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THE STUDY ON THE CORE COMPETENCE
OF CONTRACTORS' DIETITIANS OF CENTRAL
KITCHENS OF NATIONAL ELEMENTARY SCHOOLS
IN TAIPEI AREA

In order to improve the students' lunch quality in Taipei area, the research is focused on the core competence of the contractors' dietitians of central kitchens of Taipei national elementary schools. In-depth interviews and questionnaires on experts and scholars with more than 10-year experience were used, the modified Delphi method was used 3 to 4 times to connect, integrate and compile factors related to dietitians' core competence. Based on factor reliability of the pre-questionnaire (Cronbach's $\alpha > 0.7$), the analytic hierarchy process (AHP) was used for the formal questionnaire. The research was based on 385 questionnaires of the national elementary lunch customers such as school staff, teachers, parents, dieticians, supervisors, experts, scholars, auditors, and producers (directors, dietitians, HACCP qualified suppliers). The number of effective responses was 344. AHP was used for statistic analysis and feasibility testing. The purpose of the research was to propose an evaluation table for the core competence of contracted dietitians commissioned by school lunch committees which can be used as a reasonable model for HACCP diet suppliers and by schools to choose dietitians and evaluate standards of schools' dietitians. It can also be a reference for courses on dietitians' training at universities and colleges.

Keywords: school lunch; supplier outsourcing; analytic hierarchy process (AHP); core competency; HACCP.

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ДОСЛІДЖЕННЯ КЛЮЧОВИХ КОМПЕТЕНЦІЙ
ДІЄТОЛОГІВ У ІДАЛЬНЯХ МОЛОДШИХ ШКІЛ
м. ТАЙБЕЙ (ТАЙВАНЬ)

У статті досліджено ключові компетенції дієтологів їдальень державних молодших шкіл м. Тайбей (Тайвань) з акцентом на покращенні якості харчування. Опитано експертів та вчених з понад 10-річним досвідом роботи; для аналізу даних опитування використано модифікований метод Дельфі. Спираючись на результати аналізу надійності попереднього опитування, дані основного опитування проаналізовано методом аналітичної ієрархії. Використано дані 385 анкет, які було заповнено в їдальнях молодших шкіл персоналом, вчителями, батьками, дієтологами, експертами, аудиторами, директорами їдальень та представниками постачальників, сертифікованих за HACCP. Кількість повернених вірно заповненими анкет – 344. У результаті статистичного аналізу запропоновано оціночну таблицю ключових компетенцій дієтологів, найнятих Комітетом зі шкільних сніданків. Дана таблиця може бути зразком для HACCP-сертифікованих постачальників, для шкіл при виборі дієтологів та оцінці їхньої діяльності. Таблиця також може бути використана при навчанні дієтологів в університетах та коледжах.

Ключові слова: шкільний сніданок; зовнішній постачальник; метод аналітичної ієрархії; ключова компетенція; HACCP.

Табл. 5. Літ. 39.

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ИССЛЕДОВАНИЕ КЛЮЧЕВЫХ КОМПЕТЕНЦИЙ ДИЕТОЛОГОВ В СТОЛОВЫХ МЛАДШИХ ШКОЛ г. ТАЙБЕЙ (ТАЙВАНЬ)

В статье изучены ключевые компетенции диетологов столовых государственных младших школ г. Тайбей (Тайвань) с акцентом на улучшении качества питания. Опрошены эксперты и ученые с более чем 10-летним опытом работы; для анализа данных опроса использован модифицированный метод Дельфи. Основываясь на результатах анализа надежности предварительного опроса, данные основного опроса проанализированы методом аналитической иерархии. Использованы данные 385 анкет, заполненных в столовых младших школ персоналом, учителями, родителями, диетологами, экспертами, аудиторами, директорами столовых и представителями поставщиков, сертифицированных по HACCP. Количество возвращенных и правильно заполненными анкет – 344. В результате статистического анализа предложена оценочная таблица ключевых компетенций диетологов, нанятых Комитетом по школьным завтракам. Данная таблица может быть образцом для поставщиков с HACCP-сертификацией, для школ при выборе диетологов и оценке их деятельности. Оценочная таблица также может быть использована при обучении диетологов в университетах и колледжах.

