STUDY OF BUSINESS SAFETY PERFORMANCE BY STRUCTURAL EQUATIONS MODEL

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Abstract

Internal safety performance which is increasing in recent years is topic of many researches. However, researches about application of Structural Equations Model (SEM) are rarely related to arrangement of systematic safety performance model. This research is aimed to evaluate safety performance by means of private food and chemicals enterprises in Taiwan and to provide strategy and development by safety performance. So, it is possible to achieve the best model for safety performance. AMOS 17.0 was applied for construction of competitive models of SEM (study of time structure 17.0).

Keywords: safety performance, Structural Equations Model, confirmatory factor analysis

Introduction

Safety performance is defined as "total performance of organization safety management system in safe procedure" (WU, 2001). Evaluation of safety performance can be divided into three groups (WEI, 2008): 1) Old type: damages caused; frequency of unpleasant incidents and costs related to medical treatment. 2) Transmission type: study of preventing from incidents and fast achievement to safety goals and finally 3) Modern type: active evaluation of standards related to safety and health performance such as frequency of audit, evaluation, etc.

Safety and health performance is defined as total performance of investing organization procedures in safety and health management. Internal and external researches indicate that safety and health performance is related to intensity of safety changes of organizational behavior (WU, 2001; Markus, Michael, 2003; Mearns, 1998; Kristin, 2003; Nile, 2000; Estephan, 2007) which is combined with scientific approach.

Safety and health performance should evaluate the system. So, it is possible to receive important safety and health internal messages (Aston, 1997). The product of safety and health performance has special goals by which it is possible to achieve important results. Correct evaluation indexes related to safety and health performance simplifies permanent improvement of enterprise procedure.

Four important parts of self-management can be related to organization management, management, control and behavior. This increases safety and health performance and continuous improvement of management PDCA. Self-management of enterprises is reinforces and increases safety and health performance.

1. Applications of safety performance

- evaluation of safety performance and occupational health

Evaluation of safety performance and occupational health provides procedures'' indexes for safety and health management system. Rules of evaluation are:

A. According to evaluations of safety and health it is possible to provide reference indexes of safety and health and recognize progress situation of safety and health.
B. Each of safety and health performance evaluations should be carried out by a responsible person. This depends upon manner of evaluation, attitude and capability of personnel.
C. Each of evaluation procedures can provide feedback mechanism which has reinforced desirable safety and health performance indexes. In addition, this leads to improvement of undesirable safety and health indexes, too.

Evaluation of safety and health performance should be due to special safety and health performance indexes. According to this, it is possible to explain value of its application. Such evaluations should explain these issues:

1) Criterion of clear evaluations; 2) not only contains written information 3) also special standard methods 4) are based on facts. They may possibly repeat. They are operational. 5) Evaluation must be understood easily. They should be related to benefits of enterprise. 6) Evaluation should be related to main level of management sections. Evaluation of occupational safety and health is important in measurement of effects of commercial organizations and implementation of various safety and health management evaluations. Experts suggest using safety and health management system (such as control of occupational safety and health management system pre-action.) In old method occupational safety and health personnel use control of occupational safety and health management system pre-action related to safety performance evaluation methods. Statistics of unknown indexes have less sensitivity and are favorable for occupational safety and health management. Additionally, it is possible to ignore showing risks of management evaluations. So, various performance indexes perform in occupational safety and health management situation. This is logical, appropriate and obvious. They should cover provided information from evaluation of safety and health performance indexes.

- management of active performance evaluation

Active performance evaluation includes implementation of commercial safety and health management before occurrence of incidents, occupational disease or deaths. According to this, it is possible to provide important information of implementation effects. Pre-action performance evaluation can include confirmation of previous planned performance standards and achievement of special goals related to safety and health performance. Main goal is development of safety and health and reward desirable performance. It is aimed to find and solve problems. This provides accomplishment to performance goals and achieves progress.

Evaluations of active performance should contain these issues:

1) Progress of plans and goals; 2) Attitude of management commitment of managers in occupational safety and health; 3) is this person responsible for safety and health? 4) Are safety and health experts determined? 5) Level and amount of effects on safety and health experts; 6) is safety policy determined? 7) Is safety policy allocated to them? 8) Education level of safety and health; 9) effects of safety and health education; 10) comparison between number of risk evaluations and required numbers; 11) coordination of risks control; 12) coordination between rules and regulations; 13) sphere and effects of study of safety and health; 14) sphere of suggestions related to improvement f staff safety and health; 15) attitude of staff to risks and their control; 16) understanding level of risks and their control; 17) level of controlling safety and health.

