Requirement Elicitation Modeling Using Knowledge Acquisition in Automated Specification Method

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Abstract

Errors often occur during the requirements elicitation stage, causing failure of the software development process as a whole so that the system built cannot be used optimally, this data is obtained from survey data from several large companies involved in technology development. To overcome this problem, this study tries to apply elicitation requirements using the KAOS method in the case study of the SMM Reseller ordering system to obtain system requirements that are in accordance with the goals and objectives of each existing stakeholder. Based on the elicitation of system requirements, functional requirements are generated which include, automatic orders, automatic payments, manage product sales, manage orders, manage payment methods, manage problem orders, manage customer data, manage company information, automatic email notifications, and sales statistics information. The results of this study are a table of functional requirements that have been declared valid and in accordance with the goals and requirements of each stakeholder after evaluating and validating the results for each stakeholder involved.

Keywords: requirements elicitation; requirements engineering; knowledge acquisition in automated specifications; software engineering; goal tree model; functional requirements

1. Introduction

Based on survey data obtained and carried out by large companies engaged in technology development, it is stated that the failure of a software development process is caused by a lack of maximum data mining process or requirements engineering process for the system to be developed. The European Software Organization states that 40% of projects that have been worked on often experience major problems in the development process because the system requirements to be developed are inconsistent or uncertain. The Standish Report provides survey results that 9,236 IT projects fail because one of the reasons is incomplete requirements or uncertain and changing requirements [1]. The requirements elicitation stage is one of the most difficult stages in the software development process due to several main problems, namely the problem of how large the system will be developed, the problem of understanding between relevant stakeholders, and the problem of changes that occur during the software development process [2].

Requirements elicitation is a stage in the requirements engineering process where all user requirements are searched and collected for documentation so that the software to be developed can meet the requirements and

expectations of users later [3]. In the application of requirements elicitation, many companies do not understand how to select the correct requirements elicitation so they simply own or build an information system but do not understand what is actually needed so the effect is that the development project will never be completed or only partially completed and even abandon the existing system. was built because it was deemed not in accordance with the purpose [4]. Therefore, we need an appropriate requirements engineering method so that the basic requirements of the system being developed can be more complete and precise in accordance with the main objectives of the system so that the system created can be of higher quality by using the right and appropriate requirements elicitation and analysis method [5].

Requirements engineering is a process in software development that consists of elicitation, analysis, and identification of a requirement to solve problems that occur from a business process [6]. At this requirements engineering stage, there are several approaches to modeling elicitation results with goal orientation. This elicitation model involves user requirements with the aim of creating a system in software requirements engineering [7]. One method of approach in carrying

out a requirements engineering is to use the Goal Oriented Requirements Engineering (GORE) method [8]. GORE is a requirements engineering method that is different from other traditional requirements engineering methods. Other traditional requirements engineering models only model their requirements, but GORE also models their goals[9]. In the GORE model, there are several requirements engineering methods, namely: Knowledge Acquisition in Automated Specification (KAOS), I*/Tropos, and Goal-Based Requirements Analysis Method (GBRAM) [7].

The KAOS and I*/TROPOS modeling techniques are the most frequently used methods in requirements engineering[9]. The I*/TROPOS method has the advantage of a more complete requirements mechanism than other GORE methods[10]. This method is one of the methodologies in software development which is more oriented toward the Agent [11]. Because the mechanism requirements are more complete and lengthy, the process in the TROPOS method has the possibility to become more complex and longer. Meanwhile, the strength of KAOS is that it is easy for stakeholders to read or understand the goals that have been made, because the GORE model is equipped with a high-level diagram [8]. The KAOS modeling technique is better when compared to I*/TROPOS, because KAOS is a simpler method and focuses on producing more specific requirements and in accordance with the main goals of the system [9]. KAOS modeling describes a hierarchy of identified requirements into a diagram to make it easier to trace requirements (high traceability) [8]. While the GBRAM method is suitable for determining functional requirements, this method is not sufficient and proven to determine nonfunctional requirements [12].

One of the failures that occur in software development comes from errors in the process of defining and extracting requirements [13]. the success of a software system is measured by the extent to which the system has fulfilled its objectives. Therefore, identifying a goal must be a major and important activity in the development of software systems [10]. Based on the company's general problem where there is a lack of knowledge from requirements engineering so that the system built is not in accordance with the goals and main objectives of the system, an appropriate requirements engineering method is needed so that the functional requirements and non-functional requirements of the online sales system will be developed complete and precise. so as to create a quality and reliable system using elicitation methods and appropriate requirements analysis [5].

