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Keywords	nuclear power, risk perception, government trustworthiness, nuclear safety governance, cross-border nuclear safety, Guangdong China, cross-border region
JEL Classification	D81, Q42, Q48

Contact jcklam@eee.hku.hk
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What Predicts Government Trustworthiness in Cross-border HK-Guangdong Nuclear Safety Emergency Governance?

Yang Han[1], Jacqueline CK Lam[1, 2, 3*], Peiyang Guo[1,] Zhonghua Gou[4]

[1]Department of Electrical and Electronic Engineering, the University of Hong Kong

[2] Energy Policy Research Group, Judge Business School, the University of Cambridge, the United Kingdom

[3] MIT CEEPR, MIT, Cambridge, MA, USA

[4] Griffith University, Brisbane, Australia

Highlights:

• Public perception towards cross-border HK-Guangdong NSEG investigated.

• Key dimensions that explain and predict government trustworthiness towards NSEG identified.

• Important policy implications on the HK's nuclear safety and development proposed.

Abstract. China has drawn up ambitious plans in nuclear power development. After the Fukushima crisis, the HK public has expressed serious concerns about the nuclear power plants in the cross-border Guangdong area. We conducted a randomized survey of 1032 HK respondents to identify the key factors that predict HK Government's trustworthiness (GT), with regard to nuclear safety emergency governance in a cross-border context. Our result shows that the perceived benefit of nuclear power is positively associated with GT, while risk perception about nuclear power technologies, expected engagement in emergency planning, and average monthly income are negatively associated with GT. We also find that knowledge about nuclear technology and safety has no effect on GT. This contradicts

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the common view that educating the public about nuclear safety and technology will increase public trust. Further, we find that HK respondents prefer engaging with local experts than international/Guangdong authorities. To build trust in NSEG, HK Government should direct attentions towards improving public understanding on the significance and contribution of nuclear power in overall electricity generation in HK, reducing public fears of nuclear power technologies, and ensuring appropriate level of engagement with HK stakeholders. Our proposed methodology can be transferrable to other cross-border contexts.

Keywords: nuclear power; risk perception; government trustworthiness; nuclear safety governance; cross-border nuclear safety, Guangdong China, Cross-border Region

1. Introduction

Despite the occurrence of catastrophic nuclear accidents in Chernobyl and Fukushima, nuclear power continues to be developed in most parts of the world, especially in China, due to the increasing demands for energy security and climate change mitigation. Five years after the Fukushima disaster, the 2016 statistics show that 450 nuclear power reactors are in operation and 60 reactors are under construction around the world (International Atomic Energy Agency (IAEA), 2016). In China, rapid socio-economic development, population growth, energy security, and environmental concerns about climate change and air pollution have led to a nuclear expansion over the past two decades, with 36 nuclear power reactors in operation, 20 reactors under construction, and many more being planned as of 2016 (Baruah, 2011; International Atomic Energy Agency (IAEA), 2016).

Government trustworthiness in nuclear safety emergency governance (NSEG) is put to the test when the government makes plans on nuclear power. Government trustworthiness provides the needed reassurance to the public that the government is acting on behalf of their interests and their well-being. In a complex society marked by diverse public opinions, satisfying the needs of every citizen is mission impossible. Rather, it is important for the government to become trustworthy as it underpins government legitimacy and provides the mandate needed for the government to govern (Levi et al., 2009). Since using nuclear power is a potentially risky endeavour and may provoke anti-nuclear protests, government trustworthiness is often at stake when it fails to convince the public that sufficient safety measures have been warranted. Hence, it is essential to assess what affect/predict government trustworthiness in NSEG in order that informed decisions on nuclear power can be made by the government.

Government trustworthiness is not an exogenous factor to NSEG. Rather, it is intertwined with factors such as public risk perception towards nuclear power and knowledge of nuclear safety measures (Flynn et al., 1992b; Katsuya, 2001; Siegrist and Cvetkovich, 2000). Other factors that might correlate with government trustworthiness include stakeholder engagement and demographics such as income level and political affiliation (Mah et al., 2014; Meyer et al., 2013; Reiner and Liang, 2011; Wilkes, 2015). In this study, we attempt to identify the predictors/determinants of government trustworthiness in NSEG.

Our study of government trustworthiness in NSEG focuses on HK. The reasons are as follows. First, the risk of nuclear power poses a big concern for local citizens. At the time of the Fukushima accident, six operational nuclear reactors in cross-border Guangdong Province were 50 km away from the centre of HK; two reactors were also under construction in Tai-shan, Guangdong Province, 130 km away from the HK island. Second, local stakeholders are divided on using nuclear energy across the border. A study in 2013 shows that 33% of local citizens support the use of nuclear power, while 35% of them express opposing opinions (Mah et al., 2014). Third, decisions of HK Government as to whether to continue import nuclear energy from Guangdong Province after the current power purchase agreement (PPA) expires in 2034 are pending (Kao, 2016). Such decision-making may largely be affected by public perception towards NSEG and public trust in HK Government. Until now, existing literature about NSEG in HK has failed to investigate the implication of public perception on government trustworthiness. A study to gain insights into the predictors/determinants of government trustworthiness in NSEG is therefore timely and significant.

This study attempts to systematically and quantitatively investigate the predictors/determinants of HK Government's trustworthiness in NSEG. This is done by delving into five key dimensions: 1) risk perception of nuclear power technologies, 2) benefit perception of nuclear energy, 3) knowledge about nuclear technology and safety, 4) stakeholder engagement, and 5) demographics. By examining what factors can affect/predict government trustworthiness, this paper is structured as follows: Section 1 presents the introduction; Section 2 details the background and related literature; Section 3 lays out the data and methodology; Section 4 discusses the results; finally, conclusions and policy implications are drawn in Section 5.

2. Background and Related Literature

2.1 Nuclear Energy in HK

HK does not have NNPs in its own territory. At the time of the Fukushima accident, HK was in close proximity to six operational nuclear reactors in Guangdong Province. All of the six operational reactors were situated 50 km away from the centre of HK. Two of them were from Daya Bay Nuclear Power Plant (NPP), which is a joint-venture project located in Shenzhen in Guangdong Province. China Light and Power (CLP) Group, a local utility in HK, owns 25% shares of this project. The remaining equity is owned by China General Nuclear Power Group. HK has been getting its power from about 70% of the electricity output from Daya Bay since 1994. A 2014 PPA was signed to temporally increase it to 80%, so that nuclear energy would account for about 25% of the total electricity demand in HK by about 2020 (HK Environment Bureau, 2015). The remaining four operational reactors were from Lingao NPP in Shenzhen in Guangdong Province, which is located one kilometre away from Daya Bay NPP. In addition, two nuclear reactors were under construction in Tai-shan in Guangdong Province at that time (International Atomic Energy Agency (IAEA), 2016). The risks of these two nuclear power plants in close proximity are considered as small as they are 130 km from HK.

To manage the potential risk from NPPs in Daya Bay and Lingao, the HK Government has defined two emergency planning zones (EPZs) according to the distance from the reactors, namely, EPZ1-20km and EPZ2-85km, based on the International Atomic Energy Agency (IAEA) safety standards (International Atomic Energy Agency (IAEA), 2007). The island of Ping Chau is the only region in HK that lies within EPZ1 zone (see Figure 1), where strict measures including evacuation, sheltering, and the use of thyroid block agent must be implemented in case of a nuclear accident. The rest of HK is located within EPZ2, where emergency measures consist of a number of controls for food, water, and livestock.

