DECISION SUPPORT SYSTEM TO DETERMINE THE NUMBER OF PRODUCTION WITH FUZZY TSUKAMOTO METHOD IN PT KSTEX BANDUNG

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ABSTRACT

PT KSTEX is a private company engaged in the manufacture of gloves. During the production of gloves each month during the months of February 2014 through the month of January 2015 an average of 1107 scores, while the number of requests ranging from February 2014 through January 2015 every month in an average of 929 scores. The difference between the total amount of production and the amount of this demand resulted in inventory remaining glove at each end of the month often increases. This happens because the less precisely the particular company production manager in decision making glove amount that will be produced.

This study raised a case of determining the amount of production to facilitate the work, in this case on the basis of fuzzy Tsukamoto method will produce a model of a system that is able to predict and recommend the amount of production that is applied in a decision support system. Fuzzy Tsukamoto method in determining the amount of production is based on three criteria: the number of requests, inventories and production. As for the use of software analysis approaches in this study using a structured analysis approach.

Based on the results of testing. it could be concluded the decision support system determines the amount of production that was built already can assist in the production manager menentukankan production numbers should be produced every month.

Keywords: Decision Support Sistem, Production, Fuzzy Tsukamoto

1. INTRODUCTION

PT KSTEX is a private company engaged in the manufacture of gloves. The company was founded since 1995 and located in Jl.Raya Rancajigang No. 120 Majalaya District of Bandung regency, West Java.

Based on the interview with Mr. Soni as production manager stated that during this time in PT KSTEX Bandung in determining the amount of production is still not quite right. That is because in determining the amount of production that is done sometimes less precise due to the uncertain demand depends on customer demand. This resulted in a buildup of inventory at each end of the month.

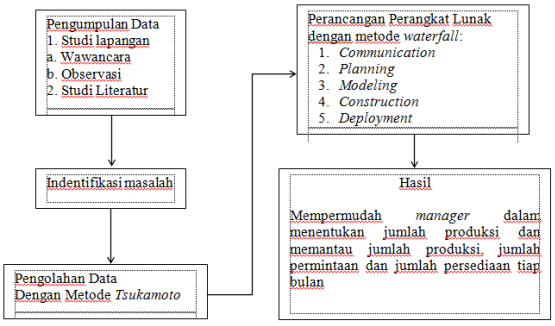
During this time the production of gloves each month during the months of February 2014 through the month of January 2015 an average of scores in 1107, while the number of requests ranging from February 2014 until January 2015 monthly average of 929 score. The difference between the total amount of production and the amount of this demand resulted in inventory glove left at each end of the month bertambah.Hal often this happens because in determining the amount of production which is less precise amount of the company's production manager, especially in decision-making number of gloves that should be produced each month.

Based on the problems that exist today in the PT KSTEX Bandung, takes a decision support system which is able to estimate the amount of production and provide recommendations. Development of the system is expected to help in determining the amount of the production of gloves that should be produced every month.

2. CONTENTS OF RESEARCH

2.1 Research Methods

The research methodology is a process used to solve a logical problem, which requires the data to support the implementation of a study. The research methodology that will be used are problem identification, data collection, data analysis, data processing with Tsukamoto method and software design methods waterfalldan objectives to be achieved. The stages of the research undertaken in conducting this study is depicted in Figure 1 flowchart research framework.



Gambar 1 Flowchart KerangkaKerjaPenelitian

The description in Figure 1 flowchart framework of the study as follows:

Methods of data collection can be obtained directly from the object of research and references that have been obtained. The means used to obtain the data is as follows:

1. Field Study

A field study is a study conducted directly by visiting the place of research, namely PT KSTEX Bandung. Field studies conducted in the following ways:

a. Observation

Observation is a method of data collection by observation of the object of research directly to the PT KSTEX Bandung.

b. Interview

The interview is the method of data collection by caramengadakan question and answer directly to the company PT KSTEX Bandung, namely Mr. Soniselaku production manager

2. Literature.

The study of literature is the method of data collection related to the research and development of training evaluation system, through books, the Internet, and papers relating to the evaluation of the training system.

2. Identify the problem

At this stage, observations permaslahan happened company PT. KSTEX Bandung.

3. Data processing methods Tsukamoto.

This stage of data processing methods Tsukamoto, each consequent upon the rules of the form IF-Then shall be represented by a fuzzy set with membership function monotonous. As a result the output inference result of each rule is given explicitly (scrip) by α-predicate (fire strength). The end result is obtained by using a weighted average.

