RFID Characteristics Test as Business Needs at Logistic Companies in Indonesia

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Abstract. In embedded RFID chips for storing records or data, such as Electronic Product Code one of them using barcode, in tag. Tags have functions to be able to transmit data for readable handheld reader or stationary reader. This reader uses radio transmission technology to read data in tags as well as EPC to supply information on the host computer. Each computer in the same system network can share and track EPC data, wherever the item is sought as long as it is within the scope of the marked or restricted area. Available information may include item code, item date, delivery date, and item price. This study presents a framework based on RFID Proxied Technology Characteristics Real Time Data Processing, Continuous Data Tracking and Discrete Data, and Reuse and explores its relationship with Business Needs. The observed populations are supervisors and managers working in logistic companies taken cross section obtained from a number of logistics companies incorporated in the Indonesian Logistics Association (ALI) in 2015. Sampling is done using convenience sampling method (convenience sampling method) because the population of respondents working in logistics companies in Indonesia is not known with certainty. This research can contribute to how users can select and measure RFID technology from their characteristics so that the application of RFID systems and technology becomes an added value for the company not just as a complementary technology only.

1. Introduction

In the RFID embedded chip to store records or data, such as EPC (Electronic Product Code), in the tag. Tags have a function to be able to transmit data for readable handheld reader or stationary reader. This reader uses radio transmission technology to read data in tags as well as EPC to supply information on the host computer. Each computer in the same system network can share and track EPC data, wherever the item is sought as long as it is within the scope of the marked or restricted area. Available information may include item code, item date, delivery date, and item price.

In logistics system environments, tags can be attached to certain items, in order to facilitate the disbursement, tracking or storage of items later. Overall RFID technology has characteristics with high...
degree of usability and greatly influences the effectiveness of information systems and technology in supporting the company’s operational activities [4] [5] [13].

The willingness of logistics companies to adopt RFID technology is significantly influenced by the strict policy of regulating cross-country union sending traffic as well as the accumulation of technology besides the organization's drive to keep innovating. [14] there is a positive relationship between a willingness to adopt RFID technology and supply chain performance at logistics services firms.

It is hoped that this research can contribute to how users can choose and measure RFID technology from their characteristics so that the implementation of RFID system and technology becomes an added value for the company not as a complementary technology.

2. Theoretical Foundation
2.1. RFID Technology Characteristics in the Field of Logistics Services

In the RFID embedded chip to store an embedded data, for example EPC (Electronic Product Code) in the tag. Tags have a function to be able to transmit data for readable handheld reader or stationary reader. This reader uses radio transmission technology to read tag data and also sends EPC to supply information on the host computer. Each computer in the same network system can share and track EPC data, wherever the item is sought as long as it is still in a single system environment. In a logistic system environment, tags are attached to certain items, to facilitate the disbursement, tracking or storage of items later. Overall RFID technology has characteristics with a high degree of usability and greatly affect the business needs in an effort to improve system and technology effectiveness in supporting the company's operational activities [14] [5] [13].

RFID Technology Characteristics in accordance with the field of logistics services according to [13] are: Real Time Data Processing, Continuous Data Tracking and Discrete Data, and Reusability.

In computer science, [2] states that real-time data processing or Real-Time Computing (RTC), or reactive computing, is a study of hardware and software related to the deadline of a system's operational response time with strict time limits, as well as according to [22]. RTC is processing control methods on the computer regarding the deadline response time, performed using computer data objects. Real-time or other input data received from the data source are classified according to pre-stored control data. While the control data itself defines the real time data source data, how the real time data will be processed, where the real time data will be used. The RFID data processing type uses the buffer method, in which the memory area that stores data while being moved between two devices or between devices and applications in order to avoid errors that occur when there is a speed difference between the first user and the second user of a data stream. [3] says that the main purpose of using RFID is real-time data processing (real-time processing data) which is sometimes called online processing. The use of real time terminology itself depends on the environment in which the RFID is installed. The operation of the RFID data process will be said to be real time if there is a guarantee that an information data can be executed or manipulated within a certain period of time. The time period may be per second or per week adjusted to the working operating environment. The American National Standards Institute (ANSI) sets the RTC standard for RFID is less than a minute.

| H1: The Higher Characteristics of RFID Technology Proxied Real Time Processing of Data (X1) will positively affect Business Needs (Y) |

