	Minimum R ²				Minimum R ²				Minimum R ²			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

- According to Cohen (1992), 45 observations is needed to detect total variance explained (R²) around 0.50, assuming significant level 5% and statistical power of 80%.
- This method is recommended by Ishak (2017) and Hair et al., (2014)

Source: Cohen, J. A power primer. *Psychological Bulletin*, 112, 155–519.

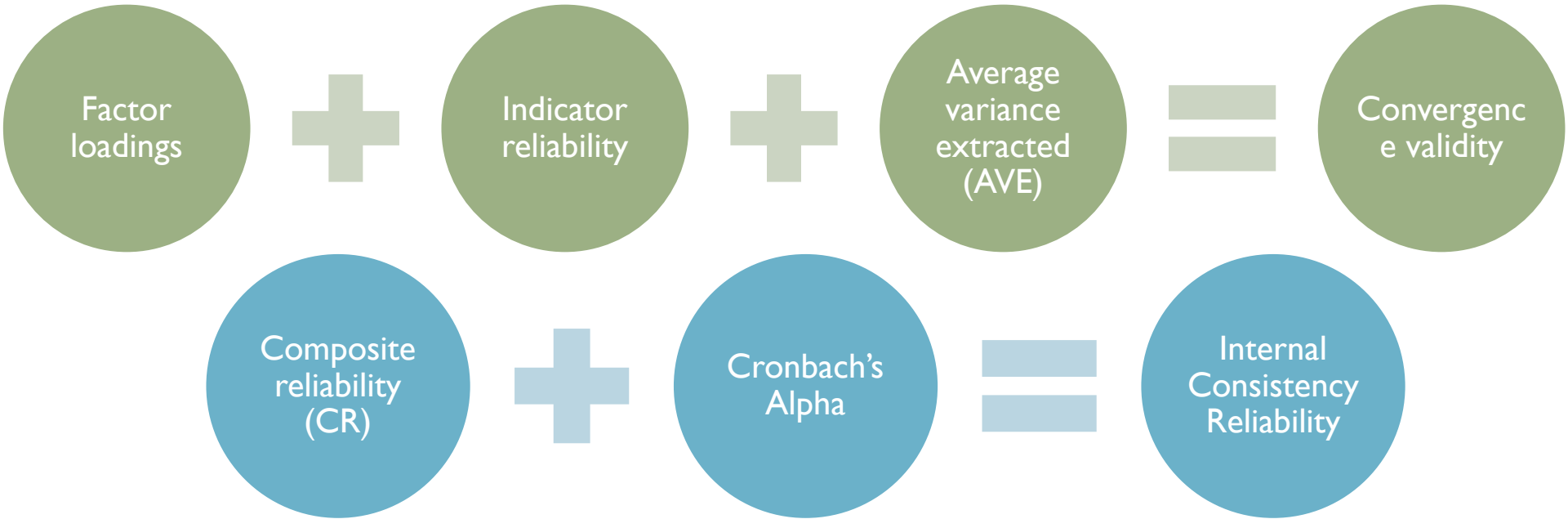
Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155- 159. doi:10.1037/0033-2909.112.1.155

Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. SAGE Publications.

Ishak, M. S. (2017, October 13-14). Partial least Squares Structural Equation Modeling using SmartPLS. Lecture presented at Workshop on Partial Least Squares structural Equation Modeling using SmartPLS in Johor, Bandar Baru Uda.

Validity and Reliability

- In determining validity and reliability of the measurement model, we need to determine the convergence validity and internal consistency reliability



Rule of Thumb

	Rule of Thumb	References
Factor loadings	>0.5	Hair <i>et al.</i> (2014) Mohd. Nasurdin <i>et al.</i> (2017) Ishak (2017)
Composite reliability	> 0.7	Hair <i>et al.</i> (2014) Mohd. Nasurdin <i>et al.</i> (2017) Ishak (2017)
Average variance extracted (AVE)	>0.5	Hair <i>et al.</i> (2014) Mohd. Nasurdin <i>et al.</i> (2017) Ishak (2017)
Cronbach's alpha	>0.6	Zeng <i>et al.</i> (2015) Hair <i>et al.</i> (2014) Ishak (2017)
Indicator reliability	>0.501	Hair <i>et al.</i> (2014) Mohd. Nasurdin <i>et al.</i> (2017) Ishak (2017)

- For this model, there are several items deleted (items: PC2; PM1; PM3; HK3; Q11; SGPS3; SGPS5; SC4; SC5; SPI; SP2) due to insufficient value of factor loading.