Ключевые слова: школьный завтрак; внешний поставщик; метод аналитической иерархии; ключевая компетенция; HACCP.

1. Introduction. Since 1973, school lunch industry for national schools has been established and outsourced to diet suppliers with HACCP standards to assure the diet balance and safety (Roseman et al., 2005; Rodgers, 2005; Lin, 2004a and 2004b; Ren et al., 1997). This leads to the growth of quantity of diet suppliers, there are at least 50 suppliers whose supply capacity is more than 10,000 pieces per lunch in Taipei now (Jeng et al, 2007; Wang and Jeng, 2007; Worsfold and Griffith, 2003; Ren et al., 1997).

As dietitians are menu designers and health care supervisors for lunch, they are responsible for and play a role in following things: whether a menu is nutritionally suitable for students; whether cooking methods of central kitchens is appropriate and whether sanitarian standards and food quality meet expectations of schools and parents (Huang et al., 2002; Yang, 2001). Thus, a contracted diet supplier plays a significant role in offering good school lunch. However, there little research on the core competence of diet suppliers with HACCP standards (Yang, 2004; Stout and Smith, 1986). The study is focused on the importance of the core competence of dietitians in supplying Taipei public national elementary schools, hoping that a set of important references on the core competence of school lunch dietitians can be proposed. Policy-making references can be made for school lunch operators, dietitians and relevant units.

2. Literature Review

2.1. Current Situation of School Nutrition Lunch

2.1.1. *Characteristics of School Nutrition Lunch.* School lunch is supplied by non-profit diet suppliers for students, while students in puberty are a specific category, in need of enough healthy and clean food (Mary and Gregoire, 2001). The characteristics of a lunch for them are enough repletion, healthy and clean, nutrition balanced, not too much exquisite food, can be finished in fixed times, and must be low charge

and on time, fixed quantity and price (Chow et al., 2006; Henroid et al., 2004; Mary and Gregoire, 2001; McKenna-Black, 2001).

2.1.2. Outsourcing School Lunch. The outsourcing situation shows there is no direct operational central kitchen equipment at schools. By public bid, the lunch job is commissioned to private suppliers (McKenna-Black, 2001). By this, the lunch kitchen can be maximized. This is so-called private management of public schools. Central kitchens in Taipei national elementary schools are called outsourcing central kitchens. First of all, a committee is formed from school staff, parent representatives, teachers, scholars and experts, to select fine suppliers for a school. There were 29 national elementary schools in Taipei area in 2008 (Taipei City Government Educational site, 2007).

During the school year of 97, there were 5 commissioned diet suppliers with HACCP standards. They were Taipei Branch of Wei Di Foods Enterprise Co., Ltd., Hung Yuan Foods Co., Ltd, China Foods Industrial & Development Co., Ltd, Tong Shien Enterprise Liability Co., Ltd. and Kung Pao King Foods Co., Ltd. They had lunch supply contracts with 29 schools. Every company assigned one group with a dietitian to each school to offer lunch service (Food Information website, Department of Health, 2008a; Taipei City Government Educational site, 2007).

2.2. Dietitians' Core Competence

2.2.1. The dietitians mentioned here are employed by the qualified diet suppliers with HACCP standards who offer school lunch. They are in charge of designing healthy lunch, offering health education supervising, and managing food service (Sheeshkam, 2008; Wang, 2007; Wang and Jeng, 2007; Howard and Schiller, 1977).

2.2.2. The definition of core competence is the competence to organize the accumulated knowledge from past to present, to communicate with and participate into companies, to integrate technical skills from different fields and to offer specific effects and value. Like knowledge, core competence can be outdated without consistent learning. Thus, core competence requires consistent training and it can be enhanced by share and application (Pralhad and Hamel, 2002; Lucia and Lepsinger, 1999; Hamel and Prahalad, 1990; Howard and Schiller, 1977). The job of a school central kitchen covers comprehensive fields from administration, health education, health consultant to research. The professional qualification includes professional health knowledge, food design ability, health analysis ability, communication skills, planning, execution and evaluation, food security, supervision of food security, financial management skills, human resources management and positive service attitude etc. (Guilland, 2003; Chow et al., 2006).

