Jurnal Manajemen Teknologi

Jurnal Manajemen Teknologi, 21(3), 2022,234-252
Available online at http://journal.sbm.itb.ac.id

A Hydroponic Vegetable Business Development Strategy: A Case Study of CV Casa Farm

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Abstract. *The Business Development Strategy for CV Casa Farm emerged from an analysis of the external and internal environments mapped using a SWOT matrix with a focus on weaknesses and opportunities. Several production problems, such as yellowing of vegetables, rotting roots, and the spread of disease that caused production failures and planting media waste, could be reduced to minimize costs and increase productivity to meet the demand for vegetables in the city of Bandung. Problems were also identified with management and governance, such as overlaps in the allocation of tasks causing unfavorable work performance and decreased productivity. Applying IoT technology could increase vegetable weight by 37.7% and reduce production failures from 12.85% to 7.14%. Based on non-financial factors, including the market, production, organization and management, human resources, and collaboration, the implementation of IoT technology was judged to be feasible. Based on a financial and partial analysis, the investment feasibility obtained NPV > 0 of Rp1,247,103,045.33, with a Net B/C value of 2.63, Gross B/C of 1.62, IRR acquisition of 31%, a payback period of four years and three months, and an increased profit of Rp27,849,345.00, the business development strategy was judged to be feasible using IoT Simon Kori technology because it met the investment criteria and brought additional benefits. In the sensitivity analysis, a 20% decrease in the product selling price was shown to have an impact on the feasibility of implementing IoT. An incremental net benefit analysis indicates that the net benefit from applying IoT technology would be Rp2,402.477,276.13.*

Keywords: *CV Casa Farm, hydroponic vegetable, IoT technology, productivity improvement, SWOT*

Abstrak. *Strategi Pengembangan Bisnis pada CV Casa Farm dibentuk berdasarkan analisis lingkungan eksternal dan internal yang dipetakan menggunakan matriks SWOT dengan berfokus pada kelemahan dan peluang. Terdapat beberapa permasalahan seperti sayur menguning, akar membusuk, penyebaran penyakit yang menyebabkan kegagalan produksi. Kegagalan produksi menyebabkan adanya limbah media tanam, Kegagalan dapat di minimalisir untuk memaksimalkan biaya yang dikeluarkan serta meningkatkan produktivitas perusahaan guna memenuhi permintaan sayur di Kota Bandung. Selain itu terdapat permasalahan pada tata Kelola manajemen yang kurang baik, seperti adanya tumpeng tindih dalam pembagian tugas yang menyebabkan kerja tidak kondusif dan produktifitas kerja menurun . Penerapan teknologi IoT dapat meningkatkan bobot sayur 37,7% dan meminimalisir kegagalan produksi dari 12,85% menjadi 7,14%. Berdasarkan aspek non finansial yang meliputi aspek pasar, produksi, organisasi dan manajemen, SDM, serta kolaborasi, penerapan teknologi IoT ini layak untuk dijalankan. Berdasarkan analisis finansial dan parsial, kelayakan investasi diperoleh NPV>0 sebesar Rp1.247.103.045,33, dengan nilai Net B/C sebesar 2,63, Gross B/C sebesar 1,62, perolehan IRR sebesar 31%), dengan Payback period sebesar 4 tahun 3 bulan, dan keuntungan tambahan sebesar Rp27.849.345,00, maka Strategi pengembangan bisnis dengan mengadopsi teknologi IoT Simon Kori pada CV Casa Farm layak untuk dijalankan karena memenuhi kriteria investasi dan terdapat keuntungan tambahan.Pada analisis sensitivitas, diketahui penurunan harga jual sebesar 20% berdampak pada kelayakan penerapan IoT Pada perhitungan analisis incremental net benefit, manfaat bersih dari penerapan teknologi IoT yaitu sebesar Rp2.402.477.276,13.*

Kata kunci: *CV Casa Farm, peningkatan produktivitas, hidroponik, SWOT, teknologi IoT*

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Received: May 23th, 2022; Revision: August 8th, 2022; Accepted: August 29th, 2022
Print ISSN: 1412-1700; Online ISSN: 2089-7928. DOI: http://dx.doi.org/10.12695/jmt.2022.21.3.1

Introduction

Food is one of the strategic sectors of economic development in Indonesia. Based on Law Number 7 of 1996 concerning food security, food in households, both its quality and quantity, is of strategic interest for economic development. Population density data show that population increases every year by 0.9% (BPS, 2019). These factors impact by decreasing the amount of available agricultural land and increasing the level of food demand, especially for vegetables. Based on BPS data (2019), per capita expenditure in Indonesia from 2016-2020 on vegetable products has increased by around 17%. To overcome these problems, various methods were introduced to increase agricultural yield on limited land, one of which is hydroponics.

One of the targeted food commodities is vegetables because these commodities play an important role in meeting the needs of food consumption and nutrition. The national production and consumption of fresh vegetables are set out in Table 1.

Table 1.
Production Of Seasonal Vegetable Crops in Indonesia 2016-2020

Year	Production (ton)	Difference (ton)
2016	11.078.657	-
2017	11.625.632	546.975
2018	12.001.433	375.801
2019	12.435.563	434.130
2020	12.772.982	337.419

Source: Central Bureau of Statistics (2021)

The data in Table 1 indicate that there has been an increase in the production of vegetable crops over the period 2016 to 2020. This increase occurred due to an increase in demand from people who began to change their consumption habits to healthy lifestyles. Syaifullah (2016) states that there is a shift in lifestyle to become healthier and to be aware of what we consume. People are increasingly aware of the need for foods that contain significant amounts of fiber, such as vegetables and fruit.

Table 2.
Production Of Seasonal Vegetable Crops in Bandung City In 2016 – 2020

Year	Production (ton)	Difference (ton)
2016	69.104	-
2017	17.416	51.688
2018	13.104	4.312
2019	192.533	179.429
2020	197.019	4.486

Source: Central Bureau of Statistics (2021)

Based on the data in Table 2, vegetable production in the last two years in Bandung City has increased annually in 2019 by 179,429 tons and in 2020 by 4,486 tons. Vegetable production in Bandung City has increased for the last two years because the demand for vegetables during the COVID-19 pandemic increased. This increased demand can be an opportunity for entrepreneurs in the agricultural sector, including CV Casa Farm, to increase production and sales. CV Casa Farm cultivates vegetables using the hydroponic method. Cultivated vegetables are leaf vegetables, such as lettuce, bok choy, and kale.