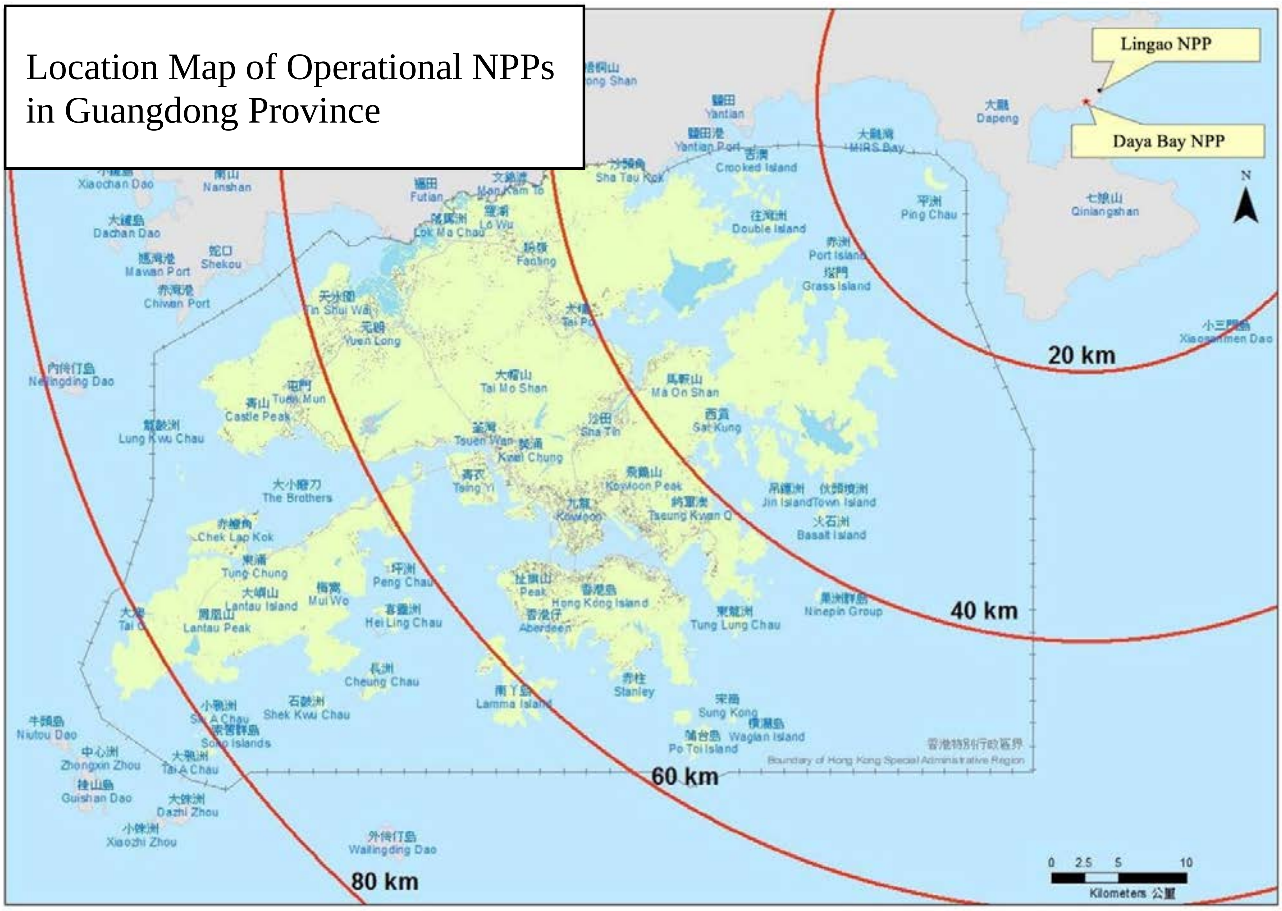

Figure 1. Emergency planning zones with Daya Bay Nuclear Power Plant (NPP) as the centric

The HK Government has planned to restrict the import of nuclear power within 25% of the total electricity demand by 2020 (HK Environment Bureau, 2015). However, as the PPA will expire in 2034, the government is faced with tough decisions on whether to extend the contract or terminate the contract and then make up for the total electricity supply in HK with other clean energy sources such as renewable energy. If the government decides to restrict the import of electricity generated by nuclear power, the two nuclear reactors in Daya Bay would be likely to be decommissioned after 2034. Nevertheless, HK would still be under the risks of nuclear power because the designed lifespans of the four reactors in Lingao NPP are far beyond this timeline.

2.2 Trust and Government Trustworthiness

Citizen trust in the government is based on the conviction that government will act on behalf of their personal/group interests (Bannister and Connolly, 2011). However, it is unlikely that the government can satisfy all needs of its citizens, in our modern societies, where expectations of citizens are high and individual interests may vary widely. To gain trust from the public, a government can strive to be trustworthy by exhibiting characteristics of trustworthiness in its decision-making (Levi, 1998). Government trustworthiness can be generally defined as an assured reliance on the character, ability, strength, or credibility of the government to protect the interests and well-being of its citizens. In the context of NSEG, high government trustworthiness can serve as an assurance that nuclear risks are sufficiently managed and contingency plans are effective in coping with the consequence of any possible nuclear accidents.

2.3 The Roles of Risk/Benefit Perception, Knowledge, Stakeholder Engagement and Demographics

2.3.1 Perceived Risk of Nuclear Power Technologies

The correlation between perceived risk and trust has been documented by many studies in the fields of risk analysis and management. Biel and Dahlstrand (1995) find a strong negative relationship between risk perception of nuclear waste storage and trust in experts. This strong negative relation is also demonstrated by studies like Flynn et al. (1992a) and Siegrist et al. (2000). However, some other studies point to a rather weak relationship between trust and risk perception (Sjoberg, 2013; Viklund, 2003). Further, some studies suggest that the relationship between trust and risk perception varies according to countries and technologies (Viklund, 2003).

Among a variety of well-established models investigating perceived risk, the most well-known one in risk perception field is the psychometric model. This method evaluates several risk characteristics represented by a number of factors such as voluntariness, dread, and novelty, of which the perceived risk is assumed to be a function of these variables (Fischhoff et al., 1978). The main assumption is that the risk is subjectively defined by individuals, who are vulnerable to a wide range of psychological, social, and institutional factors (Slovic, 1987). Based on the psychometric model, the reasons why different hazards tend to receive different perceived risks can be explained. Further, in this psychometric paradigm, risks can be generally categorized into two dimensions, namely, threat and uncertainty (Fischhoff et al., 1978). A threat risk often gives rise to instinctive feelings of terror, uncontrollability, and catastrophe, while an uncertainty risk is generally new and unknown to the public and science community. Even though cross-cultural differences have been observed, the psychometric model has been replicated in many studies in a number of countries, such as Norway (Teigen et al., 1988), Poland (Goszczynska et al., 1991), Italy (Savadori et al., 1998), France (Karpowicz-Lazreg and Mullet, 1993), and China (Chuk-ling Lai and Tao, 2003), suggesting that it can be also used to assess public perception on nuclear risk in HK.

Previous studies often focus on how trust can affect perceived risk. In HK, a survey conducted by Mah et al. (2014) suggests that trust in government could reduce the perceived risks of nuclear technologies. However, no studies have investigate the reverse direction in the HK context. It is thus important to understand how risk perception towards nuclear technologies can affect/predict HK Government's trustworthiness in NSEG.

