UNIVERSITI PUTRA MALAYSIA

RISK GOVERNANCE FRAMEWORK ON RADIOLOGICAL EMERGENCY, PREPAREDNESS AND RESPONSE FOR EMERGENCY RESPONDERS BASED ON A MIXED METHODS STUDY

ANITA BINTI ABD RAHMAN

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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Risk governance which encompasses processes and mechanisms as how decisions about risks are taken and implemented has become increasingly common, particularly in industries with established hazards. Nonetheless not much research explains risk practices and relation to governance in radiological emergency. Therefore, this study was conducted to determine influencing factors on emergency responder risk practices, exploring the view of governance founded on interviews and framing the overall governance in radiological emergency preparedness and response.

A mixed methods study comprising of a cross-sectional study through self-administered questionnaire was conducted among 229 emergency respondents from related organisations. The qualitative approach adopted an in-depth interview from 6 purposedly sampled key informants. The quantitative analysis used multiple logistic regression to determine significant predictors. The qualitative data analysed transcripts via NVivo version 12 and through abductive coding, emerging themes were identified. Subsequently, both findings were converged to answer the research objectives and informed the development of a radiological risk governance framework.

A total of 226 out of 229 respondents participated the questionnaire session, giving a response rate of 94.9 percent. The multiple logistic regression concluded seven independent variables with significant positive odds and was able to explain 57.9% of the variances for high score radiological risk practices. The variables were working in radiological related organisation (aOR=3.662, 95% CI: 1.147, 11.692; p=0.028), Risk Perception (aOR=1.170, 95% CI: 1.024, 1.338; p=0.021), Risk Management Proficiency (aOR=1.143, 95% CI: 1.037, 1.260; p=0.007), Decision Making (aOR=1.052, 95% CI: 1.001, 1.105; p=0.045), Evaluation on the Government (aOR=1.190, 95% CI: 1.100, 1.289; p<0.001), Cultural Values (aOR=1.176, 95% CI: 1.072, 1.291; p=0.001), and

Risk in Context (aOR=1.061, 95% CI: 1.001, 1.127; p=0.049). For qualitative analysis, six themes emerged where structure, radiological plan, operation, risk management practices, governance and knowledge management represented in thematic network diagram. Lastly, both findings facilitated the framing of radiological risk governance relevant for emergency responders.

Respondents from radiological related organisation had higher odds practices as their core business is specific into radiation related field. While more than two-third had high risk perception, only one third felt they were proficient in radiological risk management. This shows the need for continuous learning and training to further enhance responders understanding on potential hazards in an impacted area, how to protect people while optimizing the radiological best practices. More than two third of respondents would like to be involved in decision making as they are the one responding in actual event. Additionally, trust and evaluation of the government were important as this demonstrates leadership role. Interestingly, culture was also, and this can be seen from two angles, the cultural based on traditional value and from the organisation culture perspective. Therefore, the right culture to support risk management is an important ingredient for enhancing radiological risk practices.

This study highlighted seven factors that influenced emergency responder risk practices in radiological EPR. Through data integration, it provided inputs for improvement on the existing risk practices and the diagrammatic radiological risk governance framework is hoped to be able to add further value in appreciating the overall findings.

Keywords: governance; risk practices, radiological; emergency, preparedness, response

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KERANGKA GOVERNAN RISIKO MENGENAI KESIAPSIAGAAN DAN TINDAKBALAS KECEMASAN RADIOLOGIKAL DI KALANGAN RESPONDER KECEMASAN BERDASARKAN KAJIAN KAEDAH CAMPURAN

Oleh

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Tadbir urus atau governan risiko merangkumi proses dan mekanisme yang melibatkan bagaimana keputusan mengenai risiko diambil dan dilaksanakan menjadi semakin lazim, terutamanya dalam industri dengan bahaya yang telah dikenalpasti. Walaupun begitu, tidak banyak kajian yang menerangkan amalan risiko dan hubungannya dengan tadbir urus dalam kecemasan radiologi. Oleh itu, kajian ini dilakukan untuk menentukan faktor yang mempengaruhi amalan risiko responden kecemasan, meneroka tadbir urus berdasarkan temubual serta merangka keseluruhan tadbir urus dalam kesiapsiagaan dan tindak balas kecemasan radiologi.

