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Proposed new product development of asset management system for healthcare facilities using design thinking and lean startup

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Abstract - **An excellent health care delivery is highly associated with good hospital asset management as it is detrimental to patient safety and satisfaction. To guarantee the conditions are always ideal, hospital assets, particularly medical devices, need to be carefully managed and maintained. In Indonesia, the importance of asset management in hospitals is emphasized through Permenkes 1189/Menkes/Per/VIII/2010. However, given that hospitals have hundreds to thousands of assets of various types, management faces numerous difficulties in carrying out daily operating activities from the perspectives of asset productivity, security, and safety. Asset management in Indonesian hospitals is frequently carried out using Microsoft Excel and paper-based forms, which is inefficient for handling a large number of assets. Design Thinking and Lean Startup methodologies will be used in this study to look at what Indonesian hospitals specifically need regarding asset management system and to deliver the desired system to customers' hands faster. Inability to report accurate asset information is found to be the biggest pain and transparency of asset data is found to be the most desired gain. Based on the customer pains and gains, a mock-up MVP of hospital asset management is built with seven features that act as the pain reliever and gain creators.**

Keywords - **Asset management; Design thinking; Healthcare; Lean startup; Hospital asset; Product development; Value proposition**

I. INTRODUCTION

In the past few years, hospitals around the world have been facing a significant increase of patient load due to COVID-19 pandemic. Healthcare facilities are challenged to address their medical issues while still trying to save money and resources [9]. With the rise of the in-patient number, the demand for medical equipment is also rising [6]. However, the large number of medical equipment in hospitals carries issues related to productivity, security, safety and maintainability [4]. Problems that often occur include medical equipment that are not well maintained, missing and underutilized [7]. The unavailability of medical equipment can result in patients unable to receive effective treatment and endanger the patient's health condition and life. The appropriate availability and placement of equipment in hospitals not only improves the quality

of patient treatment but also influences the outcomes of treatment in emergency situations [11]. Therefore, asset management could be considered an exceedingly important task that should not be neglected by hospitals in order to make sure that medical equipment and other inventory owned by hospitals are effectively utilized [10].

Asset management is the process of organizing, planning, designing and controlling the acquisition, care, refurbishment, and disposal of infrastructure and engineering assets to support the delivery of services. It is a systematic, structured process covering the whole life of physical assets [2]. With the information obtained from recording asset data, the hospital will be able to know for sure what assets and how many assets are owned by the hospital, as well as its location and the total value of assets owned by the hospital. In Indonesia, the importance of asset management is emphasized through Permenkes 1189/Menkes/Per/VIII/2010 issued by the Ministry of Health for hospitals to guarantee safe, quality and useful medical devices and ensure that medical device products meet the requirements and according to established standards. Asset management is also created as an effort to support Indonesian hospital in fulfilling hospital accreditation (KARS), ISO 9001-2008 quality conformity or Joint Commission International (JCI) and Undang Undang Republik Indonesia No. 44 Tahun 2009 concerning hospitals which includes management of facilities, infrastructure and equipment in order to be well managed, effective and efficient.

In practice, there are several obstacles faced by hospitals in managing their assets, especially in terms of maintaining medical devices that require huge costs. Hospital asset budgeting, especially for medical devices, is very vulnerable to fraud because every year there will be assets budgeted to meet the needs of each unit in the hospital [5]. In order to help the hospital management to manage assets of medical equipment and non-tools medical treatment properly, effectively and efficiently, it is necessary for hospitals to have support in the form of application software, which is able to assist the hospital in managing assets. PT Nuansa Cerah Informasi (NCI), an Indonesian software developer company, which engages mainly in healthcare industry, see this opportunity to develop asset management system for healthcare as its new product.

This research first focuses on the design thinking approach as a method for producing information technology innovations that focus on "Human Centered Design". Design thinking has shown its potential to produce innovative, user-centered design concepts and is widely used by consultants such as IDEO. The right integration of the design thinking process can result in software development with creative ideas and product-market fit solutions.

In order to introduce the Design Thinking concepts into common IT development models, the Nordstrom model was chosen where it includes Lean Startup and Agile for developing new software products [3].
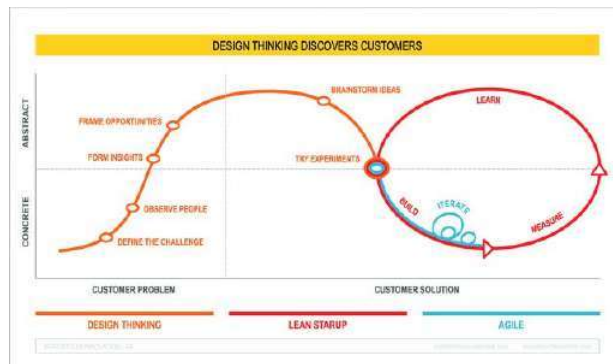
Fig. 1 the Nordstrom model [3].