4. Design Software

Data Metode analisis dalam pembuatan perangkat lunak menggunakan waterfall method. This method involves five stages, where each stage is always verification and testing. The stages are available:

1. Communication

Tahap communication an analysis to understand the problems, the needs of the software, and the stage to conduct data collection with a meeting with the manager of Production, Mr Soni, head of production and other related parties as well as pengumpulkan additional data both in journals, articles, or from the Internet relating to decision-making production quantities.

2. Planning

Planning stage is a continuation of the process of communication (requirement analysis). This stage will generate data related to user needs to sistempengambilankeputusan amount of production at PT KSTEXdalam-making software, including yangsebaiknya plan will be carried out.

3. Modeling

This modeling phase will translate the data into a design needs to be clear to users. Makes the design of the data being modeled using the ERD (Entity Relationship Diagram) as well as to describe the functional modeling using DFD (Data Flow Diagram) in the development of decision-making system for determining the amount of production at PT KSTEX.

4. Construction

Stage construction is the code generation process. Coding or coding is a translation in the language of design that can be recognized by the translation komputer.Tahap data or solving a problem that has been designed into the programming language PHP and MySQL as the database server that receives and transmits. After the coding is completed it will be testing in the form of blackbox testing and beta testing with data collection techniques by interviewing users of the system have been made. The purpose of testing is to find errors of the system to then be repaired.

5. Deployment

The final stage of deployment can be said of the decision-making system for determining the amount of production at PT KSTEX. After doing the analysis, design and coding, then the system is finished will be used by the user associated with the decision-making system for determining the amount of production. Then the system that has been made to do maintenance berkala.Di in the research, development software is not up to the stage of deployment.

5. Results

Is the end result that you want to achieve a system that is being built in solving problems that occur.

2.2 Analysis

2.2.1 Problem Analysis

Analysis of the problem is an assumption of the problems will be described in the procedures in the data processing program. After conducting research at PT KSTEX Bandung, it can be found the problems that arise are accumulated inventory every month because sometimes kuranng precise production manager in determining the number of gloves that should be produced each month.

2.2.1 Analysis of Current System

Analysis of the current system will explain the business process procedures and activities on the system is running in PT KSTEX, procedures dilakukandiantaranya:

1. The procedure for the management of production
2. Inventory Management Procedures
3. Procedure Request Product

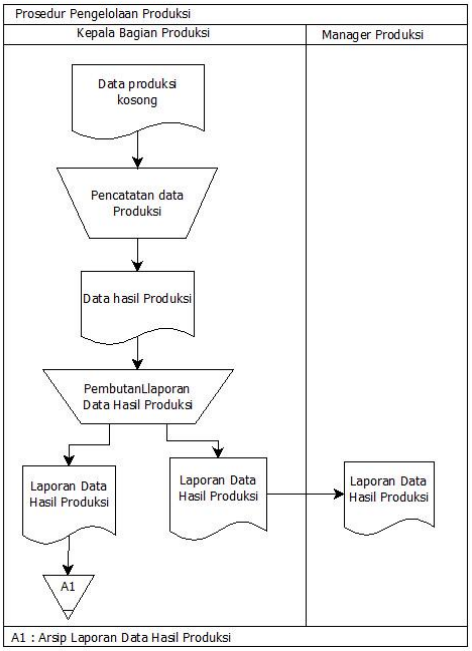
2.2.2.1 Management procedures of production

Production management procedure is a procedure performed in recording the amount generated from each process after completion of production. The processes that occur in the production management procedures are shown in Figure 3.1 with the following explanation:

a. Production data that have been completed will be recorded into the data produced hasilproduksi empty by the head of production.

b. The head of the reporting of production and archive data reports production results

c. Production reports will be submitted to the production manager.



Pictures 2 Flowmap Management of Production

2.2.2.2 Procedures inventory management

Inventory management procedure is a procedure performed in recording inventory every process after completion of production. The processes that occur in the management procedures of production are shown in Figure 2 with the following explanation:

a. Inventory data records containing data items of inventory that has been recorded and finished at the head of the inspection checks and repairs.

b. Report inventory data that has finished checking handed over to production manager

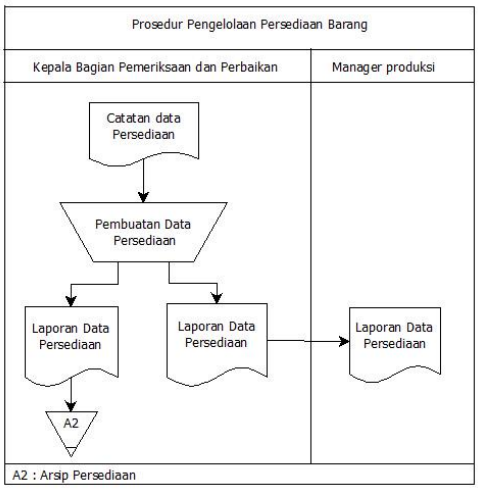


Figure 3 Flowmap Management of Inventory

2.2.2.3 Production planning procedures

Procedures sales activity is an activity concerning the procedure did demand for goods, and procedures that are running. The processes that occur in the product penjulan activities procedure shown in Figure 4 with the following explanation:

1. Consumers give requisition glove to head the sales department.
2. Data request from the head of the sales department then d leave it to production manager
3. The head of the sales department will create a sales invoice. Then the data items and sales invoices will be given to the head of transport.

