

Usability Analysis of Business Intelligence Tool Based Table Virtualization

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ABSTRACT

The use of Business Intelligence for Small-Mid Enterprise (SME) no longer impeded by the size of the resources required. The study in this paper provides an overview of how the use of proposed software can be used as an effective and efficient alternative solution in building BI Tools combined with table virtualization utilization in SQL. To know the level of usability and suitability of the developed BI Tool, the researcher conducted evaluation and analyzation using 2 (two) tools (Heuristics Evaluation and UMUX-Lite). The result found the comparison between the output (Business Intelligence Tool) produced by PHP Report Maker has a better level of usability and suitability than its competitors. Although both are in a decent median, the output needs preferences and customizations to achieve maximum functionality like well-known other development software

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1. INTRODUCTION

The Utilization of BI has been agreed that it increases the productivity of an organization from various sides [1]. The problem is that the resources needed for procurement, development and implementation in a normative context are quite significant. For example, in physical procurement and Data Warehouse implementation process, these kinds of process are required in BI development [2], [3]. In fact, this was difficult to realize by some organizations/companies primarily at the small-mid level company. An alternative solution offered by many cloud-based BI Tool developers is the next choice. The presence of products that offer the effectiveness and efficiency of BI development process is still difficult to be implemented entirely for several reasons.

Based on the above ideas, writer proposed alternative solutions of development of BI tool, especially for a small-mid level organization. This solution is to use an application which is relatively cheap and easy to use. The method of application selected in this study was then combined with the utilization of data table virtualization. Discussion on this study is directed to answer the problem of how the development of BI Tool is done and how far the performance of the results (output) is reviewed based on user perception on aspects of usability.

The study was conducted on one company at Small-Mid Enterprise (SME) level to obtain an important indicator that can be used as parameters in building an adaptive BI Tool for related companies. The obtained indicators are intended as materials to define user and system requirements that are then integrated into the standards and procedures for developing the BI Tool. Development is implemented and limited to the summary and detail report of the company's CRM database without going through the physical data warehouse process. The results of developed BI Tool then discussed, evaluated and analyzed to obtain conclusions in this study.

2. LITERATURE & RELATED WORK

2.1. AdHoc Query as BI Tools

Simon (1997) categorizes BI Tools into 4 (four) forms, namely Basic Reporting tools, Online Analytical Processing, Data Mining, and Executive Information System. These tools provide information that focuses on executive-level-insight (information presented for executive needs) which operated with dashboards and other forms of display [4].

The related terms; ad-hoc query [5] and analysis tool are analytical tools included in BI Tools designed to enable users to find what-if business information without technical assistance from IT organizations [6]. Tools like this are usually in the form of a view with navigation that allows users to select the data relevant to the condition of the desired business report. This BI tool is also referred to as Business Intelligence Front-end [7].

2.2. Data and Table virtualization as SQL View

BI Tools uses data as material to be displayed in the form of information. Sherman [5] calls out forms of data that could be sources of reports and analysis are; OLAP databases, massively parallel processing (MPP) databases, data virtualization, In-database analytics, In-memory analytics, cloud-based BI and NoSQL databases. For sources processing, Johnson rejects the notion that physical Data Warehouse is the only enterprise solution in this issue [8]. Virtualization is one of alternative solution. It further explained that the Virtual Data Warehouse is identical to the federated model implementation process.

Strengthening the opinion above, in accordance with the white paper released by Pentaho states that MySQL (MariaDB) has convincing evidence that it can be used directly for data analysis (BI) primarily through the View function (Virtual Table) which features in MySQL version 5 [9]. Thus, MySQL with view function can be used for BI Tools data source because it admits as data virtualization and becomes one form of VDW implementation [10]. Data virtualization using view on MySQL/MariaDB also becomes a technology solution for small and medium-sized enterprise (SMEs), a solution to benefit in an enterprise context [11].

2.3. BI Tools Development by PRM

PHP Report Maker (PRM) is a software that can produce PHP-based Web Scripts to display reports from various database sources such as MariaDB, PostgreSQL, Microsoft Access, Microsoft SQL Server and Oracle database. It is a class of software that is very easy to use but has rich features that can be equivalent to software that is widely known by BI Tool developers. Some parties have used it as; dashboard development to monitor academic information at the university [12], build support systems with fuzzy methods [13]. Reporting inventory tools [14]. While Scriptcase is a software that specifically has the same function as PRM in building BI Tools as promoted on its official portal.

