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Research Article

Human resources management planning in oil and gas organizations for profitability optimization

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ABSTRACT

The competition in energy market involves development of environment friendly and high scale power output plants. The major types of reliable power generation plants are found to be nuclear and hydro-oil and gas industries which are manifested a promising source of energy that produce power in large scale. Human errors are mainly occurring during the maintenance, design (planning) and operation phases. Such error are the main causes of performance degradation by imposing economical and technical losses. This paper keen on investigating the human error causes that leads to performance degradation in oil and gas industries. It was realized that human error are mainly caused by bad human resources strategies and faulty materials (monitoring tools) while studying the same over two nuclear and one coal-fired oil and gas industries.

Keywords: Sustainability, maintenance, human error, rul, impact factor, availability, criticality

INTRODUCTION

Oil and gas industries are established for supplying the market demand of fuel that used to produce the required energy in continuous manner. Tradition power industries are basically relying on fossil fuel for energy production; such industries are major and most trusted source of energy. Nevertheless; traditional energy resources manifested in gas, thermal, diesel, atomic, etc. oil and gas industries are negatively influencing the environments, it has remained as most reliable resources of energy [1]. Renewable energy resources manifested in wind and solar oil and gas industries are promising sources of cheap and environmentally friendly energy [2]. The persisted doubt of possibility of complete switching into renewable energy can be addressed by studying a metrics alike availability and criticality in both resources. Availability is defined at [3] as percentage of continuous power production by the plant without interruption. It is measured in time and reflects the periods that station/plant operational and capable to generate power. Criticality is the period that station/plant is none operational and it occurs during operational faults. Data of availability and criticality is to be collected by the station/plant team in order to put maintenance plans and preparing the required equipments. Through analyzing the data of availability and criticality, station/plant remaining useful life (RUL) can be derived/predicted [4]. RUL represents the period that station/plant will remain operational until the next expected fault occurrence. The prediction of the RUL in oil and gas industries is vital factor for the performance and cost. Availability and criticality analysis are achievable using qualitative and quantitative approaches which in turn reveal the future status of plant. Thus, it can be realized from the previous researches that conducted in domain of maintenance scheduling and planning based on Availability and criticality studies. Among that; plenty of researches such as have been made in interest of fossil fueled stations such as thermal plants [5] and gas plants [6]. Such studies are helped for aiding future error occurrences by scheduling robust maintenance plans. From the other hand, good number of researches were deployed those factors in order to estimate the performance of plant in order to optimize the production i.e. (measuring the availability and criticality in wind plants in order to enhance the power generated from wind more likely by increasing the number of towers or modification the turbine design). In order to highlight the influence of human error in various maintenance process; this paper involves three case studies showing the same over nuclear plants and coal-fired fuel based plants.

HUMAN ERROR

In order to prevent devices dysfunctionality, maintenance for the same devices is must. Since oil and gas industry are involving numerous costly and highly fault susceptible devices. Perfect maintenance may enhance the cost by preventing the fully defect of the devices and also to return the partially defected devices into service as rapid as possible. Thus, performing of preplanned

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maintenance is certainly enhancing the plant performance and reliability due to the role it is playing in clearance of malfunctioning in oil and gas industries. Defective devices are triggering safety concerns as well as financial losses [7]. Due to the substantial role of maintenance in tackling plenty of performance degradations factors as well as improving the safety measures in oil and gas industries, it is considered as vital contributor in power quality formula [8]. Human error is one of the potential factors that degrade the maintenance irrespective of the serious efforts for perfecting maintenance planning and schedules [9]. Human errors are not avoidable and their bad consequences during maintenance process are popular in industries alike aviation, defense and oil and gas industries. Human errors are contributing in almost 60% of errors occurring in industries. More specifically, an error of particular device may trigger multiple errors in the system by whole [10 b1]. According to [11 b2], nuclear reactor unplanned faults are realized associating with maintenance due to human error. In large oil and gas industries such as nuclear oil and gas industries [12] and hydro-oil and gas industries [13], it was realized that factors like cost and performance were always targetable during design and planning stages. However, influence of maintenance in both cost and performance is realized to be major. During machinery era where machines are set for performing human tasks and facilitates their lives; human factor could not fully omit. Maintenance is about those process where human can intervene and maintain the required functionality of the machines. Although, large of today's machinery systems are enabled with auto/self-maintenance; human role in in this complex is still required [14]. Human error is the major concern herein where machinery is expected to be maintained perfectly. Such perfection is impossible in practically scenario as human error is unavoidable. With emerging of new man/human machine interface (HMI) systems of user friendly features, it was expected that human error will be reduced [15]. However, human errors were realized in various forms in maintenance degradation [16]. The risks associated with human errors are manifested in equipments premature failure which increase the cost and reduce the performance [17]. Insufficient considerations of the operational errors are main reason behind sudden unexpected errors. Generally, error aids during the designing stages of oil and gas industries are merely considering hardware failure which is practically insufficient to relay on due to other errors generating during the operations. Taking another industry (apart from the power generation) it was stated at [18] that human error is participating a 70% of aviation accidents. Another experience in [19] stated that 50% of power outages in coal-oil and gas industries is occurring normally during the week days has potentially reduced after scheduling of shutdown maintenance. 60% of losses in domestic plants were realized because of human error. Thus, estimation of human error is vital for tackling the unexpected circumstances during the operations.

