Leader-member exchange, safety climate and employees' safety organizational citizenship behaviors in container terminal operators

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Abstract

Purpose – Container terminal operation is one of the most risky industries. Many of the accidents that occurred were found to be caused by human errors. However, it seems relatively little research has been conducted to examine the influence of leader-member exchange (LMX) relationship on employee safety behavior. Therefore, the purpose of this study is to examine the effects of leader-member exchange and safety climate on employees' safety organizational citizenship behaviors (SOCB) in the container terminal context based on the social exchange theory.

Design/methodology/approach – A structural equation modeling was used with confirmatory factor analysis, and survey data are collected from 265 employees in major container terminals in Taiwan.

Findings – Results indicated that LMX is positively associated with safety climate, whereas safety climate positively influences employees' safety citizenship behavior. Specifically, results indicated that safety climate mediates the effect of LMX on employees' SOCB.

Research limitations/implications – This study was limited to LMX dimensions adapted from the studies of Li and Liao (2014) and Vidyarthiv *et al.* (2014). Future research could examine the linkages between LMX, ethical climate, safety performance and supervisor leadership influence. Furthermore, this research focused specifically on employees from the container terminal operators in Taiwan. It would be valuable to collect data from employees from other countries to obtain a balanced view of the relationship between LMX, team-member exchange (TMX), safety climate and employee SOCB in container terminal operations.

Practical implications – This research provides a useful implication for container terminal operators to enhance LMX qualities and employee safety behavior through organizational participation, employee-helping behaviors and informing workers to obey safety rule and regulation.

Originality/value – Given the prevalence of accidents and unsafe behavior in container terminal operations, this research sought to examine the relationships among LMX, safety climate and employee SOCB in the container terminal context. Theoretically, this study highlights the importance of LMX and safety climate in explaining the SOCB of employees.

Keywords Safety climate, Container terminal, Leader-member exchange, Safety organizational citizenship behaviour

Paper type Research paper

1. Introduction

Safety is always a concern in the operations of container terminal and maritime transport. Despite that, there are thousands of fatalities in maritime accidents, many losses of vessels and billions of dollars in marine claims (Talley *et al.*, 2006; Talley *et al.*, 2008). Several reports and studies indicate that about 75-96 per cent of most maritime casualties are attributed to human errors (Lu and Tsai, 2010; Rothblumr, 2000; Ung and Shen, 2011). The causes of crew injuries or fatalities and vessel accidents are not always clear. Given these reasons, researchers have devoted much effort to examine safety behaviors.

A majority of previous studies have proposed that safety climate can help to predict safety-related outcomes, such as accidents or injuries (Brown and Holmes, 1986; Dedobbeleer and Beland, 1991; DeJoy, 1994; Diaz and Cabrera, 1997; Gillen *et al.*, 2002; Glendon and Litherland, 2001; Lu and Tsai, 2010; Lu and Yang, 2011; Zohar, 1980). Safety climate refers to "the shared perceptions of the employees concerning practices, procedures, and the kind of behavior that get rewarded, supported and expected in a setting". Safety Climate is a specific form of organizational climate, which is defined as "shared perceptions about organizational values, norms, beliefs, practices and procedures" (Guldenmund, 2000). Neal *et al.* (2000) found safety climate influenced self-reported components of safety performance. Katz-Navon *et al.* (2005) suggested that the notion of safety climate explained the occurrence of treatment errors in health care. Their research results demonstrated that perceived safety procedures and clear information flow were effective on reducing treatment errors. Lu and Tsai (2010) empirically examined safety climate and its effects on safety behaviors from the perceptions of seafarers in the context of container shipping. Safety policy and perceived supervisory safety behavior were shown to have a significant direct impact on safety behavior. Furthermore, Lu and Yang (2011) examined the impact of safety climate on safety behavior in passenger ferry services. Their findings indicated that safety training and emergency preparedness were positively associated with safety behavior, including safety compliance and safety participation.

Despite safety climate is a critical element of safety behavior, this research proposes that the quality of leader-member exchange (LMX) may influence safety climate and port workers' safety organizational citizenship behaviors (SOCB). Notably, studies of antecedents to safety behaviors have focused on either the quality of LMX (Hofmann and Morgeson, 1999; Hofmann *et al.*, 2003; Hofmann and Stetzer, 1996) or organization factors (Griffin and Neal, 2000; Hofmann and Stetzer, 1996; Lu and Yang, 2011; Lu and Tsai, 2010; Zohar, 2002). The notion of LMX refers to a leader who develops different types of exchange relationships with their subordinates and that the quality of these relationships influences the attitudes and behaviors of the leader and member (Illies *et al.*, 2007). The LMX theory is drawn from the social exchange theory (Blau, 1964) to explain a long-term and perceived mutual obligation on the part of employees to reciprocate high-quality relationship (Blau, 1964; Illies *et al.*, 2007). A leader initiates social exchanges by bestowing favorable treatment upon a member who will be in turn obliged to work harder to benefit the leader as a means of reciprocation (Liden *et al.*, 1997; Rockstuhl *et al.*, 2012). In a work team, there are two exchange relationships among individuals and between leaders and members (Liao *et al.*, 2010). LMX can be explained as the reciprocal exchanges between a leader and a member built on obligations, respect and trust (Grean and Uhl-Bien, 1995), whereas a team member exchange (TMX) refers to a member's social exchanges with another team member based on the reciprocal feedback, assistance and contribution of ideas (Liao *et al.*, 2010; Seers, 1989). Despite a number of studies showing that high-quality LMX relationships can enhance employees' organizational citizenship behaviors (Hofmann *et al.*, 2003; Wang *et al.*, 2005; Illies *et al.*, 2007), relative little researches has considered LMX and safety climate

simultaneously influencing workers' SOCB because these two exchange relationships co-existing within an organization.