2.3.2 Perceived Benefit of Nuclear Energy

Similar to risk perception, the correlation between perceived benefit and trust has been investigated as well. Risk perception and benefit perception are often inversely correlated (Alhakami and Slovic, 1994), and trust can affect both perceived risks and benefits (Siegrist et al., 2000). Public awareness of the benefits can directly affect their acceptance of technological risks (Starr, 1969). To improve public acceptance of nuclear technology, developing nuclear power has been reframed as a strategy to combat climate change and improve energy security (Corner et al., 2011). Before the Fukushima nuclear accident, studies showed that perceived benefits for the climate and secure energy supply could be important determinants of public acceptance on nuclear power (Visschers et al., 2011). Based on a follow-up survey shortly after the accident, the authors argue that trust in government has strong effects on benefit perception towards nuclear energy at both times (Visschers and Siegrist, 2013). Until now, few studies have looked at the reverse direction, i.e., how benefit perception could affect government trustworthiness.

After the Fukushima accident, anti-nuclear sentiment has surged significantly in many parts of the world (Kim et al., 2013). In HK, there are also debates about whether HK should stop importing nuclear energy when the PPA ends in 2034 and the Daya Bay NPP has reached at the end of its service life by then. By 2020, about 25% of HK's energy fuel mix will be nuclear energy (HK Environment Bureau, 2015). However, it is still unknown that whether the HK citizens' perceived benefits of nuclear energy in securing electricity supply in HK could affect/predict the HK government's trustworthiness. Therefore, there is a need to determine if the HK citizens' perceived benefits of nuclear energy is an important predictor of government trustworthiness with respect to NSEG. This can help HK Government understand how imported nuclear energy is perceived by the public. It will also assist the formulation of relevant policies to improve government trustworthiness in NSEG in the future.

2.3.3 Knowledge about Nuclear Technology and Safety

Knowledge could affect one's perception of government trustworthiness by altering his/her risk perception towards nuclear power. Some scholars argue that knowledge and education can be effective measures to alter people's perception or attitudes towards nuclear risks (Nealey et al., 1978; Stoutenborough et al., 2013). For instance, some early studies have established a positive statistical correlation between people's levels of knowledge on NPPs and their attitudes toward them. These studies find that laymen tend to assess nuclear risks significantly higher than the experts do (Kuklinski et al., 1982; Nealey et al., 1978). On the other hand, some studies argue that increasing level of knowledge could contribute to uncertainty and indecision. For example, a massive education campaign on nuclear energy conducted in Sweden in 1970s has shown that very little improvement of public attitudes towards NPPs was achieved (Nelkin, 1974). Additionally, the results of an Oak Ridge study, a college survey, and a California resident study all reveal that there is no significant relationship between public knowledge on nuclear energy and attitudes towards NPPs (Clelland and Bremseth, 1977; Hensler and Hensler, 1979; Sundstrom et al., 1977).

Interestingly, some studies also find that the degree of negative relationship between trust and perceived risk is influenced by knowledge. Empirical data has shown that the higher the levels of respondent's knowledge about the risk, the weaker the relationship between trust and risk perception (Siegrist and Cvetkovich, 2000; Sjoberg, 2002). When it comes to nuclear risks, research has found that people without much knowledge of the nuclear technology are more likely to base their risk perception on their trust in the government (Huang et al., 2013). Nevertheless, few studies have directly examined the role of knowledge, both general knowledge about nuclear power and specific knowledge in the context of nuclear emergency, in predicting government trustworthiness. It is therefore needed to directly examine whether knowledge (including general knowledge and specific knowledge) is a predictor of HK Government's trustworthiness in NSEG.

2.3.4 Stakeholder Engagement

Stakeholder engagement refers to involving the general public as part of the formulation, decision, and execution of policy issues (Whitmarsh et al., 2005). This process provides people with ownership and sense of belonging. It has been recognized as an important means to improve public trust (Bloomfield et al., 2001; Brunk, 2006; Cvetkovich, 2013; Denhardt, 2002; Mah et al., 2014; Petts, 2008; Stebbing, 2009). Stakeholder engagement programs, such as public consulting in HK, are frequently used to integrate different values and knowledge into the government decision-making process. Despite the potential feasibility of public engagement, a positive result is not always guaranteed. Many studies have noted that some stakeholder engagement programs may fail to engage enough citizens, and sometimes they could even create distrust (Lorenzoni et al., 2007; OECD, 2009). This might be due to the lack of information disclosure, the lack of well-thought initiatives, and the lack of political, industrial and business interactions. Arnstein (1969)'s ladder of participation is a well-established framework for evaluating the level of public engagement with good reliability and validity. It can be used to quantitively evaluate the citizens' perceived level of engagement in government decision-making (Langer et al., 2017; Menzel et al., 2013; Reilly et al., 2016).

In HK, Mah et al. (2014) find that public engagement is important to reduce risk perception of nuclear power, but existing public engagement process is often viewed as ineffective. However, how different levels of stakeholder engagement could affect government trustworthiness in NSEG, and how public engagement with different authorities (including local experts, Guangdong authorities, and international authorities) could make a difference, have yet to be answered. In order to effectively manage stakeholder engagement with NSEG in HK, it is therefore necessary to study how stakeholders perceive their levels of public engagement, and how government should engage with stakeholders in collaboration with different authorities, in order to maximize government trustworthiness in NSEG.

2.3.5 Demographics

Demographic variables are crucial for explaining how people perceive the positive and negative attributes of nuclear power. Trust perception tends to vary among the public, and socio-demographic characteristics often play an important role (Moon and Balasubramanian, 2004; Peters et al., 1997; Williams et al., 1999). Demographics can affect one’s perspective of trust in government (Mah et al., 2014; Meyer et al., 2013; Reiner and Liang, 2011; Wilkes, 2015). Typical factors being used in demographics include age, gender, education, and income. In addition, self-identification as Chinese citizen, HK citizen, or both could be used in the HK context (La Grange and Ming, 2001). These demographic factors can be included in statistical analysis, in order to determine which ones are important in predicting government trustworthiness in NSEG.

3. Data and Methods

3.1 Sampling and Survey Methods

In order to determine what factors can predict HK Government’s trustworthiness in cross-border HK-Guangdong NSEG, we conducted a survey covering five key dimensions: 1) risk perception of nuclear power technologies, 2) benefit perception of nuclear energy, 3) knowledge about nuclear technology and safety, 4) stakeholder engagement, and 5) demographics. Random telephone survey was conducted by real interviewers from 27 December 2013 to 14 January 2014. A total of 1,032 respondents were selected from HK residents aged 18 or above who speak Cantonese by representative sampling. There were six parts in the questionnaire:

A. Perception of the HK Government's trustworthiness in NSEG

B. Perception of risks of death/harm related to nuclear power technologies

C. Perception of benefits related to nuclear energy

D. Levels of stakeholder engagement in the HK Government's NSEG

E. Knowledge of nuclear technology and safety

F. Demographics

3.1.1 Part A – Stakeholder Perception of the HK Government's Trustworthiness in NSEG

In order to understand the level of stakeholder trust towards the HK Government's trustworthiness in NSEG, we developed ten questions in our survey covering seven dimensions of trustworthiness based on the HK Government's past performance in environmental protection and resources policy. The seven dimensions were designed in a five-point Likert scale: 1 refers to "strongly disagree", and 5 refers to "strongly agree". The seven dimensions include:

1. Openness – Does the government provide all relevant unclassified information to the public?
2. Reliability – Does the government endeavour to keep its promises and commitments?
3. Integrity – Does the government take actions which are consistent with its words?
4. Credibility – Has the government distorted facts to make its case? Has the government ignored the views of scientists who disagreed with them?
5. Fairness – Is the government committed to impartial decision-making? Has the government made

a good faith effort to treat everyone even-handedly?

