

observatory, competitive intelligence, decision-maker, Yii, DWH

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A YII-POWERED WEB APPLICATION TO ASSIST DECISION-MAKERS IN MUNICIPAL SOLID WASTE MANAGEMENT

Abstract

This paper adopts the concepts of observatory and competitive intelligence (CI) to model a system that will generate better insights for decision-makers in the solid waste industry. The first part of this work is to design and develop a data warehouse (DWH) of solid waste statistics using data assembled from disparate sources. Our methodology of design is the entity relationship diagram (ERD) and our implementation tool is MySQL running on phpMyAdmin. The second part of our work will be to turn our developed DWH into a Web application using the Yii PHP component framework. Our findings indicated that the application of both concepts of observatory and CI lead to better insights for decision-makers and hence better organizational performance.

1. INTRODUCTION

Since our system is supposed to be a Yii-based Web application, we use *PHP 5.6.3* and *MySQL 5.6.21* database application for the development of the Web site. The source from which we acquired all these required software tools is the XAMPP solution stack, which is an open-source, obtained from <http://www.apachefriends.org/en/xampp-windows.html>. Also our Web server will be *Apache httpd 2.4.10* and our *webroot* directory will be `C:\xampp\htdocs\mswproject/`.

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1.1. Why observatory and CI?

There is already a large body of literature on the management of municipal solid waste (MSW) using various design concepts. We note that CI has over the years been deployed in disciplines such as *wind turbine manufacturing*, *automobile manufacturing*, *software development*, *aeronautics*, and *pharmaceuticals* etc. For instance, by the aggressive application of CI techniques, Microsoft Corporation has been able to eclipse competitive products from competitors in the software industry. Products such as *WordPerfect*, *Lotus 1-2-3*, and *Netscape Navigator* have all been outdone by respective equivalent products namely; *MS Word*, *MS Excel*, and *Internet Explorer* by the determined deployment of CI as a prioritized unit within Microsoft Corporation. However, the application of the CI process in the field of solid waste management remains vastly unexplored.

What do we therefore mean by the term CI? According to SCIP (2012) [12], CI is the legal and ethical collection and analysis of information regarding the capabilities, vulnerabilities, and intentions of business competitors. Van Brakel (2005) [10] also defines CI as “*a business discipline that is used by companies and countries alike as a means to improve competitiveness by making better use of information.*” There are so many definitions given by various authors but they all invariably mean the same thing. The key thing is to ensure that the practice is legal and ethical as CI is not espionage.

An observatory is basically a facility which houses a cluster of equipment which contains a repository of data mainly for research purposes in fields such as astronomy, meteorology, and other natural phenomena. In our case, we simply mount our observatory in the study area as and when needed and collect data through observation.

2. METHODOLOGY

We first installed XAMPP which is a free and open source cross-platform Web server solution stack which contains all the tools required for this study. The word XAMPP is an acronym where:

- X means cross-platform;
- A means Apache;
- M means MySQL;
- P means PHP; and
- P means Perl.

Subsequently, we build the shell of our Web application using the *yiiic webapp* tool from the command line. Figure 1 below shows the shell of the Web application consequently generated and customized to display dynamic content as well as the name given to the Web application using the Yii framework.



Fig. 1. A screenshot displaying the homepage edited to display current datetime and last login time [source: own study]

The architecture of the proposed framework showing the CI inputs into the observatory through to the DWH and finally to the decision point for decision-makers is shown in Fig. 2 below.