Previous studies have found a positive influence of LMX on organizational citizenship behavior (Wang *et al.*, 2005; Grean and Uhl-Bien, 1995; Illies *et al.*, 2007). Safety climate could play a mediating role on the relationships between LMX and SOCB (Hofmann *et al.*, 2003). Safety climate refers to the coherent set of expectations and perceptions that employees have regarding safety in their organization (Zohar, 1980). The values and norms of an organization might affect the behaviors of employees within the relationship of LMX. Nevertheless, it seems that a limited number of prior studies have examined the relationships between LMX, safety climate and employees' SOCB. Therefore, this research drawn upon the social exchange theory and LMX theory to highlight the theoretical mechanism linking difference in organizational safety climate with employees' SOCB. This research will specifically focus on the investigation of employees who are working in container terminal companies. A safe operation should be cooperated with closer social exchange relationships between supervisors and employees. To address the research objectives, the following key research questions are posited:

RQ1. How do the quality and differentiation of LMX affect employees' SOCB in container terminal operations?

RQ2. How does safety climate influence container terminal operators' SOCB?

RQ3. What are the mechanisms through safety climate to explain the variation in the quality of LMX and employees' SOCB in container terminal operations?

Owing to its crucial importance for a long-term safety environment, the objective of this research is to examine the influence of LMX and safety climate on employees' SOCB and the mediating effect of safety climate on the relationships between LMX and employees' SOCB in the context of container terminal operations. Following this introductory section, the next section presents the theoretical background and research hypotheses on the relationships between LMX, safety climate and SOCB. An explanation of the methodology used to implement the research objective is described in Section 3. The results obtained from a questionnaire survey of employees' perceptions are detailed in Section 4. Conclusions drawn from the research findings, practical implications are discussed in the final section.

This research contributes to the application of LMX on safety research in container terminal operations. This research provides a useful implication for container terminal operators to enhance LMX qualities and employees' safety behavior through organizational participation, employee helping behaviors and informing workers to obey safety rule and regulation.

2. Theoretical background and research hypotheses
2.1 Leader-member exchange, safety climate and safety organizational citizenship behavior
According to the theory of social exchange, LMX relationships are characterized by a perceived obligation on the part of members to reciprocate high-quality relationships (Hofmann *et al.*, 2003). High-quality relationships or exchanges built on high levels of interaction, trust, support and rewards that extend beyond what is specified in the normal job description (Dienecsh and Liden, 1986; Liden *et al.*, 1997). Essentially, employees in a high quality of LMX relationship will feedback to their leaders or supervisors by participating in citizenship behaviors that benefit the leader and other colleagues within an organization (Liden *et al.*, 1997). Hence, a high quality of social relationship will foster the set of citizenship behaviors.

Container terminal operation is one of the most risky industries. The main operators or workers in a container terminal include front-line stevedores, tallies, crane operators, tractor drivers, engineers and maintenance personnel. The yard supervisor is responsible for the terminal operations and protection of the safety of containers and workers. Therefore, team work must be importantly emphasized to ensure safety. People work in container terminals by participating in different roles with other members or co-workers within an organization. Although container terminal operators engaging in different specific works, both communications emphasized an interaction between the supervisor and worker is important to influence the behaviors of workers. Focal workers or members will be more likely to meet the expectations of the supervisor (leader) when focal members felt liking, respect and admiration for the supervisor. Thus, in a high-quality relationship, the terminal supervisor (leader) and worker participate in cooperative problem-solving, mainly resulting in a set of team work behaviors that are mutually enhanced. Conversely, in a low quality relationship, this team work will be failed to develop in container terminal operations and negatively influence safety.

Accordingly, terminal employees having high-quality relationships will value their work environment. Because safety is important concern in a high-risk environment, employees who value their behaviors would be doing their work safely. Therefore, a high quality of LMX relationship will cause terminal workers to increase their roles beyond what is formally required and participate in fostering SOCB in container terminal operations. SOCB is one kind of organizational citizenship behaviors which are specifically emphasized on enhancing the safety performance of the organization. Thus, this research posits the hypothesis:

H1. LMX positively relates to safety climate in container terminal operations.

H2. LMX positively relates to SOCB in container terminal operations.

