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Service system design for A.I. Laboratory: A Service Science Perspective

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Abstract - **Telkom has recognized the importance and benefit that Artificial intelligence (A.I.) has in developing today's industry 4.0 era and relevant across various fields of study. Hence, through Indonesia Telecommunication and Digital Research Institute (ITDRI), they are developing an A.I. laboratory. This lab is the first in Indonesia that is equipped with NVIDIA DGX A-100, a device specifically designed to handle A.I. workloads, which will be used to support research in the lab. In order for the use of this lab to be effective, well known, and had impact for the company, a service system is needed that will support activities in this lab. This paper will examine how the framework of service science can be used to design a service system to optimize the business unit. Through external analysis (PEST, Porter 5 Forces, SWOT), internal analysis (in-depth interview, lean canvas, service blueprint) & determining root cause analysis that will produce a business solution. This research showed that a value co-creation and value orchestration platform from a service science perspective would be suitably applicable for the A.I. laboratory. The proposed solution to improve the A.I. lab are variative bundle package, teaching module, online platform, value exchange, etc.**

Keywords – **service science, artificial intelligence, laboratory, industry 4.0**

I. INTRODUCTION

The advancement of technology today has resulted in the emergence of artificial intelligence (A.I.), which has become an important factor that revolutionizes the way things run in various fields and aspects. This importance of A.I. has been considered based on the advantages that it brings, as it reportedly could increase productivity and address multiple problems in various sectors [1], [2]. In particular, A.I. can provide automation, visual recognition, control, and identification of problems in everyday life [3].

Telkom Indonesia (Persero) Tbk, realized this importance of acquiring Artificial Intelligence (A.I) as the supportive tool for developing innovation in knowledge, data, and Internet of Things (IoT), as a foundation to support Indonesia to facing advanced technology [4]. Therefore, Telkom through its advanced technology research (ATR) division in Indonesia Telecommunication and Digital Research Institute (ITDRI) is developing an A.I. laboratory a form of realization of their theme and strategy advanced in 2020, which is "Digitizing The Nation To Create Opportunities, one of Telkom's". In particular, this lab supports all kinds of research that will be needed by the customers. The lab is also supported by NVIDIA in terms of the development and facilities.

Systems Engineering and Service Management (SSME), is an emerging multidisciplinary approach to managing and designing values in conjunction with the building of service systems. This field and area of research was introduced to transform how we view and define a system from a holistic view to a comprehensive view that focuses on consumers or passengers at the same time [5]. SSME and the terms service science is often used interchangeably as service science is referred as the short term for SSME [6].

As a field of study, service science itself is an emerging area which draws on various early works from the field of service marketing, service operations, service management, service engineering, service economics, service computing [7], [8]. From these studies, service science introduces a new perspective of defining the term service. Service science defines service as an observable phenomenon in the shape of a service system where value co-creation interactions among entities occur [7], [9]. Value co-creation is defined as the process through which each collaborator jointly creates value or profit via resource integration and cooperation [10], [11]. Hence, the relations can be viewed by taking into account the multiple and various entities that are part of a service system, including people, businesses, non-profits, government agencies, and even cities.

However, the program offered within and from the A.I. laboratory is still unclear and needs to be developed. Meanwhile, the A.I. laboratory holds a critical aspect in supporting Telkom's theme to be made concrete, and to contribute significantly to the creation of skilful talent and take part in the development of technology in Indonesia. Therefore, a clear program for the A.I. laboratory is needed. Encouraged by this background, this paper tries to investigate and provide solutions on how Telkom can develop the A.I. laboratory through the perspective of service science. Based on the objectives of the research above, then some research questions are proposed to find the factors involved in the A.I. laboratory development and

finding the alternative solution should be conducted to improve the A.I. lab from service science perspectives.

II. METHODOLOGY

A. Research Design

In order to support the research, this research used a qualitative research method. Qualitative approach is appropriate for this study since it can analyze and provide an in-depth understanding of complex phenomenon being investigated in its natural setting. The theoretical and conceptual framework explains the path of a research and grounds it firmly in theoretical constructs [12], [13].

