The Development of Occupational Competency Analytical Standard Model using Prototyping Functional Analysis (FPA)

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บทคัดย่อ—งานวิจัยนี้มีวัตถุประสงค์เพื่อ 1) พัฒนาแบบจำลองการวิเคราะห์สมรรถนะอาชีพโดยใช้เทคนิคการวิเคราะห์ฟังก์ชันด้วยวิธีต้นแบบ 2) นำแบบจำลองที่ได้ไปพัฒนามาตรฐานอาชีพโลจิสติกส์สาขาอาชีพจัดซื้อ 3) ประเมินผลมาตรฐานอาชีพที่ได้ แบบแผนการวิจัยครั้งนี้เป็นการวิจัยและพัฒนา เป็นการวิจัยทั้งในระดับแนวคิด ระดับการนำไปใช้ และระดับประเมินค่า วิธีการวิจัยเริ่มจากพัฒนาแบบจำลองการวิเคราะห์สมรรถนะอาชีพโดยใช้เทคนิคการวิเคราะห์ฟังก์ชันด้วยวิธีต้นแบบ จากนั้นนำแบบจำลองที่ได้ไปประเมินคุณภาพโดยผู้เชี่ยวชาญ นำแบบจำลองที่ผ่านการประเมินคุณภาพไปวิเคราะห์สมรรถนะอาชีพโดยใช้วิธีการระดมความเห็นจากผู้ประกอบการและผู้เชี่ยวชาญหลายครั้งเพื่อพัฒนามาตรฐานอาชีพโลจิสติกส์สาขาอาชีพจัดซื้อ และสุดท้าย ประเมินผลมาตรฐานอาชีพที่ได้โดยใช้วิธีประชาพิเคราะห์จากกลุ่มตัวอย่างจำนวน 67 คน คัดเลือกกลุ่มตัวอย่างโดยวิธีเจาะจง (Purposive Sampling) ผลการหาคุณภาพของแบบจำลองโดยผู้เชี่ยวชาญอยู่ในระดับสูงกว่าเกณฑ์ โดยมีค่าดัชนีความสอดคล้องมีค่าระหว่าง 0.83 ถึง 1.00 ส่วนความเหมาะสมของแบบจำลองอยู่ในระดับดีมาก ผลการประเมินมาตรฐานอาชีพโลจิสติกส์สาขาอาชีพจัดซื้อจากผู้เข้าร่วมสัมมนาประชาพิเคราะห์ มีความคิดเห็นในภาพรวมอยู่ในระดับดีมาก ผลการวิจัยพบว่ามาตรฐานอาชีพโลจิสติกส์สาขาอาชีพจัดซื้อ ประกอบด้วยหน้าที่หลัก จำนวน 3 หน้าที่ สมรรถนะอาชีพจำนวน 10 หน่วยสมรรถนะ สมรรถนะย่อยจำนวน 36 หน่วยย่อย 90 เกณฑ์ปฏิบัติงาน และครอบคลุมคุณวุฒิวิชาชีพชั้น 3-4-5-6

คำสำคัญ: การสร้างต้นแบบซอฟต์แวร์, วิศวกรมซอฟต์แวร์, มาตรฐานอาชีพ, การวิเคราะห์สมรรถนะ, การวิเคราะห์หน้าที่

Abstract— This purposes of this research were 1) to develop a Prototyping Functional Analysis (PFA) model to analyze the occupational competencies 2) use the PFA model to develop of occupational logistics standard in logistics procurement and 3) to evaluate the occupational standard which developed by the PFA model. This research methodology is research and development (R&D) which perform in the approach level, implementation level and evaluation level. This research began to develop the occupational competency analyzes model using PFA approach, and then, quality verification the PFA model with multiple focused group discussion (FGD) by entrepreneur and expertise in order to develop the occupational logistics standard in procurement. The final, to evaluate the occupational standard with public presentation for endorsing of analysis by 67 samples purposive sampling.

The quality of models by experts in the higher threshold. The indexes have index of item objective congruence: (IOC ranged between 0.83 - 1.00). The appropriateness of the model is very good. The result of evaluation an occupational standard in logistics procurement by public hearing seminar was very good. The results of research found that the occupational standard in logistics procurement consists 3 Key Functions (KF) 10 Units of Competence (UoCs) 36 Elements of Competence (EoCs) 90 Performances Criteria (PCs) and covered 3-4-5-6 tier of professional qualification.

