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Human-Centered Design Approach for Developing an Aerospace Product Credit Sales Application: A System Usability Scale Evaluation

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ABSTRACT

PT. SAS Aero Sishan faces challenges in monitoring production data and managing credit sales information efficiently, resulting in delayed decision-making processes. This study aims to design an aerospace product credit sales application using the Human-Centered Design (HCD) approach and evaluate its usability using the System Usability Scale (SUS). The research was conducted through four HCD stages: requirement gathering, analysis, prototype development, and evaluation. Data were collected through observation, interviews, documentation, and usability testing involving 30 respondents. The usability evaluation produced an average SUS score of 72.42, with descriptive statistics indicating a median score of 70, a minimum score of 50, a maximum score of 100, and a standard deviation of 13.14. The obtained SUS score falls into Grade B (Good**)**, indicating that the proposed application provides acceptable usability and effectively supports users in managing credit sales activities. The findings demonstrate that applying the Human-Centered Design approach successfully accommodates user requirements and improves user satisfaction. This study contributes a user-centered framework for developing credit sales information systems in the aerospace industry and provides a practical reference for future usability-oriented system development.

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1. INTRODUCTION

The Industrial Revolution 4.0, also known as the cyber-physical system, is characterized by the integration of information and communication technology into the industrial sector. Industry is an economic activity that processes raw materials, semi-finished goods, and finished goods to increase their utility value. It also encompasses industrial design and engineering activities [1]. Technology also influences the development of the business world, changing the way existing business activities are planned, managed, and evaluated, both from a project perspective and from a day-to-day perspective. This can influence how activities are conducted, which can influence what is monitored [2]. Technological developments are evolving rapidly over time, leading to increased competition among companies seeking to outperform others. This situation requires companies to require systems capable of increasing work effectiveness and efficiency to optimally support business activities

[3]. Furthermore, technological developments also require companies to continuously adapt to compete in today's digital era [4].

PT. SAS Aero Sishan is a company in the defense industry engaged in the development of aerospace and defense systems, PT. SAS Aero Sishan also combines the expertise of the founders, previous and aerospace experts who aim to overcome the challenges faced in the Indonesian aerospace and defense industry. Founded in 2011 under the name PT. Smartadeco Indonesia and PT. Safta Ferti, In 2017 it changed its name to PT. Smarta Aero Sishan, in 2019 there was a change so that it changed to PT. SAS Aero Sishan until now. And this is also felt directly by the employees of PT. SAS Aero Sishan.

Real-time monitoring and production data analysis often hamper decision-making, or lack of information makes it difficult for employees to make decisions. This often leads to employees having difficulty obtaining accurate and timely information in changing conditions, resulting in a lack of effectiveness and innovation in employee productivity, resulting in slow and inaccurate decision-making.

From the problems that occurred at PT. SAS Aero Sishan, the design of a credit sales application for aerospace products can help improve employee effectiveness in accessing, managing, and analyzing production data and can help employees make effective and efficient decisions, assisted by using the human-centered design method.

Human centered design is a process approach between design and development in system or product design that focuses on user activities, this system can be more effective and efficient for users in understanding users in a system [5]. In the Human Centered Design (HCD) method, the system design process is carried out through the stages of identifying user needs, analyzing system needs, designing solutions in the form of prototypes, and evaluating the design results. Usability evaluation is carried out using the System Usability Scale (SUS) method to measure the level of ease of use of the system based on user perception [6], [7].

Previous studies have implemented Human-Centered Design in e-commerce, healthcare, and educational systems. However, limited studies have explored the application of HCD for aerospace product credit sales management systems integrated with usability evaluation using SUS. Therefore, this study addresses this gap by designing and evaluating a user-centered credit sales application specifically for the aerospace industry.

2. METHOD

The following methods were used in this research:

2.1 Human Centered Design

The human centered design method is a system design process that users use to create designs they need to obtain information. For what is needed, the user must find out the problems that are occurring so that they can know what the user needs [8]. Human-centered design is a problem-solving approach to system design that develops solutions by incorporating user perspectives at every stage, from problem identification to solution implementation [9]. The Human Centered Design method is an approach process that aims to meet the needs of problems currently faced by users, so that it can improve the stages needed by users to be effective and the solutions obtained can help in using the system [10]. The human centered design methodology involves users in design and development and provides valuable resources about the context of tasks, usage and how services are most likely to interact with systems, products or systems in the future [11].

