



Risk Assessment in Developing Occupational Standards for Environmental Work in Thailand

Mali Chansunthorn^{ID}, Pakpong Pochanart^{*ID}

Graduate School of Environmental Development Administration, National Institute of Development Administration (NIDA), Bangkok 10240, Thailand

Corresponding Author Email: pakpong.p@nida.ac.th

Copyright: ©2024 The authors. This article is published by IIETA and is licensed under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

<https://doi.org/10.18280/ijstdp.190117>

ABSTRACT

Received: 9 July 2023

Revised: 8 November 2023

Accepted: 24 November 2023

Available online: 31 January 2024

Keywords:

risk assessment, occupational standard professional qualifications, environmental works

This qualitative research aimed to conduct a risk assessment for developing occupational standards for environmental work in Thailand by collecting data through semi-structured interviews from 49 key informants using purposive sampling from consultants, working groups, and the endorsement board. Content analysis was applied by selecting content pertinent to the research question, defining coding categories, coding the content, and analyzing the results in relation to the keywords and risk assessment. The results were interpreted according to: 1) Publicizing the project (low and moderate risks); 2) Studying role model countries (moderate risk); 3) Conducting functional analysis (moderate risk); 4) Making and testing assessment tools (low risk); and 5) Proposing to the endorsement board (moderate risk). The new processes were proposed as: 1) Determining the conditions of selection target group (government agencies, private sector, and independent); 2) Determining the public relations and period; 3) Training on Functional Analysis; 4) Recruiting the working group; 5) Determining common and specific competency; 6) Determining the ratio of academic and practical tool; 7) Meeting for understanding and self-assessment of the testing groups and examiners; 8) Compiling the list of professional experts; 9) Collecting feedback for improvement; and 10) Creating benefits perception of the occupational standard.

1. INTRODUCTION

Current environmental problems in Thailand may arise from ongoing development activities that often conflict with environmental preservation [1]. Some aspects of the problems stem from the operations of personnel related to environmental work in management, oversight, control, and execution, all of which require proper direction. Meanwhile, the operators must possess not only knowledge and skills but also professional expertise, especially in managing human-impacted environmental resources.

The Thai industrial restructuring, as outlined in the 20-Year Strategy for the development of Industry 4.0 (2017-2036) [2], aims to enable the nation to overcome the middle-income trap and transition to a high-income country. This restructuring is a mechanism to drive the country's economy, focusing on the use of advanced technology in production and developing creative and innovative approaches.

The National Qualifications Framework (NQF) is a linkage of the national qualifications system, linking individual performance levels as a result of learning, education, training, and experience. The NQF comprises an educational qualification framework from educational agencies and occupational standards frameworks related to occupational skill standards, to ensure the integrity of the national manpower development system [3].

The research project conducted by TRIS Corporation Limited

[4], aimed at driving manpower development based on the professional qualification system, focused on the outcomes and impacts on the educational sector in Thailand. It analyzed the educational qualification framework in Thailand and in foreign countries, which included the ASEAN Qualifications Reference Framework (AQRf). The Seventh AQRf Committee Meeting and Workshop in October 2019 passed a resolution to approve the report of the comparison of Thailand's NQF with the ASEAN Qualifications Reference Framework [5]. The agencies relevant to the occupational standard that may involve environmental works include the Department of Industrial Works, Council of Engineers, Council of Science and Technology, Ministry of Education, and Ministry of Natural Resources and Environment.

In order to develop personnel in the environmental profession to an international equivalent standard, the national professional qualification system is central to certifying the competency of the manpower in accordance with occupational standards, in response to the demand of the business and industry. The concept is to ensure that an individual's ability is recognized and awarded a professional qualification in line with their competency, experience, and knowledge, and using the professional qualification to foster career advancement.

Currently, the Thailand Professional Qualification Institute Committee has classified 10 industry professional groups including the logistics and supply chain professional group; agricultural, food, and beverage professional group; real

estate, and public service professional group; service and financial professional group; health, sports, and tourism professional group; communication and mass communication professional group; digital industry professional group; creative and entertainment industry professional group; manufacturing industry professional group; and energy and environment professional group [6].

Since 2015, the Thailand Professional Qualification Institute (Public Organization) in collaboration with stakeholders in professional groups, associations and federations, public agencies, governmental sectors, and private sectors have jointly established occupational standards and professional qualifications related to environmental works and built networks for publicizing occupational standards and professional qualifications to gain international recognition and to strengthen the workforce to develop their competencies.

Therefore, in order to ensure that the process of establishing occupational standards and professional qualifications is implemented efficiently and complies with the principles of establishing occupational standards and professional qualifications, while minimizing environmental impact, it is advisable to study how to support the development of such a process. One significant concept involves risk management, which can be applied to the process for environmental personnel. The study includes risk assessment for each process of establishing occupational standards and professional qualifications related to environmental works, aiming to analyze, evaluate, and prioritize the risks of the existing process. Then, findings of the appropriate process were explored, and we proposed a process for devising measures of risk management for establishing occupational standards and professional qualifications for environmental personnel with higher efficiency. This article presents background and rationale, literature review, conceptual framework, results, discussion, conclusions and recommendation.

2. LITERATURE REVIEW

In this section, the risk principle, professional qualification, functional analysis as well as related researches were reviewed.

2.1 Professional qualification

The National Qualifications Framework (NQF) links the national qualifications systems, connecting individual performance levels resulting from learning, education, training, and experience, and includes the educational qualification frameworks from educational agencies, and the occupational standards frameworks of agencies related to occupational skill standards, as well as several organizations, to ensure the integrity of the national manpower development system.

Thailand Professional Qualification Institute (Public Organization) produced the Occupational Standard and Professional Qualification Manual [7] which provides the guideline for development of occupational standard and professional qualification in the following steps: (1) Determine the needs of professional groups or industrial groups (2) Carry out functional analysis of professional groups or industrial groups (3) Develop the unit of competence and establish the occupational standard and (4) Establish professional qualification according to occupational standard.

