

Development of Information Support System (ISS) Application for Organization Performance Improvement: Case in Tyre Manufacturer and Air Transport Company

S. Awibowo¹, A. T. Pratama², N. A. Puteri³, F. Thomafi⁴

^{1,2,3,4}Department of Industrial Engineering, Swiss German University, Alam Sutera, Tangerang, Banten, Indonesia

Keywords: ISS Application, Waterfall Methodology, Competitiveness.

Abstract. In this era of global competition, management of an organization requires an application to support the information system, in order to improve efficiency, effectiveness, and also its competitiveness. Even though it is getting more comfortable, the development of the information support system (ISS) applications still has to follow a formal methodology. One methodology in developing ISS applications is the Waterfall methodology which consists of five sequential stages, beginning with communication, planning, modelling, construction and finally deployment. A Tyre Manufacturer Company uses ISS applications that are useful in making improvements in their department or operational levels through advancements in the Preventive Maintenance process of some machines used in the production area. While an Air Transport Company uses ISS application at the top management level by measuring and controlling the company performance indicators.

Introduction

Today, business competition in the business world is increasing dramatically. Besides innovation, every organization/company must always improve its efficiency and effectiveness in order to continue to enhance its competitiveness. In line with enhancing competitiveness, they also have to increase their capacity, through investment and also improve capabilities. Enhancing competitiveness and increasing capacity will ultimately ensure the continuity and growth of the company.

Especially on enhancing competitiveness through increased effectiveness and efficiency, one method that can be used by companies is to use Information Support System (ISS) through application developments that support the production process. This initiative has an enormous opportunity by considering that recently the application is easy to be developed. Companies which invest more in information technology appear to achieve a higher level of performance and productivity[1].

Development of ISS Application using Waterfall Methodology

The waterfall methodology is one of the classic methods used in developing an application of Information Support System that can be used to support a company management process. According to Pressman[2], there are five sequential stages of the waterfall methodology: Communication, Planning, Modelling, Construction, and Development. The waterfall methodology was initially developed by Winston Royce in 1970, and also known as the Classic Life Cycle. The Waterfall model presumes that a system's creation is the result of sequentially cascading down through the phases of system development, with no provision for returning to a previously completed phase[3].

Communication. At the stage of communication, the process of identifying the required application is needed to support the improvement of the management process in the company. As an example: to support the measurement of performance in the production activities at corporate and also department level. This stage is an important stage because the ISS application will be developed if the company requirement can be identified. Through a good application development process

(project), the goals of improvement in the company will be achieved easily. This stage is also known as project initiation.

Planning. The activity in the Planning stage is to estimate the project schedule for defining when the application will finish and also how the project leader able to control the progress of application development. Planning activities also included the clarification of what and when some resources are needed and what kind of language/program needed for creating the application.

Modelling. The activities in Modelling stage of the project are to get the detail of requirements, define all the available constraint may happen in project finalization, and design the infrastructure and data structure of the application.

Construction. In this stage, the activities consist of coding or translate the design of the requirements based on the modelling stage into a program and testing the program in term of logic, functionality, and all part or feature of the application.

Deployment. The activities on this final stage are to deliver the developed application to the user, discuss with the user in order to get feedback for adjusting the preliminary application, do corrections in order to get the user satisfaction, prepare and perform the application training for the user, and finally prepare the maintenance program for the application and also anticipate the development of existing application.

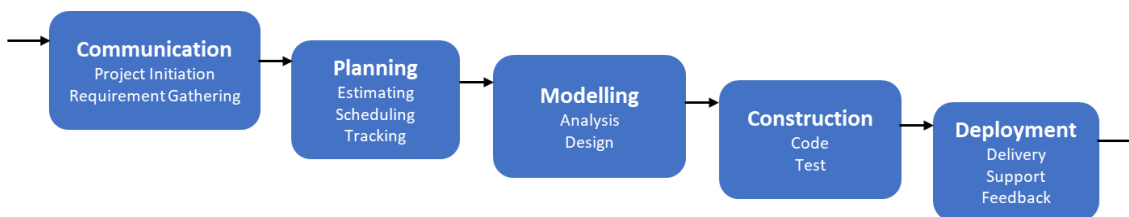


Fig. 1. Waterfall Methodology

Figure 1 shows the stages in the waterfall methodology that will be used to develop applications both at a Tyre Manufacturer and an Air Transport Company.

