Design of Occupational Health and Safety Management Information System at Telogorejo Semarang Hospital

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Article Info

Abstract

Hospital is one company that is required to develop hospital OHS Management System. Hospital OHS management System is required to carry out the process of recording and reporting OHS which is integrated with the hospital management information system. Problems that occur in the recording and reporting system include difficulties in accessing and searching data, inaccurate in inputting, processing and presenting data, susceptible to data loss, and incomplete information produced. The purpose of this study was to develop an OHS Management Information System at Telogorejo Hospital, Semarang, and test the system. The system design is built based on the stages in the Waterfall Method namely Requirement Analysis, System Design, Implementation, and Testing using the Blackbox Method. The results of this study are the establishment of the Hospital's OHS Information System which is able to produce output in the form of reports and graphs, and the system has worked well and correctly as expected and in accordance to the rules outlined by the system users and is able to accommodate multi-user use. The conclusion of this study is that the use of the Hospital's OHS Information System can simplify the data input and process, speed up data searching, and produce more accurate outputs.

INTRODUCTION

The Occupational Safety and Health Management System (abbreviated as OHS Management System, in Indonesian as *SMK3* or *Sistem Manajemen Keselamatan dan Kesehatan Kerja*) is part of the company's management system that regulates and carries out all activities related to occupational safety and health (OHS or *Keselamatan dan Kesehatan Kerja (K3)*) (Yulyanti et al., 2017). The Government Regulation Number 50 Year 2012 Regarding the Implementation of Occupational Safety and Health Management Systems says that *SMK3* consists of the organizational structure of planning, implementation, procedures, processes of responsibility

and resources needed in developing, implementing, achieving, assessing and making OHS policies with the aim of controlling risk in order to create a safe, comfortable, healthy, efficient and productive workplace.

The importance of *SMK3* in a company is to improve the implementation of accident prevention through a system approach, the need to prevent social and economic problems related to the application of *SMK3*, prevent suffering caused by work accidents and deaths, reduce absenteeism due to illness and injury, errors and work interruptions, helps in maintaining the quality of products or services, saves costs related to work accidents and occupa-

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tional diseases, monitoring of hazards and risks in the company (Messah et al., 2012). The process of implementing *SMK3* starts from setting commitments and policies; planning; application; measurement and evaluation; and management review and improvement (ILO, 2013).

Based on Law No. 13 Year 2003 concerning employment, it is stated that the *SMK3* must be implemented in every company. Every company that has more than 100 workers or less than 100 workers but has a high risk is required to develop the system and implement it in the workplace (Ibrahim et al., 2017). Hospital is one of the companies that is required to establish and develop a Hospital Vocational School. The Regulation of the Minister of Health Number 66 Year 2016 Regarding Hospital Occupational Safety and Health states that Hospital Vocational Schools are required to carry out the process of recording and evaluating Occupational Health and Safety (OHS) which is integrated with hospital management information systems. Recording, reporting and all activities related to OHS are carried out regularly. Recording and reporting systems that are still manual will complicate and slow down the processing, search and storage. To support the success of *SMK3* in hospitals, especially in recording and reporting, it is necessary to develop a Hospital Occupational Health and Safety Management Information System.

In Telogorejo Hospital's *SMK3*, the reporting and recording system is done manually. Reporting and recording are done using paper in the form of forms; this method is ineffective and inefficient. In addition to difficulties in data processing, the process of storing and searching also requires a long space and time, as well as inaccurate time in data input, processing and analysis. The absence of an output that is easily read by those who need it will also affect the duration of decision making.

The OHS information system applied previously had several problems, including information that could not be accessed directly by top-level management, difficulties in accessing data and data searching, inaccuracy in inputting, processing and presenting data, difficulties in processing and analyzing data, susceptible to data loss, and incomplete information generated. So that the hospital's OHS Information System was developed using the waterfall method with the stages of problem and needs analysis, system design, implementation and testing.

The development of OHS Information System management is carried out to overcome these problems. With the development of the OHS information system, it is expected to simplify the process of inputting, processing, storing, and searching for data as well as producing outputs that are easy to read so that it helps in the decision-making process. The purpose of this research is to develop OHS Information System Management in Telogorejo Hospital, Semarang, and to further test the system using the Blackbox Method.

