

**MODEL REKA BENTUK KONSEPTUAL OPERASIAN STORAN DATA  
BAGI APLIKASI KEPINTARAN PERNIAGAAN**

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# **PERAKUAN KERJA TESIS / DISERTASI**

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Penyerahan tesis ini, bagi memenuhi syarat sepenuhnya untuk ijazah lanjutan Universiti Utara Malaysia, saya bersetuju bahawa perpustakaan universiti boleh secara bebas membenarkan sesiapa sahaja untuk memeriksa. Saya juga bersetuju bahawa penyelia saya atau ketiadaannya, Dekan (Awang Had Salleh Graduate School) Kolej Sastera dan Sains diberi kebenaran untuk membuat salinan tesis ini dalam sebarang bentuk sama ada keseluruhannya atau sebahagiannya, bagi tujuan keserjanaan. Adalah tidak dibenarkan sebarang penyalinan atau penerbitan atau kegunaan tesis ini sama ada sepenuhnya atau sebahagiannya bagi tujuan keuntungan kewangan/komersial, kecuali setelah mendapat kebenaran bertulis. Juga dimaklumkan bahawa pengiktirafan harus diberikan kepada saya dan Universiti Utara Malaysia dalam sebarang kegunaan keserjanaan terhadap sebarang petikan daripada tesis saya.

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## Abstrak

Pembangunan aplikasi kepintaran perniagaan (BI) yang merangkumi sumber data, Gudang Data (DW), *Data Mart (DM)* dan Operasian Storan Data (ODS) memberi cabaran yang besar kepada pembangun aplikasi BI. Hal ini disebabkan oleh kekurangan model, garis panduan dan teknik yang mantap untuk membangunkan aplikasi BI jika dibandingkan dengan pembangunan sistem dalam disiplin kejuruteraan perisian. Tambahan pula, pembangunan aplikasi BI masa kini menumpukan kepada pembangunan maklumat strategik berbanding maklumat operasi dan taktikal. Oleh itu, tujuan utama kajian ini ialah untuk mengusulkan model reka bentuk konseptual ODS (CoDMODS) bagi pembangunan aplikasi BI. Melalui kaedah pengesanan pakar, model CoDMODS yang dibina dengan pendekatan penyelidikan sains reka bentuk ini dapat memenuhi sembilan ukuran dimensi kualiti model iaitu mudah difahami, meliputi langkah yang jelas, relevan, mempunyai ciri-ciri fleksibiliti, skalabiliti, ketepatan, kesempurnaan, konsisten dan menyokong jangka masa pengemaskinian. Selain itu, dua prototaip yang dibina berdasarkan model CoDMODS untuk kajian kes perkhidmatan bekalan air (iUBIS) dan penyelenggaraan telekomunikasi (iPMS) mencatatkan nilai purata min kepenggunaan yang tinggi iaitu 5.912 melalui instrumen *Computer System Usability Questionnaire (CSUQ)*. Dapatan kajian ini terutamanya model yang diusulkan, menyumbang kepada kaedah analisis dan reka bentuk pembangunan maklumat operasi dan taktikal aplikasi BI. Model ini boleh dijadikan garis panduan oleh pembangun aplikasi BI. Selain itu, prototaip yang dibangunkan dalam dua kajian kes dapat membantu pengurusan organisasi menggunakan maklumat yang berkualiti dalam operasi perniagaan.

**Kata Kunci:** Kepintaran Perniagaan, Operasian Storan Data, Model reka bentuk konseptual, Maklumat Operasi, Maklumat Taktikal.

## Abstract

The development of business intelligence (BI) applications, involving of data sources, Data Warehouse (DW), Data Mart (DM) and Operational Data Store (ODS), imposes a major challenge to BI developers. This is mainly due to the lack of established models, guidelines and techniques in the development process as compared to system development in the discipline of software engineering. Furthermore, the present BI applications emphasize on the development of strategic information in contrast to operational and tactical. Therefore, the main aim of this study is to propose a conceptual design model for BI applications using ODS (CoDMODS). Through expert validation, the proposed conceptual design model that was developed by means of design science research approach, was found to satisfy nine quality model dimensions, which are, easy to understand, covers clear steps, is relevant and timeless, demonstrates flexibility, scalability, accuracy, completeness and consistency. Additionally, the two prototypes that were developed based on CoDMODS for water supply service (iUBIS) and telecommunication maintenance (iPMS) recorded a high usability average min value of 5.912 using Computer System Usability Questionnaire (CSUQ) instrument. The outcomes of this study, particularly the proposed model, contribute to the analysis and design method for the development of the operational and tactical information in BI applications. The model can be referred as guidelines by BI developers. Furthermore, the prototypes that were developed in the case studies can assist the organizations in using quality information for business operations.

**Keywords:** Business Intelligence, Operational Data Store, Conceptual design model, Operational Information, Tactical Information.