Continuous data and discrete data according [20] [1] that continuous data are quantitative data that can be measured and have an infinite number of possible values in the selected range whereas discrete data is quantitative data that can be calculated and has a number of possible values in a limited range to choose from. While continuous data tracking and discrete data itself according [19] is a method applied to RFID in continuous data stream retrieval and discrete data continuously at a predetermined level and time period, at least has a server receiver for request or retrieval of media data stream.
According to [15] the results of RFID tag reuse testing show high viability in the field, while technically there are several key issues such as data management and security capabilities, but a positive performance on data and information gathering for companies in the field of warehousing, logistics and retail. A study conducted by the Reusable Packaging Association (RPA) in the United States has found the fact that RFID tags designed for disposables can be used multiple times and remain functioning correctly. The research uses UHF (Ultra High Frequency) RFID technology that states that RFID tags can be read more than 5000 times on a pallet from a farm to a distribution center as far as 1,000 miles as much as 109-110 rounds and remain consistent with a reading time of three seconds. Reusability is the ability of a product or object that allows for reuse or reuse [18].

2.2. Business Needs in the Field of Logistics Services

In technology planning will be in direct contact with System Development Life Cycle (SDLC) before the technology is in operation. The business needs that have been identified and defined will change over the course of time when the system is running. So, it is important to define specific business needs before designing technology and information systems architecture. The most effective way to meet user needs and reduce post-implementation costs according to [16] is to use the ETHICS (Effective Technical and Human Implementation of Computer-based System) approach, which is a structured design approach that includes organization, administration and quality work of life factor.

Business needs are important requirements for entrepreneurs who will implement a technology. The problems, objectives and benefits of system or technology implementation are expressed transparently, at least there should be a clear business model of how a company operates, there is justification in technology investment based on problems and changes that are directly related to the direction of the company, so that the business plan can be facilitate work and impact on company performance [17],[11] define business needs as a necessary prerequisite for providing a particular service, providing a range of products and to ensure the operational effectiveness of the business can run well after being analyzed, identified and understood business objectives as well as articulate strategic direction following capture risks, challenges, or problems.

3. Methodology

3.1. Research Framework

This study presents a framework based on RFID Technology Characteristics proxied Real Time Data Processing, Continuous Data Tracking and Discrete Data, and Reuse and explore its relationship with Business Needs. From the literature review and research objectives, the research framework was developed as shown in Figure 1.
3.2. **Real Time Processing of Data (X1) is one of the most important characteristics.**

According to [23] [3] the main purpose of RFID is real-time data processing (real-time processing data), output data output that can be accessed at the required time level will increase the service from the core business. Continuous and Discrete Data Tracking (X2) is applied or embedded as a feature in RFID technology. [20] [1] data management require the correct method of implementation so RFID tags can increase the positive effect on Business Needs (Y). RFID re-testing results show high viability in the field. It improves positive performance on data collection and information for companies in the field of warehousing, logistics and retail [15]. With the capability of RFID technology viability will increase the value of Business Needs (Y) prerequisites in logistics *services*.

3.3. **Population dan Sampel**

The observed population are supervisors and managers working in logistics companies taken cross section obtained from a number of logistics companies incorporated in the Indonesian Logistics Association (ALI) in 2015. Sampling is done using convenience sampling method (convenience sampling method) because the population of respondents working in logistics companies in Indonesia is not known with certainty. The number of samples required with maximum likelihood estimation is between 200-400 [7]. In addition, the minimum sample size required for data analysis with the structural equation model is 5 (five) times the number of research indicators [10]. In this study there are 16 indicators, so the minimum required number of samples is 80.

In obtaining the survey method data can minimize the occurrence of bias on the respondent and the low return of questionnaires, the questionnaires are sent via active email registered on ALI following links (link) page of the online questionnaire provided.

3.4. **Data Analysis Technique**

This research uses Partial Least Square (PLS) with the help of WarpPLS 4.0 application. This method is used because it is a fairly powerful method because it is not based on many assumptions. Data should not have normal multivariate distribution [6]. To test the validity and reliability of the latent construct used confirmatory factor analysis, then continued with significance test to test the influence of construct or variable and R2 value [12].

The statistical equation for this research model is as follows:

\[ BNEEDS = \beta_1RTC + \beta_2TRACK + \beta_3REU + \varepsilon \]  

(Equation 1)

- **BNEEDS**: Business Needs
- **RTC**: Real Time Data Processing
- **TRACK**: Continuous Data Tracking and Discrete Data
- **REU**: Reuse
3.5. Operational Definition of Variables

This study has two variables. These two variables are RFID Technology Characteristics with three proxies and Business Needs. In detail, operational definitions and measurements of research variables are described as follows.