Keywords-component; software prototyping; software engineering; occupational standard; competency analysis; functional analysis

I. INTRODUCTION

In order to work effectively and productively, employees not only need to use knowledge, but they also need to utilize expertise and several skills that come from on-the-job learning and practice. Those who have and who do not have education degrees in the field can improve their abilities to complete the tasks. This application of knowledge, skills, and abilities in carrying on occupation is called "competency."

Nodaway in Thailand, competency-based approach is recognized and applied widely in the fields of human resources, education and training. The Professional Qualification System is define by Thailand Professional Qualification Institute (public organization) or TPQI. TPQI is the main organization responsible for developing occupational standards and accrediting professional qualification. In the process of occupational standards development, TPQI will collaborates with entrepreneurs in industrial and service sectors and academic consultants to determine job market needs in order to develop occupational standard in each occupation by compiling a list ranging from the most basic competency level to the highest level of expertise. The competency level is a measurement of occupational skills, knowledge, and abilities. Functional Analysis (FA) is the recommended standard technique to develop occupational standard and professional qualification in any field.

However, the key problem of the professional standards development at the moment is the lack of a standard format for competency analysis by using functional analysis technique. Such problem effect on the result of work product in both of quality and quantity which performed by any various working group. [5]

From such problems, the researchers intend to develop a standard model of occupational competency analysis using a software prototyping model. This method is from software engineering process to develop and deliver a software product efficiency more than the traditional method. And then, validate the quality of standard model using focus group discussion by the experts, implement the model and evaluate in final.

II. OBJECTIVES

- To develop the standard model of occupational competency by using prototyping functional analysis
- To validate the standard model quality via the experts
- To perform the occupational competency standard in Logistics procurement by using the model
- To evaluate the result of the occupational standard.

III. BACKGROND

A. Meaning of Competency

"Competence" or "Competency" as a combination of practical and theoretical knowledge, cognitive skills, behavior and values used to improve performance [3]

Competence (human resources), a standardized requirement for an individual to properly perform a specific job [4]

A competency is a set of defined behaviors that provide a structured guide enabling the identification, evaluation and development of the behaviors in individual employees. [5]

The competency in Thailand,

Behavioral characteristics that are the result of knowledge, skills / abilities and other features which the individual can make a contribution to outperform peers in other organizations. [6]

Competence is the ability of an individual to do a job properly. [4]

Competencies are also what people need to be successful in their jobs. [7]

By our definition, "competence" as a combination of practical and theoretical knowledge, cognitive skills, behavior and values used to improve performance; or as the state or quality of being adequately or well qualified, having the ability to perform a specific role.

B. Professional Qualification System

The Professional Qualification System is define by Thailand Professional Qualification Institute (public organization) or TPQI. TPQI is the main organization responsible for developing occupational standards and accrediting professional qualification. In the process of occupational standards development, TPQI collaborates with entrepreneurs in industrial and service sectors to determine job market needs in order to develop occupational standard in each occupation by compiling a list ranging from the most basic competency level to the highest level of expertise. The competency level is a measurement of occupational skills, knowledge, and abilities. [1]

There are different levels of professional qualification under the professional qualification framework. A number of basic competencies for a specific occupation make up level 1 of professional qualification, while a number of advanced competencies make up the highest level of professional qualification. Not only does professional qualification help advance career, but it also can be converted to educational qualification.

C. Occupational and Professional Qualification Standard in Logistics procurement

Logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to

meet customers' requirements. Council of Logistics Management (CSCMP) (https://cscmp.org/)

The main goal of procurement is to buy goods and services that customers need, procurement can also be used to promote socioeconomic objectives. These are often referred to activities in order to acquire goods and service by Right Quality Right Quantity Right Time Right Price Right Source and Right Place. (International Trade Center, United Nation, 2013).

The occupational standard in logistics procurement is identification of individual competencies standard in occupation for procurement in logistics process.

D. Functional Analysis (FA)

Functional Analysis (FA) or Competency Model—CM) has the potential to fill an important void in Traditional Job Analysis (TJA), specifically the infusion of strategic concerns in day-to-day employee behavior. Moreover TJA and CM pursue fundamentally different goals, which those who argue for and against either of these human resource methods at times may overlook. [15]

By the Department of Employment (NTO), FA compose are functional map section (included key purpose, key role, key function and units of competence, elements of competence) and competency specification section (or comp spec. included Performance Criteria, Range Statement, Evidence Requirements, Assessment Guidance).

