論 文 内 容 の 要 旨

氏 名 PAULO DA SILVA

The 20th century was the most momentous transformation time; it was time where world societies faced enormous challenges due to the advancement of technology innovations, was time where maintaining product superior quality, time saving, low-cost production, less energy consumption and using green cooling system also became central attention of manufacturers, technologists, industries and scholars. These factors are essential and need to be managed in such to reflect with the principle of ecological modernization technology approach. The question is to what extent these manufacture related risks are effectively managed. This study was therefore carried out to analyze and explore both risk at the ordinary time and risk at non-ordinary time and proposed a holistic technology development evaluation platform approach for promoting risk management in manufacture. First, the impact of the factory environment on machine tool performances as one of the risks at the ordinary time was analyzed by assessing both manufacture temperature and heat transfer coefficient changes. It was used to analyze machine tool precisions due to manufacture of environmental fluctuation. Both experimental and FEM simulations were performed for validation. Second, identification of Timor Leste electricity sector challenges and the possible measures to obtain green energy supply for manufacture and economical development needs were undertaken as man-made disaster risks at the non-ordinary time. A comprehensive evaluation, interviews and analytical hierarchy process study were done to obtain the most priority energy option for the country. It was able to highlight that reforming the current electric power system and promoting renewable energy options such as Hydro and Solar will not only reduce the country's annual operational expenditure on the power sector but also contributing significantly to environmental protection efforts. Third, the environmental impact of using strong alkaline water for cooling during machining was assessed by using a simple lifecycle assessment and focused on transportation and machining performances. The emissions from energy, fuel and oil consumption of both proposed and conventional cooling methods were compared. SAW cooling offers significant advantages including inhibiting corrosion, prolonging tool life, improving surface roughness and reducing annual global warming potential by 72.95 %. Fourth, research the earthquake impacts on machine tool performances was conducted as part of risks due to natural phenomena. Mathematical models for parallel, rotational and turnover motions were developed to analyze machine tool motion behaviors during a seismic event. A mock-up structure was used for experimental performances to mimic earthquake motion and real Japan earthquake acceleration data were used for calculating machine tool motion behavior regarding the developed models. It shows that the calculation accuracy of using the model

was up-to 60 %. Last, multi-dimensional analysis of the Double-Eco roller technology model was conducted as an effective approach for promoting risk management in manufacture. The overall Eco-Index of roller technology was estimated based on environmental, mechanical performances and risks for safety parameters evaluation. These parameters were evaluated through several approaches such as simple LCA and Mahalanobis Taguchi methods. It was noted that there is a significant improvement in all parameters with 87.5 % DE-Index as opposed to a 3.25 % of the conventional approach of technology evaluation practices.