To increase CV Casa Farm vegetable production, there needs to be adequate production preparation of production quantity, equipment, and technology to support a smooth production process. Using the hydroponic cultivation method, CV Casa Farm has identified several weaknesses in its production process. Based on observation results, as much as 5.71% of the 12.85% of production failures was caused by yellow leaves. This originated in the pH condition of the water being too alkaline. The average value of the degree of acidity in the inventory at CV Casa Farm is set out in Table 3.

Table 3.
The Average Level of Acidity of The Water Solution Supply At CV Casa Farm

Time	Seedling	Week After Planting			
		1	2	3	4
08.00-09.00	7.4	7.5	7.7	7.7	7.4
14.00-15.00	7.6	8.1	8.1	7.5	7.7

Source: CV Casa Farm (2021)

Table 3 shows the actual pH level in the water tank ranging from 7.4-8.1. Sutiyoso's research (2018) states that the value of water in the stockpile is alkaline based on an ideal pH for hydroponic vegetables of 5.5-6.5. Plants with a pH above 6.5 cause nutrients to settle and, as the nutrients cannot be absorbed, plants will show symptoms of nutrient deficiency causing yellow leaves and stunted plant growth and death at the tips of shoots or leaves (Nurdin, 2017). The fluctuations in pH levels is unpredictable. Further, there are limitations to what assistants can achieve in monitoring in the greenhouse and these limitations can hinder the success of the production process. Therefore, technology that can automatically and continuously monitor and control the condition of the water supply is needed. The technology that has this capability is the Internet of Things (IoT). IoT is a technology with the concept of and method for remote control, monitoring (supervision), data transmission, and various other tasks.

IoT can be connected to a network, accessed anywhere, and can facilitate a range of activities, such as obtaining topographic details, fertility levels, acidity, weather, and soil temperature (Bafdal & Ardiansah, 2020). The application of IoT technology in the maintenance process of hydroponic vegetable cultivation can improve the quality of vegetables, specifically plant height and leaf width (Dani, 2020).

There are six basic systems for hydroponics including: the NFT (Nutrient Film Technique), DFT (Deep Flow Technique), floating raft system, tidal system, water culture system, and aeroponic system (Komaludin, 2018). Based on the results of interviews, NFT use is recommended in hot areas or areas that have minimal air circulation or wind, or that have electrical stability due to pump use. If the plant is exposed to disease, it will infect other plants. DFT is recommended for systems with a strong airflow and unstable electricity,

although it has a higher cost to ensure that the water does not puddle and cause the roots to rot. The floating-raft system is recommended for areas with minimal electricity and minimal air circulation, although it has the disadvantage that nutrient deposition can occur if mixing is not optimum.

In the business unit, CV Casa Farm conducts vegetable cultivation activities using the Nutrient Film Technique (NFT) system with a production capacity of 9,608 holes and Deep Flow Technique (DFT) with a production capacity of 5,156 holes. Problems occur in the maintenance process, which causes vegetables to be wasted due to failures, such as yellowing of leaves, roots rotting from stagnant water, spread of disease, and waste planting media that can pollute the environment. The losses that CV Casa Farm experiences are significant, with an average of 5-8 kg per harvest. Nor does CV Casa Farm have good management governance in the allocation of work tasks, which causes overlap in activities between employees. This overlap can cause employees to lose focus and agility when dealing with problems in the greenhouse. Therefore, production processes need to be improved to manage these cultivation and workforce problems.

With the use of IoT, problems in enterprises can be minimized and overcome. Using the hydroponic method, the cost of cultivating vegetables is significant, and if maintenance is not carried out appropriately, financial resources cannot be optimized, and a balance between inputs and outputs cannot be achieved. The production process is important in achieving this balance, because if production fails and vegetables cannot be marketed or consumed, the company will lose income. Technological advances create opportunities for CV Casa Farm to adopt smart farming methods. Further, government initiatives support the use of technology to increase crop productivity.

By implementing smart farming, productivity is expected to increase, enterprise income will grow, and food self-sufficiency will be realized. According to Zahra et al. (2021), the use of the smart farming systems for cultivating hydroponic plants can meet the functional needs of the enterprise.

This study aims to formulate business development ideas by analyzing the strengths, weaknesses, opportunities, and threats assessed as part of a feasibility study on the financial and non-financial components of the enterprise to ascertain if the strategy to implement smart farming methods is feasible.

Research Methodology

The data used in the study come from both primary and secondary data sources. Primary data were obtained directly through observation, interviews, surveys, and discussions with enterprise stakeholders, including directors, employees, and external stakeholders, such as IoT technology manufacturers, salad sellers, and catering services. Secondary data were obtained indirectly from reference books, research journals, e-books, and agency websites.

A SWOT (strengths, weaknesses, opportunities, threats) method was used to analyse the data, specifically to identify where strengths and opportunities could be maximized and weaknesses and threats minimized (Rangkuti, 2015). The analysis focused on identifying internal weaknesses in CV Casa Farm's business and taking advantage of external opportunities.

The study methods used were both qualitative and quantitative. The qualitative method includes a description of the business development plan up to the business development stage, including market and marketing, production, organizational and management, human resource, and collaboration factors.

The quantitative method was used to assess business feasibility based on financial factors, including a profit and loss analysis, cash flow analysis, investment criteria analysis (including net present value (NPV), Gross benefit/cost (B/C) ratio, Net benefit/cost (B/C) ratio, internal rate of return (IRR), payback period (PP), sensitivity analysis, analysis of incremental net benefit, and partial analysis. The following Figure 1 is a framework for conceptualizing business development activities at CV Casa Farm.