- study of unknown performance evaluation

In old method, organizations evaluate safety and health performance. Most of the evaluations are previously carried out on data. This measurement evaluation includes comparison between numbers of incident situations, wrong signs or occupational diseases and value of relevant individuals. This is based on results of comparison. They are considered as safety solution for improvement of safety and health performance and progress aspects. Utilization of negative products in number of incidents and occupational diseases which are caused because of safety and health performance, are considered as unknown performance evaluation (United States Department of Labor, 2000; Asfahl, 1999).

Some of the limitations and lacks of unknown performance evaluations are apparent in application of safety and health managements, such as inefficient information about commercial organizations. Evaluated incidents, accidents and occupational diseases are possibly slow. So, real procedure of safety and health cannot be recognized as recognition reference of safety and health strategies. Occurrence of some incidents is possibly small but results of incidents can be strongly serious. These occurrences are inefficient in some incidents.

Information related to evaluation of unknown performance should include issues below:

1) Wrong behaviors 2) undesirable situations 3) wrong warning about events 4) incidents that only damage properties 5) temporary reports about dangerous events 6) waste of work hours 7) so dangerous occupational events 8) disease which is caused by occupational and non-occupational diseases 9) a group of protesters 10) competition of representatives and environment correction 11) regulate situations of representatives competition.

- combination of active and inactive performance indexes with each other

Evaluation system of occupational safety and health performance related to commercial organizations can combine active and inactive evaluation indexes according to rules above. Evaluation of applied active performance studied coordination of organizational safety and health like identification of this issue that do previous and new personnel change their positions? According to effective factors framework related to evaluation of ISO 14031 standards performance in evaluation of environmental performance, it is possible to study occupational safety and health indexes in occupational safety and health situations performance indexes of (OHSCPIs), (OHSMPIs) and (OHSOPIs) (Lin and Chen, 2002).

Sampling of Structural Equations Model from Relevant Issues

Structural Equations Model includes three main issues: hypotheses testing, structural confirmation, sampling study and comparison:

- Hypotheses testing are first issue in structural equation model. Researchers have a model of their hypotheses. Hypotheses testing method values relationship between physical samples and individual variables.
- Structural confirmation is consisted of a set of aspects which cannot be evaluated and observed directly but its nature is confirmed by acquires statistical data. So, it is one of the main advantages of structural equations model (Bollen & Long, 1993). Variables' relations cannot be easily supposed as results of various issues between variables' relations but it includes hidden reason and relations related to effects and group topics. Study or moderate of events' structure depends on nature and topic of categorized variables. So, perception of hypothetical relations between variables is hard. Thus, a set of hypothetical structural relations should be considered and statistical moderation should be searched.
- Sampling study and comparison: it is cleared by hypothetical testing, then structural confirmation of hypothetical model becomes significant and statistical methods perform as research model. Main goal is the comparison in which model can respond correct information.

Evaluation model can create a relation between evaluation indexes and hidden variables. Study of confirmatory primary factor examines and tests validity of evaluation method.

Structural model studies random path of relation between latent variables. It basically helps studying latent variable path in structural model nature test (Wu, 2006; Chen, 2007). This research uses the best model of software AMOS 17.0 (study of time structure 17.0). Due to this, it is possible to define model strategy and random resistance, random direction and direct and indirect relation.

- Arrangement of Structural Equation Model Compatibility

SEM supposes that when each parameter in hypothetical model is evaluated successfully, total evaluation of model can be implemented on a group of compatibility index procedure. Evaluation procedure should be repeated. Due to this, it is possible to observe compatibility index which indicates priority of study in SEM plan. According to evaluation indexes of model compatibility, SEM method must be examined by three evaluation indexes. So, it is possible to understand whether each of those types is studied or not?

Index seems desirable:

- Total evaluation of model compatibility: according to second power value: value of smaller second power is better. But second power value is related to degree of freedom. So, compatibility of P-value is more than 0.05 (P>0.05) which means that they are acceptable in this model.
- Study of evaluation model: evaluation of path coefficient as main evaluation: when all standardized path coefficients are more than 0.7. It means that they perform as a desirable evaluation system. In addition, it is possible to use indexes such as structural confidence and distribution as evaluation basis.

