The Development and Use of The Probabilistic Financial Decision Model for a Company Expansion

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Abstract

In the United States, companies are expanding constantly. However, in an industrial equipment dealership expanding into a new state, it is important to understand the industry, new market, and costs associated with expanding. With using financial statements of data-backed percentages for growth, research seeks to set up a financial model to see if expansion for an industrial equipment dealership into the state of North Carolina will be a financially wise decision. Wesley Worldwide, an industrial equipment dealership, is moving forward with the investment of expanding into North Carolina. However, it is vital to understand the financial predictions for profit return on investment. The methodology for doing this was to collect all previous sales, gross profit, expense, and market data, and research to create a model to detect and predict the future markets and sales growth potential in North Carolina. Through all the previous data, three different forecasts were made. Not only does this mathematical model predict the success of expanding into North Carolina, but it also creates measuring points along the way for what needs to be improved or focused on the most while in the expansion period.

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Introduction

Intention & Importance

This thesis will explore how to understand and create a financial model calculating the gross profit of an industrial equipment dealer expanding into a new territory. For privacy purposes, North Carolina has been chosen as the "example" state for explaining the financial model of the expansion, even if it is not the actual state. For privacy purposes as well, the company will be referred to as Wesley Worldwide, a legitimate equipment dealership. Anytime personal communication involving this company comes from the CEO of Wesley Worldwide, with the name will be kept confidential for trade secret reasons.

While the action of acquiring companies happens frequently in the business industry, seeing the mathematical decision-making process is not as frequently seen or understood. Especially in a growing equipment dealership, implementation of more formal data analysis processes is needed to provide a foundation for formal decision making and confirmation of logistical thinking.

Background on Wesley Worldwide

Wesley Worldwide, an industrial equipment dealer, is expanding into a new state, North Carolina. In this study, the data analytics model that Wesley Worldwide used to expand into the state of North Carolina will be explained and calculations shown in this paper. After applying and being accepted on a deal to be an official, permitted dealer, Wesley Worldwide will be entering a new market and expanding into North Carolina to sell, service, and provide material

handling solutions. When businesses expand, they usually are buying another dealer or have some sort of equity they are buying; in this case that is not the reality. In this case, the only thing being acquired is the presence in the territory in order to be allowed to service and sell forklifts. There will be a significant amount of capital invested in the new territory, but there will be no initial purchase price to be in the new territory.

Already one of the largest material handling forklift dealers in the country, Wesley Worldwide is in over 10+ states. Some of the most common products and brands sold by Wesley Worldwide are CAT, Mitsubishi, Kalmar lift trucks, rail car movers, and Ottawa, etc. For a business model, the largest three areas Wesley Worldwide focuses on for the company are maintenance and service, rental products, and fleet management. Rental solutions offered by Wesley Worldwide include short term and long-term equipment rental. Service and product support ensure that all customers' equipment is functioning and in good condition. With the expansive company size and solution offerings, Wesley Worldwide seeks to provide each customer with a 20,000-foot view of the whole customer's equipment fleet in order to maximize equipment strategies.

With the current market and supply chain issues, one of the biggest demands currently is rental solutions. In fact, one of the largest sales strategies for the new state of North Carolina is providing and offering rental solution rapidly for all customers. The market that Wesley Worldwide mainly works in is business to business. Some of the largest customers are Walmart, Kraft-Heinz, and United Natural Foods, Inc [personal communication]. The outlook for the business expanding into new territory looks promising, however, understanding the models and financials behind the business expansion is key before making such a crucial decision.

Markets Overview

Markets for Wesley Worldwide's products and services are primarily manufacturing, distribution, and heavy industry, all totally business to business. Customer awareness is largely through digital marketing, the website, and to a lesser extent telemarketing and personal sales calls. This trend to digital marketing and away from personal sales calls has continued for over five years.

Wesley Worldwide is very blessed that most of their revenue is derived from the material handling industry which reports all orders and shipments of individual units monthly for each county/province in North America, something on which many consumer products companies spend millions of dollars just to drive an estimate each month for their corresponding orders and shipments. In addition, this monthly data is divided into five different classes or types of equipment. To give some perspective, roughly one piece of material handling equipment is sold in the US for every 100 cars that are sold[1]. From this information, it is relatively easy to determine market share, trends, and opportunities in thousands of geographic areas.

Wesley Worldwide's business opportunities historically have been relatively equally divided between providing equipment to customers and providing support of equipment owned or used by customers. They provide equipment to customers through rental or sale of new or used equipment. They also provide aftermarket support of customer equipment, generating parts and service labor sales. They use the order data to determine Wesley Worldwide's performance of providing equipment to the marketplace. The shipment data enables us to determine our performance of providing aftermarket services to existing equipment in the marketplace. Over time, shipments will equal orders.

Averaging across all five classes of equipment, Caterpillar's share of the U.S. market is around 7%. Some Wesley Worldwide divisions have attained 18%. For parts and service (aka product support) revenue, Wesley Worldwide can estimate potential from past data on average product support (PS) revenue generated per Class of material handling equipment.