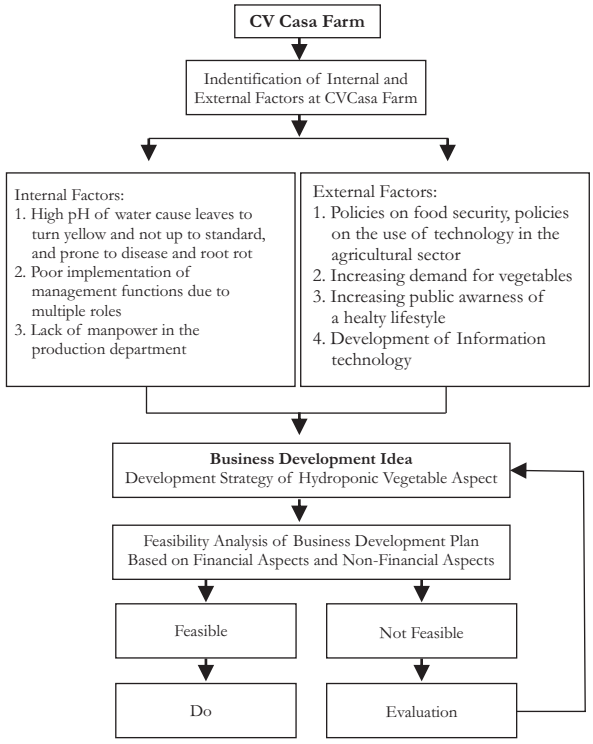

Figure 1.
Business Development Idea Framework at CV Casa Farm

The framework of business development proposals at CV Casa Farm was developed by analyzing the company's external environment, i.e., the macro environment, which included political factors, government policies, economic factors, socio-cultural factors, technological factors, and ecology. The industry environment consists of competitors, suppliers, customers, new entrants, and substitute products. In the company's internal environment, marketing, production, organizational and management, HR, collaboration, and financial factors were analyzed. Business development ideas were obtained by making a SWOT matrix and analyzing both financial and non-financial factors regarding the business feasibility of business development ideas.

Results and Discussion

Business Development Proposal Formulation

The formulation of business development proposals was based on a study of the company's external and internal environments which was then mapped using a SWOT matrix.

According to the analysis, there were supportive government policies, public awareness of a healthy lifestyle, and progressively developing technology to support the hydroponic business. Identified opportunities included CV Casa Farm lettuce prices being cheaper because some competitors sell hydroponic vegetables at a price of Rp35,000.00 to Rp70,000.00 per kg based on the existence of loyal, regular

customers, cooperation with production materials suppliers, and large capital input required to set up a similar business. There are several alternative business development strategies that CV Casa Farm can carry out; in others, there are obstacles that must be removed or minimized, especially in production, so that activities can run well from upstream to downstream. The key to sales lies in production. If the production process is not optimal, it will cause crop yields to be wasted when the quality is below standard, or the product cannot be consumed. In this case, both before and after production activities will be disrupted causing losses to the company. Putri (2017) supports this view, stating that product quality conformity should be achieved and must meet expected target specifications. This is necessary to support the production process to maximize production results so that upstream to downstream activities run smoothly and alternative strategies can be implemented.

Identification of Weakness-Opportunities (WO) strategies was based on problems in the company's vegetable production and in the potential of the company. An amount of 5.71% of vegetables was wasted due to yellow leaf coloring and stunted growth. This condition was caused by uncontrolled pH conditions in the water tank. This production failure factor can be controlled by utilizing technology to monitor and automatically and remotely control pH conditions. Further, in implementing the management function, employees still have a dual role in carrying out tasks that should be the responsibility of employees in the production division only. This situation occurred because of the lack of manpower in the production department. In this regard, the development of information technology provides an opportunity for CV Casa Farm to take advantage of the technology to maximize output and reduce labor intensity in the production process.

Government policies support this utilization of technology to increase agricultural productivity and achieve food security. Government Regulation Number 17 of 2015 provides an opportunity for all agricultural enterprises, especially actors in the hydroponic vegetable cultivation business, to continue to increase productivity to support food security.

Public awareness of a healthy lifestyle has increased during the COVID-19 pandemic and supports the increasing demand for vegetables. Based on Aprilia et al. (2022), public awareness about a healthy lifestyle arises through greening with hydroponic plants and consuming vegetables. This potential increase in demand for vegetables creates an opportunity for CV Casa Farm to meet consumer demand and reach new markets by increasing the quantity of production and preventing failures in the production process. The expenditure of substantial capital to implement IoT Simon Kori technology gives CV Casa Farm the strength to survive because new entrants will find entry conditions difficult and market opportunities for CV Casa Farm are open. The results of the SWOT matrix can be seen in Figure 2.

The business development strategy was formulated by applying automatic control system technology, commonly called IoT technology. Automation in the hydroponic vegetable maintenance process is expected to achieve company goals by implementing smart farming, minimizing failures in the production process and maximizing workers to be effective and efficient.

Product Planning

The IoT technology to be implemented at CV Casa Farm will modify the manual monitoring and control system to make it automatic and continually remotely controlled. This technology will expand and facilitate connectivity via the internet which will share data and sensor reception.

INTERNAL / EXTERNAL	STRENGTHS	WEAKNESSES
	1. Having customers in the form of resellers 2. Good online company branding 3. High quality seeds and planting media 4. Strategic location 5. High quality products 6. Vegetable production using the hydroponic method 7. Good coordination between the owner and the employees 8. Good relationship between the employees and the owner 9. Financial records are in order 10. Company's private ownership of the capital	1. Not marketing products to end consumers 2. Have not done vegetable sales continuously through social media 3. Sales depend on orders 4. Frequent oversupply 5. No waste handling 6. There is no handling of products that are not sold and do not pass the sorting 7. High pH of water causes yellow leaves 8. Don't have processed products yet 9. The implementation of management functions is not good because there are employees who have multiple roles 10. Lack of manpower in the production department 11. No written contract with partners
OPPORTUNITIES 1. Food security policy 2. Government advice to eat fruits and vegetables as substitutes for multivitamins 3. Policy on the use of technology in the agricultural sector 4. The demand for vegetables is increasing in the era of the covid-19 pandemic 5. Increasing public awareness of healthy living 6. People's online shopping habit during the covid-19 pandemic 7. People's preference for practicality 8. The development of information technology 9. The production environment is in the city 10. Cooperating with suppliers of production materials 11. The price of competitor's hydroponic lettuce is more expensive 12. Regular customers who have loyalty 13. Newcomers are difficult to enter because of the large capital	**S-O STRATEGY** 1. Increasing lettuce production by building a new greenhouse (S2, S3, S5, S10, O1, O4, O5, O6, O11, O13) 2. Utilization of food technology and automatic harvesting (S1, S3, S6, S10, O3, O8) 3. Improving customer service (S2, S4, S5, S7, S8, S9, O2, O7, O9, O10, O12)	**W-O STRATEGY** 1. Application of Internet of Things (IoT) technology (W7, W9, W10, O1, O3, O4, O5, O8, O11, O13) 2. Adding a product variant in the form of vegetable salad (W1, W2, W3, W4, W6, W8, O4, O5, O6) 3. Expansion of vegetable marketing using e-commerce (W1, W2, W4, W6, O2, O4, O5, O6, O7, O8, O9) 4. Increased cooperation with suppliers and markets (W11, O10, O11, O12) 5. Using peat moss planting media to minimize production waste (W5, O4, O8)
THREATS 1. Implementation of social distancing 2. Declining people's income due to the pandemic 3. Inflation rate 4. People prefer conventional vegetable products 5. More modern competitor technology 6. Threat of pests and diseases 7. Planting media waste (rock wool) can pollute the environment 8. Availability of raw materials is not sustainable because they are imported 9. Competitors have already marketed vegetable products through e-commerce 10. Competitors do better promotions 11. Customers buy competitors' products 12. There are similar products from conventional traders	**S-T STRATEGY** 1. Creation of sales and educational applications (S2, S3, S5, S6, T9, T10, T11) 2. Increasing sales through cooperation with hotels, restaurants and cafes (S2, S5, S6, T1, T3, T11) 3. Increasing public awareness about organic vegetables through extension programs (S1, S5, S7, S8, T2, T4, T8, T12) 4. Application of integrated pest control technology (S2, S4, S9, S10, T5, T6, T7)	**W-T STRATEGY** 1. Using environmentally friendly planting media (W5, T8, T9) 2. Expansion of new market segmentation by collaborating with partners (W1, W2, W3, W4, W11, T1, T2, T4, T11, T12) 3. Production management improvements (W6, W7, W8, W9, W10, T3, T5, T6, T7, T10)