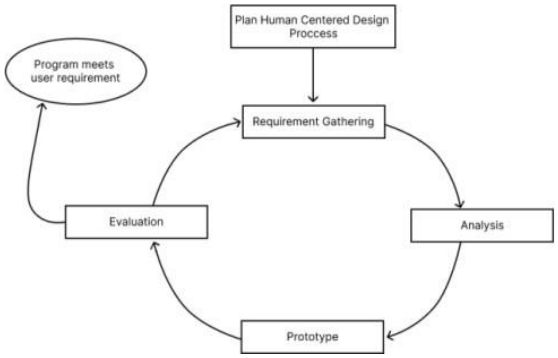

Figure 1. Human Centered Design

There are several stages in the human centered design method as follows:

a. Requirement Gathering
   A phase of searching or finding problems faced by users, in finding the information needed by users.
b. Analysis
   The second phase in user needs is determined in user needs so as to achieve the goals desired by the user in the user definition by using analysis.
c. Prototype
   The third phase in the design is produced to solve the problem, in completing this third phase in making a prototype in the required design.
d. Evaluation
   The final phase includes a design evaluation that can help users understand the design that was created, in creating the design draft [8].

Table 1. Human-Centered Design Activities and Participants

HCD Stage	Participants	Activity
Requirement Gathering	5 employees	Interview and Observation
Analysis	Researchers and Company Representatives	Requirement Analysis and UML Modeling
Prototype	Researchers	UI Prototype Development
Evaluation	30 respondents	System Usability Scale (SUS) Questionnaire

2.2 System Usability Scale (SUS)

The System Usability Scale (SUS) is a measurement method for system usability satisfaction that uses 10 questions from level 1 (strongly disagree) to level 5 (strongly agree), from the results of these questions calculated from 0 to 100, then from these results can be known the value of user satisfaction in the usability of the system [12]. The System Usability Scale (SUS) method was developed by John Brooke in 1986 as an instrument to measure the level of usability of a system based on user perception. This method can be used to evaluate various types of products, such as software, hardware, mobile applications, websites, and other information systems through testing that directly involves users in the evaluation process [13].

The final SUS score results are as follows:

a. For every question with an odd number (1,3,5,7,9), the score is reduced by (1).
b. Can calculate the score for each even numbered question (2,4,6,8,10), but the score will be deducted from the total score for even numbers (5).
c. In the SUS score, to get the results, the questions for the respondents must be added up, then the total result is multiplied by 2.5, after that, make the average and final value of the SUS score [12].

The System Usability Scale (SUS) has a deficiency in selecting factors or features that have problems in the system, but its advantages can help determine whether this system can be used by users well or has problems with the usability of the system, the following is an assessor of the system usability scale. The SUS feature is more interesting in the other 10 questions such as being able to be answered quickly by users, can be evaluated and the results start with a score from 0 to 100, making it easier for individuals to understand it or groups. The system usability scale includes several questions from the 10 SUS test questions listed above, This SUS test can also be accessed quickly and easily during usability testing when evaluating systems and products. The questionnaire contains 10 questions that allow users to measure user opinions about the ease of use in an application or product, which can respond with words ranging from " Strongly Agree "to" Strongly Disagree [14], [15].

Prior to usability evaluation, the SUS questionnaire adopted a standardized instrument developed by Brooke (1996), which has been widely validated in previous usability studies. Therefore, no modification was made to the questionnaire items.

2.3 Data Collection

Data were collected through direct observation of business processes, semi-structured interviews with company employees, documentation review, and usability testing using the System Usability Scale questionnaire.

3. RESULT AND DISCUSSION

The design of the credit sales system application for aerospace products at PT. SAS Aero Sishan uses the human centered design method and system usability scale, in helping PT. SAS Aero Sishan for real-time monitoring and analysis of production data in decision making or obtaining information between one employee and another in making decisions, so that by designing the credit sales system application, it can make efficient and effective decisions.

3.1. Human Centered Design Method

The stages of human-centered design include: requirements gathering, analysis, prototyping, and evaluation :

1) Requirement Gathering

This stage involves analysis of ongoing system processes and analysis of documents in the form of customer data, vendor data, payments, job lists and purchase orders.