2.2 Safety climate and safety organizational citizenship behavior
Organizational climate refers to shared perceptions of employees regarding the organizational policies, practices, procedures and employee behaviors that are rewarded and encouraged in a specific organization (Zohar and Tenne-Gazit, 2008). Organizational policies and practices relate to specific performance facets including financial performance, service quality and safety (Zohar and Tenne-Gazit, 2008). Safety climate is a specific form of organizational climate and is referred to individual perceptions of the safety value in the work environment (Neal *et al.*, 2000). Safety climate refers to the coherent set of perceptions and expectations that employees regard safety in their organizations (Zohar, 1980). Safety climate can be defined as individual perceptions of safety-related practices, procedures and policies pertaining to safety issues that affect personal benefits at work (Christina *et al.*, 2009; James and James, 1989). When these safety perceptions are shared and emphasized among individuals in a specific work environment, a safety climate emerges (Christina *et al.*, 2009). Clarke (2006) used a meta-analysis to propose that safety climate is a meaningful determinant of safety behaviors and is related to accidents. Thus, safety climate is expected to positively influence employee's safety behaviors and to reduce potential risks and accidents. A majority of prior studies (Brown and Holmes, 1986; Dedobbeleer and Beland, 1991; DeJoy, 1994; Gillen *et al.*, 2002; Glendon and Litherland, 2001; Lu and Tsai, 2010; Lu and Yang, 2011; Zohar, 1980) suggest safety climate positively influence on safety performance. Lu and Yang (2011) demonstrated five dimensions of safety climate based on previous studies, namely, safety motivation (Griffin and Neal, 2000; Zohar, 1980), safety

policy (Lu and Tsai, 2008), safety communication (Clarke, 1999; Zohar, 2002), emergency preparedness (Lu, and Yang, 2011) and safety training (Zohar, 1980). Safety training and emergency preparedness which provided by an organization positively affect self-reported safety behaviors, such as safety compliance and safety participation. Accordingly, this research posits the hypothesis:

H3. Safety climate positively relates to SOCB in container terminal operations.

3. Methodology

3.1 Sample

Data collection of this research was based on a questionnaire survey. The samples include employees who are working in Taiwanese container terminals and engage in operations, such as tally, lashing and stevedore activities. Questionnaires were delivered to 424 container terminal employees by research assistants in Mach 2016. A total of 265 usable questionnaires were collected, which represented 62.5 per cent of the target sample. Table I indicates that the majority of participants (51.7 per cent) were aged between 31 and 50 years, followed by aged between 51-60 years (22.6 per cent), aged less than 30 years (17.7 per cent) and aged more than 60 years (8.0 per cent). Nearly 18 per cent were aged 30 or below and 8 per cent were aged 60 or above. In total, 19 per cent of the participants were supervisors or at a higher position and 24.2 per cent and 48.2 per cent were shore workers and yard workers, respectively. Only 8.3 per cent of the respondents were maintenance engineers. Results indicated that more than 67 per cent of the respondents had attained a bachelor's degree or above educational level. Nearly 33 per cent of the respondents had attained a senior high school or below educational level. The main job nature of more than half of the

Characteristics of the respondents	Frequency	(%)
Age		
Less than 30	47	17.7
31-40	68	25.7
41-50	69	26.0
51-60	60	22.6
More than 60	21	8.0
Job title		
Supervisor or above	51	19.3
Shore worker	64	24.2
Maintenance engineer	22	8.3
Yard worker	128	48.2
Educational level		
Senior high school or below	97	32.8
Bachelor's degree	161	60.8
Master's degree or above	17	6.4
Department		
Warehousing	55	20.8
Container operations	112	53.0
Maintenance	25	9.4
Engineering	15	5.7
Other	56	21.1

Table I.
Profile of the respondents ($n = 265$)

respondents was in container operations, followed by others (21.1 per cent), warehousing (20.8 per cent), maintenance (9.4 per cent) and engineering (5.7 per cent).

3.2 Measure

3.2.1 Leader-member exchange. This research was interested in the overall exchange relationship. Participants were asked to rate the LMX relationship with their supervisor by using 11 measures as recommended by Li and Liao (2014), Maslyn and Uhl-Bien (2001) and Vidyarthiv *et al.* (2014). A five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used such that higher scores reflected higher quality LMX. Reliability test based on a Cronbach's alpha was 0.85.

3.2.2 Safety climate. Safety climate was measured by using a revised and updated version from previous studies of Glendon and Litherland (2001), Neal *et al.* (2000), Lu and Yang (2011), Probst (2015) and Zohar (1980). Similarly, 18 items used a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) with higher scores representing higher safety climates. In particular, 18 safety climate items can be categorized into three dimensions, namely, supervisory safety, safety training and safety response. Reliability test based on a Cronbach's alpha for supervisory safety, safety training and safety response were 0.95, 0.89 and 0.87, respectively.

3.2.3 Safety organizational citizenship behavior. SOCB was measured by modifying several OCB measures. Drawing on the theoretical and prior studies by Farh *et al.* (2004), Lee *et al.* (2007) and Podsakoff *et al.* (2003), SOCB was measured by 16 items using a five-point Likert scale where 1 corresponding to "strongly disagree" and 5 representing "strongly agree" and are intended to capture SOCBs demonstrated by container terminal employees. These SOCB items can be identified as three dimensions, namely, safety-related participation, helping and courtesy. Scale scores were created such that higher scores reflected higher performance of the safety behavior. Reliability test based on a Cronbach's alpha for organizational participation, helping and courtesy were 0.92, 0.72 and 0.89, respectively.

