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Price Identification And Financial Feasibility Study of Hydroponic Agriculture Iot Solution Launch Project at PT XYZ

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Abstract

Since 2015, the Internet of Things technology has grown significantly, reaching over 400 million users by 2022 in Indonesia. Recognizing the potential, PT XYZ, an innovative Indonesian telecommunications company, intends to launch an IoT solution for hydroponic agriculture. The launch project requires an initial investment of around Rp 500 million. Given that amount, PT XYZ aims to determine the selling price using a value-based pricing strategy and assess the project's financial feasibility and risks before proceeding. Primary and secondary data will be utilized in this research to determine the customer's willingness to pay (WTP), Capital budgeting cash flow, which includes the hypothetical price of IoT, calculating the weighted average cost of capital (WACC), free cash flow to the firm (FCFF), and terminal value. The study used various capital budgeting techniques, such as net present value (NPV), profitability index, payback period, internal rate of return (IRR), and Excel's goal seek feature, to determine the IoT solution's pricing. A risk analysis using sensitivity and Monte Carlo simulations have conducted. The research finds that the present value of benefits, or WTP, for the IoT solution, is Rp 90,708,238. Considering PT XYZ's targeted internal rate of return of 20%, the determined selling price is Rp 20,120,408, which lies within the customer's WTP, making the project feasible. Capital budgeting techniques show a payback period of 4.08 years, an NPV of Rp 3,424,935,505, and a profitability index of 8.21 over five years, indicating positive outcomes. However, the sensitivity analysis reveals that a change in product price, cost of goods sold, and salary expenses will significantly impact the NPV, resulting in a 12.69% risk, with profitability remaining high at 87.31%. In conclusion, PT XYZ's hydroponic agriculture IoT solution launch project is considered feasible, considering potential risks and mitigation strategies.

Keywords: Capital Budgeting; Internet of Things; Risk Analysis; Willingness to Pay.

A. INTRODUCTION

The Industrial Revolution 4.0 is a significant shift in how humans process resources to produce goods in various industries, including transportation, manufacturing, and agriculture. The current iteration (4.0) emphasizes the integration of automation and cyber technology, focusing on cyber-physical systems—advanced information technologies like cloud computing and cognitive computing aid this technology. The Internet of Things (loT) is one of the main pillars of Industrial Revolution 4.0, connecting the global internet to industrial production lines. A Procter & Gamble employee first introduced the term loT named Kevin Ashton. However, the term Internet of Things that he once introduced is a notion where computers and the internet rely on humans for gathering information (Ashton, 2009).

Meanwhile, the loT term right now is considered a technological revolution in the form of a network for physical things that enables connectivity to the internet in order to transmit and receive data across platforms. The loT combines sensor devices, connectivity, data processing, and user interfaces, enabling communication and data exchange without human interaction. loT is closely related to machine-to-machine (M2M) technologies, such as smart watches, smart homes, and home robotics. Since its introduction in 2015, IoT usage has rapidly increased, particularly during the COVID-19 pandemic. The number of global active loT connections reached 14.4 billion connected devices in 2022 and is expected to reach 16.7 billion users by 2023 (Sinha, 2023).

In Indonesia, smart homes and smartphones are driving the growth of loT. As the number of smartphone users expands, so does the number of loT devices. The government has supported IoT development in Indonesia through the program "Making Indonesia 4.0: Fourth Industrial Revolution (4IR)" since 2018, aiming to accelerate Indonesia's vision of becoming the 10th largest economy globally. The 4IR (Fourth Industrial Revolution) focuses

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on implementing advanced technologies like AI, wearables, robotics, 3D printing, and the Internet of Things in five priority sectors, including food and beverage and electronics. As stated in Buku Putih Indonesia ICT Industry Outlook 2021, the number of loT users in Indonesia exceeded 400 million devices, with a market share of 444 trillion rupiahs. The manufacturing and healthcare industries contributed the most to this growth, accounting for 18% and 17% of the total market share, respectively (Prasetya, Harsono, & Pratama, 2020). Businesses are increasingly adopting IoT devices to increase productivity and operational efficiency. Meanwhile, technology and telecommunications companies, such as PT XYZ, which has been providing Indonesian citizens with cellular and internet networks since 1996, use this opportunity to expand their service and offerings by actively developing IoT devices to help businesses optimize operations, increase efficiency, and generate value through integrated connectivity.