3. Research Method

3.1. Design and reliability analysis for a pre-questionnaire by in-depth interviews and the modified Delphi method. The study first collects the factors on core competence of the contracted dietitians of central kitchens of Taipei national elementary schools by in-depth interviews and questionnaires with 25 experts, scholars and HACCP diet suppliers with more than 10-year experience. Then, the study combines, integrates and compiles the factors by the modified Delphi method (Table 1) 3 to 4 times, the agreed factors on dietitians' core competence are reached. 100 pre-questionnaires are made based on these factors. With the returned prequestionnaires, the factors are cross-checked and the reliability analysis of the core competence of the

contracted dietitians at central kitchens of Taipei national elementary schools is carried out (Cronbach's $\alpha > 0.7$).

Table 1. Modified Delphi Method for Experts and Scholars Team

Service Units	Number	Service Units	Number
National Ocean University	1	Aletheia University	1
National Kaohsiung Marine University	1	Fu Jen Catholic University	2
National Pingtung University of Science and Technology	1	Bureau of Standards, Metrology and Inspection	2
Taiwan Accreditation Foundation	1	Fisheries Department	1
Shih Chien University	1	Health units	3

3.2. The Delphi method is also known as expert judgment, one of anonymous group decision methods. Via individual investigations on experts as interviewees and anonymous group decision method, the study integrates experts' knowledge and opinions on a specific question or even after repeated specific procedures. Then, a stable agreement on a question among experts is reached (Murry and Hammons, 1995). To save time for an agreement reached by an expert group, the method uses anonymous letters for compilation, the so-called modified Delphi method.

3.3. The study uses AHP (analytic hierarchy process) to establish the layers, and then organizes AHP formal questionnaires. AHP was initially developed by Saaty in 1971 to a set a systematic decision model. It is used for priority decision, source assignment, distribution and investment combination etc. Its purpose is to solve the decision-making problems. From 1972 to 1978, Saaty adopted it for NSF industrial power quota, Sudan transportation system research, U.S. Arms Control and Disarmament Agency for analysis of terrorism etc. After some improvements, Saaty proposed a complete methodology in 1980. The revised edition published in 1986 made the method nearly perfect and its application fields are wider now, for example, behavioral sciences, marketing management etc. (Saaty, 1990; Teng and Tseng, 1989a; Teng and Tseng, 1989b; Saaty and Vargas, 1982; Saaty, 1980). After the reassurance of reliability analysis of responsive pre-questionnaire on factors (SPSS, 2006) (Cronbach's $\alpha > 0.7$), AHP is used here to establish AHP formal questionnaire. It includes the purpose of the first layer, 5 evaluation dimensions in the second layer (administrative process capability dimension, sanitary supervisor and management dimension, crisis handling capability dimension, nutrition lunch preparation capability dimension and dietitian personality dimension), and 18 evaluation criteria in the third layer (Table 3).

3.4. AHP questionnaire survey. The study sent out 385 questionnaires to the national elementary nutrition lunch customers (school staff, teachers, parents, and dieticians), supervisors (experts, scholars, auditors who work in the Bureau of Public Health and Bureau of Education), and producers (directors, dietitians, HACCP chefs) (Table 2). The questionnaires were returned in 3 weeks and analyzed by Expert Choice 2000 Version II (2003). In this study, the differences among data acquired by relative weights from AHP evaluation element of different layers is analyzed by Duncan's multiple range test (Duncan, 1955).

4. Results and Discussions

4.1. The test results of the pre-questionnaire. The first stage of the study is to reconfirm the factors of the evaluation dimensions for the core competence of the contractors' dietitians at the central kitchens of Taipei national elementary schools. As Table 2 shows, the study selects those factors with Cronbach's $\alpha > 0.7$, including the hygiene supervisor ability, administrative affairs handling ability, nutrition lunch preparation ability, dietitian personalities and crisis-handling ability.