B. Data Collection Method

To conduct this study, the data were from primary which were collected through a focus group discussion. The informants were selected thro Telkom's senior general manager, field supervisor and lab researcher, three academicians, 12 students and 5 industry practitioners. The diverse informants were selected to provide a holistic view of the service system from both the consumers and providers side. In addition to the primary data, secondary sources such as company reports and literature reviews is used to complement the primary data.

C. Data Analysis

The collected data were then followed with two analyses, which are internal environmental and external analysis. Once the internal and external analysis, swot analysis is conducted before finally proposing the solution. The overall research framework of the study is illustrated in the figure below.

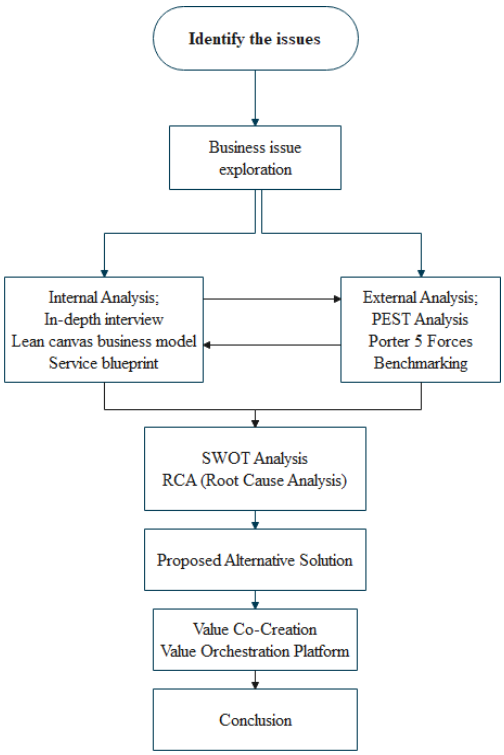

Fig. 1. Research design

Business issue exploration to determine the main problem of A.I. Lab, classified using five sections in this report. The first one is Internal Analysis which contains in-depth interview, lean canvas analysis and service blueprint, to identify factor that needed in developing lab. The second one is external analysis, which contains PEST analysis, porter 5 forces and benchmarking. After the internal and external analysis has been conducted, the third step is SWOT analysis, including Root Cause Analysis to find the root of problem. Afterwards, the author proposes the alternative solution, value co-creation, value orchestration which will answer research question number two which will lead to the conclusion.

III. RESULTS

A. Internal Environment Analysis

Based on the blueprint analysis, the author identified 3 fail points that were a problem in the blueprint activity, as explained at the table below

TABLE I
FAIL POINTS ANALYSIS

NO.	FAIL POINTS	ANALYSIS
1	Time consuming on proposal	**Description:** The process on proposed collaboration is takes quite a long time before it approved. User/customer who wanted to use the lab can't use the lab immediately because must passed this bureaucracy first. Category: Uncontrollable factor
2.	Had difficulty in research	**Description:** Sometimes users/customers who wanted to use this lab to added an A.I. feature, have difficulty implementing their ideas into the machine. It takes some expertise to help translate ideas into programs and operate this machine. Category: Controllable factor
3.	Limited of human resource and machine	**Description:** Another problem identified was the support process; currently, ITDRI has not enough researchers or expertise in this field to accommodate or to run this lab. This has an impact on service disruption. Therefore, the addition of human resources, as well as other supportive tools is important. Category: Controllable factor

For the lean canvas analysis of the A.I lab, the results are presented in the following figure:

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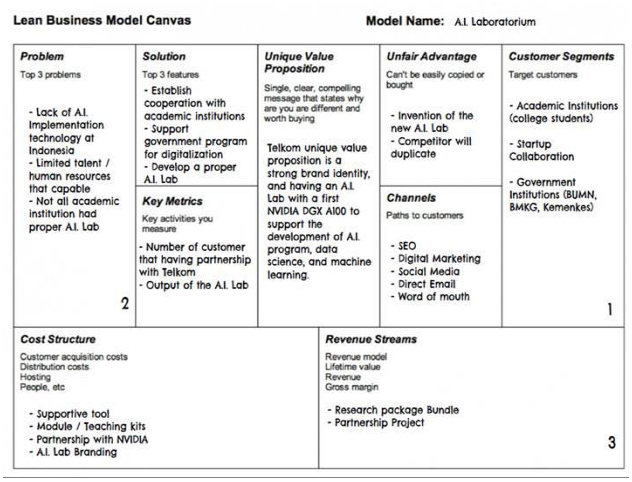

