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***“СТРАТЕГИЧЕСКОЕ УПРАВЛЕНИЕ ЧЕЛОВЕЧЕСКИМИ  
РЕСУРСАМИ В НОВЫХ ЯДЕРНЫХ СТРАНАХ: ОПЫТ ПЕРВОГО  
ЯДЕРНОГО ОБЪЕКТА В БАНГЛАДЕШ”***

***“STRATEGIC HUMAN RESOURCE MANAGEMENT IN NEWCOMER  
NUCLEAR COUNTRIES: EVIDENCE FROM BANGLADESH'S FIRST  
NUCLEAR FACILITY”***

## **Аннотация**

Актуальность этой работы заключается в том, что проект атомной электростанции в Руппуре является стратегически важным проектом, поскольку это первый ядерный объект в Бангладеш. В условиях очень рискованных и критически важных с точки зрения безопасности условий эксплуатации эксплуатационная надежность и долгосрочная устойчивость проекта напрямую зависят от работы персонала. В документе дается обзор деятельности отдела кадров в RNPP и даются предложения о том, как можно увеличить стратегический вклад отдела кадров. Исследование, проведенное с использованием смешанных методов, включало анкетный опрос 300 сотрудников, а также полуструктурированные интервью со специалистами и руководителями. Кроме того, была изучена официальная проектная документация. Количественные данные включали описательный статистический анализ, корреляционный и регрессионный анализ. С другой стороны, качественные данные были проанализированы с использованием тематических методов. Результаты показывают, что система управления персоналом функционирует достаточно хорошо в том, что касается таких аспектов, как обучение сотрудников, сертификация и формирование мощной культуры безопасности. И наоборот, не так много аспектов демонстрируют схожие слабые места, а именно: мотивация и удержание сотрудников, стратегическое кадровое планирование, пути карьерного роста и успешная межкультурная интеграция. Предложенная модель эффективности управления персоналом будет применена в реальной жизни в связи с совершенствованием кадровой политики RNPP. В дополнение к этому, это также способствует развитию национального человеческого капитала в развивающемся ядерном секторе Бангладеш.

**Ключевые термины:** эффективность управления персоналом; ядерно-энергетический проект; культура безопасности; смешанные методы; Руппур; управление персоналом мегапроекта.

## **Abstract**

The topicality of this work consists in the fact that the Rooppur Nuclear Power Plant Project is the strategically significant project because it is the first nuclear facility in Bangladesh. In a very risky and safety critical operating environment, operational reliability and long-term sustainability of the project is directly related to human performance. The paper reviews the performance of the HR department in RNPP and gives suggestions on how the strategic contribution of the HR department can be increased. The survey used as the mixed-methods approach of the study has included the questionnaire survey of 300 employees, as well as, the semi-structured interviews with specialists and managers. In addition, official project documentation was also examined. The quantitative data involved descriptive statistical data analysis, correlation, and regression analysis. Qualitative data were analyzed on the other hand using thematic methods. The outcomes reveal that the HR system is functioning fairly well regarding such aspects as employee training, certification, and establishment of a powerful safety culture. Conversely, not so many aspects show any similar areas of weakness, namely: employee motivation and retention, strategic workforce planning, career development pathways and successful cross-cultural integration. The suggested HR effectiveness model will be applied in reality to enhancing the human resource policies of RNPP. In addition to this, it is also contributing to develop the national human capital in the developing nuclear sector in Bangladesh.

**Key terms: HR effectiveness; nuclear power project; safety culture; mixed-methods; Rooppur; mega project HRM.**

## 1. Introduction

Rooppur Nuclear Power Plant Project (RNPP) is a nuclear power plant which is the first nuclear power facility in Bangladesh and among the largest megaprojects in the history of Bangladesh. Having two VVER-1200 Generation III+ reactors with an installed capacity of 2400 MW, RNPP is a key move towards energy security and technology (IAEA, 2018). But nuclear megaprojects are not similar to traditional infrastructure projects: human error in their case could cause disastrous outcomes, and human resource management (HRM) is not an administrative role of the project but a pivotal factor in terms of safety (Reason, 2016; Meshkati, 2012).