2) Analysis

In the second stage o f the human centered design method using unified modeling language (UML):

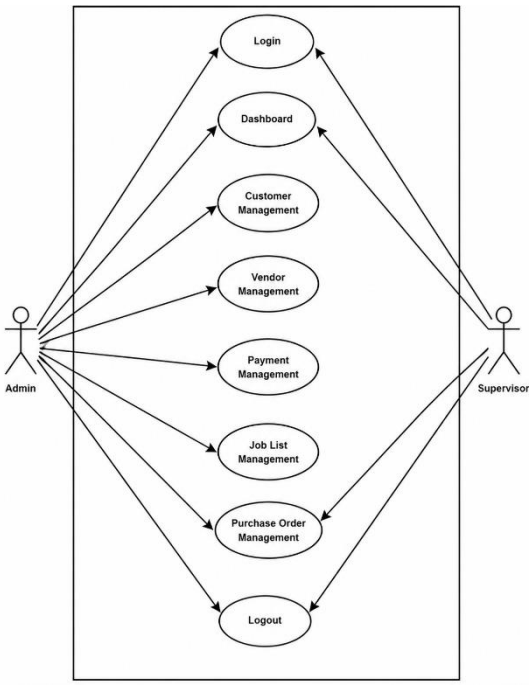

Figure 2. Use Case Diagram

In Figure 2, the use case diagram shows that the admin can do everything by logging in, using the dashboard and managing sales of aerospace products, while the superior can log in, use the dashboard and log out.

3) Prototype

At this stage, the design of the interface or interface design is produced from the results of the requirement gathering and analysis that has been carried out by the researcher, after this, a prototype is designed for the credit sales application for aerospace products at PT. SAS Aero SISHAN as follows:

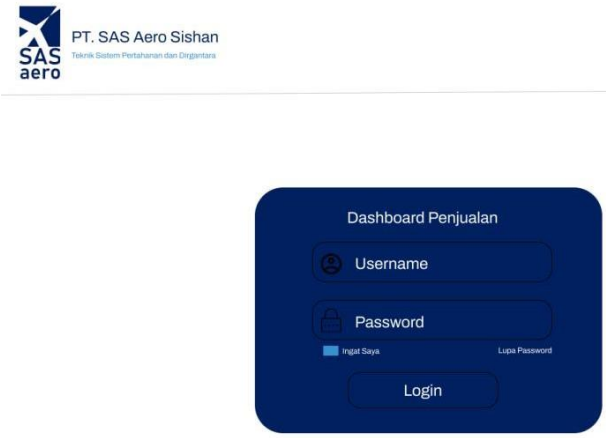

Figure 3. Login

In Figure 3, the main page of the application-based sales dashboard system is designed. When the admin or superior wants to log in, they must use the registered username and password so they can enter the dashboard system.

The login interface was intentionally designed with a minimalistic layout to reduce users' cognitive load and simplify authentication. According to the Human-Centered Design principle, minimizing unnecessary interface elements can improve learnability and reduce user errors during first-time interaction.

Figure 4. Dashboard Page

The credit sales dashboard page is the main menu that can be accessed by admins or superiors to get the information they need. In this designed sales dashboard, there are several things that can be accessed, such as date, month, year in real-time monitoring and product data analysis that can be accessed with graphical changes that can be used by admins and superiors.

The dashboard emphasizes graphical visualization of production and sales information to facilitate rapid decision making. This design aligns with HCD principles by prioritizing users' primary tasks and information needs identified during the requirement gathering stage.

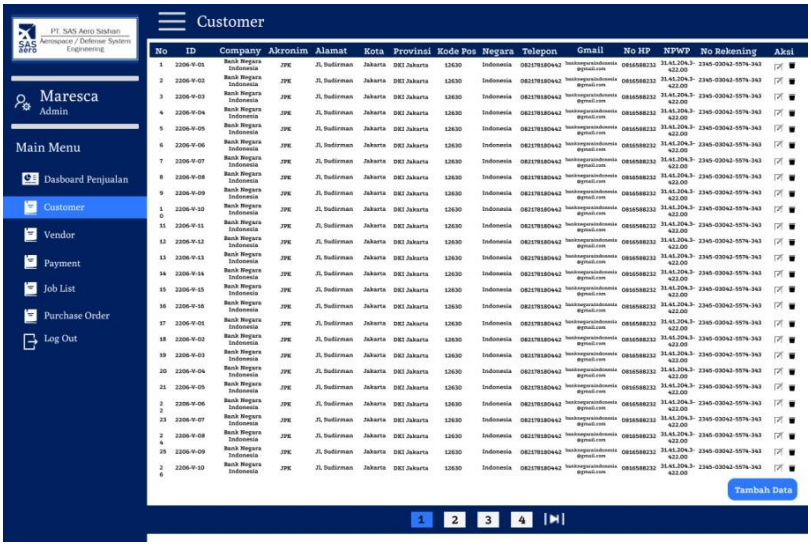

Figure 5. Customer Page

The customer management page displayed contains customer data, which can be accessed by the admin to manage the data, delete, edit and add data that needs to be added to the customer data carried out by the admin.

