Capital Investment Analysis for the Product of a Startup Company

Case Study: Detection Program for Traffic Light Violations

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Abstract

This research is an exploratory study to analyze cost-effectiveness of the investment for detection programs to monitor traffic light violations in Khon Kaen Province. A mixed method for data collection was employed in response to the research question. The case study was for the JP Intelligence System Engineering Co., Ltd, a technology startup that produced a controlling traffic violations program in Khon Kaen Province, and research data was collected by interviewing the director of the company and Khon Kaen Provincial Police Officers. The quantitative method with management accounting techniques used in analyzing the data consisted of the Payback Period, Net Present Value (NPV), and Internal Rate of Return (IRR). It was shown that with a 450,000-baht investment, the Payback Period would be a duration of two years, two months, and two days. The Net Present Value (NPV) was gauged at 750, 542.85 baht, greater than 0, indicating that this project can have a greater return on investment. Regarding the Internal Rate of Return (IRR), the findings show 48.88%, higher than the discount rate (6.60%). Accordingly, the investment was considered a

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profitable project since it provided a short payback time with a positive net present value and a high internal rate of return. Therefore, based on the cost-effectiveness analysis, the investment for detecting programs capable of reporting and investigating traffic violations has a greater financial advantage.

Keywords: Startup, Payback Period, Net Present Value, Internal Rate of Return, Capital Investment Analysis, New Technology Product Development

Introduction

Road accidents are one of the leading causes of injury and death, increasing every year. According to the report of the Thai Health Promotion Foundation, road accidents are one of the three major causes of mortality for Thai people (Thai Health Promotion Foundation, 2019). When considering the causes of road accidents, drivers' behaviors, such as driving recklessly and violating traffic rules, were the sole contributors to road accidents. Road accidents have tragic results both for individuals and society (Thai Health Promotion Foundation, 2019).

Khon Kaen Province is the sixth-largest province in the northeast with the third-largest population in the country, or about 1,802,872 people (Central Registration Office, 2019). In 2019, it was found that in Khon Kaen Province, there were a total of 6,891 accidents, causing a total number of 7,818 injuries and fatalities (Accident Information Center, 2019). Many factors contribute to the causes of traffic accidents, which include violating traffic rules such as running red lights, refusing to obey road signs, and not wearing a motorcycle helmet (Accident Information Center, 2019).

JP Intelligence System Engineering Co. Ltd. has created a traffic violations program to examine and report the cases of traffic light violations. The program can record the images of accidents, document traffic offenders' behaviors, and register those pictures on a database. This information can later be used in the process of issuing police warrants. Introducing this program to the traffic monitoring system should help lighten the duties of those individuals who

supervise the enforcement of traffic regulations. The project has been proposed to organizations with the power to purchase, such as the Khon Kaen Provincial Administrative Organization, the Khon Kaen Municipality, and the Provincial Police Office Foundation. Wonghabut et al. (2019: 42) reveals that the program can detect 85% of red-light violation cases from various vehicle types during both daytime and nighttime. Validation results reveal that the program has 96.3% accuracy. Detection of motorcyclists without a helmet is also validated and also yields an accuracy of 96.3%. Despite the high efficiency of the program, it cannot guarantee that investing in this new technology product is of more value to investors. Therefore, this research is to investigate a cost-effective analysis of the traffic monitoring program.

The data was collected by using a mixed qualitative and quantitative method. Firstly, we interviewed the director of JP Intelligence System Engineering Co. and police officers of the Khon Kaen Provincial Police Office. Then the data was analyzed using management accounting techniques (payback period, net present value, and internal rate of return) to evaluate the cost-effectiveness of the program (Aungvaravong, 2020; Silva, Morrison & Linhares, 2019; Chotinarumon, 2013; Laopuangsak, Chantaranumchu & Dittavirun, 2011; Thongsukhowong, 2011; Lefley, 1996). Results reveal that investing in this product is beneficial. The finding of this study is applicable to estimating the financial benefits of similar innovative technology products (Silva, Morrison & Linhares, 2019; Lawrence et al, 2019; Saisuthanawit & Charoenchai, 2018; Malatji, Zhang & Xia, 2013).

