Application of knowledge engineering approach to mitigate the infant mortality risk of HV cable system in MEA Thailand

Asawin **RAJAKROM**; Metropolitan Electricity Authority, Bangkok, Thailand, asawin.raja@mea.or.th

ABSTRACT

MEA has recently experienced many infant mortality failure events on its HV cable system although the installation teams have possessed very high skill through lifelong experiences in cable jointing works. The cases were carefully studied using the knowledge engineering methodologies in order to identify the root causes and seek out the preventive measures particularly those related to the installation works. It was found that installation environments, installation procedures and techniques, jointers' skill as well as inspection and test methods all contribute to the failure probability. The countermeasures have then been developed to overcome the problems of joint failure.

KEYWORDS

Cable joint failure; Cause effect analysis; HV cables; Infant mortality; Knowledge engineering.

INTRODUCTION

Metropolitan Electricity Authority (MEA), the distribution utility supplying electricity to the customers in Bangkok Metropolis, Thailand, has implemented the underground cable system for several decades. The main purpose is to enhance the distribution system reliability and beatify the Bangkok metropolitan cityscape. Recently, MEA has launched the roadmap to support the government policy in turning Bangkok Metropolis into the capital of ASEAN through the modernization its distribution network. Hence the number of undergrounding projects has been established for the near future. The projects include the conversion of overhead to underground system along the main streets in Bangkok totaling 260 km of street length as well as the strengthening of sub-transmission system totaling 270 circuit-km. This passes on the huge burden to the project execution team including the cable installation works, the quality control of cable jointing and termination in particular.

MEA installation team although possesses very high skill through lifelong experience in cable jointing works, working under the adverse environment and stressful condition somehow deteriorates the quality of jointing work. It was evidenced by the number of accessories breakdowns during the commissioning soak test on the cable line, particularly the cable joints which installed in the manhole buried underneath the road surface. It sometimes even occurred right after the voltage switching-on. This event can be considered as "infant mortality" of bathtub failure pattern that seriously required particular attention from the project execution team. The knowledge engineering approach together with the analytical tool has then been employed to digest the problems, analyze causes and effects and seek for the appropriate solutions.

This paper aims to share the experiences of applying knowledge engineering approach to mitigate the infant mortality risk of HV cable system in MEA.

KNOWLEDGE ENGINEERING IN GENERAL

Knowledge is the whole body of data and information that people bring to bear to practical use in action, in order to carry out tasks and create new information [1]. It can be categorized as theoretical (concept) and practical (process) knowledge or as verbalized (explicit) and "embedded in head" (tacit) knowledge. Business success depends primarily on how well the organization can utilize these knowledge on real jobs. Although the knowledge already exist in the organization, the elicitation of such knowledge, however, is not a kind of "mining from the expert's head", it requires the systematic approach instead.

Knowledge engineering provides the methods to obtain a thorough understanding of the structures and processes used by knowledge workers (or cable jointers in this case), even where much of their knowledge is tacit, leading to a better integration of information technology in support of knowledge work. On the other hand, knowledge engineering is a process of eliciting, structuring, formalizing, and operationalizing information and knowledge involved in a knowledge-intensive problem domain (or cable jointing works in this case), in order to construct a program that can perform a difficult task adequately.

Knowledge engineering offers various useful tools and techniques to elicit the knowledge from knowledge sources. Each technique has unique characteristics and is suitable for use in particular situation. Fig. 1 summarizes different techniques that can be employed for knowledge capture under certain circumstance [2]. However, in order to obtain most benefits of knowledge engineering tools, a combination of techniques may be required in pursuing the critical knowledge used by the knowledge workers to succeed their tasks.

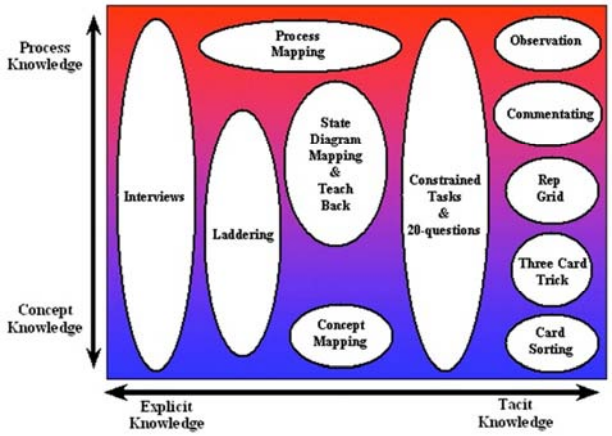

Fig. 1: Applicability of knowledge elicitation techniques