Kajian kaedah campuran digunakan dimana kajian keratan rentas melalui soal selidik telah dilakukan di kalangan 229 responden kecemasan dari berbagai organisasi. Manakala kajian kualitatif menggunakan 6 informan utama dikenalpasti bagi menjalani sesi temubual. Analisa kajian keratan rentas telah mengguna regresi logistik berganda untuk menentukan peramal yang signifikan yang membentuk model regresi. Data kualitatif menganalisis transkrip menggunakan NVivo versi 12. Seterusnya, kedua-dua penemuan kuantitatif dan kualitatif disatukan untuk menjawab persoalan kajian dan memudahcara merangka governan risiko radiologikal.

Sejumlah 226 daripada 229 responden tealh menjawab soal selidik, memberikan kadar respons sebanyak 94.9%. Regresi logistik berganda mendapati tujuh pembolehubah yang signifkan dengan ods positif dan menjelaskan 57.9% varians terhadap amalan risiko radiologi. Pembolehubah tersebut adalah bekerja dalam organisasi berkaitan radiologi (aOR=3.662, 95% CI: 1.147, 11.692; p=0.028), Persepsi Risiko (aOR=1.170, 95% CI: 1.024, 1.338; p=0.021), Kemahiran Pengurusan Risiko (aOR=1.143, 95% CI: 1.037, 1.260; p=0.007), Membuat Keputusan (aOR=1.052, 95% CI: 1.001, 1.105;

p=0.045), Penilaian terhadap Kerajaan (aOR=1.190, 95% CI: 1.100, 1.289; p<0.001), Nilai Budaya (aOR=1.176, 95% CI: 1.072, 1.291; p=0.001), dan Risiko dalam Konteks (aOR=1.061, 95% CI: 1.001, 1.127; p=0.049). Bagi analisis kualitatif, enam tema muncul di mana struktur, pelan radiologi, operasi, amalan pengurusan risiko, tadbir urus dan pengurusan pengetahuan yang dipetakan dalam rajah rangkaian tematik. Akhir sekali, berdasarkan kedua-dua kaedah membantu dalam merangka governan risiko radiologikal.

Responden daripada organisasi berkaitan radiologi memiliki amalan praktik yang lebih tinggi kerana mereka khusus dalam memastikan kesiapsiagaan terhadap kecemasan dan respon radiologi, Walaupun lebih dua pertiga responden mempunyai persepsi risiko tinggi, hanya satu pertiga merasakan mereka mahir dalam pengurusan risiko radiologi. Ini menunjukkan keperluan pembelajaran dan latihan secara berterusan untuk meningkatkan pemahaman responden mengenai bahaya di kawasan yang terkena impak radiologi, bagaimana melindungi masyarakat dan mengoptimumkan amalan terbaik dalam kesiapsiagaan dan kecemasan radiologi. Lebih dari dua pertiga menyatakan bahawa mereka ingin terlibat dalam membuat keputusan kerana mereka adalah orang yang terlibat dalam memberi respons. Tambahan pula, kepercayaan dan penilaian terhadap kerajaan juga penting kerana ini menunjukkan peranan kepemimpinan. Menariknya, budaya juga signifikan, dan ini dapat dilihat daripada dua sudut iaitu berdasarkan tradisi budaya dan perspektif budaya organisasi. Oleh itu, budaya yang menyokong pengurusan risiko adalah bahan penting untuk meningkatkan amalan risiko radiologi.

Kajian ini menunjukkan tujuh faktor yang mempengaruhi amalan risiko responden terhadap kecemasan dan kesiapsiagaan radiologi. Melalui integrasi data, input dalam menambahbaik praktik risiko sedia ada dan kerangka goveran risiko radiologi diharapkan dapat memberi nilai tambah dalam memberi konsolidasi dapatan keseluruhan kajian.