Research Objective

To make a cost-effective analysis of the traffic monitoring program consisting of Payback Period, Net Present Value (NPV) and Internal Rate of Return (IRR).

Definition

1) Cash flow is the in-flow or out-flow of cash or of other forms of exchange equivalent to cash. The received cash is known as cash flow in, while the paid cash is called cash flow out. There are two types of cash flow as described below:

Negative cash flow is expressed as the situation when the accumulation of the cash flow is negative due to the amount of money paid out in cash being greater than the amount of money received in cash (Thongsukhowong, 2011).

Positive cash flow occurs when the cash flow accumulation is positive, resulting from having a greater amount of received cash than cash paid out (Thongsukhowong, 2011).

2) Discount Rate

Sektrakul (2008), explained that the discount rate is used to calculate the future value to the present value.

3) Financial Costs

According to Pradabkul (2016), financial costs are costs or expenses incurred from a financing allocation or from the business financial management, such as applying for loans. An entity's financial costs can vary, such as interest or fees.

Literature Review

1. Startup

Sirisuttanan (2018) defines the term "startup" as an organization established to create a repeatable business model, and it is a rapidly growing business model. It is committed to developing new products or services within a highly unpredictable environment. Moreover, it is a new business that seeks to increase and solve the problems in its daily business life. The startup owners need to be responsive to the customers' needs by creating unique goods that offer an alternative to the conventional trends. Most startups nowadays are related to IT and technology.

JP Intelligence System Engineering Co., Ltd, is a **Software as Service** start-up. It has developed a ready-made software program, which can detect red light violations, and which can find motorcyclists who do not wear helmets using the innovative Red Light Violation Detection System, Magic Eye 4.0. This technology functions by detecting cars that cross the stop line when the traffic light is red. If a vehicle exceeds the stop line, the program sounds an alarm. Then a camera records a picture and video of the offending vehicle and obtains its registration number.

2. Payback Period

This is the method of financial appraisal used to evaluate the capital project, and calculates the return per year from the start of the project until the accumulated returns are equal to the cost of the investment, at which time the investment is said to have been paid back (Lefley, 1996: 208). It is primarily used for capital investment communication and decisions.

Finding the payback period of an investment project is based on the value of the financial loss on the investment and the time that benefits will be returned from the investment. The calculation can be divided into two cases as follows:

2.1 The return or net cash inflow after tax is an equal amount earned every year throughout the project life. This can be calculated using the following equation:

Payback Period = Initial investment / Annual net cash input after tax

2.2 In case of differences in the annual net cash inflow, the cash flow calculation can be done by obtaining a figure of accumulated cash flow for each year. During the first year of investment, there would be a negative cash flow value. After receiving the statistics for each year's accumulated cash flow, each year's cash flow is deducted from the initial investment. The time when the result of the deduction leaves the accumulated cash flow with an exact value of 0 marks the precise year of the Payback Period. If the accumulated cash flow does not remain precisely at "0", there is some positive

figure remaining. The payback period can be detected by comparing the input cash flow in the negative year with that of the positive figure in the overlapping year. The proportion of the remaining cash flow is used to compare (Thongsukhowong, 2011a).

Given that the payback period is an indicator that can help make investment decisions, it is essential to assess the cost-effectiveness of installing the traffic violation monitoring and reporting program to determine the investment's payback period. If any project has a short payback period, investors will quickly receive benefits from investing in that project.

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4. Net Present Value

This is the method that calculates the difference in the present value of the expected future return based on the required minimum rate of return or the capital cost versus the initial cost. It can be calculated using the following equation:

$$NPV = \left(\sum_{t=1}^{n} \frac{C_t}{(1+r)^t} \right) - I$$

NPV = Net Present value

n = number of interest periods/number of years

I = Initial Investment

R = Interest Rate / Rate of Return

Ct = Net cash flow received for each period

T = Year 1 to Year n

The decision to accept a project depends on the net cash flow, which must only be positive to confirm the worthiness of the investment. The positive future of net cash flow must show that the return on investment is higher than the required rate of return or greater than the cost of acquisition (Thongsukhowong, 2011b).