E. Software engineering process by using Prototyping Functional Analysis (FPA)

(1) Software Prototyping

Software prototyping is the activity of creating prototypes of software applications [8], i.e., incomplete versions of the software program being developed. It is an activity that can occur in software development and is comparable to prototyping as known from other fields, such as mechanical engineering or manufacturing [9]. A prototype typically simulates only a few aspects of, and may be completely different from, the final product.

(2) Types of prototyping

- Throwaway or Rapid Prototyping refers to the creation of a model that will eventually be discarded rather than becoming part of the final delivered software [10]. After preliminary requirements gathering is accomplished, a simple working model of the system is constructed to visually show the users what their requirements may look like when they are implemented into a finished system.
- Evolutionary Prototyping (also known as breadboard prototyping) [11] is quite different from Throwaway Prototyping. The main goal when using Evolutionary Prototyping is to build a very robust prototype in a structured manner and constantly refine it. The reason for this is that the Evolutionary prototype, when built, forms the heart of the new system, and the improvements and further requirements will be built.

(3) Prototyping Process

The process of prototyping involves the following steps [9]

- Identify basic requirements. Determine basic requirements including the input and output information desired. Details, such as security, can typically be ignored.
- Develop Initial Prototype. The initial prototype is developed that includes only user interfaces.
- Review. The customers, including end-users, examine the prototype and provide feedback on additions or changes.
- Revise and Enhance the Prototype. Using the feedback both the specifications and the prototype can be improved. Negotiation about what is within the scope of the contract/product may be necessary.

If changes are introduced then a repeat of steps #3 and #4 may be needed.

There are many advantages to using prototyping in software development; reduced time and costs and improved and increased user involvement [11]

When considering that the process of the software prototyping based on software engineering as well as a procedure with the occupational competency analysis. Researchers or consultants (or developer) is drafting a prototype of each work step (such as functional map, UoC, EoC, competency spec., and so on), and propose the draft version to review and revise by occupation owner (or user) at each time until to complete.

IV. METHODOLOGY

A. Population and Sample

The population is worker in industrial logistics, purchasing field area.

Sample is 67 purchaser by purposive random sampling.

B. Methodology Tasks method and tools

Tasks and method/tools as below table 1

TABLE 1 Tasks and method/tools

Task ID	Tasks	Methods/Tools
1.	Literature Review	Focused reviewing
2.	Develop the Model of Competency Standard Analysis using the Prototyping Functional Analysis (PFA)	Software Engineering/Process Modeling
3.	Validate the PFA model by quality experts	Focus Group Discussion
4.	Develop the Occupational Standard in Logistics procurement using the PFA model	Focus Group Discussion with Working Group
5.	Evaluate the Occupational Standard by public hearing seminar	Purposive Random Sampling
6.	Analyze and summarize the experiment	Statistical Method

V. Results of Experiment

1. The competency analysis model.

1) Prototyping Functional Analysis (PFA) model as figure 1.