To solve the problem of errors in the requirements elicitation process that are not in accordance with the main objectives of the software system, it is necessary to model the results of the requirements elicitation in accordance with the goals and main objectives of the system to be built, namely using the Goal Oriented Requirements Engineering (GORE) method. One of the requirements engineering methods in GORE is Knowledge Acquisition in Automated Specification (KAOS).[13]. The Knowledge Acquisition in Automated Specification (KAOS) method is a goal-oriented requirements engineering method and is the first developed and most frequently used in the requirements engineering process [5]. KAOS focuses on realizing and analyzing business processes, then determines the requirements according to business goals[8]. By using KAOS, it is hoped that it can solve problems to map the goals or objectives of a system to become clearer.

Due to the rapid advancement of technology in today's era, buyers can make transactions or orders even remotely, for example using certain platforms or systems, namely ordering systems using internet facilities [14]. This research will apply a goal-oriented method using the Knowledge Acquisition in Automated Specification (KAOS) method in a case study of the SMMReseller ordering system to obtain a model of the requirements of the entire system in accordance with the goals and main objectives of the system to be built so that it can used and developed in subsequent software engineering stages.

2. Research Methods

The methodology used in this research is to use a survey by conducting interviews and interviews aimed at stakeholders or stakeholders in the organizational structure to find out the various requirements and goals in each existing channel as the basis for developing the SMMReseller Ordering System. Figure 1 is a research flowchart that is used as a reference for what steps must be taken in conducting research.
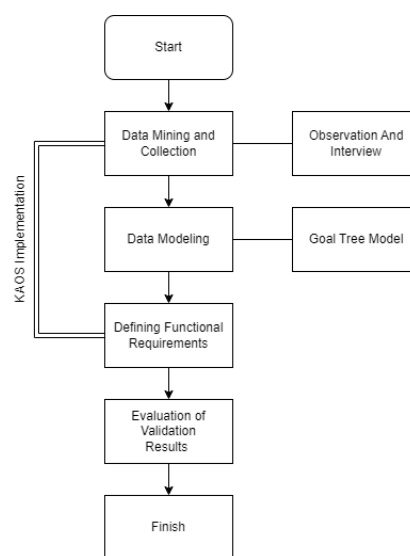

Figure 1. Research Flowchart

Figure 1 explains the research flow starting from Data Collection and Data Collection using interviews with each relevant stakeholder, then the results of the interview will be modeled at a later stage in the form of a Goal Tree Model. Based on the Goal Tree Model diagram that has been obtained, it will be defined in the form of Functional Requirements and in the last stage an evaluation and validation of the results will be carried out for each relevant stakeholder.

2.1. Data Mining and Collection

At this stage, excavation and collection of data requirements from the SMMReseller ordering system begins. Exploration of requirements is carried out using the interview method and providing several questions that lead to system objectives with "why" and "how" to relevant stakeholders [5].

The first process carried out based on the KAOS method is conducting an interview with stakeholders and observing directly the daily operational activities of the company [8]. This initial activity aims to find out in advance the business process or daily workflow and find the requirements of each related actor to find out the main purpose of the system to be built [10].

The sources or actors who will be interviewed to find out the identification of business requirements, goals and problems that exist in SMMReseller in Table 1 below:

Table 1. SMMR Stakeholders

No	Position	Job Desk
A1	Owner	Monitor operational activities and find out reports on daily business operations
A2	Administrator/ Customer Service	Responsible for all daily business operations
A3	Customers/Users	Place an order in the system as needed

Table 1 describes the stakeholders who will be interviewed, these stakeholders get from everyone involved in SMMReseller operations. This table also describes the Job Desk of each stakeholder so that the interview questions posed will be in more detail on each stakeholder's tasks and functions within SMMReseller.

Customer/user requirements are taken from the point of view of the business owner, where the business owner often communicates with clients so they understand what the system requirements are from the customer/user side. Based on the stakeholders who must be interviewed, the question instrument is divided into 3 parts according to position in the SMMReseller business process. The instrument questions were compiled and taken based on the question points in the previous study entitled "Implementation of the Knowledge Acquisition in Automated Specification (KAOS) Method in the Inventory Management

Information System at the Engineering Section of TVRI West Java Station" by focusing on questions that aim to find out targets and objectives from each stakeholder. At this stage the application of the KAOS method lies in the questions asked,

The question instruments as interview material for the Business Owner section are in Table 2.