The International Atomic Energy Agency (IAEA) refers to human resources as one of three pillars of national nuclear infrastructure along with legal-regulatory frameworks and technical systems (IAEA, 2018). In the case of newcomer nuclear countries, such as Bangladesh, this problem is exacerbated by poor knowledge base within the country, reliance on foreign experts, and a requirement to systematize the transfer of knowledge. Even though, its strategic significance, there is absolutely no empirical investigation on assessing HR performance in nuclear megaprojects in the context of developing countries.

The projected study efforts on this gap by including an evidence-based, systematic assessment of the HR Department at RNPP, including recruitment, training, performance management, retention, and cross-cultural workforce integration in a safety critical, internationally coordinated megaproject setting.

## **2. Literature review and Problem Statement**

### **2.1 Theoretical Framework**

This study is knowledgeable by three supplementary theories. The Human Capital Theory (Becker, 1993) postulates that an investment in the knowledge, skills as well as abilities of the employees has organizational returns in terms of increased productivity and safer performance within the organization. This, in the nuclear scene, translates to the systematic training, certification and lifelong professional development. The concept of human capital is described as a Resource-Based View (Barney, 1991) which formalizes the concept of the human capital as a valuable, rare, inimitable, and non-substitutable (VRIN) strategic resource in organizations where organizations having better human resource systems lead to sustainable competitive advantage. Safety Culture Theory (IAEA, 2016) stipulates that safety outcomes in high-reliability organizations are determined by the combination of organizational values and the leading commitment, as well as behavioral norms.

### **2.2 Nuclear Megaprojects HRM.**

The main characteristics of megaprojects include technological complexity, longer timeframes, numerous players and high uncertainty. Flyvbjerg (2014) shows that failures of megaprojects are, more frequently than technical, based on organizational and managerial failure. The HRM should offer in nuclear power projects: (a) highly skilled, certified workforce; (b) regular training and maintenance of competence; (c) attention to safety metrics development in the performance systems; (d) retention of knowledge at the different project stages; and (e) cross-cultural, multi-national team management (IAEA, 2018; OECD-NEA, 2017).

### **2.3 Gap in Research and Problem Statement.**

Although RNPP is a strategically important aspect, there was no systematic empirical assessment of its HR effectiveness before this research. Such

issues include: a lack of skills in specialized nuclear fields, reliance on external expertise, bureaucratic public-sector human resource policies and procedures, and inadequate institutionalized cross-cultural management systems. This paper hence poses the following question: How is the HR Department of RNPP effective regarding the core HR functions, and what should be done to improve the nuclear safety as well as operational sustainability?

### 3. Methodology

#### 3.1 Research Design

It used a mixed-method convergent parallel design, which covered both quantitative surveys with qualitative interviews and document analysis. Such a design allows methodological triangulation with numerical trends being described and contextualized by qualitative knowledge (Creswell & Plano Clark, 2017).

The sample and data collection are explained as follows: 3.2 Sample and Data Collection.

**Quantitative element:** 300 RNPP employees (stratified random sample) were given a structured questionnaire on HR effectiveness that assessed six dimensions (recruitment, training, performance management, retention, safety culture, cross-cultural management). The instrument was highly reliable (Cronbachs 89, overall with a 76-87 per dimension). The 5-point Likert scale was utilized to respond.

**Qualitative element:** 15-20 key informants such as HR managers, departmental heads and safety officers and even technical supervisors were interviewed using semi-structured interviews. The duration of interviews was 45-60 minutes and thematic analysis was used to analyze these interviews.