Fig. 2. Lean business model canvas

As for the interview analysis, the results show that according the Telkom management, they have an opportunity in building this lab, but they still have problems with limited talent and their own machines. They hope to be the first to conduct value exchange programs with customers

From the customer's point of view, they all agree on the construction of this lab, but they also hope that the lab is really ready with inter-campus collaboration so that they can include the activity in their credits. They also expect adequate facilities and if possible, they would like the laboratory to have an interesting appearance and a learning program that results in a profitable certification for them.

Functional Strategy

Functional Strategy, according to Wheelen, Thomas L., is an approach a functional area takes to achieve corporate and business unit objectives and strategies by maximizing resource productivity. That is concerned with developing and maintaining a distinctive competence to provide a company or business unit with a competitive advantage (2012, 238).

This strategy is an approach to the functional area to achieve company and business unit goals by maximizing resource productivity. The functional strategy created for the A.I. laboratory is from the SWOT analysis that researchers conducted in the previous chapter. The SWOT analysis is then extended to the TOWS Matrix.

TOWS Matrix analysis is a tool that examines external opportunities and threats faced by certain companies that can be matched with the strengths and weaknesses of A.I. laboratory services. The TOWS matrix for the lab is presented below:

TABLE II
TOWS MATRIX

TOWS MATRIX	**STRENGTH** 1. Leading provider of IT and communication in Indonesia 2. Wide product and service offerings 3. Having its first advanced supportive tool for A.I. in Indonesia 4. Growing customer base 5. Strong brand identity	**WEAKNESSES** 1. Limited resources of supportive tool devices 2. Lack of necessary input data 3. Limited talent / human resource 4. Not yet establish cooperation with other parties
OPPORTUNITIES 1. Become a leader in the field 2. The development of information technology is growing rapidly 3. Next level advanced technology in Indonesia 4. The high number of potential users of the lab	**Strength – Opportunity** 1. Developing new business product for A.I. laboratory (S1, S2, O1, O2, O3) 2. Creating a proper A.I. laboratory with advanced facilities in it (S3, S4, O3, O4)	**Weaknesses – Opportunity** 1. Establish cooperation with potential users for the advance A.I. lab especially at academic sector (W1, W2, W3, O1, O4) 2. Create a new line business for this lab (W4, O3, O2)
THREATS 1. Legislation and policy at Indonesia 2. Personal data abuse 3. More competitor will play in this field 4. A.I. remains inhuman	**Strength – Threat** 1. Supporting government program for digitalization to benefit each other (S1, S2, T1, T2) 2. Having a competitive advantage to compete in this field (S3, S4, T3, T4)	**Weakness - Threats** 1. Develop lab with its own advantages containing renewable technology facilities and good talent who can operate the A.I. lab (W1,W2,T3,T4)

Several strategies can be applied to A.I. laboratory at Telkom Indonesia based on the TOWS matrix table above. The strategy was developed after examining strengths, weaknesses, opportunities, and threats. Next step is figure out which strategy is best for the current business problems. The following is an explanation of each strategy that was discovered:

1. **Strength and Opportunities (SO) Strategies**
   - Developing new business product for A.I. laboratory

To achieve the desired target, Telkom can start to create a new business for A.I. laboratories. For this project, making a business model is the right thing to support this strategy.

- Creating a proper A.I. laboratory with advanced facilities in it

By establishing an A.I. laboratory, Telkom has started to follow the development of advanced technology. Thus, creating a lab equipped with renewable machines and technology, such as the steps taken (buying NVIDIA DGX A100) and completing supporting equipment, will give Telkom a competitive advantage.

2. Weakness & Opportunity (WO) Strategies

- Establish cooperation with potential users for the advance A.I. lab especially at academic sector

By cooperating with various parties, Telkom can start a new step in the development of this lab. For this reason, by offering several facilities and services in this lab, the lab will get users who are right on target. Also, by working with the education sector, Telkom takes part in developing high-quality Indonesian talents in the fields (A.I.)

- Create a new line business for the lab.