Blackbox testing is a software testing in terms of functional specifications to determine the operational functions of information systems, input and output of software in accordance to what is needed by users (Asnawati & Utami, 2015). Blackbox testing is also called behavioral testing, specification-based testing, input / output testing, or functional testing. The purpose of Blackbox testing is to look for errors in the wrong or missing functions, errors in the interface, errors in the structure of funds or database access, performance errors, and initialization errors and the final destination. Blackbox testing in this study was designed to answer the question of how functional validation was tested.

METHOD

The design of OHS Management System in the hospital uses the waterfall system development method. The stages of OHS Information System development are Requirement Analysis, System Design, Implementation, and Testing (Solichin, 2009).

1. Requirement Analysis

Requirement analysis is the first stage in software development to explore all forms of information from beginning to the end in the hope of knowing the problems and obstacles they face. In this stage, in-depth interviews and observations are conducted to find out the problems and needs of users related to the OHS Information System (Pratomo & Widajati, 2013). All software requirements are obtained at this stage. Information about problems and requirements are analyzed to obtain documentation of user needs to be used at a later stage (Dermawan & Hartini, 2017).

2. System Design

The design of the system aims to give an idea of what should be done and how it looks. This stage helps in specifying hardware and system requirements and defining overall system architecture. In this stage, design is carried out before developing the system such as use case diagrams, context diagrams, and user interface designs (Sasmito, 2017).

3. Implementation

In this stage programming is done. Software design is realized as a series of programs or program units (Akhmad, 2016). This stage is the actual stage in working on a system. In this stage the OHS Information System will be formed.

4. Testing

Software testing using the Blackbox Method provides documentation of test results that inform the suitability of the software being tested with the specified specifications (Andrika, 2017). The testing technique used is Requirement Testing. The testing focuses on the functional requirements of the software.

RESULTS AND DISSCUSSIONS
1. Requirement Analysis

Telogorejo Hospital is one of the private hospitals in Semarang that is committed to always prioritizing the OHS based on the decision of the president director. To support the implementation of OHS in the hospital, a hospital management information system is required in order to improve OHS performance, especially in the reporting and recording process (Tabrani & Pudjiarti, 2017).

Telogorejo Hospital's reporting and recording system is still using paper forms. The inspection officer will record the inspection / investigation results data on the form and then submit it to OHS staff. When there are parties who want to use, the original form is duplicated then the original form will be saved. This system requires a long time in data processing, requires a lot of space in data storage, and has difficulties in finding data.

Reports that will be entered into the system are work accident investigation reports, fire extinguisher inspection reports, hydrant inspection reports, OHS inspection reports, hazardous and toxic materials inspection reports, Pre-Construction Risk Assessment (PCRA) reports, and PCRA follow-up reports.

2. System Design

The design of the system in the development of the OHS Information System Management in Telogorejo Hospital is designed based on use case diagrams, Data Flow Diagrams (DFD), and user interfaces.