These processes of occupational standards and professional qualification were based on New Zealand and Australia's occupational standards and professional qualification which are applicable to all educational agencies in both public and private sector [5].

2.2 Functional analysis

The Functional Analysis of the National Innovation System (NIS) approach was studied. This approach is applied for the estimation and measurement of efficiency and performance of NIS [8]. The Thailand Professional Qualification Institute (Public Organization) produced the occupational standard and professional qualification manual with functional analysis for professional or industrial groups [7].

2.3 The principle of the risk management

Risk assessment is the international standard process which provides principles and generic guidelines on risk management that can be used by any public, private or community enterprise, association, group or individual. It can be applied to any type of risk, positive or negative consequences throughout the life of an organization, and with a wide range of activities, including strategies and decisions, operations, processes, functions, projects, products, services and assets. The design and implementation of risk management plans and frameworks will need to take into account the varying needs of a specific organization, particular objectives, context, structure, operations, processes, functions, projects, products, services, or assets and specific practices employed [9]. In this work we focused on the issues of defining risk assessment in developing occupational standards, analyzing the processes of project identify risk, determining positive or negative consequences and designing risk management plans after the improvement of existing process.

Risk means uncertain event that may occur in the future. If so, it will have negative impact on reaching the objectives or mission of an organization. In other words, risk is the opportunity for mistake, loss, unexpected event, and undesired event so that it hinders operation from reaching the set objectives [10]. Uncertain event in this work refers to the effects of all processes from the beginning until the end of the project.

Risk Factor is the cause or reason of risk that hinders any operation from reaching the set objectives. Risk should be able to be identified as for the cause, the reason, and the time of occurrence. Risk identification is crucial as it will ensure the determination of the appropriate measures of risk management. Risk Assessment classifies and ranks the importance of the existing risks by assessing the Likelihood and the Impact from both external and internal risk factors. [11].

ISO 31000 and risk analysis text books [9, 12-14] define steps in risk analysis as (1) Establish context, which means for example to define the purpose of the risk management activities, and specify goals and criteria (2) Identify situations and events (hazards/threats/opportunities) that can affect the activity considered and objectives defined. The methods have been developed for this task (3) Conduct cause and consequences analysis of these events, and impact to activities, objective and goal (4) Make judgements of the likelihood and impact of the events and their consequences, and establish risk characterization (5) Analyze and evaluate risk, to judge the risk significance and (6) Perform risk treatment (Figure 1).

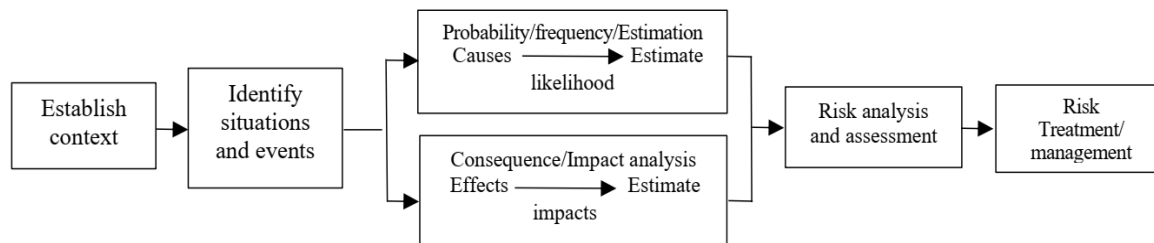


Figure 1. Risk process

Source: [12-15]

Risk response is operated after project process identifies its risks and assesses the significance of the risks by using appropriate methods to respond to the risk in order to reduce loss or the likelihood of risk at the level acceptable [16]. The model of ISO 31000:2009 includes the following: Establishing the context; risk identification; risk analysis; risk evaluation; and risk treatment. The implementation is made based on the overall risk management process. In addition, it is necessary to carry out communication and consultant regularly, as well as monitoring and reviewing when necessary [17].

This research is related to the methods of risk analysis designed for the environmental impact assessment process for develop assumptions, improvements, implementation and performance, as well as the improvement of the implementation process and use of risk analysis methods in environmental impact assessment process. The processes of undertaking risk assessment are identified, estimated and ranked of risks includes potential losses of exposed population, property, services, livelihoods in environment, and assessment potential impacts on society [18]. A paper by Aven [19] mention that if criteria of risk acceptance are introduced as a risk management tool, they should be formulated by the authorities. From literature review we focused on the process of risk analysis and assessment in the project based on risk assessment principles in order to design an appropriate risk management approach.

3. CONCEPTUAL FRAMEWORK

This conceptual framework is an analytical thinking process in order to answer the objectives and research questions in the area of improving the original process with the results of the risk assessment to make the process more efficient and proposed the prototype process after the improvement of existing process.

This research is the qualitative research [20, 21] to conduct risk assessment, and to propose measures of risk management for the processes of establishing occupational standards and professional qualification [7, 11, 17]. The present processes are (1) Publicizing the project to the target group (2) Studying occupational standards of role model countries (3) Conducting Functional Analysis to be proposed to the endorsement board for approval (4) Making assessment tools based on occupational standards, and assess quality of tools and (5) Testing assessment tools with the target group and proposing to the endorsement board for approval [7].

Risk assessment framework for this work is to improve the 5 processes of the established professional standards and identify situation after that analysis and assessing possibilities of risks from the scale of impact and likelihood in order to calculate total risk scores and determine levels of risk (1-5

scale) in order to treatment for each process in term of take the opportunity, treat, transfer or terminate.

4. METHODS

4.1 The data collecting process

(1) Primary Data were collected from semi-structured interviews by 49 key informants for 3 groups based on the structure of establishing occupational standards: project consultants, working group, and endorsement board. The semi-structured in-depth interview is open-ended questions containing keywords which are flexible and ready to be revised in accordance with each informant and the situation. We focused on the qualitative interview aiming to find mutual explanation from informants regarding viewpoints toward risk assessment and the processes of establishing occupational standards and professional qualification related to environmental work. The questions are determined based on related issues, and keywords are used to guide the interview.