By creating a new business line, Telkom's opportunity to steal a start in the development of A.I. this lab is wide open. Besides, a structured business model will assist in the operation of the A.I. lab.

3. Strength – Threat (ST) Strategies

- Supporting government program for digitalization to benefit each other

By supporting the government's national strategy program for digitization, Telkom can take part in the success of the program initiated by President Joko Widodo. If what Telkom has done is successful, the government can make regulations that are also beneficial for the development of A.I. in Indonesia.

- Having a competitive advantage to compete in this field

By having advantages over other labs such as machines with renewable technology, an attractive package, of course, will be a differentiator for Telkom to compete in the development of this laboratory.

4. Weakness – Threat (WT) Strategies

- Develop lab with its own advantages containing renewable technology facilities and good talent who can operate the A.I. lab

With good talent, even A.I. remains inhuman, the program can run smoothly because even though we input data into machine learning, in the future this will be of great help to humans, therefore the development of this lab is vital. Having advantages and distinctions is an advantage for Telkom.

Alternative Solution Based on Root Cause

As explained in the previous chapter in the root cause analysis that the factors that contribute to inefficient use of A.I. lab are policy, procedure, people and factory factors so that problem solving is needed to improve services efficiently in A.I. laboratory, as explained in the table below:

TABLE III
ALTERNATIVE SOLUTION BASED ON ROOT CAUSE

No.	Factor	Causes	Root Causes	Solution
1	Policy	Focus on basic services	Not based on service science approach Have not explore the market widely	Implementation of A.I. lab services based on service science approach and creating a lean model canvas to define the needs of the lab.
2	Procedure	Unclear service standard	Time consuming on proposal No module/teaching kit yet	Create a standard operational procedure and preparing the module by joint-collaboration with academic institution.
3	People	Limited researchers & expertise in this field	People still think industry 4.0 far ahead	Hold a socialization program through public lectures on campus, advertisements, and social media, regarding how close Indonesia is to entering the industrial era 4.0
4	Plant	Lack of A.I. implementation	Limited machine and resources	Create an agreement with other cluster of BUMN who are members of the penta-helix program to support the procurement of goods, and preparing additional people who had competency in this laboratory.

Value Co-Creation Process in A.I. Lab Services

In the process of creating value co-creation in the A.I. lab services, there are four process phases that need to be identified between the customer and the provider, namely the process of co-experience, co-definition, co-elevation and co- development [14]

Co-experience and co-definition process

In co-experience process, customers need to understand about A.I. lab services, while providers need to provide all of components about laboratory services. For example, through the process of making a website and also search engine optimization, Telkom can create a platform that contains about this laboratory. This is an effort to make it easier for users to interact with lab providers. And in the exploration process, it is hoped that students and other parties will be interested in trying this lab, because of the

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attractive appearance, attractive learning packages, and supporting lab facilities.

Co elevation process

In this process the customer has more expectations for the provider and the provider provides based on his ability. This process is a two-way positive interaction in which increased expectations result in improved service quality (needs-pull) [15]. For example, a laboratory provider provides a guarantee of service quality by providing a program that which can support their knowledge needs. For example, after a special website or application for this lab, there is a link to register online, this makes it easier for them to submit proposals. In addition, it is hoped that this lab can provide several research packages, which will later be divided into 3; basic service: research with existing programs and only borrowed machines, educational service: internship program as a researcher for several periods of time which can later be converted into the value of their courses. Training service: opens opportunities for those who are already working to get opportunities in short-term training programs to increase their skills, and the expected output is a certification that can be downloaded online.

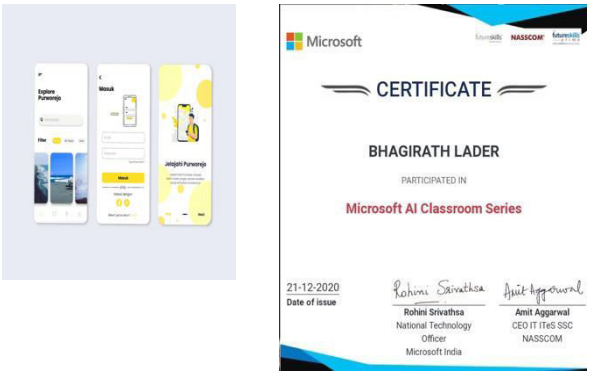

Fig. 3. Variative packages and certification.