Application for Production Improvement

PT. “Tyre” is a tire manufacturing company used by various vehicles that was founded in 1951. In this company, there are many production activities that carried out manually. One example is reporting process in the area of Facility Maintenance Department.

The Facility Maintenance Department of PT. Tyre is responsible to maintain the existing machinery or production facilities in production area by performing Corrective Maintenance and Preventive Maintenance, in order to ensure the continuity of the production processes. Every engineer in Facility Maintenance Department have to go around and check the availability of the production machines in the production area. In order to provide services 24 hours a day and 7 days a week, the engineers in the Facility Maintenance Department work according to a predetermined schedule, 1 shift works as long as office hours, while the other 4 shifts work in turns. At the end of their working hours, the engineers must prepare a Daily Shift Maintenance Report (DSMR) as a daily report of their activities as shown in Figure 2.

Communication. Since the Daily Shift Maintenance Report was prepared manually, some problems occur. The engineers must prepare additional time to finalize a report (approximately 20 minutes). The department must allocate a specific location to keep the existing documents with the significant volume as time goes as shown in Figure 3. It is not easy to find certain documents when needed because access to documents is difficult; then it is not easy to analyze the collected data. Actually, the plant maintenance department able to make improvements based on the existing maintenance process of the machines in the production area through all the collected documents.

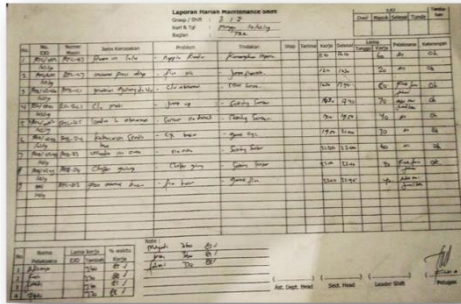


Fig. 2. Daily Shift Maintenance Report



Fig. 3. Collection of Daily Shift Maintenance Report.

Based on Figure 2 and Figure 3, processing of DSMR document can no longer be done manually. Information technology-based applications or Information System Support Application is needed to achieve excellent management. In order to build the required application, it is needed to define what kind of required data. The required data can be defined from the existing Daily Shift Maintenance Report.

Planning. At this planning stage, technical scheduling of the system development will be designed. The items in the planning stage are Collection of Application Requirements – System Planning (Display programming, Functional Programming, Application Test, Making database Server, Network Programming, and Making Report Templates) – System Trial. The lead time for application development is 12 weeks. Currently, the application development has been completed, and it is in the trial stage.

Modelling. The system model for developing the ISS Application for DSMR Management can be seen in Figure 4.

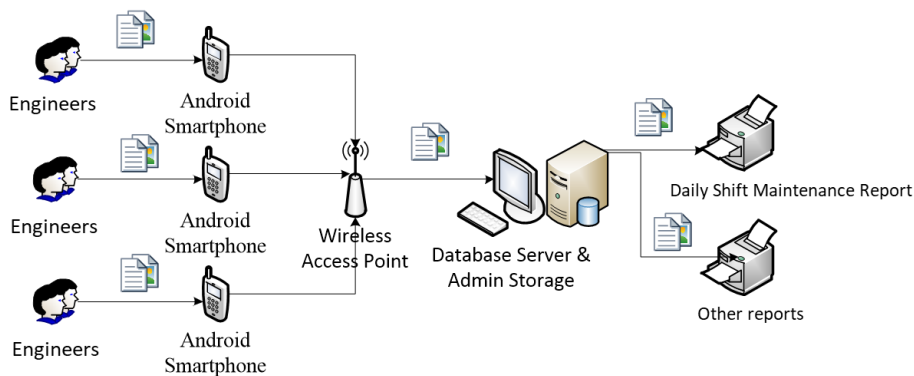


Fig. 4. System Modelling

The design of DSMR is based on an Android smartphone application that used to help the Engineers in the Facility Maintenance Department in making daily reports effectively and efficiently. In this application, engineers will fill their activity through the daily report data form on the smartphone, and the data can be stored temporarily on the user's smartphone. At the end of the working hours, they have to send the stored data on the smartphone into the data server via the existing Wi-Fi facility in the company. Furthermore, the server administrator can create DSMR reports (daily) or other reports needed by the head of the Facility Maintenance Department periodically.