The customer management interface allows administrators to perform CRUD operations efficiently through a simplified navigation structure. This approach minimizes operational complexity and supports task efficiency.

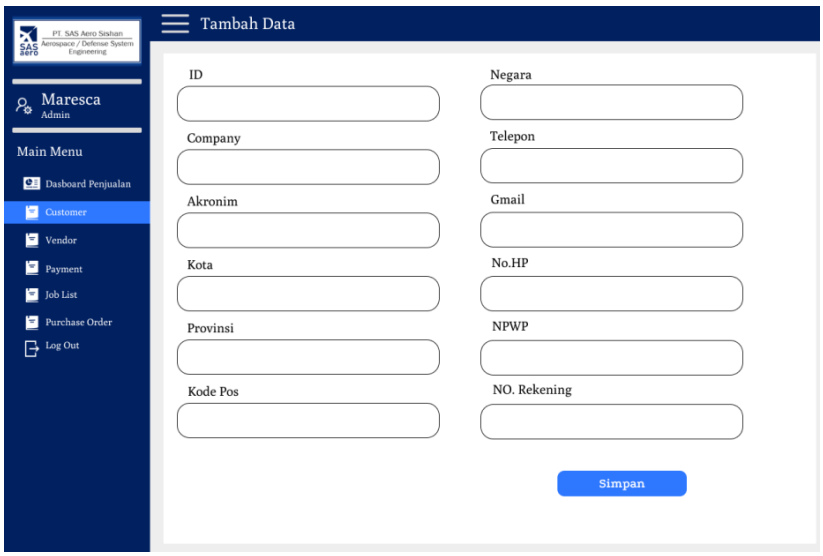

Figure 6. Add Data Page

4) Evaluation

In the final stage of the human-centered design method, namely the evaluation carried out on the design of the aerospace product credit sales system application by checking the design desired by PT. SAS Aero Sishan, in designing the application it can help employees in getting the information they need.

3.2. System Usability Scale Method

In the assessment conducted using the system usability scale and 10 questions to users, the results of the questions generated from prototype testing on the aerospace product credit sales application, which were conducted on 30 respondents from 25 respondents of PT. SAS Aero Sishan and 5 respondents from outside PT. SAS Aero Sishan to conduct testing on the sales application design, using 10 questions from the system usability scale questionnaire on answers 1 to 5 for each question. The following results have been added up from the provisions based on the SUS formula, so the results can be concluded as in the table below.

Table 2. SUS Score Results

Responden (R)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	TOTAL	TOTAL
R1	4	3	4	0	4	1	4	1	4	1	26	65
R2	4	4	3	1	3	3	4	3	4	4	33	82,5
R3	4	4	4	2	2	0	3	4	3	3	29	72,5
R4	3	3	4	1	3	0	3	0	3	2	22	55
R5	4	2	3	3	4	1	4	1	3	3	28	70
R6	4	3	4	3	0	2	3	0	4	2	25	62,5
R7	3	3	2	4	3	0	4	3	2	0	24	60
R8	3	1	4	1	2	3	4	4	4	1	27	67,5
R9	4	2	3	1	3	2	3	3	4	0	25	62,5
R10	4	2	4	2	2	2	4	2	4	2	28	70
R11	4	2	3	0	3	4	4	1	3	0	24	60
R12	4	1	4	0	1	3	3	3	3	3	25	62,5
R13	4	3	3	1	3	4	4	4	3	0	29	72,5
R14	3	3	3	3	4	3	3	3	4	3	32	80
R15	3	1	4	1	4	4	4	2	3	0	26	65
R16	4	3	4	0	4	3	4	4	4	2	32	80
R17	4	4	4	0	4	4	4	4	4	3	35	87,5
R18	4	4	4	0	4	4	4	4	4	4	36	90
R19	4	4	4	4	4	4	4	4	4	4	40	100
R20	3	1	4	3	4	1	3	3	3	3	28	70
R21	3	0	3	0	3	3	3	1	3	1	20	50
R22	4	0	4	4	4	4	4	4	4	3	35	87,5
R23	4	1	4	2	4	3	3	3	3	0	27	67,5
R24	3	3	4	4	4	0	4	4	4	3	33	82,5
R25	4	0	4	4	4	0	4	4	4	4	32	80
R26	4	3	3	0	1	1	4	1	3	0	20	50
R27	4	4	4	4	4	3	4	4	4	4	39	97,5
R28	4	1	3	1	4	4	3	3	3	1	27	67,5
R29	4	4	4	4	4	0	4	4	4	4	36	90
R30	4	1	4	2	3	0	4	2	3	3	26	65
						Score						72,42

