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Industrial maintenance data collection and application: developing an information strategy for an industrial site

Roy F. Evans
University of Wollongong
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INDUSTRIAL MAINTENANCE DATA COLLECTION AND APPLICATION:
DEVELOPING AN INFORMATION STRATEGY FOR AN INDUSTRIAL SITE

A thesis submitted in fulfilment of the requirements for the award of the degree of 

DOCTOR OF PHILOSOPHY

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By 

ROY EVANS, ME Hons (Maintenance Management)

SCHOOL OF MECHANICAL MATERIAL AND MECHATRONIC ENGINEERING

2008
ABSTRACT

This work involved the evaluation of the efficacy of industrial information management. The study was prompted by the observation that contemporary society seemingly struggles to effectively utilise and manage the volumes of information that new technologies are delivering. It is reasonable to assume that industry, as a mirror of contemporary society, may be struggling to manage the convergence of equivalent information technologies.

Traditionally, within industry, structured organisations of people use work processes to record plant history in computerised work management systems. This work employs a socio technical perspective to examine conflict that is likely to be occurring within such structured groups of people. Social (socio) in respect of participants’ behavioural changes, technical in respect of understanding data selection for machine condition management.

Field research used constructivist evaluation methodology in three phases. Evaluation of current information management practice, in three electricity-generating power stations, was followed by an ethnological study to determine why industrial information management developed in the way that it had. By way of comparison, a third field research phase evaluated financial and medical information management processes.

At the evaluated sites, industrial information management was found to be an inadequately developed concept. Processes were found to be managed without application of explicitly stated strategies or audit protocols. Staff considered recording of work to be a transactional process directed at monitoring human performance rather than being a process for analysis to facilitate plant condition management and to develop plant knowledge.

Conclusions based primarily upon the ethnographical study indicate that the effects of informal social influence, power conflict, scientific work process and job design all contribute to an imbalance that develops between explicit recording and the complementary development of a tacit knowledge base. In contrast, medical ward management employed a combination of socio technical principles and informal double loop analyses to address corresponding conflict.

Outcomes of the study indicate that an evaluative matrix, developed for the study, would be suitable for professional audit of site information strategies and processes. Complementing the evaluative matrix has been the development of a practical methodology, based upon socio technical principles, which would be suitable for the development of convergent site information and production strategies.
ACKNOWLEDGEMENTS

Research of this nature could not be conducted nor be completed without the support of family, friends and colleagues. Throughout this project, I have been privileged to enjoy such support.

Colleagues who assisted and made the field work so enjoyable and productive deserve special mention: Les Rowlandson, Helen Rooke, Ray Walker, Wayne Winterbine, Marguerite Tierney and Steve Gambrill.

The challenging ethnological phase of the research could not have been completed without the support of retired staff. In particular, I would like to acknowledge the contribution made by Bill Eddy who described for me his development of the first recorded Australian industrial work planning and asset management system.

The project could not have been undertaken without the support and encouragement of Dave Williams nor the foresight and confidence placed in the study by Professor G Arndt.

I remain indebted to Kim Draisma for her ability to be able to select from her library the right book to begin every sociological literature discussion.

Finally, and certainly not least, I wish to acknowledge the patient support and reflective management of my supervisor Richard Dwight – the person that listened and encouraged me throughout the project.
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## GLOSSARY OF DEFINITIONS