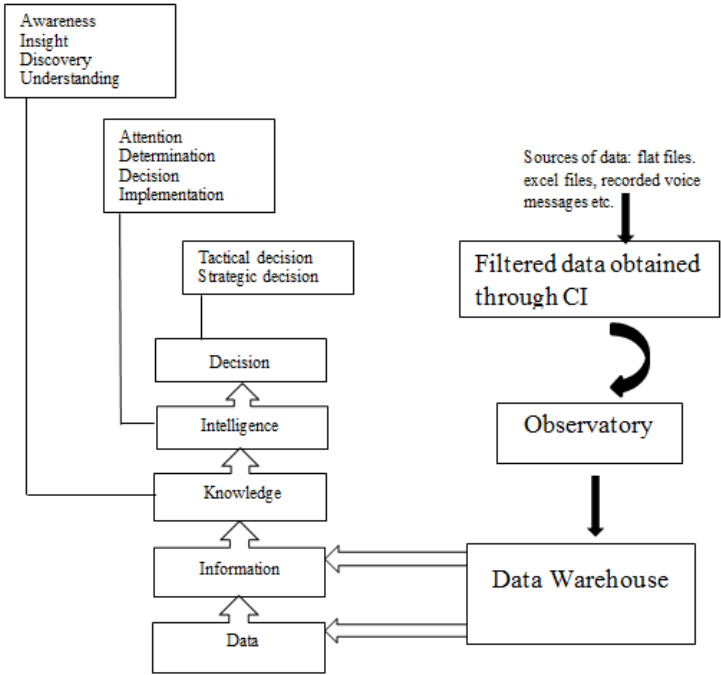


Fig. 2. Architecture of framework of research showing the crucial CI and observatory stages [source: own study]

2.1. Data Warehouse Design Approach

In our design, we adopt the Third-Normal Form (3NF) Data Model as against a Dimensional Data Model or a combination of both for our data warehouse [13]. The benefit of adopting a 3NF ERD model is that it will enforce a “Single View of the Truth”, something not possible with a Dimensional Model.

In our case, the application server will be MySQL DBMS which will host the data warehouse. Subsequently, we will build the Web application using the Yii PHP component framework.

2.2. Data model

The modeling of data in this write-up will be done using ER modeling. We submit that is the best schema to use as it helps a lot in avoiding redundancy of data [6, 7]. We also affirm that the concept of entity-relationship diagram (ERD) — developed by Chris Data, Ted Codd (1970) [4] and Chen (976) [5] — is the option that is most suitable for this design since it works very well with a relational DBMS such as *MySQL*.

We want to design the warehouse to strictly enforce what the operational database does enterprise-wide. The end result of E-R modeling is the E-R diagram (ERD), a graphical representation of the logical structure of a database [1].

2.3. Implementation of the physical DWH

The next stage is the design of the physical DWH in phpMyAdmin using MySQL. XAMPP includes phpMyAdmin which is an open-source, browser-based tool for managing MySQL database servers.

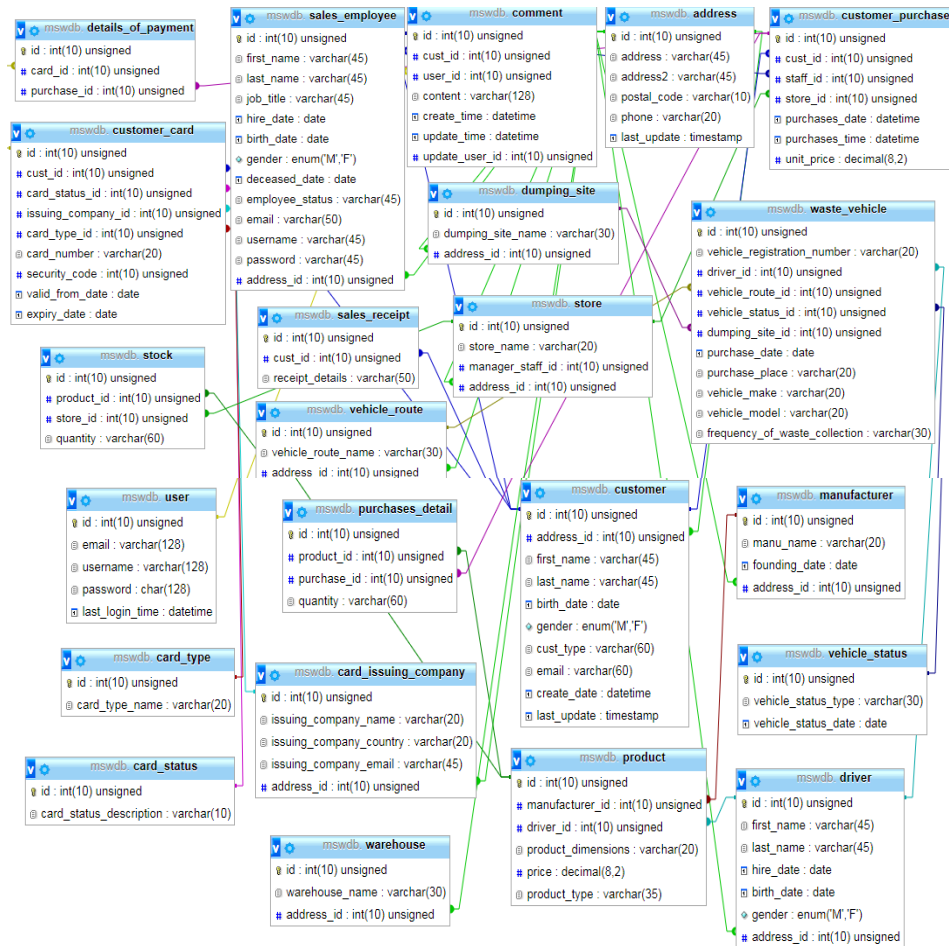


Fig. 3. The physical implementation of the DWH for MSW management built using MySQL running on phpMyAdmin as the UI [source: own study]