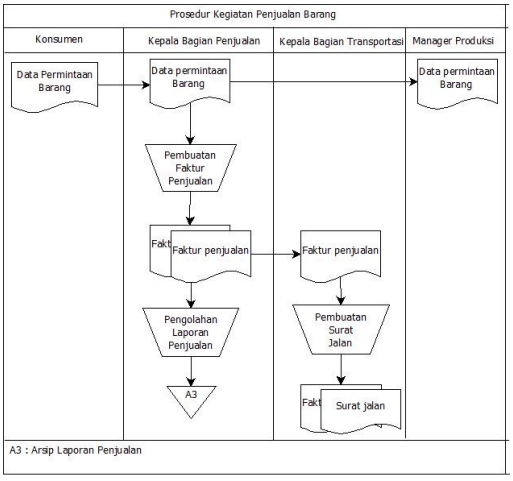


Figure 4 Flowmap Activity Product sales

2.2.1 Analysis Tsukamoto Fuzzy

In this method, in general there are three steps to determine the amount of production based on inventory data and data requests with Tsukamoto method, namely: fuzzification, inference and defuzzification (specify the crisp output).

Sample case:

PT KSTEX is a company that produces gloves. From the data in February 2014 s / d in December 2014, Table 3.1 Based jumlahpermintaan known today, the month of January 2015 as many as 550 scores, danpersediaan still 1261 scores. How many scores yangharus gloves are manufactured on next?

After the fuzzy rules formed next is to determine the highest value and the lowest value of all the attributes that choose to use the query functions min and max for each of these functions atribut.dari obtained the highest value and the lowest value as follows:

Table 1 Data Demand, Inventory and Production Gloves

Data Gloves	Holsters (Kodi)
Maximum demand	1670
Minimum demand	550
Maximum inventory	1546
Minimum inventory	957
Maximum production	1289
Minimum production	698

After determining the highest and lowest values of all the attributes that select the next step in completing permasalahaan yamg have described is by menggunakanmetode Tsukamoto manually, there are several steps that ditempuh.Langkah-steps are: defining fuzzy variables, inference, and defuzifikasi:

a. Modeling the fuzzy variables (fuzzification)

There are three fuzzy variables to be modeled, namely: demand, supply, and production of goods.

1) Request; consists of 3 fuzzy set, ie DOWN, FIXED and UP. Request membership function is represented in Figure 5.

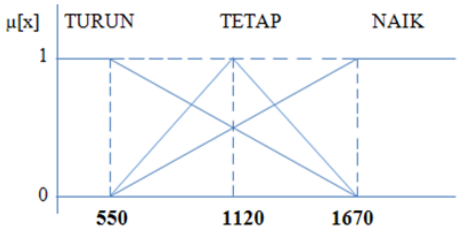


Figure 5 membership functions of fuzzy sets DOWN, FIXED and variable UP of Request

Association Membership Function DOWN, UP FIXED and of variable demand:

$$\mu pmtTURUN[x] = \begin{cases} 1 & x \le 550 \\ \frac{1670 - x}{1120} & 550 \le x \le 1670 \\ 0 & x \ge 1670 \end{cases}$$

$$\mu pmtTETAP[x] = \begin{cases} \frac{x - 550}{560} & x \le 550 \\ \frac{1670 - x}{560} & 550 \le x \le 1110 \\ 0 & 1110 \le x \le 1670 \\ & x < 550 \vee x > 1670 \end{cases}$$

$$\mu pmtNAIK[x] = \begin{cases} 1 & x \le 550 \\ \frac{x - 550}{1120} & 550 \le x \le 1670 \\ 0 & x \ge 1670 \end{cases}$$

Membership value set DOWN, UP from variabel Permintaan FIXED and can be searched by:

$\mu pmtTURUN[550] = (1670 - 550)/1120$
=1

$\mu pmtTETAP[550] = 1$

$\mu pmtTNAIK[550] = (550 - 550)/1120$
=0

2) Inventory; consists of 3 fuzzy set, ie LITTLE, MEDIUM, and LOT. LITTLE membership function set, MEDIUM, and LOT of variables Inventories represented in Figure 5.