Figure 2.
SWOT Matrix of CV Casa Farm

The product to be implemented is Simon Kori, product type Simon Kori V2.0 Full Panel. The product control panel for Simon Kori will be implemented at CV Casa Farm. The IoT Simon Kori technology control panel mock-up is set out in Figure 3.

The application of IoT technology in the hydroponic vegetable cultivation process can improve vegetable quality and minimize production failures. Further, IoT application can have an impact on reducing the workload of production employees so that overlap of roles will cease. According to Menurut Bahari (2017), system automated NFT hydroponics has better crop yields than conventional systems.

This type of product is specially designed for industrial-scale hydroponic greenhouses with a tank capacity of 1,000-5,000 liters with full control and monitor features. Parameters to be monitored and controlled include nutrient level, humidity, water level, pH, water temperature, and room temperature .In the monitoring system, sensors are used to detect and produce output in the form of data that can be read on a hand-held gadget or computer via an application, while the control system will produce output in the form of a nutrient check pump, A B mix nutrient pump, pH stabilizer pump, raw-water filling pump, and exhaust fan/sprayer.

Market Planning and Marketing

The market is a group of people who have an interest in, income to develop, and access to a particular product or service and potential buyers who want to buy a product; 'marketing' is an effort to create and sell products to various parties with a specific purpose (Kasmir & Jakfar, 2017). 'Marketing planning' is what will be carried out after the application of IoT technology in partnership with salad sellers and catering services in the city of Bandung. Marketing planning was formulated using the STP strategy (Segmenting, Targeting, Positioning). Based on the results of the market survey regarding lettuce products with the target respondents being salad sellers and catering services in the city of Bandung, sales of lettuce to the target market have considerable potential. A total of 90.3% of the 32 respondents are willing to switch to buying lettuce from a producer who sells vegetables that are cheaper and of better quality.

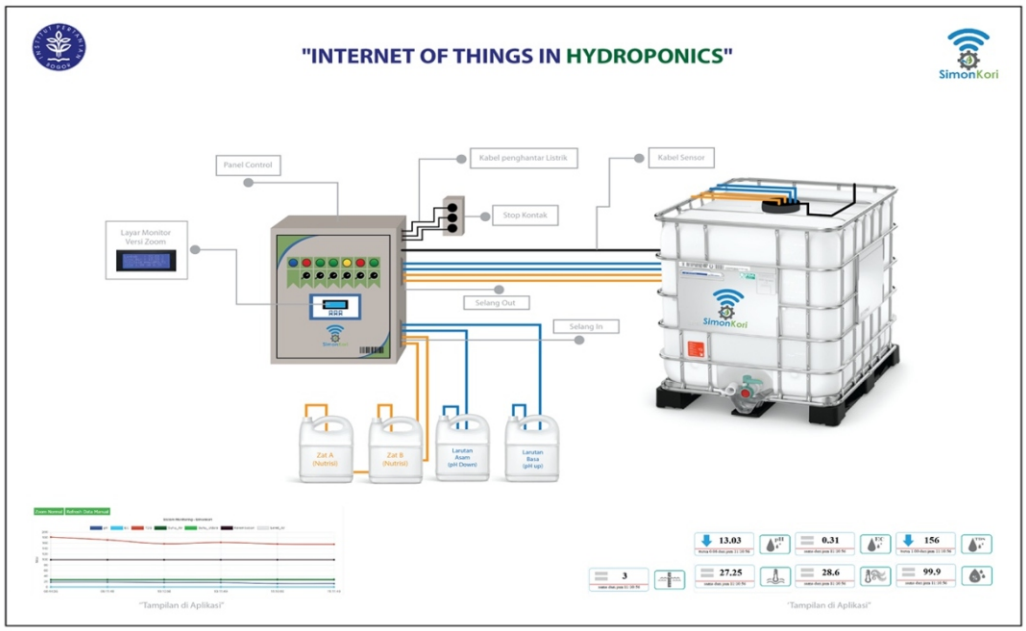

Figure 3.
Mock-up of IoT Simon Kori Technology Control Panel on CV Casa Farm hydroponics

1. *Segmenting*

Lettuce product segmentation was differentiated geographically, demographically, and psychographically. Based on geography, the marketing of lettuce products occurs in the areas of Bandung City and Great Bandung. Based on demographics, the target market segmentation for vegetables was based on age, namely, children (2-10 years), teenagers (11-19 years), adults (20-60 years), and by type of work. Based on psychographics, lettuce sales targeted the market according to lifestyle and personality characteristics.

2. *Targeting*

The target market for lettuce are the people of Bandung City who work as salad sellers and catering services aged 20-60 years with personality characteristics that consider the quality and freshness of production raw materials. Prior to marketing development, lettuce is marketed to households who work as resellers; after marketing development, the target market would increase by selling to the people of Bandung City who work as salad sellers and in catering services.