Co-development process

In this process, paying attention to the innovations produced by the service. Usually the customer evaluates and assesses the value generated by the provider. For example, From the learning process that has been carried out, it is hoped that they can create ideas, data, or something that can be useful for the campus and for Telkom. This is because ITDRI wants a value exchange between the two parties so that they are mutually beneficial. If there is a strategic collaboration between campuses and Telkom, it is not impossible that providers can establish laboratories at universities that have been collaborated before.

Fig. 4. Value exchange between provider and customers.

Value Orchestration Platform A.I. Lab Services

In developing this laboratory program, a platform needs to be made with value co-creation process as its foundation. There are three categories as concrete steps of orchestration platform values, namely involvement, curation and empowerment strategies [15], [16]. The figure below is an important scheme in the strategy that can be used to strengthen the achievement of the value co-creation process.

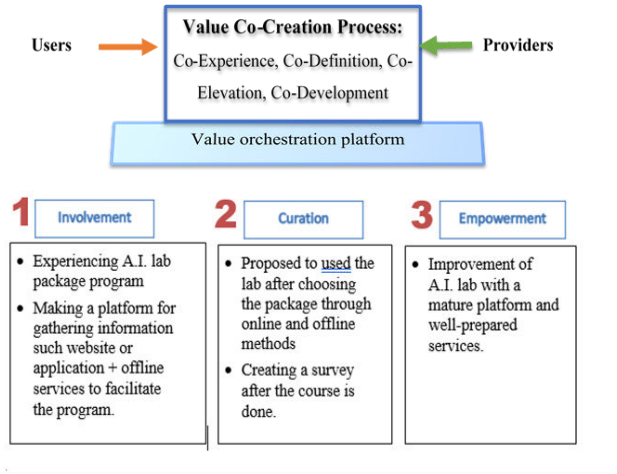

Fig. 5. Value co creation & orchestration platform.

By developing this A.I. lab package program, Telkom especially ITDRI can involve students, academic institution, and the other BUMN cluster. Academic institution can help provide input from every aspect of the A.I. lab program such module and teaching kits, while students involvement is related to the program activities such as making a platform in a form of an application or offline service.

The value co-creation process in the platform including its strategies will be elaborated below:

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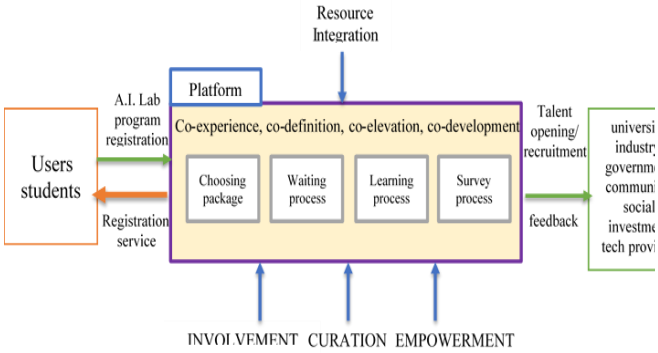

Fig. 6. Value co-creation process

IV. DISCUSSION

Proposed Business Model

After analysing and filling in the lean business canvas, internal analysis, external analysis, and making the TOWS Matrix, we must determine the business model to be used. A business model is a model that describes the rationale for how organizations capture and create value [17]. The proposed business model is based on analysis of three parts. The first is build-on core which contains what the core product is, how the product produces and delivers value. The second is complement, containing what the product must have in order to complement each other, how to relate to the product, and who is sending the complement. The last one on this part is boost & defend, which contains how we can boost demand & supply for the complement, which is in the second line of the table, and what makes the product so hard to copy.

Based on the analysis that has been carried out, the proposed business model that can be used is as follows:

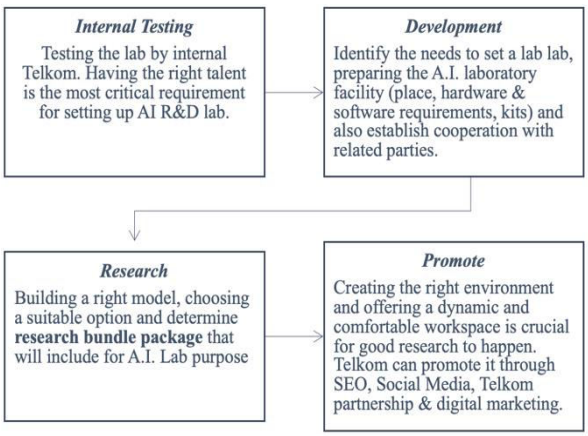

Fig. 7. Proposed business models.

