Moneter : Jurnal Keuangan Dan Perbankan, 11 (1) (2023) 8-17
Published by: Universitas Ibn Khaldun
Journal homepage: http://ejournal2.uika-bogor.ac.id/index.php/MONETER
E-ISSN : 2615-514. P-ISSN : 2302-2213

DESIGN OF IOT AND ONION AGRICULTURE DATABASE USING BPR LIFE CYCLE

Nisrina Salwa Thifaal[1], Farrikh Alzami[2]*, Alvin Steven[3], Rindra Yusianto[4], Filmada Ocky Saputra[5], Mila Sartika[6], Pulung Nurtantio Andono[7], Firman Wahyudi[8]

[12357] Faculty of Computer Science, Dian Nuswantoro University, Semarang, 50131, Indonesia
[4,6]Dian Nuswantoro University, Semarang, 50131, Indonesia
[8]Ramani, B.V, The Netherland

E-mail: [1]nisrinasalwathifaal@gmail.com, [2]alzami@dsn.ac.id

Article Information

Article history:
Accepted: December 2022
Fixed: January 2023
Accepted: January 2023

Key Word: *Internet of Things; Business Process Reengineering; Bawang Merah; Agriculture; Sensor*

Abstract

One of the food commodities produced by the agricultural sector with high economic value is red onion. As the population of Indonesia increases, the need for red oniom has also increased. The level of red onion production from year to year is also increasing. Especially the central Java area as the largest red onion producing center in 2021. Therefore, the amount of red onion production needs to be maintained and increased by monitoring overall land conditions. Such as weather conditions, air, temperature, and humidity. A sensor to detect these factors is already available but there is no database to accommodate the data from the sensor. The purpose of this research is to produce a Business Process Model and Notation (BPMN) of red onion surveillance system on Internet of Things (IoT) based farmland. The stages carried out are by collecting data related to the research and analyzing business processes using the Business Process Reengineering Life Cycle (BPR) method. This method improves business processes to become more efficient and renewable. This research produces a database design to accommodate incoming data from Internet of Things sensors. Things (IoT) on red onion farming.

Introduction

Red Onion (*Allium ascalonicum L*) is a horticultural commodity that is widely consumed by humans for a mixture of cooking spices. Besides being used as a mixture of spices, it is also sold in processed forms such as fried onions and essential oils (Pathology & Microbiology Lab, Faculty of Agriculture and Animal Husbandry UIN Suska *Riau*, 2013). The need for red onion production has increased every year. This is due to population growth which also increases every year. The production of red onion also continues to increase. Red Onion production has increased by 10.42% in 2020 by 1.82 million tons until 2021 reaching 2 million tons. This increase in production began in 2017 at 1.47 tons and the number continues to increase every year with an average increase of 8%. The highest red onion production occurred in August 2021 with a total of 218.74 thousand tons with a harvest area of 18.07 thousand hectares. Meanwhile, the lowest production occurred in February with 126.7 thousand tons. The region with the largest red onion production last year was Central Java province with a contribution of 564.26 thousand tons or 28.15% and a harvest area of 55.98 hectares (Dihni, 2022).

Onion farming activities cannot be separated from various kinds of obstacles, both in activities from upstream to downstream, in terms of *supply chain management* and *customer relationship management* (Andono et al., 2022). However, in the upstream factor (planting), there are several constraints that affect yields, including: 1) soil fertility; 2) Weather; 3) temperature; 4) Soil pH; 5) wind direction factors. These factors can be recorded using IoT (Xu et al., 2022) for further processing to obtain the right agricultural pattern. The obstacle faced when using this IoT is the need for an internet connection that is always available. while many farming locations do not have a strong enough internet connection.

Based on the explanation above, a database is needed to accommodate data received from *Internet of Things* (IoT) sensors that can detect any factors that can affect the growth of onions from planting seeds to harvesting onions. The stored data will be sent periodically to find the optimal agricultural pattern. In addition, to find out what factors affect the production of onions, a questionnaire or data collection has been carried out by giving questions to correspondents directly and conducting surveys to onion producing centers in *Central Java* province. From the questionnaire and survey to the location of the red onion production center, information was obtained that it is necessary to monitor the condition of the onion from planting to harvesting to maintain the quality of the onion.