The net present value method is essential in the investment decision-making process. The net present value must be assessed to determine whether installing a program that monitors and reports traffic violation cases is worthwhile.

5. The Internal Rate of Return (IRR)

This is the rate of return an investor expects to receive on an item to be invested in. IRR is a discount rate that makes the present value of the net cash inflow equal to the net investment cash. In this case, the NPV was equal to zero. When the IRR is greater than the financial cost, the investments are profitable and worth investing in. The higher IRR value indicates that the investment will be profitable. If the IRR is less than the financial cost, it means that the investment will not be profitable and should be rejected. When IRR is equal to zero, the investment is equal to the capital. Awirottananon (2018) demonstrated that it could compare IRR to the loan's interest rate. The project is worth the investment if the IRR is higher than the loan's interest rate. On the other hand, if the IRR is lower than the loan's interest rate, the project is not worth the investment.

The formula for the IRR Calculation

$$0 = -CF + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \frac{CF_n}{(1+IRR)^n}$$

CF = net cash flow per year, N = investment year

To assess the worthiness of investment in the program that monitors and reports cases of traffic light violations, it is necessary to calculate the internal rate of return to help the potential buyers make a purchasing decision.

Occasionally, there are conflicts between the NPV and IRR because of a great difference in the free cash flows in the first and the final years. Therefore, the analysts would use the NPV as the primary reference because it uses Weighted average cost of capital (WACC), an actual cost of money that is more reasonable than the IRR (Chotinarumon, 2013).

6. Method for Estimation of Income

Sanitwong Na Ayuthaya (2005) reveals several methods to estimate incomes. It depends on many factors, such as the nature of the business, the cost of personnel budgeting and the duration of the budget. The estimated income is as follows:

1) **The Casual Approach** is an estimation of income that is based on the factors, which affect business performance. All related factors are used as a foundation for the analysis of income.

2) **The Non-Casual Approach** estimates income, which is based on historical data. In this approach, it is assumed that all the factors affecting the past operations of the business will continue to have the same effect in the future. Statistical methods are used to help identify trends.

3) **The Indirect Approach** is a method for estimating revenue from all the sales that the industry is operating. The data is then evaluated according to the proportion of the business, which causes the company to be analyzed according to the specified policies, which includes making predictions about the movements of a business' s competitors.

4) **The Direct Approach** is an estimation of income based on evaluating the necessity of commodities for consumption. Since there is a limitation about income estimation, the non-casual approach was used for income estimation in this study.

7. Road Traffic Act, B.E. 2522

Section 22 of The Road Traffic Act of B.E. 2552 states that drivers must follow the traffic signs or road markings that appear in front of them in the following cases:

(1) When seeing the amber traffic light, the driver must prepare to stop the vehicle behind the stop line to prepare for the action in (2). However, if the driver has already passed the stop line when the amber light comes on, then the drive can proceed.

(2) When seeing a red traffic light or other stop signs, the driver must stop the vehicle behind the stop line.

(3) When seeing a green light traffic light or other green signs to mean "Go," the driver can continue driving unless there is another traffic instruction that is otherwise specified.

(4) When seeing a green arrow sign directing a driver to turn or to go straight, or when seeing a red light with a green arrow directing a turn or moving forward, the driver must drive with caution and must allow the pedestrians or the vehicles on the right side to go first.

(5) When seeing a flashing red light installed on any side of an intersection, the driver must stop the vehicle behind the stop line. When seeing that it is safe and there are no traffic obstructions, the driver should continue driving with caution.

(6) When seeing a flashing amber light at any location, the driver must reduce the vehicle speed and pass that road with caution.