Table 2. Business Owner Interview Question Instrument

No	Question
PO1	How is the operational workflow so far within the scope of work of the Business Owner at SMMReseller?
PO2	What are the problems that have often occurred so far in daily operational activities as a Business Owner?
PO3	From the point of view of the Business Owner, why does SMReseller need to create a centralized system?
PO4	What are the duties and objectives of a Business Owner in SMMReseller operational activities?
PO5	Based on the existing assignments, what features and what are expected to make the task easier as a Business Owner?
PO6	As a Business Owner, who do you usually deal with in daily operational activities?
PO7	What kind of system do you want from this SMMReseller?

Table 2 lists the question instruments that will be asked of the Business Owner stakeholders during the interview process. This question aims to obtain detailed interview results from the scope of the Business Owner which can later be developed into a system requirement.

The question instruments as interview material for the Administrator section are in Table 3.

Table 3. Administrator Interview Question Instrument

No	Question
PA1	How is the operational workflow so far within the Administrator's scope of work at SMMReseller?
PA2	What are the problems that have often occurred so far in daily operational activities as an administrator?
PA3	From the Administrator's point of view, why does SMMReseller need to create a centralized system?
PA4	What are the duties and objectives of an Administrator in SMMReseller operational activities?
PA5	Based on the existing assignments, what features and what are expected to make the task easier as an Administrator?
PA6	As an administrator, who do you usually deal with in daily operational activities?
PA7	What kind of system do you want from this SMMReseller?

In Table 3, the instrument questions that will be asked to Administrator stakeholders are written during the interview process. This question aims to obtain detailed interview results from the scope of the Administrator which can later be developed into a system requirement.

The question instruments as interview material for the Customer section are in Table 4. Table 4 lists the question instruments that will be asked of Customer stakeholders from the Business Owner's point of view during the interview process. This question aims to obtain detailed interview results from the scope of the

customer which can later be developed into a system requirement.

Table 4. Customer Interview Question Instrument

No	Question
PP1	How has the order flow so far been at SMMReseller?
PP2	What are the problems that have often occurred so far in ordering activities at SMMReseller?
PP3	From the customer's point of view, why does SMMReseller need to create a centralized system?
PP4	Do customers usually only make purchases? Are there any other activities? If so, what and how?
PP5	As a customer, who do you usually contact when placing an order or other activities at SMMReseller?
PP6	What kind of system do you want from this SMMReseller?

Based on the results of interviews and observations made at this stage with each stakeholder who represents and is responsible for each part of the organizational structure, the results will be obtained in the form of problems from ordering activities at SMMReseller. These problems are obtained from the conclusions of the answers of each stakeholder which will be written in table form and given a code which will later be used to determine High-Level Goals. In table 5 is an example of the results of the problems based on the answers from stakeholders.

Table 5. Problem Results

No	Problem
M1	Problem 1
M2	Problem 2
M3	Problem 3
M4	Problem 4

Table 5 is an example of writing a table containing Problem Results. Obtained from the conclusions based on the results of interviews from each *stakeholders* related.

2.2. Data Modeling (Goal Tree Model)

The results of previous stakeholder interviews need to be modeled in a diagram to see more clearly the relationship of each existing entity [5]. Then the data obtained in the previous stage will be defined goals and their derivatives such as soft goals and agents based on the objectives obtained from the results of interviews with related parties [8]. So based on the problems at the previous needs exploration stage, there are several High-Level Goals which will later be developed into modeling using the KAOS method in the form of a Goal Tree Model [8]. The Goal Tree Model is a diagram in the KAOS method that functions to determine the functional and non-functional requirements of the system to be built [15]. Table 6 is an example of the results of High-Level Goals based on the results of interviews with each stakeholder. The High-Level Goals table in Table 6 is a table used in the KAOS method and will contain the objectives of each problem obtained based on the results of interviews with each stakeholder at the previous stage.

Table 6. Results of High-Level Goals

No	Objective	Problem
1	Goals/Goals 1	M1
2	Goals/Goals 1	M2
3	Goals/Goals 1	M3
4	Goals/Goals 1	M3

In the KAOS method, to describe the results of elicitation you can use the KAOS modeling notation in the form of a diagram [8]. The model intended to describe the results of requirements elicitation is the Goal Tree Model (GTM) which is then described using the KAOS modeling notation (Figure 4) [5].
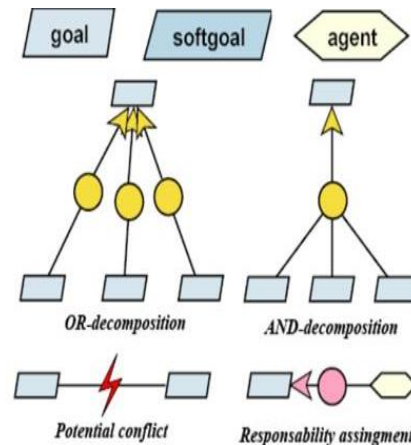

Figure 2. KAOS Modeling Notation[5]

Figure 2 is the notation used to describe and model the system's High Level Goals in the form of a Goal Tree Model diagram. By mapping the softgoals, namely the conditions that must be met to achieve the goal, then the next step is to map the goals and softgoals into a hardgoal [13]. From the modeling results in the form of the Goal Tree Model, at this stage hard goals will be obtained which will serve as the requirements of the system to be developed [8]. Table 7 is an example of hardgoals mapping results.