2.4. Design of the CI process

Our research methodology is both qualitative and quantitative by approach. Some argue, however, that the qualitative approach is more interesting. Silverman (2010) [11] argues that the qualitative research method is more interesting because of the subjectivists' perspective which always looks for the experiences, views and opinions of people. Miles and Huberman (1994:1) [9] have also posited that words tend to have more impact on people than numbers would if possible. The objective is to impress on managers the contribution that the integration of CI into the operations of the organization can make to better decision-making. Decision-makers will need reports as well as charts to understand

metrics better and so there is a justification for both a qualitative and quantitative approaches. CI as matter of fact is a unit that supports sales and marketing functions of an organization and so it is always difficult to quantify it in terms of revenue. However, its impact is mainly qualitative and this is time-tested and proven.

2.4.1. Data Collection

The data collection technique involved in-depth interview sessions and observations we personally made within our study area with regards to solid waste management.

3. PRESENTATIONS AND DISCUSSION OF RESULTS

3.1. Responses on costs of solid waste containers surveyed on the market

We surveyed 95 residents within randomly selected addresses in the Adentan municipality of our study area about their concerns with regards to the cost of the solid waste containers they need to store their domestic waste products. The variety of responses from these respondents indicated that the costs were also a factor in the poor state of solid waste management within these areas. A total of 55 % of our respondents agreed that the waste bins were either *very expensive*, *expensive* or *not affordable* as shown in Fig. 4.

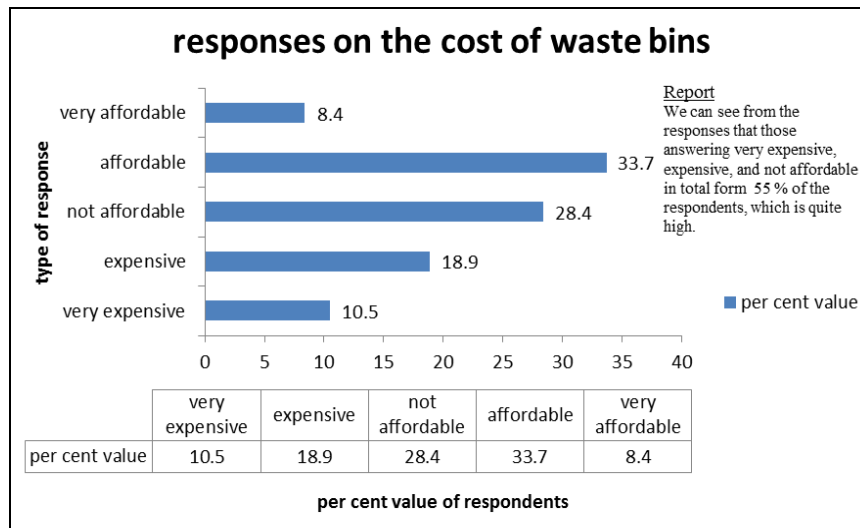


Fig. 4. Chart showing responses of residents on the cost of waste bins [source: own study]

3.2. Responses from selected residents within the study area

Figure 5 below shows the responses we also obtained from a random sample of 43 residents within our study area concerning the general waste management situation. Here 41.9 % of respondents said the situation was average. This is indicative of the fact more room is there for improvement in terms of the way and manner things are done now.