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<tbody>
<tr>
<td>Concept</td>
<td>A human process of abstraction; a process that is used by humans to develop mental frameworks (abstract categories) for sorting ideas</td>
<td>2.2.4</td>
<td>19</td>
</tr>
<tr>
<td>Communities of practice</td>
<td>Dynamic and informal groupings of individuals; where the individuals share a common interest and purpose and are able to interact communally to achieve an outcome</td>
<td>2.5.4</td>
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</tr>
<tr>
<td>Data</td>
<td>The measure of variance from a nominated reference datum</td>
<td>2.2.6</td>
<td>23</td>
</tr>
<tr>
<td>Datum</td>
<td>Nominated state or condition of a defined entity</td>
<td>2.2.6</td>
<td>23</td>
</tr>
<tr>
<td>Domain</td>
<td>The ontological limited space that contains the entities and defined limits for an epistemological and ontological reference grid</td>
<td>2.2.6</td>
<td>23</td>
</tr>
<tr>
<td>Epistemology</td>
<td>Personal conceptualisation of what exists; a philosophy about how people perceive reality</td>
<td>1.4.2</td>
<td>8</td>
</tr>
<tr>
<td>Ethnological study</td>
<td>An ethnological study is carried out to develop understanding of how people, in a study group, construct their world – their reality and belief systems. The assumptions that support ethnology are constructivist</td>
<td>4.1</td>
<td>70</td>
</tr>
<tr>
<td>Term</td>
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<td>-------------------------------------------------------------</td>
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<tr>
<td>Evaluation</td>
<td>The systematic determination of the quality or value of something</td>
<td>1.4.3</td>
<td>10</td>
</tr>
<tr>
<td>Evaluand</td>
<td>What is being evaluated</td>
<td>1.4.6</td>
<td>13</td>
</tr>
<tr>
<td>Evaluator</td>
<td>The person facilitating the evaluation</td>
<td>1.4.5</td>
<td>13</td>
</tr>
<tr>
<td>Failure (in relation to industrial machines &amp; technical systems)</td>
<td>The transition of a technical system to the state where it (the technical system) is inadequate for its function</td>
<td>2.2.7</td>
<td>24</td>
</tr>
<tr>
<td>Hermeneutics</td>
<td>The theory of understanding</td>
<td>2.2.4</td>
<td>19</td>
</tr>
<tr>
<td>Maintenance</td>
<td>The total of activities required to retain (technical systems) in, or restore them to the state necessary for fulfilment of the production function</td>
<td>2.2.7</td>
<td>24</td>
</tr>
<tr>
<td>Maintenance concept</td>
<td>The set of rules prescribing what maintenance is required</td>
<td>2.2.7</td>
<td>24</td>
</tr>
<tr>
<td>Merit</td>
<td>Merit is the intrinsic value of something. The term is used interchangeably with ”quality” and relates, in this study, to the potential for accuracy of interpretation of data by stakeholders operating within the process being evaluated</td>
<td>1.4.3</td>
<td>11</td>
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<tr>
<td>Term</td>
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<td>-------------------------------------</td>
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<td>---------</td>
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</tr>
<tr>
<td>Need</td>
<td>That something, such that without it dysfunction of process would occur</td>
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</tr>
<tr>
<td>Ontology</td>
<td>Ontology is a formal and explicit specification of a shared conceptualisation</td>
<td>2.2.5</td>
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</tr>
<tr>
<td>Power</td>
<td>The act of exercising discipline over an individual or society’s time and space</td>
<td>2.5.5</td>
<td>46</td>
</tr>
<tr>
<td>Production strategy</td>
<td>A strategy that reduces interactive operational and maintenance policies, within each technical system, to a select set of data parameters appropriate for monitoring functional and physical condition</td>
<td>2.2.7</td>
<td>25</td>
</tr>
<tr>
<td>Reality</td>
<td>Reality is any person’s interpreted truth – the content of their conceptualisation</td>
<td>2.2.3</td>
<td>18</td>
</tr>
<tr>
<td>Reliability</td>
<td>The probability that an item will perform its function under stated conditions of use and maintenance for a stated measure of the variate (time, distance etc)</td>
<td>2.3.2</td>
<td>27</td>
</tr>
<tr>
<td>State or condition of a technical system</td>
<td>The physical ability (condition) considered relevant to fulfilment of its (the technical system) function</td>
<td>2.2.7</td>
<td>24</td>
</tr>
<tr>
<td>Term</td>
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</tr>
<tr>
<td>Technical system</td>
<td>A collection of physical elements fulfilling a specific function</td>
<td>2.2.7</td>
<td>24</td>
</tr>
<tr>
<td>Terotechnology</td>
<td>A combination of management, financial, engineering and other practices applied to physical assets in pursuit of economic life cycle costs</td>
<td>2.3.3</td>
<td>31</td>
</tr>
<tr>
<td>Want</td>
<td>A conscious desire without which dissatisfaction may occur; process function would not be affected</td>
<td>2.5.7</td>
<td>53</td>
</tr>
<tr>
<td>Work orders</td>
<td>A written instruction detailing work to be carried out</td>
<td>6.3</td>
<td>109</td>
</tr>
<tr>
<td>Work (tolerable)</td>
<td>Observed plant defect that is able to be deferred and clustered to be completed in association with programmed maintenance</td>
<td>6.3.2</td>
<td>115</td>
</tr>
<tr>
<td>Work (intolerable)</td>
<td>Observed plant defect that will result in loss of plant function and requires immediate attention</td>
<td>6.3.2</td>
<td>115</td>
</tr>
<tr>
<td>Worth</td>
<td>Worth is the extrinsic value of something. The term is used interchangeably with “value” and relates, in this study, to the suitability of data for accurate simulation of the process by multiple stakeholders operating external to the process being evaluated</td>
<td>1.4.3</td>
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