Research Methodology

According to structural equation model, relations between two aspects are considered. Framework of researches is displayed in figure 1.

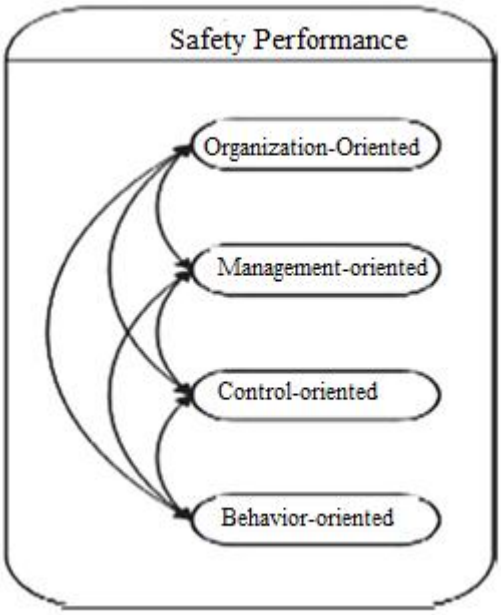

Figure 1- researches framework

4-1) research hypotheses: according to research goal it is possible to help safety performance and study structural model. Research hypotheses are: 1) safety performance which is consisted of 4 parts that are related to each other. 2) 4 aspects of safety performance can be explained by higher level aspects.

4-2) questionnaire: safety performance questionnaire is designed for this research. This is done according to safety performance. Safety performance level contains 31 parts which are used as questions related to hypothetical relations (as it is shown in table 1).

Table 1- business from safety performance aspects

Organization oriented	1. In decision-making commitment and support is high and there is a clear attitude of leadership. 2. In order to encourage staff especially safety and health workers outsourcing is used in the organization. 3. Transparent and powerful responsibility of safety and health is recognized by all staff, from workers to senior managers. 4. All staff, from low position workers to senior managers know about safety and health representation. 5. Dissemination of safety and health policies is effective in creating relationships in organization. 6. The goal is implementation of safety and health

	plan.
Management-oriented	1. Implementation of studying occupational satisfaction and procedure analysis 2. Implementation of evaluating risk hidden in industrial hygiene and measurement of operational environment with perception of hidden risk factor. 3. Utilization of new materials and facilities for identification of risk factors and predicting actions 4. Utilization of safety performance analysis and other methods depends on risk factors in workplace safety and hygiene management plan. 5. Automatic control of workplace is planned regularly. 6. Arrangement of relation for staff is a respond to hidden risks each time. 7. Incident information for analysis and improvement actions.
Control-oriented	1. Employment of experienced occupational safety and health personnel for implementation of improvement actions 2. Elimination resources of identified hidden risks. 3. Utilization of reliable and effective projects for improvement methods for controlling risks. 4. Utilization of job rotation and other official progresses in order to decrease risk exposure. 5. Utilization of action and work codes for improvement of special action procedures. 6. Utilization of effective personal protection and fist aids for risk reduction. 7. Utilization of a system for following efficiency improvement. 8. Implementation health management systems 9. Arranging emergency methods
Behavior-oriented	1. Education of management personnel in all safety and health levels 2. Informing managers, personnel and producers of disease related to damaging environment and workplace 3. Staff learns that work safety methods protects

from risks by controlling.
4. Correct perception of staff from protection
5. Perception and capability of emergency respond for management, nurses, staff, producers and spectators.
6. Knowledge of emergency action
7. Comprehensive perception of staff from safety and health management contents.
8. Effective safety and health responsibility for staff

4-3) research methods: in this research software SPSS and AMOS 17.0 were used as tools for determination and specification of research goals and research hypotheses. It is possible to follow accepted analytic methods. So, data study will also be done.

A. Descriptive statistical study: main features and characteristics of model structure will be understood easily by this method. Data, personal variables, various variables and standard deviation related to studied researches are coded. Little number of variables won't be accepted in responding the questions. Small standard deviation indicates high coordination in questions.
B. Reliability study: confidence means evaluation of information reliability. It is considered as evaluation tool (criterion). This tool is supposed as a tool for coordination evaluation or stability of psychological attitudes. Reliability is considered high when there is coordination between group members after evaluation of similar groups with goals evaluation and similar nature. Reliability of this research is calculated by Cronbach's A coefficient. It is possible to evaluate coordination with criterion by means of □. More value indicates better coordination. In total research, coefficient A should be more than 0.7. It is based on rules that are shown in table 2.