PT XYZ has created various loT solutions for various industries, including cold chain, urban planning, healthcare, livestock, and the agricultural industry. For the agricultural industry, they developed solutions for businesses that cultivate hydroponic plants, which require frequent monitoring of environmental factors like temperature, humidity, sunlight, pH, and nutrient levels. They have also conducted a proof of concept (POC) by installing the IoT device on a 1,000-square-meter hydroponic garden in Depok. The administrator of the hydroponic garden reported that the IoT solution increased output yields by up to 300kg per month, reducing the demand for fertilizer and possibly reducing the number of workers needed.

Recognizing the immense benefits of their IoT solution, PT XYZ is considering launching the Internet of Things (loT) solution for hydroponic agriculture to a larger market. Through comprehensive market research, PT XYZ has identified a significant market in Indonesia, with around 1,479 hydroponic businesses as potential customers. As stated by (Gofton & Ness, 1997) in their Business Market Research Book, a financial feasibility study allows a project manager to investigate whether the proposed project will yield positive or negative results before investing time and money into it: The financial feasibility study can be analyzed by using capital budgeting techniques (Leon, Isa, & Kester, 2008), consisting of payback period, net present value (NPV), profitability index, and internal rate of return.

Based on information from various sources, PT XYZ understands the significance of conducting a financial feasibility analysis before proceeding with its project in order to prevent any losses. However, this analysis is contingent on PT XYZ establishing the selling price for the lot solution. As a result, this research aims to assist PT XYZ in determining the price of the lot solution through a value-based pricing strategy. This will involve assessing the customers' willingness to pay for PT XYZ's hydroponic agriculture loT solution. Additionally, the research will evaluate the financial feasibility of PT XYZ's project to launch the loT solution for hydroponic agriculture. Furthermore, the study will identify and address any potential risks associated with PT XYZ's project for its hydroponic agriculture IoT solution.

B. RESEARCH METHODS

The researcher employed primary and secondary data sources to ensure a comprehensive and robust analysis. Primary data was gathered through interviews with PT XYZ's representative responsible for the launch project and the person in charge of the hydroponic garden in Depok to understand the benefits of loT solutions from the user standpoint. Additionally, extensive secondary data was utilized, including relevant data on the project from PT XYZ's representative, industry beta, inflation rate, risk-free rate, market return, and other relevant market data available on the internet to strengthen the research.

The data analysis will be conducted in four stages. The initial stage involves determining the customer's willingness to pay for the lot solution. Assumptions will be made to develop the cash flow before and after using the loT solution, along with calculations of incremental cash flow and the benefits present value (PV). The next stage focuses on determining the capital budgeting cash flow from PT XYZs perspective, using a hypothetical price value as an assumption for product price since the exact price will be determined in the next step. At this stage, calculating the cost of capital using the weighted average cost of capital (WACC), free cash flow to the firm (FCFF), and the terminal value is also part of the capital budgeting cash flow determination. The third stage will determine the loT solution price based on PT XYZ's targeted internal rate of return (IRR). This involves calculating the capital budgeting techniques and identifying the loT solution price from the financial model to achieve PT XYZ's targeted IRR. The loT solution can be determined by utilizing the Goal Seek feature in Excel.

In the final stage, the project's feasibility will be assessed by comparing the loT solution price with the customer's willingness to pay. If the customer's willingness to pay exceeds the determined price, it indicates that the target IRR can be achieved, making the project feasible for PT XYZ to pursue; otherwise, it may not be viable.

Finally, a risk analysis will be conducted using sensitivity analysis and Monte Carlo simulations of 10,000 times further to evaluate potential uncertainties and their impact on the project.