6. Caring – Does the government listen to concerns raised by the public?
7. Competence – Does the government have the necessary skills and expertise to carry out its duties? Is the government staffed by first-class experts?

3.1.2 Part B – Stakeholder Perception of Risks of Death/Harm Related to Nuclear Power Technologies

To further analyse the underlying factors influencing the respondents' risk perception of nuclear power technologies, eight five-point Likert scale questions were developed based on the psychometric paradigm proposed by Fischhoff et al. (1978). These questions consist of two categories with regards to risk perception, namely, threat and uncertainty. The threat dimension is associated with five risk questions of "chronic – catastrophic", "immediacy of effect", "voluntariness", "control over risk", and "severity of consequences", reflecting several characteristics of the underlying risk such as involuntarily, uncontrollability, and catastrophe. The uncertainty dimension is linked with three risk questions, including "newness", "known – unknown to yourself", and "known – unknown to scientist", illustrating the new and unknown risk to the public and science community. The eight dimensions include:

1. Voluntariness (Threat) – Do you think citizens get into a nuclear risky situation voluntarily or involuntarily?
2. Immediacy of effects (Threat) – If there's a nuclear accident, to what extent is the risk of death immediate?
3. Control over risks (Threat) – If you are exposed to a nuclear accident, do you think you can, by

personal skill or diligence, avoid death?

4. Chronic-catastrophic (Threat) – Do you think the influence of a nuclear accident is chronic or acute?
5. Severity of consequences (Threat) – How likely is it that the consequences of a nuclear accident will be fatal?
6. Known – Unknown to yourself (Uncertainty) – To what extent are the risks of a nuclear accident known clearly by the citizens who live within the nuclear radiation area?
7. Known – Unknown to scientist (Uncertainty) – To what extent are the risks of a nuclear accident known to science nowadays?
8. Newness (Uncertainty) – Is the saying “nuclear accidents would bring risks” familiar to you?

3.1.3 Part C – Stakeholder Perception of Benefits Related to Nuclear Energy

To understand how the respondents’ benefit perception of nuclear power technologies could affect their trust in NSEG, one question related to energy supply was asked on whether HK needs nuclear power as a mix of energy sources to ensure a reliable supply of electricity, with a five-point Likert scale, where score 1-5 refer to “strongly disagree” to “strongly agree”.

3.1.4 Part D – Levels of Stakeholder Engagement in the HK Government’s NSEG

Stakeholder engagement is an important part of NSEG decision-making. It could be conducted through different mechanisms and it is considered to provide a basis for increasing stakeholder trust in NSEG (Mah et al., 2014). To identify which engagement level could give stakeholders the maximum trust in the HK Government’s NSEG, six questions were developed based on the ladder of engagement method (Arnstein, 1969), with a five-point Likert scale where score 1-5 refer to “decrease a lot”, “decrease a bit”, “no change”, “increase a bit”, and “increase a lot”, respectively. Six levels of stakeholder participation were asked, ranging from the lowest form of engagement level (Level 1, Informing) to the highest form of engagement level (Level 6, Citizen Control):

1. Level 1, Informing – Stakeholders are kept being informed of the Contingency Plan
2. Level 2, Consultation – Stakeholders' opinions about the Contingency Plan are collected
3. Level 3, Concession – Stakeholders can join the conversation on the Contingency Plan
4. Level 4, Partnership – Stakeholders can take part in decision-making of the Contingency Plan
5. Level 5, Delegated power – Stakeholders can veto the Contingency Plan
6. Level 6, Citizen control – Stakeholders can make full decisions for the Contingency Plan

In addition, we asked our respondents whether the HK public should be involved in developing the NSEG with a five-point Likert scale, where score 1-5 refer to "strongly disagree" to "strongly agree". We also asked our respondents how stakeholder engagement with different authorities would affect their trust on the NSEG with a five-point Likert scale, where score 1-5 refer to "decrease a lot", "decrease a bit", "no change", "increase a bit", and "increase a lot", respectively. The authorities consist of local experts, international authorities, and Guangdong authorities:

1. If stakeholders were engaged alongside local experts and international authorities
2. If stakeholders were engaged alongside local experts and Guangdong authorities
3. If stakeholders were engaged alongside international authorities and Guangdong authorities
4. If stakeholders were engaged alongside local experts, international authorities and Guangdong authorities

3.1.5 Part E – Knowledge of Nuclear Technology and Safety

To understand the level of our respondents' knowledge with regards to nuclear technology and safety, and how this can affect their trust in HK Government's NSEG, two types of questions were assigned to our respondents, including general knowledge of nuclear power and specific knowledge in the context of nuclear emergency (Table 1). In particular, seven questions were asked, covering nuclear energy, location of Daya Bay NPP, source of natural radiation, food safety, medications, evacuation region, and source of nuclear incident information. Question 1 and 3-5 are related to the general knowledge about nuclear energy and radiation exposure, while Question 2 and 6-7 aim to test the specific knowledge in terms of the important countermeasures for HK residents in a nuclear emergency.

Table 1. Questions for knowledge of nuclear technology and safety

Questions	Choices	Answer description (percentage based on 1032 samples)		
		Correct	Incorrect	Refuse to answer
1. Which material is used as fuel for producing electricity in a nuclear power station? (Correct answer: A)	A) Uranium; B) Coal; C) Oil; D) Natural gas	73%	19%	8%
2. How far are the Daya Bay nuclear power stations from the city centre of Hong Kong? (Correct answer: D)	A) 10 km; B) 15 km; C) 20 km; D) 50 km	59%	25%	16%
3. What is the main source of natural radiation in daily life? (Correct answer: A)	A) Radon gas in air; B) Cosmic rays; C) Rock and soil; D) Food and drinks	33%	59%	9%
4. Which of the following foods are most susceptible to radioactive fallout? (Correct answer: B)	A) Eggs; B) Leafy vegetables; C) Shrimp; D) Fish	59%	36%	6%
5. For people in close vicinity to a nuclear accident site, which of the following medications could be taken to alleviate the effects of radioactive iodine? (Correct answer: A)	A) Thyroid Blocking Agent; B) Antibiotics; C) High protein; D) Analgesic	55%	22%	24%
6. According to the current contingency plan, which part of Hong Kong needs to evacuate in a nuclear emergency? (Correct answer: C)	A) Lamma Island; B) Lantau Island; C) Ping Chau; D) The whole of Hong Kong	25%	68%	7%
7. Which institution is the source of official information in case of a nuclear incident? (Correct answer: B)	A) HK Observatory; B) Guangdong Government; C) World Health Organization; D) Center for Food Safety	31%	64%	5%

3.1.6 Part F – Demographics

Similar to other related studies, demographics can be important predictors. Five demographics, including age, gender, average monthly income, education, and self-identity are included in our proposed trust model to determine if they could also be used to predict HK Government's trustworthiness in NSEG.