Table 2-Reliability coefficient according to table standard (Li, 2007)

Value limit	Importance
1.00 > a ≥0.90	Excellent
0.90 > a ≥.080	Good
0.80 > a ≥0.70	Acceptable
0.70 > a ≥0.60	Suspicious
0.60 > a ≥0.50	Weak (inappropriate)
0.50 > a ≥0.00	Inacceptable

C. Factor study: it is supposed as information technology which basically helps smaller aspects to provide main data structure. Due to this, it is

possible to explain complicated relevant variables because factors cannot be observed directly.

D. *T*-test study: it is done due to test expectations and predictions that in those two groups data is similar to each other. According to this, it is possible to determine whether priorities of groups show compatibility variable or not. In similar situations, important difference of variables can be moderated.
E. ANOVA method: this method basically examines that whether predictions of some independent groups are the same or not.
F. Structural equation model (SEM) study: due to this study, subjects provide a targeted method by means of hypothesis effects and reasoning. Then they are studied by provided information. In addition, all aspects of development cover test such as test study.

Results and Discussion

I. Model Retrieval diagram

Totally, 458 questionnaires were sent and 380 of them were received. It was obvious that 10 questionnaires were invalid and 370 were valid. Rate of validity recycle was 80.8% (as it is indicated in tables 3 to6)

Table 3- characteristics list of retrieval research model

Number of samplings	Improved sample	mprovement rate	Number of effective samples	Valid improvement	Number of invalid samples
458	380	83%	370	80.8%	10

Table4- criterion of ? and ? in various aspects of safety performance

T-value	Number of non-supervisors=262		Number of supervisors=104		
	Standard Deviation	Mean	Standard Deviation	Mean	
4.652	0.73750	3.5889	0.68971	39784	Organization-oriented
3.388	0.71643	3.5567	0.35130	38310	Management-oriented
3.330	0.6906	3.6968	0.63003	39588	Control -oriented
2.903	0.73117	3.6685	0.65990	19080	Behavior-oriented
3.771	0.68448	3.6277	0.62105	39193	Total safety performance

*P<0.05
***P<0.01
****p<0.0001

Table-5, variance analysis in different aspects of safety performance

Aspects	Variance resource	Sum of squares	Degree of freedom	Mean of sum of squares	F-test	Importance
Organization-oriented	Inter-group In the group Total	7.018 196.72 203.090	2 366 368	3.509 0.536	6.55 0	** 0.002

Management-oriented	Inter-group In the group Total	4.458 179.396 183.854	2 366 368	2.229 0.490	4.54 7	0.011*
Control-oriented	Inter-group In the group Total	3.548 169.434 172.982	2 366 368	1.774 0.463	3.38 2	0.023*
Behavior-oriented	Inter-group In the group Total	3.280 184.991 188.281	2 366 368	1.645 0.505	3.25 4	0.040*
Total safety performance	Inter-group In the group Total	4.441 163.951 168.392	2 366 368	2.220 0.448	4.95 7	** 0.008

*p<0.05
**p<0.01
**P<0.001

Table-6, variance analysis after providing service in various aspects of safety performance

Aspects	Variance resource	Sum of squares	Degree of freedom	Mean of sum of squares	F-test	Importance
Organization-oriented	Inter-group In the group Total	7.989 19.028 200.016	3 364 367	2.663 0.528	5.04 8	0.02**
Management-oriented	Inter-group In the group Total	5.350 176.640 182.010	3 364 367	1.783 0.485	3.67 4	0.012*
Control-oriented	Inter-group In the group Total	4.295 167.998 172.293	3 364 367	1.432 0.462	3.10 2	0.027*
Behavior-oriented	Inter-group In the group Total	2.818 183.852 185.671	3 364 367	0.939 0.505	1.86 0	0.136
Total safety performance	Inter-group In the group Total	4.867 62.3471 167.214	3 364 367	0.446	3.63 7	0.013*

*p<0.05
**p<0.01

II. Study of central attention situation and sample distribution

According to distribution of factory staff in various aspects of safety performance, higher values will have better aspect effects. Due to this, concept of staff distribution of A to C factories in different aspects of safety performance is given in tables 8 to 10. In comparison between total aspects of safety performance between 3 factories, it is observed that A and B factories have higher value than factory C (A=3.783, B=3.796, C=3.544).