C. RESULTS AND ANALYSIS

Project Overview

PT XYZ, a telecommunications company, plans to expand its business by offering advanced technology to Indonesian businesses. Developed loT solutions for industries like cold-chain, healthcare, and agriculture have only reached the Proof of Concept stage. Currently, these solutions have not been introduced to the market. PT XYZ plans to launch one of its loT solutions, specifically the hydroponic agriculture solution, to generate revenue through sales to the designated market. The company will establish a collaborative partnership with a designated vendor to produce large quantities of loT solution devices, procuring the product annually to meet sales targets and maintain minimum order quantities. The process for executing the project will be as follow:

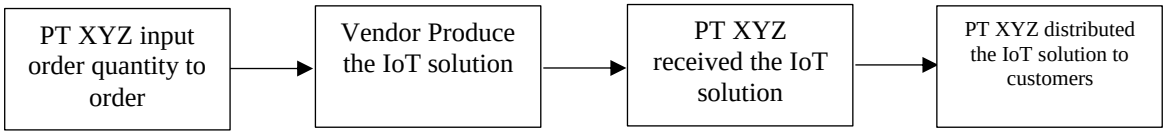

Figure 1. Project Executing Flows

PT XYZ has identified 1,479 hydroponic agriculture businesses in Indonesia as potential markets for their loT solution. The project aims to reach 20% of the market available in Greater Jakarta and Bandung within the first five years, allowing strategic resource management and sustainable expansion. PT XYZ already owns a Jakarta building with office space, workers, and funds and plans to employ five workers, including a Head of Project, staff members, and an IoT Engineer. Additional workers may be hired as needed. Regarding the initial investment, the project will require cash on hand, technical equipment, storage equipment, sales inventory, office rent, and salary for the first 3-mions of 2023, costing R p554,750.000.

Stage 1 — Determine Customer's Willingness to Pay (WTP)

The researcher aims to employ a value-based pricing strategy by assessing PT XYZ's customers' willingness to pay for the loT solution for hydroponic agriculture. This assessment will involve understanding customers' preferences and their perceived value of the solution from their perspective.

To assess the customer's willingness to pay, it is essential to calculate the present value of the benefits derived from the loT solution. However, conducting the present value calculation requires a discount rate on which the researcher does not have information. To overcome this, the researcher calculated the average weighted average cost of capital (WACC) of 10 companies in the agriculture industry. This calculation results in a discount rate of 16.12%.

Table 1. Present Value of Incremental Cash Flow

Present Value of Incremental Cash Flow (in Rp)					
Year	**1**	**2**	**3**	**4**	**5**
	39,170,760	24,327,921	23,862,399	23,373,264	22,859,545
Accumulated CF	**39,170,760**	**63,498,681**	**87,361,080**	**110,734,344**	**133,593,889**
Discount Rate	16.12%				
PV of Cash Flow	33,734,453	18,043,814	15,242,252	12,857,782	10,829,937
Acc. PV of Cash Flow	**33,734,453**	**51,778,267**	**67,020,519**	**79,878,301**	**90,708,238**
Total Benefit	**90,708,238**				

Sources: Research data, 2023

As seen in the above figure, the total benefit for the IoT solution is Rp90,708,238. This amount is the customer's willingness to pay towards the hydroponic agriculture IoT solution.

Stage 2 — Determine Capital Budgeting Cash Flow

In the previous stage, the researcher primarily focused on the customer's point of view because the intention was to determine the customer's willingness to pay. However, in the second data analysis stage, the emphasis will shift to PT XYZ's perspective. The data analysis will be conducted from the viewpoint of PT XYZ, considering their interests and objectives. Additionally, hypothetical price assumptions are used since the real IoT price will be determined in the next stage.

As mentioned before, this stage involves calculating the cost of capital of PT XYZ, which will be calculated using the weighted average cost of capital. Since PT XYZ only utilizes its capital for this project, the cost of debt is based on the average lending rate of the five banks PT XYZ usually uses, which is 7.37%. Meanwhile, the cost of equity is calculated by considering PT XYZ beta, risk-free rate, and market return of JKSE, resulting in 8.12%. Hence, the weighted average cost of capital for PT XYZ is 8.12%, and the capital budgeting cash flow can be seen in the figure below.

