The Moderating Effect of Organizational Structure in Knowledge Management for International Ports in Taiwan

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Abstract—**Knowledge management was an important dimension for international enterprise (such as international ports) to maintain the competitive advantages. Organizational structure played an important role in knowledge management. This study tried to find the effect of organizational structure in knowledge management capability on job performance in international ports in Taiwan. The research data was obtained from Shang's study in the Survey Research Data Archive (SRDA) provided by the Academia Sinica in Taiwan. The samples of Shang's study focus on shipping academics, employees of port authorities, and container shipping managers and executives. The questionnaire survey was feedback from 62 shipping academics, 66 employees of port authorities and 106 executives in October 2007. The main data analysis methodology in this study was structural equation modeling analysis. The research model include knowledge management capability, job performance, and organizational structure. With the result of the study, knowledge management capability was positive with job performance, and organizational structure was positive with the relationship of knowledge management capability and job performance. Although organizational structure not affect job performance directly, but it still play an important role in management.**

Keywords-knowledge management competence, job performance, organizational structure

I. INTRODUCTION

Knowledge management competency is an important dimension for international enterprise (such as international ports) to retain the competitive advantages. The organizational structure played an important role in the success of knowledge management [1]. The organizational structure of many organizations reflects a shift away from hierarchical structures and towards a greater reliance on decentralized authority, teamwork, and supporting incentives. This shift involves the role of information processing [2].

While numerous previous studies were regarding organizational structures was positive with job performance in knowledge management [1, 3, 4, 5, 6], and these studies suppose organizational structure affect job performance directly. But some research disagreement the effect of organizational structure on job performance in knowledge management [7, 8], and organizational structure was no influence in knowledge management base on the result of these studies.

Previous studies all built on the model that organizational structure affect job performance directly. Over these years, investigations of moderator effect have increased in the research. Moderator effect was a third variable that affects the relationship between an independent variable and a dependent variable and provides useful information about phenomenon occurred. It provides substantive interpretations of the underlying nature of the independent and outcome variables' relationship. [9, 10]. A moderator is an independent variable that affects the strength and/or direction of the connotation between another independent variable and an outcome variable [9]. The independent variable's connotation with the outcome variable is stronger or weaker at different levels of the moderator variable. Moderators may be naturally occurring, measured or determined variables or can be artificially created by manipulation of the conditions.

With the view of international port, the competitions not only come from neighboring ports, but also whole world ports. Early, harbor managers enhanced the competitiveness of ports with more modern equipment, and it caused by the lack of difference between the ports [11]. The competitive advantage that based on equipment was easy to imitate, and difficult to obtain a sustainable competitive advantage. The knowledge was not as easy be copied as equipment [12]. So the competitive advantage that based on knowledge was possible than the competitive advantage that based on equipment to obtain a sustainable competitive advantage [13]. It was very important to explore the factor of knowledge management capability in Taiwanese international ports.

The four international ports in Taiwan facing competitive pressure were more and more these years. Especially the rise of Chinese international ports (such as Shanghai port, Shenzhen port, Yantian port, Qingdao port, and Tianjin port), Taiwanese international ports were in a difficult situation. How to enhance

the competitiveness with knowledge management was very important for Taiwanese international ports.

Organizational structure played an important role in the knowledge management capability. This study tried to find the moderating effect of organizational structure, in the relationship of knowledge management capability with job performance in four international ports in Taiwan.

A. Organizational Structure

Robbins [14] defined organizational structure as the formal allocation of work roles and administrative mechanism to control and integrate work activities. This study focuses on the four most important aspects of structure which include centralization, formalization, complexity, and integration.