3. *Positioning*

The marketing strategy for business development was formulated using a 4P marketing mix strategy (Product, Price, Place, Promotion). The positioning of Casa Farm's vegetable products will occur by highlighting the advantages of the product. CV Casa Farm can strengthen its position by instilling an image of its lettuce products through the statement "Sayur Segar, Hidroponik, Greenhouse, dan Bebas Pestisida" (Fresh Vegetables, Hydroponics, Greenhouse, and Free of Pesticides). The statement is expected to attract the interest of a new target market that would choose Casa Farm as a partner.

(1). Product

A product is an object or service that can meet the needs or wants of consumers (Kasmir & Jakfar, 2017). The product to be sold is fresh lettuce which is cultivated using the hydroponic method. CV Casa Farm produces and sells lettuce because of demand and in accordance with the wants and needs of consumers of fresh lettuce. In line with this statement and based on the market survey conducted, consumers chose lettuce based on taste, quality, and freshness.

Consumers are interested if products have better quality and lower prices. The Casa Farm products are good quality because they are produced from quality imported seeds and provide a sweeter, crunchy taste. Casa Farm prices can compete well in the market. Hydroponic lettuce can be processed into salads, stir-fries, or eaten directly as healthy snacks or fresh vegetables. Casa Farm's lettuce products are packaged using a printed plastic package with the company tagline.

(2). Price

Price is the amount of money given in exchange for goods or services (Kasmir & Jakfar, 2017). Price is an important factor in marketing because it can determine the level of company profit; therefore, price determination must be adjusted to several influencing factors, such as costs incurred, profits to be obtained, and market price competition. The determination of price is based on the calculation of the Cost of Goods Sold (COGS), using variable and fixed costs (VC, FC) and total sales. Following is the calculation of the cost of production, mark-up, and selling price.

$$COGS = \frac{(VC + FC)}{Total\ sales}$$

$$= \frac{(Rp\ 40{,}086{,}600 + Rp\ 110{,}873{,}680.71)}{13{,}404.72}$$

$$= \frac{Rp\ 150{,}960{,}280.71}{13{,}404.72}$$

$$= Rp\ 11{,}261.72$$

$$COGS\ mark\ up = \frac{Cost\ per\ unit}{(1 - desired\ profit)}$$

$$= \frac{Rp\ 11{,}261.73}{(1 - 63\%)}$$

$$selling\ price$$

$$= Rp\ 30{,}347.11$$

$$= Rp\ 30{,}000/kg$$

(3). Place

The placement or distribution of the product is a crucial part of target marketing. Companies must position and distribute products in places that are easily accessible to potential buyers (Kasmir & Jakfar, 2017). Being in the middle of the city, the Casa Farm vegetable distribution location is a strategic and easily accessible to consumers as well as to drivers and expeditions. The distribution location of Casa Farm's vegetables is the city of Bandung. Consumers can purchase Casa Farm products on Street Cikadut (Subur) No. 70 Karang Pamulang Village, Mandalajati District. If consumers order online, distribution will occur from the D'Casa Grande Complex.

Vegetable distribution is carried out from CV Casa Farm directly to producers, namely, salad sellers and catering services; vegetable products are then processed and marketed to final consumers. Lettuce sales will also occur online. Online purchasers can order Casa Farm products via WhatsApp. Vegetables distribution occurs from morning to evening daily. Consumers can order one day in advance or same-day with the order deadline of 12 noon.

(4) Promotion

Promotion is a strategy to attract and retain customers. A promotional objective of the company is to inform potential customers about all types of products offered and to attract new customers (Kasmir & Jakfar, 2017). Casa Farm lettuce promotions are carried out through social media, such as Instagram, Facebook, and WhatsApp, through sharing product photos and posters.

Promotions using WhatsApp are designed to reach target markets based on relationships, while promotions through social media are designed to reach a wider target market. CV Casa Farm promotions occur at certain times, usually every morning, afternoon, or evening when people are resting. CV Casa Farm has an advertising budget but prefers to promote its products using its manpower budget.

Workers are assigned as administrators to undertake digital marketing, manage social media, and respond to potential buyers. Digital marketing undertaken by marketing staff optimizes the company's branding through search optimization organization (SEO), google 'my business', google search, and similar promotional platforms.

Production Planning

Production or technical planning relates to the technical business development process and its operation after the business is completed (Nurmalina et al., 2014). Production planning analysis was carried out to ascertain the estimated costs likely to be incurred or generated. The production planning after business development at CV Casa Farm in terms of the location and production process remains the same, that is, at Street Cikadut, Arcamanik District, Bandung City. The following are the variables that have undergone changes and additions following business development.

(1). Production process

The vegetable production flow at CV Casa Farm starts from the preparation of tools and materials, seeding, planting, maintenance, and harvesting to post-harvest handling.

(2). Technology

The technology to be used after business development is IoT technology. IoT technology is designed to monitor and control the production process automatically in real time. This IoT technology uses a network so that plant maintenance can be monitored remotely. Prior to business development, CV Casa Farm did not possess this technology. IoT technology has been implemented to support the production process to minimize failure. One of the factors that cause production failure is uncontrolled pH conditions. Uncontrolled pH conditions cause plant leaves to turn yellow and thus become waste. The percentage of production failure of yellow leaves is 5.71% and the percentage of total production failure is 12.85%. The application of this technology is expected to reduce total production failure from 12.85% to 7.14%.

The input from the application of IoT technology is the pH value in the tank water. The output of the IoT technology application is pH sensor value data displayed in an application via a panel: pH up and pH down solution control pump, pH value status above or below ideal, and pump status being on or off, with notifications received on a mobile phone or application.

The process of applying IoT technology begins with setting the ideal pH standard in the application as a control reference; the sensor will then work to detect the pH value in the water tank. The sensor reads the pH value in the water tank then sends the pH value data to the panel screen and application via cable and wireless. The application will read the sensor value; if the pH value does not match the pH value that has been set in the application, it will automatically give a command to the pump to control the level according to the pH need. The pump receives the next command and performs a control function by adding the pH stabilizer solution. The pH-up pump will automatically turn on when the pH value is < 5-6 and turn off when the pH value = 5-6; the pH-down pump will automatically turn on when the pH value is > 5-6 and turn off when the pH value = 5-6.