Construction. In order to support the development of the ISS Application for inputting data of DSMR on smartphones, Android Studio is utilized [4]



Fig. 5. GUI (Graphical User Interface) design in smartphone for inputting data (in Bahasa Indonesia)

Figure 5. shows the GUI (Graphical User Interface) for inputting data of DSMR. In developing this DSMR system, a database server is needed to be used to collect and store data report from all groups of Engineers on each shift in the Facility Maintenance Department. XAMPP version 3.2.2 is open source software that used to support this database server.

Based on the data available in the server, performing a daily DSMR can be done faster than manually. By manipulating applications on the server, the DSMR can be created by presenting collected data using the DSMR template that is available on the server software.

Deployment. The final stage of the development of the DSMR ISS application is to ask engineers to utilize the application. The engineers used the DSMR ISS application for several days as a testing phase. In order to support the implementation of the application, the company should prepare specific servers and more reliable Wi-Fi facilities.

Result or impact. The implementation-simulation process of the ISS Application for DSMR has been carried out and based on the data obtained from the 10 (ten) days of the simulation. There are several benefits that can be obtained as explained in Table 1.

Table 1. Benefit of ISS Application for DSMR

No	Benefits	Manual	With Apps
1.	Report Preparation (Minutes)	27.24	3.21
2.	Data retrieve	Difficult	Easy
3.	Data saving	Manual; need special space	Digital
4.	Back Up data	Not available	Available
5.	Data processing	Not easy	Easy

Further analysis of the history of engine damage can be processed based on the maintenance data at the database server. The results of this analysis able to provide a recommendation for improving the existing preventive maintenance.

As an example, Figure 6 shows the information of Engine RTL-TL1 which is obtained within ten days based on the collected data. The Engine RTL-TL1 has been damaged 13 times with a total downtime of 375 minutes. From the available data, it turns out that the most damage occurs due to the leakage of the hose or nipple on the certain area of the engine.

tanggal	grup	shift	ejo	mesin	kerusakan	problem	tindakan	kerja	selesai	pelaksana	keterangan
24/02/2019	D	3	RTL/0101/02/19	RTL TL1	Temperature container over	Temperature over	Blow low press	04:05:00	04:45:00	Angga, Alif	OK
25/02/2019	C	2	RTL/0101/02/19	RTL TL1	C/v assembly geser	C/v geser	Adjust c/v	20:30:00	21:15:00	Alwani, Arif	OK
26/02/2019	B	1	RTL/0127/02/19	RTL TL1	Centering rs error	Centering error	Clear white balance	08:00:00	08:45:00	Fariz	OK
26/02/2019	C	2	RTL/0101/02/19	RTL TL1	Selang cyl RH2 pecah	Selang pecah	Repair selang	15:10:00	15:25:00	Ibnu, Alwani	OK
26/02/2019	C	2	RTL/0101/02/19	RTL TL1	Selang driver RH2 pecah	Selang pecah	Repair selang	15:40:00	16:00:00	Ibnu, Alwani	OK
26/02/2019	C	2	RTL/0101/02/19	RTL TL1	Selang drive RH1 pecah	Selang pecah	Repair selang	20:00:00	20:15:00	Dharma, Roy	OK
26/02/2019	A	3	RTL/0101/02/19	RTL TL1	Nepple drive RH1 pecah	Nepple pecah	Ganti nepple	23:10:00	23:35:00	Fahmy, Indra	OK
27/02/2019	D	2	RTL/0101/02/19	RTL TL1	Sleeve roll rh1 no out	Sensor tidak on	Setting sensor	17:15:00	17:50:00	Agung, Alif	OK
28/02/2019	A	3	RTL/0101/02/19	RTL TL1	Temp container over	Chiller problem	Reset chiller	02:00:00	02:45:00	Rizky, Puja	OK
03/03/2019	C	1	RTL/0101/03/19	RTL TL1	Selector RH2 rusak	Selector switch rusak	Ganti selector	10:00:00	10:15:00	Alwani, Arif	OK
03/03/2019	C	1	RTL/0101/03/19	RTL TL1	Temp cooling over	Tor overload	Reset tor	14:15:00	14:45:00	Arif, Alwani	OK
04/03/2019	A	2	RTL/0101/03/19	RTL TL1	Selang pvc bocor	Selang bocor	Repair selang	22:15:00	22:30:00	Anfin, Puja	OK
05/03/2019	D	1	RTL/0101/03/19	RTL TL1	C/v take away no run	Couple abnormal	Geser couple	07:15:00	07:45:00	Angga, Alif	OK