(2) Secondary data were collected from documents from public agencies, reports regarding environmental quality in Thailand, e.g., the 12th National Economic and Social Development Plan (2017 – 2021), potential industrial groups, [6], professional qualification system [3], and processes of establishing occupational standards and professional qualification, Competency Development Technique [5], principle, definition, significance of risk assessment, principle of risk management and risk management guidance [17, 11, 22] and other related studies (best practice countries).

(3) Data for the risk assessment of the establishing occupational standards and professional qualification process related to environmental work from (1) and (2) were then analyzed in the following step.

4.2 Data analysis

There are three processes to analyze the data as follow.

(1). Establishment of the context: The data analysis involves data interpretation to find out the meaning from collected data, to gain understanding of the data contents, and to use the cause explanation and linkage of key informants by linking rationality both directly and indirectly. [20, 21] The further step is to summarize viewpoints toward risks in each process of establishing occupational standards and professional qualification. [11, 17, 22]. During the interview data acquired from the transcription and note-taking were analyzed to gain understanding of the overall content [23]. In reference to the above-mentioned processes in conceptual framework, our processes are modified situationally as follow.

(1.1). Identify the establishing occupational standards and professional qualification processes [7].

(1.2). Review relation of process objective and objective of establishing occupational standards and professional qualification for each process [7, 16].

(1.3). Identify the aim of each objective of establishing occupational standards and professional qualification.

(1.4). Define risk issues and risk situation [11, 17, 22].

(1.5). Define cause and factor of risk issues and risk situation.

(2). Risk analysis and evaluation used risk assessment criteria for prioritizing the significance risks [11, 17, 22, 24]. This step consists of two processes as follow.

(2.1). Assessing possibilities of risks from the scale of impact and likelihood in order to calculate total risk scores and determine levels of risk (1-5 scale) [25-27] (1) Very low risk: No potential, being adequately controlled; no further control measures are required. (2) Low risk: No potential for serious consequences. Risk management is not essential. (3) Moderate risk: Potential for moderate consequences. Risk management is recommended. (4) High risk: The potential for extreme consequences but risk low probability. Risk management is recommended. (5) Very high risk: Potential for extreme consequences, high probability. Risk management is necessary.

(2.2). Comparing the potential impact on the objective of establishing occupational standards and professional qualification include time and aim [22, 28, 29].

(2.3). Capturing main idea about the viewpoints toward risks of the processes of establishing occupational standards and professional qualification related to environmental works. If the data was not sufficient for analysis or determining issues, add more informants [23, 30].

(2.4). Reviewing each significant issue classified and acquired from informant in order to further draw conclusions based on the research objectives [31].

(3). Risk treatment and management can be either one of the four actions; take the opportunity, treat, transfer or terminate. For some risks the best response may be to transfer them. However, by far the greater number of risks will belong to treat category. The conclusions from risk analysis and evaluation were drawn based on the research objectives aiming to explore risks of the processes of establishing occupational standards and professional qualification related to environmental works. This research adapted the concept of risk management or risk response to up the risk management related processes that are shown in Figures 2 and 3 [28].

The content analysis was applied by choosing the content from research question, defining the categories of coding, coding the content, and analyzing the results. The coding is defined by keywords toward risk assessment and processes of establishing occupational standards for example: “What are the events that hinder on the process 1-5 in accordance with the objectives and goals” and “Potential factors and the causes of potential risk and consider the impact on the objectives of the operation in this process with risk level 1-5”.

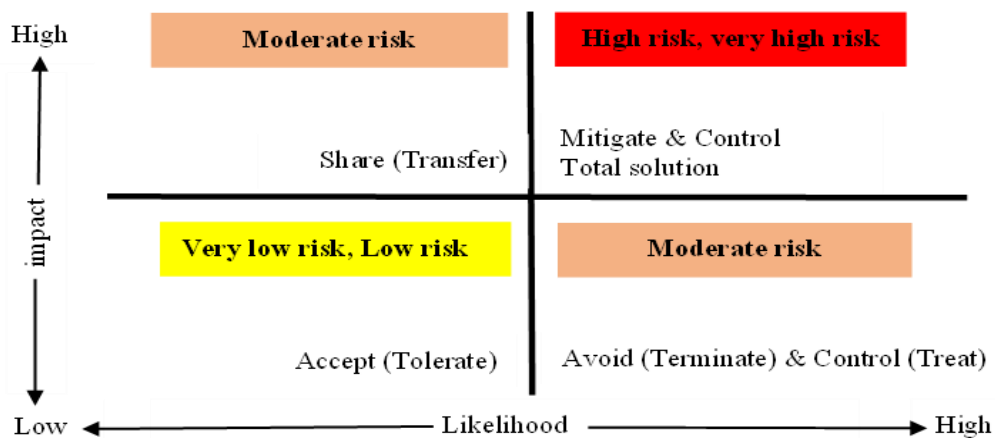


Figure 2. Risk treatment and management concept
Source: [12, 13, 28]

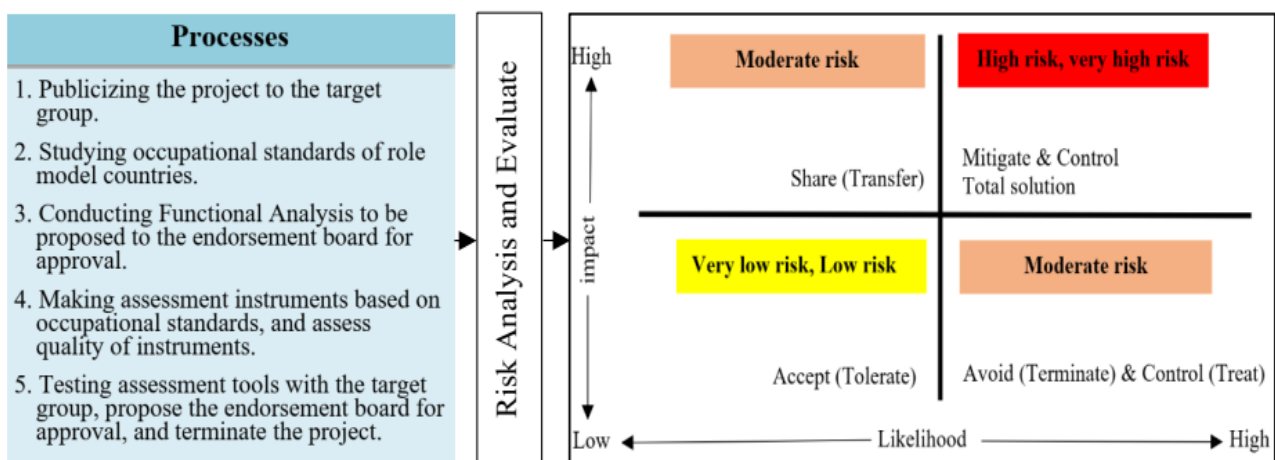


Figure 3. Risk management for processes of establishing occupational standards and professional qualification