Organizational structure played an important role in knowledge management and knowledge management system. Well-designed organizational structural was helpful for improving the efficiency of knowledge management. Traditional organizational structure was for maximize benefit for each department and sub-group. But traditional organizational structure was not helpful in knowledge sharing knowledge transformation with cross department. Traditional organization structure should reduce the organizational level and break the barriers of the department for helping staff communication and cooperation [1, 3, 4, 5, 6, 7, 8]. Mahmoudsalehi, Moradkhannejad, and Safari [6] suggest that organizational structure is positively related to knowledge management. The findings extend theoretical implications for organizational factor effects on knowledge management. In general, if the characteristics of organizational structure were less centralized, less formalized, more complicated and more integrated, the levels of knowledge management would be enhanced.

A well-design organizational structural for knowledge management was helpful for knowledge acquisition, knowledge transformation, knowledge application, and knowledge protection. The manager should build reward system and performance evaluation criteria for encourage employees to knowledge creation and sharing [2, 4].

With the feedback of 595 the largest manufacturing firms listed in Common Wealth 1000 largest firms in Taiwan, the results of Liao, Chuang, and To's study [1] shown that environmental uncertainty tends to require firms to increase their knowledge management capability, which in turn manifests itself in structural changes with the structural equation model analysis support a mediating knowledge management capability between environmental uncertainty and structural attributes. Based on 146 Taiwanese firms listed in the China Credit Information Service Incorporation, Chen, and Huang's study [15] supported the process-oriented view and indicate that social interaction plays the mediating role between organizational structure, and knowledge management.

For understanding the government role in providing necessary assistance to the small and medium-sized enterprises for pursing knowledge management system, Lee, and Lan [16] indicated that a successful knowledge management implementation depends on a harmonious amalgamation of infrastructure and process capabilities, including technology, culture and organizational structure.

Summarize these study, the employees should change the organizational structure and the old ways of doing things to new one that helpful in knowledge sharing with an open attitude. The staff can obtain the knowledge that they need easily with the new organizational structure. Besides, the manager should build the reward system and performance evaluation criteria of knowledge management and innovation.

B. Knowledge Management Capability

The knowledge management capability of an organization refers to the degree to which the organization creates, shares, and utilizes knowledge resources across functional boundaries. This definition focuses on the organization's knowledge management activities at the organization level rather than at the department, team, or individual levels because the purpose of this study is to understand how the firm adds value to its departments. This study examines firms' knowledge management capability in terms of their emphasis on three knowledge management activities: knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection [17].

Knowledge acquisition is the process of obtaining knowledge. The creation of organizational knowledge requires the sharing and collaboration of previous experiences. Collaboration takes place at two levels within the organization: between individuals and between the organization and other relative organization. Collaboration between individuals brings together individual differences for creating knowledge [17]. So, the collection of information of existing competition, supplier, and customer is very important in knowledge management.

Knowledge conversion is the process that making existing knowledge useful. The process of knowledge conversion is the organization's ability to distribute, record, update regularly, and integrate information [17].

Knowledge application is the actual use of the knowledge, and effective application of knowledge. Effective storage and retrieval mechanisms enable the organization to quickly access knowledge [17]. The object of knowledge application include solve new problem, improvement the efficiency, meet the needs of customers, and build the strategy.

Knowledge protection is the process of protect the knowledge within an organization from illegal or inappropriate use or theft. Without knowledge protection process, knowledge would lose the important qualities of get advance [17]. The methodology of knowledge protection include the concept of the protection of knowledge assets, the knowledge of avoid outside illegal users use inside knowledge assets, the rule of knowledge assets clear classification and control, and the measures of avoid inside illegal users steal inside knowledge assets.

C. Job Performance

The Job Performance included task performance and contextual performance [18]. Task performance is defined as the work activities that contribute to an organization's technical core [18]. Task Performance is a working process which occurs when an assigned person (or a workgroup of persons) effectuates a task's plan: this refers to a manner in which they realize the work which was projected for a task. Since there is a task attributed with the main elements of its plan (the task goals, a plan of actions to reach these goals reasonably, and certain success measures to appraise effectiveness of these efforts) it is time to appoint the right performers who are able to undertake the practical work. Task performance relates to transforming raw materials into the goods and services which are specific to the job, the core technical skill. It means task performance include cooperation, perseverance, patience, support, discipline, and enthusiasm.