3.2 Statistical Models

3.2.1 Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is applied to understand what dimensions are affecting the perception of stakeholder on government trustworthiness. The analytical approach utilizes a variance and covariance matrix of the dimensions to extract latent factors, calculate loadings and construct a weight vector to estimate the respondents' perception on government trustworthiness (Lee and Zhong, 2015). The procedures to derive the weight of seven trustworthiness dimensions are listed as follows:

1. Latent factors representing dimensions of government trustworthiness are identified. Each latent factor depends on a set of loadings and each loading measures the correlation between the individual dimension and the factor. The latent factors that preserve a significant amount of cumulative variance of the original data are retained to form an un-rotated factor matrix. Eigenvalues are computer-generated indicators signalling the significance of latent factors. The greater the eigenvalue, the more the component is considered a significant variable. In this study, factors that have eigenvalues larger than one are retained.
2. The un-rotated factor matrix is transformed into a rotated factor matrix by varimax rotation to obtain a simpler structure:

$$\text{Rotated factor matrix} = \begin{bmatrix} FL_{11} & \cdots & FL_{1,\mathrm{n}} \\ \vdots & \ddots & \vdots \\ FL_{\mathrm{m},1} & \cdots & FL_{\mathrm{m,n}} \end{bmatrix} \quad (1)$$

where *FL* is the factor loading, *m* is the total number of dimensions, and *n* is the total number of factors.

3. A vector equal to the proportion of the explained variance is extracted from the rotated factor matrix:

$$\text{Proportion vector} = [\mathrm{P}_1 \quad \ldots \quad \mathrm{P}_\mathrm{n}] \quad (2)$$

$$\mathrm{P}_\mathrm{j} = \frac{\sum_{\mathrm{k}=1}^{\mathrm{m}} (FL_{\mathrm{k,j}})^2}{\sum_{\mathrm{l}=1}^{\mathrm{n}} \sum_{\mathrm{k}=1}^{\mathrm{m}} (FL_{\mathrm{k,l}})^2} \quad (3)$$

where *P* is the proportion of the explained variance, and *j* is the column number.

4. Intermediate weights of seven dimensions are calculated from the rotated factor matrix corresponding to the factor loadings. An intermediate weight matrix can be formed:

$$\text{Intermediate weight matrix} = \begin{bmatrix} IW_{1,1} & \cdots & IW_{1,\mathrm{n}} \\ \vdots & \ddots & \vdots \\ IW_{\mathrm{m},1} & \cdots & IW_{\mathrm{m,n}} \end{bmatrix} \quad (4)$$

$$IW_{\mathrm{ij}} = \frac{(FL_{\mathrm{i,j}})^2}{\sum_{\mathrm{k}=1}^{\mathrm{m}} (FL_{\mathrm{k,j}})^2} \quad (5)$$

where *IW* is the intermediate weight, *i* is the row number, and *j* is the column number.

5. By multiplying the proportion vector (2) by the transpose of the intermediate weight matrix (4), a weight vector to estimate the HK respondents' perception on government trustworthiness can be constructed:

$$\text{Weight vector} = [\mathrm{P}_1 \quad \ldots \quad \mathrm{P}_\mathrm{n}] \begin{bmatrix} IW_{1,1} & \cdots & IW_{1,\mathrm{n}} \\ \vdots & \ddots & \vdots \\ IW_{\mathrm{m},1} & \cdots & IW_{\mathrm{m,n}} \end{bmatrix}^\mathrm{T} = [\mathrm{W}_1 \quad \ldots \quad \mathrm{W}_\mathrm{m}] \quad (6)$$

where W is the weight of the dimensions.

In general, the higher the weight W_m, the greater the contribution of dimension *m* (*m* ranges from 1 to 7) to the respondents' perception on overall government trustworthiness. By identifying the weight of each dimension, one can predict how the same increase in the respondents' agreement on such dimension will affect their perception on overall government trustworthiness. Similarly, PCA can also be applied to analyse the eight dimensions of risk perception of nuclear power technologies and how these risk dimensions are related to each other.

3.2.2 Ordinal Logistic Regression

We use the ordinal logistic regression models to further examine the statistical influence of key variables listed in Section 3.1, including 1) risk perception of nuclear power technologies, 2) benefit perception of nuclear energy, 3) knowledge (general and specific) of nuclear technology and safety, 4) stakeholder engagement, and 5) demographics (see Table 2 for detailed definitions of independent variables).

Table 2. Definition of dependent and independent variables

Dependent variable	**Definition**
Trustworthiness	Respondent's view on the HK Government's trustworthiness in NSEG;
Independent variable	**Definition**
Overall risk perception	Overall risk perception towards nuclear power technologies
Risk perception (Threat)	Risk perception (Threat) towards nuclear power technologies
Risk perception (Uncertainty)	Risk perception (Uncertainty) towards nuclear power technologies
Benefit perception (Energy supply)	Respondent's view on whether HK needs nuclear power as a mix of energy sources to ensure a reliable supply of electricity
General knowledge	Total scores of general knowledge of nuclear technology/safety
Emergency knowledge	Total scores of emergency knowledge of nuclear technology/safety
Expected engagement in contingency planning	Respondent's expectation on whether the public should be involved in developing the nuclear safety contingency plan

Minimum engagement for trust	Minimum level of engagement with increase in HK Government's trustworthiness equal to "increase a bit" or "increase a lot"
Engagement with HK and INTL	Change of HK Government's trustworthiness in NSEG by respondent's engagement with local experts and international authorities
Engagement with HK and GD	Change of HK Government's trustworthiness in NSEG by respondent's engagement with local experts and Guangdong authorities;
Engagement with INTL and GD	Change of HK Government's trustworthiness in NSEG by respondent's engagement with international authorities and Guangdong authorities;
Engagement with ALL	Change of HK Government's trustworthiness in NSEG by respondent's engagement with local experts, Guangdong authorities, and international authorities;
Gender	Gender of the respondent;
Age	Age of the respondent
Income	Average monthly income of the respondent;
Education	Education level of the respondent;
Self-identity	Self-identity of the respondent, with four categories of "Hong Kong citizen", "Chinese Citizen", "both", and "none of the above"

As the dependent variable (government trustworthiness) is categorical and ordered, the ordinal logistic regression model is adopted for statistical analysis (Lam et al., 2013). It can be denoted as follows:

$$\ln\left[{P_{jk}}/{1-P_{jk}}\right] = \alpha_j - \beta_1 X_1 - \cdots - \beta_{\mathrm{n}} X_{\mathrm{n}} + \varepsilon \qquad (7)$$

where

$P_{jk} = Prob(Y_k \leq j), j = 1\ or\ 2;$

Y_k = response by respondent k; Y_k = 1 ("high trustworthiness"), or 2 ("undecided trustworthiness");

α_j is the y-intercept for j = 1 ("high trustworthiness"), or j = 2 ("high trustworthiness" or "undecided trustworthiness");

β_j is the slope of the selected variable X_{i} (see Table 2); and

ε is the random error with zero mean and finite variance.

P_{1k} is the probability of respondent k vote the HK Government as highly trustworthy in NSEG, and P_{2k} is the probability of respondent k vote for the low trustworthiness or fail to decide whether the HK Government is trustworthy or not in NSEG.