Based on the explanation above, this research will use the *Business Process Reengineering* method in the field of red onion farming. This research aims to improve business processes that have not run optimally to become more effective and efficient

Methods

Data Collection Methods

The research method used is the *Business Process Reengineering Life Cycle* (BPR) method. In this method there is a data collection method with the necessary research and information (Wasiati, 2017). Data collection is related to the condition of the onion field from planting to harvesting onions in red onion production centers in *Central Java*. Data collection is done using qualitative data. This data is used to describe in detail the object of research descriptively and based on the quality aspects of the object of research. Qualitative research methods provide an adequate place to communicate knowledge with different conditions, especially if they really understand and are comprehensive. The second data collection is done by finding data sources. Researchers get data through interviews, observations and collect data from various sources to serve as a reference in redesigning the current business process. The interview and observation process is carried out with parties related to the onion production process such as farmers, collectors, and distributors. As for data collection, it is done through the internet, journals and recording data related to red onion that can support the course of research.

Analysis Method

There are two analysis methods used. The fisrt analysis method is: *Business Process Modeling and Notation* (BPMN) is a standard form of model to explain business processes by providing graphical symbols. The explanation of the business process is explained in the flowchart technique, BPMN is organized and made in the graphical form of the ongoing business process and explains the process for ork orders. BPMN aims to provide a simple notation that can be understood by business people so that it can be used to make decisions quickly and easily. BPMN is often used in government, companies and even academic services (Ismanto et al., 2020). The second analysis method is: *Business Process Reengineering* (BPR) is part of *reengineering*. *Business Process Reengineering* is a concept to change business processes that have weak points in the process. The goal is to improve the performance of an organization to run more efficiently and competitively (Wimpertiwi et al., 2014). The result of *Business Process Reengineering* is an improvement in cost, speed, and service (Attaran, 2004). There are several stages in this method, such as: 1) Visioning; 2) Identifying; 3) Analyzing; 4) Re-designing; 5) Evaluating; and 7) Improving. For details of the seven stages in Business Process Reengineering will be explained in the results section.

Data Collection Methods

The data collection method used by researchers to obtain information related to their research is to collect data from the object of their research such as knowing the condition of the land, the process of planting to harvesting red onion in the red onion center. onion production in *Central Java*. The data and information were collected from onion farmers, collectors and distributors for further processing and analysis.

Data Type

The type of data used by researchers to redesign business processes on land situations for the red onion planting process at red oniom production centers in *Central Java* is to use qualitative data.

Qualitative data used by researchers to describe in detail the object of research descriptively and based on the quality aspects of the object of research. Qualitative research methods provide an adequate place in communicating science with different conditions, especially if it is truly understood and comprehensive. Researchers get data through interviews, observations and collect data from various sources to become a reference in redesigning business processes accompanied by interviews with resource persons from related parties

Data Source

The data source used to collect data is primary data. Primary data is data obtained directly from the main source (Pramiyati et al., 2017). This data is obtained by researchers from relevant sources through observations and interviews with resource persons from parties related to the onion harvesting process such as farmers, collectors and distributors. The next data source is secondary data. Secondary data is data that has been arranged in the form of written documents obtained from companies, previous literature and from the internet. This data is obtained through data collection from the internet, journals, and recording data related to red onion. In addition, it is also data related to research and data that can support in redesigning the onion planting process.

Data Collection Technique

The techniques used to obtain data related to the research are: 1) Observation; Researchers made observations on red onion farmland and observed related to the condition of red onion farmland while taking notes. Observations were made at red onion producing centers in *Central Java*. 2) Interview; In this study, interviews were conducted with red onion farmers, red onion collectors, and red onion distributors. By conducting this interview, researchers can find out information related to red onion farming. 3) Documentation is a research activity in the form of taking pictures by researchers used to strengthen research results. In this red onion research, researchers took a sample of red onion pictures to find out the differences in red onion characteristics in each region. 4) Literature study is carried out in order to obtain theoretical data, so with that the author collects data by reading and studying literature such as books, papers or other references that are relevant to the issues discussed (Syam, 2018). Literature studies collected are also in accordance with the research topic.

Results

Data Collection Process

One of the most important parts of this research is data collection. This activity is carried out in order to obtain information related to the research being conducted and the current condition of the red onion planting process. Data is obtained from observations, interviews and documentation from parties related to the red onion production process. The results of observations and interviews will be analyzed and made a discussion on the methods used. There are two stages in the data collection process, namely the visioning stage and the identfying stage. These stages are the initial stages in re-engineering business processes and knowing the background and functions of red onion production.