Contextual performance has emerged as an important aspect of overall job performance. Job performance is no longer considered to consist strictly of performance on a task. Rather, with an increasingly competitive job market, employees are expected to go above and beyond the requirements listed in their job descriptions [18]. Examples of contextual performance include volunteering for additional work, following organizational rules and procedures even when personally inconvenient, assisting and cooperating with coworkers, and various other discretionary behaviors. By strengthening the viability of social networks, these activities are posited to enhance the psychological climate in which the technical core is nested. Contextual performance concerns aspects of an individual's performance which maintains and enhances an organization's social network and the psychological climate that supports technical tasks. It means contextual performance include responsible, concordance, completion, and circumspection.

II. MATERIALS AND METHOD

This study focused on the effect of knowledge management capability with work performance with the moderator effect of knowledge management resource in 4 international ports (Kaohsiung port, Keelung port, Taichung port and Hualien port) in Taiwan. The research framework was as Figure I. The knowledge management resource as moderator variable in this study included organizational culture, organizational structure, and the support of information technology.
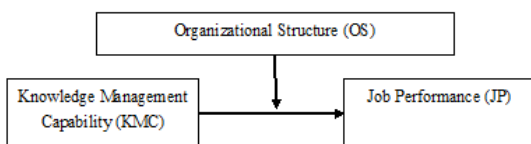

Figure I Research Framework

A. Research Data

The research data was obtained from Shang's study [19] in the Survey Research Data Archive (SRDA) provided by the Academia Sinica in Taiwan. Shang's study was finished in August 1, 2007.

The samples of Shang's study focus on shipping academics, employees of port authorities, and container shipping managers and executives. The questionnaire survey was sent to 62 shipping academics, 66 employees of port authorities and 106 executives in October 2007. The container shipping managers' samples were selected from the Directory of the National Association of Shipping Agencies and Companies, whereas the shipping academics were selected based on those who had taught in shipping departments at the university in Taiwan.

B. Research Tools

The research data in Shang's study was obtained with questionnaire. The knowledge management resource (include organizational culture, organizational structure, and the support of information technology) questionnaires and knowledge management capability questionnaires were built based on the study of Gold, Malhotra, and Segars [17], and Lee, and Choi [20]. The work performance questionnaires were built based on Befort and Hattrup's study [21] and Moorman and Wells's study [22]. The questionnaires were with 7 points Likert scale, from strongly disagree to strongly agree were given a scale of 1 to 7 points. The scale reliability of the questionnaires was as table I, and it was over .84.

Table I Items used to measure knowledge management competence.

Item	Questionnaire
KMC	Knowledge Management Capability
KMC01	The collection of knowledge and message of the competitive ports, regularly.
KMC02	The collection of knowledge and message of the port authority, regularly.
KMC03	The collection of knowledge and message of the carriers, regularly.
KMC04	The boss was able to distribute the knowledge to the employees.
KMC05	The boss could record the experience for future decision-making.
KMC06	The boss updated knowledge, regularly.
KMC07	The boss could preserve the experience through documentation, education, training, or database.
KMC08	The boss could solve new problem with the application of previous experience.
KMC09	The boss could improvement the efficiency with the application of previous experience.
KMC10	The boss could meet the needs of customers with the application of previous experience.
KMC11	The boss could adjust the strategy with the application of previous experience.
KMC12	The staff had the concept of the protection of knowledge assets.
KMC13	The managers could avoid outside illegal users use inside knowledge assets.
KMC14	The managers made knowledge assets clear, classification, and controllable.
KMC15	The managers could avoid inside illegal users use inside knowledge assets.

The questionnaires for job performance were as Table II. There were 11 items in this part, and The scale reliability of the

questionnaires of job performance were as table 4, and it was over .95.

Table II Items used to measure job performance.