Use Case Diagrams are diagrams that illustrate all activities carried out by the system (Triandini & Suardika, 2012). The Use Case Diagram in the Telogorejo Hospital's OHS Information System is follows:
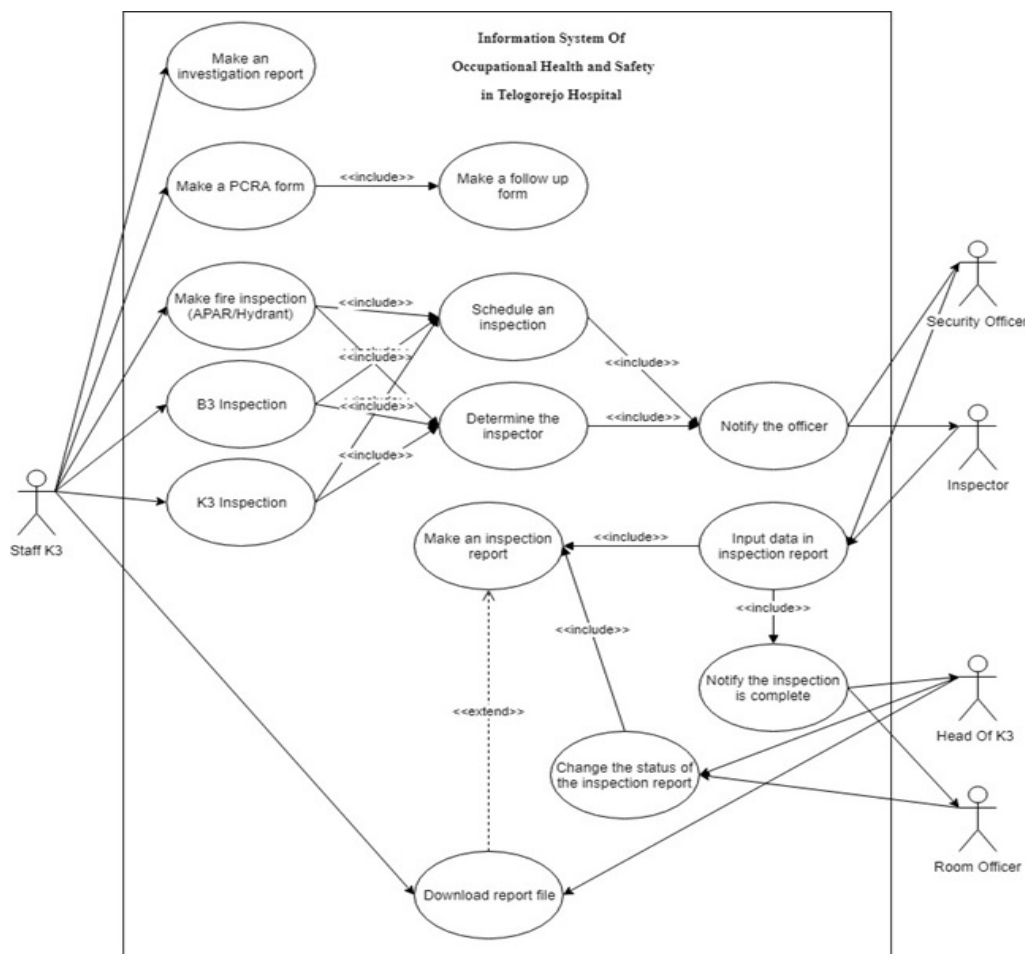

Figure 1. Use Case Diagram of OHS Information System in Telogorejo Hospital, Semarang
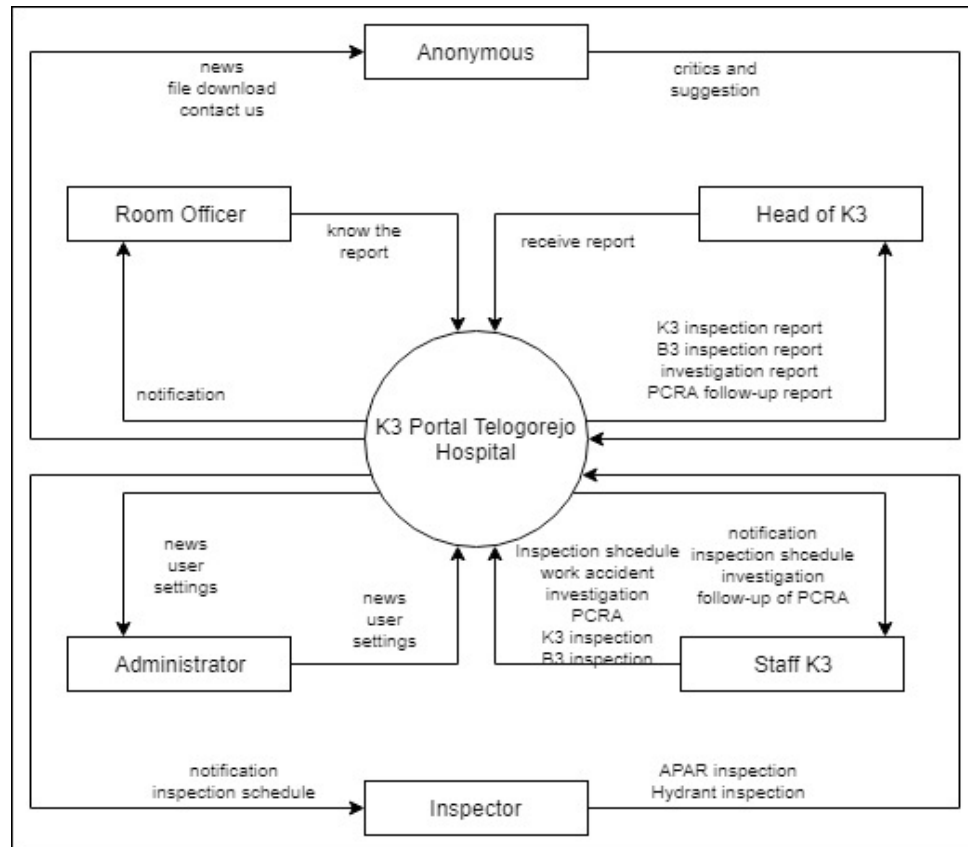
Figure 2. Context Diagram of OHS Information System