P_{jk} could be further determined as

$$P_{jk} = \exp(A_{jk}) / [1 + \exp(A_{jk})] \qquad (8)$$

where

$$A_{jk} = \alpha_j - \beta_1 X_1 - \cdots - \beta_n X_n + \varepsilon$$

Therefore, the probability of respondent k viewing the HK Government as highly trustworthy in NSEG can be achieved through

$$P_{1k} = \exp(A_{1k}) / [1 + \exp(A_{1k})] \qquad (9)$$

where

$$A_{1k} = \alpha_1 - \beta_1 X_1 - \cdots - \beta_n X_n + \varepsilon$$

Since there is a positive correlation between P_{1k} and A_{1k}, in general, the probability of respondent k viewing the HK Government as highly trustworthy in NSEG can be interpreted as follows:

If $\beta_i > 0$, an increase in variable X_i will decrease the HK Government trustworthiness in NSEG;

If $\beta_i < 0$, an increase in variable X_i will increase the HK Government trustworthiness in NSEG.

We conduct model selection to study the key factors that can affect the HK Government's trustworthiness in NSEG. It is conducted in three stages. First, univariate analysis is undertaken to assess the potential strength of each independent variable. Next, we run a multivariate ordinal logistic regression model with the selected variables that carry a p-value less than 0.1. Finally, we repeat the analysis by including only the statistically significant variables that carry a *p*-value less than 0.05.

4. Results and Discussions

We conducted PCA with varimax rotation to determine the relative contribution of each dimension in predicting the HK Government's trustworthiness (see Section 4.1) and the risk perception of nuclear power technologies (see Section 4.2). We then conducted an ordinal logistic regression analysis to study the key factors that can affect and predict government trustworthiness in NSEG in HK based on five different sets of factors: 1) risk perception of nuclear power technologies, 2) benefit perception of nuclear energy, 3) knowledge of nuclear technology and safety, 4) stakeholder engagement, and 5) demographics (see Section 4.3).

4.1 HK Government's Trustworthiness in NSEG

HK respondents have different perspectives on the trustworthiness of the HK Government in NSEG. As illustrated in Table 3, the PCA model reveals that one component has an eigenvalue greater than one and explains 52.74% of the total variance, verifying a sufficiently large correlation between the dimensions. This component is also clustered with all seven dimensions, especially for caring, reliability and fairness. By contrast, integrity, openness, competence and credibility are less important predictors of HK Government's trustworthiness. Based on Equation (1) – (6), the PCA model capturing the relative weightings of the seven dimensions used to estimate the perception of overall government trustworthiness in NSEG for all respondents is:

$$\text{Trustworthiness}_{\text{x}} = \begin{bmatrix} 0.167 \\ 0.166 \\ 0.111 \\ 0.160 \\ 0.114 \\ 0.156 \\ 0.126 \end{bmatrix}^{T} \begin{bmatrix} \text{Integrity} \\ \text{Reliability} \\ \text{Openness} \\ \text{Fairness} \\ \text{Competence} \\ \text{Credibility} \\ \text{Caring} \end{bmatrix} \qquad (10)$$

where x indicates respondent x.

Table 3. Principal component analysis of the seven key dimensions of trustworthiness in NSEG

Key dimensions	**Survey questions**[1]	**Mean**	**Component 1**
Integrity	The government takes actions that are consistent with its words.	2.48	0.786
Reliability	The government tries hard to keep its promises.	2.81	0.783
Openness	The government tells the whole truth of issues.	2.67	0.642
Fairness	The government is committed to impartial process for making decisions. The government makes a good faith effort to treat everyone even-handedly.	2.66	0.768
Competence	The government has the necessary skills and ability to carry out its job. The government is generally staffed by first-class experts.	2.96	0.648
Credibility	* The government ignores the views of scientists who disagree with them. * The government distorts the facts to make its case.	2.83	0.758
Caring	* The government does not listen to concerns raised by people like you.	2.73	0.682
Total variance explained			
Initial eigenvalue			3.69
Percentage of variance			52.74%
Cumulative percentage			52.74%

1. * indicates that the answers are recoded in reverse order for analysis.

According to the weight calculated above, integrity (16.7%), reliability (16.6%), fairness (16.0%), and credibility (15.6%) are the four most heavily weighted dimensions and account for over 60% among all seven dimensions, followed by caring (12.6%), competence (11.4%), and openness (11.1%). With predominant dimensions identified, the HK Government can clarify means to improve its overall government trustworthiness in NSEG by drawing more attention on these specific fields, i.e., integrity, reliability, fairness, and credibility. Additionally, the HK Government can prioritize relevant strategies for improving government trustworthiness in NSEG based on the weightings of each dimension.

4.2 Risk Perception of Nuclear Power Technologies

PCA is also applied to assess the eight key risk dimensions of nuclear power technologies (Table 4). All three components (Component 1: Uncertainty; Component 2: Threat; Component 3: Threat) have eigenvalue greater than one and explain 19.94%, 18.76% and 14.16% of the total variance, respectively. Thus, these three components explain around 52.86% of the total variance. More specifically, three uncertainty components – “newness”, “known – unknown to yourself”, and “known – unknown to scientist” are clustered on the first component reflecting the overall uncertainty, while “chronic – catastrophic”, “immediacy of effect”, and “severity of consequences” are clustered on the second component (Threat). In addition, one dimension of “voluntariness” is clustered on the third component (Threat). The remaining dimension – “control over risk” fails to cluster on any of these three components statistically significantly. In detail, to provide a general picture of risk perception, PCA is performed and weighted vectors are constructed to estimate the loading of each risk dimension of the nuclear power technologies based on the same referencing equations from (1) – (6):

$$\text{Risk perception of nuclear power plants}_x = \begin{bmatrix} 1.051 \\ 0.444 \\ 0.914 \\ 0.417 \\ 1.005 \\ 0.794 \\ 0.841 \\ 0.035 \end{bmatrix}^T \begin{bmatrix} \text{Voluntariness} \\ \text{Immediacy of effect} \\ \text{Control over risk} \\ \text{Chronic} - \text{catastrophic} \\ \text{Severity of consequences} \\ \text{Known} - \text{unknown to yourself} \\ \text{Known} - \text{unknown to scientist} \\ \text{Newness} \end{bmatrix}$$

(11)

where x indicated respondent x.

Table 4. Principal component analysis of key dimensions of nuclear radiation risk from nuclear power plants

Key dimensions	**Survey questions**[1]	**Component 1 (Uncertainty)**	**Component 2 (Threat)**	**Component 3 (Threat)**
Chronic-catastrophic	Do you think the influence of a nuclear accident is chronic or acute? (1=chronic, 5=acute)	-0.176	**0.548**	0.045
Immediacy of effect	* If there's a nuclear accident, to what extent is the risk of death immediate? (1= immediate, 5=delayed)	0.004	**0.725**	-0.285
Voluntariness	Do you think citizens get into a nuclear risky situation voluntarily or involuntarily? (1=voluntary, 5=involuntary)	0.178	0.118	**0.755**
Control over risk	* If you are exposed to a nuclear accident, do you think you can, by personal skill or diligence, avoid death? (1=uncontrollable, 5=controllable)	0.112	0.456	0.346
Severity of consequences	How likely do you think the consequences of a nuclear accident are fatal? (1=certain not to be fatal, 5=certain to be fatal)	0.098	**0.657**	0.250

Newness	* Is the saying "nuclear accidents would bring risks" familiar to you? (1=very unfamiliar, 5=very familiar)	**0.540**	0.074	-0.579
Known-unknown to yourself	To what extent are the risks of a nuclear accident known clearly by the citizens who live within the nuclear radiation area? (1=very clear, 5=very unclear)	**0.735**	-0.127	0.186
Known-unknown to scientist	To what extent are the risks of a nuclear accident known to science nowadays? (1=very clear, 5=very unclear)	**0.777**	0.058	0.006

In terms of risk dimensions with regard to nuclear power technologies, HK respondents tend to accord top priorities to voluntariness, severity of consequences, and control over risk.