Results

- Convergent Validity
- Internal Consistency Reliability
- Measurement Model
- R Square
- Bootstrapping

Convergent Validity and Internal Consistency Reliability (1)

Latent Variable	Indicators	Convergent Validity			Internal Consistency Reliability	
		Loadings	Indicator Reliability	AVE	Cronbach's Alpha	Composite Reliability
Process Management	HK1	0.900	0.810	0.672	0.878	0.911
	HK2	0.877	0.769			
	PCI	0.771	0.594			
	PC3	0.725	0.526			
	PM2	0.814	0.663			
Quality Information	QI2	0.844	0.712	0.710	0.866	0.907
	QI3	0.793	0.629			
	QI4	0.893	0.797			
	QI5	0.837	0.701			

Convergent Validity and Internal Consistency Reliability (2)

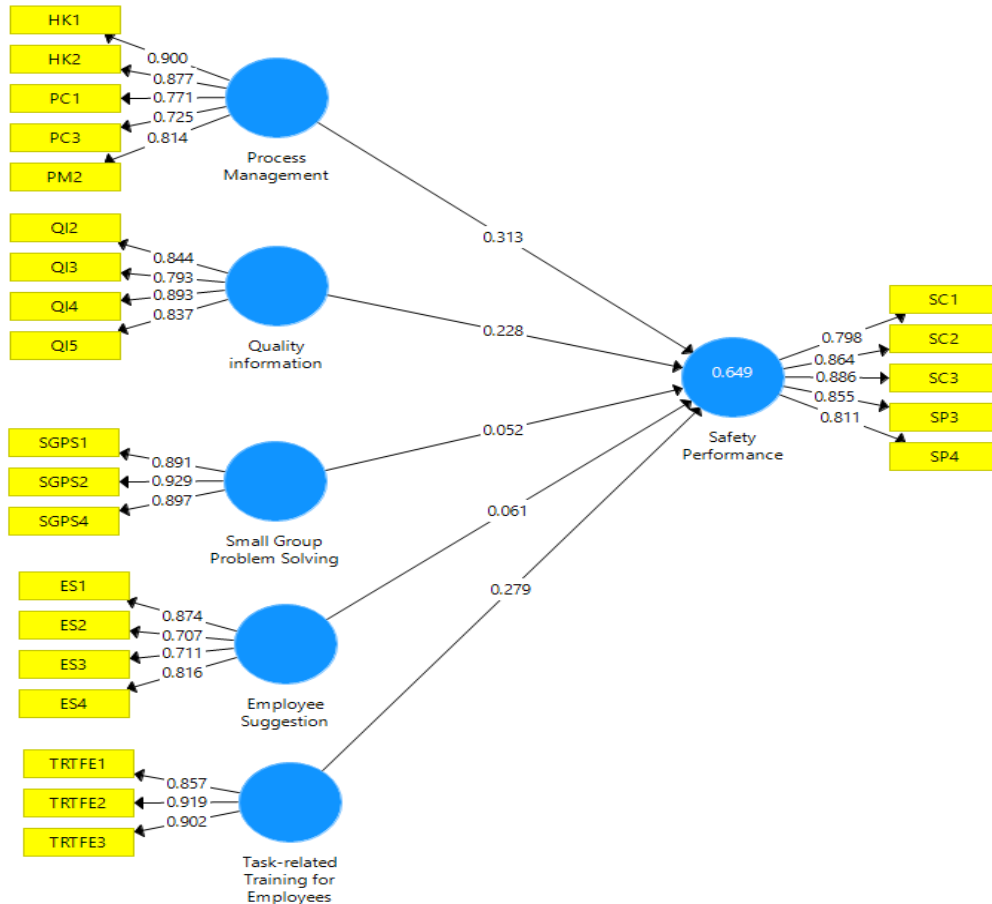
Latent Variable	Indicators	Convergent Validity			Internal Consistency Reliability	
		Loadings	Indicator Reliability	AVE	Cronbach's Alpha	Composite Reliability
Small Group Problem Solving	SGPS1	0.891	0.794	0.821	0.891	0.932
	SGPS2	0.929	0.863			
	SGPS4	0.897	0.805			
Employee Suggestion	ES1	0.874	0.764	0.609	0.787	0.860
	ES2	0.707	0.500			
	ES3	0.711	0.506			
	ES4	0.816	0.666			

Convergent Validity and Internal Consistency Reliability (3)

Latent Variable	Indicators	Convergent Validity			Internal Consistency Reliability	
		Loadings	Indicator Reliability	AVE	Cronbach's Alpha	Composite Reliability
Task-Related Training for Employees	TRTFE1	0.857	0.734	0.798	0.874	0.922
	TRTFE2	0.919	0.845			
	TRTFE3	0.902	0.814			
Safety Performance	SC1	0.798	0.637	0.712	0.898	0.925
	SC2	0.864	0.746			
	SC3	0.886	0.785			
	SP3	0.855	0.731			
	SP4	0.811	0.658			