3.3 Analytical method

We used the IBM SPSS 24.0 (2016) for Windows and AMOS 24.0 (2016) statistical packages for the following analyses. Regarding the research steps and methods, a descriptive statistic and a confirmatory factor analysis (CFA) were used to examine unidimensionality and convergent validity. Moreover, a structural equation modeling was used to examine the effects of SOCB and safety climate on safety behavior, as well as the effect of safety climate on SOCB.

Several analytical methods were conducted in this study, including the descriptive statistics of respondents' profiles and measures, exploratory studies of the dimensions of LMX, safety climate and SOCB, as well as casual research of the relationships between variables. The latter refers to a cause-and-effect relationship that was used to examine the influence of LMX and safety climate on employee SOCB and the mediating effect of safety climate. First, a widely review of previous studies and interviews with terminal operators were conducted. Measures for LMX, safety climate and SOCB were drawn from previous studies. To increase the adequacy of measures and validate the research hypotheses, this research conducted in-depth interviews and discussions with 10 practitioners in container terminal.

Second, an exploratory factor analysis (EFA) and CFA were used to validate the relationships between latent variables (i.e. LMX, safety climate and SOCB) and manifest variables (i.e. measure items) and verify measurement models. A CFA with multiple-indicator measurement was adopted to evaluate unidimensionality between variables (Segar, 1997).

Third, a structural equation modeling (SEM) was adopted to test the research hypotheses and assess the relationships among the latent variables and manifest variables. To validate the measures and the fit of the conceptual model, unidimensionality, item reliability and discriminate validity were examined in this research (Iacobucci and Churchill, 2010).

Because the data collection of this research was based on a self-report questionnaire survey, the responses may be biased as the result of measuring multiple constructs using a single respondent. It is possible to have the common method variance (CMV) problem (Podsakoff *et al.*, 2003). According to the suggestion from Podsakoff *et al.* (2003), this research used the ex -ante approach to reduce the potential CMV bias. First, we informed the participants that their responses will be confidential and anonymous. The respondents were notified that there were no right or wrong answers to encourage them to answer as honestly as possible. Second, the dependent variable (i.e. SOCB) was measured based on employees' perceptions of their SOCB, while the independent variables (LMX and safety climate) were based on employees' perceptions of their social exchange relationships with their supervisors working in the same team. As a result, the problem of common method variance problem can be reduced in this research.

4. Results

4.1 Exploratory factor analysis results

This research uses an exploratory factor analysis to identify the major factors/dimensions underlying the measurement items of the safety climate and SOCB in the context of container terminal companies. Principal component analysis with VARIMAX rotation was used to obtain the factors with eigenvalues greater than 1.0 (Hair *et al.*, 2010).

Exploratory factor analysis with VARIMAX rotation was used to clarify the factors underlying SOCB. The Kaiser-Meyer-Olkin value was 0.928 and Bartlett's Test of Sphericity was 2469 ($p < 0.000$), indicating that the results were accepted. Only one factor was obtained to underlie the LMX dimension was viewed by the survey respondents. The single factor consisted of all items, namely, *I like my supervisor very much as a person, my supervisor is the kind of person one would like to have as a friend, my supervisor is a lot of fun to work with, my supervisor would defend me to others in the organization if I made an honest mistake, my supervisor would come to my defense if I was attacked by others, my supervisor defends my work actions to a superior, even without complete knowledge of the issue in question, I do work for my supervisor that goes beyond what is specified in my job description, I am willing to apply extra efforts, beyond those normally required, to further the interests of my work group, I respect my supervisor's knowledge of and competence on the job, I admire my supervisor's professional skills and I am impressed with my supervisor's knowledge of his/her job*. Therefore, this factor was identified as a LMX dimension. "My supervisor defends my work actions to a superior, even without complete knowledge of the issue in question" had the highest factor loading on this dimension. This factor accounted for 64.7 per cent of the total variance.

Table II shows three factors underlay the 18 measuring safety climate attributes. The KMO statistics was 0.952 and Bartlett's Test of Sphericity was 3,682 ($p < 0.001$), which confirmed their suitability for further factor analysis (Hair *et al.*, 2010). The three factors accounted for approximately 71.7 per cent of the total variance. These three factors/dimensions of safety climate are described below.