4.3 Factors Explaining HK Government's Trustworthiness in NSEG

The results of our ordinal regression analysis are tabulated in Tables 5 - 7. Overall, our statistical analysis shows that risk perception towards nuclear power technologies (including overall risk perception, threat dimension, and uncertainty dimension), benefit perception with regard to energy supply, expected engagement in contingency planning, and average monthly income are significant predictors of HK Government's trustworthiness in NSEG.

Table 5. Univariate ordinal logistic regression that explains/predicts the HK Government trustworthiness in NSEG[1]

Independent Variables	β-value	*p*-value
Overall risk perception	0.652	0.000***
Risk perception (Threat)	0.793	0.000***
Risk perception (Uncertainty)	0.296	0.000***
Benefit perception (Energy supply)	-0.448	0.000***
General knowledge	0.458	0.051
Emergency knowledge	-0.057	0.788
Expected engagement in contingency planning	0.337	0.000***
Minimum engagement for the HK government to gain the citizens' trust	0.001	0.712
Engagement with HK and INTL	0.058	0.678
Engagement with HK and GD	-0.233	0.121
Engagement with INTL and GD	-0.103	0.365
Engagement with ALL	0.173	0.268
Gender [male][2]	-0.024	0.838
Age	-0.001	0.347
Income	0.176	0.002**
Education [primary or below][3]	-0.679	0.000***
Education [secondary][3]	0.097	0.451
Self-identity [Hong Kong citizen][4]	-0.030	0.955
Self-identity [Chinese citizen][4]	-0.816	0.150
Self-identity [both][4]	-0.636	0.235

Remarks:

1. Reference category for dependent variable: "low trustworthiness"
2. Reference category for gender: "female"
3. Reference category for education: "tertiary or above"
4. Reference category for self-identity: "none of the above"
5. *p-value < 0.05, **p-value < 0.01, ***p-value < 0.001

Table 6. Ordinal logistic regression that explains/predicts the HK Government trustworthiness in NSEG[4]

Variables (Coefficients)	
Total number of valid opinions	863
Number of 1 ("high trustworthiness") opinions	225
Number of 2 ("undecided trustworthiness") opinions	200
Number of 3 ("low trustworthiness") opinions	438
McFadden pseudo R^2	12.1%
Intercept for response = 1 ("high trustworthiness"): α_1	3.790***
Intercept for response = 1 ("high trustworthiness") or response = 2 ("undecided trustworthiness"): α_2	5.040***
X_1 Overall risk perception: β_1	0.463***
X_2 Risk perception (Threat): β_2	0.496***

X_3 Risk perception (Uncertainty): β_3	0.360***
X_4 Benefit perception (Energy) β_4	-0.285***
X_5 General knowledge: β_5	0.172
X_6 Expected engagement in contingency planning: β_6	0.277***
X_7 Income: β_7	0.222**
X_8 = 1 if Education = "primary or below" else 0: β_8	-0.243
X_9 = 1 if Education = "secondary" else 0: β_9	0.268

Remarks:

1. Reference category for dependent variable: "low trustworthiness"
2. Reference category for education: "tertiary or above"
3. **p*-value < 0.05, ***p*-value < 0.01, ****p*-value < 0.001
4. All dependent variables that predict overall government trustworthiness via univariate analysis with *p*-value < 0.1 (see Table 5)

Table 7. Ordinal logistic regression that explains/predicts the HK Government trustworthiness in NSEG5

Variables (Coefficients)	
Total number of valid opinions	863
Number of 1 ("high trustworthiness") opinions	225
Number of 2 ("undecided trustworthiness") opinions	200
Number of 3 ("low trustworthiness") opinions	438
McFadden pseudo R^2	11.7%
Intercept for response = 1 ("high trustworthiness"): α_1	3.648***
Intercept for response = 1 ("high trustworthiness") or response = 2 ("undecided trustworthiness"): α_2	4.890***
X_1 Overall risk perception: β_1	0.467***
X_2 Risk perception (Threat): β_2	0.501***
X_3 Risk perception (Uncertainty): β_3	0.354***
X_4 Benefit perception (Energy supply) β_4	-0.284***
X_5 Expected engagement in contingency planning: β_5	0.285***
X_6 Income: β_6	0.221**

Remarks:

1. Reference category for dependent variable: "low trustworthiness"
2. **p*-value < 0.05, ***p*-value < 0.01, ****p*-value < 0.001
3. All dependent variables that predict overall government trustworthiness via multivariate analysis with *p*-value < 0.05 (see Table 6)

4.3.1 Risk Perception of Nuclear Power Technologies

Most respondents hold low or neural perceptions towards nuclear risk in HK. In terms of how the respondents would assess the level of nuclear risk in HK, 37.4% perceive a low risk and 22.8%

perceive a high risk. Overall risk perception, threat dimension of risk perception, and uncertainty dimension of risk perception are significant predictors of overall government trustworthiness in NSEG. Based on the direction and magnitude of parameter estimates, increase in risk perception (overall, threat, and uncertainty) would decrease overall government trustworthiness in NSEG. The results are consistent with previous findings in HK that risk perception is negatively correlated to government trustworthiness (Mah et al., 2014).

4.3.2 Benefit Perception of Nuclear Power Technologies

HK respondents hold different views in terms of the benefit of nuclear power technologies. In terms of how the respondents would consider nuclear power as a mix of energy sources to ensure a reliable supply of electricity in HK, 39.7% perceive an agreement, while 50.6% perceive a disagreement. Benefit perception of using nuclear energy in energy mix in HK is a significant predictor of overall government trustworthiness in NSEG. Based on the direction and magnitude of parameter estimate, increase in benefit perception of nuclear energy would increase overall government trustworthiness in NSEG. This implies that the HK Government could improve public understanding of the benefits related to nuclear power technologies, in order to increase public trust in NSEG in HK.

4.3.3 Expected engagement in contingency planning

Most respondents have higher expectations on the stakeholder engagement level in HK. With regard to how the respondents would assess whether HK public should be involved in developing the nuclear safety contingency plan, 19.4% disagree that HK pubic should be involved, and 74.6% agree. Our statistical model also shows that expected engagement in contingency planning is a significant predictor of overall trustworthiness. Based on the direction and magnitude of parameter estimate, increase in respondent's expected engagement in contingency planning would decrease his/her perception of government trustworthiness in NSEG. In other words, higher expected engagement in contingency planning is associated with lower level of public trust in overall government trustworthiness in NSEG, suggesting that reducing the level of engagement with the HK stakeholders serve the key to improve government trustworthiness in NSEG.

4.3.3 Demographics Factor: Income

Demographics information including gender, age, income, education, and self-identification are analysed. Our ordinal regression model shows that among all demographic variables, higher level of average monthly income is associated with lower level of the overall government trustworthiness in NSEG.