A driver who wishes to drive straight must take the lane marked with the "go straight on" sign. A driver who wants to make a turn must enter the lane with a turning sign. All drivers must enter the desired lane immediately after seeing the notice signs (Office of the Council of State, 2019).

8. Rates of Traffic Fines

According to the Road Traffic Act, when determining the amounts of the fines to be enforced for the traffic violators, The Royal Thai Police (2020) have accordingly specified the amounts of the penalties by the Road Traffic Act of B.E. 2522 as follows:

2 Characteristics of traffic signs and road signs

Based on Article 25, Section 22, and Section 152, the following offensive traffic behaviors are subject to fines of 500 baht:

(1) Not following the amber traffic signal.

(2) Failing to follow the red-light signal or other red traffic signs with the word "Stop."

(3) Failing to obey the green-light signal or other green traffic signs with the word "Go."

(4) Failing to follow the green arrow light, which signals the drivers to keep going or to turn, and failing to follow the red light with the green arrow light, indicates making a turn or going straight.

(5) Failing to follow the flashing red light.

(6) Failing to follow the flashing amber light.

17 Characteristics of Miscellaneous Violations

In analyzing the cost-effectiveness of investing in the program that detects traffic light violations, the cash flow, which has been taken from the traffic violation fines, should be considered. Therefore, it is essential to understand the forms of violation and the rates of the penalties.

Prior Studies related to Capital Investment Analysis

This research is an exploratory study to investigate the financial evaluation of new technology product development by startups, particularly a traffic violations program, using management accounting techniques. The product launched in the end of 2017; consequently, there is a limitation about the prior related article. Therefore, the related papers are relevant to the capital investment analysis.

Saisuthanawit and Charoenchai (2018) analyzed the cost and engineering economic value of the interlocking block pilot plant using the Mae Moh Power Plant Bottom Ash Project. Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) and a sensitivity analysis were used to analyze the cost and engineering economic value of the project. The interlocking block pilot plant investment cost is

2,027,000.00 baht and the operational cost per year is 1,707,200.00 baht. For analysis, the discount rate at 3 and 7.12 percentages was used. The engineering economic value analysis showed that the net present value (NPV) was equal to 7,465,205.13 and 5,836,766.15 baht. The Internal Rate of Return of the project (IRR) was equal to 60.51 and 54.34 percentages. The Benefit Cost Ratio (BCR) was equal to 1.45 and 1.42 respectively. The payback period was equal to 18.85 months. Therefore, the interlocking block pilot plant using the Mae Moh Power Plant Bottom Ash Project is worth the investment.

Malatji, Zhang & Xia (2013) investigated the financial appraisal methods that can provide optimal decisions for building energy efficiency investment decisions. Based on 25 case studies, the results show that a project is attractive for investment if Net Present Value is positive (greater than zero) with short payback periods; that is, a project is profitable which can identify monetary savings.

Lawrence et al. (2019) studied the effect of monetary payback time and firm characteristics on electricity saving in the energy-intensive industry in Sweden from 2007 to 2015. The PLS results reveal that the monetary investment and payback time are more likely to influence electricity-saving in the energy-intensive industry in Sweden than the firm characteristics.

Laopuangsak, Chantaranumchu & Dittavirun (2011) studied the costs and benefits of a Bypass Road Project on the Route San Pa Tong – Hang Dong (Part 1) in Chiang Mai Province. This research study aimed at analyzing the costs, benefits, and economic value of the construction of this bypass. The results showed that the project had had an NPV of the cost for saving the use of cars at the rate of 52.59 million baht, while the value of saving travel time was rated at 234.0 million baht. The benefit value was 286.59 million baht. The NPV cost of 132.65 million baht resulted in an NPV value of 153.94 million baht. When an NPV value is greater than zero, a project is considered suitable for investment. The benefit and cost ratio were rated at 2.16, which is greater than

1. These results indicated that investment was appropriate. Moreover, the IRR was found to be greater than the investment cost at 25.2%. Based on the findings, it was concluded that the construction of the bypass would be a worthwhile investment.