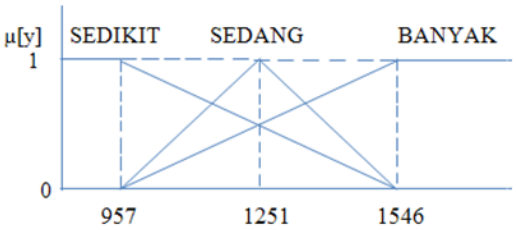


Figure 5 LITTLE fuzzy set membership function, MEDIUM and LOTS of variable Supplies

LITTLE Association Membership function, MEDIUM, and LOT of variables Inventory:

$$\mu psdSEDIKIT[y] = \begin{cases} 1 & y \le 957 \\ \frac{1546 - y}{589} & 957 \le y \le 1546 \\ 0 & y - 1546 \end{cases}$$

$$\mu psdSEDANG[y] = \begin{cases} \frac{y - 957}{295} & y = 1261 \\ & 957 \le y \le 1261 \\ \frac{1546 - y}{295} & 1251 \le y \le 1546 \\ 0 & y \le 957 \vee y \ge 1546 \end{cases}$$

$$\mu psdBANYAK[y] = \begin{cases} 1 & y \le 957 \\ \frac{y - 957}{589} & 957 < y < 1546 \\ 0 & y - 1546 \end{cases}$$

LITTLE Association Membership Value, MEDIUM, and LOT darivariabel Inventory can be searched by:

$\mu psdSEDIKIT[1261] = (1546 - 1261)/589$
=0.483870967742

$\mu psdSEDANG[1261] = (1546 - 1261)/295$
= 0.966101694915

$\mu psdDANYAK[1261] = (1261 - 957)/589$
= 0.516129032258

3) Production of goods; consists of 3 fuzzy set, ie LESS, STILL and INCREASE. FuzzyBERKURANG membership function set, and

INCREASE FIXED ProduksiBarang of variables represented in Figure 6.

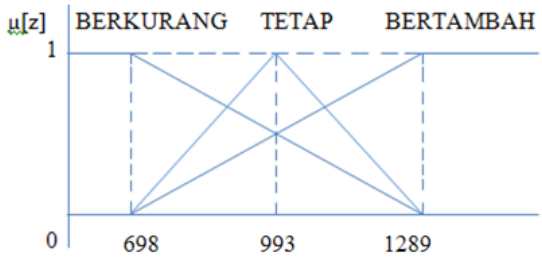


Figure 6 The set of fuzzy membership function REDUCED, AND EQUIPMENT danBERTAMBAH of variables Production

The set of fuzzy membership functions REDUCED, FIXED and INCREASE variable Goods Production:

$$\mu PrBrgBERKURANG[z] = \begin{cases} 1 & z \leq 698 \\ \frac{1289 - z}{591} & 692 \leq z \leq 1289 \\ 0 & z - 1209 \end{cases}$$

$$\mu PrBrgTETAP[z] = \begin{cases} 1 & z \leq 698 \\ \frac{z - 698}{402} & 698 < z < 993 \\ \frac{1289 - z}{591} & 993 < z < 1289 \\ 0 & z \geq 1289 \end{cases}$$

$$\mu PrBrgBERTAMBAH[z] - \begin{cases} 1 & z \leq 698 \\ \frac{z - 698}{591} & 698 \leq z \leq 1289 \\ 0 & z \geq 1289 \end{cases}$$

REDUCED Association Membership Value, FIXED, and INCREASE darivariabel Production can be searched by:

$$\mu PsBrgBERKURANG[698] = (1289 - 698)/591$$
$$= 1$$
$$\mu PsBrgTETAP[698] - (993 - 698)/402$$
$$= 0.733830845771$$
$$\mu PrBrgBERTAMBAH[698] - (698 - 698)/591$$
$$= 0.001692047377$$

b. inference

[R1] IF DOWN Demand And Supply LOT LESS THEN Production of Goods;

Antecedent membership value to the fuzzy rules [R1] are denoted by α1 is obtained by the following formula:

$$\alpha 1 = \mu pmtTurun \cap psdBanyak$$
$$= \min(\mu pmtTurun[550], psdBanyak[1261])$$

= min (1,0.516129032258)
= min 0.516129032258

According to the membership function set REDUCED Goods Production in the fuzzy rules [R1] in equation (2.11) then the value z1 is:

$$z1 = 1289 - 0.516129032258(1289 - 698)$$

⇔z1=1289 – 305
⇔z1=984

[R2] IF Demand And Supply DOWN THEN BEING REDUCED ProduksiBarang;