Kata-kata kunci: governan, amalan risiko, radiologikal, kecemasan, siapsiaga, tindakbalas

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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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LIST OF ABBREVIATIONS

AELB	Atomic Energy Licensing Board
AMAN	*Anak Malaysia Anti Nuklear*
aOR	Adjusted Odds Ratio
BKRP	Medical Radiation Regulatory Division *Bahagian Kawalselia Radiasi Perubatan*
BNM	Bank Negara Malaysia
CAP	Consumer Association of Penang
CBRNe	Chemical Biological Radiological Nuclear explosive
CDC	Centres for Disease Control and Prevention
CEP	Continuous Education Point
CI	Confidence Interval
COREQ	Consolidated Criteria for Reporting Qualitative Studies
cOR	Crude Odds Ratio
COVID-19	Coronavirus Disease 2019
DOSM	Department of Statistic Malaysia
EPR	Emergency Preparedness and Response
FINERMAPS	Feasible, Interesting, Novel, Ethical, Relevant, Manageable, Appropriate, Potential value, Publish-ability, Systematic
GSG	General Safety Guide
GSR	General Safety Requirement
HADR	Human Assistance Disaster Response
HAZMAT	Hazardous Material Team
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection

IDI	In-depth Interview
ILO	International Labour Organisation
IQR	Inter Quartile Range
IRGC	International Risk Governance Council
IT	Information Technology
KMS	Knowledge Management System
MARPA	Malaysian Radiation Protection Association
MCCG	Malaysian Code of Corporate Governance
MLR	Multiple Logistic Regression
MMR	Mixed Method Research
MNA	Malaysian Nuclear Agency
MNS	Malaysian Nuclear Society
MOH	Ministry of Health
MOSTI	Ministry of Science Technology and Innovation
MREC	Medical Research Ethics Committee
NADMA	National Disaster Management Agency
NGO	Non-Governmental Organisation
NIH	National Institute of Health
NREP	Nuclear Radiation Emergency Preparedness
NSC/	National Security Council
MKN	*Majlis Keselamatan Negara*
NDT	Non-Destructive Testing
NMRR	National Medical Research Register
NORM	Naturally Occurring Radioactive Materials

OECD	Organisation for Economic Cooperation and Development
OSH	Occupational Safety and Health
PBT	*Pihak Berkuasa Tempatan/* Local Authority
PNKB	*Pasukan Nuklear Kimia Biologikal*/Nuclear Chemical Biological Team
RIC	Risk in Context
RAM	Radioactive Materials
RMP	Royal Malaysian Police
ROC	Receiver Operating Curve
RRP	Radiological Risk Practices
3S	Safety, Security, and Safeguard
SD	Standard Deviation
SDG	Sustainable Development Goals
SLR	Simple Logistic Regression
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SPSS	Statistical Package for Social Science
STEAM	Science, Technology, Engineering, Arts and Mathematics
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
TCV	Total score of Culture Values
TDM	Total score of Decision Making
TIC	Toxic Industrial Chemical
TEG	Total score of Evaluation in the Government
TRRP	Total score of Radiological Risk Practices

TRMP	Total score of Radiological Management Proficiency
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WHO	World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Background

Decision making, an integral part of human existence is usually based on certain factors for example, one owns perception, culture and value preferences that act as guides on how we live our life. However, this process can become rather complex when people get together forming a group for example, in workplace organisation. Dawning from a Latin word 'gubernare' which basically means to control or spearhead, governance can be further defined as structures and processes that are designed on how organisation is controlled and operates, and the mechanisms to ensure accountability (Governance Institute of Australia, 2022). This is a needed entity to facilitate the process of management so that people can come together to decide collectively and accomplished successful goals or outcomes.

Over the years, the term governance has been part of common parlance for decades, emerging as a new organising concept in administration and management. It has since evolved of being traditionally controlled by the government; to a more diversified approach as current political decision on public management are influence by other stronger factors such as the social will, economy, and international movement such as the corporate and environmental sectors. As such various definition and principles emerges but the general pillars of good governance include lawfulness, accountability, transparency, integrity, economic and financial sustainability, and model organisation (Németh, 2016). Example of organisation implementing governance are the corporate, another institution that benefited the use of governance practice is the healthcare sector where it has been shown that better governed countries tend to have healthier populations thus suggesting the association between governance and health systems (Mitchell & Bossert, 2010). Moreover, as scientific knowledge becomes more closely aligned with economic and political power, governance has gained popularity and become more broader in taking into account the structural complexity (organisational and technological), with associated differentiation and interdependencies, (Baccarini 1996) risk and uncertainty (Williams 1999); hence created various other terminology based on organisation approach such as corporate governance, public governance as well as the term risk governance.