Laopuangsak, Chantaranumchu & Dittavirun (2013) analyzed the economic worthiness of an intersection project on Highway 331 in Ban Nong Khla in the Sriracha District of Chonburi Province. The study aimed to investigate the benefit costs and the economic benefits of the section construction project. The study methodology consisted of a cost-benefit analysis and a financial worthiness analysis using NPV, the benefit/cost ratio, and IRR. The results showed that the project had the following: 1) an NPV for car usage with a savings of 209.36 million baht, 2) a value of 130.32 million baht for saving travel time, and 3) a benefit value of 339.68 million baht. Moreover, the cost's present value of 105.99 million baht led to the NPV of 233.69 million baht, while the ratio of benefit and cost was 3.20, and the IRR value was 35.9%. This figure shows that the NPV value is greater than zero. The ratio of benefit and cost was more significant than 1, and the IRR was greater than the investment cost by 12%. The results indicated that the intersection construction project in the Ban Nong Kla Village in Sriracha had been a worthwhile investment.

Methodology

1. Population and Sample

This research is an exploratory study since there is a lack of investigation into the financial evaluation of new technology product development of startups, particularly a traffic violations program, using management accounting techniques. Mixed method is adopted to collect data.

For the qualitative method, it consists of a case study and interview. The researchers used purposive sampling to select the case study (Saunders, Lewis & Thornhill,

2007), and we chose JP Intelligence System Engineering Co. Ltd. to be the case study. This company is a new startup that has created a traffic violations program to examine and report cases of traffic light violations. More specifically, their new technology product can help reduce the causes of road accidents and the recklessness of drivers' behaviors, which are time-consuming for traffic police officers. Therefore, investigating the financial benefit of implementing this traffic violations program is of interest. Interviews were separated into two groups: firstly, concerning product information and pricing, the researchers selected the director of JP Intelligence System Co. Ltd. for interview because he can provide in-depth detail of the new technology's product development. Secondly, concerning the end users, the researchers chose three police officers from Khon Kaen Provincial Police Office because their duty is related to traffic light violations.

The quantitative method is financial analysis. For this stage, the secondary data received from the interview was analysed using management accounting techniques: Payback Period, Net Present Value (NPV), and Internal Rate of Return (IRR) (Aungvaravong, 2020; Thongsukhowong, 2011; Lefley, 1996).

2. Data Collection

The researchers collected data using semi-structured interviews and open-ended questions, allowing the researchers to control the interview without losing the overall direction (Saunders, Lewis & Thornhill, 2007). Before starting the interview, we presented a consent form asking permission from the interviewees. For interviewing the director, he was asked questions about the financial costs of the product and general information about the product and the company. Meanwhile, for interviewing the police officers, they were asked questions about the traffic light violations rules, penalties and the duties of their job. The interviews took approximately 20-30 minutes per person. Audio-recording and note-taking were used to record the conversation during the interview.

3. Data Analysis

The management accounting techniques used for project evaluation consisted of the Payback Period, Net Present Value (NPV), and Internal Rate of Return (IRR). These techniques are most extensively used for capital investment appraisal to new technology products (e.g., Jedwanna and Pongthanaisawan, 2021; Ashford, Dyson & Hodges, 2016; Laopuangsak, Chantaranumchu & Dittavirun, 2011; Laopuangsak, Chantaranumchu & Dittavirun, 2013; Silva et al. 2019).

Findings

1. Payback Period

Based on an interview with police officers from the Khon Kaen Provincial Police Office, it was found that the cash flow of the Khon Kaen Police Office was coming from traffic light violation fines. Moreover, the researchers asked for information about the fine orders generated by the traffic monitoring and reporting program issued in 2020. The Police Office had to be responsible for some expenses related to the cost that ccurred when issuing the orders. These costs included a printer rental fee of 5,500 baht per month, a paper fee of 600 baht per month, and a postal service fee of 3 baht per order.