Antecedent membership value to the fuzzy rule [R2] are denoted by α2 obtained by the following formula:

$$\alpha 2 = \mu pmtTURUN \cap psdSEDANG$$
$$= \min(\mu pmtTURUN[550], psdSEDANG[1261])$$

= min (1,0.966101694915)
= 0.966101694915

According to the set membership function fuzzy dalamaturan REDUCED Goods Production [R2] in equation (2.13) then the value of Z2 is:

$$\Leftrightarrow z2 = 1289 - 0.966101694915(1289 - 698)$$

⇔z2 =1289 – 570
⇔z2 = 719

[R3] IF Demand And Supply DOWN A LITTLE LESS THEN Production of Goods;

Nilai keanggotaan anteseden untuk aturan *fuzzy* [R3] yang dinotasikandengan α3 diperoleh dengan rumus sebagai berikut:

$$\alpha 3 - \mu pmtTURUN \cap psdSEDIKIT$$
$$= \min(\mu pmtTURUN[550] \cap psdSEDIKIT[1261])$$

= min (1,0.516129032258)
= min 0.516129032258

Antecedent membership value to the fuzzy rule [R3] dinotasikandengan α3 which is obtained by the following formula:

$$\Leftrightarrow z3 = 1289 - 0.516129032258(1289 - 698)$$

⇔z3 = 1289 - 305
⇔z3 = 984

[R4] FIXED IF Demand And Supply LOT LESS THEN Production of Goods;

Antecedent membership value to the fuzzy rule [R4] dinotasikandengan α4 which is obtained by the following formula:

$$\alpha 4 = \mu pmtTETAP \cap psdBANYAK$$
$$= \min(\mu pmtTETAP[550] \cap psdBANYAK[1261])$$

= min (0,0.516129032258)
= min 0

According to the set membership function fuzzy dalamaturan REDUCED Goods Production [R4] in equation (2.17) then the value z4 is:

$$\Leftrightarrow z4 = 698 - 0(1289 - 698)$$

⇔z4 = 698+0
⇔z4 = 698

[R5] IF Demand And Supply WAS THEN FIXED FIXED ProduksiBarang;
Antecedent membership value to the fuzzy rule [R5] dinotasikandengan α5 which is obtained by the following formula:

$$\alpha 5 = \mu pmtTETAP \cap psdSEDANG$$
$$= \min(\mu pmtTETAP[550] \cap psdSEDANG[1261])$$
= min (0,0.966101694915)
= min 0

Since the production of goods FIXED, then according to Figure 6 directly tampakbahwa $ Z5 = $ ZT = 993.

[R6] FIXED IF Demand And Supply LITTLE THEN INCREASE ProduksiBarang;
Antecedent membership value to the fuzzy rule [R6] dinotasikandengan α6 were obtained by the following formula:

$$\alpha 6 = \mu pmtTETAP \cap psdSEDIKIT$$
$$= \min(\mu pmtTETAP[550] \cap psdSEDIKIT[1261])$$
= min (0,0.483870967742)
= min 0

Menurut fungsi keanggotaan himpunan Produksi Barang BERTAMBAH dalamaturan *fuzzy* [R6] pada persamaan (2.20) maka nilai z6 adalah:

$$\Leftrightarrow z6 = 0(1289 - 698) + 698$$

⇔z6 = 0+698
⇔z6 = 698

[7] IF Demand And Supply RIDE LOT THEN INCREASE Goods Production;
Antecedent membership value to the fuzzy rule [R7] are denoted by α7 obtained by the following formulas:

$$\alpha 7 = \mu pmtNAIK \cap psdBANYAK$$
$$= \min(\mu pmtNAIK[550] \cap psdBANYAK[1261])$$
= min (0,0.516129032258)
= min 0

According to the set membership function fuzzy dalamaturan INCREASE Goods Production [R7] in equation (2.22) then the value is z7:

$$\Leftrightarrow z7 = 0(1289 - 698) + 698$$

⇔z7 = 0+698
⇔z7 = 698

[R8] IF Demand And Supply UP ARE THEN INCREASE Goods Production;
Antecedent membership value to the fuzzy rule [R8] which dinotasikandengan α8 obtained by the following formula:

$$\alpha 8 = \mu pmtNAIK \cap psdSEDANG$$
$$= \min(\mu pmtNAIK[550] \cap psdSEDANG[1261])$$
= min (0,0.966101694915)
= min 0

