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Big Data Analysis of the UAE Nuclear Policy

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***Abstract* – The National Nuclear Policy is critical basis for regulation and compliance of operation of the peaceful use of the nuclear power in any country. Within this context, it is no doubt that knowing the status of Nuclear Policy directly related to Security, Safety and Safeguard is essential for the government and stakeholders of the nuclear (and radiation safety) industry. There are only a few available research papers to compare and get the access of the UAE nuclear data. Thus, the purpose of this research is to help analyze the UAE nuclear policy and its change precisely. Big Data Analysis was used as a methodological solution to identify the trend of UAE Nuclear Policy basis. It is a reliable and beneficial tool for data engineers who want to get insights. This analysis of significant volume of data has confirmed in three shapes. First: a visualized word cloud shows the priorities of the policy on nuclear infrastructure. Second: identifying the most frequent keywords to detect significant issues related to safety and security. Third: cluster analysis results in the frame of the UAE nuclear policy which is useful to identify strategic directions. With the verification, this research indicates the trend of the policy establishment and its change – according to the international and national issues - directly related to safety, security, and safeguards starting from the very beginning, from 2010. Also, the result indicates that using the Big Data Analysis will support stakeholders and decision-makers by improving the quality of Nuclear Knowledge Management to reduce the uncertainty and its caused risk and related issue.**

***Keywords* – About UAE Nuclear Policy, Big Data analysis, Human Capital, Safety, Security, Safeguard**.

I. Introduction

The United Arab Emirates (UAE) has reached the gold standard in its nuclear policy and nonproliferation agreements since 2009. The UAE has progressed quickly in nuclear infrastructure under the strong nuclear policy compared with other countries historical data. With its regional characteristic of GCC, however, it has the high vulnerability of evacuation issue as the accident occurred and also safety and security measures under developing the nuclear energy program of the UAE and world nuclear policy.

Therefore, a well-established nuclear policy is critical for regulation and compliance of operation of nuclear power plant. Within this context, it is no doubt that knowing the status of nuclear policy directly related to security and safety is essential for government and stakeholders.

Research about the nuclear policy and its change(s) in the UAE is not available; also, there are limitations to acquire enough information and insights, the author refers only the publicly available official reports. To analyze the policy precisely in this research, the Big Data Analysis is used as a methodological solution to support the identification of the data characteristics and their connections to safety and security drivers of the peaceful use the nuclear power in the UAE.

II. Method and Data

By using Python and R Programming, - especially a basic analytics for insight - tracking the development of the UAE nuclear policy confirmed in three shapes of ideas. **First**: a visualized word cloud shows the priorities of the policy on nuclear infrastructure development. **Second**: identifying the most frequent words in each year's data enables to detect the significant issues related to safety and security such as proliferation and nuclear accident. **Third**: cluster analysis results in the frame of the UAE nuclear policy which is useful to identify strategic directions. With the verification, this research indicates the trend of the policy establishment and its change – according to the international and national issues - directly related to safety, security, and safeguards starting from the very beginning, from 2010.

2.1 *Keyword Analysis*

Keyword analysis is one of the central portions of statistical analysis. It determines the volume of keywords and gains insight into the competitive relevance through sentences and phrases. (Wiki)

All the Data has been gathered from the open data cloud and based on the annual report for public data access. Collected data per year from 2010 to 2017, from FANR annual report, ENEC sustainability report, National Report from government sectors, articles on IAEA website and web crawled articles, carries out this research. All gathered data is extracted mainly as nouns and adjective to perform the keyword analysis for what to put weight on in *Figure 1.* For the analysis of the data the R Programming software was used.

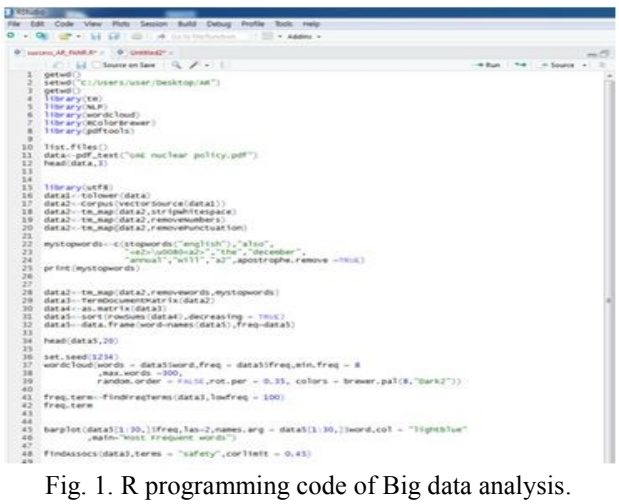

Fig. 1. R programming code of Big data analysis.