Visioning Stages

Tahapan This stage is the first stage in the Business Process Reengineering Life Cycle (BPR). This stage describes the current business process. In red onion farming, the business process starts from planting red onion seeds. Harvesting red onion is done within 3 months. After harvesting, the red onion are given to red onion collectors or red onion distributors.

Pemodelan As-is Business Process

One of the main business processes in the current red onion production process is planting red onion seeds until harvest. When planting red onion seeds, there are factors on the land that can affect the success of the red onion harvest. These factors include wind speed, humidity temperature, light intensity and soil moisture. Then red onion farmers will manually predict these factors without using the help of a system or tool. If the farmer's prediction is correct, the onion harvest is likely to be successful. But if the farmer's prediction is wrong then the possibility of the onion fails to be harvested. The sensors used on the land also do not have a database. So that the sensor cannot store data that has been captured to be used as a report for onion farmers. Therefore,

researchers will create a database so that the sensor can store land data and be used as information for red onion farmers related to land conditions.

Identifying

The next stage of the *Business Process Reengineering Life Cycle* is identification. At this stage, analyze using the *value chain in* order to know the main function of the main activities and supporting activities in the main business process and supporting activities for the main business process of producing red onion products. The following is the form of the *value chain* as well as an explanation of the value chain analysis.

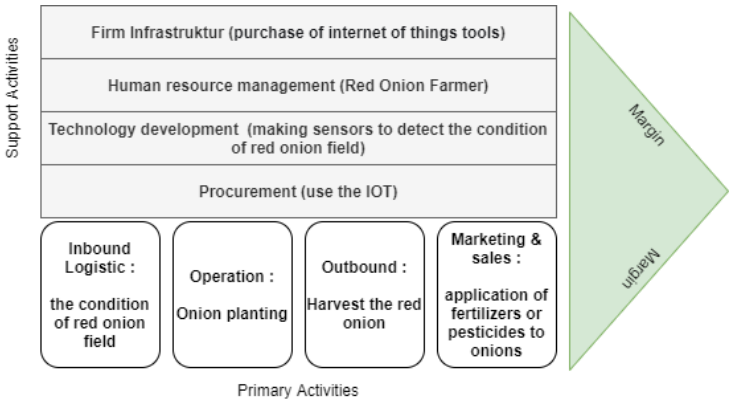


Figure 1 : *Value Chain Analysis*

The description of Figure 1 can be explain as follows:

First. Main Activities

There are four components in the main activities that need to be analyzed using the value chain. The following is an explanation of the components red onion production system:

a. Inbound Logistics (Land Condition)

This land monitoring is used to determine the condition of the land before red onion farmers plant onion seeds. When monitoring land, sensors are needed that have database in them to monitor land conditions and store data from land conditions. This activity aims to make farmers know the condition of their lland before planting onion seeds and can reduce the risk of crop failure.

b. Operation (Onion Planting)

When planting onions, farmers do not have a definite reference to know the right time to plant onion seeds. Farmers only make predictions manually and see yesterday's experience to plant seeds. So a report is needed to find out when the right time to plant the onion.

c. Outbound (Onion harvesting)

In this onion harvesting process, farmers need information about the condition of the onions to be harvested. The condition in question is whether the onion is ready to be harvested or the condition of the onion that is not ready to be harvested, and whether the condition of the onion is suitable for harvesting. This condition can be known from the factors that exist on the land. Therefore, farmers need information on what factors can affect the success of onion harvest.

d. Application of fertilizers or pesticides on onions

To apply fertilizers or pesticides to onions, farmers need to know the condition of the land. In order to know this condition, it is necessary to provide sensors that can monitor the condition of the land and what factors affect the condition of the land.