(3). Production capacity

The production capacity after business development is adjusted to the capacity of the equipment, application of technology, decreased percentage of production failure, and average sales before business development. In the greenhouse, there are 21 installations with each installation containing 416 holes. The net weight of vegetables before development was 100 grams, with an increase in harvest weight of 37.7%. The percentage is obtained based on Dani's research calculation (2020) used as a reference for controlled vegetable-growth research with an average height difference of 10cm and a weight of 3.77grams. Determination of production quantity after business development can be seen in Table 4.

Table 4.
CV Casa Farm Vegetable Production Quantity After Development

Year	Production capacity (kg/month)	Failure rate (%)	Q for sale (kg/month)	Q for sale (kg/year)
1	1,202.95	7.14%	1,117.06	8,936.48
2-10	1,202.95	7.14%	1,117.06	13,404.72

Source: Processed data

Organizational Planning and Management
Organizational and management aspects are important to be analyzed for the feasibility of a business because even though a business has been declared feasible to be carried out without the support of good management and organization, it is not impossible that it could still fail (Kasmir & Jakfar, 2017).

(1). Planning
Planning is a process to determine the direction of the company and the activities needed to achieve the company's set goals. Business development at CV Casa Farm does not require new workers nor a new organizational structure. CV Casa Farm already has technical employees and does not need to recruit.

(2). Organizing
Organizing is the process of grouping activities based on type of work. Employees of the technical department will be trained to improve partnerships with government institutions and larger, more advanced industries (Sayekti et al., 2018). The duties and responsibilities of technical employees are to carry out routine controls weekly to check the condition of the greenhouse machines, the condition of the technology, or damage to the greenhouse, and to make repairs if an error or damage has occurred. Employee competence can be improved through education and training and through internship programs in large companies or industries, with government institutions, and in larger, more advanced industries (Sayekti et al., 2018).

(3). Actuating
For organizational management, the leaders/managers must encourage subordinate employees to undertake their work by leading, motivation, and giving orders and instructions (Kasmir & Jakfar, 2017). This will ensure that employees do their work well according to their respective responsibilities.

(4). Controlling
Supervision is a process to measure and assess the implementation of management instructions and to determine whether it is in accordance with the plan. The director of CV Casa Farm routinely supervises the garden to assess whether the conditions in the garden are optimal. After applying IoT technology, the intensity of supervision will be increased to minimize the obstacles identified above.

Human Resource Planning
Human resource planning is an activity carried out systematically to predict or estimate the needs of human resources in an enterprise (Kasmir & Jakfar, 2017). The human resources needed after business development are three people, namely, one worker in the production division, one in the marketing division, and one in the technical division. The workforce needs are adjusted to the activities of the company, namely, production, maintenance, and marketing. After business development, the technical staff will be trained on the operation of IoT technology. Training will increase competence to achieve expected performance based on existing skills and knowledge (Muslimet al., 2017).

The need for fewer human resources is due to the application of IoT technology which makes work more effective and efficient (Ciptadi & Hardyanto, 2018). The wage payment system at CV Casa Farm is monthly. Each employee receives a salary of Rp100,000.00 per day working six days a week. For a month, an employee's salary is Rp2,400,000.00. After business development, technical employees with additional job responsibilities will not receive additional salaries as the salary is already standard at CV Casa Farm and the level of activity of technical personnel after development remains the same.

Collaboration Planning

Collaboration is the fundamental process of a form of cooperation based on trust, integrity, and breakthrough in terms of consensus, ownership, and integration in all aspects of the organization (Kaloh, 2007). After business development, CV Casa Farm will collaborate with partners, namely, salad sellers and catering services in Bandung City to supply fresh vegetables using a contract system. For procurement of raw materials, collaboration will remain the same as before business development, namely, collaboration with the printer in Bandung, the seed producer, and the producer of agricultural production facilities. CV Casa Farm also collaborates with several delivery services, such as grab express, jnt express, and other expedition services.

Financial Planning

Financial assessments can determine the company's level of performance. Before analyzing financial aspects, the duration of the business must be determined. Economic life can be used to determine the length of the business's life or the term of the business. Economic life is the age of the business based on a period approximately equal to the economic life of the largest asset in the business (Nurmalina et al., 2014). Financial planning can be undertaken by analyzing the income statement, cash flow, and incremental net benefit and undertaking a sensitivity and partial analysis.

The following is a description of each calculation used for the financial analysis. The basic assumptions used by CV Casa Farm in financial planning include that:

a) The business age is determined based on the age of the IoT technology, which is 10 years.
b) The capital derives from personal capital of the owner of CV Casa Farm.
c) The production site belongs to CV Casa Farm.
d) The land used for production has an area of 500 m^2.
e) The production of the first year is eight months; from the second to the tenth year it will be 12 months.
f) Lettuce is sold at a price of Rp30,000/kg.
g) One production cycle is one month.
h) Production after business development will be 1,117.06 g due to an increase in production quantity, a decrease in production failure from 12.84% to 7.14%, and an increase in vegetable weight by 37.7%.
i) The prevailing average bank deposit interest rate is 4.08% as of June 29, 2021.
j) The investment cost for the first year after development is Rp976,292,150.00.
k) The income tax rate is 0.5% based on Government Regulation Number 23 of 2018 concerning Income Tax on income from businesses received or obtained by taxpayers who have a certain gross turnover (Ministerial Regulation 2018).

(1). Investment Cost

Investment costs are those that are generally incurred at the beginning of the activity and at certain other times to obtain benefits at a later period (Nurmalina et al., 2014). Investment costs incurred before business development amount to Rp942,495,600.00, while investment costs after business development amount to Rp976,292,150.00. Investment costs after business development will increase by Rp33,796,550.00 because of additional costs incurred, such as purchasing IoT technology, CCTV, and training technical staff.

(2). Operating costs

Operational costs consist of variable and fixed costs to run the business. Variable costs are in line with annual production or sales development (one unit of time) (Nurmalina et al., 2014). Fixed costs are not affected by the annual production or sales volume (one unit of time) (Nurmalina et al., 2014). The total variable cost before business development is Rp26,220,000.00 per year, while the variable cost after business development is Rp40,086,600.00 per year. Variable costs will increase by Rp13,866,600.00 as production quantity increases.

Variable costs include seeds, rock wool, AB mix nutrition, pH stabilizer, plastic packaging, crackle plastic, yellow trap, masking tape, and staples. Fixed costs includes labor, salaries, electricity and water, wifi, maintenance, and depreciation cost. Fixed cost before the development were Rp110,873,680.71 per year, and after the development will be Rp114,018,335.71, representing an increase of Rp3,144,655.00 due to additional electricity costs.