Table 2. The Cross-check Analysis on the Factors of the Evaluation Dimensions of Core Competence of the Contractors' Dietitians of Central Kitchens of National Elementary Schools in Taipei Area

Evaluation dimension	Mean	Cronbach's α	Evaluation dimension	Mean	Cronbach's α
Dietitian personality	3.24	0.774c*	Nutrition lunch preparation ability	3.52	0.807b
Hygiene supervisor ability	3.95	0.872a	Crisis-handling ability	2.91	0.706 d
Ability of being familiar with food laws and willing to cooperate with sanitary units	2.42	0.549 e	Administrative affair handling ability	3.88	0.863 a

* The letters a-e show a significant difference between the data of the same column $p > 0.05$, Duncan's test, (1955).

4.2. Statistic analysis of the AHP Questionnaires. The evaluation objects of the study are the central kitchen contractors of the public elementary schools in Taipei. The date of the study was from February 16, 2009 to June 20, 2009. In this study, 385 questionnaires were issued, 339 pieces were retrieved. The response rate was 88.05%. A copy of a questionnaire was responded in a blank and 4 were with error answers, and finally the study had 334 valid questionnaires. Therefore, the effective response rate was 86.75%.

Table 3. The Respondent Analysis of the Sample of the Study

Respondents		Questionnaires Sent Out	Questionnaires Recovered	Valid Questionnaires
Consumers	Teachers and staff	116	97	94
	Actually involved in the nutrition lunch volunteer parents, teachers	116	99	98
	Parent Representatives	39	36	35
	Accredited nutritionists by Bureau of Education at schools	25	22	22
Producers	Outsourcing contractors	30	28	28
Experts and scholars	Taipei Assessment Committee, Executive of Department of Health and HACCP assessment verified members	43	43	43
Steering units	Taipei Area Bureau of Education	2	2	2
	Taipei Area Health Department	14	12	12
Total		385	339	334

4.3. Sample Structure. Personal basic statistic analysis of 344 effective AHP questionnaires is carried out. The analysis includes gender, age, education, experience in catering and relevant industry, satisfaction with supplier choice and scorecard. Most of the respondents are female, 73.33% of the valid questionnaires. This is because the majority of school central kitchen workers are female. The age of most of the respondents is 31 to 40 (34.25% of the valid questionnaires). It is because the workers of school lunch suppliers, dietitians, teachers and parents are mostly within this age range. Most of the respondents are college graduates, 76.92% of the valid questionnaires. The school lunch decision-makers, experts and top management are the source of offering the study important considerations and suggestions. Besides, teachers, experts, scholars and officials from supervision units who manage school lunches have high education background. Thus, parents have no need to worry about this condition of nutrition lunch supervision. Workers with 1 to 6-year work experience at the school central kitchens take up 55.14% of the valid questionnaires.

4.4. Detailed Analysis

4.4.1. The Analysis of the Evaluation Dimensions in the Second Layer. From the 334 valid questionnaires, it is seen after the AHP analysis that among 5 evaluation dimensions, the administrative process capability is the most significant one, followed by the sanitary supervisor and management, the crisis handling capability, the nutrition lunch preparation capability and the dietitian personality (Table 4).

4.4.2. The Analysis of the Evaluation Criteria in the Third Layer

(1) Dietitian Personality Dimension

As shown in Table 4, among 4 evaluation criteria of the dietitian personality, the most important one is the dedication, attachment to quality and supervised-oriented, followed in order by the mood control and pressure resist, flexible to use professional knowledge, and cheerful optimism and initiative. The dedication, attachment to quality and supervised-oriented are the index to evaluate the dedication of dietitians. But, for service industry, mood control and pressure resist are considered the most needed abilities to be cultivated (Heller et al., 2002; Prahalad and Hamel, 2002).

(2) Nutrition Lunch Preparation Capability Dimension

As shown in Table 4, among 3 evaluation criteria of the nutrition lunch preparation capability, the most important one is the nutrition analysis and menu creation capability, followed by the ability of being familiar with food material quality and cost control, and the supervision of chefs' nutrition lunch preparation. Raguso et al. (2004) state that the most professional responsibilities of a dietitian are nutrition analysis and menu creation capability.