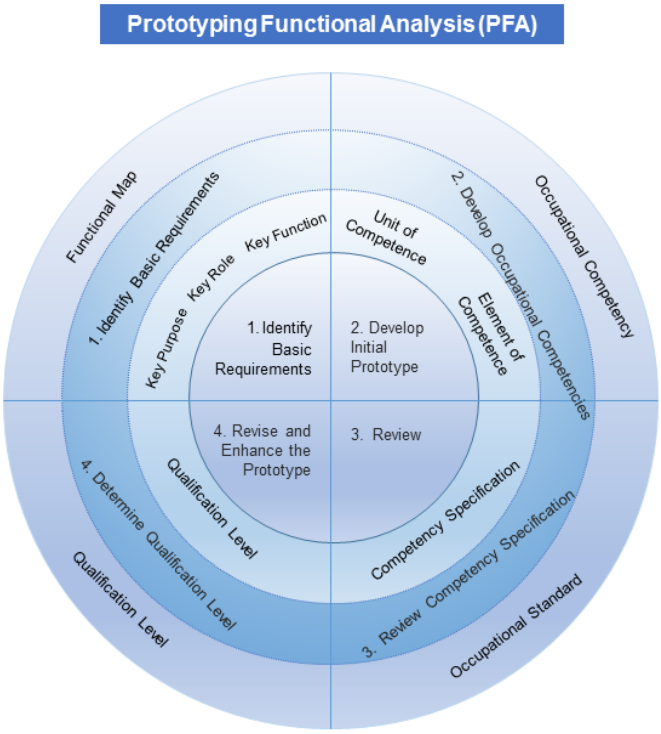

Figure 1. Prototyping Functional Analysis (PFA) model

2) Design Concept.

The model is designed according to the guidelines below; Layering approach, spiral model, serializibility and systematic approach or I-P-O (Input-Process-Output).

3) Model Components

The model is compose of 4-tier.

1-Tier: The Prototyping Process and Key Stakeholder

TABLE 2. The Prototyping Process and Key Stakeholder

Tier	Prototyping Process	Key Stakeholder
1	Identify basic requirements	PA, EP, CS
2	Develop Initial Prototype	WG, CS, EC
3	Review	WG, CS, OO, EC
4	Revise and Enhance the Prototype	WG, CS, OO, EC

Key Stakeholder Indicators

Professional Association (PA), Entrepreneur (EP), Consultant (CS), Working Group (WG), Endorsement Committee (EC), Owner Occupation (OO)

2-Tier: Input Factors

Input Factors showed as table 3.

TABLE 3. Input Factors

Tier	Input Factors
1	Key Purpose (KP), Key Role (KR), Key Functional (KF)
2	Unit of Competence (UoC), Element of Competence (EoC)
3	Competency Specification (Comp Spec.)
4	Qualification Level

3-Tier: Process Factors (Competency Analysis Process)

The Process Factors (Competency Analysis Process) showed as table 4.

TABLE 4. Process Factors

Tier	Competency Analysis Process
1	Identify Competency Domain
2	Define and Develop Occupational Competencies
3	Review Competency Specification
4	Review and revise qualification level

4-Tier: Output Factors (Work Product)

The Output Factors showed as table 5

TABLE 5. Output Factors

Tier	Output (work product)
1	Functional Map
2	Occupational Competency
3	Occupational Standard
4	Professional Qualification

The finally, the components of competency analysis standard model using prototyping functional analysis (PFA) can be summarized in the following table-6.

2. The result of PFA model's validation by experts

The researchers propose the model had the quality validation by focus group discussion (FGD) Krueger's technique from the 12 experts in logistics professional/entrepreneur and specialist in occupational standard.

The results showed that the quality of models by experts in the higher threshold. The indexes have index of item objective congruence: (IOC ranged between 0.83 - 1.00). The appropriateness of the model is very good ($\bar{x}$=4.82, S.D = 0.38).

TABLE 6. Component's summary of competency analysis standard model using PFA

Prototyping Process	**Key Stakeholders**	**Input**	**Competency Analysis Process**	**Output**
1. Identify Basic requirements	PA, EP, CS	KP, KR, KF	1. Identify Competency Domain	Functional Map
2. Develop Initial Prototype	WG, CS, EC	UoC, EoC	2. Define and Develop Occupational Competencies	Occupational Competency
3. Review	WG, CS, OO, EC	Com. Spec.	3. Review Competency Specification	Occupational Standard
4. Revise and Enhance the Prototype	WG, CS, OO, EC	Tier	4. Review and revise qualification level	Professional Qualification

3. The result of PFA model's validation by public hearing

The result of evaluation an occupational standard in logistics procurement by public hearing seminar by 67 samples purposive sampling was very good ($\bar{X}$=4.11, S.D. = 0.74). The result were as below;

TABLE 7. General Information

Degree	Percent (%)
Diploma	5
BA	30
MA	55
Ph.D.	10

TABLE 8. Occupation

Occupation	Percent (%)
Senior operation	25
Management	37
Entrepreneur	15
Other	23

TABLE 9. Work Experience

Experience	Percent (%)
less than 5-year	16
5-10-year	15
more than 10-year	69

B. The result of evaluation an occupational standard in logistics procurement by public hearing seminar was very good ($\bar{x}$=4.11, S.D. = 0.74).