By interviewing the director of JP Intelligence System Engineering Co., Ltd., the researchers were able to obtain the number of orders issued by the traffic violation monitoring and reporting program from 2017 to 2019.

Therefore, the researchers estimated the revenues, which were generated from the order penalty payments issued in 2020, as a foundation for the cost-effective analysis. It was assumed that any factors that had affected past operations would still yield the same effect to the present day's operations. Based on this calculation the net cash flow was computed, as displayed below.

Table 4.1: The Annual Net Cash Flow of the Agency

Years	Cash Flow Received	Cash Flow Paid	Net Cash Flows
2017*	66,330	17,600	48,730
2018	535,688	116,811	418,877
2019	353,926	102,014	251,912
2020	892,500	145,794	746,706

* The 2017 data was collected after introducing the traffic violations monitoring and reporting program from November and December.

The researchers considered the importance of the relationship between money and time. For this purpose, the discount rate calculation was analyzed. The researchers investigated some related studies as follows: a) a study that investigated the payback efficiency of a project to substitute the NGV vehicles with electric buses for the service of the public transportation organization (King Mongkut's Institute of Technology Ladkrabang, 2016), and b) a study which was conducted on tax incentives in the business of manufacturing hard-disk drives that are promoted by BOI and the cost-effectiveness and worthiness of the promotion sector (Saisuthanawit and Charoenchai, 2018). In both studies, it was found that the discount rate was used about the rate of Minimum Loan Rate (MLR) issued by commercial banks registered in Thailand. Accordingly, for this research, the MLR of 6.60%, which the commercial banks published, was used to calculate the discount rate (Bank of Thailand, 2017). In addition, this referential MLR loan rate was fixed throughout the project.

Table 4.2: The Agency's Accumulated Cash Flow

Years	Net Cash Flows	Net Cash Flows in Discount Rate of the Present Value	Accumulated Cash Flows
Initial Investment Cost			(450,000.00)
2017 (Nov.–Dec.)	48,730	45,712.95	45,712.95
2018	418,877	368,614.24	414,327.18
2019	251,912	207,958.77	622,285.95
2020	746,706	578,256.90	1,200,542.85

From Table 4.2, the results show that an initial investment of the project of 450,000 baht will be returned by 2019. The calculation reveals that the payback period was two years, two months, and two days.

2. The Net Present Value (NPV)

$$NPV = \left(\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}\right) - I$$

NPV = net present value

I = Initial investment cost (450,000 baht)

Ct = Net cash flow received for each period

T = Year 1 to Year n

n = number of years used in the calculation (specifically, it was four years for this research)

r = Discount rate of 6.60% based on the minimum loan rate (MLR) from commercial banks for 2017 (data from the Bank of Thailand). This rate was fixed throughout the project.

Table 4.3: The Calculation of Net Present Value (NPV)

Years	Initial Investment Cost	Net Cash Flows	PVIF	Net Cash Flows in the Discount Rate of the Present Value
2017	(450,000)	48,730	0.938086304	45,712.95
2018		418,877	0.880005914	368,614.24
2019		251,912	0.825521495	207,958.77
2020		746,706	0.774410408	578,256.90
		PV		**1,200,542.85**

*The discount rate was based on the Minimum Loan Rate (MLR) issued by the commercial banks in 2017 (Bank of Thailand, 2017).

When

$$NPV = \left(\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}\right) - I$$

NPV = 1,200,542.85 – 450,000

= 750, 542.85

From Table 4.3, the project's initial investment was 450,000 baht, and that the Net Present Value (NPV) over the four years of the project was 750, 542.85 baht, which

was greater than 0, indicating that this project has a greater rate of return than the investment cost.

3. Internal Rate of Return (IRR)

$$0 = -CF + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \frac{CF_n}{(1+IRR)^n}$$

CF = Yearly Cash Flow

N = Years of investment (This study calculates a 4-year project.)

$$0 = -450000 + \frac{48{,}730}{(1+IRR)} + \frac{418{,}877}{(1+IRR)^2} + \frac{251{,}912}{(1+IRR)^3} + \frac{746{,}706}{(1+IRR)^4}$$

The Internal Rate of Return (IRR) was 48.88, which had a higher value than the discount rate of 6.60.