Table 7. Hardgoals Mapping Results

No	Hardgoals name
G1	Hardgoals name 1
G2	Hardgoals name 2
G3	Hardgoals name 3

These hardgoals are used to simplify the process of determining functional requirements, then the hardgoals that have been obtained will be written in table form and given a code number to later be entered into the functional requirements table.

2.3. Defining Functional Requirements

In the previous stage Goals, Softgoals, Agents, and Hardgoals of the entire system have been defined in the form of diagrams, then from these diagrams it can be derived which eventually becomes hardgoals and can become system functional requirements [5].

Functional requirements are types of requirements that contain services that must be provided, how the system reacts to a user action, and what the system must do in certain situations in a system to be developed [8]. The application of the KAOS method based on the results of the Goal Tree Model obtained in the previous stage is used to determine functional requirements including the goals of each of these requirements. In determining functional requirements, it is also explained which users (users) have a role in using the system in each of its functional requirements.

Table 8. Functional Requirement

No	User Code	Description of Requirement	Goals	Objective
1	A1	Requirement 1	G1	Goal 1
2	A2	Requirement 2	G2	Goal 2
3	A3	Requirement 3	G3	Goal 3

Table 8 is an example of an instrument resulting from functional requirements which is written in tabular form with several columns explaining each functional requirement such as Number, User Code, Description of Requirements, Goals, and Objectives.

2.4. *Evaluation and Validation of Results*

The final stage is to evaluate and validate the results of the requirements elicitation model in the form of the Goal Tree Model (GTM) and the results of functional requirements for stakeholders in the SMMReseller organizational structure through the Requirements Validation process. This process can provide a clear picture of predetermined requirements so that they can be implemented into the system. The validation process will be carried out by providing predetermined functional requirements data in the form of diagrams to system stakeholders [13].

In order to validate the results, the results of the research in the form of a Goal Tree Model diagram and Table of Functional Requirements will be conveyed to each stakeholder through online personal discussions such as via Google Meet or Zoom. If in the discussion there is input on the requirements of each stakeholder then it will be discussed right away and if it is approved by each relevant stakeholder then it will be entered into the functional requirements table and will be documented using the Validation Results Table.

Table 9. Validation Results

No	Information	Source
1	Addition of Feature A to problem A	Actor1 - Position
2	Addition of Feature B to problem B	Actor2 - Position
3	Addition of Feature C to problem C	Actor3 - Position

Table 9 is an example of a table that will be used to write down input related to the results of the system's Functional Requirements from each stakeholder

3. Results and Discussions

3.1. Data Mining and Collection

Data mining and collection was carried out using interviews and observation methods to each relevant stakeholder who is responsible for the SMRseller organizational structure by providing several questions that are more directed to "why" and "how". In this study the stakeholders involved and who will be interviewed are Business Owners, Administrators/Customer Service, and Customers from the point of view of business owners to get more valid results.

The results obtained in this first stage are in the form of answers from each stakeholder which are then concluded to obtain a Table of Problems, where this table is the problems that often occur in the SMMReseller business process, so that later these problems can be developed to become system requirements at this stage. -the next stage with the aim of eliminating or minimizing the problems that occur at this time.

The first interview was conducted with the Business Owner based on several questions as shown in Table 2 and the results in Table 10 were obtained.

Table 10. Business Owner Interview Answers

No	Question	Answer
JO1	PO1	The workflow is still conventional where if a buyer wants to place an order, they have to go through customer service first and go through many stages afterward.
JO2	PO2	There are several problems that often arise in daily operations: Financial records are still mixed up and untidy, the wrong admin orders causing losses, too many people are involved so that the order process flow takes too long, can't monitor directly from each admin and customer services involved, the target market is too narrow so that buyers who place orders do not increase or tend to be stagnant
JO3	PO3	It is necessary to create a system to simplify the flow of the sales process and minimize employee errors and want to improve financial records so that all activities can be centralized and can be monitored through only one system
JO4	PO4	Check daily financial reports and statistics, monitor daily operational activities, carry out business development such as promotions both offline and online
JO5	PO5	The features needed are clear which can reduce existing errors and simplify operational activities. Maybe like: Automatic ordering system (Start ordering until it's finished processing), statistical features report all daily data, display information about products and company details, other features that make it easier for SMMReseller employee job desks
JO6	PO6	Usually associated with the entire team, in a day each team in each division is required to report activities carried out in a day such as the number of incoming orders, the number

No	Question	Answer
		of error orders, the remaining balance reports at vendors, etc.
JO7	PO7	A system that as much as possible can make every SMRreseller operational activity automatic and facilitate every job and can reduce errors from every job. Of course, the system is easy to use and also interesting for everyone.