According to the set membership function fuzzy dalamaturan INCREASE Goods Production [R8] in equation (2:24) then the Z8 is:

$$\Leftrightarrow z8 = 0(1289 - 698) + 698$$

⇔z8 = 0+698
⇔z8 = 698

[R9] Demand INCREASED IF LITTLE Production And Inventory Item grow;
Antecedent membership value to the fuzzy rule [R9] are denoted by α9 obtained by the following formula:

$$\alpha 9 = \mu pmtNAIK \cap psdSEDIKIT$$
$$= \min(\mu pmtNAIK[550] \cap psdSEDIKIT[1261])$$
= min (0,0.483870967742)
= min 0

According to the membership function set INCREASE Goods Production in the fuzzy rules [R6] in equation (2.26) then the value is z6:

$$\Leftrightarrow z9 = 0(1289 - 698) + 698$$

⇔z9 = 0 + 698
⇔z9 = 698

c. Menentukan Output *Crisp (Deffuzzyfikasi)*
In the method Tsukamoto, crisp output used to determine defuzifikasi, namely:

$$Z = \frac{\alpha 1 * z1 + \alpha 2 * z2 + \alpha 3 * z3 + \alpha 4 * z4 + \alpha 5 * z5 + \alpha 6 * z6 + \alpha 7}{\alpha 1 + \alpha 2 + \alpha 3 + \alpha 4 + \alpha 5 + \alpha 6 + \alpha 7 + \alpha 8}$$
$$= \frac{0.516129032258 * 984 + 0.966101694915 * 719 + 0.516129032258 * 984 + 0}{0.516129032258 + 0.966101694915 + 0.516129032}$$
$$= \frac{694.627119}{1.99835975}$$

Z = 347.567325

Thus, according to calculations by the method above Tsukamoto, jumlahrekomendasi glove production to be produced PT KSTEX in the next 347 scores.

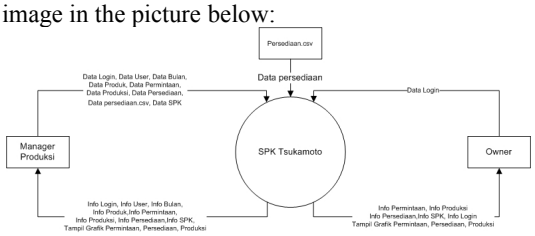
2.2.1 Functional Requirements Analysis
Analysis of functional requirements is an overview of the data flow that occurs in the system. Functional requirements on the applications to be built covering Diagram Context, Data Flow

Diagrams (DFD), the specification process and Data Dictionary.

1. Diagram Context

Context diagram is a diagram that consists of a process and describe the scope of a system. Context diagram is the highest level of the DFD that describes the entire input to the system and the output of the system.

Form DFD (Data Flow Diagram) shown in the image in the picture below:



Gambar 3.9 Diagram Konteks SPK Tsukamoto

1. DFD

Data Flow Diagrams (DFD) is a medium that is used to describe the flow of data flowing on an information system. DFD system to determine the amount of production at PT KSTEX proposed consists of several processes in the data flow diagram, more can be explained in the following description.

1. DFD level 1

DFD Level 1 system for determining the amount of production can be seen in Figure 3.9. DFD processes contained in the Level 1 system for determining the amount of production is the login process, master data processing, processing of SPK.

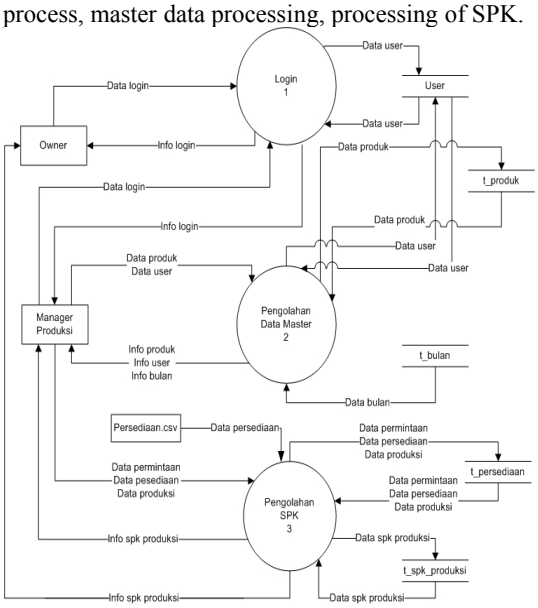


Figure 3.10 DFD Level 1 SPK Tsukamoto

2.2 System Design

2.3.1 Relation Scheme

Connectedness describe in detail tables in the system or clear, then the use of the scheme will be explained in the picture relasi.Skemarelasi 7.