Table 1: Variable Operational Definition

| Variable Name          | Variable Definitions                                                                 | Scale  |
|------------------------|---------------------------------------------------------------------------------------|--------|
| Real Time Data Processing | Reactive computational methods on computer data objects with associated controls and assurance that an information data can be executed or manipulated within a very strict period of time (ANSI sets real time data processing for RFID is less than a minute) | Ordinal |
| Continuous Data Tracking and Discrete Data Reuse | Tracking methods applied or embedded as a feature in RFID technology in quantitative measurable quantities and quantities of data streams from an object at a specified level and time period, at least having a receiving server for request or retrieval media data stream. The ability of a product or object that allows it to be reused or repeated or adds its useful life. | Ordinal |
| Business Needs         | The necessary prerequisites for providing a particular service, providing a range of products as well as to ensure the effectiveness of business operations work well after being analyzed, identified and understood business objectives also articulate the strategic direction and capture risks, challenges, or problems. | Ordinal |

4. Case Study

The function of the Results section is to present objective results objectively, without interpretation, in a logical order and regularly using illustrative materials (tables and drawings) and text. A summary of statistical analysis can be loaded in text form (usually in parentheses) of relevant tables or images (in legend or footnote to tables or drawings). The results should be organized in a series of tables and / or drawings sequentially to present the main findings in the logical order. The description of the Results follows the sequence and answers to the question/hypothesis under investigation are highlighted. Important negative results should also be reported. The author usually writes the description part of the results based on the arrangement of tables and drawings.

4.1 Data Screening Process

Questionnaires began to be spread on June 24 and closed on July 1, 2015, the number of respondents has reached 404 of 815 email addresses sent by questionnaires, from 404 data entered only 386 that can be processed. The process of screening data must pass two tests namely reliability and validity test.

Test Reliability is used to measure the consistency of answers to a question from time to time [13]. The measurement used in this study is the Cronbach Alpha statistical test, according to Nunnally [13] a construct is said to be reliable / reliable if the Cronbach Alpha value is greater than 70%. Reliability test results for each variable can be seen below.

4.2 Characteristics of Respondents

Based on gender, it was found that male respondents were 273 people (70.7%) and female respondents were 113 people (29.3%). This data shows that most respondents are male. Judging from the age of respondents aged 36.4 years with the middle and 35 years mode, standard deviation 9.4 years.

Furthermore, in relation to the job, the respondent's working period has an average value of 6,131 with median and mode 5,000 and minimum score of 0.3 and maximum of 30. This means that respondents have worked in the logistics company currently for 6.1 years. Most of the respondents in this study were Senior Supervisor (132 person / 34.2%) and Manager (124 person / 32.1%) the rest
they did not put their position in questionnaire. This is consistent with the sampling technique used, i.e., mail delivery. ALI official e-mail keywords are usually only known by managers or as low as senior supervisors. So, based on the profile of the respondents, this research sample is quite representative.

4.3 Descriptive Statistics
The structural equation model is used to test H1, H2, and H3. This descriptive statistic explains the tendency to centralize the data (central tendency) or the tendency of the respondent's answer to the questions conveyed in the questionnaire. Based on the measure theory [9], Likert scale is arbitrary, so the value set is subjective, because adjusted by the desire of the researcher. Therefore, in this case, the researcher determines the range of categories for the mean of the indicator is as follows:

| Range | Category |
|-------|----------|
| 1 - 2.2 | Very low |
| 2.2 - 3.4 | Low |
| 3.4 - 4.6 | Medium |
| 4.6 - 5.8 | High |
| 5.8 - 7 | Very High |

Table 2: Likert Scale

| Variables | Range Actual | Actual Variables | Standard deviation | Category |
|-----------|--------------|------------------|--------------------|----------|
| Real Time Data Processing | 4-28 | 26,510 | 3,511 | Medium |
| Continuous Data Tracking and Discrete Data | 4-28 | 25,86 | 3,446 | Medium |
| Reuse | 4-28 | 26,11 | 2,953 | Low |
| Business Needs | 4-28 | 20,82 | 4,449 | Medium |

The measurement scale using the Likert scale of 1-7 points yields the theoretical range for the Real Time Data Processing variable between 4 (acceptance to low variable) to 28 (acceptance of the high variable). The results of measurements on all respondents' answers indicate that the actual score turns between 4-28 with an average score of 26.510 and standard deviation 3,132. Average calculation result ± standard deviation indicates receipt of respondent to Real Time Data Processing and Tracking Data Continuous and Discrete Data included in Medium category whereas Reuse is categorized Low but Business Needs enter in Medium category.