Second. Supporting Activities

This supporting activity contains components that are useful for assisting overall operational activities in the main activity. So that it can run continuously. The following is an explanation of each component contained in the supporting activities:

a. Firm Infrastructure (Purchase of IoT Tools)

Firm infrastructure is an activity that is needed so that business processes run smoothly. Purchasing tools for IoT needs is included in firm infrastructure because it will help business processes.

b. Human Resource Management (Onion Farmers)

The next supporting component is human resource management. The human resources in onion production are onion farmers. Onion farmers will run the system. Previously, farmers will be given training on how to use the system.

c. Technology Development

Technology development is the next component of activities related to system design and development. The use of IoT sensors on agricultural land is a technological development from previously using manual methods to being computerized

d. Procurement

Procurement is the procurement or behavior to acquire goods or services for business purposes. Procurement is generally associated with business processes because companies need to procure and purchase goods or services from outside the company such as third-party vendors or suppliers. Procurement in this onion business process is the use of IoT. Companies need vendors or third parties to help use IoT and get reports or data from the IoT

Analisis Dan Pemodelan

After the data collection process is carried out, the next stage is to analyze the data as a division related to the flow and method of conducting data analysis. This process is included in the analyzing process in the BPR method.

Analyzing

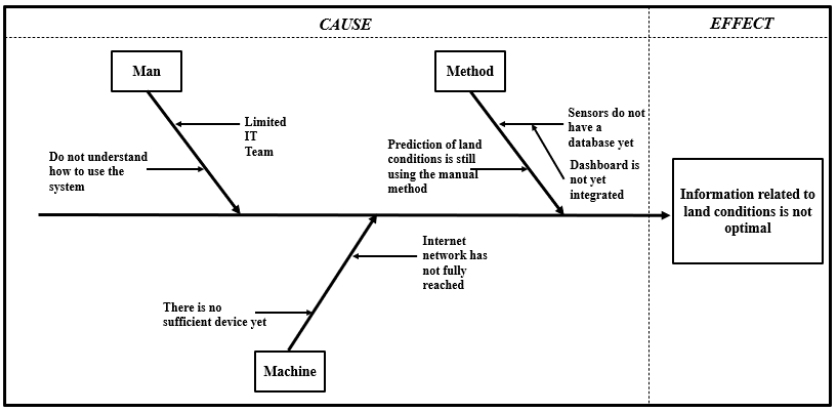
It is necessary to analyze the problem using PIECES analysis to help the data analysis process. In analyzing the system, there are six indicators used to solve existing problems including Performance, Information, Economic, Control, Efficiency, Service (Padli & Sugiyono, 2021). The following is an explanation of the analysis using the PIECES method:

Table 1 : PIECES Analysis

No.	Aspects	Problem	Impact
1.	Performance	Onion farmers who only make manual predictions of the planting to harvest process in red onion production.	Farmers prediction errors in the production process up to the onion harvest cause farmers to fail to harvest or yield unsatisfactory results.
2.	Information	Information on weather conditions, temperature, air and land conditions are not known to farmers on sensor. There is no database to store data	Onion farmers currently cannot know the exact condition of the land and its supporting factors. Farmers only use manual predictions related to the state of the land and its supporting factors
3.	Ekonomic	Onion crop failure that causes farmers to lose money and business capital	Onion farmers who experience crop failure suffer losses. Both material and non-material losses.
4.	Control	Farmers cannot control or know the situation of their land. This makes it difficult for farmers to control their land.	Since farmers cannot control the land, they cannot know when is the best time to plant onion seeds or harvest onions.
5.	Efficiency	Land conditions and factors that cannot be known with certainty simultaneously cause the production process to be less efficient.	Onion planting may not be done at the right time and may lead to crop failure.
6.	Service	Farmers who experience crop failure reduce red onion	Stock the amount of red onion that cannot meet the needs of the

	production	community

Based on the PIECES analysis table above, it can be concluded that the problem contained in red onion land is that red onion farmers do not know the land conditions and factors contained in the land such as wind, weather, humidity and other factors with certainty and only through manual predictions. So that estimates are inaccurate and can cause crop failure. Meanwhile, the sensors that monitor land conditions along with their factors do not yet have a database in them which causes farmers to have no data related to the condition of their land. This will be described using a fishbone diagram. Fishbone analysis is a tool used to analyze problems and factors that cause these problems (Putri & Wibawa, 2017). This diagram will show an impact or result of a problem, with various causes (Monoarfa et al., 2021).



Fgifure 2 : Fishbone Diagram

Based on the fishbone diagram above, it can be concluded that the problems found on red onion farms are as follows:

First. The IT team on the farm is still rare, so there is no renewable system that runs optimally so when used it is still not perfect.