The difference is related to comparison between provided data with many work experiences. As a result, staff is working for more than 15 years.
According to safety performance, three factories have desirable results in methods, practices and utilization of personal effective methods.
Safety performance parts with low average are basically offered in management aspects. Most of the workers of three factories don't agree with implementation of industrial health evaluation in enterprise and hidden risks of workplace evaluations. It is possible to understand hidden factors of risks, used materials and utilities.
Safety performance part describes study of standard deviation of A and B factories which are similar to each other while about knowledge of these factories it's vice versa because managers are ranked from higher positions to lower. Employees clearly provide safety and health responsibilities. This encourages staff to participate in arrangement of safety and health programs. It includes all staff, their work field and their safety and health policy and relations but cognitive coordination is observed in two sections: study of progress evaluation after incidents and arrangement of immediate reaction and practices.

Table-7, distribution of staff perception in A factory in various aspects of performance

Aspects	Mean	Standard Deviation	Mean (in decreasing order)
Organization-oriented	3.876	0.667	1
Management-oriented	3.766	0.668	2
Control-oriented	3.753	0.739	3
Total safety performance	3.739	0.673	3
Total safety performance	3.783	0.656	4

Table-8, distribution of staff perception in B factory in various aspects of performance

Aspects	Mean	Standard Deviation	Mean (in decreasing order)
Organization-oriented (3)	3.881	0.733	1
Management-oriented (4)	3.870	0.774	2
Control-oriented (1)	3.732	0.784	3
Total safety performance (2)	3.699	0.769	3
Total safety performance	3.796	0.730	4

III. reasons and rules related to elimination of observed variables

If total observed variable were more than 40 questions, it affects the model. So, rules of variables elimination are given below:

a) Observed variables in SEM should be less than 40 questions. They will probably have desirable results. In this method, some questions must be prepared for safety performance of each aspect.

Table-9, distribution of staff perception in C factory in various aspects of performance

Aspects	Mean	Standard Deviation	Mean (in decreasing order)
Organization-oriented (4)	3.624	3.568	1
Management-oriented (3)	3.568	3.530	2
Control-oriented (1)	3.530	3.453	3
Total safety performance (2)	3.453	3.544	3
Total safety performance	3.544	3.568	4

b) According to validity, each of the aspects need to maintain high and lower level of 0.8 in order to prevent from each aspect to lose its main goal. Reliability is provided after questions elimination in table 10.

Table-10, analysis of table reliability after elimination of questions related to various aspects of safety performance

Attitude	Question	Cronbach's value	Total safety performance
Organization-oriented	1-5 1-6 1-7	0.944	0.970
Management-oriented	2-4 2-6 2-7	0.911	
Control-oriented	3-1 3-2 3-5	0.913	
Behavior-oriented	4-6 4-7 4-8	0.930	

c) Factor loading of each observed variable should be at least 0.7 (or 0.6) or higher. They can be achieved by SPPS or AMOS. Factor loading after question elimination is shown in table 11.

d) Results of SEM should be arranges in listed increasing indexes.

Table-11, analysis of table factors after elimination of questions related to various aspects of safety performance

Orientation	Question-respond	Factor loading	Eigen value	Variance (%)

Organization-oriented	1-5 1-6 1-7	0.870 0.958 0.640	2.56	85.29
Management-oriented	2-4 2-6 2-7	0.844 0.912 0.883	2.33	77.51
Control-oriented	3-1 3-2 3-5	0.876 0.911 0.858	2.33	77.78
Behavior-oriented	4-6 4-7 4-8	0.845 0.935 0.930	2.45	81.80

IV. Study of Structural equation model

Structural equation model utilizes approximate value. This simplifies real environment. Desirable model can offer a complicated phenomenon in simple method while it owns the complexity. Due to this, it is possible to describe the model. Structural equation model of performance is confirmed by means of retrieval. It is understandable that organizational changes affect safety performance. Safety changes also affect some of the safety performances. Competitive model of safety performance uses the maximum model evaluation method. He first value is indicated in table 13 after completion of CFA validity plan.

After individually speaking about safety performances model, created safety performance should be completed. Results of competitive methods are shown in figure 3.