Table 10 are the answers to the question instruments in Table 2 that were asked to the Business Owner stakeholders. This answer was obtained after going through interviews with the SMMReseller Business Owner.

The second interview was conducted with the head of the Admin/Customer Service division based on a number of questions as shown in Table 3 and the answers obtained can be seen in Table 11.

Table 11. Admin/Customer Service Interview Answers

No	Question	Answer
JA1	PA1	Admin and Customer Service have the obligation to handle buyer orders starting from filling out the order form until the order is processed. Customer Service is in charge of direct communication with buyers. The admin is in charge of ensuring that the buyer's orders are safe and appropriate until the order is processed
JA2	PA2	Several problems often occur in this division, namely: Incorrect input of orders / incoming orders do not match data from buyers, the process flow is too long so that quite a lot of buyers do not place orders, recording orders that are still often wrong and forgotten, checking payments that are still manually, buyer data and orders are often lost because they are not recorded centrally
JA3	PA3	It is necessary to create a centralized system to deal with various existing problems, so that it can simplify the work of Admin and Customer Service
JA4	PA4	The administrator is in charge of handling all order processes, starting from inputting orders to vendors and reporting on daily sales results *Customer Service* in charge of communicating with buyers, starting from answering buyer questions, receiving orders, reporting order processes, and reports on the number of daily buyers
JA5	PA5	Maybe more features that can ease the work of Admin and Customer Service and can reduce errors in this division, such as: Automatic ordering, automatic payments, automatic recording of all data, automatic order reports, and possibly other features that support Admin and Customer Service work
JA6	PA6	If from the Admin, contact Customer Service to receive orders and liaise with vendors to input and check orders If Customer Service clearly deals directly with buyers and conveys orders to the Process Admin
JA7	PA7	What is clear is that we need a system that can lighten the work and reduce frequent

No	Question	Answer
		errors, perhaps as if the entire process were automated. So that later it can also improve the performance of Admin and Customer Service

Table 11 are the answers to the question instruments in Table 3 that were asked to Administrator stakeholders. This answer was obtained after going through interviews with the SMMReseller Administrator.

The third interview was conducted with the Business Owner but to find out the Buyer's point of view because if you interview only a few buyers, the results obtained will be invalid. Based on several questions as in Table 4 and the results of the answers can be seen in Table 12.

Table 12. Customer/Buyer Interview Answers from a Business Owner's Perspective

No	Question	Answer
JP1	PP1	As a buyer, if you want to order, you have to chat to Customer Service first, then you will be given an order form to fill in the order data. Then, payment confirmation is done manually by the SMMReseller Admin and order status information is also done manually by the SMMReseller Customer Service. So everything is still done manually by employees.
JP2	PP2	Usually, the SMMReseller Admin often forgets to send the nominal and the purpose of payment so that the buyer does not place an order because the response is too long, the payment system is still with manual confirmation so it takes too long, the latest order status report is usually forgotten, it is not given to the buyer, if the order has a problem, the buyer often confused about what to do and who to contact
JP3	PP3	To simplify the process flow in placing an order, such as automating payments, filling out the order form yourself, and so on so that you don't have to wait too long for Admin or Customer Service
JP4	PP4	Apart from placing orders, customers or buyers often ask about the latest promos or upcoming promotions, and customers will also make complaints if the order they ordered has problems or is not appropriate.
JP5	PP5	As a customer, who do you usually contact when placing an order or other activities at SMMReseller? Customers will only get in touch with Customer Service to place orders, check order status, or complain about problematic orders
JP6	PP6	A system that can simplify and speed up customers in placing orders, checking order status, and making payments. If possible all activities that must be carried out from the customer side can be automated

Table 12 are the answers to the question instruments in Table 4 that were asked to the Business Owner stakeholders. This answer was obtained after going

through interviews with customers but from the perspective of the SMMReseller Business Owner.