One particular area where governance is gaining popularity is in the working sectors that uses certain material known to be hazardous and has the potential to cause disaster if not managed properly, for example the World Health Organisation (2012) has developed a document entitled 'Rapid Risk Assessment of Acute Public Health Events' as a guidance for systematic process of rapid and defensible decision-making in dealing with hazardous event such as biological, chemical as well re-emerging diseases while Schmidt et al., 2013 adopted this concept in order to challenges in vector-borne disease for better and effective management. Risk governance has been defined as system of

rules, practices, and standards that guide an organisation in identifying potential hazards and acting to reduce or eliminate their impact. In these organisations, the term risk governance was more preferred as it involves in the translation of the substance and core principles of governance to the context of risk and risk-related decision making of the organisation as it is more specific than the general terminology of governance (van Asselt & Renn, 2011). In other words, risk governance should encompass the structural component of the corporate governance, the systematic operation through risk management as well as complying with regulatory requirement.

Of particular interest, risk governance has pertinent role in the technology use of radioactive material (RAM) in various field due to its potential for global impact. Taking into example Klang Valley as being the heart of Malaysia with Kuala Lumpur as it centre township including it adjoining cities and town in the state of Selangor has been rapidly developing in terms of infrastructure and population as well as industries that uses RAM. Moreover, it also houses the governmental administrative offices for which preparedness towards any emergency event remain crucial in maintaining national safety and security. To date RAM usage in Malaysia is not specifically for health and disease management in laboratory facilities for the purposes of science and technology but has fan out to penetrate the industrial and agricultural/farmed based sectors in response to the 'Green Revolution' that emphasized on the use of agrochemical, water management and irrigation systems to promote higher yielding plant varieties and longer food preservation (Khairuddin, 2003). Additionally, since the year 2009, Malaysia has decided for nuclear energy to be considered as one as the possibility of becoming the future leading sustained source of carbon-free electricity supply post-2020 especially for Peninsular Malaysia, thus reshaping a cleaner energy revolution. Even though much advancement has been achieved through this technology, its full uses remain debatable as the dreaded perceived risk of using nuclear power toppled with countries that has experienced disaster relating to it has always outweigh its potential benefits. This further posed challenges in introducing the technology into one's country. On the other hand, Malaysia has always been proactive in planning for the future. Strategies, approaches, management, and responsible organisation have been developed and coordinated to issues related to RAM such as public health activities related to health emergency and disaster preparedness, response, and recovery. The recent 2011 Fukushima triple disaster was an eye opener as it was reported that their governance somehow failed and emphasizes greater importance of having good risk governance for the country's national and regional disaster preparedness and response (Tosa, 2015). The effect of this Japan disaster experience has even altered Malaysia nuclear power plant planning and it was decided and announced by the past Minister in the Prime Minister's Department Datuk Nancy Shukri that any decision pertaining to plans to develop the nation's first two nuclear power plants will only be decided after the year 2030 (Carvalho, 2016). This is a good lesson learned to assess our own emergency responder radiological risk practices which can be defined as the practice of systematically thinking about all possible outcomes before it happens and defining procedures to accept, avoid, or minimize the impact of risk (CDC, 2006) and how they perceived and judge risk governance especially in the field of radiological EPR.

In Malaysia, the use of RAM cannot be underestimated as this particular technology has generally gained popularity over the century. As of 2019, more than 4000 licenses have been registered with our regulatory bodies for industrial use as well as for medical purposes (AELB, 2019 & MOH 2019). To gain some ideas Table 1.1 listed some industrial that uses RAM and its specific purpose.

Table 1.1 : Summary of certain industries and its purpose use of radioactive materials

Industry		Purpose
Mining Oil and Gas Construction		Non-destructive testing (NDT) to measure depth and thickness, detect oil and assess leaks and crack in piping system.
Medical (radiology, nuclear medicine)	-	Investigation, diagnosis and treatment on certain condition; example: tumour/cancer management.
Sterilization	-	Material/products are free form microorganisms.
Gauging	-	Dimensional measurement of an object.
Research	-	Academic purposes in physic and science.