Figure 1 illustrates the functions that must exist in the system identified from the four entities (Azza and Dores, 2018). The four entities are OHS staff, inspection officers, security and OHS committee chairmen. The function of the inspection and security officer entity is to fill out the inspection form. The functions of the OHS staff entity are creating PCRA forms, PCRA follow-up and inspection forms, scheduling inspections and assigning staff. The function of the room attendant entity is to know whether an inspection / investigation has been carried out in his room. While the function of the OHS committee chairperson entity is to approve reports and receive report results.

DFD is a series of diagrams that illustrate the activities that exist in a system in which there is a visible link between existing data. The technique of making DFD is illustrated by context diagram or DFD level 0 then followed by each section's analysis namely DFD level 1, DFD level 2 and so on (Marimin and Prabowo, 2006). The following is the DFD of the OHS Information System in Telogorejo Hospital, Semarang:

Figure 2 explains the flow of data input and output on the OHS information system in the hospital and the user entities involved. Based on Figure 2, the user who utilizes the OHS Information Sys-

tem in the hospital is the Chairman of the Hospital's OHS Committee. Administrators are tasked for notifying news related to hospital's OHS and making system arrangements including user settings, inspection officers, security. OHS staff are tasked for entering data into the information system, while the OHS committee chairman receives information generated by the system. The data related to the OHS Information System in the hospital viewed from a security perspective are fire extinguisher and hydrant inspection data. While viewed from other point of view, OHS staff are instructed to do inspection schedule data, work accident investigation, PCRA, PCRA follow-up, OHS inspection and hazardous and toxic materials (in Indonesian abbreviated B3 or Bahan Beracun dan Berbahaya) inspection. Information generated by the OHS Information System is the hazardous and toxic materials inspection report, the OHS inspection report, work accident investigation report, PCRA follow-up report and work accident investigation report.

User Interface is a series of graphical displays that can be understood by computer users and programmed in such way to make it readable by a computer operating system and operates as expected. The following is the user interface of OHS Information System in Telogorejo Hospital:

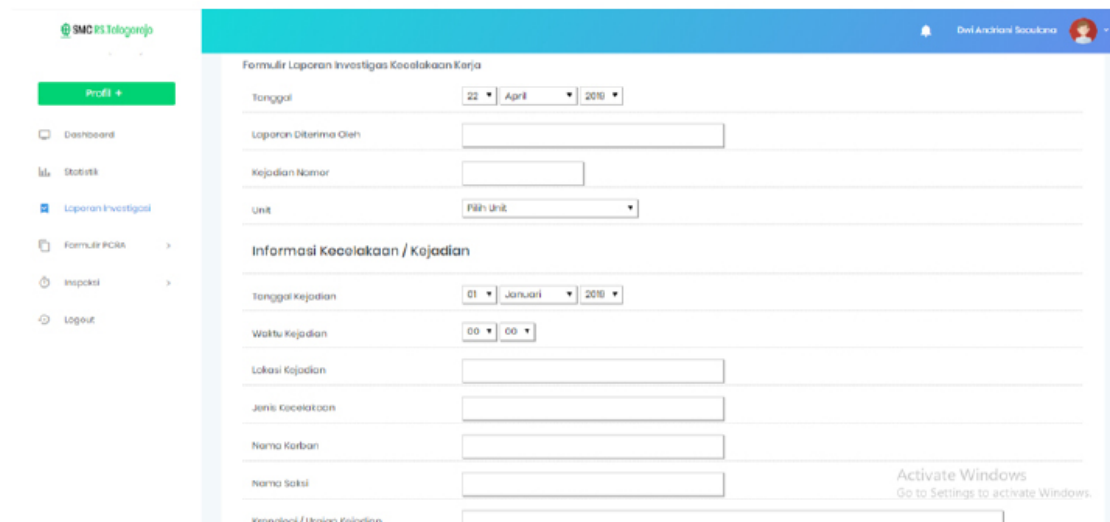Picture 3. Main User Interface of OHS Information System in Telogorejo Hospital