3. METHODOLOGY

3.1. Development Framework

To facilitate the understanding and the flow of analysis in this paper, we draw the order of framework as follows:

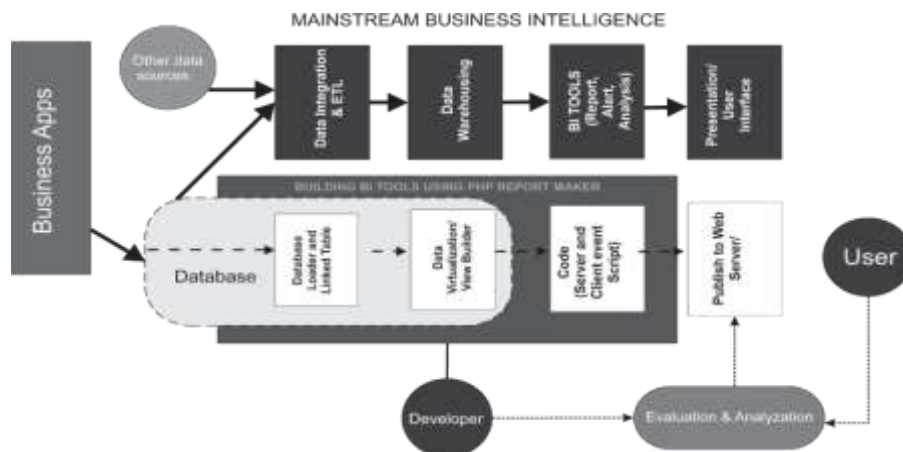


Figure 1. Framework Rationalized the BI Tool Development with SQL View using PRM

The picture above shows the design concept of BI Tool that will be built and analyzed in this research. This framework also explains the methodological steps in the study. To obtain data for analysis, the study was conducted in several stages. Starting from the initial data collection stage, the design and development stage, the publication stage and ending with access by the user. The data obtained through the process of BI Tool development, the results of generated output compares with the results derived from competitors output. The researcher uses *Scriptcase* [15] as comparison software in this study. In the last, the survey and post-test will be held to obtain user perception data over BI Tool interface generated.

3.2. Usability Analysis

The BI Tool performance concerning the use of conformity with user requirements and user-usability aspects will be tested based on the 2 (two) ISO/IEC 25010 quality standard, both are Functional and Usability [16]

The researcher concludes that taking two quality standards has represented required aspects of perceived analysis for the initial development of an application. According to [17] it only takes usability variables to know the quality and performance of software that is temporarily developed based on user experience. To measure both, the required measuring tools that have been tested as follows:

- Analysis based on Developer Evaluation/Researcher, performed by heuristics evaluation/review method to evaluate the usability of an app's display by an expert pursuant to rules or policies enacted [18], with the following formula:

$$\text{ProblemsFound } (i) = N(1 - (1 - i)^n) \text{ [19]}$$

A calculation pattern designed by David Travis was used to summarize the scores the analysis [20] to assist the researcher in completing the calculations of this evaluation.

- Analysis based *User Experience* data, performed using *Usability Metric for User Experience (UMUX) Lite*. UMUX-Lite is a tool provided to measure user perceptions about the usefulness of an application/software based on user experience according to two raw variables. The formula applies to UMUX-Lite as follow:

$$\text{UMUXLITE} = 0.65(\text{item1} + \text{item2} - 2) (100/12) + 22.9 \text{ [21]}$$

4. RESULT AND ANALYSIS

4.1. Requirements

The following table is the standard description used for synchronization requirement which is then initialized with the code for easy subsequent classification:

Table 1. The Developed BI Tool Requirements Classification based ISO 25010

ISO Standards	Code	Requirements
Usability	US01	Users can recognize that the BI Tool used is really purposed for their work needs.
	US02	Can be learned, easy to use
	US03	Protect against usage errors
	US04	Aesthetic and accessible interface
Functional Suitability	FS01	Existing functionality includes user-defined tasks and goals
	FS02	The functionality presented provides correct results with the solid output precision level
	FS03	Existing functionality facilitates certain work to be done by the user.