Based on interviews with 3 SMMReseller stakeholders and obtained answers from each stakeholder, it can be concluded to find any problems that occur at SMMReseller based on the answers from each stakeholder.

Table 13. Problem Results

No	Problem
M1	Errors often occur when recording daily sales because the entire recording is still done manually by the Admin.
M2	There are no centralized reports or other statistical information about sales because there are only daily sales records and they are not processed further due to a lack of time and manpower to process the data.
M3	There is no exact record of the details of orders that have been processed so far.
M4	There are no detailed records of customers who have already made an order.
M5	The flow of the ordering process is too long and long so that many customers do not place orders.
M6	There is no centralized information about the company, service details, and how to place an order, so many potential customers are confused.
M7	Marketing techniques that are still traditional by way of Word of Mouth (Word of mouth) so that they are less effective in reaching a wider market.
M8	Every time a customer makes a transfer, the admin has to check mutations manually, which is a waste of time and ineffective.
M9	Often customer transfers do not match the order nominal, making it difficult for the admin to check and return the excess funds that have been received.
M10	The admin in the Process Operations section often makes mistakes in inputting order data to vendors, which often causes quite high losses for the company.
M11	Often the admin forgets to process orders so that the processing time of an order increases longer and causes the customer to be dissatisfied.
M12	Order information is processed until the order has been processed, it is still done manually by chat with the customer, so it requires quite a lot of effort and time.
M13	When a problem occurs with an order, the customer must contact the relevant Admin via Whatsapp chat so

No	Problem
	that there is no centralized report data about the details of the problematic order in a certain period.

Table 13 describes the results of the problems obtained from each answer to the question stakeholders obtained from the interview results. This table records every problem that exists in SMMReseller's operational activities so that a total of 13 problems are obtained.

3.2. Data Modeling (Goal Tree Model)

By applying the KAOS model in this study, the operational problems of SMMReseller from the results of excavation and data collection will be modeled using the Goal Tree Model diagram. Data modeling can later be used to determine the functional requirements of the right system according to the purpose of developing the SMMReseller ordering system.

Table 14. Results of High-Level Goals

No	Objective	Problem
1	Improving the quality of management and sales orders	M1
2	Improve records and management of important data	M2, M3, M4
3	Build a simple and automated ordering system	M5
4	Improving marketing quality	M6, M7
5	Simplify and automate the payment system	M8, M9
6	Increase the accuracy and speed of the order process	M10, M11
7	Know the status and current order process	M12
8	Knowing the problematic order data recap	M13

The first result at this stage is the High-Level Goals table which is written in Table 14. Table 14 or the High-Level Goals table contains a mapping of goals or goals from each data problem that has been collected from the results of stakeholder interviews. Based on the problems faced, several High-Level Goals are obtained as in Table 14 which will later be developed into a diagram of the Goal Tree Model using the KAOS method to obtain Goals, Softgoals, Hardgoals, and Agents.
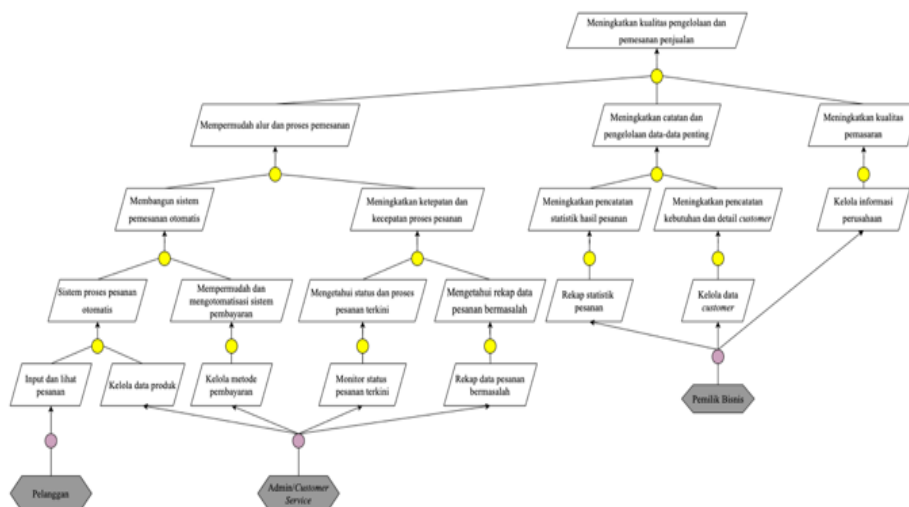

Figure 3. KAOS Modeling Results (Goal Tree Model)

Furthermore, at this stage, the results of the Goal Tree Model diagram are obtained as shown in Figure 5 based on the High-Level Goal Table with several branching notations that describe Goal, Softgoal, Hardgoal, and Agent. Figure 3 shows the main goals or system goals which are derived from subgoals to become hardgoals as system requirements.