**Secondary data:** Systematic examination of HR policy documents, training manuals, safety guidelines and IAEA reports.

### 3.3 Data Analysis

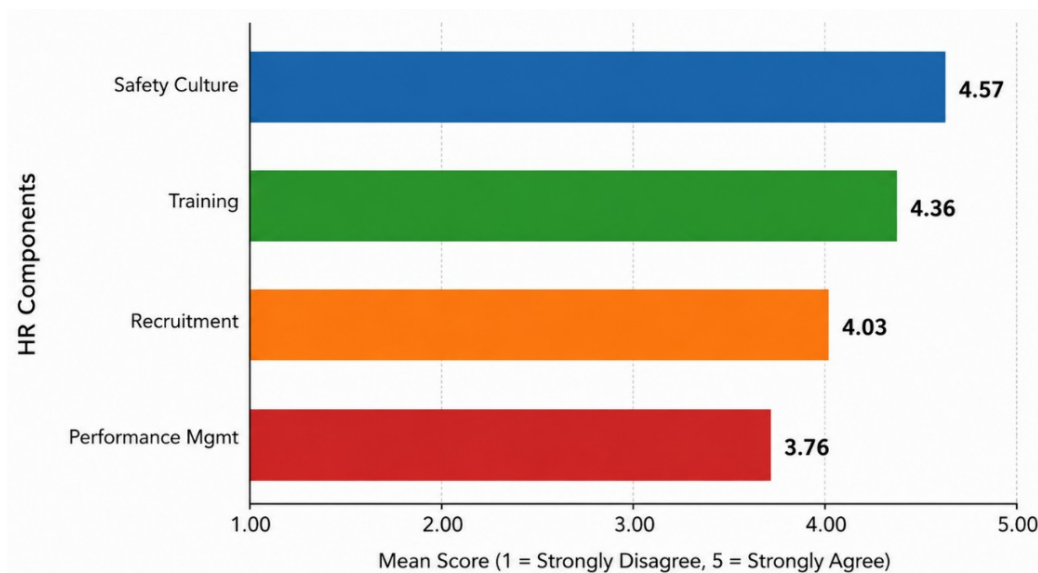
Data and statistics were considered in the form of quantitative data and analyzed with SPSS, using descriptive statistics, Pearson correlation and multiple regression. The qualitative information was coded using thematic NVivo. Conclusions have been incorporated in the interpretation process.

### 4. Result and Respondent Profile

Out of 300 participants, 47.3% of respondents were operational staffs, 32.0% supervisory and 20.7% management. Experience distribution: 28.0% (<3 years), 40.3% (3-6 years), 31.7% (>6 years). This guaranteed the representation at organizational levels.

**Table1: Expressive Statistics of HR Efficacy Dimension**

HR Component	Mean	Standerd deviation	Construal
Safety Culture	<b>4.57</b>	<b>0.49</b>	<b>High</b>
Training Effectiveness	<b>4.36</b>	<b>0.42</b>	<b>High</b>
Recruitment	<b>4.03</b>	<b>0.57</b>	<b>Moderate-High</b>
Performance Management	<b>3.76</b>	<b>0.61</b>	<b>Moderate-High</b>



## Figure: Graphical Representation of HR Efficacy Component

### 4.3 Training and Safety Culture

The highest ratings were obtained in safety related training (M=4.55 in terms of adequacy of safety related training). Strong safety awareness was reported (M=4.57) as well as apparent leadership commitment to safety (M=4.42). But training needs assessment had lower scores (M=3.36) which indicates reactive training planning rather than strategic training planning.