4.3.3 Variables Not Affecting and Predicting HK Government's Trustworthiness

Two types of questions, including general knowledge and specific knowledge (in the context of nuclear emergency) have been used to assess the influence of knowledge on the HK Government's trustworthiness in NSEG. Our ordinal regression model shows that both general knowledge and specific knowledge are not significant predictors of public trust in NSEG (p-value > 0.05, see Table 6). This implies that strategies that spoon-feed the public with information would not increase government trustworthiness in NSEG in HK. Our ordinal regression model also indicates that demographics variables, including age, gender, self-identification (p-value > 0.1, see Table 5), and education (p-value > 0.05, see Table 6), are insignificant predictors of HK Government's trustworthiness in NSEG.

The summary of minimum engagement for the HK government to gain the citizens' trust (the minimum level of engagement with increase in trust equal to “increase a bit” or “increase a lot”) reveals that the majority of HK respondents (91.19%) prefer the stakeholder engagement Level 1 – Informing, followed by the Level 2 – Consultation with a percentage of 5.39% (see Table 8). In general, HK respondents tend to trust the HK Government in NSEG most at Level 1, suggesting that an increment in the level of engagement has insignificant contributions to the improvement of overall government trustworthiness.

Table 8. Summary of the minimum engagement for the HK government to gain the citizens’ trust (minimum level of engagement with increase in trust equal to “increase a bit” or “increase a lot”)

Level	Number of respondents (%)
Level 1	91.19
Level 2	5.39
Level 3	1.55
Level 4	1.55
Level 5	0.10
Level 6	0.20

Moreover, we also examine how stakeholder engagement with different authorities (including local experts, Guangdong authorities, and international authorities) would affect our respondents’ trust in NSEG in HK. In total, 80.5% of respondents show an increase in trust if they were engaged with local experts and international authorities, 79.6% of respondents show an increase in trust if they were engaged with local experts and Guangdong authorities, and 71.7% of respondents show an increase in trust if they were engaged with Guangdong authorities and international authorities. This implies that HK respondents prefer engaging with local experts than international/Guangdong authorities. However, our statistical analysis shows that stakeholder engagement with different authorities would not significantly affect people’s trust on NSEG in HK. This statistical insignificance is most likely due to the significant number of non-replies to this set of questions. .

4.4 Significant Factors for Predicting HK Government's Trustworthiness in NSEG

Based on the selected ordinal logistic regression model with only significant variables (see Table 7), the formula for predicting the probability of high government trustworthiness of NSEG in HK is as follows:

$$P(\text{High Trustworthiness}) = \exp(A)/[1 + \exp(A)] \qquad (12)$$

where

$$\begin{aligned} A = 3.648 \quad & - 0.467 \times \text{ Overall risk perception towards nuclear technologies} \\ & - 0.501 \times \text{Risk perception towards nuclear technologies (Threat)} \\ & - 0.354 \times \text{ Risk perception towards nuclear technologies (Uncertainty)} \\ & + 0.284 \times \text{Benefit perception (Energy supply)} \\ & - 0.285 \times \text{Expected engagement in contingency planning} \\ & - 0.221 \times \text{Income.} \end{aligned}$$

5. Conclusions and Policy Implications

This study evaluates potential determinants/predictors of the HK Government's trustworthiness in NSEG, including risk perception of nuclear power technologies, benefit perception of nuclear energy, knowledge about nuclear technology and safety, stakeholder engagement, and demographics. The main findings and policy suggestions are as follows:

1. PCA model has identified integrity as the most influencing factor in predicting the overall government trustworthiness in NSEG in HK, followed by reliability, fairness, and credibility. This implies that priorities should be given to these four dimensions to improve the public trust most

effectively.

2. In consistent with the existing literature on risk perception of nuclear power technologies, our results show that lower perceived risk towards nuclear power technologies, including overall risk perception, threat dimension of risk perception, and uncertainty dimension of risk perception, can improve the HK Government's trustworthiness in NSEG. Therefore, strategies for reducing risk perception, including both threat dimension and uncertainty dimension, should be implemented to enhance the overall government trustworthiness.

3. Our statistical analysis shows that the perceived benefits of having nuclear energy in energy mix in HK is a statistically significant predictor of overall government trustworthiness. To improve public trust towards NSEG in HK, the benefits and contribution of nuclear power in the electricity supply of HK can be highlighted and such message should be broadly shared across the general public.

4. In contrast to the common views that knowledge could improve public trust in NSEG, we find that knowledge of nuclear technology and safety is not a significant predictor of government trustworthiness. This suggests that providing scientific knowledge alone may not reduce public fears and increase public confidence in nuclear power technologies. Alternative innovative approaches to engage and educate the public and increase their awareness towards nuclear safety, such as science fairs or competitions that cover the relevant areas of science and technology may need to be introduced, in order to increase government trustworthiness in the HK context.

5. In terms of stakeholder engagement, an important insight from our survey is that HK people prefer engaging with the local experts than international/Guangdong authorities. This suggests that local experts should be substantially involved in public engagement activities when collaborating with other

international/Guangdong authorities. Moreover, our results have shown that the expected engagement in emergency planning is negatively associated with the overall government trustworthiness. Therefore, to improve the level of government trustworthiness, reducing the level of engagement with the HK stakeholders may be the key. Specifically, devoting more efforts into stakeholder engagement may not have significant impacts on improving the government trustworthiness, as most people are satisfied with the lowest level of engagement (Level 1 - Informing), while the minimum engagement for trust is statistically insignificant in predicting the HK Government's trustworthiness.

6. Among all demographic factors represented by age, gender, education, average monthly income, and self-identity, only average monthly income contributes to the overall public trust in NSEG statistically significantly. The higher the level of monthly income, the lower the Government's trustworthiness. This implies that HK Government's trustworthiness can be improved more significantly if we target at the higher income groups for nuclear emergency trust-building.

The lack of trusts among different stakeholders including the Government, professionals in the industry, and regulators, has presented a major challenge in the realm of nuclear power, especially when it involves cross-border nuclear power decision-making (Siegrist et al., 2000; Siegrist et al., 2005). The lack of transparency, incomplete information provision, and accidents can exert strong effects on the levels of trust of citizens towards the stakeholders (He et al., 2013). The social and civic connection between government and trust basically refers to the construction and maintenance of a prosperous and civil society. According to a government and its officials, a high likelihood of low political legitimacy is observed in a society where people doubt each other and choose not to engage (Blind, 2007). The stakeholders in HK have widely adopted the command-and-control mode of governance, and critics on the introduction of voluntary agreements could be related to deficits in trust. It is difficult to change the status quo, as many stakeholders presumably do not trust the government or the businesses to operate these voluntary agreements effectively (Hills, 2005). To improve the public trust in NSEG in HK, the concepts of nuclear regulation and risk management may need to be integrated into the policymakers' agenda. A more risk-coping approach for the industry needs to be established, and corporate governance of security performance needs to be refined (World Institute for Nuclear Security (WINS), 2014). On a larger scale, local nuclear experts should connect with international/Guangdong authorities in a structured and effective manner and share their insights on security practices to HK citizens. Nuclear security needs to be improved and the nuclear industry needs to be incentivized to encourage best practices and outstanding performances including the capability to cope with security threats. The government should be accountable for the management strategies and resources in preparation for the potential adverse events. In the long term, reducing public fears towards nuclear technologies, ensuring appropriate level of public engagement, and offering suitable training/education programmes in nuclear power and energy security would be a sustainable solution.

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