Fig. 6. Data of RTL-TL1 Machine Damage

In the existing Daily Preventive Maintenance Program, it proves that there is no checking process for the conditions of the hose on the RTL TL1 engine, so this activity must be added.

Application for Management Performance Measurement

Performance Management to describe the combination of processes and technologies that help an organization measure, monitor, and manage its business to optimize performance and achieve goals [5]. One proces which strongly support the Performance Management is the implementation of Key Performance Indicator (KPI) Management System, because KPIs focus on the aspects of organizational performance that are the most critical for the current and future success of the organization[6].

PT. “AirTransport” is a transportation/airline company, operate in almost all area of Indonesia. The company was established in 2003. Today, they have developed the KPI management system for monitoring the performance, for the company and department level.

Communication. Preparation for the KPI set was conducted at PT. AirTransport, starting from the KPI Set of Corporate level that was also known as KPI Set of the CEO/President Director of PT AirTransport. The details of the CEO KPI set are shown in Table 2.

Table 2. Key Performance Indicator for Corporate Level

No	Key Performance Indicator	Target	Weight	Source of Information
1.	Net Profit (IDR)	≥200 M	16	Director of Finance
2.	Customer Satisfaction Index	80%	8	Director of Commercial
3.	On Time Arrival	≥(80%)	15	Director of Operation
4.	Market Share	≥(12%)	8	Director of Commercial
5.	Quality Implementation Index	100%	3	Dir. of Quality, Safety & Security
6.	IOSA Certification	100%	10	Dir. of Quality, Safety & Security
7.	Reliability Index	≥99%	5	Dir. of Maint. & Engineering
8.	Fleet Availability	≥93%	7	Dir. of Maint. & Engineering
9.	2019 Milestones Achievement	≥90%	7	Director of HC & Service
10.	PMS Implementation	100%	6	Director of HC & Service
11.	Value Enhancement	100%	3	Director of HC & Service

The KPI set for the Corporate/CEO level is then cascaded to a set of KPIs for Directors, and then cascaded to a set KPIs for Vice Presidents (VP). In order to support the management of the

company's performance through the achievement of decided KPI sets, periodic measurement activities are needed.

To get objective results, periodic measurements (for example, monthly) of the achievement of company performance must be started by measuring the achievement of set KPIs for VP levels. While the achievement of KPI set at the Director level (and CEO), is the result of the accumulation achievement of KPI set of all VPs under the related Director. An ISS application is developed in order to support those activities.

Planning. The development process of the ISS Application consists of data collection, display programming, functional programming, making database system/server, implementation test, and design the required report. Estimation for the time needed is ten weeks and will be finished at the end of May 2019.

Modelling. The Modelling for making the ISS Application for Company Performance Measurement (CPM) or KPIs Online Monitoring that will be developed can be seen in Figure 7.