Factor 1 was designated the supervisory safety, as it consisted of the following eight items:

(1) my supervisors involve in setting safety goals with employee;

(2) my supervisors care about employee's safety;

Safety climate attributes	F1	F2	F3
SUP1: My supervisors involve in setting safety goals with employees	0.841	0.251	0.179
SUP2: My supervisors care about employee's safety	0.833	0.210	0.219
SUP3: My supervisors discuss regular safety issues with employees	0.826	0.261	0.212
SUP4: My supervisors enforce safety rules	0.809	0.216	0.275
SUP5: My supervisors praise employees' employees' safety behaviors	0.792	0.263	0.192
SUP6: My supervisors audits employees' safe behaviors	0.777	0.242	0.221
SUP7: My supervisors mention safety to be as equally important as the efficiency	0.742	0.310	0.259
SUP8: My supervisors act on safety suggestions from employee	0.720	0.279	0.311
TRA1: Safety training programs do apply to my workplace	0.238	0.778	0.296
TRA2: The design of safety training program is good	0.296	0.753	0.192
TRA3: Safety training programs are helpful to prevent accidents	0.236	0.734	0.325
TRA4: Safety training programs in my company do work	0.349	0.721	0.316
TRA5: Safety training programs in my company are enough	0.341	0.718	0.224
RES1: My company responds quickly to safety concerns	0.327	0.140	0.781
RES2: My company investigates safety problems quickly	0.256	0.220	0.776
RES3: My company posts warning sign for hazardous cargo	0.124	0.276	0.708
RES4: My company provides safety information	0.261	0.308	0.705
RES5: My company frequently conducts safety inspections	0.248	0.299	0.696
Eigenvalues	9.92	1.82	1.17
Percentage variance	55.1	10.1	6.5
Cronbach's alpha	0.95	0.89	0.87

Table II.
Exploratory factor analysis of safety climate attributes

(3) my supervisors discuss regular safety issues with employees;

(4) my supervisors enforce safety rules;

(5) my supervisors praise employees' employees' safety behaviors;

(6) my supervisors audits employees' safe behaviors;

(7) my supervisors mention safety to be as equally important as the efficiency; and

(8) my supervisors act on safety suggestions from employee.

As these items were related to the supervisor, this factor was therefore identified as supervisory safety. "My supervisors involve in setting safety goals with employees" had the highest loading on this dimension. This factor accounted for 55.1 per cent of the total variance.

Factor 2 was labelled the safety training factor, as it comprised the following five items:

(1) safety training programs do apply to my workplace;

(2) the design of safety training program is good;

(3) safety training programs are helpful to prevent accidents;

(4) safety training programs in my company do work; and

(5) safety training programs in my company are enough.

"Safety training programs do apply to my workplace" had the highest factor loading on this factor, followed by *the design of safety training program is good*. Factor 2 accounted for 10.1 per cent of the total variance.

Factor 3 was called the safety response factor, as it comprised the following five items:

(1) my company responds quickly to safety concerns;

(2) my company investigates safety problems quickly;

(3) my company posts warning sign for hazardous cargo;

(4) my company provides safety information; and

(5) my company frequently conducts safety inspections.

The item my company responds quickly to safety concerns had the highest factor loading on this factor, followed by my company investigates safety problems quickly. Factor 3 accounted for 6.5 per cent of the total variance.

Factor analysis was also used to identify SOCB attributes. Results revealed that approximately 68.5 per cent of the total variance was represented by the information contained in the factor matrix as shown in Table III. Three SOCB dimensions were found to underlie the various sets of safety organizational citizenship behavior attributes of container terminal operations. They were identified and described below.

Factor 1 was called the organizational participation factor. It consisted of the following seven items:

(1) attending safety meetings;

(2) volunteering for safety committees;

(3) participating in setting safety goals;

(4) making safety-related recommendations about work activities;

(5) encouraging co-workers to get involved in safety issues;

(6) rising safety concerns during planning sessions; and

(7) expressing opinions on safety matters even if others disagree.

These items represent attributes that are by nature with organizational participation. "Attending safety meetings" had the highest factor loading on this factor, followed by volunteering for safety committees and participating in setting safety goals. Factor 1 accounted for 52.6 per cent of the total variance.

SOCB attributes	OCB 1	OCB 2	OCB 3
PAR1: Attending safety meetings	0.769	0.106	0.263
PAR2: Volunteering for safety committees	0.761	0.203	0.197
PAR3: Participating in setting safety goals	0.743	0.055	0.291
PAR4: Making safety-related recommendations about work activities	0.710	0.267	0.195
PAR5: Encouraging co-workers to get involved in safety issues	0.680	0.164	0.342
PAR6: Rising safety concerns during planning sessions	0.610	0.373	0.207
PAR7: Expressing opinions on safety matters even if others disagree	0.599	0.499	0.082
HEL1: Helping teach safety procedures to new workers	0.092	0.858	0.247
HEL2: Helping others with safety-related responsibilities	0.160	0.799	0.381
HEL3: Helping other crew members learn about safe work practices	0.322	0.717	0.361
COU1: Passes along information to co-worker	0.377	0.684	0.290
COU2: Trying to prevent co-workers from being injured on the job	0.165	0.269	0.816
COU3: Informing co-workers to obey safety rule	0.319	0.305	0.757
COU4: Inspecting new co-workers to follow safety procedures	0.367	0.248	0.732
COU5: Taking action to stop safety violations to protect co-workers	0.327	0.299	0.704
COU6: Be aware of the safety of co-workers	0.313	0.438	0.561
Eigenvalues	8.42	1.55	1.00
Percentage variance	52.6	9.6	6.3
Cronbach's alpha	0.92	0.72	0.89

Table III.
Exploratory factor
analysis of SOCB
attributes

Factor 2 was designated the helping behavior factor. It comprised the following three items:

(1) helping teach safety procedures to new workers;

(2) helping others with safety-related responsibilities; and

(3) helping other crew members learn about safe work practices.