4.4 Data analysis
The following is presented in the process of data analysis and inferential statistics using WarpPLS 4.0 to draw conclusions for testing the various hypotheses proposed in this study. From the overall indicator of variables used, there are several indicator items that are ultimately not used in testing the structural equation model because the loading factor is below 0.40 (Sholihin & Ratmono, 2013). Indicators used in Real Time Data Processing Variable (REALTIME / X1), still consist of five data tracking variables Continuous and Discrete Data (TRACK / X2) originally five pieces but used are three indicators, while Variable Reuse (REUSE / X3) using two indicators of three indicators as well as business needs variables (BNEEDS / Y1) of the six indicators used only four indicators, it is because the loading factor value is not in accordance with the rule of thumb. The remaining indicators are then tested for the Confirmator Factor Analysis, the results show above 0.60 with a p-value less than 0.05. Therefore, it can be concluded that these indicators can still explain the variables well [21].
Table 4: Test Result of Confirmatory Factor Analysis

| Code  | Loading Factor | Type     | SE  | p-Value |
|-------|----------------|----------|-----|---------|
| X1A   | 0.651          | Reflective | 0.047 | <0.001 |
| X1B   | 0.672          | Reflective | 0.046 | <0.001 |
| X1C   | 0.726          | Reflective | 0.046 | <0.001 |
| X1D   | 0.774          | Reflective | 0.046 | <0.001 |
| X1E   | 0.798          | Reflective | 0.046 | <0.001 |
| X2A   | 0.78           | Reflective | 0.046 | <0.001 |
| X2B   | 0.807          | Reflective | 0.046 | <0.001 |
| X2C   | 0.818          | Reflective | 0.045 | <0.001 |
| X3A   | 0.775          | Reflective | 0.046 | <0.001 |
| X3C   | 0.775          | Reflective | 0.046 | <0.001 |
| Y1A   | 0.844          | Reflective | 0.045 | <0.001 |
| Y1B   | 0.833          | Reflective | 0.045 | <0.001 |
| Y1C   | 0.688          | Reflective | 0.046 | <0.001 |
| Y1E   | 0.608          | Reflective | 0.047 | <0.001 |

After the confirmatory factor analysis, then tested the validity of convergent, discriminant and reliability. The results show that the indicators of all constructs in this study are highly correlated. This is evident from the Average Variance Extracted value above 0.50. Reliability test results also show that the accuracy, consistency and accuracy of the instrument in measuring each construct is also evident. This is evident from Cronbach’s Alpha and Composite Reliability values above 0.70 all.

Table 5: Validity and Reliability Test Results

| Testing | Parameter          | Value | Rule of Thumb | Conclusion |
|---------|--------------------|-------|---------------|------------|
| Validity| Average Variances Extracted |       |               |            |
|         | REALTIME/X1        | 0.528 | >0.50         | Valid      |
|         | TRACK/X2           | 0.643 | >0.50         | Valid      |
|         | REUSE/X3           | 0.601 | >0.50         | Valid      |
|         | BNEEDS/Y1          | 0.562 | >0.50         | Valid      |
| Cronbach’s Alpha | REALTIME/X1        | 0.774 | >0.70         | Reliable   |
|         | TRACK/X2           | 0.722 | >0.70         | Reliable   |
|         | REUSE/X3           | 0.736 | >0.70         | Reliable   |
|         | BNEEDS/Y1          | 0.734 | >0.70         | Reliable   |
| Reliability| Composite Reliability |       |               |            |
|         | REALTIME/X1        | 0.847 | >0.70         | Reliable   |
|         | TRACK/X2           | 0.844 | >0.70         | Reliable   |
|         | REUSE/X3           | 0.751 | >0.70         | Reliable   |
|         | BNEEDS/Y1          | 0.835 | >0.70         | Reliable   |

