



**Faculty Information and Communication Technology**

**BUSINESS INTELLIGENCE TOOL ANALYSIS AND EXPLORATION  
OF ATTENDANCE MANAGEMENT SYSTEM (AMS) USING AUTO  
REGRESSION TREE (ART)**

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**Master of Computer Science (Software Engineering and Intelligence)**

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ATTENDANCE MANAGEMENT SYSTEM (AMS) USING AUTO REGRESSION  
TREE (ART)**

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**A thesis submitted  
in fulfillment of the requirements for the degree of Master of Computer Science  
(Software Engineering and Intelligence)**

**Faculty of Information and Communication Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

## DECLARATION

I declare that this thesis entitled “Business Intelligence Tool Analysis and Exploration of Attendance Management System (AMS) Using Auto Regression Tree (ART)” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

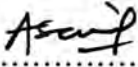
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## APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in term of scope and quality for the award of Master of Computer Science (Software Engineering and Intelligence).

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## **DEDICATION**

My Lord, Allah (swt) who blessed me with a lot of graces.

My ideal Prophet Muhammad (pbuh)

I dedicated this dissertation:

To my beloved mother and my dear father

To my precious wife "Huda"

To my daughter "Fatima", my son "Mohammed Ali", my sisters and my brothers for their  
love and encouragement.

## ABSTRACT

“Time is money.” There is perhaps no more accurate analogy in business. Unfortunately, if there is one thing that we all have difficulty managing, it is time. That includes the ability to accurately measure and manage the attendance of staff. Sure, most organizations have been tracking time worked for basic payroll functions for some time. But using staff attendance data for long-term labor forecasting, short-term staff scheduling, or overall labor cost reductions are functions that have eluded most but the top performing companies. A growing number of organizations are implementing attendance management system (AMS), and AMS now finds itself in the middle of this movement. The rising interest in automated AMS is driven by the difficulty in tracking what has become a rapidly moving target. Organizations must respond to constantly changing market and industry conditions, try to manage an increasingly diverse workforce, and increasingly disperse workers.

The central goal of this study is to enhance a model for human resource (HR) assignments in skill-based environments. AMS are tools for efficient management of labour resources and accurate labour reporting. The AMS module implemented using Microsoft .NET environment is presented in the study. Analytical capabilities of data collected by the system by means of business intelligence platform of SQL Server 2005 are considered. Some charts and figures produced by data mining tools including OLAP, and Time Series are given. AMS deals with the maintenance of the staff attendance details. It is generating the attendance of the staff on basis of presence. It is maintained on the daily basis of their attendance. The staff attendance reports based on daily, weekly or monthly and consolidate will be generated.

## ABSTRAK

*"Masa adalah wang." Tidak mungkin tidak ada analogi yang lebih tepat dalam perniagaan. Malangnya, jika ada satu perkara yang kita semua mempunyai kesukaran menguruskan, ia adalah masa. Ini termasuk keupayaan untuk mengukur dengan tepat dan menguruskan kehadiran kakitangan. Pasti, kebanyakan organisasi telah mengesan masa bekerja untuk fungsi gaji asas untuk beberapa ketika. Tetapi menggunakan data kehadiran kakitangan untuk ramalan jangka panjang tenaga kerja, penjadualan kakitangan jangka pendek, atau pengurangan kos buruh keseluruhan fungsi-fungsi tersebut yang tidak terurai paling tetapi bahagian atas persembahan syarikat. Semakin banyak organisasi melaksanakan sistem pengurusan kehadiran (AMS), dan AMS kini mendapati dirinya di tengah-tengah pergerakan ini. Kepentingan yang semakin meningkat dalam automatik AMS didorong oleh kesukaran untuk mengesan apa yang telah menjadi sasaran yang bergerak pantas. Organisasi perlu bertindak balas kepada keadaan pasaran dan industri yang sentiasa berubah, cuba untuk menguruskan tenaga kerja yang semakin pelbagai, dan pekerja semakin bersurai.*

*Matlamat utama kajian ini adalah untuk meningkatkan model untuk sumber manusia (HR) tugas dalam persekitaran yang berasaskan kemahiran. AMS adalah alat untuk pengurusan sumber yang cekap tenaga kerja dan laporan buruh tepat. The AMS moduale dilaksanakan menggunakan persekitaran Microsoft .NET dibentangkan dalam kajian ini. keupayaan analisis data yang dikumpul oleh sistem melalui platform risikan perniagaan SQL Server 2005 akan dipertimbangkan. Seseengah carta dan angka yang dihasilkan oleh alat perlombongan data termasuk OLAP, dan Siri Masa diberikan. AMS berkaitan dengan penyelenggaraan butiran kehadiran kakitangan. Ia menjana kehadiran kakitangan pada asas kehadirannya. Ia dikekalkan secara harian kehadiran mereka. Laporan kehadiran kakitangan berdasarkan harian, mingguan atau bulanan dan menyatukan akan dijana.*