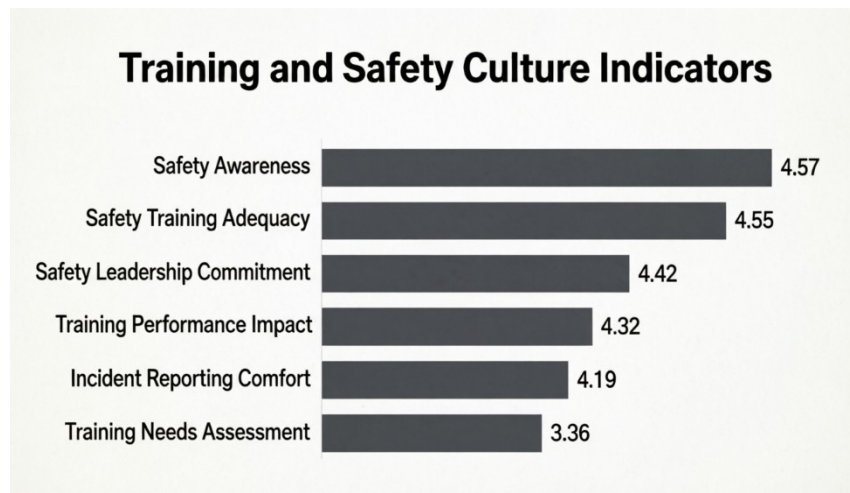


Figure: Training and Safety Culture Indicators

### 4.4 Performance Management and Retention

The weakest dimension was performance management (M=3.76). The interview information showed the fear of transparency when it comes to appraisal and the quality of feedback. One manager observed: "Appraisal of technical performance is generally well reflected but behavioral and safety attitudes are not always well reflected in appraisals. The scores of retention and motivation were moderate (M=3.41), the scores of management communication (M=3.38) and complaint handling (M=3.31) were lower, which means that the technical HR functions are strong, and the mechanisms of employee engagement still need to be strengthened.

## 4.5 Correlation Analysis

**Table 2 : Correlation Between Training Effectiveness and HR Effectiveness**

Variables	HREI	Training Relevance	Training Impact	Safety Training
HREI	1.00	0.71	0.75	0.80
Training Relevance	0.71	1.00	0.85	0.72
Training Impact	0.75	0.85	1.00	0.74
Safety Training	0.80	0.72	0.74	1.00

$p < 0.01$  (2-tailed; HREI = HR Effectiveness Index). Safety culture was most strongly correlated with overall HR effectiveness ( $r=0.74$ ), and then with training effectiveness ( $r=0.71$ ). The weakest correlation was found with performance management ( $r=0.58$ ), which is also in line with its lower mean score.

## 4.6 Hypothesis Testing

<b>4.6 Hypothesis Testing</b>				
Table 3. Regression Analysis Results				
Hypothesis	$\beta$	t-value	p-value	Result
H <sub>1</sub> : Training → Safety Culture	0.62	9.45	0.000	Accepted
H <sub>2</sub> : Transparent Recruitment → Performance	0.54	7.88	0.000	Accepted
H <sub>3</sub> : Performance Management → Motivation	0.58	8.12	0.000	Accepted
H <sub>4</sub> : Cross-cultural HR → Teamwork Efficiency	0.51	6.94	0.000	Accepted

**Table 3. Regression Analysis Results**

All four hypotheses were accepted at  $p < 0.001$ , which proved the validity of the structured HR practices in influencing the safety culture, employee performance, motivation, and cross-cultural collaboration.

## **5. Discussion**

### **5.1 Interpretation of Findings**

The findings indicate a paradoxical profile: RNPP HR department is the strongest in such areas as operational-technical functions (safety training, certification, monitoring compliance) and more-weak in such aspects as strategic developmental functions (performance management transparency, career development, retention, cross-cultural institutionalization).

This trend aligns with the public-sector HRM in developing countries, where cultures of compliance and bureaucratic procedures prioritize control over engagement (Zafarullah and Rahman, 2021). With nuclear megaprojects this imbalance comes along with certain risks. Global safety training but lack of equal care to motivate and retain the skilled personnel might have the result that skilled personnel will leave at the time when the competency of the skilled personnel is most in demand. Equally, performance schemes that do not focus on behavioral safety measures can unintentionally reward production over precaution.