These items represent attributes that are by nature related to helping behavior. Factor 2 accounted for 9.6 per cent of the total variance. The item "helping teach safety procedures to new workers" had the highest factor loading on this factor, followed *by helping others with safety-related responsibilities.*

Factor 3 was called the courtesy factor. It included the following six items:

(1) passes along information to co-worker;

(2) trying to prevent co-workers from being injured on the job;

(3) informing co-workers to obey safety rule;

(4) inspecting new co-workers to follow safety procedures;

(5) taking action to stop safety violations to protect co-workers; and

(6) be aware of the safety of co-workers.

"Passes along information to co-worker" had the highest factor loading on this factor, followed by trying to prevent co-workers from being injured on the job. Factor 3 accounted for 6.3 per cent of the total variance.

4.2 Reliability and validity

A content validity was conducted through a theoretical review and pilot study. Measure in the questionnaire was based on previous studies and discussed with a number of practitioners in container terminals. Tables II and III show the Cronbach's alpha values which were well above the 0.7 value considered adequate for achieving a satisfactory level of reliability in research (Churchill and Iacobucci, 2002). Table IV shows the means, standard deviations and corrected item-total correlation coefficients of each factor, which are all above the recommended threshold of 0.3 (Hair *et al.*, 2010).

Constructs	Mean	SD	LMX	SCL1	SCL2	SCL3	OCB1	OCB2	OCB3
LMX	3.71	0.746	1						
SCL1	3.95	0.699	0.614**	1					
SCL2	3.94	0.622	0.544**	0.662**	1				
SCL3	4.17	0.575	0.473**	0.609**	0.662**	1			
OCB1	3.92	0.529	0.384**	0.431**	0.496**	0.294**	1		
OCB2	4.17	0.534	0.426**	0.517**	0.538**	0.445**	0.712**	1	
OCB3	4.14	0.596	0.355**	0.477**	0.471**	0.438**	0.564**	0.745**	1

Table IV.
Means, standard deviations and correlations between LMX, safety climate and SOCB

Notes: SD: Standard deviation; **Significance level $p < 0.01$; LMX: Leader-member exchange; SCL1: Supervisory safety; SCL2: Safety training; SCL3: Safety response; OCB1: Organizational participation; OCB2: Helping behavior; OCB3: Courtesy

4.3 Confirmatory factor analysis results

CFA was performed to ensure the validity of the measurement model (Anderson and Gerbing, 1988) consisting of three constructs, namely, LMX, safety climate and SOCB. A number of goodness-of-fit indices recommended by previous researchers were examined to assess the fit and unidimensionality of the measurement model (Bagozzib and Yi, 1988; Koufterosk, 1999). The statistical criteria for model modification decisions included standardized residuals and model fit indices. Principally, standardized residuals less than 2.5 or greater than 2.5 do not suggest a problem (Hair *et al.*, 2010). However, standardized residual value of one item *I like my supervisor very much as a person* (LMX1) in the LMX dimension exceeded 2.5 and therefore, was removed from further analyses. The results show the following fit values: Chi-square statistic ($\chi^2 = 210.5$ df = 84), the normal fit index (NFI = 0.94), comparative fit index (CFI = 0.96), goodness-of-fit index (GFI = 0.90), adjusted goodness-of-fit index (AGFI = 0.87), root mean square residual (RMR = 0.02) and root mean square error of approximation (RMSEA = 0.07). This indicates that the model was acceptable (Hair *et al.*, 2010). Furthermore, a convergent validity was tested by indicating the critical ratio (CR) which indicated that all are statistically significant on the factor loadings (Dunn *et al.*, 1994). Critical ratio represents the parameter estimated, divided by its standard error. The CR value should be greater than 1.96 or smaller than –1.96 for the estimate to be significant (Koufterosk, 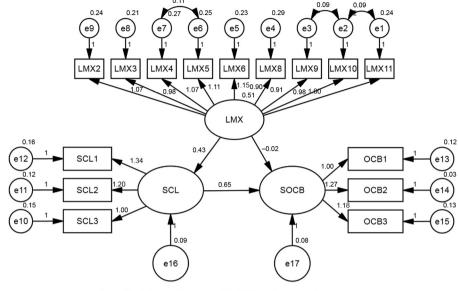1999; Byrne, 2016; Hair *et al.*, 2010). The results confirmed that all indicators measured the same construct and providing satisfactory evidence of the convergent validity and unidimensionality of each construct (Anderson and Gerbing, 1988).

4.4 Results of hypotheses testing

The results of hypotheses testing were shown in Figure 1. The results indicated that goodness-of-fit index was calculated to be 0.91 and the adjusted goodness-of-fit index yielded 0.87 after adjustment was made for degrees of freedom relative to the number of variables. This indicated that 91 per cent of the variances and covariances in the data observed were predicted by the estimated model. Moreover, results of fitting the structural model to the data revealed that the model had a good fit as indicated by the normed fit index (NFI = 0.93), root mean square residual (RMR = 0.02) and root-mean-square error of approximation (RMSEA = 0.07).