The classification table above used as the basis for the preparation of the user and system requirements listing. Both requirements act as the guidelines in the development process. Also, resulting list of parameters used for the analysis. The detailed user and system requirements table are listed in attachments.

4.2. BI Data Modelling (Star Scheme)

The study uses star scheme as data modelling to produce fact tables. Meanwhile, view (as virtual table) is a fact table obtained from the relation of several dimension tables contained in the database. Data model adapted to the system requirement, a simple example can be described below:

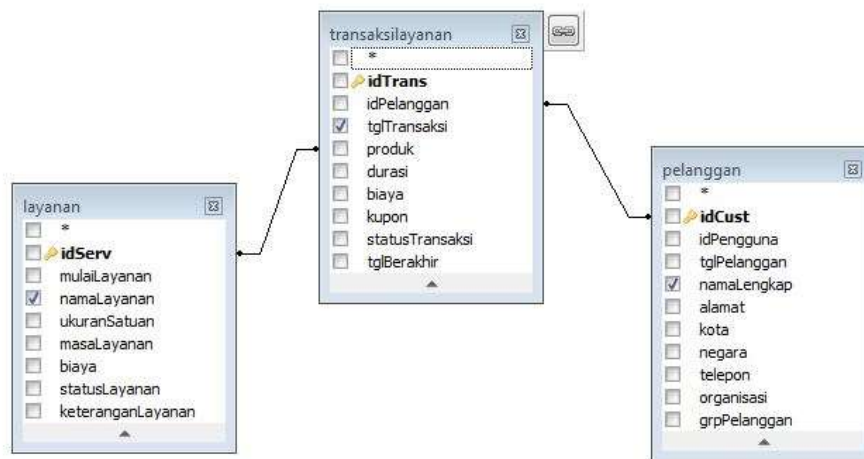


Figure 2. The Simple Example How View Formed as Fact Table

The fact table in the example figure above is constructed from several dimensional tables in *view* form. Due to its virtual nature, the fact table that is logically stored in the database with the name of the "viewTransactionServices". Thus, the table does not display its physical form. However, if it is compared to BI data modelling by involving logical table then this fact table will be tangible as in Figure 3 follows:

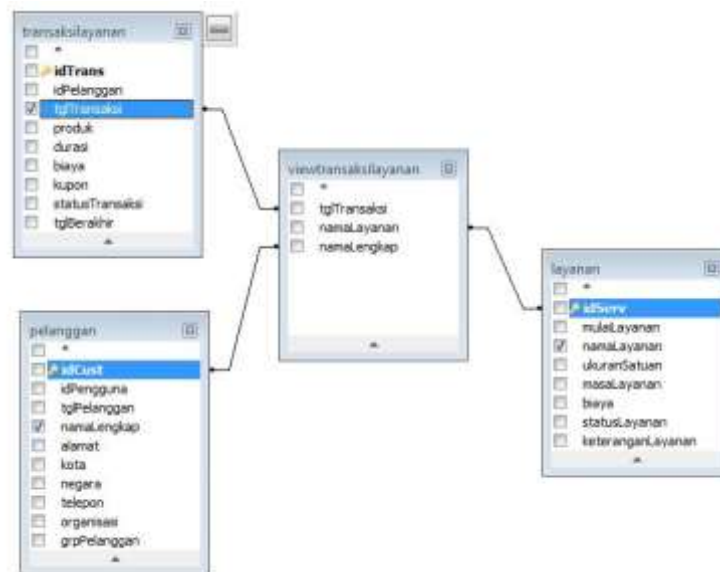


Figure 3. The Physical BI Data Modelling for Fact Table “viewTransaksiLayanan” (Simulated using Custom View Feature in PRM)

Based on our experiment performed using PRM's custom view facility with the data model as shown in Figure 3 found that the data output is 100% like the table which produced the model in the logical model (Figure 2). Furthermore, the results of the table virtualization created following the requirements used in PRM and SC for the further process of the BI Tool development.