MAINTENANCE OF OIL AND GAS STATIONS

Planning is essential step any industry for increasing the profitability and consistent under the sever market competition [20]. More specifically, oil and gas industries industry is large in terms of investment and also highly susceptible for competitions of energy market. Since energy generation technologies are continuously emerging for kilowatt cost reduction and for creating environmentally friendly systems with less possible emissions. In order to continue plant sustainability (performance in the designed/targeted level), robust maintenance is required. As prescribed above, maintenance is critical for oil and gas fields performance; the said maintenance of coal-fired based oil and gas industries is realized according to the report of Energy Sector Management Assistance Program (ESMAP) [21] of the World Bank. However, maintenance of such type of plants in Asia Pacific region was realized and the following problems were found:

- a) In the said oil and gas industries i.e. coal fired power generation, it was found that such plants are by whole lack for documented maintenance even in case of maintenance of essential and critical parts of the plants.
- b) Ordinary, operational historical maintenance database is found not deployable for extracting data alike average time between the part failures and subsequently no failure model is seen constructed.
- c) Maintenance is conducted according to the fashion cited/inherited from other plants and the planning is made for long times i.e. three years in advance based on the same inputs which led to unexpected shutdown of the plant.
- d) Due to the old age of the mentioned plants, the existed monitoring systems are not being used. even through, its performance is not upto the mark which lead to inadequate maintenance quality.

CASE STUDY

The framework of the said case study is that bias which can be used to classify the human error. Thus, the consensus among the realized publications/reports of the cases mentioned herewith can be stated as error due to human faults are collected base on the error cause and type of task as well as the circumstances of detection. The framework of the classification is demonstrated in Figure 1.

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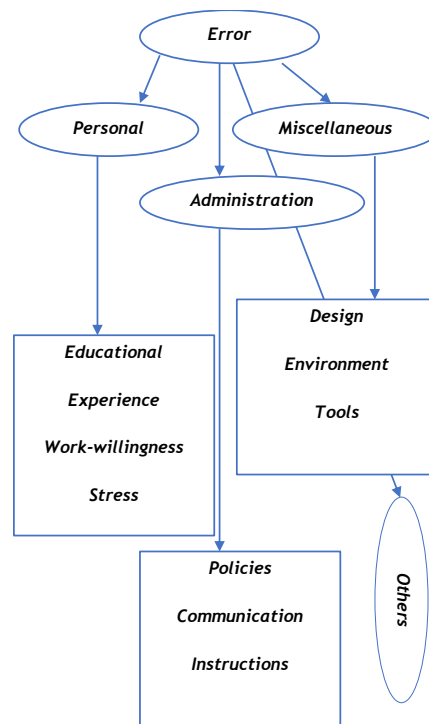


Figure 1: Classification of the cause of human error in oil and gas industries

Such type of errors can be occurred in various type of tasks including: during the designs and planning, during the operation phase and during the maintenance phase. For the research samples CA, CB and CC, the data of human error can be illustrated in Table 1. In order to understand the causes that leads to the so-called human error in power generation industry, we have taken three case studies which represent the causes of human error in two nuclear oil and gas industries s located in united states of America and India as well as one coal-fired oil and gas industries located in India. In further discussions, we are going to term for each mentioned case as CA, CB and CC where CA stands for US based nuclear plant, CB stands for India based oil and gas industries and ultimately CC stands for India based coal-fired oil and gas industries .

CA: US based commercial boil water reactor suffering from abnormalities occurrences. The data of the same occurrences are reported to the US nuclear regulatory commission (UNRC) and released by them [22].

Table 1: data formulation from the selected case studies.

Plants Errors	CA	CB	CC	Impact factor
Educational	1	0	0	1
Experience	1	1	1	3
Work-willingness	1	0	0	1
Stress	1	0	0	1
Polices	1	0	1	2
Communication	1	0	0	1
Instruction	1	0	0	1
Design	1	0	0	1
Environment	1	0	0	1
Monitoring tools	1	1	1	3
Human dense	0	1	0	1
Plant age	0	0	1	1
None documented maintenance	0	0	1	1

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CB: India based nuclear oil and gas industries s, data are reported to the reactor control division and released by Bhabha atomic research center [23].