Item	Questionnaire
JP	Job Performance
JP01	I often take care of my own work progress.
JP02	I could finish the work before the deadline.
JP03	I could finish the overall work successful.
JP04	I would handle the detail of works carefully.
JP05	Overall, I can accomplish the tasks that required by leader.
JP06	I often maintain cooperation with co-worker.
JP07	I would overcome barriers for complete the task.
JP08	I often showed tolerant attitude in working.
JP09	I would support the decision that making by boss.
JP10	In the workplace, I would self-restraint and discipline.
JP11	I would eagerness in handling a difficult assignment.

The questionnaires for organizational structure were as Table III. There were 5 items in this part, and The scale reliability of the questionnaires of job performance were as table IV, and it was .91.

Table III Items used to measure organizational structure.

Item	Questionnaire
OS	Organizational Structure
OS01	Most of the staff with an open mind in and new knowledge and new methodology.
OS02	The organizational structure of my organization was helpful in knowledge management
OS03	The staff would easily obtain the knowledge that they need, and not limited by sub-group.
OS04	The items of performance evaluation included the performance of knowledge creation and knowledge sharing.
OS05	The reward system was helpful in innovation.

The values of scale reliability of the questionnaire in this study were shown as Cronbach's α in Table IV. The values of scale reliability in this study were from .80 to .91 as the suggestion of Hair, Anderson, Tatham, and Black's recommend of .70 up (1998).

Table IV Scale Reliability

Scale	N	Mean	S.D.	Cronbach's α
Organizational Structure	5	3.40	0.66	0.84
Knowledge Management Competence	15	3.59	0.62	0.95
Job Performance	11	4.03	0.43	0.91

C. Methodology

The main data analysis methodology in this study is Structural Equation Modeling (SEM) for these latent variables: knowledge management capability, work performance, organizational culture, organizational structure, and the support of information technology, and the software for data analysis was Mplus 6.1. This study detected the effect of knowledge management capability on work performance with the moderator effect of organizational culture, organizational structure, and the support of information technology.

The structural model was investigated using Mplus 6.1 with random maximum likelihood. Path analysis was performed on the model using standardized maximum likelihood estimation.

The path analytic method offers the advantage of testing the overall model fit with multiple endogenous variables as in the model as well as individual a priori hypotheses.

III. RESULTS

Data analysis applies a multi-step approach in this study. First, the measurement model was tested by subjecting the measures to a series of confirmatory factor analyses. Second, a structural equation model with moderating variable was developed to test the hypotheses.

A. The sample and data collection procedure

A total feedback of 219 staffs who work in Kaohsiung port, Keelung port, Taichung port and Hualien port in Taiwan were collected. Some basic demographic information is collected, indicating approximately 147 male (67.12%) and 72 female (32.88%) in the sample population, most of them are 46~50 years old, and there are 103 staffs in this age range (22.37%) (Table V).

Table V Data Summarize

Variable		Frequency	Percent (%)
Gender			
	Male	147	67.12
	Female	72	32.88
Age			
	~25	1	0.46
	26~30	7	3.20
	31~35	14	6.39
	36~40	43	19.63
	41~45	51	23.29
	46~50	103	47.03
	51~	1	0.46
Port			
	Kaohsiung port	73	33.33
	Keelung port	60	27.40
	Taichung port	73	33.33
	Hualien port	13	5.94
Total		219	100.0

B. Measurement Model

Table VI, VII presents standardized loading and other metrics for the item measures as well as reliability and validity measures. Hair, Anderson, Tatham, and Black (1998) suggest that in a sample of 150 respondents, factor loadings of .45 and above are significant.

In Table VI, all items in the measurement model indicate factor loadings ranging from .70 to .83 and are thus acceptable for the remainder of the analysis. The composite reliability for KMC was .95, exceed the recommended threshold of .70 (Segars, 1997) and are fully acceptable. Average variance extracted (AVE) exceed the recommended threshold of .50 (Segars, 1997) while the environmental uncertainty construct has an AVE very close to that norm.

Table VI The assessing of measurement model of knowledge management capability.