Table-13, proportional with various values of structural equation model related to safety performance (12 observed variables)

Model	Total appropriate index				
	GFI	AGFI	RMR	RMSEA	CFI
Nothing mode	0.145	0.010	0.433	0.456	0.00
First order single factor	0.766	0.662	0.027	0.165	0.892
First order four factors	0.587	0.404	0.027	0.278	0.696
First order four factors related to second order	0.941	0.905	0.383	0.069	0.983
single factor model	0.935	0.900	0.017	0.73	0.981

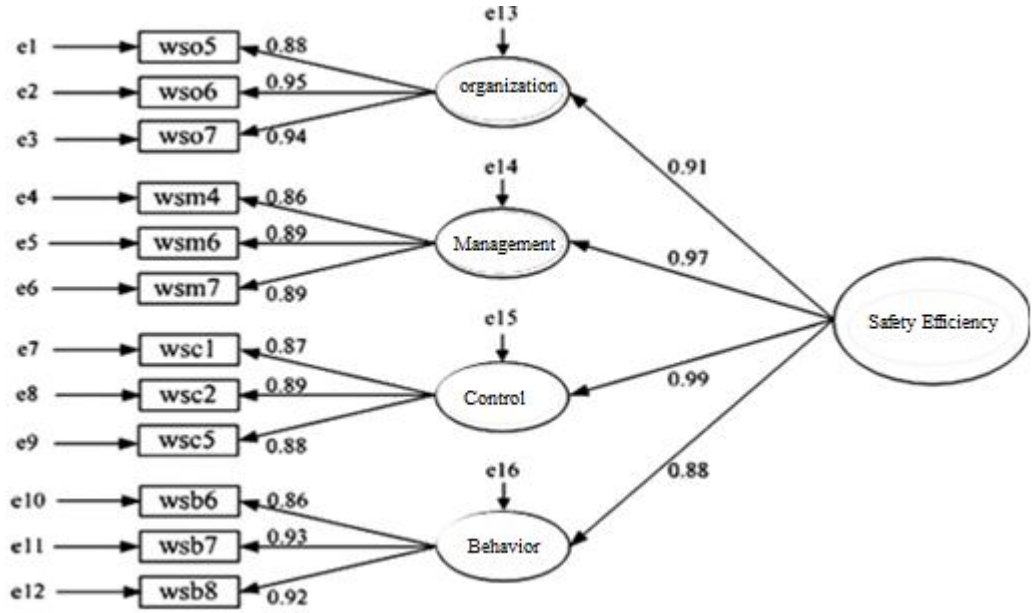

Figure 2-path plan of second order safety performance (12 observed variables)

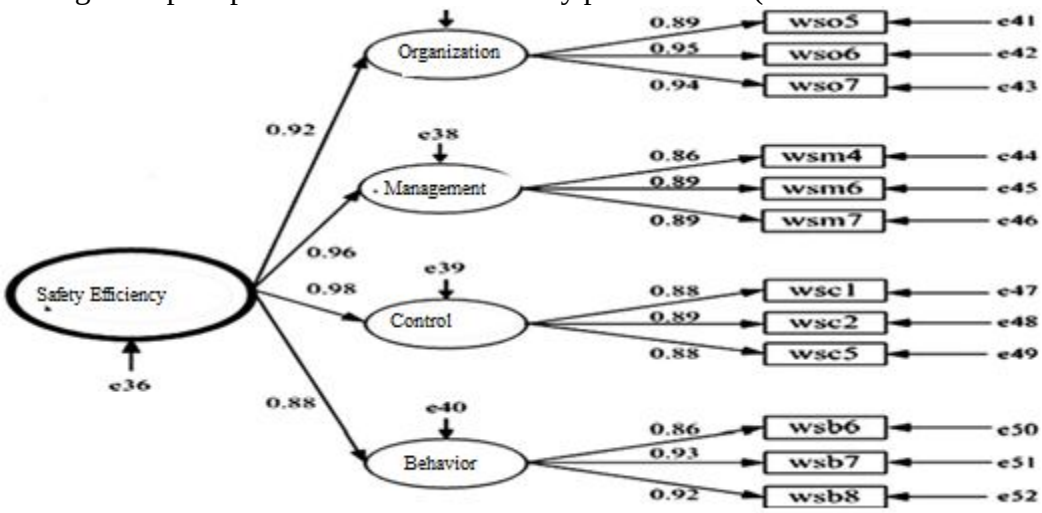

Figure 3- second order safety performance models related to path plan

V. Results of research hypotheses arrangement

By determination of hypotheses related to studies of this research, moderation and discussion is given below:

- Safety performance is consisted of four aspects which are related to each other.
- Four aspects of safety performance can be described by higher aspects. Aspects of safety performance related to food and chemicals should be cleared. It can be understood that second order safety performance which is implemented by 12 observed variables is related to first four latent variables. They are considered as desirable method. Theoretical model is implemented according to stability of 4 aspects of safety performance: organization-orientation, management-orientation,

behavior orientation and control-orientation. Creation of two hypotheses is accepted.