Proposed Blueprint Activity of A.I. Lab Service

To be better than existing service, a blueprint activity is needed to support the service. This Blueprint will provide an overview of all activities in detail from the back-stage, front stage, support processes, customer activities and customer interactions with field officers and technology at A.I. lab services. The Blueprint activity on the A.I. lab is explained in figure below:

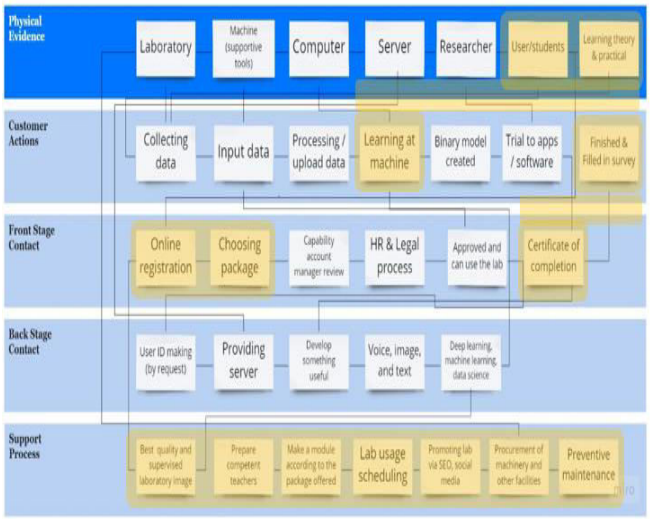

Fig. 8. Proposed service blueprint.

Based on the service blueprint in figure above, there is a difference in service blueprints compared to existing A.I. lab service blueprint activities, that is online registration dan choosing package. Here the user can choose the research package to be carried out, and also register on the platform that has been provided. During the waiting process, they can monitor where their file process has arrived. After getting approval, the user can learn theory and practice directly on the machine according to the available modules. After completing the program, users are required to fill out a survey or feedback column to get a certificate of completion for their participation in trying and studying at A.I. this lab. For students, it is hoped that the study program here can be converted into a credit for their chosen course at the university. As for the workers, it can be a plus for them in developing A.I. skills. them and can be included in the CV. In the support process, several things need to be considered, such as preparing teaching staff, making modules, scheduling labs, procuring machines and other needs, carrying out preventive maintenance and promoting this lab through SEO, social media, etc.

V. CONCLUSION

The research was conducted to answer research questions related to factors involved in the A.I. laboratory development and optimizing laboratory that are still minimally used with qualified facilities. Author concluded factors involved in the development of A.I. this laboratory consists of the government, technology providers, communities, universities, users/customers and also industries that play a role in digitizing Indonesia. With the collaboration between the 5 parties, it is hoped that it can help Telkom Corpu in developing research and innovation. To evaluate and assess business prospects, the author used two primary analysis activities: internal analysis illustrate the supplier side and external analysis

for the consumer side. The internal analysis used blueprint activity, lean business model canvas analysis, qualitative data analysis from the interviews, and root cause analysis, while the external analysis compromised of PEST analysis, Porter 5 Forces, and benchmarking. The best alternative approach for optimizing the laboratory which has not been taken advantage of that much is to offer the service in three packages. The packages are namely basic, educational, and short-term training. This solution was approached using the service science approach which focuses on by co-creation value principles and value orchestration platforms. In addition, to make the business ideas clearer and more comprehensible, as well as to realize a premium, efficient, and optimal A.I. laboratory business service, and give better services to users. The author conducted a SWOT analysis and offered strategies based on the results of the TOWS matrix study. SWOT analysis was also used to get a clearer and more understandable of business concepts, and to carry out a premium, efficient, optimal and better A.I. lab service business for the customers. In addition, the TOWS matrix results analysis was referred to for proposing the appropriate strategic solution for the A.I. Laboratory. Financial projection and number of human resources, machines, and supporting tools needed cannot be disclosed in this paper since it the company's confidential data.