The fact that safety culture is the strongest predictor of HR effectiveness ( $r=0.74$ ) can be explained by the fact that safety culture is the central element of the formal structures of nuclear HRM (IAEA, 2016). Though, the comparatively lower performance management scores advocate that this safety orientation has not been adequately embedded in appraisal systems a gap that Reason (2016) cautions

against able to erode the safety culture by sending incompatible signals about what matters to the organizations.

## 5.2 Cross-Cultural HR Challenges

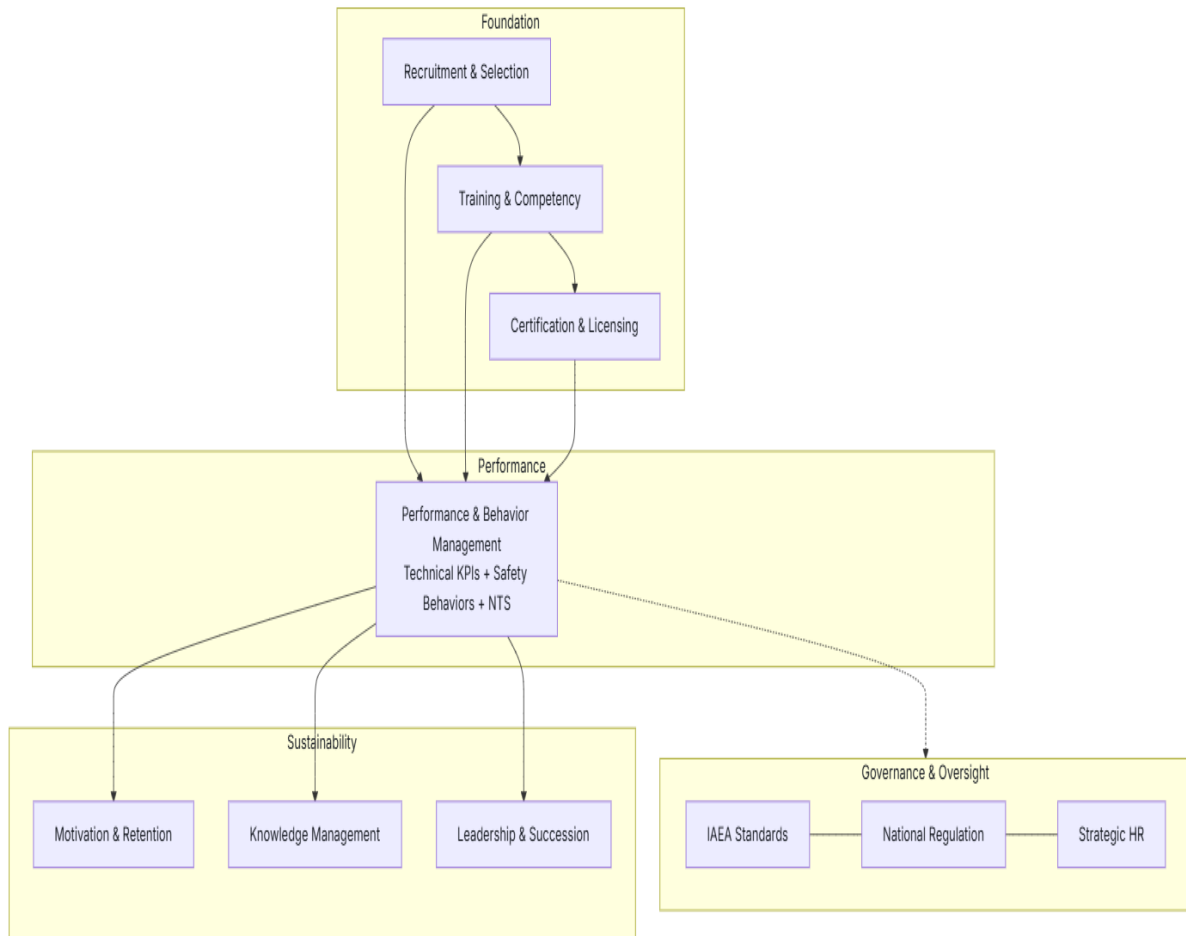
There were qualitative results that cross-cultural management was identified to be a critical and yet under-institutionalized area. Although the technical collaboration between the Bangladeshi and the Russian staff was said to be strong, cultural differences in styles of communications, authority to make decisions and work norms created cultural barriers in coordination. According to one of the interviewees: "There has been good technical co-operation, but still administrative and cultural integration needs well-organized policy support. This supports the fact that Hofstede (2011) found that the cultural difference in power distance and uncertainty avoidance are also significant to the performance of a multinational team.