From the results of the measurement to the model shows the result that overall shows the feasibility as a model. The average path coefficient, Average (APC) = 0.324, P <0.001, R-squared (ARS) = 0.476, P <0.001 show the significance value (p-value) less than 0.05 so it can be concluded that the research
The research model is feasible. Next, average block VIF (AVIF) = 2.055, (acceptable <= 5, ideally <= 3.3) and average full collinearity VIF (AFVIF) = 2.495, (acceptable <= 5, ideally <= 3.3) meaning that this research model well worth it. Furthermore, the score of Tenenhaus GoF (GoF) = 0.628, included in the big category (0.628 > 0.36) means the research model is feasible as well as from Symson's paradox ratio (SPR) = 1,000, R-squared contribution ratio (RSCR) = 1,000 and Statistical Suppression Ratio (SSR) = 1,000 (acceptable if >= 0.7; ideally = 1) indicates that this research model is ideal.

Then from Figure 2 which is the output WarpPLS obtained results that Real Time Data Processing positive effect on Business Needs with the estimated coefficient of 0.41 and level of significance below 0.01. Then, Continuous and Discrete Data Tracking positively affects the Business Need with an estimated coefficient of 0.21 and a significance level below 0.01. Next, Reuse has a positive effect on Business Needs with an estimated coefficient of 0.35 and a significance level below 0.01. The variable capability of Real Time Data Processing, Continuous Data Tracking and Discrete Data and Reuse in explaining Business Need variability is 0.68 (R2 = 0.68).

![Figure 2: Structural Equation Model](image)

5 Lesson Learned

On the basis of inferential statistical data analysis conducted by using WarpPLS, the hypothesis can be tested and the results of statistical tests are presented as follows.

| Influence | Coefficient | Significance | Conclusion |
|-----------|-------------|--------------|------------|
| REALTIME X1 → BNEEDS/Y1 | 0.405 | <0.001 | accepted |
| TRACK/X2 → BNEEDS/Y1 | 0.213 | <0.001 | accepted |
| REUSE/X3 → BNEEDS/Y1 | 0.353 | <0.001 | accepted |

**Rule of Thumb p-value <0.05**

Test results show that:

1. H1 which states that The Higher Characteristics of Real Time Processing of Data (X1) Real Time Processing of Data (X1) technology will have a positive effect on Business Needs (Y), indicating sufficient evidence to be accepted with the estimated value of time variable coefficient Real Processing Data generated by 0.405 with p-value <0.001 (significant <0.05). Thus the findings are in line with the theory that the character of RFID technology, especially Real Time Data Processing in accordance with the field of logistics services [13] because the logistics services related to the deadline of operational response with the guarantee of strict time limits or in other words information data must be executable or manipulated within a certain period of time or less than one minute [2] [3] [22].
2. H2 which states that The Higher Characteristics of RFID Technology Proxied Continuous Data Tracking and Continuous Data Tracking / X2 will positively affect Business Needs (Y), indicating sufficient evidence to be accepted by estimation value of variable coefficient of Continuous Data Tracking and Discrete Data generated equal to 0.213 with p-value <0.001 (significant <0.05). Thus, the findings are in line with the theory that the character of RFID technology, especially Continuous Data Tracking and Discrete Data in accordance with the field of logistics services [13]. RFID technology can be said to be capable of receiving continuous and continuous data streams of discrete data at predetermined levels and time periods at least in dealing with data flow requests or retrieval [1][19][20].

3. H3 which states that Higher Reality Technology Characteristics Reusable (X) will have a positive effect on Business Needs (Y), indicating sufficient evidence to be accepted. This is in accordance with the model of supporting structural equations, where the estimated value of the reused variable coefficient is 0.353 with p-value <0.001 (significant <0.05). Thus the findings are in line with the theory that the character of RFID technology particularly High Reuse or high viability in the field is needed by logistics services [13][15] and is consistent with time read three seconds even if reused or re-entered. [18][24].

6 Conclusion

Previous studies on the measurement of RFID technology have been made, but the findings have not shown consistent results. Therefore, in this study testing the model that can explain whether the characteristics of RFID technology is a business requirement in logistics companies in Indonesia. The results obtained can be described as follows: (1) Characteristics of RFID Technology Proxied Real Time Processing of Data (X1) positively affects the Business Needs (Y), (2) Characteristics of RFID Technology proxies Continuous Data Tracking and Discrete Data (Continuous Data and Non-Continuous Data Tracking / X2) positively affect Business Needs (Y), (3) Characteristics Reused Reusability (X3) RFID technology will positively affect Business Needs (Y).

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