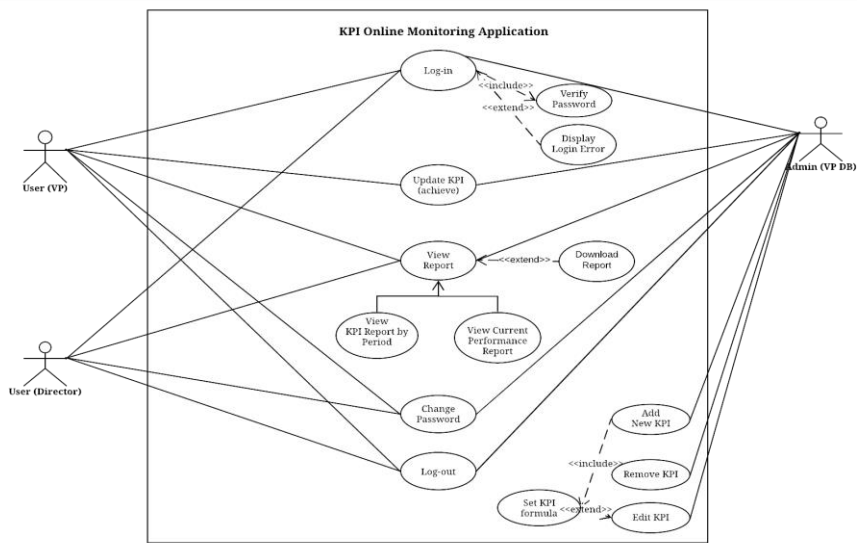


Fig. 7. Use Case diagram for ISS Application for CPM.

Every month, VPs will measure their performance, then enter the data into the ISS application for CPM. By using a special formula, the application will help to calculate the achievement of the KPI set of Directors and CEOs as well as relations between KPIs that have been determined based on their respective relationships and weights.

Fig. 8. Example of a required mask for Data Entry

Construction. Website based is being carried out as the stage of the application development. The data entry process will be carried out at the level of VP and will be designed to be applied using a Smartphone.

Deployment. The initial stage after the application development is complete is the trial process. Based on the trials, discussions were held with the user to get inputs so that the application became more effective.

This process is then followed by creating a user manual and training on the use of the ISS application.

Result and Impact. By the process of measurement and monitoring performance management, there will be benefits that can be obtained by PT AirTransport as follows:

- a) With the development of ISS application for CPM (especially if the process of interaction with the application can be done Smartphone), the measurement process and determination of PT AirTransport's performance becomes more effective and efficient. Given that so far, PT AirTransport has just developed its performance measurement using a set of KPIs and done manually.
- b) If the development of the KPI set can be carried out up to the individual/employee level, then the performance of each employee will be able to measure. Based on the results of measuring the performance of each employee, a fair reward and punishment program can be determined.

Conclusion

Although included in the category of Industry 2.0, there are still many benefits that can be obtained from the development of ISS applications to improve organizational efficiency and effectiveness. Increasing efficiency and effectiveness in this way must be seriously considered by considering the following.

- a. Technology is getting simpler so the development of ISS applications that support management processes in organizations/companies can be done more easily, faster and cheaper.
- b. With the right creativity, the use of the ISS application to support company management can be done at various levels of the organization, starting from the top management level, to the operational level below.
- c. This initiative can be done on various types of companies, producers of real products or services.
- d. By implementing ISS applications in various organization functions of a company or implementing of integrated ISS Application/ ERP, companies will be better prepared to face the Industry 3.0 era, or even Industry 4.0.

Creativity in developing ISS applications in various business organizations will help increase the efficiency and effectiveness, which at the end will support its Competitiveness.

References

- [1] J. Smith, "Information Technology' s Influence on Productivity," 2008.
- [2] R. S. Pressman, *Software Engineering: A Practitioner's Approach*. New York: McGraw Hill, 2010.
- [3] S. D. Seilheimer, "Information management during systems development: A model for improvement in productivity," *Int. J. Inf. Manage.*, vol. 20, no. 4, pp. 287–295, 2000.
- [4] Fariz Thomafi, *Pengembangan Aplikasi ANDROID dan Implmentasi Metoda SMED dalam Meningkakan Efisiensi Kerja di Departemen Maintenace PT. XYZ*. Tangerang: Swiss German University, 2019.
- [5] W. W. Eckerson, *Performance Dashboards Measuring, Monitoring, and Managing Your Business*, no. November. New Jersey: John Wiley & Sons Inc., 2011.
- [6] D. Parmenter, *Key Performance Indicators Developing, Implementing, and Using Winning KPIs*, 3rd ed. New Jersey: John Wiley & Sons Inc., 2015.