Risk treatment and management concept: risk control offers opportunities to implement solutions that support risk avoidance, prevention and reduction. Risk avoidance aims to eliminate hazards, activities and exposures that have negative impact. In reality for the risk avoidance, a minimal amount of risk still exists. But in certain scenarios, risk can be avoided completely. Risk prevention aims to reduce the frequency or likelihood of the event or loss. This might mean preventing process breakdowns by maintenance and inspection schedules. Risk reduction aims to lower the severity of a particular loss that has already occurred. So, all of treatment and management depend on risk level.

4.3 Key informants

(1) The samples in the study are selected by a stratified random sampling with the following steps [30, 32].

(1.1) The total of 72 professional groups according to the announcement of occupational standards and professional qualification in the Royal Thai Government Gazette were investigated.

(1.2) These 72 groups were then classified into ten industrial groups including two groups directly related to environmental works.

(1.3) The two groups directly related to environmental works comprises 7 sub-groups. The 49 key informants from 7 sub-groups are selected by a purposive sampling based on the structure of establishing occupational standards. These key informants were from (1) Consultant were selected to serve as advisors to the occupational standards establishing project with 3 representatives from each sub-group (a project leader, researcher and a coordinator) totaling 21 samples (2) working groups representing government or private sector selected by 7 sub-groups with 3 representatives for each sub-group totaling 21 samples (3) the endorsement board for each sub-group comprises representatives of associations, federations, clubs, foundations, professional councils, federation of industries, chamber of commerce, and others in professional

groups, including experts and representatives of related government organizations, totaling 7 samples.

4.4 Area scope

This study is conducted in Thailand.

4.5 Timing scope

This study explores the establishment of occupational standards and professional qualification related to environmental works during the 2015-2017 fiscal years (October 2014 – September 2017).

5. RESULTS AND DISCUSSION

The results of risk assessment and development of occupational standard and professional qualification process for environmental works were presented as follows: (1) Risk identification (2) Risk analysis and evaluation (3) Risk treatment and management to propose guidance for establishing occupational standards and professional qualification more efficiently. This research selected only significant risk issues in order to analyze and evaluate the likelihood and impact to avoid or prevent the process delay and incompleteness. In overall, the risk levels for five processes (Figure 3) are low and moderate. We found low and moderate level of risk for the 1st process, moderate level for the 2nd process, moderate level for the 3rd process, low level for the 4th process and moderate level for the 5th process. The distribution across processes shows that the risk effect in the 1st process affected the 2nd and the 3rd causing the overall process to be delayed and causing a moderate risk to both processes. Furthermore, the 5th process is affected by the risks of the 3rd process as detailed in Tables 1 and 2. M and L in Table 1 denote moderate and low risk respectively.

Table 1. Research result

Old Process	Risk Identification	Risk Analysis and Assessment	Risk Treatment and Management	Recommendations of Process
1st Process: Publicizing the project to the target group				
	1) Public relations do not reach people in professional groups and do not cover all groups 2) No frequency and period are determined as suitable for public relations	1) The target groups aimed by the public relations are numerous, different, and diverse, there are both relevant and irrelevant opinions on the professions (M) 2) PR media, media format, period do not reach the target group (L)	1) The group attending the PR session should be selected specifically for the professions 2) Designate PR media, media format, period to reach the target group and as mass media	<u>Additional</u> 1) <i>Designate the selection conditions/criteria and ratio of agencies in professions (public, private, independent organization)</i> 2) <i>Designate the PR media, media format, period, conditions to follow up.</i>
2nd Process: Studying occupational standards of role model countries				
	1) The time is too little 2) Some countries have a lot of information and in some countries the information are not sufficient 3) Some countries have different contexts to establish occupational standard 4) Selecting the working group is still specific and does not cover actual professions	1) Competencies analysis of foreign countries and the domestic are not complete and do not reflect the situations which have different professional groups and competencies (M) 2) There is little time to work especially in large group (M) 3) The working group are not representative (M)	1) Avoid the risk from meeting in large group, change to meeting in small group 2) Reduce the scale of impact derived from selecting the role model country with similar context to Thailand 3) Recruitment of the working group instead of selection	<u>Additional</u> 1) <i>Training/workshop to provide knowledge to conduct Functional Analysis and link it to the study of foreign countries and relevant policies</i> 2) <i>Recruitment of the working group instead of selection</i>