## 5.3: Proposed HR Effectiveness Model at RNPP.

According to the empirical evidence, it is suggested to construct a context-specific HR Effectiveness Model with six interdependent pillars:

1. Safety-Centered HR System- introducing safety measurements into every HR activity.
2. Competency Lifecycle Management – The integrated pathways are  
**Recruit → Train → Certify → Retain**
3. Knowledge Transfer & Localization - formal system of mentoring and documentation.
4. Balanced Performance-Safety-Behavior Management - balanced scorecards with behavioral measurements.
5. Strategic Workforce Planning & Talent Pipeline - forecasting and succession planning.

6. Cross-Cultural Integration Framework - oriented structure, language support and resolution of conflict.



**Figure 5.3: Proposed HR Effectiveness Model at RNPP.**

## 6. Conclusion and Recommendations

### 6.1 Summary of Contributions

**This study is the first systematic and empirical assessment of HR effectiveness in Rooppur Nuclear Power Plant Project. Key contributions are:**

- (a) empirical evidence that safety culture and training effectiveness are the strongest predictors of HR effectiveness in nuclear megaprojects.
- (b) identification of gaps such as "transparency of performance management" and "cross-cultural institutionalization.
- (c) a context specific HR effectiveness model for "newcomer" nuclear countries.
- (d) methodological demonstration of mixed-methods HR evaluation in high-risk environments, such as nuclear power plants, where the public sector is the key focus.

### 6.2 Practical Recommendations

#### **Medium-term (2-3 years):**

1. Formally introduce training system
2. Embed behavior-based safety indicators in performance evaluation
3. Introduce training programs for cross-cultural communication
4. Digitized HR records and performance monitoring.

#### **Long term (3–10 years):**

1. National nuclear HR capacity roadmap.
2. Formalized career pathways and professional recognition.
3. Formalized knowledge management and expert mentoring system.
4. Strengthening of career pathways and professional recognition.

### **Policy level:**

1. increase HR autonomy within public-sector context.
2. link pay and incentives of high-skill strategic sectors to public-sector regulation.
3. incorporate HR standards of IAEA into country's policy.

### **6.3 Limitations and Future Research**

This study, although designed as a rigorous mixed-methods analysis, has several limitations which should be noted. First, the analysis is a single case (RNPP) and may not be applicable to other nuclear projects in other national or regulatory environments. Secondly, cross-sectional data reflect perceptions at a precise time, so fundamental links between HR practices and safety outcomes cannot be firmly drawn. Third, the nuclear security protocols required restrictions in access to some strategic documents (such as, detailed performance records, classified safety reports), with the possible omission of some objective indicators. Fourth, the sample, though stratified, may be under-represented of foreign experts because of language and availability problems. Fifth, there may have been a social desirability bias in the self-reported responses, especially for safety culture.

Future studies should focus on longitudinal studies following HR interventions and safety measures throughout the entire plant life cycle. Comparative studies on various nuclear projects (like Bangladesh, UAE, Belarus) would result in the identification of context-specific and universal HR effectiveness factors. Also, quantitative modelling of HR–safety–performance relationship by using objective indicators (such as incident rates, certification pass rates) would benefit causal inferences. Finally, ethnographic studies of the processes of cross-cultural transfers of knowledge could be used to improve localization practices with regards to new nuclear countries.

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