Second. Prediction of land conditions still uses manual methods and sensors are not equipped with a database to store data.

Third. Some farming areas are in remote areas and are still unfamiliar with new devices so many systems have not yet entered the farm.

Re- Designing

After knowing the existing problems, a solution is needed to solve the problem as a review of the problem in order to get a solution according to the needs of the business process.

Table 2 : Problems and solutions

No.	Problems	Solution
1.	The business process has not been running well because farmers do not know exactly how the land conditions such as weather conditions, temperature, and others. They only use manual predictions based on past production processes.	A system that can accurately display the overall land condition is needed.
2.	The sensors used to monitor land conditions do not yet have a database in them. So it cannot display data or reports related to the condition of the onion fields.	Providing a database on the sensor so that it can store the data that has been captured and can be used as information for farmers related to their land.

Based on the explanation above, the solution to the problem is to create a database for sensors on the land. From the database can generate data for overall land conditions that can be used by farmers to find out the condition of the land and the right time to plant onion seeds. The process flow is described using *Business Process Management and Notation* (BPMN) as follows:

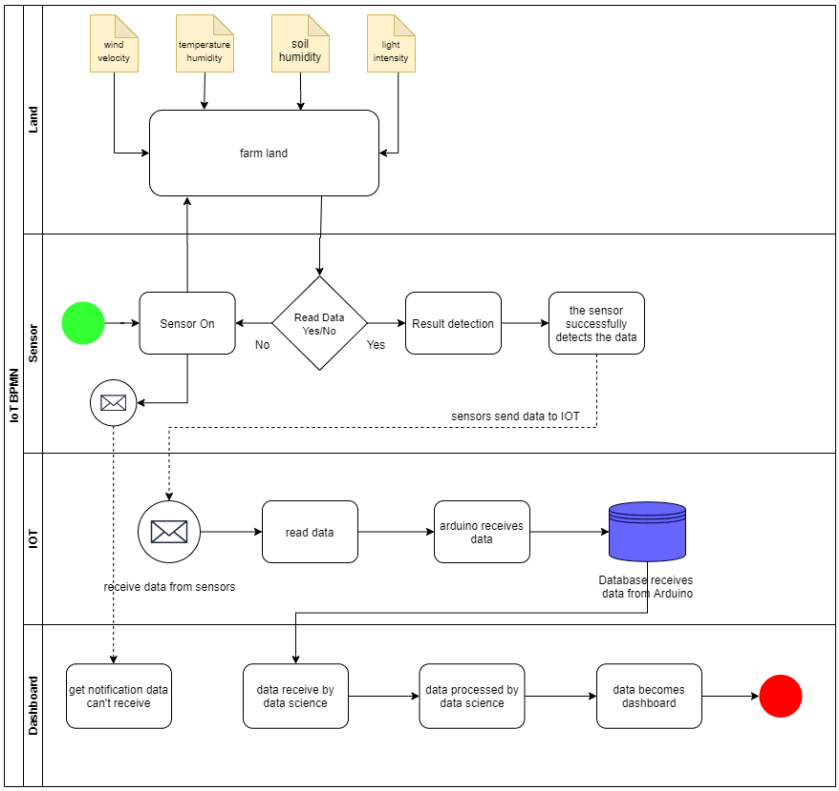


Figure 3 : IoT BPMN

First. Sensors detect wind speed, temperature humidity, soil moisture, and light intensity

Second. If the data is read, the sensor will detect the condition of the land.

Third. After successfully detecting the data the sensor will send the data to the Internet of Things (IoT)

Fourth. Data is sent by the Internet of Things (IoT) to the Arduino for transmission to the database.

Fifth. If the data is already in the database, data science will process the data to make a dashboard.

Sixth. If the data cannot be read by the sensor, the sensor will notify the dashboard that the sensor cannot detect land conditions.