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## LIST OF ABBREVIATIONS

<b>Abbreviations</b>	<b>Description</b>
.NET	A Software Framework Developed by Microsoft
AMS	Attendance Management System
ART	Auto Regression Tree
AQIP	Academic Quality Improvement Process
BI	Business Intelligence
CIO	Chief Information Officers
DBMS	Data Base Management System
DMX	Data Mining Extensions (DMX) language
DSS	Decision Support Systems
DW	Data Warehouse
HOLAP	Hybrid OLAP
HR	Human Resources
HRMS	Human Resources Management System
KPI	Key Performance Indicators
OIC	Organisation of Islamic Cooperation
OLAP	Online Analytical Processing
OLTP	Online Transaction Processing

MOLAP	Multi-dimensional OLAP
MSSQL	Microsoft SQL Server
MySQL	Open-Source Relational Database Management System (RDBMS)
ROLAP	Relational OLAP
SOA	Software-Oriented Architecture
T&AS	Time and Attendance System
TTS	Time-Tracking System
WFM	Workforce Management System
WOA	Web-Oriented Architecture

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Higher education plays an important role in developing knowledge based economies of developed countries. An efficient, quality of higher education system is required for this start phase of educational the economies of the Islamic World. The role of higher education in developing the economies of the Islamic World can be recognized in major dimension which is to improve labor productivity, entrepreneurial vigor, and quality of life by joining the scopes and skills of the people. The knowledge serves as a catalyst for rapid development and socioeconomic growth reflected through improved living standards and reduced poverty.

The quality of higher education could be influenced by: infrastructure availability, authorization system and the administrative policies and procedures which implemented in those organizations. The growth of sub-standard in institutions of higher education is absolutely critical to monitor and control. To ensure provision of quality education, a comprehensive multilevel mechanism has been developed to assessment against pre-defined Key Performance Indicators (KPI).

A KPI is pointers by which a university measures its efficiencies, performance, and success (Sukboonyasatit et al., 2011). furthermore, a KPI visualize in real-time by using dashboards which is a collection of unrelated information systems and huge data sets which is gathered and displayed in a simple method, that provide graphic representations of real-time vision of manager's performance.



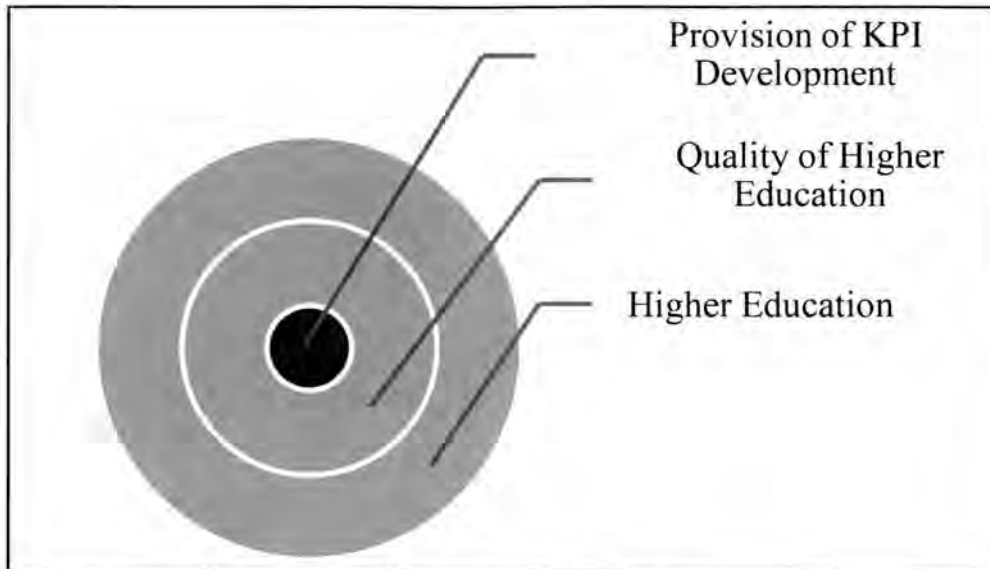


Figure 1.1: Level of Higher Education

business intelligence (BI) encompasses a variety of tools, applications and methodologies that enable organizations to collect data from internal systems and external sources, prepare it for analysis and develop. BI tools run queries against the data, create reports and visualize KPI in dashboards (Harts et al., 2011). Business Intelligence tool is designed to personalize and analyze staff performance. The data for analyzing the staff performance may come from structured data that use aggregation or generalization of items described by elementary attributes defined within a domain. Researchers could use these new technologies, or analytic tools, to measure KPI for drive growth (Minkara, 2012)