Old Process	Risk Identification	Risk Analysis and Assessment	Risk Treatment and Management	Recommendations of Process
3rd Process: Conducting Functional Analysis to be proposed to the endorsement board for approval				
	1) The number of meetings for brainstorming is too little 2) The groups attending the public hearing are too broad and diverse, and not specific professions 3) Official meeting is not held often, informal meeting has to be held and the analysis has to be rushed so the competency issue is missing 4) Functional Analysis does not classify the types of work such as the public, the private sectors, and independent organizations	1) Functional Analysis does not cover all professions, not general, but specific group, not covering actual professions (M) 2) Difficult to summarize the overview. Takes a lot of time to summarize (M)	1) Reduce risk by training /workshop for specific professions to provide knowledge in conducting Functional Analysis 2) Reduce impact from the determination of professions competency by determining the general core competency and specific competency classified for the public and private sector and the independent	<u>Additional</u> <i>Determine the general core competency and the specific competency classified for the public and the private sector, and the independent</i>
4th Process: Making assessment tools based on occupational standards, and assess quality of tools				
	1) No classification of those who set the test papers such as academics, people in profession, and those with all-round knowledge 2) Some types of test papers do not suit the target group and are very academic	Test papers are very academic and too difficult and do not reflect the actual competency and cannot measure the Knowledge, Skill, Attribute (KSA)(L)	Avoid risk from the assessment method that does not cover KSA by determining the appropriate ratio for academic and practical test papers for professions with similar characteristics	<u>Additional</u> <i>Designate the ratio and the period appropriate for academic and practical test</i>
5th Process: Testing assessment tools with the target group, propose the endorsement board for approval				
	1) Target group for testing is not the representative. 2) Selection of examiners based on their qualifications/skills are not sufficient to perform their duties 3) Examiners and those who sit for assessment test are not specified to give feedback to improve the tools	1) Selection of the target group for assessment tool test may not constitute sufficient representation (M) 2) Process of assessment test does not reflect the assessment process that should actually take place (M)	1) Make a list of experts in each profession. 2) Determine the target group by specifying the criteria and conduct self-assessment before participate in the assessment test 3) Determine criteria and training the examiner to understanding prior to the assessment test.	<u>Additional</u> 1. <i>Self-assessment (sample and examiners), meeting/training.</i> 2. <i>Make a list of experts in each profession.</i> 3. <i>Receive feedback to improve the assessment tools from actual users.</i> 4. <i>Create benefits perception of the occupational standard.</i>

Table 2. Proposed new process for establishing occupational standards and professional qualification

Old Process	Proposed New Process
1st Publicizing the project to the target group	
1) Publicizing the projects 1.1) Determine the PR media which matches the stakeholders in the professions 1.2) Prepare and present information or evidence in cooperating or coordinating with entrepreneurs, personnel in professional group, relevant public and private sector, and general public 2) Recommend the list of individuals and agencies deemed appropriate to the institute	1) Publicizing the projects 1.1) Determine the PR media, media formats, periods, and conditions to follow up news from the publicized media 1.2) Prepare and present information or evidence in cooperating or coordinating with entrepreneurs, personnel in professional group, relevant public and private sector, and general public 2) Designate the selection conditions/criteria and ratio of agencies in professions (public, private, independent organization) 3) Designate the PR media, media format, period, conditions to follow up.
2nd Studying occupational standards of role model countries	
1) Studying and analyze information related to the target group to establish occupational standard and professional qualification 1.1) Study the occupational standard and professional qualification of the professional groups who establish the foreign occupational standard of no fewer than 3 role model countries, with at least 1 AEC member country (if available) 1.2) Example of the process to request for the certification of individual professional qualification to certify professional qualification according to occupational standard of at least 1 country 1.3) Designate and certify knowledge, ability, or competency of individuals relevant to the professional groups which establish Thai and international occupational standards currently used in Thailand	1) Studying and analyze information related to the target group to establish occupational standard and professional qualification 1.1) Study the occupational standard and professional qualification of the professional groups who establish the foreign occupational standard of no fewer than 3 role model countries, with at least 1 AEC member country (if available) 1.2) Provide example of the process to request for the certification of individual professional qualification to certify professional qualification according to occupational standard of at least 1 country 1.3) Designate and certify knowledge, ability, or competency of individuals relevant to the professional groups which establish Thai and international occupational standards currently used in Thailand

Old Process	Proposed New Process
1.4) Information relevant to occupational standard established in Thailand 1.5) Demonstrate past research works 2) Present the results of the study and the analysis 3) Recommend the names of individuals and agencies appropriate to the institute for selection and approval as the working group	1.4) Identify information relevant to occupational standard established in Thailand 1.5) Demonstrate past research works 1.6) Arrange training/workshop to provide knowledge to conduct Functional Analysis and link it to the study of foreign countries and relevant policies 2) Present the results of the study and the analysis 3) Recruitment the working group instead of selection
3rd Conducting Functional Analysis to be proposed to the endorsement board for approval	
1) Establish occupational standard using the technique of Functional Analysis by covering the work levels, from basic to advanced, and operated by: 1.1) Organize workshop and give advice to the working group to prepare the chart of job description 1.2) Determine the levels of professional qualification of each profession in accordance with Thailand Professional Qualification Framework (TPQF) according to the format of occupational standard and professional qualification as set by the institute 2) Present the results of the establishment of occupational standard and professional qualification to the endorsement board for consensus approval 3) Organize public hearing to present the results of the establishment of occupational standard and receive feedback 4) Recommend the names of at least 3 experts deemed appropriate for selection and approval as the assessors of the quality of the competency assessment tools according to occupational standard	1) Establish occupational standard using the technique of Functional Analysis by covering the work levels, from basic to advanced, and operated by: 1.1) Organize workshop and give advice to the working group to prepare the chart of job description 1.2) Determine the levels of professional qualification of each profession in accordance with Thailand Professional Qualification Framework (TPQF) according to the format of occupational standard and professional qualification as set by the institute 1.3) Determine the general core competency and the specific competency classified by the public and the private sector, and the independent. 2) Present the results of the establishment of occupational standard and professional qualification to the endorsement board for consensus approval 3) Organize public hearing to present the results of the establishment of occupational standard and receive feedback 4) Recommend the names of at least 3 experts deemed appropriate for selection and approval as the assessors of the quality of the competency assessment tools according to occupational standard
4th Making assessment tools based on occupational standards, and assess quality of tools	
1) Conduct assessment, assessment tools, and test papers used to test knowledge consisting of: 1.1) Analyze occupational standard to construct the assessment tools in each unit of competence by classifying into the tools to measure knowledge, skills, and others 1.2) Determine the assessment methods and construct the assessment tools according to the guideline of assessment in all levels of all professional qualifications according to occupational standard covering all performance criteria in the unit of competence according to occupational standard as well as answers, and in confidentiality 2) Assess the quality of the assessment tools and the test papers by no fewer than 3 experts, and in confidentiality	1) Conduct assessment, assessment tools, and test papers used to test knowledge consisting of: 1.1) Analyze occupational standard to construct the assessment tools in each unit of competence by classifying into the tools to measure knowledge, skills, and others 1.2) Designate the ratio and the period appropriate for academic and practical test 1.3) Determine the assessment methods and construct the assessment tools according to the guideline of assessment in all levels of all professional qualifications according to occupational standard covering all performance criteria in the unit of competence according to occupational standard as well as answers, and in confidentiality 2) Assess the quality of the assessment tools and the test papers by no fewer than 3 experts, and in confidentiality
5th Testing assessment tools with the target group, propose the endorsement board for approval	
1) Conduct competency assessment test as designated in the professional qualification of the target group with the established assessment tools 1.1) Designate the target group in the assessment tool test of no fewer than 3 professional qualifications, no fewer than 10 persons in each professional qualification without those sitting for the assessment to sit for the assessment in the professional qualification undergoing the assessment test except the professional group with the level of fewer than 3 professional qualifications according to occupational standard 1.2) Determine the examiners according to the examiners' qualification as certified by the institute 1.3) Conduct the competency assessment test as determined in the professional qualification 1.4) Summarize the assessment process, assessment results, and analysis of the results of competency assessment test 2) Present the summary of the assessment process, assessment results, analysis of the results of competency assessment test to	1) Conduct competency assessment test as designated in the professional qualification of the target group with the established assessment tools 1.1) Designate the target group in the assessment tool test of no fewer than 3 professional qualifications, no fewer than 10 persons in each professional qualification without those sitting for the assessment to sit for the assessment in the professional qualification undergoing the assessment test except the professional group with the level of fewer than 3 professional qualifications according to occupational standard 1.2) Conduct self-assessment (sample and examiners), meeting/training. 1.3) Determine the examiners according to the examiners' qualification as certified by the institute 1.4) Conduct the competency assessment test as determined in the professional qualification 1.5) Summarize the assessment process, assessment results, and analysis of the results of competency assessment test 1.6) Receive feedback to improve the assessment tools from actual users. 2) Present the summary of the assessment process, assessment results, analysis of the results of competency assessment test to