4.3. Process of BI Tool Development

BI Tool development process using PRM and SC is relatively easy to do. This is because all activities can be done by utilizing the features that are available and are directed specifically to produce the report display in the form of tables and graphs. The summary of the process can be seen in the comparative process table as follows:

Table 2. The BI Tool Development Process using PRM Compared to its Competitor

Process	PRM	SC
Sandboxing	Manual	Manual
DB Connection	Supported 6	Supported 9
DB Customization	View Builder	SQL editor
UI Preference	Simple	Complex
Report Page Dev	Integrated	Stand Alone
Chart Page Dev	Integrated	Semi Integrated
Dashboard Page Dev	Full Integrated	Semi Integrated
Page Block	1-4 Columns (auto)	1 Column (manually for more than 1 column)
Manual coding and additional logic and features	Third party libraries extension) and Framework (fully supported)	Third party library
Security Page	Integrated	Stand Alone
Menu and Language Preference	Integrated	Stand Alone
Script Production	Very fast	Very slow
Publication and release	Simple	Layered Process

The table above shows the summary of overall process of BI Tool developments using two software which proposed in this study (PRM and SC). In general, both have the same process. However, the facts show that the PRM process in some facets is easier to do with relatively better results. For example, in PRM it was found that the integrity of one process and other processes was very strong. The integrity of this process allows development is running more systematically. Where systematic process will greatly support the realization of a good SDLC as well.

4.4. Output PRM and SC

The result is a collection of PHP scripts and other files generated through the process of generating and compiling. The file generates several web pages that have certain functions and features described as follows:

Table 3. The Description of Output Features Generated by PRM and SC

Features	PRM	SC
General (Support all requirements)	Yes	Yes
Table Features	Summary, grid, pivot, detail, Crosstab and quarterly table, popup detail	Summary, grid, pivot, crosstab, detail.
Chart Features	29 Chart models, Gantt Chart, Serial, clickable chart	20 Chart models, Gantt, clickable chart, detailed chart per grid value
Search and Filter Features	Basic, extended, time and date based, custom filter, sort, drilldown	Basic, year, dynamic filter (drag & drop), sort
Security	AUTH system and anti xss and sql injection	AUTH system
Another Page	Dashboard, data detail modal page	
UI built in	Bootstrap framework, jquery, flash chart	jQuery, html5, flash chart
File size	Small	Very Big

In general, the output has been able to meet the needs of the requirement listed in this study. Specifically, several features and forms distinguish between the results obtained both as described in Table 3.

4.5. Evaluation and Analysis

a. Heuristics Evaluation

Here is a graph showing the difference and the deviation between the scores came by the BI tool developed using PRM and Scriptcase. The scores taken from developer perception using heuristics evaluation method.

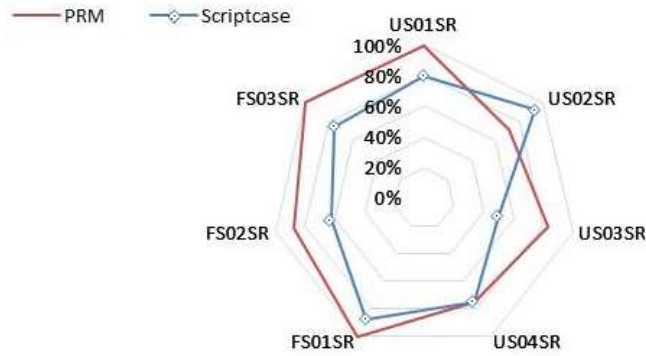


Figure 4. Graph of Difference Score BI Tool Built with PRM and Scriptcase

The figure shows that the PRM output is higher in majority aspects. There is five output usability have higher advantages compared to SC. While SC only excels on one aspect that is the aspect with code USR02. The evaluation results also state that there is a similarity of usability score in both outputs, i.e. on aspects with code US04SR.

b. Perceived Usability analysis (UMUX-Lite)

The matrix applicable to UMUX-Lite is between 22.9 - 87.9 where the lowest score is the best result with a median of 55.4. Based on this standard we can describe the comparison of output (output) of PRM and Scriptcase according to the user perception as follows:



Figure 5. Perceive Usability Comparison to PRM and SC Output based on UX from Users

The figure above explained that all users give their perception for output (BI Tool) produced by PRM better than output by Scriptcase. However, with the fact that all opinions under the median, it can be stated that both of this software has been stated to have a good usability level to be used in building the BI Tool. In other words, the results of the BI Tool both built using PRM and Scriptcase have met the user usability perceptions and deserve to be used for BI customer service needs in this company.