Finally, it is important to highlight that how the KPIs for the universities of Islamic World were developed and what were the steps taken to reach across the Organisation of Islamic Cooperation (OIC) region consultation aiming at the ownership for the developed KPIs. The regional consultation across all Islamic countries and mutual consensus was considered important for the purpose of successful implementation of the KPIs and ease of achieving these KPIs by the universities of Islamic World looking forward to attain a significant level of global compatibility in the higher education sector.

## 1.2 Introduction

The selection of an appropriate strategy is critical for a university's success, and each university needs to capitalize on its own specialties and competencies for a competitive advantage. Strategy creation and planning in universities is generally a collective effort which relies on consensus. It is a complex process involving the setting of objectives and goals to achieve the strategic vision, and an analysis tool for evaluating and comparing different options and prioritizing objectives and goals is required. A high deductive capacity is necessary for aggregating the different trade-offs while prioritizing, which is challenging for a human mind.



Figure 1.2: Business Planning

The success of the administration depends on many aspects, including: organizational, economical, and scientific aspects (Altbach, Philip G and Salmi, 2011). Specially, the leadership management in high ranking universities it is a part of the success of these organizations (McCaffery, 2010). In past, the organizations with main modest

advantages were those that presented the best product or the latest technology, or those that were the largest in terms of wealth. Now, however, the only thing that makes an organization the best in the class is the level of people working at it (Aguinis et al., 2012). From this perspective the importance of the human resources (HR) department highlights as the core of management sector in enterprises. In most institutions, HR suffers from many challenges that prevent it from playing its part and success. The most significant challenges are: processes and tasks, management the relationships in the workplace and how to make decisions.



Figure 1.3: Human Resources Challenges

In the last two decades, advancements in software technologies have arisen to an amazing level. These advancements enhance not just exceptionally normal territories of our daily life, but additionally range of training, well-being, generation commercial ventures, and so on. Every day, the nature of the work and the business environment is shifting dramatically.

A growing number of organizations are implementing workforce management

system, and attendance management system (AMS) now finds itself in the middle of the movement (Management and February, 2008). AMS is one of the extremely important systems in all organization that gives numerous advantages to it. This kind of system can cover those duties which the organizations need it. This system provides the administration and in particular the HR department with many benefits, like (Cooney, 2009) : to enable the administration to control of the work hours of all staff And to override human errors occurring in transcription, interpretation or deliberate mistakes. AMS assists control with reducing so as to work expenses over-installments, which are regularly brought about by translation mistake, understanding error and purposeful slip. The important benefit of AMS is improved of labor management through comprehensive data analysis and reporting (Cooney, 2009). AMS can assistance in developing general strategies or alternative temporary solutions faster through data analysis capabilities.

Additionally, the advantages of AMS are: First, Simple and easy to use. Second, eliminates paperwork and the risk of making errors while the ability to enable notifications a dashboard-type screen to Absences, latecomers and leaves. Third, hugely reduces time spent managing staff attendance. Forth, automated and web-based is easy for accessible. No compatibility issues needs keep safe an internet connection only. It's available via the internet at all times and from any location. Fifth, records are kept safe and confidential through tracking changes on the punching records even for authorities. Sixth, current and previous years' records are available in an instant. Seventh, provide configurable, multi-level, management approval system. Eight, users can easily view their individual leave summaries for the year. Management overview of company leaves at a glance. Finally, the data can be easily copied and pasted to other applications.

Most of manual AMS notably waste a large of effort and time without providing the

required information quickly. Manual procedures are dispensed with and additionally the staff expected to look after them. It is regularly hard to conform to work regulation, yet an AMS is important for guaranteeing consistence with work regulations in regards to verification of attendance. Compared to a manual system, attendance management system offers a number of advantages: Firstly, increase employee productivity. Secondly, mainstream justice in workplace environment. Thirdly, reduce financial waste. Fourthly, increase information accuracy (Arbain, 2014).

Also, traditional AMS, it lacks a comprehensive analysis of the full data so that It doesn't offer analysis skills with high quality. AMS was entirely normal to investigate the capacities of its business intelligence (BI) to create sophisticated and helpful analyses that go past minor late coming and attendance reports. It empowers a business to have full control of all representatives working hours (Salian, 2012).