When

$450{,}000 = 48{,}730/(1+48.88\%)^1 + 418{,}877/(1+48.88\%)^2 + 251{,}912/(1+48.88\%)^3 + 746{,}706/(1+48.88\%)^4$

$450{,}000 = 48{,}730*0.67168189 + 418{,}877*0.45115656 + 251{,}912*0.30303369 + 746{,}706*0.20354224$

$450{,}000 = 32{,}731.06 + 188{,}979.11 + 76{,}337.82 + 151{,}986.22$

$450{,}000 \approx 450{,}034.21$

Discussion and Conclusion

This exploratory research study investigates the evaluation of the cost-effectiveness of installing a program to monitor and report cases of traffic light violations in Khon Kaen Province. A mixed method was used for research methodology. We selected JP Intelligence System Engineering Co., Ltd. to be the case study since it is a new startup to create a traffic violations program to examine and report the cases of traffic light

violations. Next, we interviewed with the director of JP Intelligence System Engineering Co., Ltd. and three police officers in Khon Kaen Provincial Police Office, in order to receive product information. Lastly, we adopted a quantitative method with management accounting techniques for the project's assessment, consisting of the Payback Period, the Net Present Value (NPV), and the Internal Rate of Return (IRR).

The finding shows that with the project's investment cost of 450,000 baht, the business would have a payback period of two years, two months, and two days, with the net present value (NPV) of 750, 542.85 baht and the internal rate of return (IRR), which was equal to 48.88%. The finding indicates that the payback period was short: two years, two months, and two days. The Net Present Value (NPV) was equal to 750, 542.85 baht, greater than 0, indicating that this project has a greater return on investment. The NPV result was aligned with Saisuthanawit and Charoenchai (2018) and Chatwiriyacharoen (2015), given that if NPV is positive, the project under investigation yields greater returns than the investment. Therefore, implementing the traffic light monitoring and reporting project will offer a greater return than the investment costs, which indicates that the project will be profitable. The Internal Rate of Return (IRR) was equal to 48.88%, greater than the reference discount rate of 6.60%, which was derived from the minimum loan rate (MLR) issued by the commercial banks in 2017. This shows that the project is profitable. This result was supported by Awirothananon (2018) who demonstrated that if the IRR is higher than the loan interest rate, the project is worth the investment, which was the conclusion for this project.

This research contributes to management accounting research in startups in two ways. Firstly, we investigate the capital investment of startups' products in which there is the limitation of study of management accounting in this field. Particularly, our findings can guide startup owners to apply management accounting techniques to estimate the value of their products since it is difficult to assess the precise financial benefits of new

technology products before prototype installation. Secondly, introduction of new technology by startups contends a highly uncertain ecosystem under different perspectives: market, product features, competition, people and finance (Teberga, Oliva & Kotabe, 2018). Therefore, investing in new technology products has unclear benefits and a high risk for investors. Our findings can be used as a guideline to make optimal decisions in similar projects in future. Next, for the practical implication, the program validation has 96.3% accuracy for detection of traffic violations (Wonghabut et al., 2019), but there is no guarantee about its financial valuation. Therefore our study provides further contributions to assure that this program also provides financial profitability and high value for investment.

Suggestion

This research has limitations, which further studies can improve upon. Firstly, our study did not focus on possible influencing factors of the investment project, such as inflation, interest rates/discount rate changes, economic growth, and the firm's characteristics. Further studies may concern themselves with these factors. Secondly, this research is an exploratory study in which information is limited for comparison since the startup launched their product in the end of 2017 and their product is the first traffic violations program of its kind. Further studies may investigate the same type of product and compare their findings with our results. Lastly, in terms of generalization, we focus on one startup type, and further investigation may broaden our scope.

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