(3). Estimated Revenue

Revenue estimation will be obtained from the sale of lettuce. In the first year, business preparation will cover four months, meaning that production occurs for eight months only. From the second year to the tenth year, production will be carried out for 12 months to generate more sales. The average annual revenue before business development was Rp131,554,693.61, and the average annual revenue after business development is Rp323,947,400.00. The average difference in revenue before and after business development is Rp192,392,706.39. The increase in revenue is due to an increase in the monthly quantity of production, an increase in selling price, a decrease in production failure of 7.14%, and an increase in lettuce weight of 37.7%. Based on Komaludin's research (2018), there will be a cost efficiency of 62% in maintenance, indicating a more effective hydroponic plant business.

(4). Profit and Loss Analysis

The income statement contains the total revenue, expenses, and profit conditions of a company in an accounting or production year (Nurmalina et al., 2014). The purpose of preparing an income statement is to describe the company's performance in achieving company goals over a certain period. The following data set out in Table 5 are the income statement figures of CV Casa Farm after business development.

Table 5.
CV Casa Farm Income Statement After Business Development

Description	Year (Rp)	
	1	2-10
Revenue	268,094,400.00	402,141,600.00
Variable costs	26,724,400.00	40,086,600.00
Gross profit	241,370,000.00	362,055,000.00
Fixed costs	76,012,223.81	114,018.,35.71
EBIT	165,357,776.19	248,036,664.29
Interest	-	-
EBT	165,357,776.19	248,036,664.29
Tax (0,5%)	826,788.88	1,240,183.32
EAT	164,530,987.31	246,796,480.96

EBIT: earnings before interest and taxes; EBT: earnings before taxes; EAT: earnings after taxes

(1) Cash Flow Analysis

Cash flow is structured to show changes in cash available during a certain period and to provide reasons for the changes in cash available by showing the sources of cash and their uses (Nurmalina et al., 2014). To perform cash flow analysis, several business feasibility investment criteria are used as follows:

Net Present Value (NPV), or the present value of net benefits is the difference between the total present value of the benefits and the total present value of costs, or the total present value of additional net benefits over the life of the business (Nurmalina et al., 2014). The resulting NPV is the unit of currency (Rp). Mathematically, the NPV value can be formulated as follows:

$$NPV = \sum_{t=1}^{n} \frac{Bt}{(1+i)^t} - \sum_{t=1}^{n} \frac{Ct}{(1+i)^t} = \sum_{t=1}^{n} \frac{Bt - Ct}{(1+i)^t}$$

A business is said to be feasible if the NPV is greater than 0 (NPV> 0), which means that the business is profitable or provides benefits; thus if a business has an NPV less than 0, it is not feasible to run.

After business development that includes applying IoT technology to CV Casa Farm, the resulting NPV calculation is NPV> 0, which is Rp1,247,103,045.33. This value is the current value when the business is operating.

Gross Benefits/Costs (B/C) is an investment criterion that describes the effect of additional costs on additional benefits received. The following is the calculation of Gross B/C:

$$Gross\ B/C = \frac{\sum_{t=1}^{n} \frac{Bt}{(1+i)^t}}{\sum_{t=1}^{n} \frac{Ct}{(1+i)^t}} = \frac{Rp\ 3{,}256{,}629{,}587.39}{Rp\ 2{,}009{,}526{,}533.06} = 1.62$$

Based on this criterion, a business is said to be feasible if the Gross B/C is greater than 1 and not feasible if the Gross B/C is less than 1. The result of the Gross B/C calculation after business development is Gross B/C>1, which is 1.62, which means that each expenditure of Rp1.00 will generate a gross benefit of Rp1.62.

Net B/C is the ratio between positive net benefits and negative net benefits, interpreted as net benefits of the business resulting from each unit loss of the business. The following is the calculation of Net B/C:

$$Net\frac{B}{C} = \frac{\sum_{t=1}^{n} \frac{Bt - Ct}{(1+i)^t}}{\sum_{t=1}^{n} \frac{Bt - Ct}{(1+i)^t}} \rightarrow \frac{(Bt - Ct) > 0}{(Bt - Ct) < 0} = \frac{Rp\ 2{,}014{,}092{,}044.18}{Rp\ 766{,}988{,}988.85} = 2.63$$

Net B/C investment criterion is said to be feasible if the Net B/C value is greater than one and inappropriate if the Net B/C value is less than one. The result of the Net B/C calculation after business development is Net B/C > 1, which is 2.63, which means that each expenditure of Rp1.00 will generate a net benefit of Rp2.63.

The Internal Rate of Return (IRR) is an investment criterion used to assess the generation of business returns from investments. The amount generated from this calculation is in a percentage unit (%). The following is the IRR formula:

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} X\ (i_2 - i_1)$$

A business is said to be feasible if the IRR value is greater than the opportunity cost of capital (DR). IRR calculation after business development at CV Casa Farm can be seen in Table 6.

Table 6.
Internal Rate of Return After Business Development At CV Casa Farm

Year	Net benefit (Rp)	DF1 = 30%	PV DF1 30% (Rp)	DF2 = 31%	PV DF2 31% (Rp)
1	-798,282,150.0(	0.77	-614,063,192.3	0.76	-609,375,687.0
2	267,015,000.0(	0.59	157,997,041.4	0.58	155,594,079.6(
3	267,000,000.0(	0.46	121,529,358.2	0.44	118,767,434.2
4	262,521,000.0(	0.35	91,915,899.3(	0.34	89,141,280.2
5	267,015,000.0(	0.27	71,914,902.7	0,.6	69,211,646.5(
6	252,465,900.0(	0.21	52,304,928.8	0.20	49,954,538.7
7	260,091,000.0(	0.16	41,449,744.5	0.15	39,284,954.5
8	263,415,000.0(	0.12	32,291,906.2	0.12	30,371,772.4(
9	267,015,000.0(	0.09	25,179,406.4(	0.09	23,501,414.2
10	470,843,7500(	0.07	34,154,134.7(	0.07	31,634,709.7(
		NPV1	**14,674,129.98**	**NPV2**	**-1,913,856.74**

$$IRR = 30\% + \frac{Rp\ 14{,}674{,}129.98}{(Rp\ 14{,}674{,}129.98 - Rp\ 1{,}913{,}856.74} X\ (31\% - 30\%)$$
$$= 31\%$$

After business development, the IRR value is 31%, which means that the investment is feasible because the value is greater than the average bank interest rate of 4.08%.