Item	Std. Loading	t-value	R^2	C.R.	AVE
KMC				0.955	0.587
KMC01	0.708	19.840	0.501		
KMC02	0.711	20.117	0.505		
KMC03	0.703	19.465	0.494		
KMC04	0.818	33.916	0.669		
KMC05	0.845	39.995	0.714		
KMC06	0.783	28.166	0.613		
KMC07	0.768	26.159	0.590		
KMC08	0.808	32.010	0.652		
KMC09	0.830	36.420	0.690		
KMC10	0.815	33.317	0.664		
KMC11	0.805	31.581	0.648		
KMC12	0.746	23.579	0.557		
KMC13	0.685	18.232	0.469		
KMC14	0.727	21.640	0.528		
KMC15	0.710	20.171	0.504		

In Table VII, all items in the measurement model indicate factor loadings ranging from .62 to .74 and are thus acceptable for the remainder of the analysis. The composite reliability for JP was .91 (>0.70), and are fully acceptable. Average variance extracted (AVE) exceed the recommended threshold of .50 while the environmental uncertainty construct has an AVE very close to that norm.

Table VII The assessing of measurement model of job performance.

Item	Std. Loading	t-value	R^2	C.R.	AVE
JP				0.913	0.512
JP01	0.621	13.874	0.386		
JP02	0.712	19.314	0.507		
JP03	0.736	21.206	0.541		
JP04	0.598	12.751	0.357		
JP05	0.761	23.640	0.579		
JP06	0.741	21.723	0.549		
JP07	0.714	19.517	0.510		
JP08	0.683	17.306	0.466		
JP09	0.642	14.803	0.412		
JP10	0.744	22.010	0.553		
JP11	0.701	18.444	0.491		

Table VIII was the inter-correlations among latent variables. Correlation analyses show that latent variables had a significant association with each other. In addition, the square of AVE was used to examine the reliability of the instruments. A cutoff value of higher than .7 is acceptable since these instruments have been adopted from previous studies (Nunnally, 1978). All constructs have higher than .7 cutoff alpha values, ranging from .70 to .77.

Table VIII Inter-correlations among latent variables.

	N	KMC	JP	OS
KMC	15	[0.772]		
JP	11	0.442*	[0.703]	
OS	5	0.723*	0.344*	[0.721]

1. []: Figures in parentheses were the square of AVE
2. *: P-value < 0.05

In this study, the structural equation model was tested using the random maximum likelihood method with Mplus 6.1 software. The first model in this study was the structural equation model with job performance on knowledge management competence with organizational culture as moderating variable. The second model in this study was the structural equation model with job performance on knowledge management competence with organizational structure as moderating variable. The last model in this study was the structural equation model with job performance on knowledge management competence with the support of information technology as moderating variable.

C. The Moderating Effect of Organizational Structure

The second model in this study was the structural equation model with job performance on knowledge management competence with organizational structure as moderating variable.

In Table IX, all items in the measurement model indicate factor loadings ranging from .70 to .73 and are thus acceptable for the remainder of the analysis. The composite reliability for OS was .84(>.70) and are fully acceptable. Average variance extracted (AVE) exceed the recommended threshold of .50 [23] while the environmental uncertainty construct has an AVE very close to that norm.

Table IX The assessing of measurement model of organizational structure.

Item	Std. Loading	t-value	R^2	C.R.	AVE
OS				0.843	0.517
OS01	0.708	16.951	0.501		
OS02	0.700	16.506	0.490		
OS03	0.720	17.646	0.518		
OS04	0.733	18.478	0.538		
OS05	0.734	18.533	0.539		

The result of structural equation modeling analysis for the moderating role of OS was as Table X. In step 1, KMC was positive with JP. In step 2, KMC was positive with JP but OS. In step 3, KMC and the interaction of KMC and OS were positive with JP.

Table X SEM Summary for the Moderating role of OS on the Relationship between KMC and JP.