Table V summarizes the hypotheses testing results which indicated that all hypothesized relationships were significant and in the expected direction, except for the path from LMX to SOCB, which was shown to be insignificant. As shown in Figure 1, LMX was found to have a positive influence on safety climate (estimate = 0.43, C.R. = 10.2) and safety climate was positively related to SOCB (estimate = 0.65, C.R. = 6.3). Thus, *H2* and *H3* were supported. As regard, the relationship between LMX and SOCB, the results indicated that there was no direct impact of LMX on SOCB in this study. *H1* was therefore not supported. Nevertheless, the results suggested that LMX had an influence on safety climate and indirectly affected the SOCB in container terminal operations.

Hair *et al.* (2010) suggested that a mediating effect existed if the relationship between independent and dependent variables was reduced in magnitude and became insignificant. Accordingly, further analysis was conducted to examine whether safety climate played an intermediary role between LMX and SOCB. The findings imply that employees with a higher perception of LMX will have higher safety climate and better SOCB. These are consistent with the findings reported in previous studies (Brown and Holmes, 1986; Dedobbeleer and Beland, 1991; DeJoy, 1994; Gillen *et al.*, 2002; Glendon and Litherland, 2001; Lu and Tsai, 2010; Lu and Yang, 2011).

ChiSq/df = 2.506, P-Value = 0.000, GFI = 0.907, AGFI = 0.868, CFI = 0.961,
IFI = 0.961, NFI = 0.937, RFI = 0.922, RMR = 0.021, RMSEA = 0.076

Notes: LMX1: I like my supervisor very much as a person; LMX2: My supervisor is the kind of person one would like to have as a friend; LMX3: My supervisor is a lot of fun to work with; LMX4: My supervisor would defend me to others in the organization if I made an honest mistake; LMX 5: My supervisor would come to my defense if I was attacked by others; LMX 6: My supervisor defends my work actions to a superior, even without complete knowledge of the issue in question; LMX 7: I do work for my supervisor that goes beyond what is specified in my job description; LMX 8: I am willing to apply extra efforts, beyond those normally required, to further the interests of my work group; LMX 9: I respect my supervisor's knowledge of and competence on the job; LMX 10: I admire my supervisor's professional skills; and LMX 11: I am impressed with my supervisor's knowledge of his/her job

Figure 1.
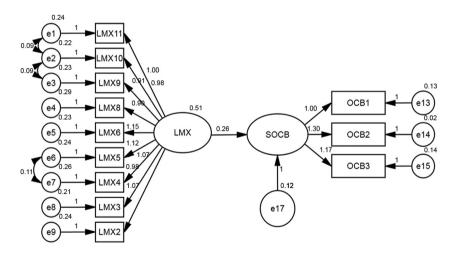Structural equation
modeling results

Further analysis was conducted to examine the effect of the mediating variable (safety climate) on the relationship between LMX and SOCB. Following Hair *et al.*'s (2010) suggestion, a fully mediating effect exists if the relationship between independent variable (LMX) and dependent variable (SOCB) is not significant. As shown in Figure 2, this research specified a direct path between LMX and SOCB. The model provided an acceptable fit with the data (χ^2/df = 2.81, $p < 0.01$, GFI = 0.921, AGFI = 0.877, RMR = 0.02, RMSEA = 0.08). It was noted that there was a significant and positive effect of LMX on SOCB (estimate = 0.36) in the model. Figure 2 showed that safety climate mediated the relationship between LMX and SOCB (James *et al.*, 2006; Mayer *et al.*, 2010).

As shown in Figure 1 and Table VI, the research findings revealed that LMX did not have a direct effect on SOCB. However, the results indicated that LMX had a positive direct effect on safety climate (direct effect = 0.43), whereas safety climate had a direct positive effect on SOCB (direct effect = 0.65). Therefore, LMX had an indirect effect on SOCB

Path	Estimate	S.E.	C.R.	p
SCL ← LMX	0.435	0.043	10.219	**
SOCB ← LMX	−0.018	0.050	−0.367	0.714
SOCB ← SCL	0.650	0.103	6.308	**
LMX11 ← LMX	1.000			
LMX10 ← LMX	0.977	0.046	21.098	**
LMX9 ← LMX	0.912	0.058	15.647	**
LMX8 ← LMX	0.899	0.063	14.337	**
LMX6 ← LMX	1.148	0.067	17.145	**
LMX5 ← LMX	1.114	0.067	16.528	**
LMX4 ← LMX	1.065	0.067	16.010	**
LMX3 ← LMX	0.979	0.060	16.457	**
LMX2 ← LMX	1.071	0.064	16.657	**
Response ← SCL	1.000			
Training ← SCL	1.203	0.090	13.310	**
Supervisor ← SCL	1.340	0.105	12.706	**
Participation ← SOCB	1.000			
Courtesy ← SOCB	1.268	0.085	14.845	**
Helping ← SOCB	1.178	0.091	12.999	**

Notes: S.E. is an estimate of the standard error of the covariance; C.R. is obtained by dividing the covariance estimate by its standard error; and **significance level $p < 0.01$