CC: India based coal-fired oil and gas industries s based in Punjab, Gujarat, Rajasthan, Andhra Pradesh and Tamil Nadu. Data is released by Energy Sector Management Assistance Program (ESMAP) [21].

Thus, Table 1, illustrated the human error causes over various types of oil and gas industries s including nuclear (CA and CB) and conventional coal-fired oil and gas industries (CC). Over the mentioned case studies, it is known that energy generated from nuclear plants are much higher than that of other plants [12]. Considering the cost of production as compared to the coal-fired plants, the later has maintained its position in energy industries. The collection of those samples (cases) was performed after fulfilment the diversity factors in generation type e.g. (nuclear and coal-fired) and the locality (e.g. USA and India). From error assessment point of view, Table 1 brings the consensus of error causes among the aforementioned plants. However, the data is feed into table in form of binary indicators i.e. (zeros and ones) where zeros indicates the none popularity of that error causes in the plant and ones indicated the popularity of error causes.

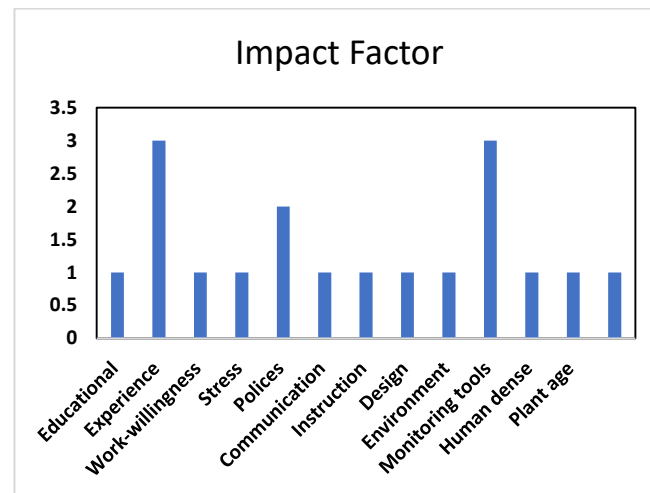


Figure 2: Impact factor of error causes in the oil and gas industries s (according to the research sample).

Results of impact factor for the human error causes as shown in Figure 2 revealed that “experience” and “monitoring tools” errors are having consensus among all the plants i.e. (CA, CB and CC). Thus, experience of the staff is vital for the human error causes from the other hand, faults of monitoring tools such as meters and indicators are also common reason behind the human error in the plants.

RECOMMENDATIONS

In order to tackle the human error involved into maintenance degradation, several aspects need to be followed in oil and gas industries s. Human resources need to be efficiently performed in such way the expert bodies and mostly required profiles are hired. The human resources need to be restructured in such ways all the responsibilities and tasks are clearly defined. Adequate structure of the responsibility involves efficiently fulfillment of four majors in the plants namely, operational an maintenance (O&M), Human resource (HR), Finance and materials. Within maintenance department e.g. (O&M), several responsibilities (profiles) are required; the same is listed in Table 2.

Table 2: responsibilities restructure in oil and gas fields.

Profile	Required Responsibilities
Operations	To be addressed by the general manager of the project where the main planning is made by.
Maintenance planning	To be addressed by the department managers of in every section/unit in the field.
Station chemistry	To be addressed by the chemist and other delegations such as soil specialists and geologists.
Efficiency and operations	To be taken car by the site engineers each as per his/her specialization.
Parts maintenance	To be taken care by the technicians and human resource department where the suitable staffs need to be assigned.

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CONCLUSION

Oil and gas industries are vital for various performance degradations that influencing the Quality of service. Among that, maintenance performance degradation due to human error. This paper discussed the influencing factors that contributes the expansion of human error in the oil and gas industries. The sample of this study is considered three cases namely: CA, CB and CC which stand for two nuclear oil and gas industries and one coal-fired oil and gas industries. Human error framework was related to three main causes namely: administrative, personal, Miscellaneous and others. Thus, data are collected from the reports published by the specific organizations where the plants are belonging to; the same is gathered from each publication and used to formulate the Table 1. The impact factor of each error cause is being measured and the leading causes of human error was found to be “lack of experience” and “faults of monitoring tools”. Staff experience is responsibility of human resource department which need to recruit the experience professional bodies for operating the plant. From the other hand, faulty tools and monitoring equipment are another cause of human error, the same is realized at all cases of research sample where the faulty monitoring and measurement tools are mainly causing human errors.

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