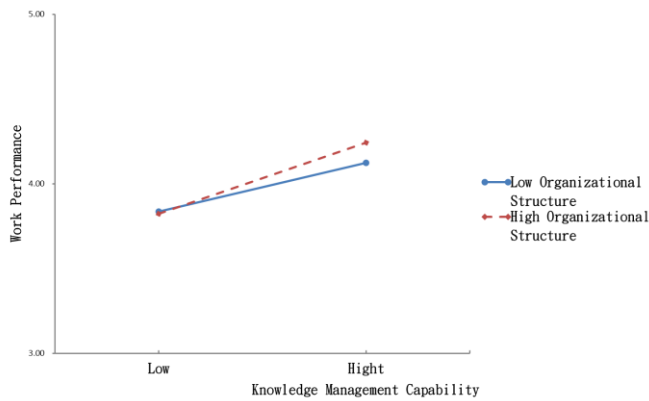|	Step 1	Step 2	Step 3
Antecedents			
KMC	0.280*	0.440*	0.320*
(t-value)	(5.594)	(3.520)	(3.557)
Moderator			
OS		0.031	-0.013
(t-value)		(0.233)	(-0.155)
Interactions			
KMC $\times$ OS			0.133*
(t-value)			(2.337)

*: P-Value <0.05

Figure II Interaction of KMC and OS on WP

Based on Table 12, OS was a moderating variable with KMC and JP. The interaction of KMC and OS on JP was as Figure II, and the structural equation model was as Figure III.
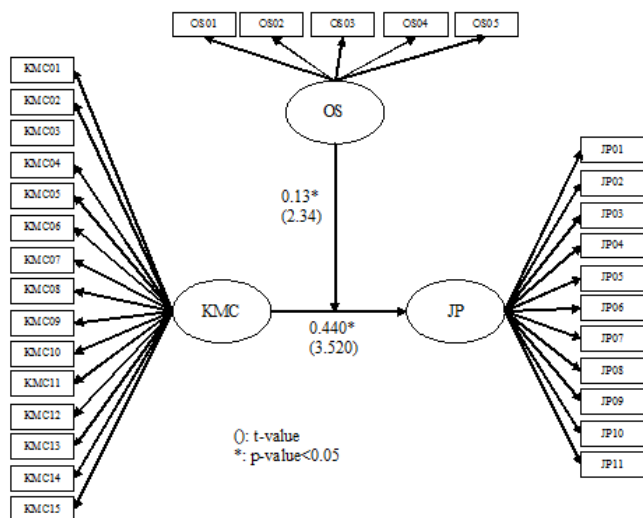

Figure III The SEM Model of KMC and OS on JP

IV.   DISCUSSION AND CONCLUSION

The Results of the structural equation modeling analysis with a moderator variable of organizational structure was as Figure 3. Knowledge management capability and job performance of knowledge management were significantly related with the moderator of organizational structure

With Table 10 Step 1, it could find that knowledge management capability was positive with job performance. The good skill and technology of knowledge acquisition, knowledge conversion, knowledge application, and knowledge protection were helpful for improving job performance, and this result was the same as Gold, Malhotra, and Segars's study [17].

With Table 10 Step 2, it could find that organizational structure unaffected job performance directly, but organizational structure was positive with the effect that knowledge management capability on job performance (Table 10 Step 3). The findings provide support for the fact that organizational structure plays a moderating role in knowledge management capability and job performance. Organizations thus emphasize knowledge management capability in dealing with environmental uncertainty and its impact on the organization structure.

Most studies only focus on direct effect or mediating effect in the knowledge management model. That was why organizational structure played an important role in knowledge management on job performance [1, 3, 4, 5, 6], but some disagree that [7, 8]. With the result of this study, organizational structure still played an important role in knowledge management even organizational structure not affect knowledge management capability or job performance directly. Future research can also build on and extend the proposed integrated model of knowledge management by including other variables such as organization culture, and technology support as independent variable, moderating variable, and moderating variable. More research needs to clarify the factor on the deployment of knowledge and organizational structures.

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