IoT Dashboard User Interface

The following is the user interface on the Internet of Things (IoT) dashboard):

IoT dashboard home page

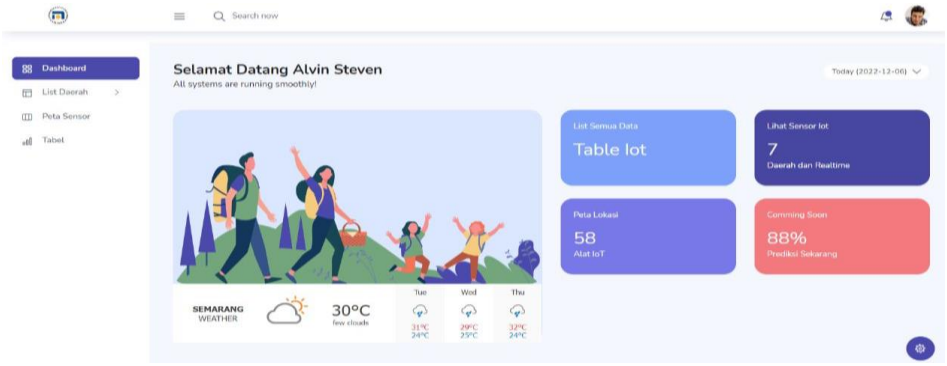


Figure 4 : Dashboard IoT

In the initial view of the dashboard, there are features that show weather predictions, air temperature, location, number of IoT sensors to data contained in the IoT table.

Output display of IoT sensor data

Figure 5: Tampilan data dari sensor

The picture above shows the output display of data that has been taken from sensors on agricultural land. Examples of data displayed are wind speed data, air temperature data, air humidity data, soil temperature data, soil moisture data, soil Ph data, whether the device is on or not and where the sensor is located.

Display of IoT sensor data in each region.

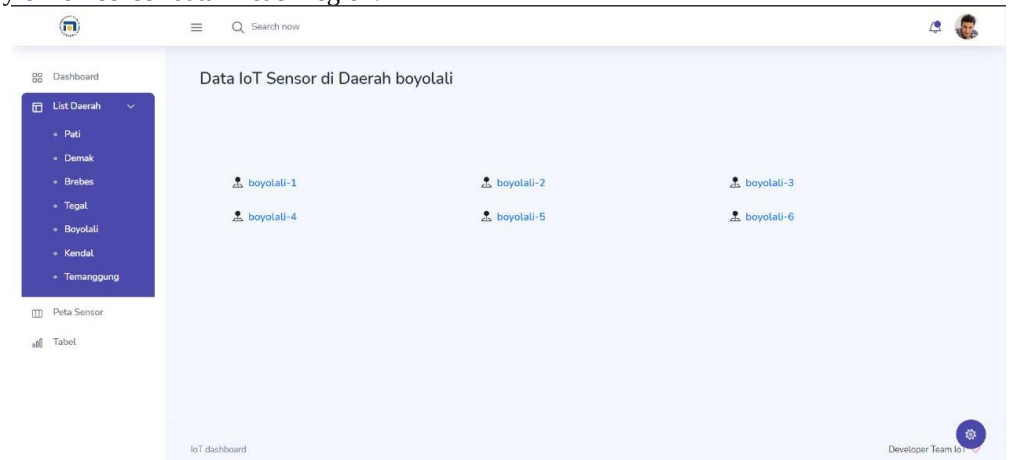


Figure 6 : IoT sensor data

The picture above shows a display that contains IoT sensor data in an area that has an IoT sensor installed. The data can be downloaded for onion farmer information.

Conclusion

Based on the discussion that has been presented above, it can be concluded that the red onion production process has not fully run well. Especially on red onion farmland. Farmers do not know how the exact land conditions such as wind speed, temperature humidity, light intensity, and soil moisture. Farmers only use manual predictions to determine land conditions. This can cause crop failure in red onion. In addition, the sensor used to monitor land conditions does not have a database so that the sensor cannot store data about land conditions and farmers do not get reports on the condition of their land. Changes are needed so that the red onion production process can run optimally. Improvements are made by creating a database for Internet of Things (IoT) sensors using the *Business Process Reengineering Life Cycle* (BPR) method. The method reorganizes business processes that have not run well to be maximized. The proposed business process flow is drawn using *Business Process Modeling and Notation* (BPMN). The explanation of the business process in BPMN is explained in the *flowchart* technique, arranged and made a graphical form of the ongoing business process and explains the process for work orders. With the creation of a database, sensors located on agricultural land can store data that has been detected by sensors and can be displayed to farmers for information on how the condition of red onion farmland.