Old Process	Proposed New Process
<p>the endorsement board for consensus approval</p> <p>3) Recommend the name of at least 1 agency which is deemed to have the ability to serve as a certifying body of individual competency according the occupational standard to the institute with approval from the endorsement board</p> <p>4) Summarize the results of the establishment of occupational standard and professional qualification</p> <p>5) Publicize to entrepreneurs, personnel in professional group, relevant government agencies and private sector to know the results of the establishment of occupational standard and professional qualification through various media channels in total no fewer than 5 work pieces such as newspaper (size not smaller than 6 x 5 column inches), magazine, journal, internet, PR board, television, radio, and press conference, etc.</p>	<p>the endorsement board for consensus approval</p> <p>3) Recommend the name of at least 1 agency which is deemed to have the ability to serve as a certifying body of individual competency according the occupational standard to the institute with approval from the endorsement board</p> <p>4) Summarize the results of the establishment of occupational standard and professional qualification</p> <p>5) Publicize to entrepreneurs, personnel in professional group, relevant government agencies and private sector to know the results of the establishment of occupational standard and professional qualification through various media channels in total no fewer than 5 work pieces such as newspaper (size not smaller than 6 x 5 column inches), magazine, journal, internet, PR board, television, radio, and press conference, etc.</p> <p>6) Create benefits perception of the occupational standard.</p> <p>7) Make a list of experts in each profession.</p>

5.1 Discussion

Based on the significance and the background of the research problems to produce and develop the personnel in all professional fields and to have the knowledge, skill, attribute of the persons who perform work with standard and on a par with international standards, professional qualification system is therefore used to drive the standard. The professional qualification system is the center of the certification of manpower's competency according to the occupational standard in response to the needs of the industrial sectors. It is the mechanism to ensure that individuals are recognized for their ability and receive the professional qualification consistent with the competency, experience, and knowledge to use the professional qualification in the development of their profession for progress.

The 1st process involves public relations to establish occupational standard and professional qualification to the target group in the profession. The objectives and the goals of this process are to invite the professional groups to express opinions in the establishment of occupational standard and professional qualification. The study results revealed that in this process there was a low risk. That is, the manual of occupation standard determines the needs of the professional groups or industrial groups. In the beginning, the establishment of occupational standard or unit of competence for any enterprise group must start with the determination of the needs of the enterprise group or professional holder. There must be determination of the definition framework, definition, scope, economic activities, and clear goals of the needs inside and outside the enterprise group in order to devise the purpose and then formulate the action plan to meet the objectives of the enterprise group and develop the professional holders for higher outcome [7]. The determination of needs must start with Stakeholder Analysis, Cluster Analysis, Manpower Analysis, Demand-Supply Analysis, Performance Outcome Analysis, qualification certification system, certificate, curriculum, trainings, analysis of the requirements of labor standards, requirements of occupational standards, legal requirements, or professional licenses [33].

The study results revealed that in terms of risk issue, the public relations did not reach the people in the professional groups and did not cover all groups. There was risk as it was not consistent with the determined manual. Therefore, in some professional fields, there was risk and it had impact on the next process of professional standard development. The risk

analysis and assessment were conducted. The guideline of risk mitigation, risk management, and control was recommended. Therefore, the risk was at low levels. It was also found that in some professions whose operation followed the manual of occupational standard, there was no risk. Review from foreign standards indicated that the occupational standard was already established as the role model, for example, New Zealand's occupational standard and professional qualification and Australia's occupational standard and professional qualification [5].