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REFERENCES

[1] Strusani, D., & Houngbonon, G. V. (2019). The Role of Artificial Intelligence in Supporting Development in Emerging Markets. *EM Compass*, *69*, 5. www.ifc.org/thoughtleadership%0Ahttp://hdl.handle.net/10986/32365

[2] Mou, X. (2019). Artificial Intelligence : Investment Trends and Selected Industry Uses. *EMCompass Notes*, *71*, 8. https://openknowledge.worldbank.org/handle/10986/32652

[3] Yogaswara, R. D. (2019). Artificial Intelligence As an Activator for Industry 4.0 and Its Challenges for Government and Private Sectors. *Jurnal Masyarakat Telematika Dan Informasi*, *10*(1), 67–72.

[4] Almada-Lobo, F. (2016). The Industry 4.0 revolution and the future of Manufacturing Execution Systems (MES). *Journal of Innovation Management*, *3*(4), 16–21. https://doi.org/10.24840/2183-0606_003.004_0003

[5] Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. Journal of Interactive Marketing, 18(3), 5–14. https://doi.org/10.1002/dir.20015

[6] Maglio, P. P., Vargo, S. L., Caswell, N., & Spohrer, J. (2009). The service system is the basic abstraction of service science. Information Systems and E-Business Management, 7(4 SPEC. ISS.), 395–406. https://doi.org/10.1007/s10257-008-0105-1

[7] Maglio, P. P., & Spohrer, J. (2008). Fundamentals of service science. Journal of the Academy of Marketing Science, 36(1), 18–20. https://doi.org/10.1007/s11747-007-0058-9

[8] Barile, S., Spohrer, J., & Polese, F. (2012). Editorial Column—System Thinking for Service Research Advances. Service Science, 2. https://doi.org/10.1287/serv.2.1_2.i

[9] Ng, I., Maull, R., & Smith, L. (2011). Embedding the New Discipline of Service Science. April, 13–35. https://doi.org/10.1007/978-1-4419-8270-4_2

[10] McColl-Kennedy, J. R., Vargo, S. L., Dagger, T. S., Sweeney, J. C., & van Kasteren, Y. (2012). Health Care Customer Value Cocreation Practice Styles. Journal of Service Research, 15(4), 370–389. https://doi.org/10.1177/1094670512442806

[11] Vargo, S. L., & Lusch, R. F. (2004). Evolving to for Logic Marketing. The Journal of Marjeting, 68(1), 1–17. https://doi.org/10.1300/J047v07n04_02

[12] Basias, N., & Pollalis, Y. (2018). Quantitative and qualitative research in business & technology: Justifying a suitable research methodology. Review of Integrative Business and Economics Research, 7, 91-105.

[13] Adom, D., & Hussain, Emad.Kamil. and Joe, A. . A. (2018). THEORETICAL AND CONCEPTUAL FRAMEWORK : MANDATORY INGREDIENTS THEORETICAL AND CONCEPTUAL FRAMEWORK : MANDATORY INGREDIENTS Engineering Dickson Adom * Emad Kamil Hussein. International Journal of Scientific Research, 7(1), 93–98. https://www.researchgate.net/publication/322204158%0ATHEORETICAL

[14] Galbrun, J., & Kijima, K. J. (2009). A co-evolutionary perspective in medical technology: Clinical innovation systems in Europe and in Japan. Asian Journal of Technology Innovation, 17(2), 195–216. https://doi.org/10.1080/19761597.2009.9668679

[15] Kijima, K., & Arai, Y. (2016). Value Co-creation Process and Value Orchestration Platform. 137–154. https://doi.org/10.1007/978-1-4939-3594-9_10

[16] Goda, K., & Kijima, K. (2015). Servitization of Machine-Tool Trading Company to Value Orchestration Platform: Visualization of Japanese Integral-Modular Strategie. Journal of Service Science and Management, 08(03), 349–364. https://doi.org/10.4236/jssm.2015.83037

[17] Štefan, S., & Richard, B. (2014). Analysis of Business Models. 6(4), 19–40. https://doi.org/10.7441/joc.2014.04.02