Lean startup is a new approach of entrepreneurship that advocates building the product iteratively and deliver to the market for earlier feedback [8]. Applying Lean startup methodology helps established company to build the right product and to find the right market segment faster by wasting elimination and continuous flow [24]. This study aims to explore the pains and gains of Indonesian hospitals regarding asset management tasks and to propose a rapid new product development of asset management system for healthcare through Design Thinking and Lean Startup approaches.

II. METHODOLOGY

The research was conducted through qualitative approach as the occurred problem requires exploration based on the customer's point of view. Qualitative approach unlocks the opportunity to dive deeper to the thought and opinion of the respondent to get a better understanding through first-hand experience, truthful reporting, and quotations of actual conversations.
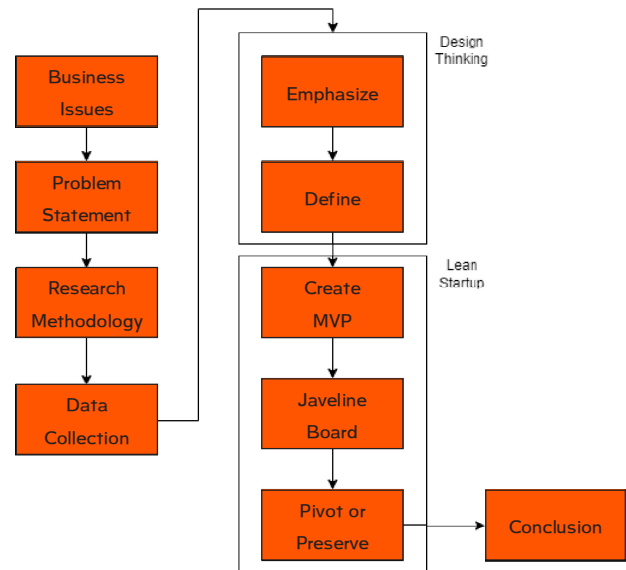

Fig 2. Research framework.

The research starts with practices of Design Thinking to find out the needs of users, identify problems and propose solutions to be built in the next step. The Empathize stage of the Design Thinking process involves developing a sense of empathy towards the user who is going to be using the final product. FGDs were conducted with six Indonesian client hospitals of NCI separately with the total of 13 participants from various departments which correlated with asset management in the hospitals; Facilities and infrastructure department; Financial department; IT department.

After information gathered from the FGD, the second step of the design thinking process is Define. Define is about synthesizing the findings into powerful insights in order to bring clarity and focus to the design space. This step begins with analyzing the information gathered from the FGDs and understanding about the experience of the users. Then, synthesizing the analysis is done with the output of the list of features that are able to solve the problems faced by customers. The MVP Ideation is done through brainstorming that was followed by development team of PT NCI to see the problems from different perspectives in order to build the solution.

After the MVP is developed, the next step is to collect feedback from target customers. In this research, the mockup MVP is demonstrated through a short presentation to 10 participants from 6 different hospitals through online meetings where the functionality of each page was explained to obtain feedbacks.

III. RESULTS

A. Design Thinking

Based on the FGDs result there are several pain points of the existing asset management that respondents are currently facing in their daily tasks that is illustrated in Figure 3. The most extreme pain point is the inability to report accurate asset information that could impact the evaluation of hospital operations. Regional hospitals are responsible to report their assets list and valuation to the government as the asset procurement is funded by public tax, making their asset as part of regional property. Several regions in Indonesia have their own regulations to regulate the assessment of regional property and the procedures for their elimination. To control the regional property, at least once a year there will be audit that take place in regional hospital where asset information clarity is being checked. Misalignment of asset clarity will be taken seriously as it is vulnerable to fraud. The FGDs result generated four gains expressed by the respondents as shown in Figure 3. This is in accordance with a finding that there is a tendency that customers find it difficult to express their needs in a product accurately.

practice in hospitals by providing status updating access for different departments in the hospital that have intersections with assets. The system will be equipped with automatic preventive maintenance reminders as the pain reliever of unscheduled maintenance. This feature will also reduce the risk of asset breakdown which contributes to over budgeting. The last pain reliever for the MVP is asset location traceability which is expected to improve the problem of scattered assets.

The most essential customer gain based on the FGD result is the transparency of asset data. From the results of the brainstorming, there are three gain creators for the MVP idea. The first gain creator is remote accessibility, in which users are able to access asset information through multiple devices such as mobile phones or PC wirelessly through the web-based system. Not only limited to monitoring asset status, users will be able to update asset status and location through these devices. To fasten the process of asset identification, each asset will be equipped by QR code or RFID tags as identification code that will be quickly identified through scanning from mobile devices.