5. CONCLUSION

Subjective considerations including the limitations of infrastructure and resources owned by the company become a reason for building alternative BI Tool development in this study. The development makes use of relatively easy-to-operate and affordable software combined with table virtualization for ETL utilization. The process is done comparable with the use of similar software for building Adhoc Report, as well as the output it produces. The output consisting of summary and detail report in both table and graphic form (crosstab report and serial chart) that provide visualization of data not yet found on company CRM system.

Based on the evaluation and analysis of user perceptions, found that PRM output has a higher usability level than Scriptcase. Also, all the user state that the output PRM is more declared more suitable for

the company. Nevertheless, the outputs from both; PRM and its competitors are still within a reasonable median used for the BI purposes of the SME.

REFERENCES

- [1] B. Heesen, *Effective Strategy Improving Performance with Business*, Second Edition, New York: Springer Heidelberg, 2016.
- [2] R. Kimball and M. Ross, *The Data Warehouse Toolkit, second edition The Complete Guide to Dimensional Modelling*, New York: Wiley Computer, 2002.
- [3] R. J. Thierauf, *Effective Business Intelligence Systems*, London : Quorum Books, 2001 .
- [4] A. Simon, *Modern Enterprise Business Intelligence and Data Management*, Waltham: New York, 2014.
- [5] R. Sherman, *Business Intelligence Guidebook from Data Integration to Analytics*, Waltham: Elsevier Inc., 2015.
- [6] J. R. R. G. Robert Stackowiak, *Oracle Data Warehousing and Business Intelligence Solutions*, Indianapolis: Wiley Publishing, 2006.
- [7] C. Howson, *Successful Business Intelligence, Secret to Making BI a Killer App*, New York: McGraw-Hill, 2008.
- [8] B. D. T. a. *Practice, Bitemporal Data Theory and Practice*, Waltham: Morgan Kaufmann, 2014.
- [9] Seth Grimes, Alta Plana Corporation, "MySQL V5 Ready for Prime Time Business Intelligence," Pentaho, 2006.
- [10] W. Abramowicz, *Filtering the Web to Feed Data Warehouses*, London: Springer, 2002.
- [11] S. Schulte, C. Janiesch, S. Venugopal, I. Weber and P. Hoenischa, "Elastic Business Process Management State of the art and open challenges for BPM in the cloud," *Future Generation Computer Systems Volume 46*, pp. 36-50, 2015.
- [12] Sulastri, Hari Murti, Yunus Anis, , "Perancangan Dashboard Untuk Memonitor Informasi Akademik Mahasiswa Di Universitas Stikubank (UNISBANK) Semarang," UNISBANK, Semarang, 2015.
- [13] E. Panggabean, "Sistem Pendukung Keputusan Evaluasi Kinerja Dosen Menggunakan Metode Fuzzy Simple Additive Weighting (Fsaw)," *Jurnal Mantik Penusa*, pp. 1-10, 2016.
- [14] B. H. Prakoso, "Pembuatan Aplikasi untuk Mengelola Persediaan Barang Farmasi pada RumahSakit ABC dengan Fitur Alert dan Reporting," ITS, Surabaya, 2016.
- [15] Scriptcase, "Home," 15 06 2017. [Online]. Available: <http://www.scriptcase.net/>.
- [16] ISO 25000, "ISO/IEC 25010," 16 07 2017. [Online]. Available: <http://iso25000.com/index.php/en/iso-25000-standards/iso-25010>.
- [17] C. Pribeanu, "Comments on the reliability and validity of UMUX and UMUX-LITE short scales," in *National Institute for Research and Development in Informatics - ICI Buchares*, Bucharest, 2016.
- [18] E. Hvannberg, G. Cockton and E. L.-C. Law, *Maturing Usability: Quality in Software, Interaction and Value*, Zurich: Springer, 2008.
- [19] J. Nielsen, "How to Conduct a Heuristic Evaluation," 01 01 1990. [Online]. Available: http://echo.iat.sfu.ca/library/heuristicevaluation_Nielson.pdf.
- [20] E. García, A. García, L. de-Marcos, S. Otón and J.-R. Hiler, "Semiautomatic Evaluation of Websites Usability," in *The Fifth International Conference on Advances in Computer-Human Interactions*, Alcalá de Henares, 2012.
- [21] J. Sauro and J. R. Lewis, *UMUX-LITE Quantifying the User Experience: Practical Statistics for User Research 2nd Edition*, Cambridge: Morgan Kauffman, 2016.