Conclusion

This research was prepared for determination of performance evaluation criterion in experimental researches methods. Due to this, it is possible to clear safety performance situations of food and chemicals industry. By providing a resource for implementation strategies and development of performance management, safety management performance can develop according to an attitude that managers have provided by means of intra-organizational factors and study of its direct and indirect effect. Hypothetical confirmatory results of this research indicate that safety performance aspects can e described by aspects at higher levels. First of all, this research shows structural equation model related to safety performance of some groups and then confirms implemented hypothetical models. After moderation and study of systematic model, first-order multifactor coefficient and second-order single factor model, it is understandable that these models are considered as the best models in safety performance. Due to this, it is possible to complete created new models. They have desirable value.

References

1. Australia Health & Safety Organization, 1997. Safety Management Achievement Program. Safety Map, The Organization.
2. American Industrial Hygiene Association, 1996. Occupational Health and Management System: An AIHA Guidance Document. AIHA OHSMS.
3. Asfahl, C.R., 1999. Industrial Safety and Health Management, fourth ed. Practice-Hall Inc., Upper Saddle River, New Jersey, pp. 18–21.
4. Baumgarther, H., Homburg, C., 1996. Application of structural equation modeling in marketing and consumer research. A review. International Journal of Research in Marketing 13, 139–161.
5. Benavides, F.G., Benach, J.M., Gonzalez, S., 2005. Description of fatal occupational injury rates in five selected European Union Countries: Austria, Finland, France, Spain and Sweden. Safety Science 43, 497–502.
6. Bollen, K.A., Long, S.L., 1993. Testing Structural Equation Modeling. Sage Publication, Newbury, UK.
7. British Standards Institution, 1999. Occupational Safety and Health Assessment
8. Series OHSAS 18001: The Occupational Safety and Health Management Systems Specification. BSI, London.
9. The British Standards Institution, 1996. BS 8800: Guide to the Occupational Safety and Health Management Systems, BSI.
10. Chen, S.Y., 2007. The Structural Equation Model. Psychology Press Ltd.
11. Chhokar, J.S., Wallin, J.A., 1984. Improving safety through applied behavior analysis. Journal of Safety Research 15, 141–151.
12. Chou, T.M., 2001. Enhanced business competitiveness and advantage through structural equation modeling and multivariate statistical methods. Journal of Probability and Statistical Science, 269–289.

13. Ewing, M.T., Napoli, J., 2005. Developing and validating a multidimensional nonprofit brand orientation scale. Journal of Business Research 58, 841–853.
14. Fuller, C.W., 2005. An assessment of the relationship between behavior and injury in the workplace: a case study in professional football. Safety Science 43, 213–224.
15. Gervais, M., 2003. Good management practice as a means of preventing back disorders in the onstruction sector. Safety Science 41, 77–88.
16. Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1998. Multivariate Data Analysis. Prentice-Hall, Inc., New Jersey.
17. International Labor Organization, 2001. Guidelines on the Occupational Safety and Health Management System. ILO-OSH 2001. ILO.
18. Industrial Development Bureau, 2000. Ministry of Economic Affairs. Occupational Safety and Health Management System Guidance Manual, Taipei.
19. International Organization for Standardization, 1999. Environment Management System Standard. ISO 14000 Series ISO.
20. International Organization for Standardization, 1999. The Year 2000 Revision of ISO 9000 Quality Management System Standard. ISO.
21. Japan Industrial Safety & Health Association, 1997. The Occupational Safety and Health Management System (OHS-MS): JISHA Guidelines: Tokyo the Associates.
22. J reskog, K.G., Sorbom, D., 1993. Structural Equation Modeling with the SIMPLIS
23. Command Language. Scientific Software International, Inc., Chicago.
24. Krause, T.R., Seymour, K.J., Sloat, K.C.M., 1999. Long-term evaluation of a behavior based
25. method for improving safety performance: a meta-analysis of 73 interrupted time-series replications. Safety Science 32, 1–18.
26. Kristin, S.C., Michael, J.B., Ronald, S.L., 2003. Organizational climate as a moderator
27. of safety knowledge–safety performance relationships. Journal of Organizational Behavior 24, 861–876.
28. Li, C.C., 2007. The Proficient SPSS Statistical Analysis in Practice and Application, CHWA.
29. Lin, M.C., Chen, C.Y., 2002. A study of the occupational safety and health
30. management system performance evaluation model. Chemical Engineering, 77–88.
31. Lust, J.A., 1996. Understanding performance appraisal: social, organizational, and goal-based perspectives. Personnel Psychology 4 (2), 511–514.
32. Manuele, F.A., 1995. Quality and safety: a reality check. Professional Safety, 26–29.
33. Markus, B., Michael, F., 2003. Innovation is not enough: climates for initiative and psychological safety process innovations and firm performance. Journal of Organizational Behavior 24, 45–68.
34. Mearns, K., Flin, R., Gordon, R., Fleming, M., 1998. Measuring safety culture in the offshore oil industry. Work and Stress 12 (3), 238–254.