4. The result of occupational standard which developed by the PFA model

1) The Functional Map of Occupational Standard in logistics procurement by PFA model as figure 2

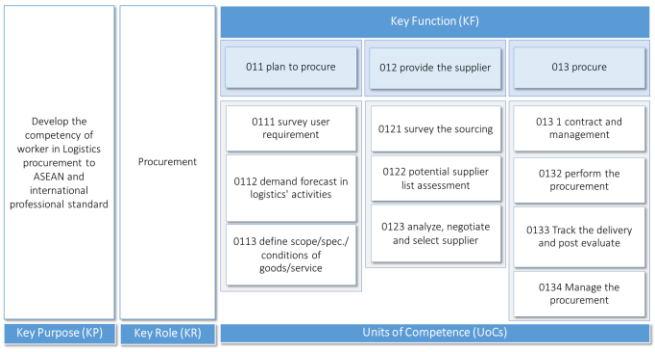

Figure 2 Functional map of Occupational Standard in logistics procurement

2) The results of research found that the occupational standard in logistics procurement consists 3 Key Functions (KF) 10 Units of Competence (UoCs) 36 Elements of Competence (EoCs) 90 Performances Criteria (PCs) and covered 3-4-5-6 tier of professional qualification as figure 3.

Occupational Competency Standard in Logistics Procurement

Units of Competence (UoCs)	Elements of Competence (EoCs)	Performance Criteria (PC)	Professional Qualification
10 UoCs	36 EoCs	90 PC	Procurement Level 3-4-5-6

Figure 3 Summary of Occupational Competency Standard in Logistics Procurement

5. The result of evaluation the unit of competency on Logistics procurement showed that all respondents has consensus agreement.

VI. Conclusion

1. Research aims to develop models of competency analysis using prototyping functional analysis which the result is the Prototyping Functional Analysis model (PFA).

2. The quality of models which validated by experts in the higher threshold. The indexes have index of item objective congruence. The appropriateness of the model is very good.

3. The result of evaluation an occupational standard in logistics procurement by public hearing seminar was very good.

4. The results of research found that the occupational standard in logistics procurement consists 3 Key Functions (KF) 10 Units of Competence (UoCs) 36 Elements of Competence (EoCs) 90 Performances Criteria (PCs) and covered 3-4-5-6 tier of professional qualification. The result of evaluation the unit of competency on Logistics procurement showed that all respondents has consensus agreement.

VII. Discussion and Recommendation

1. Discussion

This purposes of this research were to develop a Prototyping Functional Analysis (PFA) model to analyze the occupational competencies, use the PFA model to develop of occupational logistics standard in logistics procurement, and to evaluate the occupational standard which developed by the PFA model. This research methodology is research and development (R&D) which perform in the approach level, implementation level and evaluation level.

In the approach level, researcher began to develop the occupational competency analyzes model using PFA approach, and then, quality verification the PFA model with multiple focused group discussion (FGD) by entrepreneur and expertise in logistics industry.

In the implementation level, the PFA model was used to analyze the occupational competency in order to develop the occupational standard and professional

qualification in logistics procurement which complied on the Thailand Professional Qualification Framework (TPQF).

In the evaluation level, the result of the occupational standard and professional qualification in logistics procurement are being developed that can be evaluated by public presentation for endorsing of analysis by 67 samples purposive sampling.

The results showed that the quality of models by experts in the higher threshold. The indexes have index of item objective congruence. The appropriateness of the model is very good, which has the opposite effect on research of Babchar Witsyanuwat [2]

The result of evaluation an occupational standard in logistics procurement by public hearing seminar was very good. This is consistent with the result of Anothai Ngamwichaikij [18] and Monchai Korniyom [19]

The results of research found that the occupational standard in logistics procurement consists 3 Key Functions (KF) 10 Units of Competence (UoCs) 36 Elements of Competence (EoCs) 90 Performances Criteria (PCs) and covered 3-4-5-6 tier of professional qualification. This is consistent with the result of Akkarat Poolkrajang and team [20]

The findings are the result of research planning, implementation as planned, and evaluated carefully.

2. Future work.

1) Should expand scale of research and development of professional competencies in supply chain procurement by using PFA model.

2) Should research to develop the occupational standard in other fields by using the PFA model.

3) Should comparison research to develop the occupational standard between PFA model with traditional model.

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