Owing to the rapid development of RAM use/activities in Malaysia which require effective control, enforcement as well as ensuring safe and peaceful use, the Atomic Energy Licensing Act came into establishment in 1984 (Act 304, 1984). Currently, the available radiological framework focuses on the legislative as well as organisational component with minimum information on risk practices and community involvement. Having better understanding on how emergency responders perceive risk and what factors influence radiological risk practices such as gender, working sectors, risk proficiency trust and others that focus specific on individuals is due timely because it considers dynamic elements that may have an impact on the present framework. This is different from risk management as the latter has more on a conceptual overview on systematic method that enable organisations to minimize risk (Governance Institute of Australia, 2022). Thus, it is thought that this type of research needs further explanation and is deemed necessary in evaluating the risk governance that are in place for radiological emergency management. At the same time, identifying the relation and influences on how emergency responders perceive risk governance framework which is supposed to be a conceptual or realistic structure that provide guidance and practices to cope with radiological emergencies (IRGC, 2017) and hopefully be of certain value in customising our own action mechanism in future decision making.

1.2 Problem Statement

In the context of health and safety, the concept of risk involves value judgments that reflect much more than just the probability and consequences of the occurrence of an event (Slovic, 2001).

Legislatively, any activity related to RAM fall under the Atomic Energy Licensing Act, 1984 which also covers the Basic Safety Radiation Protection (BRP) Guideline 2010. In addition, the National Security Council (NSC) Directive No. 20 emphasize on the policy and mechanism of an integrated management system for disaster and relief management on land which include radiological emergencies at the stage of pre, during and post disaster as well as determining roles & responsibilities of various agencies involved in disaster management.

Operationally, there are two ministries involved in matters related to usage of radioactive materials or nuclear technology: the Ministry of Science, Technology, and Innovation (MOSTI) and the Ministry of Health (MOH). For most of the activities related to non-medical application of radioactive materials it falls under the jurisdiction of the Atomic Energy Licensing Board (AELB) whilst the control of application in medical field is still under the purview of the Ministry of Health (MOH). This unique dual collaboration in enforcing one act for example in radiological EPR, the lead technical agency is AELB whilst MOH becomes the medical responder need to be further studied in assessing the risk governance, identify challenges and opportunity for future improvement. At the moment, the available framework concentrates on own organisation and operational scope and there is no risk governance framework that can reflect comprehensive relation among organisation and properly serve as a guide to cope with risk (IRGC, 2017).

Based on existing data, there are approximately 1362 licensees for radiological use in the industrial sectors (AELB, 2019) while there are 4337 licensees in the medical sectors (MOH, 2019). This shows that while RAM is becoming more common to be used in both sectors for various beneficial intention that is supposed to be supporting the economic growth and improving health of the nation's population, its detrimental effects should there be misused still exist. As a result, effective control, enforcement as well as ensuring safe and peaceful use becomes a cornerstone in optimizing its overall use.

Apart from that, under the Radiological Emergency Preparedness and Response Training and Capability Development in Southeast Asia, it was concluded that country still had issues related to radiological EPR and need to improve the integration of the radiological response into an all-hazards approach and related inter-agency interoperability (Regional Security of Radioactive Sources Project, ICRP 2012). This thus promote the use of risk management approach into the governance framework.

Furthermore, effort in creating safer and healthier life not only involved workplace setting but has extended to societal involvement where community perceptions of risk have been found to play an important role in determining the priorities and legislative agendas of regulatory bodies. One can view public involvement as being good as it is supposedly promoting empowerment, on the other hand, public resistance can create even more damaging effect if not tackle appropriately. In the topic of radiation, when the use is for the purpose of medicine-related purposed such as disease investigation and treatment modality, community are able to accept the risk it poses but for any other reason for example as an energy source, it has been stigmatised as entailing unnaturally

great risk. However, not much is known as how far community is participating and being engage in terms of radiological EPR. In turn, the planning and evolving into newer technology such as management of low level of naturally occurring radioactive materials (NORMS) which has lesser risk compared to medical use or the implementation of incinerator has been laborious. It is now known that incorporating community into governance framework is necessary as this complement the structures and processes for decision making at a community level.

It has also been shown by previous study that lack of a governance operating model may lead to an incomplete or faulty governance structure, or to inconsistencies, overlaps, and gaps among governance mechanism (Bello, Bustamante & Pizarro, 2021). Therefore, having a proper framework encompassing relevant factors, areas and people is an important key success especially in radiological EPR.