In the case study of the SMMReseller Ordering System, it was found that the main purpose of creating this centralized system was "Improving the Quality of Management and Sales Ordering", which means that this system can make it easier in terms of sales and in terms of recording to increase sales efficiency both from the admin side and from the buyer's side. Furthermore, from the diagram that has been described, 3 softgoals are obtained to support and achieve the main objectives, namely "Simplifying the flow and process of ordering", "Improving records and management of important data", and "Improving the quality of marketing". This is in accordance with the divisions in SMMReseller, namely the Operations division which handles the requirements of buyer orders, Admin which handles operational records, and Marketing which handles product marketing requirements.

From the first softgoal that was obtained, it continued to be lowered, such as to achieve the softgoal "Facilitate the flow and order process" then required other softgoals, namely "Build an automatic ordering system" and "Increase the accuracy and speed of the order process", this softgoal was lowered until it got Hardgoal and Agent involved in the system, where later these Hardgoals and Agents can be used for developing Tables of Functional Requirements at a later stage.

To make it easier to read diagrams and to make it easier to write down functional requirements in the next stage, the diagram is mapped into tabular form to get the Hardgoal of each problem.

Table 15. Hardgoal results

No	Hardgoal
G1	Input and view orders
G2	Manage product data
G3	Manage payment methods
G4	Monitor the status of the latest orders
G5	Problem order data recap
G6	Order statistics recap
G7	Manage customer data
G8	Manage company information

Table 15 is the hardgoal results obtained from the Goal Tree Model diagram. There were 8 hard goals such as order input, product data management, payment method management, and so on. Where this Hardgoal Table can later be used to determine the functional requirements of the system.

In addition to the hardgoal table obtained, Table 16 also lists the agents or stakeholders involved in each hardgoal. The agent results are used to determine who is involved in each functional system requirement. The agent results table is also obtained from the Goal Tree Model diagram.

Table 16. Agent results

No	Agents
AG1	Customer
AG2	Admin/Customer Service
AG3	Business Owner

3.3. Defining Functional Requirements

At this stage, functional requirements are determined based on the results of the Goal Tree Model diagram in the previous stage. The functional requirements that can be concluded based on the results of modeling using the KAOS method are shown in Table 17.

Table 17. Functional Requirements

No	Agents	Requirement	Goals	Target	Objective
1	AG1	Users can view information about the products being sold	G1	Users	Users can independently view product details before placing an order
2	AG1	Users can fill in or input all order details	G1	Users	Customers can place orders independently quickly and precisely
3	AG1	Users can see the status of the latest orders	G1	Users	Customers can see the status of the latest orders quickly and precisely
4	AG2	Users can manage product data	G2	Users	Admin can manage product data that you want to display to customers
5	AG2	Users can manage payment methods	G3	Users	Admin can manage the payment method that you want to use for customer order transactions
6	AG2	Users can see the status of the latest orders from vendors	G4	Users	Admin can quickly see the status of the latest orders from vendors
7	AG1	Users can complain through the system for problematic orders	G5	Users	Customers can directly complain through related orders if the

No	Agents	Requirement	Goals	Target	Objective
8	AG2	Users can see orders that are in trouble	G5	Users	order has a problem Admin can see which orders are having problems to be completed as soon as possible
9	AG3	Users can view sales statistics	G6	Users	Business Owners can view reports on all sales data
10	AG3	Users can manage customer data	G7	Users	Business owners can see customer data that makes orders
11	AG3	Users can manage company information	G8	Users	Business Owners can manage company information for online promotion needs
12	-	The system can store order details from customers	G1, G6	System	The system can store all order data so it will not be lost
13	-	The system can create orders automatically	G1	System	The system can automatically generate orders and totals for customers
14	-	The system can detect automatic payments	G1, G3	System	The system can detect payments automatically from customer orders
15	-	The system can forward orders automatically to vendors	G1	System	After the payment is detected, the system automatically forwards the order to the vendor according to the order details
16	-	The system can update order status automatically from vendors	G1, G4	System	The system automatically updates order status to inform customers
17	-	The system can display all SMMReseller product details	G2	System	The system can display product details to customers before placing an order
18	-	The system can display a choice of payment methods	G3	System	The system displays the choice of payment method information to customers when placing an order
19	-	The system can provide email notifications of the latest order status	G4	System	The system can provide notifications via email to customers about the status of the latest orders instantly
20	-	The system can accept problematic order input	G5	System	The system can accept problematic order input from customers
21	-	The system displays order statistics based on a certain time period	G6	System	The system can display various sales statistics based on certain periods
22	-	The system can store customer information that makes an order	G7	System	The system stores information from customers who place orders
23	-	The system can display company information	G8	System	The system displays company information for online promotion purposes