Table C.3 Free Cash Flow to The Firm

Free Cash Flow to The Firm (in Rp)						
	0	**1**	**2**	**3**	**4**	**5**
EBIT	(255,750,000)	8,048,937	29,166,134	53,929,731	82,836,779	116,446,631
Tax	-	1,770,766	6,416,550	11,864,541	18,224,091	25,618,259
NOPAT	(255,750,000)	9,819,703	35,582,684	65,794,272	101,060,871	142,064,889
Depreciation	-	6,152,167	6,152,167	6,152,167	6,152,167	6,152,167
Operating Cash Flow	(255,750,000)	15,971,870	41,734,851	71,946,439	107,213,037	148,217,056
Changes in Current Asset	144,000,000	186,546,859	38,492,661	42,975,187	47,979,710	(134,554,892)
Changes in Account Payable	-	98,630,137	11,485,622	12,823,140	14,316,413	15,983,580
Net Current Asset Investment	144,000,000	87,916,722	27,007,038	30,152,047	33,663,297	(150,538,472)
Net Fixed Asset Investment	75,000,000	-	-	-	-	-
Free Cash Flow to the Firm	(474,750,000)	(71,944,853)	14,727,812	41,794,392	73,549,741	298,755,528
Terminal Value						5,413,920,005
Total Cash Flow	(474,750,000)	(71,944,853)	14,727,812	41,794,392	73,549,741	5,712,675,533

Sources: Research data, 2023

Stage 3 — Determine IoT Solution Price Based on PT XYZ Targeted IRR

The previously calculated capital budgeting cash flow will be used to determine capital budgeting techniques, including payback period, NPV, profitability index, and IRR. The financial models developed at an earlier stage are crucial in setting the pricing of the loT solution. Initially, hypothetical prices were used in the calculations. However, the IoT price can be determined once the financial model for capital budgeting techniques is established.

To determine the optimal pricing for the loT solution, the researcher will use the Goal Seek feature in Excel, setting the IRR cell to 20% by adjusting the hypothetical price cell. This process identifies the appropriate price for the hydroponic agriculture loT solution to achieve the targeted internal rate of return of 20%, which is Rp20,120,408, with the payback period, NPV, and profitability index calculated as follows:

Table 4. Summary of Capital Budgeting Techniques

Factors	**Result**	**Decision Criteria**	**Decision**
Payback Period	4.08	< 5 years	**Accept**
NPV	Rp 3,424,935,506	NPV > 0	**Accept**
Profitability Index	8.21	PI > 1	**Accept**
IRR	20%	20% ≤ IRR	**Accept**

Sources: Research data, 2023

Stage 4 — Determine Project Feasibility

The project's feasibility can be defined by assessing if the price of the lot solution aligns with the customer's willingness to pay. This evaluation is crucial to achieving PT XYZ's targeted internal rate of return (IRR) within the 5-year timeframe. If the cost of the IoT solution, as determined by the financial model and desired IRR, is lower than the customers' willingness to pay, then the project is feasible. However, if the loT price exceeds the

customer's willingness to pay, the project is considered unfeasible, as the desired IRR cannot be achieved. The comparison between the loT solution price and customer willingness to pay is shown in the figure below.

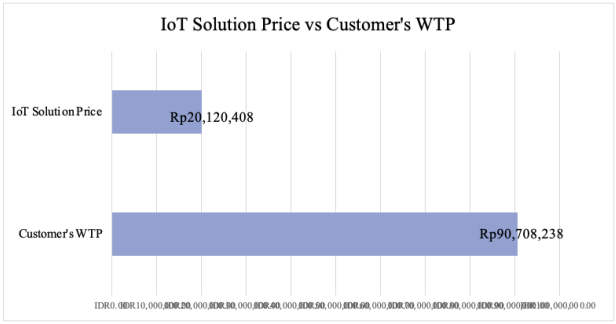

Figure 2. IoT Price Comparison with Customer's WTP

The figure above shows that the price of the IoT solution is significantly lower than the customer's willingness to pay. Therefore, offering the loT solution for R 20,120,408 should attract customers, as the benefits outweigh the cost. Based on this observation, it can be confidently concluded that distributing the loT solution for hydroponic agriculture is feasible and can be pursued.

The researcher conducts risk analysis using sensitivity analysis and Monte Carlo simulation to identify potential risks to PT XYZ's project feasibility. This step acknowledges the possibility of NPV < 0 and responds to the final research objectives. Sensitivity analysis assesses variables significantly impacting the project's Net Present Value (NPV) based on the assumptions generated in stage 2. The researcher adjusts variables using a swing of +/- 10%.