In the 3rd process functional analysis was conducted and testing assessment tools with the target group was conducted in the 4th process. Then in the 5th process, occupational standard and professional qualification were proposed to the endorsement board for approval. The process must be systematically undertaken in detail because good outcome consisted of activities which were major and minor work combined in productivity, goods or product, and service which integrated necessary knowledge, necessary skills, and competency [3, 7, 34-36]. Functional Analysis is the analysis of profession from the brainstorming the personnel in the professional group to designate the scope of duty and work content beginning with the construction of the functional map consisting of key purpose, key role, and key function to set up unit of competency, and element of competency [37]. It causes significant risk that impacts the determination of the qualification of each profession as it is not consistent with the manual of occupational standard establishment. Therefore, it is not possible to determine the details in the occupational standard that is consistent with the actual professional groups and impact on the construction of the individual competency assessment tools according to the occupational standard. But some professional fields do not find the risk issue so it does not lead to the risk identification, risk analysis, and risk assessment.

The study was conducted to construct the management model from the initial process by assessing the situations of the likelihood of risk, and having the trend or impact which will prevent the establishment of occupational standard and professional qualification from reaching the objectives by considering the likelihood of the event and the scale of the impact. The study results revealed that all processes had the likelihood of risks, delaying the project, causing technical mistakes, and resulting in the process unable to proceed as planned. This is in line with the principles of risk assessment according to the guideline of ISO 31000:2009 [38, 39] and project risk management which is the operational risk that allows the project to complete within the set timeframe. The

risk management framework can be operated through planning, risk identification, risk analysis, planning in response to risks, monitoring and control of risk management [16], or cautious planning of risk management in appropriate process [29] The study on risk analysis and assessment, risk control and management indicated that the project will meet with success with recommendation of the occupational standard process so as to find the appropriate procedure or process as summarized in project risk management [16, 22, 28].

The key result of this paper found that the first process must be precise because it will affect the next process. Some professions, there was no risk because the review of the past research from foreign standards and the occupational standard was already established as the role model. It shows that many countries recognize the importance of creating professional standards.

6. CONCLUSIONS AND RECOMMENDATION

6.1 Conclusions

Based on the establishment of the occupational standard and professional qualification process in the professional field relevant to environmental work, our research aims (1) to conduct risk assessment and develop the processes of establishing occupational standards and professional qualification related to environmental works, (2) to propose risk management guideline for the processes of establishing occupational standards and professional qualification related to environmental work, and (3) to propose the processes of establishing occupational standards and professional qualification acquired after the improvement of existing process for more efficiency were achieved. Additional steps for improvement for all 5 processes were recommended:

The 1st process: Publicizing the project to the target group: Additional: (1) Designate the conditions/criteria of selection and ratio of the agencies in the professions (public, private, independent organizations); (2) Designate the public relation media, media format, period, conditions of monitoring the reception of news from the publicized media.

The 2nd process: Studying occupational standards of role model countries: Additional: (1) Organize workshop training to provide knowledge in conducting the Functional Analysis and then linking with the foreign studies and relevant policies; (2) Recruit of the working group instead of selection.

The 3rd process: Conducting functional analysis to be proposed to the endorsement board for approval. Additional: Designate the general core competency (general) and the specific competency classified for the public and the private sectors, and independent organizations, etc.

The 4th process: Making assessment tools based on occupational standards, and assess quality of tools: Additional: (1) Determine the appropriate ratio and duration of academic and practical test papers; (2) Conduct self-assessment (the sample and the examiners), meeting/training held to come to common understanding before the assessment test.

The 5th process: Testing assessment tools with the target group, propose the endorsement board for approval: Additional: (1) Set up the database of the list of experts in each profession (2) Determine the reception of feedback to improve the assessment tools from real users (3) Create benefits

perception of the occupational standard.

6.2 Recommendation

We expected that the outcome of this research would enhance the changes and movement forward to the implementation of environmental work made by environmental related personnel. These personnel would be able to perform their tasks efficiently, in compliance with competencies and performance criteria and provide to user such as Thailand Professional Qualification Institute (Public Organization), Ministry of Labor, Ministry of Education, vocational, formal, non-formal, Ministry of Higher Education, Science, Research and Innovation, Ministry of Industry, Ministry of Natural Resources and Environment, etc., with benefit to the Thai social and working standard. This research work contributes significantly to the achievement of sustainable development goals (SDGs) at least in 3 goals, i.e., Goal 4 quality education, Goal 8 decent work and economic growth and Goal 17 partnerships for the goals.

If the results of this research are to be further expanded, the possibility of allocating additional resources such as time, personnel and related resources should be considered. This may have an outcome and impact on various factors such as more working steps from all processes, increasing of duration time to operate, and necessary manpower and budget.

Future research should focus on utilization of the occupational standard and professional qualification which respond to the needs of a particular professional group, whether they correspond to the required competency and whether the relevant agencies and professional groups can utilize them to develop the country's manpower, education, enhanced development and modified instruction curriculum in line with the demand of entrepreneurs. These people can work efficiently and appropriately to their competency and proper performance criteria.

REFERENCES

- [1] Office of Natural Resources and Environment Policy and Planning. (2008). 2008 Annual Report. <http://fd.forest.go.th/th/wp-content/uploads/2010/07/yearlypaper2551.pdf>, accessed on Apr. 4, 2023.
- [2] Ministry of Industry. (2016). The Achievement in implementation of the Government Policy and industrial Strategy Fiscal Year 2016. https://www.industry.go.th/web-upload/file_download.pdf, accessed on Feb. 2, 2017.
- [3] National Qualifications Framework Committee. (2017). "(Draft) National Qualifications Framework revised version" In the meeting No. 1/2017 on 9 January 2017. https://www.cedefop.europa.eu/files/4163_en.pdf.
- [4] TRIS Corporation Limited. (2020). The research project to drive manpower development with professional qualification towards the outcome and impact on the educational sector. Bangkok.
- [5] Thailand Development Research Institute. (2017). Project to Review and Formulate the Strategic Plan of Thailand Professional Qualification Institute 2017-2021. Bangkok: Thailand Professional Qualification Institute (Public Organization).
- [6] The order of Thailand Professional Qualification Institute Committee no.262-271/2018, titled the Appointment of the Occupational Standards and