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## Senarai Kependekan

BI	Kepintaran Perniagaan ( <i>Business Intelligence</i> )
BIDS	<i>Business Intelligence Development Studio</i>
CIF	<i>Corporate Information Factory</i>
CEDI	Institut Pembangunan Koperasi Dan Keusahawanan( <i>Co-operative and Entrepreneur Development Institute</i> )
CIM	<i>Computation Independent Model</i>
CLDS	<i>Data Warehouse Development Life Cycle – Reverse from SDLC</i>
CoDMODS	Model Reka Bentuk Konseptual Operasian Storan Data ( <i>Conceptual Design Model Operational Data Store</i> )
CSUQ	<i>Computer System Usability Questionnaire</i>
DM	<i>Data Mart</i>
DSS	Sistem Sokongan Keputusan ( <i>Decision Support System</i> )
DW	Gudang Data ( <i>Data Warehouse</i> )
DWARF	<i>Data Warehouse Requirement Definition Technique</i>
DWRM	<i>Data Warehouse Requirement Management</i>
EERM	Model Hubungan Entiti Teperluas ( <i>Enhanced Entity Relationship Model</i> )
ERM	Model Hubungan Entiti ( <i>Entity Relationship Model</i> )
ERP	<i>Enterprise Resource Planning</i>
ETL	<i>Extract-Transform-Load</i>
GST	Teori Sistem Umum ( <i>General System Theory</i> )
INFOQUAL	Kualiti Maklumat ( <i>Information Quality</i> )
INTERQUAL	Kualiti Antara Muka ( <i>Interface Quality</i> )
iPMS	<i>intelligent Preventive Maintenance System</i>
IPTA	Institusi Pengajian Tinggi Awam
IT	Teknologi Maklumat ( <i>Information Technology</i> )
iUBIS	<i>intelligent Utility Billing Information System</i>
JAD	<i>Joint Application Development</i>
JKR	Jabatan Kerja Raya
KBT	Teori Berasaskan Pengetahuan ( <i>Knowledge Based Theory</i> )
MIS	Sistem Maklumat Pengurusan ( <i>Management Information System</i> )
NRW	Air Tidak Berhasil ( <i>Non Revenue Water</i> )
ODS	Operasian Storan Data ( <i>Operational Data Store</i> )
OIPT	Teori Pemprosesan Maklumat Dalam Organisasi ( <i>Organization Information Theory Processing</i> )
OLAP	<i>Online Analytical Processing</i>
OLTP	<i>Online Transaction Processing</i>
PIM	<i>Platform Independent Model</i>
PSM	<i>Platform Specific Model</i>
SADA	Syarikat Air Darul Aman
SDLC	Kitar Hayat Pembangunan Sistem ( <i>Software Development Life Cycle</i> )
SK	<i>Surrogate Key</i>
SOM	<i>Semantic Object Model</i>



SPAN	Suruhanjaya Perbadanan Air Negara
SSAS	<i>SQL Server Analysis Service</i>
SSIS	<i>SQL Server Integration Service</i>
SSRS	<i>SQL Server Report Service</i>
SYABAS	Syarikat Bekalan Air Selangor
SYSUSE	<i>System Usefulness</i>
SQL	<i>Structured Query Language</i>
UBIS	<i>Utility Billing Information System</i>

# CHAPTER ONE

## Pengenalan

### 1.1 Latar Belakang

Persekitaran perniagaan masa kini memerlukan maklumat yang berkualiti untuk menilai pencapaian organisasi, memahami kehendak pelanggan, mengetahui kemampuan pesaing dan membuat keputusan dalam organisasi. Penggunaan teknologi maklumat dilihat sebagai teknologi yang dapat memproses maklumat secara sistematik dalam organisasi. Kelebihan penggunaan teknologi maklumat dalam pengurusan maklumat secara langsung akan mendorong organisasi membangunkan pelbagai sistem aplikasi untuk menyokong operasi sesebuah perniagaan. Justeru, semakin banyak sistem aplikasi dibangunkan akan menyebabkan organisasi terpaksa mengurus data yang banyak dan berlakunya limpahan maklumat dalam organisasi. Tambahan pula, data yang diproses dalam sistem aplikasi masa kini terdiri daripada pelbagai peringkat, data dari aplikasi yang berbeza dan data ditempatkan di lokasi yang berbeza (Luo, 2012; Mohanty, 2006). Rainer, Turban, Sharda dan Delen (2011) menambah, keadaan ini akan menyebabkan pengurusan data bertambah sukar dan menimbulkan masalah bagi mendapatkan maklumat yang tepat untuk membuat keputusan dalam organisasi.

Kepintaran Perniagaan (*Business Intelligence-BI*) dan Gudang Data (*Data Warehouse-DW*) merupakan dua pendekatan teknologi yang sedang berkembang maju dalam bidang teknologi maklumat untuk menyelesaikan masalah ini. Menurut ramalan yang dibuat Gartner, pasaran BI berkembang sebanyak 9.7% iaitu meningkat ke angka 0.8 billion USD pada tahun 2011 (Gartner, 2011). Perisian BI juga diletakkan sebagai 5 keutamaan teratas bagi teknologi yang digunakan oleh

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