Nowadays, there are many colleges and universities in Malaysia whether they are belonging to government or private sector. Thus, university or colleges need some competitive advantages to sustain their quality and standards. Universities that renew accreditation through the Academic Quality Improvement Process (AQIP) identify indicators, measures, and results that are key to the functioning of the entire institution. This study is significant because colleges and universities need appropriate measures and results to have a meaningful way to compare themselves with peer institutions. Knowing Key Performance Indicators (KPI) of other institutions, and being able to benchmark can aid colleges and universities in the approach, deployment, learning and integration of strategic planning, and areas of growth leading to performance excellence. KPI “ represent a set of measures focusing on those aspects of organizational performance that are the most critical for the current and future success of the organization” (Parmenter, 2010).

Generally, KPI are known as a way to communicate the measures that matter. Identifying KPI and measures aid institutions in providing results across the institution, and help colleges and universities prioritize resources and align processes to achieve outcomes. Compiling these indicators could aid higher education institutions by allowing comparison of similar data with like institutions, or by creating indicators so they have the ability to compare themselves against like institutions. Key Performance Indicators (KPI) is an evaluation basis and target that can concretely reflect important and influential factors in the operations of an organization or department. Business intelligence (BI) tool used to summarize measure and virtualize KPI for analysing staff performance. MS-SQL platform use Microsoft Time Series algorithm which is an autoregressive model in that function corresponds to a regression tree.

This project proposes alternative solutions for Attendance Management System (AMS) for staff considering the provision of analytical tool to present a software application which is easy to use, scalable, and distributable with provides secure conditions.

### **1.3 Problem Statement**

Most of Malaysia university or colleges are strives to enhance the quality and availability of data. In 2011 Altbach and Salmi determined the main aims of Malaysia university or colleges as, to deliver effective information to support decision making, evaluate performance and to underpin all aspects of services and activities (Altbach, Philip G and Salmi, 2011), and to provide reliable information and statistics and produce a range of operational and academic reports that feed into university functions and processes, such as: departmental or individual staff reporting requests, Stakeholder's requests, Annual

monitoring and planning, Performance Indicators, Periodic review meetings (Altbach, Philip G and Salmi, 2011).

Currently no studies could be found which focus on how institutions are using included in their Academic Quality Improvement Process (AQIP) data to benchmark themselves against other institutions; therefore, this study examines how higher education institutions measure their own quality by examining the key performance indicators (KPI) included in their AQIP Systems Portfolio.

Presently, the need to improve the data quality can be observed in most of the organizations (Navaz et al., 2013), where it became the process of classifying and analyzing the data difficult process (Gorgan, 2015). Any organization can significantly note that a large quantity of data without analysis of the collection does not work on the institution (Popovič et al., 2012). At present it is possible to diagnose that a data quality and an easy usage stay the hardest challenges (Henschen, 2015). Most of the attendance management systems do not focus on the analysis perspective of data collection. Additionally, there are a number of matters in the existing attendance systems: First, lack in visualizing and calculating employees working hours. Second, poor or cumbersome in reporting capabilities for annual, monthly and daily data.

Traditional AMS, it lacks a comprehensive analysis of the full data so that It doesn't offer analysis skills with high quality. Data attendance analysis carried out manually by the human resources department staff, or sometimes the reports present to senior management and he will be responsible of data analysis. In spite of the current progress in the technology, but the calculation process of employee hours is still difficult to identify. For example, in the current attendance system of UTeM there are a number of issues need to be reviewed and that is (Gorgan, 2015): first, lack of visualizing annual,

monthly and daily data to calculate working hours. Second, poor or cumbersome in reporting capabilities. Third, Limit options flexibility. Fourth, integration challenges with multiple applications source. Finally, services focus on the collection and presentation of data without including analytical capabilities. It is noticeable that some of these issues, its public for most universities and other special case for UTeM.

Therefore, the main goal of this project to enhance a model for human resource (HR) assignments in skill based environments. It's to integrate in AMS with analytical capabilities for UTeM staff.

#### **1.4 Objectives**

This project was done to achieve several objectives:

- i. To investigate the best BI tool for AMS, in order to enhance the quality of data for decision making.
- ii. To integrate BI tool in AMS, in order to determine the staff attendance KPI and analyses.
- iii. To evaluate the proposed BI Tool in terms of its capabilities in predicting staff attendance KPI and analyses by using real company data.

#### **1.5 Research Questions**

The following research questions have been framed to set the direction for this research:

- i. What is the best BI tool for AMS, in order to enhance the quality of data for decision making?
- ii. How to integrate BI tool in AMS, in order to determine the staff attendance KPI