Table V.
Structural equation
modeling results

Notes: Chi sq/df = 2.814, P-Value = 0.000, GFI = 0.921, AFGI = 0.877, CFI = 0.966, IFI = 0.967, NFI = 0.949, RFI = 0.933, RMR = 0.021, RMSEA = 0.083

Figure 2.
Direct path between
LMX and SOCB

Path	Total effect	Direct effect	Indirect effect
LMX → Safety climate	0.43	0.43	–
LMX → SOCB	0.28	–	0.28
Safety climate → SOCB	0.65	0.65	–

Table VI.
Path analysis results

(indirect effect = 0.28) via safety climate. The total effect between LMX and SOCB was 0.28, providing evidence of safety climate's mediating effect.

5. Discussion and conclusions

Given the prevalence of accidents and unsafe behavior in container terminal operations, this research sought to examine the relationships among LMX, safety climate and employees' SOCB in the container terminal context. Theoretically, this study highlights the importance of LMX and safety climate in explaining the SOCB of employees. Moreover, the study answers several important questions: how LMX and safety climate influence employees' SOCB in container terminal operations. In particular, this study revealed the mediating effect of safety climate on the relationship between LMX and employees' SOCB.

To the best of the author's knowledge, this is the first study to provide empirical evidence of the importance of LMX and safety climate in explaining employees' SOCB in the container terminal context. More specifically, this study fills the gap in the maritime and transportation literatures, as there is a scarcity of studies explaining employee safety behavior from LMX and safety climate perspectives in the container terminal or port context.

This research makes several important contributions to the field of maritime safety in three ways. First, given the timely need for maritime safety researchers to adopt LMX in examining safety behavioral-related problems. Second, as there seems to be a lack of LMX applications in the maritime safety literature to date, this research provides safety researchers with a comprehensive methodology to follow when they apply LMX in their researches. Finally, this research contributes to the body of maritime safety literature with findings on LMX adoption in the container terminal context.

5.1 Implications of the study findings

This study has several implications for safety research and LMX. First, this research highlights the importance of LMX and SOCB on safety and maritime studies. Although previous studies on safety climate (Lu and Tsai, 2010; Lu and Yang, 2011; Zohar, 1980) noted that an organization's values or norms of safety could influence employees' SOCB, relative little research to date has examined the influence of LMX relationship. The research findings add to the emerging body of safety research, suggesting that front-line supervisor, and the climates they help to create within their work groups can have a positive impact on the SOCM of their subordinates in container terminal operations.

Second, study findings demonstrate the value of LMX, as LMX has been found to be positively associated with safety climate. This study suggests that container terminal operators can focus on developing a safety climate that emphasizes the good SOCB of employees by focusing on adherence to the law and professional standards and public rather than self-interest. To increase safe conduct, an organization should develop a closer LMX relationship to encourage safety climate and systems that reward team work of SOCB and discipline unsafe conduct.

Third, this research found that safety climate plans an important role in influencing employees' SOCB that must be taken into consideration by terminal operators. Consistent with previous studies (Lu and Tsai, 2010; Lu and Yang, 2011; Zohar, 1980), safety climate was found to be positively related to employees' SOCB. Given the benefits of safety climate in increasing employees' SOCB, container terminal operators should endeavor to select and/ or train safety programmes for employees and supervisors. Training programs should include communicating the importance of safety, rewarding and supporting employees who behave safely and serve as SOCB role models. Container terminal operators should develop a safety response system to create a safety climate.

This research has not found the direct effect of LMX on SOCB. Instead, this study has found the mediating effect of safety climate on the relationship between LMX and SOCB. Another important finding of this study is that safety climate mediates the relationship between LMX and employee SOCB. Therefore, terminal operators could enhance LMX qualifying through organizational participation, employee helping behaviors and informing workers to obey safety rule and regulation. When employees operate in a safety climate, they are likely to engage in SOCB.

5.2 Limitations and future research

This research has several potential limitations to provide meaningful directions for future research. First, the collected data on SOCB and perceptions of safety climate and LMX relationship in container terminal operations may have been subject to bias as a result of the reluctance of the respondents to report unsafe behaviors because of potential personal repercussions and an interest in avoiding lawsuits against the organization. Second, this study was limited to LMX dimensions adapted from the studies of Li and Liao (2014) and Vidyarthiv *et al.* (2014). Future research could examine the linkages between LMX, ethical climate, safety performance and supervisor leadership influence (Wimbush and Shepard, 1994). Third, it would be valuable to study the differences in SOCB at the individual level (e.g. educational level, age and religion) using safety culture as a sociological, group-based construct (Treviño *et al.*, 1998). Fourth, this research focused specifically on employees from the container terminal operators in Taiwan. It would be valuable to collect data from employees from other countries to obtain a balanced view of the relationship between LMX, team-member exchange (TMX) (Hofmann *et al.*, 2003; Liden *et al.*, 1997), safety climate and employee SOCB in container terminal operations. Finally, future studies may also be conducted using the longitudinal analysis to examine the effects of safety climate and LMX on SOCB in other industries such as shipping or port operations.

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