

Prachuab Klomjit 2009: A Knowledge-Based System for Manual Lifting Task. Doctor of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Associate Professor Kongkiti Phusavat, Ph.D. 295 pages.

The objectives of this research were to survey the manual lifting tasks in Thai factories, to collect and analyze manual lifting task criteria, to conduct the experiments for verifying the *RLE* (*NIOSH* Revised Lifting Equation 1991), and to develop the expert system by the framework from the *RLE*.

From 7 factories surveyed, there were 31 separated tasks and 81 subjects. The results showed that these liftings required workers to work outside the limitation to appropriately use *RLE* equation, including the conditions, the environments and the postures. Then, the experimental biomechanics, physiology, and psychophysics approach were conducted and found that the capacity of Thai male was as same as western male. In addition, the *RLE* equation was related to the 95th percentile of Mital's table, so that it can be used to estimate the percentile multiplier, temperature multiplier for the new *RLE* referred as "*RLE'*".

After combining between existing knowledge base and new knowledge base, the prototype of an expert system for manual lifting task was developed, to be called the "ML-Expert", by *RLE'* framework, *OWAS* (for postures evaluation), other criteria, and recommendation intervention, in the rule base form and decision tree (to evaluate the recommendation before improvement). This system was developed by Java Expert System Shell (*JESS*). Then, the system was evaluated by comparing between two groups: ML-Expert system using and another group using work improvement technique every month in 6 months period (for short time comparison) and 9 months period (for trend analysis). The results showed that (9 topics) Abnormal Index (*AI*), Lifting Index (*LI*), Biomechanics compressive force on *L5/S1* disc, % of suggestion to be used, user satisfaction, efficiency of improvement, time usage of improvement, production efficiency and loss, quality of work life (fatigue, sickness, absence) of ML-Expert system using group were better in all cases. Especially, user satisfaction, efficiency of improvement, time usage of improvement, and production efficiency were better at 95% significant level. Additionally, the target impact was analyzed by *AHP* (Analytic Hierarchy Process) method. The result showed that performance, quality, quality of work life, safety, cost, and environment were better than those obtained from another method, at 95% significant level.

Student's signature

Thesis Advisor's signature