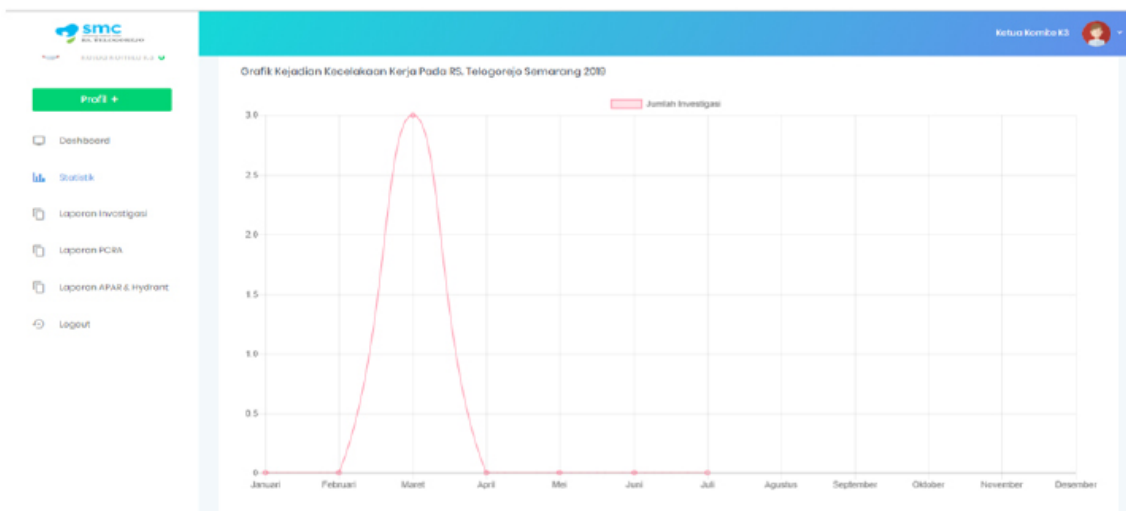Figure 4. Interface of Work Accident Investigation Data Input

Figure 5. Output of OHS Information System

3. Implementation

The implementation of the system is the stage of implementing the system that has been designed to be ready for use. The system is installed in a Linux-based operating system with a web server using Apache version 2.4 or above. In terms of programming languages, the development uses PHP version 5.3 or above and the database server uses MySQL database version 5.6 or above. The way to install OHS Information System is by installing software. The softwares needed in this system are, Xampp, MySQL and Sublime Text.

4. Testing

The testing in this study conducts the Blackbox Method (Tristianto, 2018). The testing technique used is Requirement Testing (Firmansyah & Udi, 2018). The testing focuses on the functional requirements of the software. The testing of OHS Information System in Telogorejo Hospital is follows:

The results of the development of the reporting and recording the OHS Information System in Telogorejo Hospital, Semarang, shows the results that the previous OHS Information System problems can be overcome and facilitated by the existence of a new OHS Information System. The system that has been developed is in line with the expectations and rules of the system user. The results of this study are in line with research conducted by Sari & Wuryanto (2018), stating that the use of the OHS administration program is the right solution to simplify the process of data input and data search and the resulting reports are more accurate (Sari & Wuryanto, 2018). These results are also supported by research conducted by Alfasih et al. (2013), stating that the information system built using PHP and MySQL provides benefits that can present information quickly, accurately and relevant, simplify inputting, processing and outputting data, and increase work productivity (Alfasih et al., 2013).

Table 1. Testing of OHS Information System in Telogorejo Hospital using Backbox Method

No.	Actor Actions	System Reaction	Test result
1.	Home	Display the homepage	The system successfully displays the home page
2.	News	Displays pages and news listings	The system successfully displays a page and a list of news
3.	Download	Display the page and provide downloadable files	The system successfully displays the page and provides the downloadable files
4.	Contact	Displays the contact page	The system successfully displays the contact page
5.	Suggestion	Displays the page and records the suggestions entered	The system successfully displays and records the suggestions entered
6.	Log in	Performs user authentication that has been registered	The system successfully authenticated the user and prevented unregistered users from entering the system
7.	Inspection Scheduling	Scheduling and giving notice to related users	The system succeeded in scheduling according to the specified time and successfully made notifications to related users
8.	Receive Inspection Schedules	Give notice to other users regarding the inspection schedule	The system successfully provided notification to other users regarding the inspection schedule
9.	Input the Results of Inspections and Investigations	Record the results of inspections and investigations	The system successfully records the results of inspections and investigations of each user
10.	Download Report File	Provides report files for download	The system successfully provided downloadable report files for the user
11.	See Graph-Form Outputs	Present the number of work accident reports in graphical form	The system successfully presents a work accident report in graphical form
12.	Log Out	Do logging out activities	The system successfully logged out

