DEVELOPMENT AND APPLICATION OF A MALAYSIAN SOCIO-TECHNICAL DISASTER MODEL

By

AINI MAT SAID

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Doctor of Philosophy

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DEDICATION

To my beloved

Husband: Fakhru'l-Razi Ahmadun
Late Parents: Meriam Abdullah dan Mat Said bin Hj. Abdul Latif
And Children: Muhamad Soffee-Ullah, Asiyah Hananah, Maryam Nahdiyah Khadijah Najwa, Fatimah Zahrah, Abu Bakr As-Siddiq and Umar Al-Faruq.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

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Chairman: Professor Mohamed Daud, PhD

Faculty: Engineering

Understanding of the development and causes of the disasters provides a tool for organizational and institutional diagnosis of vulnerability and risks. The hindsight gained from these negative events could be utilized by government and enterprises to design organizational structures that will help reduce the likelihood of disaster as the nation progresses. A multi strategy research was designed utilizing qualitative and quantitative approach to develop a socio-technical disaster model and a learning system for Malaysia. Using a grounded theory approach, six inquiry reports were used to identify the phases associated with the development of the socio-technical disasters and their underlying causes. Management of the inquiry into these disasters and the recommendations made by the tribunal of inquiry were also analyzed. Nvivo software program was utilized to model the latent errors attributed to the disasters. A survey was conducted among Malaysian Disaster experts who were selected using judgmental sampling in order to determine their views on disaster and disaster inquiry management. Data obtained from both qualitative and

quantitative study was then transferred into a Visual Basic 6.0 computer program to form a learning and advice model.

Despite the differences of disasters involved and their technologies, the disasters were found to exhibit common features and characteristics. The findings demonstrated that socio-technical disasters are not sudden cataclysmic events but they evolved in phases with long developmental period. Underlying causes of the disasters are found to be due to latent errors that are accumulated and get embedded in the system during the incubation period. Inside the organization, a complex set of managerial, procedural, training, safety and failure to learn factors interact with external factors of regulatory and human failures to produce the disasters.

The experts were found to have only fair perception towards the management of Public and Royal inquiries into disasters in the country. They were least satisfied with recommendations and learning aspect of the inquiry. This commensurate with the overall perception of the experts that the management of the disaster inquiry should be improved in order to increase learning from them. It was suggested that a flexible guideline should be developed so that it is not entirely left to the personal style of the chairman as currently practiced.

The data obtained from the study was further utilized to develop an advice and learning model for public access through an application of an expert system. This is a useful tool for teaching at higher institutions; media of instructions for training institutions and industries; and e- learning for professional development.

Abstrak tesis yang dikemukan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**PEMBENTUKAN DAN APLIKASI MODEL
BENCANA SOSIO-TEKNIKAL DI MALAYSIA**

Oleh

AINI MAT SAID

Februari 2006

Pengerusi: **Profesor Mohamed bin Daud, PhD**

Fakulti: **Kejuruteraan**

Memahami bagaimana sesuatu bencana berlaku dan apakah punca ianya terjadi akan menjadi satu pedoman untuk organisasi dan institusi untuk mengenalpasti kerapuhan dan risiko yang dihadapinya. Pengajaran yang didapati dari tinjauan kembali tragedi-tragedi yang telah berlaku boleh digunapakai oleh kerajaan dan pengusaha untuk merancang dan melaksanakan struktur-struktur bagi mengurangkan risiko bencana sejajar dengan pembangunan negara. Satu kajian pelbagai strategi dengan menggunakan pendekatan kajian kualitatif dan kuantitatif telah digunapakai untuk membentuk satu model dan sistem pembelajaran bencana socio-teknikal di Malaysia. Dengan menggunakan kaedah 'grounded' teori, enam laporan bencana telah digunakan untuk mengenalpasti fasa dan punca utama kejadian bencana. Analisis juga dilakukan terhadap pengurusan penyiasatan dan cadangan yang dibuat oleh tribunal penyiasatan. Program komputer 'Nvivo' telah digunakan untuk melakarkan model kesilapan terpendam untuk setiap bencana. Satu tinjauan juga telah dijalankan keatas pakar-pakar bencana di Malaysia dengan menggunakan kaedah persampelan 'judgmental' untuk mengenalpasti pandangan mereka terhadap bencana dan pengurusan bencana. Data yang diperolehi dari kedua-dua keadah

kualitatif dan kuantitatif kemudiannya dipindahkan ke komputer program 'Visual Basic' untuk dijadikan model pembelajaran dan penasihatan.

Walaupun bencana-bencana itu berbeza dari aspek teknologinya , mereka didapati mempamerkan sifat dan cici-ciri yang sama. Dapatan kajian menunjukkan bahawa bencana socio-teknikal tidak berlaku dengan secara tiba-tiba tetapi mengambil masa yang lama dan beransur-ansur berkembang melalui fasa-fasa tertentu. Punca utama bencana didapati disebabkan oleh kesilapan terpendam yang berkumpul dan tertanam dalam sistem pada fasa inkubasi. Dalam organisasi, factor-faktor pengurusan, prosidur, latihan, keselamatan dan kegagalan untuk belajar telah berinteraksi dengan faktor luaran seperti kelemahan perundangan dan kesilapan manusia telah mencetus bencana-bencana tersebut. Pakar-pakar bencana didapati hanya mempunyai persepsi yang sederhana terhadap kedua-dua pengurusan penyiasatan bencana iaitu penyiasatn Awam dan Diraja. Mereka paling tidak berpuas hati dengan aspek rekomendasi dan pembelajaran dari penyiasatan. Ini selari dengan persepsi menyeluruh terhadap pengurusan penyiasatan bencana dimana mereka merasakan pembaikan perlu dibuat untuk mengambil pengajaran dari bencana-bencana. Mereka telah mengutarakan supaya satu panduan yang anjal dibentuk supaya kaedah dan cara pengurusan penyiasatan tidak sepenuhnya terletak ditangan pengerusi penyiasat sebagaimana yang berlaku sekarang ini.

Data yang didapati dari kajian ini seterusnya digunakan untuk membentuk satu model pembelajaran dan penasihatan untuk kegunaan umum melalui aplikasi sistem pakar. Kedua-duanya merupakan satu alat bantu untuk pembelajaran di institusi pengajian tinggi; media pengajaran untuk pusat latihan dan industri; dan e-pembelajaran untuk perkembangan profesional.

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"God grants wisdom unto whom He wills, and whosoever is granted wisdom has been granted wealth abundant. But none bears this in mind save those who are endowed with insight. "

Al-Baqarah: 269

I certify that an Examination Committee has met on 7th February 2006 to conduct the final examination of Aini Mat Said on her Doctor of Philosophy thesis entitled "Development and Application of Malaysian Socio-technical Disaster Model" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of Examination Committee are as follows:

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This thesis submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee are as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted to any other degree at UPM or other institutions.

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AINI MAT SAID

Date: 7 February 2006

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