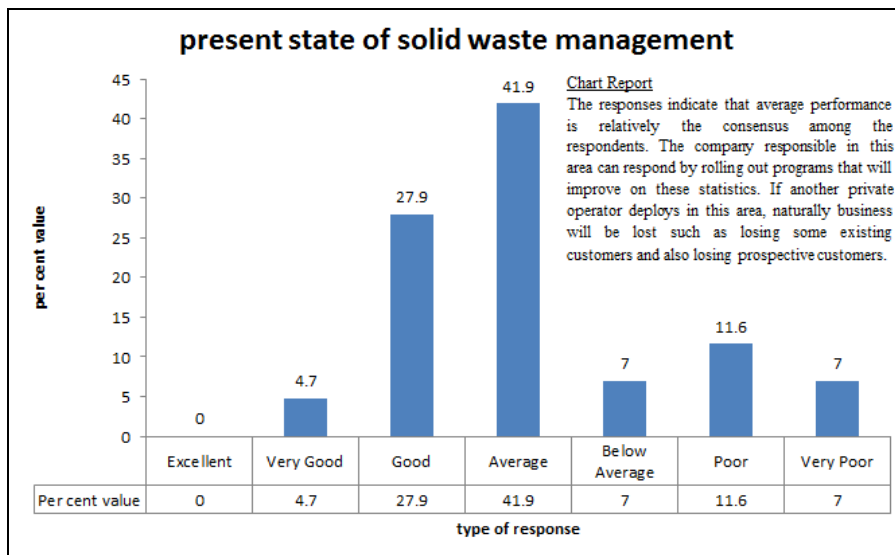


Fig. 5. Chart showing the per cent value of responses from residents of the study area concerning the state of sanitation in their community [source: own study]

3.3. Observations made with regards to times of domestic waste collection

Figure 6 displays the times that assigned solid waste-carrying vehicles arrived to carry domestic waste to the dumping site during the 60-day window during which we mounted our observatory to see things first hand for ourselves. We noted that the regular times of solid waste collection by the waste management company was not strictly followed and there were also days when even the trucks did not turn up.

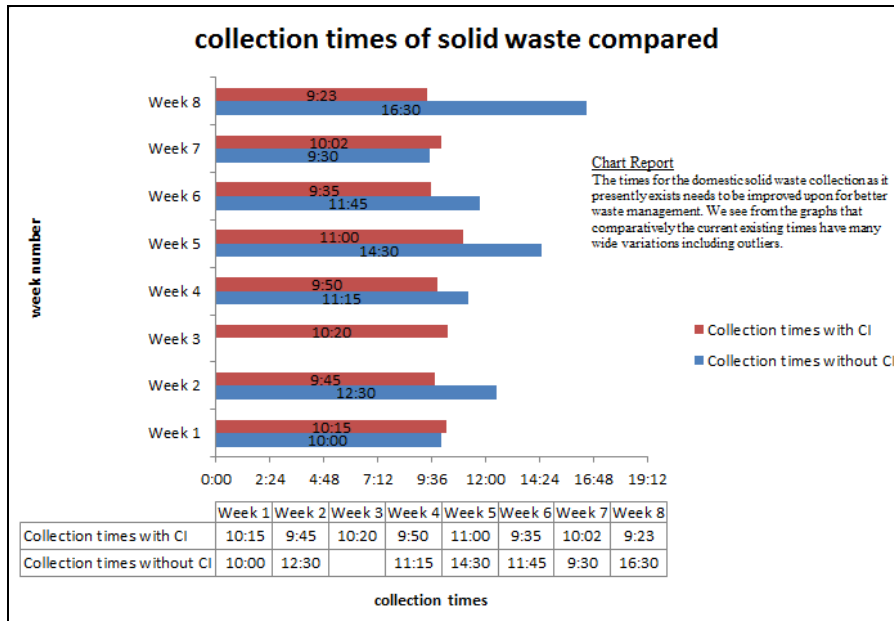


Fig. 6. Graph comparing the times of MSW collection using CI and without CI [source: own study]

3.4. Implementation of the Yii-powered Web application

A typical Web page of a customer of the waste management company who has purchased a waste-carrying bin is shown in Fig. 7 below. From the results obtained through the CI process, this very customer for instance, could benefit from decision-makers in the waste management company if they do a critical analysis and up their game such as factoring the cost of the waste bins into their business plans to attract new customers or retain existing ones.



Fig. 7. A screenshot of the view of the details of a customer of the waste management company [source: own study]

4. CONCLUSIONS

We have modeled a Yii-powered Web site of a data warehouse meant to assist management in decision-making of MSW management. For a fact, a DWH is the business analyst's dream of having all the historical data or information about a specific task assembled in one place. This is exactly what we have done. We want to contribute to the effective management of MSW by way of the production of intelligence acquired through the processing of disparate sources of information. A major finding of this research work is that the frequency of waste collection in various communities within the study area is not good enough. The improvement we expect can be achieved if the concept of CI is fully integrated into the core business of the organization.

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