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III. RESULT

3.1 *Comparison of UAE Nuclear Policy development and Change*

The policy change has confirmed according to the yearly bounded frequent data words. It also reveals the main nuclear issue related to the change status either positive or negative. The targeted data from National Report [1~3], FANR Annual reports [4~9], ENEC Sustainability reports [10~12], IAB Report [17 ~32], and IAEA articles from the web deals with the official statement, consequences of policy, activities performance, serious issues focuses on International security agreements [33~38] and Human Resource Development series [13~16]. Data from 2014 is included in the year 2015, and 2016 ones also came in 2017's since there were no significant change and lack of source.

Table 1. Rank of frequent keyword by year.

Fukushima

	2010	2011	2012	2013	2015	2017	2018
1	safety	safety	safety	safety	safety	innovation	safety
2	iaea	iaea	management	international	security	safety	management
3	management	management	security	security	radiation	international	security
4	international	security	international	management	management	security	international
5	radiation	radiation	energy	radiation	international	management	radiation
6	security	staff	radiation	programme	fuel	energy	iaea
7	energy	training	iaea	energy	standards	radiation	energy
8	staff	director	programme	iaea	energy	audit	programme
9	training	international	national	national	iaea	department	national
10	director	national	protection	regulation	protection	committee	protection
11	programme	review	power	protection	programme	development	training
12	safeguards	facilities	review	activities	barakah	iaea	staff
13	standards	entities	activities	director	national	energy	standards
14	government	standards	radioactive	standards	knowledge	programme	director
15	power	ministry	construction	power	training	national	safeguards
16	regulations	radioactive	staff	radioactive	conducted	protection	department
17	facilities	safeguards	facilities	training	safeguards	knowledge	power
18	national	cooperation	safeguards	emirates	emergency	training	activities

Since 2010 from the data set, Nuclear Safety, red colored, has got the priority steadily. Nuclear Industry Infrastructure has started with intensive staff Training and Education, green colored. After Fukushima accident in 2011, Safety, Security, and Management show intimately high ranked and increased approximately 23% than before in 2012. Also, Risk Assessment and Design condition enhanced on nuclear policy, IAEA Programme execution, pink colored, National Protection, yellow colored, activities started to show on the data set.

After 2014, world has met the nuclear security issue and UAE nuclear policy affected shows 'Radiation' and 'safeguard' in high sensitivity along with safety, security, and management. In 2015, all four BNPP (Barakah), orange colored, was under construction and importance of the Nuclear Knowledge Management, green colored, also mentioned in the cycle. To prepare the Fuel, peach colored, delivery in 2016, committed regulation require--ment combined with the policy statement.

Not only with safety culture in UAE nuclear industry, from 2017, but Development of Innovation culture and Audit Department, blue colored, also seems to get high ranked in policy in HR before construction completion.

3.2 *Analysis of the UAE Nuclear Policy Basis*

The Figure 2 below indicates the frequency and weight of keywords occurred in policy basis as size and location; the more prominent and the central. The policy basis gets the result of priority with 'safety', following by frequent words like management, security, international, radiation, etc. As we can see above, safety and security are way emphasized like one of central IAEA role. Also, training, staff, director, and programme perform pretty high value on policy base.

Fig. 2. Word cloud of the keywords for the UAE Nuclear Policy.

Figure 3 identifies the cluster related to each keyword of analyzed data. The main content of the UAE Nuclear Policy is safety as mentioned above on word cloud. Result enables to make a summary of roles and strategy as following below:

1. Radiation protection & security management as the primary role of safety
2. Meeting the IAEA standards as a regulatory qualification for energy & protection
3. Authority investment on building the high level of a human-capacity under the programme, training of safeguards activities

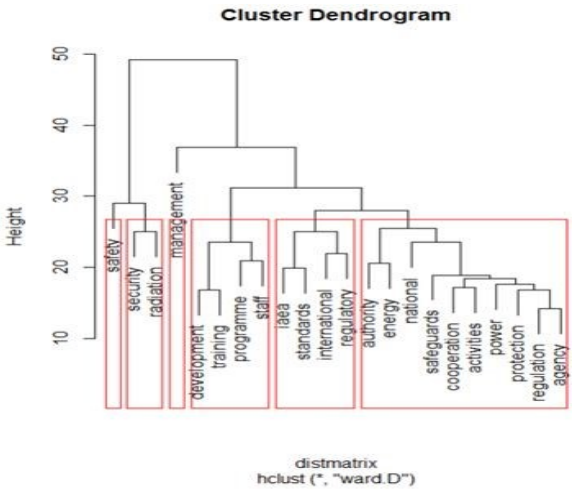

Fig. 3. Clustering analysis for the UAE Nuclear Policy.