Blackbox testing is intended to find out and be able to operate the OHS Information System. If the user states that the function is in accordance to what is needed by the user, then the features in OHS Information System Management have been functioning properly according to user needs. Blackbox testing on OHS Information System Management in Telogorejo Hospital, Semarang, showed the results that the system testing between actor actions and system reactions was successful and appropriate. So, it can be concluded that the Telogorejo Hospital's OHS Information System has worked well and correctly according to the expectations and rules outlined by the system users and is able to accommodate multi-user use. The test is in line with research conducted by Febriharsa (2018) which carried out a functionalist test (Blackbox testing) on the Batik Professional Certification Institution Information System, showing that this application was technically feasible to use because the application functioned well and in accordance to what is understood by the user (Febiharsa et al., 2018). The test results are also in line with Mustaqbal et al. (2015), testing using Blackbox testing in the graduation prediction application of national state collage entrance exam (SNMPTN or Saringan Masuk Perguruan Tinggi Negeri) states that after testing it is known that application functionality can run (Mustaqbal et al., 2015). The results of the Blackbox testing in this study are also supported by the results of research conducted by Jaya in (2018) stating that application testing using a Blackbox shows that the application is able to handle data, both normal and abnormal, so it is able to improve the application's ability to process data both in normal or abnormal conditions (Jaya, 2018).

CONCLUSION

Telogorejo Hospital's OHS Information System is a solution related to existing problems. The hospital's OHS Information System is able to help inputting, processing and outputting data, speed up the process of storing, processing and searching data, display readable outputs, and it is easily accessed by top management so that it helps and accelerates top level management in decision making.

Telogorejo Hospital's OHS Information System has also worked well and correctly as expected and in accordance to the rules outlined by the system users and is able to accommodate multi-user use.

ACKNOWLEDGEMENT

REFERENCES

Akhmad, E. P. A. 2016. Pengembangan Sistem Informasi Akademik Berbasis Web di Jurusan Ketatalaksanaan Pelayaran Niaga Program Diploma Pelayaran Universitas Hang Tuah Surabaya. *Jurnal Aplikasi Pelayaran dan Kepelabuhan*, 7(1): 1–20.

Alfasih, B. I. H., Anam, C. & Masy'am, A. 2013. Implementasi Black Box Testing Pada Sistem Informasi Pendaftaran Santri Berbasis Web Dengan Menggunakan PHP dan MySQL. *Jurnal Sains dan Teknologi*, 6(1): 23–38.

Andrika, Y. 2017. Penerapan Model Waterfall Pada Sistem Informasi Rawat Jalan Dengan Kartu Pasien Ber-Barcode Studi Kasus : Puskesmas Kenanga Sungailiat. *Journal Of Computer Science and Information Systems,* 1(2): 195–204.

Asnawati & Utami, F. H. 2015. *Rekayasa Perangkat Lunak*. 1st edn. Yogyakarta: CV Budi Utama.

Azza, G. M. & Dores, A. 2018. Sistem Informasi Manajemen Marketing Tools Serta Penerapan Metode AHP (Analytical Hierarchy Process) Pada Proses Uji Kualitas Barang (Studi Kasus : PT. Edi Indonesia). *Jurnal Cendekia,* XVI: 107–114.

Bangun, S. 2016. Sistem Manajemen Keselamatan Dan Kesehatan Kerja (SMK3) Pada Proyek Gedung (Studi Kasus Di Ibukota DKI Jakarta). *Jurnal Sains dan Teknologi Utama*, XI(2): 101–110.

Dermawan, J. & Hartini, S. 2017. Implementasi Model Waterfall Pada Pengembangan Sistem Informasi Perhitungan Nilai Mata Pelajaran Berbasis Web Pada Sekolah Dasar Al-Azhar Syifa Budi Jatibening. *Paradigma*, 19(2): 142–147.