R Square

R² value for safety performance was 0.649 suggesting that 64.9% of the variance in safety performance can be explained by process control, quality information, small group problem solving, employee suggestion and task-related training for employees



Bootstrapping Results

	Path Coefficients	T Statistics	P Values
Employee Suggestion -> Safety Performance	0.061	0.508	0.612
Process Management -> Safety Performance	0.313	2.467	0.014*
Quality information -> Safety Performance	0.228	1.860	0.063
Small Group Problem Solving -> Safety Performance	0.052	0.291	0.771
Task-related Training for Employees -> Safety Performance	0.279	1.530	0.127

- Only H_1 is proven to be significant. Thus, null hypothesis is rejected.
- In contrast, we fail to reject null hypothesis for H_2 , H_3 , H_4 and H_5 .
- Given these points, it is concluded that process management have significant influence on safety performance at $p < 0.05$.

Discussion

- The outcome of this research is consistence with Wanberg *et al.* (2013) as they also found that quality constructs have a positive relationship with safety constructs.
- Zeng *et al.*(2015) also come to same result as their research found that only hard aspects of quality management positively influences the dependent variable (speed of new product introduction), but not soft aspect of quality management.
- This result also similar with Vinodkumar & Bhasi (2010), which in their research, it shows that management practices in safety proven to be significant towards safety performance.

Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour : Assessing the mediating role of safety knowledge and motivation. *Accident Analysis and Prevention*, 42(6), 2082–2093. <https://doi.org/10.1016/j.aap.2010.06.021>

Wanberg, J., Asce, S. M., Harper, C., Asce, S. M., Hallowell, M. R., Asce, A. M., ... Asce, A. M. (2013). Relationship between Construction Safety and Quality Performance. *Journal of Construction Engineering and Management*, 139(10), 4013003-1-4013003–10. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000732](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000732).

Zeng, J., Phan, C. A., & Matsui, Y. (2015). The impact of hard and soft quality management on quality and innovation performance: An empirical study. *Intern. Journal of Production Economics*, 162(February 2016), 216–226. <https://doi.org/10.1016/j.ijpe.2014.07.006>

Conclusion

- The findings from this research revealed that hard aspects of quality management particularly process management construct have significant relationship with safety performance in wood based furniture industry.
- Whereas, soft aspects of quality management do not show any positive reaction towards safety performance in wood based furniture industry.
- The outcome explained that respondents agree that only hard aspects of quality management influence the safety performance in wood based furniture industry.

Future Works

- Increase the sample size with minimum sample size of 70 responses.
- Develop a new measurement model with injury rate and rework rate as the dependent variable.
- Carry out a case study validation to validate the measurement model.

References

- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 112, 155- 159. doi:10.1037/0033-2909.112.1.155
- Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge Management: An Organizational Capabilities Perspective. *Journal of Management Information Systems*, 18(1), 185–214. <https://doi.org/10.1080/07421222.2001.11045669>
- Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. SAGE Publications.
- Ishak, M. S. (2017, October 13-14). *Partial least Squares Structural Equation Modeling using SmartPLS*. Lecture presented at Workshop on Partial Least Squares structural Equation Modeling using SmartPLS in Johor, Bandar Baru Uda.
- Mohd. Nasurdin, A., Tan, C. L., & Naseer Khan, S. (2017). Do Job Satisfaction, Work Engagement, Self-Efficacy and Empathy Matter in Determining Task Performance? *Proceedings of the 12th Asian Academy of Management International Conference 2017*, 423–433.
- Vinodkumar, M. N., & Bhasi, M. (2010). Safety management practices and safety behaviour : Assessing the mediating role of safety knowledge and motivation. *Accident Analysis and Prevention*, 42(6), 2082–2093. <https://doi.org/10.1016/j.aap.2010.06.021>
- Wanberg, J., Asce, S. M., Harper, C., Asce, S. M., Hallowell, M. R., Asce, A. M., ... Asce, A. M. (2013). Relationship between Construction Safety and Quality Performance. *Journal of Construction Engineering and Management*, 139(10), 4013003-1-4013003–10. [https://doi.org/10.1061/\(ASCE\)CO.1943-7862.0000732](https://doi.org/10.1061/(ASCE)CO.1943-7862.0000732).
- Zeng, J., Phan, C. A., & Matsui, Y. (2015). The impact of hard and soft quality management on quality and innovation performance: An empirical study. *Intern. Journal of Production Economics*, 162(February 2016), 216–226. <https://doi.org/10.1016/j.ijpe.2014.07.006>

Thank You