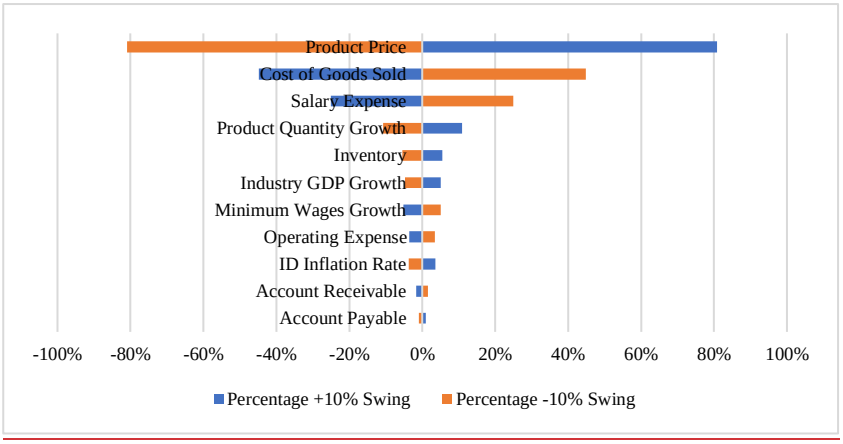

Figure 3. Butterfly Chart of Sensitivity Analysis

The sensitivity analysis shows that salary expense, cost of goods sold, and product price are the sensitive drivers of the NPV, indicating that a change in any of them could significantly impact the project's NPV. Furthermore, Monte Carlo simulations of 10,000 times are also conducted to determine the percentage risks.

Table 5. Descriptive Statistics of Monte Carlo Simulation

Descriptive Statistics	
Min	(19,155,720,351.20)
Max	33,080,909,036.92
Mean	8,043,848,359.16
Standard Deviation	7,049,967,438.09
Median	8,086,164,246.46
Kurtosis	(0.03)
Skewness	(0.00)
Prob NPV<0	12.69%

Sources: Research data, 2023

The simulation yields insightful results, indicating a high probability of 87.31% for the project to achieve an NPV greater than 0. However, it is important to recognize that a 12.69% likelihood remains for the project to experience a negative NPV, signifying that there are still inherent risks involved despite the overall favorable outlook that needs to be mitigated by PT XYZ.

D. CONCLUSIONS

PT XYZ, a leading private telecommunications company in Indonesia, aims to expand its business by offering Internet of Things (loT) solutions to its business customers. Specifically, they plan to launch an IoT solution for hydroponic agriculture, investing Rp 554,750.000 to capture 20% of the available market within five years. To ensure the project's feasibility, PT XYZ conducted a comprehensive analysis, including identifying the price for the loT solution based on customer willingness to pay.

The research assessed the loT solution's benefits, including additional monthly revenue of Rp5,100,000 and monthly cost savings of R 1,520.000. Calculations of incremental cash flow and present value indicated a customer willingness to pay Rp 90,708,238 over the solution's lifespan of 5 years. To achieve the targeted internal rate of return of 20%, this research determined the optimal price to be Rp 20,120.408. Since the price of the loT solution is within the customer's willingness to pay, PT XYZ has the potential to achieve their targeted internal rate of return (IRR) of 20%, affirming the project's feasibility with an NPV of Rp 3,424,935,505, a payback period of 4 years and 29 days, and a profitability index of 8.21.

Moreover, the research considered potential risks through risk analysis, revealing the impact of fluctuations in product price, costs of goods sold, and salary expenses. PT XYZ recognizes the need to mitigate these risks before proceeding with the project. After conducting various simulations, the likelihood of the project's profitability remains substantial at 87.31%. Therefore, PT XYZ is encouraged to proceed confidently in distributing the hydroponic agriculture loT solution to the market while still considering actions to mitigate the risk.

To ensure profitability, PT XYZ should be cautious about COGS fluctuations and negotiate stable pricing agreements with vendors. Salary expenses, product pricing, competitor pricing, and market dynamics should be carefully considered. Despite customer acceptance, PT XYZ should develop a comprehensive marketing strategy targeting market segments that align with the solution's benefits and needs. A targeted approach will drive sales and ensure consistent revenue generation throughout the project's lifespan.

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