Fig 3 Customer profile

Fig 4 Value proposition

'Transparency of asset data' is categorized as the most essential. With the current practice of asset management in hospitals which utilize sheet form and Microsoft Excel to store asset information, it requires a lot of time and effort to access asset information when needed for reporting purposes.

To build the solution, Value Proposition Canvas is used to map steps that can be taken to make users complete their functional work through gain creators and pain relievers in product & service offered. To overcome the biggest pain, the MVP of the system will be equipped with a feature to generate reports easily. In providing the accurate asset information, an integrated database must be built as a library to gather real-time status of asset information. This integration will eliminate the pain of scattered asset data collection that is faced by current asset management

B. Lean Startup

From the identified points of pain relievers and gain creators based on Design Thinking process, a mock up minimum viable product (MVP) is built. In software development businesses, MVP can also be used to support the design process, bridge communication gaps and facilitate cost-saving activities [1]. In this research, a mockup MVP of asset management systems for healthcare facilities is developed to represent the functionality of the real system through user interface. Features within the mockup MVP are built based on the customer's highest pain and gain that are explained in the previous section

a. Asset List Page: Page containing information on every asset owned by the Hospital such as Asset ID, Category, Brand, Amount, and Price.

Fig 5. Asset list page

Fig 8. Asset maintenance information page

b. Asset Report Page: Feature to generate reports automatically from the system in PDF or Excel format.

Fig 6. Asset report page

c. Asset Information Page: Detailed information of each asset can be stored on this page such as Asset name, Asset ID, Brand, Price, UMDNS and other records.

Fig 7. Asset information page

d. Asset Maintenance Information Page: Feature where users input maintenance requirements/asset calibration such as maintenance type and interval to the database. This feature generates an automated notification of asset maintenance reminders to responsible staff through email.

e. Preventive Maintenance/Calibration Schedule Page: Page to show information on asset maintenance schedules, details of actions, and maintenance status whether it is carried out or not.

Fig 9. Preventive maintenance page

f. Repair Schedule after Damage (Corrective Maintenance) Page: A page that allows maintenance staff to see what repairs need to be made in the future.

Fig 10. Corrective maintenance page

g. Asset Dashboard Page: The main page contains a summary of hospital asset information starting from the asset value, value for each category, and the maintenance costs that have been spent.

Fig 11. Asset dashboard page

After conducting an MVP test through mockup presentations, there are 12 points of feedback from the customers that should be followed for the next stage of development. The feedbacks are then group to five aspects:

1. User interface: The system is expected to have a simple interface that focuses on what is contextually important, reducing text, and creating an instantly recognisable image.

2. Features: Some suggested features to be added range from 'Request of Maintenance', 'Asset Depreciation', and 'Generate Kemenkes Maintenance Form'.

3. Security & Accessibility: The hospital asset management system is desired to have a limitation of access for different departments within the hospital management to provide safer data security.

4. Language: Bahasa Indonesia is more preferable to be used in the system to reduce the misunderstanding from the language barrier.

5. Pricing: The final product price is expected to be not as expensive as hospital information system product.

IV. DISCUSSION

After conducting FGDs with six hospitals in Indonesia as the target customer, there are several pains and gains that are identified within the current practice of asset management in hospitals. The most extreme pain point is the inability to report accurate asset information. It was discovered during the FGD that every hospital, particularly regional hospitals, have an obligation to report the total asset value to the regional government at least once a year. All of the six hospitals participating in this research revealed that they have not provided accurate asset value due to the difficulty in managing hundreds to thousands of assets. The misaligning information could lead to the investigation of Badan Pemeriksaan Keuangan Republik Indonesia which will affect the hospital evaluation, accreditation, and reputation. Private hospitals

also have a responsibility to value their asset value to the shareholders. Based on the customer gains, the most desired gain is the transparency of asset data. In current practice, the asset information is not integrated and scattered in different departments in hospitals. Causing inefficiency of time and effort when specific asset information is needed.

V. CONCLUSION

This study explored the challenges faced in the current asset management practice in Indonesian hospital by applying the Nordstrom Model to IT development. This paper makes several contributions. First, it examines the pains and gains in Indonesian hospital asset management. The importance of asset management system in Indonesian hospital is accordance to the finding that the medical equipment maintenance service becomes a priority for the hospital managers to reduce the cost and the dependency on external parties while ensuring that the medical devices are safe, accurate, and operating at the required level of performance [9]. The second contribution is that using the Lean startup principles as the framework, we provide the basic product-market fit example guideline for future development of asset management system for healthcare industry. The successful use of mock up MVP in this study supports finding that MVP bridges communication gaps between entrepreneurs, developers, customers and facilitate the cost-saving activities in software development [1].

We envision a future study which will investigate in-depth the next iterations of Agile development of this system. Moreover, a comparative study on the companies that have used Lean startup and conventional software development is put into the next agenda.

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