- Professional Qualification Sub-Committee.
- [7] Thailand Professional Qualification Institute (Public Organization). (2022). Occupational Standard and Professional Qualification Manual. Bangkok: Thailand Professional Qualification Institute (Public Organization).
- [8] Althaus, C., Bridgman, P., Davis, G. (2007). The Australian Policy Guidance (4th ed.), https://www.google.co.th/books/edition/Public_Affairs_and_Administration_Concept/, accessed on Feb. 2, 2022.
- [9] SW. (2009). Risk management – Principles and guidelines ISO 31000:2009. Standards Switzerland ISO. <https://www.iso.or>, accessed on Feb. 2, 2022.
- [10] Lindley, D.V. (2006). Understanding Uncertainty, 11th edition. New Jersey: Hoboken.
- [11] Kindinger, J.P., Darby, J.L. (2000). Risk factors analysis: A new qualitative risk management tool proceeding of the project management institute annual seminar and symposium, September 7 – 16, 2000 Houston, Texas.
- [12] ISO. (2009). Risk management—Vocabulary. Guide 73:2009.
- [13] ISO. (2009). Risk management—Principles and Guidelines. ISO 31000:2009.
- [14] Aven, T. (2016). Risk assessment and risk management: Review of recent advances on their foundation. *European Journal of Operational Research*, 253(1): 1-13. <https://doi.org/10.1016/j.ejor.2015.12.023>
- [15] Kolluru, R.V. (1994). Risk assessment and management. In *Environmental Strategies Handbook: A Guide to Effective Policies and Practices*. New York: McGraw-Hill.
- [16] Henry, D. (2002). SDLC Project Management Risk Management Standards Version 1.1 Information Management Branch.
- [17] Hulett, D.T. (2001). Key characteristics of a mature risk management process. In *Proceedings of the Fourth European Project Management Conference, PMI Europe 2001 June 67 London*.
- [18] Zelenáková, M., Zvijáková, L. (2017). Risk analysis within environmental impact assessment of proposed construction activity. *Environmental Impact Assessment Review*, 62: 76-89. <https://doi.org/10.1016/j.eiar.2016.10.003>
- [19] Aven, T. (2012). The risk concept—historical and recent development trends. *Reliability Engineering & System Safety*, 99: 33-44. <https://doi.org/10.1016/j.res.2011.11.006>
- [20] Kaemkate, W. (2008). *Research Methodology in Behavioral Sciences*. Bangkok: Chulalongkorn University Printing House.
- [21] Naiphat, O. (2008). *Quantitative and Qualitative Research Methodologies in Behavioral and Social Science*. (3rd publication). Bangkok: SE EDUCATION Public Company Limited.
- [22] Sangan Changchat. (2004). *Project Risk Management*. School of Accountancy, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah Darul Aman, *Malaysia Science*, 50: 958-967.
- [23] Chantavanich, S. (2010). *Methods of Qualitative Research* (18th publication). Bangkok: Chulalongkorn University Printing House.
- [24] The Glasgow School of Art. (2023). Basic principles of risk assessment. <https://www.gsa.ac.uk/media/1023317/Basic-Principles-of-Risk-Assessment-Guidance.pdf>, accessed on Apr. 4, 2023.
- [25] Aven, T., Flage, R. (2017). *Risk Assessment with Broad Uncertainty and Knowledge Characterisations: An Illustrating Case Study*. Knowledge in Risk Assessments. Aven T, Zio E, editors. NY: Wiley.
- [26] SRA. (2015). Glossary society for risk analysis. <http://www.sra.com/resources>, accessed on Aug. 14, 2015.
- [27] Vanem, E. (2012). Ethics and fundamental principles of risk acceptance criteria. *Safety Science*, 50(4): 958-967. <https://doi.org/10.1016/j.ssci.2011.12.030>
- [28] Project Management Process Improvement Office. (2003). *Project Risk Management Handbook* Sacramento, California.
- [29] PMI Europe. (2001). *Managing and Modeling Project Risk Dynamics: A System Dynamics – Based Framework*. In the 4th European PMI Conference, London, UK.
- [30] Chantavanich, S. (2009). *Data Analysis in Qualitative Research* (9th publication). Bangkok: Chulalongkorn University Printing House.
- [31] Veland, H., Aven, T. (2015). Improving the risk assessments of critical operations to better reflect uncertainties and the unforeseen. *Safety Science*, 79: 206-212. <https://doi.org/10.1016/j.ssci.2015.06.012>
- [32] Krejcie, R.V., Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3): 607-610. <https://doi.org/10.1177/001316447003000308>
- [33] Hauxwell, J. (2002). A national vocational qualification in the operating theatre: Participants' perspectives on its effects on staff relationships. *Journal of Vocational Education and Training*, 54(4): 477-496. <https://doi.org/10.1080/13636820200200210>
- [34] Galloway, P. (2015). Using functional analysis in archival appraisal: A practical and effective alternative to traditional appraisal methodologies. *The American Archivist*, 78(2): 588-591. <https://doi.org/10.17723/0360-9081.78.2.588>
- [35] Riel, M. (1992). A functional analysis of educational telecomputing: A case study of learning circles. *Interactive Learning Environments*, 2(1): 15-29. <https://doi.org/10.1080/1049482920020103>
- [36] Watson, T.S., Ray, K.P., Turner, H.S., Logan, P. (1999). Teacher-implemented functional analysis and treatment: A method for linking assessment to intervention. *School Psychology Review*, 28(2): 292-302. <https://doi.org/10.1080/02796015.1999.12085966>
- [37] Stewart, J., Sambrook, S. (1995). The role of functional analysis in national vocational qualifications: A critical appraisal. *British Journal of Education and Work*, 8(2): 93-106. <https://doi.org/10.1080/0269000950080207>
- [38] Rovins, J.E., Wilson, T.M., Hayes, J., Jensen, S.J., Dohaney, J., Mitchell, J., Johnston, D.M., Davies, A. (2015). *Risk Assessment Handbook*. <https://www.researchgate.net/publication/290883771>, accessed on Apr. 4, 2023.
- [39] Stippich, W.W. (2015). 4 COSO risk assessment principles of the 2013 framework. <https://www.corporatecomplianceinsights.com/the-4-risk-assessment-principles-of-the-coso-framework>, accessed on Apr. 17, 2023.