The usability evaluation produced an average System Usability Scale (SUS) score of 72.42, indicating that the proposed credit sales application achieved an acceptable level of usability. Based on the SUS interpretation scale, this score falls within the Grade B (Good) category, suggesting that the application is generally easy to learn, efficient to use, and capable of supporting users in performing credit sales management activities at PT. SAS Aero Sishan.

The obtained SUS score demonstrates that applying the Human-Centered Design (HCD) approach successfully addressed users' needs identified during the requirement gathering and analysis stages. By involving users throughout the design process, the developed prototype provides interfaces that are easier to

understand and operate, thereby improving user satisfaction and reducing the complexity of completing daily operational tasks.

Table 3. Descriptive Statistics of System Usability Scale (SUS) Scores

Statistic	Value
Mean	72.42
Median	70.00
Minimum	50.00
Maximum	100.00
Standard Deviation	13.14

Table 3 presents the descriptive statistics of the System Usability Scale (SUS) scores obtained from 30 respondents. The proposed application achieved an average SUS score of **72.42**, with a median score of **70.00**, indicating that most respondents rated the system positively. The SUS scores ranged from **50.00** to **100.00**, reflecting variations in user perceptions regarding the application's usability. Furthermore, the standard deviation of **13.14** indicates a moderate level of response variability, suggesting that respondents' evaluations were relatively consistent and that the developed application provided a satisfactory usability experience for most users.

Table 4. Comparative Analysis of Usability Evaluation Results

Study	Design Method	SUS Score	Interpretation
Muhammad et al. (2023)	HCD	78.50	Excellent
Faizah et al. (2024)	HCD	88.25	Excellent
Rochman et al. (2022)	HCD	74.50	Good
This Study	HCD	72.42	Good

Table 4 presents a comparison between the usability evaluation results obtained in this study and those reported in previous studies implementing Human-Centered Design (HCD) or User-Centered Design (UCD) with the System Usability Scale (SUS). The comparison shows that previous studies achieved SUS scores ranging from 74.50 to 88.25, while the proposed credit sales application obtained an average SUS score of 72.42, which falls into the Good category and exceeds the minimum acceptable SUS benchmark of 68. These results indicate that the developed application provides an acceptable level of usability and is capable of supporting users in performing credit sales management activities effectively.

Although the usability score obtained in this study is slightly lower than those reported in several previous studies, the result still demonstrates that the Human-Centered Design approach successfully accommodated user requirements throughout the design process. Differences in SUS scores may be influenced by variations in application domains, system complexity, user characteristics, and the level of system development evaluated. Overall, the comparison confirms that the proposed application achieves competitive usability performance and provides a solid foundation for further implementation and future system improvements.

4. CONCLUSION

This study successfully designed an aerospace product credit sales application for PT. SAS Aero Sishan by applying the Human-Centered Design (HCD) approach through four stages: requirement gathering, analysis, prototype development, and evaluation. The usability evaluation using the System Usability Scale (SUS) involving 30 respondents produced an average score of 72.42, which falls into Grade B (Good), indicating that the proposed application provides acceptable usability and is capable of supporting employees in managing credit sales information and production monitoring more effectively.

This study contributes a user-centered approach for developing credit sales information systems in the aerospace industry by integrating Human-Centered Design with usability evaluation using the System Usability Scale. However, this research is limited to prototype evaluation and has not yet been implemented in a real operational environment. Future research may focus on full-scale system implementation, integration with Enterprise Resource Planning (ERP) systems, and further usability evaluation to improve system performance and user experience.

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