(3) Sanitary Supervisor and Management Dimension

As shown in Table 4, among 3 evaluation criteria of the sanitary supervisor and management, the most important one is the stipulating self-sanitary management plan and writing sanitary management report, followed by the ability of being familiar with food laws and willing to cooperate with sanitary units, HACCP assessment and good food sanitary training. This means that executing HACCP is the key to prevent food poisoning which is in line with many researches (Chow et al., 2006; Rodgers, 2005).

(4) Crisis Handling Capability Dimension

As shown in Table 4, among 4 evaluation criteria of the crisis handling capability, the most important one is adaptability of food and equipment problems in tem-

perament food service, followed by the adaptability of food service caused by natural hazards, customer complaint handling and response to food poisoning.

(5) Administrative Process Capability Dimension

As shown in Table 4, among 4 evaluation criteria of the administrative process capability, the most important one is communication with suppliers and schools, followed by coordination between schools and contractors, coordination with a school to execute nutrition education and communication with school lunch supervisors.

Table 4. Analysis Results for Evaluation Dimensions and Evaluation Criteria

Evaluation dimension in the second layer	Local priority*	Evaluation Criteria in the third layer	Local priority	Global Priority	Weight ranking
Dietitian personality	0.133 ^e	Cheerful optimism and initiative	0.155	0.021	
		Dedication, attachment to and quality supervised-oriented	0.387	0.051	10
		Flexible to use professional knowledge	0.173	0.023	
		Mood control and pressure resist	0.285	0.038	
		$\lambda_{max}=4.131$ CI =0.034		CR =0.030	
Nutrition lunch preparation capability	0.166 ^c	Being familiar with food quality and cost control	0.338	0.056	9
		Supervision on chefs' nutrition lunch preparation	0.176	0.029	
		Nutrition analysis and menu creation capability	0.486	0.081	4
		$\lambda_{max}=3.091$ CI =0.023		CR =0.204	
Sanitary supervision and management	0.233 ^d	HACCP assessment and good food sanitary training	0.389	0.060	8
		Stipulating self-sanitary management plan and writing sanitary management report	0.435	0.106	1
		Being familiar with food laws and willing to cooperate with sanitary units	0.395	0.067	6
		$\lambda_{max}=3.082$ CI =0.017		CR =0.016	
Crisis handling capability	0.186 ^b	Response to food poisoning	0.102	0.019	
		Adaptability of food and equipment problems in temperament food service	0.405	0.075	5
		Customer complaint handling	0.225	0.042	
		Adaptability of food service caused by natural hazards	0.268	0.050	
		$\lambda_{max}=4.057$ CI =0.022		CR =0.020	
Administrative process capability	0.282 ^a	Communication with school lunch supervisors	0.130	0.047	
		Coordination with a school to execute nutrition education	0.174	0.063	7
		Coordinating between schools and contractors	0.227	0.082	3
		Communication with suppliers and schools	0.250	0.090	2
		$\lambda_{max}=4.109$ CI =0.017		CR =0.015	
$\lambda_{max}=5.035$ CIH =0.097		CRH =0.043			

5. Discussions

5.1. Comparisons of Evaluation Factors of 4 kinds of Stakeholders. As shown in Table 4, all the respondents and school stakeholders believe that the most important

factor is the administrative process-capability followed by the sanitary supervisor and management for the evaluation dimensions in the second layer. As for the dietitian personality, except experts and scholars, it is believed to be the comparatively less important factor at all 5 evaluation dimensions.

5.2. Importance of Evaluation Criteria. As shown in Table 4, the respondents state that comparatively important evaluation criteria are the following 10 items sequenced by the global priority: the stipulating self-sanitary management plan and writing sanitary management report, communication with suppliers and schools, coordination between schools and contractors, nutrition analysis and menu creation capability, adaptability of food and equipment problems in temperament food service, being familiar with food laws and willing to cooperate with sanitary units, coordination with school to execute nutrition education and HACCP assessment and good food sanitary training, being familiar with food quality and cost control, and dedication, attachment to quality and supervised-oriented.