Bibliography

Andono, P. N., Ocky Saputra, F., Shidik, G. F., & Arifin Hasibuan, Z. (2022). End-to-End Circular Economy in Onion Farming with the Application of Artificial Intelligence and Internet of Things. *2022 International Seminar on Application for Technology of Information and Communication (ISemantic)*, 459–462. https://doi.org/10.1109/iSemantic55962.2022.9920447

Attaran, M. (2004). Exploring the relationship between information technology and business process reengineering. *Information & Management*, *41*(5), 585–596. https://doi.org/10.1016/S0378-7206(03)00098-3

Dihni, V. A. (2022, June 9). *Produksi Bawang Merah RI Naik 10,42% pada 2021*. Https://Databoks.Katadata.Co.Id/Datapublish/2022/06/09/Produksi-Bawang-Merah-Ri-Naik-1042-Pada-2021#:~:Text=Badan%20Pusat%20Statistik%20(BPS)%20mencatat,Memproduksi%201%2C47%20juta%20ton.

Ismanto, I., Hidayah, F., & Charisma, K. (2020). Pemodelan Proses Bisnis Menggunakan Business Process Modelling Notation (BPMN) (Studi Kasus Unit Penelitian Dan Pengabdian Kepada Masyarakat (P2KM) Akademi Komunitas Negeri Putra Sang Fajar Blitar). *Briliant: Jurnal Riset Dan Konseptual*, *5*(1), 69. https://doi.org/10.28926/briliant.v5i1.430

Lab Patologi, K., & dan Mikrobiologi Fak Pertanian dan Peternakan UIN Suska Riau, E. (2013). RESPON BAWANG MERAH (Allium ascalonicum L) TERHADAP ZAT PENGATUR TUMBUH DAN UNSUR HARA. In *Jurnal Agroteknologi* (Vol. 3, Issue 2).

Monoarfa, M. I., Hariyanto, Y., & Rasyid, A. (2021). Analisis Penyebab bottleneck pada Aliran Produksi briquette charcoal dengan Menggunakan Diagram fishbone di PT. Saraswati Coconut Product. *Jambura Industrial Review (JIREV)*, *1*(1), 15–21. https://doi.org/10.37905/jirev.1.1.15-21

Padli, M., & Sugiyono, S. (2021). Implementasi persediaan barang pada PT.Marketama Indah menggunakan metode PIECES. *Jurnal Manajamen Informatika Jayakarta*, *1*(4), 336. https://doi.org/10.52362/jmijayakarta.v1i4.569

Pramiyati, T., Jayanta, J., & Yulnelly, Y. (2017). PERAN DATA PRIMER PADA PEMBENTUKAN SKEMA KONSEPTUAL YANG FAKTUAL (STUDI KASUS: SKEMA KONSEPTUAL BASISDATA SIMBUMIL). *Simetris : Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer*, *8*(2), 679. https://doi.org/10.24176/simet.v8i2.1574

Putri, R. O., & Wibawa, B. M. (2017). Identifikasi Permasalahan Komplain pada E-Commerce Menggunakan Metode Fishbone. *Jurnal Sains Dan Seni ITS*, *6*(1). https://doi.org/10.12962/j23373520.v6i1.21485

Syam, E. (2018). Rancang Bangun Sistem Informasi Manajemen Data Mahasiswa Dan Dosen Terintegrasi. *IT JOURNAL RESEARCH AND DEVELOPMENT*, *2*(2), 45–51. https://doi.org/10.25299/itjrd.2018.vol2(2).1220

Wasiati, H. (2017). REKAYASA ULANG LAYANAN PRAKTEK KERJA LAPANGAN MAHASISWA MENGGUNAKAN BUSINESS PROCESS REENGINEERING DI STMIK AKAKOM YOGYAKARTA. *Respati*, *10*(28). https://doi.org/10.35842/jtir.v10i28.142

Wimpertiwi, D., Sasongko, A. H., & Kurniawan, A. (2014). Konsep Business Process ReenginEering untuk Memperbaiki Kinerja Bisnis Menjadi Lebih Baik: Studi Kasus Perusahaan Susu Kedelai "XYZ." *Binus Business Review*, *5*(2), 658. https://doi.org/10.21512/bbr.v5i2.1189

Xu, J., Gu, B., & Tian, G. (2022). Review of agricultural IoT technology. *Artificial Intelligence in Agriculture*, *6*, 10–22. https://doi.org/10.1016/j.aiia.2022.01.001