Febiharsa, D., Sudana, I. M. & Hudallah, N. 2018. Uji Fungsionalitas (Blackbox Testing) Sistem Informasi Lembaga Sertifikasi Profesi (SILP) Batik Dengan AppPerfect Web Test dan Uji Pengguna. J*ournal of Information Education*, 1(2): 117–126.

Firmansyah, Y. & Udi. 2018. Penerapan Metode SDLC Waterfall Dalam Pembuatan Sistem Informasi Akademik Berbasis WEB Studi Kasus Pondok Pesantren Al-Habi Sholeh Kabupaten Kubu Raya, Kalimantan Barat. *Jurnal Teknologi dan Manajemen Informatika,* 4(1): 184–191.

Ibrahim, H., Damayati, E. S., Amansyah, M. & Sunandar. 2017. Gambaran Penerapan Standar Manajemen Keselamatan Dan Kesehatan kerja Rumah Sakit Di Rumah Sakit Umum

Daerah haji Makassar. *Al-Sihah : Public Health Science Journal,* 9(2): 160–173.

ILO. 2013. *Keselamatan dan Kesehatan Kerja Keselamatan dan Kesehatan Sarana untuk Produktivitas.* (Translation). Jakarta: Score. 1–111.

Jaya, T. S. 2018. Pengujian Aplikasi dengan Metode Blackbox Testing Boundary Value Analysis (Studi Kasus: Kantor Digital Politeknik Negeri Lampung). J*urnal Pengembangan IT (JPIT)*, 3(2): 45–48.

Marimin, H. T. & Prabowo, H. 2006. *Sistem Informasi Manajemen Sumber Daya Manusia*. Bogor: Gramedia Widiasarana Indonesia.

Messah, Y. A., Tena, Y. B. & Udiana, I. M. 2012. Kajian Implementasi Sistem Manajemen Keselamatan dan Kesehatan Kerja Pada Perusahaan Jasa Konstruksi Di Kota Kupang. J*urnal Teknik Sipil,* 1(4): 101–114.

Mustaqbal, M. S., Firdaus, R. F. & Rahmadi, H. 2015. Pengujian Aplikasi Menggunakan Blackbox Testing Boundary Value Analysis (Studi Kasus : Aplikasi Prediksi Kelulusan SNMPTN). *Jurnal Ilmiah Teknologi Informasi Terapan,* 1(3): 31–36.

Pratomo, A. A. & Widajati, N. 2013. Tingkat Pemenuhan Safety Inspection Menurut International Safety Rating Systems di Bukit Tua Development Project PT. PAL Indonesia Persero Tahun 2013. *The Indonesian Journal of Occupational Safety and Health,* 2(1): 28–34.

Sari, P. R. & Wuryanto, A. 2018. Perancangan Sistem Informasi Administrasi Pembinaan K3 Pada PT. Exaudi Bina Karya. *Jurnal Infokar,* 1(1): 101–109.

Sasmito, G. W. 2017. Penerapan Metode Waterfall Pada Desain Sistem Informasi Geografis Industri Kabupaten Tegal. *Jurnal Pengembangan IT (JPIT),* 2(1): 6–12.

Solichin, A. 2009. *Pemrograman Web Dengan PHP dan MySQL*. Universitas Budi Luhur.

Tabrani, M. & Pudjiarti, E. 2017. Penerapan Metode Waterfall Pada Sistem Informasi Inventori PT. Pangan Sehat Sejahtera. *Inkofar (Industri, Komputer dan Farmasi),* 1(2): 30–40.

Triandini, E. & Suardika, I. G. 2012. *Step by Step Desain Proyek Menggunakan UML*. 1st edition. Yogyakarta: Andi Offset.

Tristianto, C. 2018. Penggunaan Metode Waterfall Untuk Pengembangan Sistem Monitoring dan Evaluasi Pembangaunan Pedesaan. *Jurnal Teknologi Informasi ESIT,* XII(01): 8–22.

Yulyanti, D., Rifki, M., Rudiansyah, & Sugiarto, H. 2017. Analisis Sistem Pencatatan dan Pelaporan Kecelakaan Kerja di Rumah Sakit X Tahun 2017. *Jurnal Kesehatan*, 10(2): 1–7.