5.3. Appropriate Evaluation Model for Dietitians of School Lunch Suppliers. The results show that stipulating self-sanitary management planing and writing sanitary management reports of dietitians of the school outsourcing lunch suppliers is considered the most important factor to be evaluated. This is the basis for discussion whether dietitians should have strict self-management regulations on a diet or maintain high standard sanitary quality of school nutrition lunch (Taylor, 2008; Jeng et al., 2007; Chow et al., 2006; Lin, 2004a and 2004b; Saleh and Ryan, 2003). This capability, together with being familiar with food laws and willing to cooperate with sanitary units, is the index to judge the dietitians' ability of sanitary supervision and management and to execute HACCP self-management.

Communication with suppliers and schools and coordination between schools and contractors are considered the second important evaluation criteria of core competence for appraising the ability of dietitians (Table 4). Besides practical experience and proficient skills of dietitians, the next important factor is whether dietitians can be a bridge between schools, contractors and kitchen workers (Taylor, 2008; Wang and Jeng, 2007; Roseman et al., 2005; Saleh and Ryan, 2003; Mary and Gregoire, 2001).

Nutrition analysis and menu creation ability are the basis to judge whether a dietitian can prepare the school lunch matching the needs of both nutrition and diversity when considering nutrition balance and color, flavor and taste. This is also used as a reference whether a dietitian has the ability to coordinate with a school to execute nutrition education and guide children to learn about nutrition and dining etiquette (Department of Health, 2008b; Raguso et al., 2004; Heller et al., 2002). 4 evaluation criteria of the crisis handling capability are the adaptability of food and equipment problems in temperament food service, the adaptability of food service caused by natural hazards, the customer complaint handling, and the response to food poisoning. These 4 criteria are the standards for evaluation of school nutrition safety by outsourcing lunch suppliers at any time and any place (Food Information website, Department of Health, 2008c).

The characteristics of a school lunch include abundant offering in a fixed time. Therefore, the abilities of dealing with accidents such as natural disasters, the ability of temporary but emergent offering when necessary, or the ability of customer complaint handling are all testing the crisis handling ability of dietitians. Thus, the dieti-

tian personal characteristics, especially being positive and pressure-resistant and mood-controlling are the important criteria to evaluate the ability of dietitians when facing emergencies and solving other problems (Heller, 2002).

6. Conclusions. The results of the study can be used further to form an evaluation table as shown in Table 5 "The Score Table of Suggestions on the Core Competence of Contractors' Dietitians of Central Kitchens of National Elementary Schools in Taipei Area." The results of the study can be used not only as an appropriate evaluation model for food suppliers under HACCP, but for and selection recruitment of dietitians for schools, and can also be used as a reference during dietitian training courses at universities.

Table 5. The Score Table of Suggestions on the Core Competence of Contractors' Dietitians of Central Kitchens of National Elementary Schools in Taipei Area

(Total score is 100)

Producer Name: _____ Evaluation Dates(day/month/year): _____

Grading item	Specific gravity of grading	Grading breakdown	Specific gravity of grading	Scoring
Dietitian personality	13.3	Optimism and initiative	2.1	
		Dedication, attachment to quality and supervised-oriented	5.1	
		Flexible to use professional knowledge	2.3	
		Mood control and pressure resistance	3.8	
Nutrition lunch preparation capability	16.6	Being familiar with food quality and cost control	5.6	
		Supervision on chefs' nutrition lunch preparation	2.9	
		Nutrition analysis and menu creation capability	8.1	
Sanitary supervisor and management	23.3	HACCP assessment and good food sanitary training	6.0	
		Stipulating self-sanitary management plan and writing sanitary management report	10.6	
		Being familiar with food laws and willing to cooperate with sanitary units	6.7	
Crisis handling capability	18.6	Response to food poisoning	1.9	
		Adaptability of food and equipment problems in temperament food service	7.5	
		Customer complaint handling	4.2	
		Adaptability of food service caused by natural hazards	5.0	
Administrative process capability	28.2	Communication with schools lunch supervisors	4.7	
		Coordination with school to execute nutrition education	6.3	
		Coordinating between schools and contractors	8.2	
		Communication with suppliers and schools	9.0	
Total				

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Стаття надійшла до редакції 15.07.2011.