1.3 Significance of Study

Laypeople's perception on radiological risk which perhaps, is based on biases, ignorance or inadequate knowledge cannot be translated directly and taken into consideration for any governmental decision. At the same time, however, these perceptions reflect the real concerns of people and include the undesirable effects that 'technical' analyses of risk often miss. This research is thought to be among the pioneer especially in the context of radiological risk governance. One of the strengths that has been put forward in this research is that it tried to understand in-depth the emergency responder conceptualization of risk and governance which has rich information than that of experts and reflects legitimate concerns that are typically overlooked from expert risk assessments. Concurrently, the breath of the related factors on risk governance by including all relevant players was also determined on how it is being practised in a multilevel governance context where decision making at local scale is handled by higher decision at national and regional level (Wilbanks et al. 2007). In addition, it attempted to look at risk governance in terms of dual management or ownership and try to identify its strength and weaknesses especially in terms of enforcement, radiological EPR and interagency collaboration. This hopefully provide information for rooms of improvement.

The convergent of both approach in terms of qualitative and quantitative analyses which represent a comprehensive research methodology. This methodology also known as mixed method design encourages the two methodological approaches into a single study will hopefully strengthen the research as being whole and comprehensive (Creswell, 2007) and thus able to provide gaps on better ways to harmonise into having an efficient, integrative risk governance that could be in future, an example for other countries to follow. Lastly it serves as a purpose of increasing information in the body of knowledge on radiological risk governance and a reference basis for future research in similar discipline area.

1.4 Research Questions

Before beginning any research, formulating a research question in necessary to highlight why this study is important to be conducted and serve as the guiding point to investigate as well as to explain issue that needs to be highlighted for more inquiry. One needs to begin by identifying the subject of interest and then do preliminary research on that subject. Rattan et al., 2019 mentioned a good research question should have the following acronym 'FINERMAPS' characteristics of being feasible, interesting, novel, ethical, relevant, manageable, appropriate, potential value, publish-ability, and systematic.

Over the last 10 years, the area of radiation safety and health as well as its emergency preparedness and response has become more relevant as it uses increases. As mentioned earlier, governance that has certain regime of norms, arrangements are an important implementation in any organisation to be successful, however how much the concept of risk being used is something that need to be explained. Generally corporate governance which encompasses the organisational concept is in placed in majority of industries and to date industries in Malaysia that deals with known hazards and has a clear explanation on the use of risk governance is in the banking and insurance sectors. Little is known as to how much it is being practice is RAM related industries. At the same time, issues highlighted as the research problems which include dual ownership of legislative role, multiagency involvement and coupled with current move from international organisation that promotes the use of such entity to strengthen the aspect of safety, security and safeguard in RAM usage need much attention.

By understanding what the current practice is in particular towards radiological emergency, preparedness and response (EPR) and formulising a customized risk governance for was seen beneficial for current and future practices. Therefore, the proposed research questions were as below:

a. What are the factors that influence emergency responder practices in radiological EPR?
b. How does the emergency responder perceive risk governance on radiological EPR?
c. What risk governance framework can be develop based on the convergent of the qualitative and quantitative findings?

1.5 Research Objectives

The research objectives were proposed as follows:

1.5.1 General Objective

To determine influencing factors on risk practices and framing the risk governance on radiological EPR among emergency responders in Klang Valley using a mixed methods approach.

1.5.2 Specific Objectives

The distinct objectives based on different research methods were constructed as below:

Quantitative study:

i. To measure the association of studied factors (sociodemographic, occupational factors, risk perception, proficiency, cultural, social, ethical values, decision making and trust) on emergency responder practices in radiological EPR in Klang Valley.

ii. To determine the predictors on emergency responder practices in radiological EPR in Klang Valley.

Qualitative study:

iii. To explore emergency responder's perception on risk governance in radiological EPR in Klang Valley.

Mixed methods study:

iv. To frame risk governance based on the convergent findings on radiological EPR for emergency responders in Klang Valley.

1.6 Research Hypothesis

For the first two objective which was to explain emergency responders' factors on risk practices in radiological EPR was determined through quantitative statistical analyses with research hypothesis as below:

- There is a significant relationship between studied factors (sociodemographic, occupational factors, risk perception, proficiency, cultural, social, ethical values, decision making and trust) on emergency responder practices in radiological EPR in Klang Valley.

Subsequently, the third objective was to establish a risk governance framework on radiological EPR for emergency responders in Klang Valley through data integration and convergence on the quantitative and qualitative research designs.

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