35. Mueller, L.O., 1996. Basic Principles of Structural Equation Modeling: An Introduction to LISREL and EQS. Springer Texts in Statistics, New York. Neal, A., Griffin, M.A., Hart, P.M., 2000. The impact of organization climate on safety climate and individual behavior. Safety Science 34, 99–169.
36. Occupational Safety and Health Assessment Series 18001 (OHSAS18001). The Occupational Safety and Health Management System Guidance for the Implementation of OHSAS 18001.
37. Occupational Safety and Health Administration, 2003. USA OSHA 2003–2008 Strategic Management Plan. Department of Labor.
38. Occupational Safety and Health Administration, 2003. USA Voluntary Protection Programs (VPP): Policies and Procedures Manual. OSHA.
39. Occupational Safety and Health Administration, 2005. VPP Chart as of May Department of Labor. US.
40. Petersen, D., 2000. Safety management 2000 – our strength and weaknesses. Professional Safety, 16–19.
41. Phillips, B., Williams, J.L., 1999. Safety performance measures. In: Proceedings of the 38th Annual Professional Development Conference ASSE. Baltimore, Maryland, pp. 549–570.
42. Redinger, C.F., Levine, S.P., Blotzer, M.J., 2002. Evaluation of an occupational safety and health management system performance measurement tool – III: measurement of initiation elements. American Industrial Hygiene Association Journal 63, 41–46.
43. Standards Australia, 1997. Standards New Zealand: The Occupational Safety and Health Management Systems – General Guidelines on Principles, Systems and Supporting Techniques. AS/NZS 4804.
44. Johnson, E. Stephen, 2007. The predictive validity of safety climate. Journal of Safety Research 38, 511–521.
45. Steven, M.H., 1997. Extraordinary signals-how to conduct good business performance assessments. Taipei, 9–15
46. . Stricoff, R., 2000. Scott safety performance measurement: identifying prospective indicators with high validity. Professional Safety 145 (1), 36–39.
47. Su, T.S., Hsu, I.Y., 2008. Perception towards chemical labeling for college students in Taiwan using globally harmonized system. Safety Science 46, 1385–1392.
48. Tsao, C.C., 1998. A Study of the Labor Safety and Health Management Evaluation System. Institute of Occupational Safety & Health, Taipei.
49. US Department of Labor, 2000. OSHA Forms 300 for Recording Work Related Injury and Illness. 29 CFR Part 1904. Washington, DC.
50. Wei, S.S., 2008. A Study of Implementation of Safety Performance Management Industrial Safety Technology Quarterly.
51. Wentz, C.A., 1999. Safety Health and Environmental Protection. McGraw-Hill International Edition, New York.

52. Wu, T.C., 2001. A Study of Safe Climate and Safety Performance of Four Types of Manufacturing Industries in Taiwan. Doctoral Dissertation, Department of Industrial Education, National Changhua Normal University.
53. Wu, M.L., 2006. The Application of the Structural Equation Model SIMPLIS. Wunan Book Co., Ltd.
54. Wu, T.C., Kang, C.L., 2004. A study on the survey of safety performance perceived by the workers of in the four types of manufacturing industry in Taiwan. Journal of Occupational Safety and Health, Council of Labor Affairs, Taipei 12 (1), 73–90.