3.3 *Result Verification*

The result of Comparison of UAE Nuclear Policy development and change (3.1) and Analysis of the UAE Nuclear Policy Basis (3.2) indicate that the concept/ priority of 'safety', 'security', and 'safeguard' is on top status (a, b, and c) and also clearly shows that it meets the IAEA Safety Standards requirements, investment in the sustainability of the Human Capital (Capacity Building) for are mostly matched with the policy mentioned in [1] and reflected on Fig 4

Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy (National Report) [1]

a. Operational transparency.
b. Highest standards of non-proliferation.
c. Highest standards of safety, security and safeguards.
d. Working directly with the IAEA and conform to its standards.
e. Develop domestic nuclear power capability in partnership with interested parties in the country.
f. Approach any peaceful domestic nuclear power program for long-term sustainability.

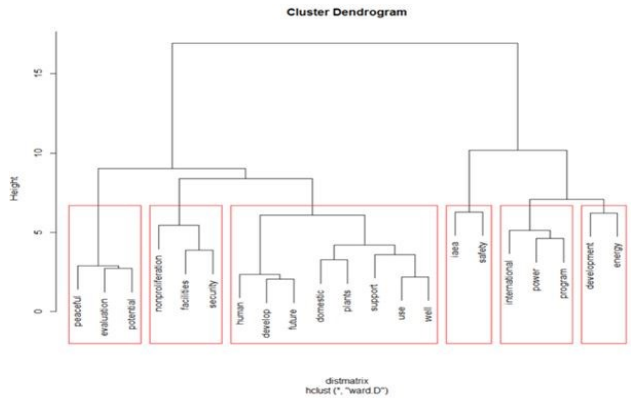

Fig. 4. Clustering Analysis of the UAE nuclear energy policy.

IV. Conclusion and Limitation

This research remarks the conclusion that big data analysis is a reliable and beneficial tool for users especially big data engineers who want to get insight out of the non-numeric data. This research also enables to look around the status of UAE nuclear policy and change per year related to the major safety and politic security issues nationally and internationally.

The result refers that

First: the implementation of UAE nuclear policy is following the big frame of the initial statement since 2010.

Second: the UAE has dealt with situations gracefully meeting the IAEA Safety Standard requirements; internationally suggested actions after Fukushima accident and international security recommendations on world nuclear, put the safety, security management on top priority as well as national protection.

Third: UAE has steadily developed the Human resource strategy for domestic sustainable capacity building, unique HR business models, and start on innovation culture according to the UAE Government initiatives.

Not only with this result of policy research, but Big Data Analysis would also enable a new approach - lie in government reaction, authority regulation revision, risk assessment of nuclear power plant issues and models. The UAE Government has established the Ministry of Artificial Intelligence based on the enormous possibilities of Big Data in sectors. With the context of the growth, application of Big Data Analytic would play a crucial role for Risk Information Decision Making for productive risk information sharing between departments.

Under the strict goal of safety on priority, following the standard of IAEA, the challenges of successful clean energy supplier are meeting the requirements from decision-makers, and regulatory. Thus, the lack of risk information sharing would easily raise the possibilities of failure and risk of NPP Configuration Management to get the right decision to order.

To reduce the complexity of the entire NPP management process, adequate knowledge education and risk information sharing with others are essential, which is the keycard of communication to reduce the uncertainty. [38] With this view, utilizing the Big Data analysis as an educational and instructional supportive tool, it will improve the quality of Knowledge Management and Configuration Management to find out more clear ideas on problem-solving and reducing the risk of the NPP.

Acknowledgement

The UAE nuclear- and radiation safety infrastructure development is continuing, so this research also will continue in the following years - after start up of the four nuclear reactors at the Barakah Nuclear Power Plant. The Author appreciate those organizations who make their data available for this research and will be greatly appreciate to receive any additional data from the participants/ contributors of this amazing development to make the research more comprehensive.

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