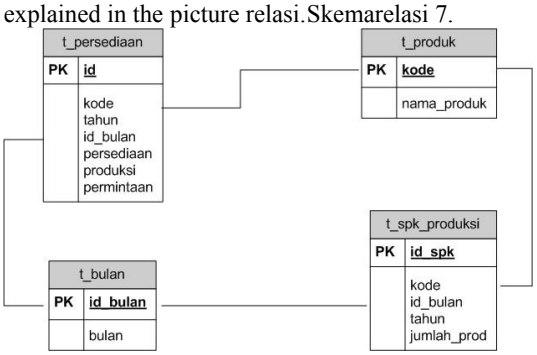


Figure 3.16 Diagram relationship

2.3.2 Menu Structure Design

The menu structure is built to explain the menu design process that can be used by the user. The menu structure is generally made in this system consists of menus and sub-menus.

Menu Structure Design Manager / Admin

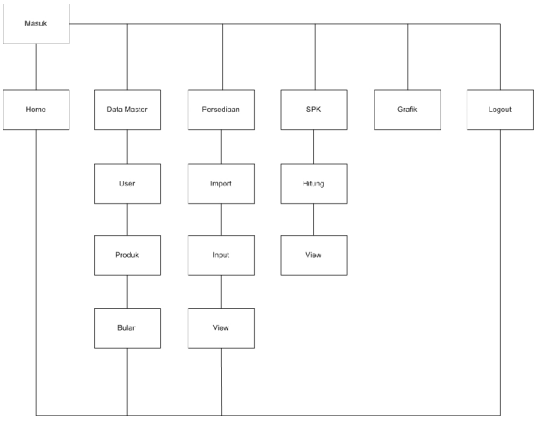


Figure 3.17 The design of the menu structure manager / admin

The design of the menu structure owner

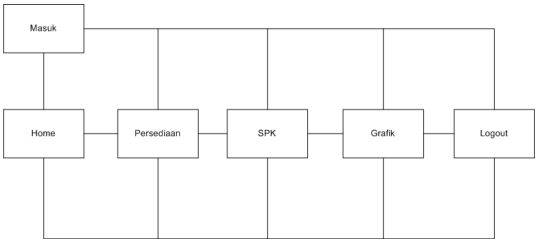


Figure 3.18 The design of the menu structure owner

2.3 Interface Implementation

Interface implementation of a system built one of which can be seen in Figure 9, 10, and figure 11.

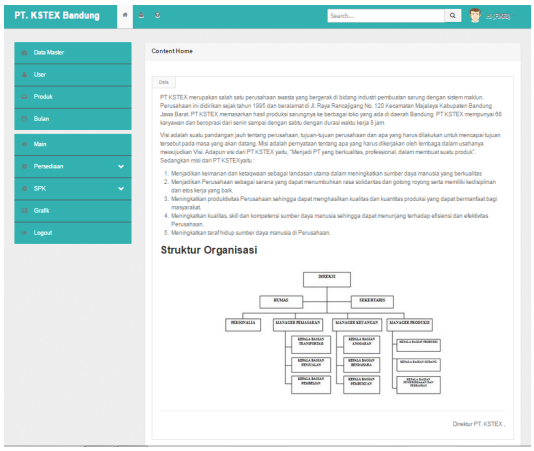


Figure 9 Interface Home Manager

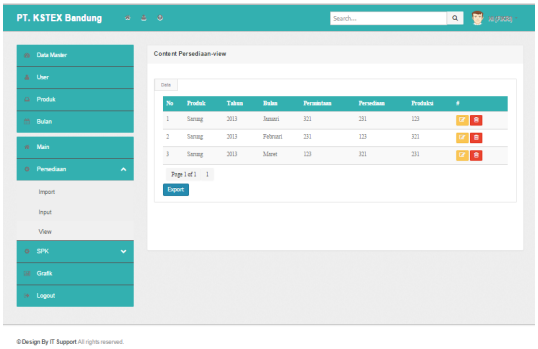


Figure 10 Interface Data Processing Page

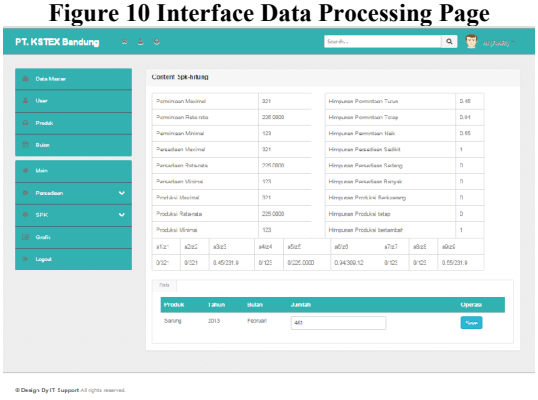


Figure 11 Determination of Total Production Interface Process

2.2 Semantic Network

Here is a semantic network of the system to be built is as shown in Figure 13 and Figure 14:

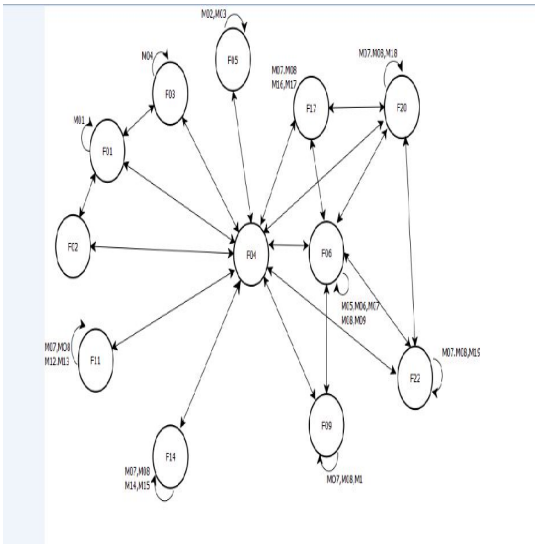


Figure 12. Semantic Network Admin

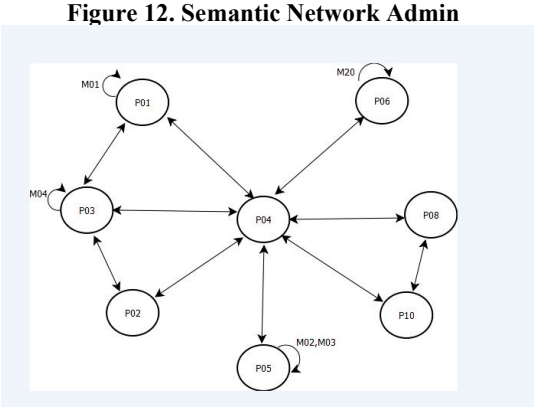


Figure 13. Semantic Network Manager

2.3 Pengujian

Software testing is a critical element of software quality assurance and presented the basic study of the specification, design, and coding. Testing is done by using black box and beta testing with the interview. Using black box testing focuses on functional requirements of software. Thus, testing by using black box method focuses on the functional requirements of the software. This testing allows the software engineer to get a set of input conditions that fully all the functional requirements for a program.

Based on the results of each user or the respondent answers to the question posed in the beta test can be concluded that the system is easy to use and assist the work of each part described as follows

Based on the answers of each user or respondents to questions on testing betadapat be concluded that the system has a user friendly, easy to use and help work on the PT. KSTEX Bandung.

2 CLOSING

3.1 Conclusion

After doing the analysis, design, and testing, it can be concluded that a decision support system for determining the amount of production has been able to assist managers in determining the amount of the production of gloves that should be produced for every month.

3.2 Suggestions

Based on the conclusions that have been described, it is expected a decision support system for determining the amount of production for each month by Tsukamoto method PT. KSTEX Bandung can be developed further by determining the amount of the production of gloves every day. It will produce a total production of more accurate in determining the amount of production at PT. KSTEX Bandung**.**

REFERENCES

[1] Gordon, B. Davis. 1991. *Kerangka Dasar Sistem Informasi Manajemen Bagian 1*, PT. Pustaka Binamas Pressindo. Jakarta.

[2] Jogiyanto HM. 1999. *Analisis dan Disain Informasi: Pendekatan Terstruktur Teoridan Praktek Aplikasi Bisnis*, Andi Offset. Yogyakarta.

[3] Daihani, D.U. 2001. *Komputer Pengambilan Keputusan*, Gramedia. Jakarta.

[4] Kusrini. 2007.*Strategi Perancangandan Pengolahan Basis Data*, Andi. Yogyakarta.

[5] Sri Kusumadewi & Sri Hartati. 2006. *Neuro Fuzzy-Integrasi Sistem Fuzzy dan Jaringan Syaraf,* GrahaIlmu. Yogyakarta.

[6] Turban, E., Aronson, J. E., and Liang, T. P.2005. *Decision Support Sistem and Intelligent Sistem*, 7th Edition, Pearson Education Inc. Upper Saddle River. New Jersey.

[7] Sri Kusumadewi & Hari Purnomo. 2004. *Aplikasi Logika Fuzzy Untuk Sistem Pendukung Keputusan Edisi Pertama,* GrahaIlmu. Yogyakarta.