Payback Period (PP) is a method used to measure the speed of a return on investment which is formulated as follows:

$$PP = t + \frac{(a-b)}{(c-b)} X\ 1\ year$$

Businesses that have a short payback period or fast return have the potential to be selected. A business is said to be feasible if the PP value is less than the age of the business. The calculation of the payback period can be seen in Table 7.

Table 7.
Payback Period After CV Casa Farm Development

Year	Investment	Cash flow	Cumulative cash flow
1	766,988,998.85		
2		246,491,014.42	246,491.014,42
3		236,815,110.87	483,306,125.29
4		223,714,902.82	707,021,028.11
5		218,624,707.52	925,645,735.63

$$PP = 5 + \frac{(Rp\ 766{,}988{,}998.85 - Rp707{,}021{,}028.11)}{(Rp\ 925{,}645{,}725.63 - Rp\ 707{,}021{,}028.11)} X\ 1$$
$$= 4.27$$

The calculation of the payback period after business development results in the value of PP < business age, which is 4.27 or four years and three months, which means that it is feasible because it is less than the age of the business, which is 10 years.

(1). Incremental Net Benefit Analysis
Incremental net benefit is the net benefit with business minus the net benefit without business (Nurmalina et al., 2014). The calculation of incremental net benefit analysis is used to identify the net benefit after business development. The net benefit after business development at CV Casa Farm can be calculated from the value of the incremental net benefit over the life of the business (10 years), which is Rp2,402,477,276.13.

(2). Sensitivity Analysis
Sensitivity analysis is used to calculate the impact of a changing situation on the results of a feasibility analysis. The purpose of this analysis is to assess the feasibility of an investment or business activity if there is a change in the calculation of costs or benefits (Nurmalina et al., 2014). The variables included are NPV, IRR, and Net B/C, taking into account changes, such as price changes, implementation delays, cost increases, and production results. The magnitude of the change in the sensitivity analysis is known from the company's experience. The value of a significant change indicates that the business being carried out is sensitive and vice versa.

In developing this business, the components that have undergone changes included a decrease in lettuce production and a decrease in the selling price of lettuce. The decrease of 15% (600kg) in total annual production at CV Casa Farm was due to pests, diseases, and weather and the decrease in the selling price of lettuce by 20% from 25,000.00 per kg to Rp. 20,000.00 per kg was caused by pandemic conditions. The results of the feasibility test of investment criteria obtained from the sensitivity analysis can be seen in Table 8.

The results of the sensitivity analysis show that the change in the components in the form of a decrease in the selling price of lettuce was the biggest change compared to the decrease in lettuce production. In general, the business development of the application of IoT technology at CV Casa Farm is sensitive to the decline in the selling price of lettuce.

(3). Partial Analysis
Partial analysis is carried out to evaluate the consequences of changes in production methods or farming organization (Putri, 2018). Partial planning focuses on factors related to change only. Partial analysis is used to determine how much additional profit or loss is generated after business development. The partial budget analysis for the application of IoT technology can be seen in Table 9.

Table 8.
The Results Of The Calculation Of The Sensitivity Analysis Of CV Casa Farm Business Development

Component	Percentage (%)	NPV (Rp)	IRR (%)	Net B/C	PP (year)
Lettuce production decrease	15	Rp779,105,304.80	21%	1.97	6.65
Lettuce selling price decrease	20	Rp623,106,057.96	17%	1.76	6.45

Table 9.
Analysis Of the Partial Budget For The Application Of Iot Technology

Change: **Purchase of IoT technology to minimize failures in the production process and improve vegetable quality**			
Loss		**Profit**	
Additional cost (year)		**Cost saved (year)**	
IoT technology depreciation	2,854,655.0(	Wasted vegetables 49.92kg* Rp 30,000*12	17,971,200.0(
CCTV depreciation	50,000.0(		
Technical staff training	5,000,000		
Electricity and water	4,800,000		
Lost income (year)		**Additional income (year)**	
There isn't any		Vegetable weight increase 62.73kg*Rp 30,000*12 bulan	40,554,000
Total loss	**12,704,655.00**	**Total profit**	**12,704,655.0(**
Additional benefit = Rp 40,554,000.00 – Rp 12,704,655.00 =Rp 27,849,345.00			

Table 9 shows that the additional benefit obtained after the application of Internet of Things technology is Rp27,849,345.00. This value was obtained after calculating the total profit lost from the calculation of wasted vegetables plus the increased vegetable yield minus the costs incurred or losses that will arise in the production process. The potential benefits arising from the application of IoT technology are greater than the disadvantages. Therefore, the plan is highly recommended financially.

Conclusion

The business development proposal to be carried out is the application of IoT technology. This proposal was assessed based on an analysis of the external and internal environment of the enterprise and using a SWOT matrix. The strategy coming from the SWOT analysis is a W-O (Weakness-Opportunity) strategy that minimizes weaknesses by taking advantage of opportunities.

In terms of the resulting production, as much as 5.71% of vegetables were wasted due to yellow leaf coloring, stunted growth, and root rot. In the implementation of management functions, employees played a dual role carrying out tasks that should have been the responsibility of production employees. Technological development provides an opportunity for CV Casa Farm to take advantage of the use of technology in the production process to maximize output and reduce the intensity of labor. Further, the increasing demand for vegetables provides an opportunity for CV Casa Farm to reach new markets and increase production quantity by preventing failures in the production process.

The business development proposal of applying IoT technology after analysis based on non-financial factors, which include market and marketing factors, production factors, organizational and management factors, human resource factors, and collaboration factors, is feasible and can be made operational. Based on an analysis of the financial aspect, the business proposal of implementing IoT technology is also feasible and can be made operational based on an NPV>0 which is Rp1,247,103,045.33, the current value obtained when the business is operating. The IRR>DR value is 31%. The value of Net B/C>1 is 2.63, which means that every Rp1.00 of expenditure will result in a net benefit of Rp2.63. The Gross B/C>1 is 1.62, which means that each expenditure of Rp1.00 will generate a gross benefit of Rp1.62.

Based on the calculation of the payback period, the application of IoT technology produces a return of four years and three months and is feasible because it is less than the age of the business, which is 10 years. The application of IoT technology was also assessed for its net benefits over the life of the business using the incremental net benefit analysis. This produces a net benefit over the life of the business, which is 10 years, amounting to Rp2,402,477,276.13.

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