The main result at this stage is the Table of Functional Requirements as shown in Table 17. The Table of Functional Requirements also presents detailed information on each existing requirement such as who the actors are involved in, what the purpose of the need is, and what problems are resolved from this requirement. Furthermore, this table will be confirmed to the relevant stakeholders to be evaluated and validated whether it is in accordance with the goals and expectations of the SMMReseller Ordering System from each stakeholder.

3.4. Evaluation and Validation of Results

The last stage in system requirements elicitation using the KAOS method is to evaluate and validate the results that have been obtained, namely the table of functional requirements. Evaluation and validation is carried out by presenting the results to each relevant stakeholder to convey the results of system requirements in the form of a table of functional requirements, where in SMMR Reseller the interested stakeholders are Business Owners, Admin/Customer Service, and Customers from the point of view of business owners.

Based on the results of the presentation of the system requirements, each relevant stakeholder agrees and states that the table of functional requirements that has been produced in table 17 using the KAOS method is valid and is considered in accordance with the goals and wishes of each relevant stakeholder. Therefore there is no evaluation or correction of the results of the table of functional requirements generated using the KAOS method in table 17.

3.5. Results Analysis

By applying the KAOS method, a Goal Tree Model diagram can be produced which is used to determine functional requirements. The Goal Tree Model diagram image is very helpful in determining the final results of this study, namely the functional requirements of the system that can match the goals of each relevant stakeholder.

From the research conducted, the final result is in the form of a table of functional requirements which contains various descriptions of system requirements along with other details such as goals or objectives to be achieved from each system requirement that has been defined, as well as agents or stakeholders who will be involved in each requirement. This result contains all system requirements based on each goal or goal of each stakeholder in SMMReseller, this is indicated by writing down what goals will be achieved from each of these functional requirements. The agents or stakeholders involved in each requirement are also written in the results of this elicitation which serve as a parameter that the features built will be intended for whom.

As an example, one of the results of the functional requirements obtained in number 1 explains that the description of the requirement is 'Users can see information about the product being sold'. The goal to be achieved in this requirement is the goal with code G1 where the description of this code can be seen in Table Hardgoal or in Table 15, the Agent or Stakeholder involved is an Agent with code AG1 where a description of this code can be seen in the Agent Table or in Table 16, and the types of requirements that describe related requirements are included in the functional requirements for Users or requirements for the System. This also applies to all system requirements that are obtained with differences in Goal, Agent, and Requirement Type.

4. Conclusion

Based on the research that has been done, the results obtained are functional requirements that are goal-oriented. The results of the functional requirements of this system are obtained by requirements elicitation using the KAOS method so that it can match the requirements, objective and goals of each stakeholder involved in the SMMReseller business process.

Several other features generated from the Table of Functional Requirements are such as Automatic Ordering System, Automatic Payment System, Manage Sales Products, Manage Orders, Manage Payment Methods, Manage Problem Orders, Manage Customer Data, Manage Company Information, Automatic Email Notifications, and Sales Statistics Information.

The results of functional requirements that are in accordance with the goals and goals of each stakeholder can be seen by obtaining several functional requirements description results that are relevant to the duties and functions of each stakeholder in the SMMReseller business process, such as one of the descriptions of functional requirements 'Users can manage product data' which is in accordance with the duties or work of the Admin/Customer Service, namely to manage all SMMReseller product data.

This was also then reaffirmed by evaluating and validating the results for each stakeholder and each stakeholder stated that the results of the functional requirements in this study were in accordance with their respective requirements, goals and goals. With this the conclusion that can be drawn from this research is that the results of system requirements elicitation using the KAOS method can be in accordance with the goals and goals of each stakeholder who will be involved in a business process.

Based on the results and discussion that have been obtained in this study, suggestions for further research or other researchers who wish to discuss or develop on the same topic are: Using the results of this requirements elicitation to proceed to the next stage of software development so that it becomes a complete system and can be implemented according to existing requirements, 2. Applying the KAOS method to other systems with case studies and different conditions such as stakeholders or different types of systems from research to find out how effective the KAOS method is in a requirements elicitation, combines this KAOS method with other elicitation methods to improve the results and accuracy of system requirements, compares the KAOS method with other elicitation methods in the same system to get the best system requirements results

from a requirements elicitation.

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