Further, the needed rental fleet size and composition can be targeted at 4% of that of the annual International Truck Association (ITA). Previously, Wesley Worldwide acquired new companies or expanded into new territories 10+ times in the last 15 years. This provides a data-backed method to be able to put the best foot forward in the next expansion.

Overview

The first thing to begin with when expanding into a new territory is understanding all the key factors and influencers of revenue, cost, and risks. This is shown below in an influence diagram. Influence diagrams allow visualization of the impact of one variable onto the overall decision process, as well as what variables are influential to the final decision. Brainstorming what unexpected variables could possibly influence the diagram is another benefit. Fig. 1 is an influence diagram to visualize what factors will be most influential in revenue and cost when expanding into the new territory of Alabama.

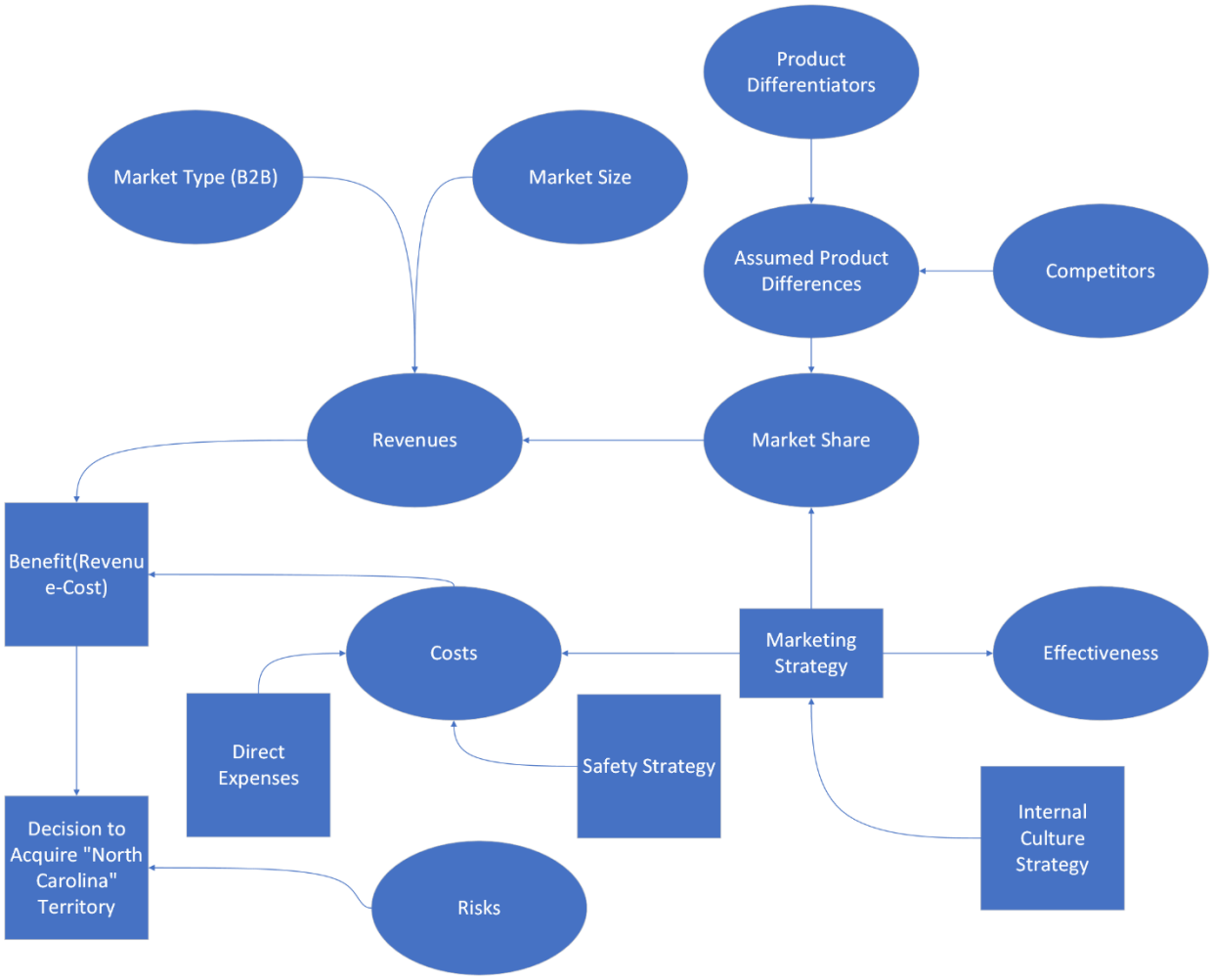

Fig. 1. The influence diagram of a business expansion.

Background

This paper will introduce three scenarios which represent three different profits based off of market fluctuation predictions. The three different profits will be shown by an upper level for a higher market return, a middle level for an average market return, and a lower level for a lower market return. While these are not exact numbers, most of the numbers for the upper scenario came from percentages for sales and profit from some of the best years within the last fifteen years of the equipment dealership.

This financial model calculates new sales equipment based off of goal market share. The market share is based off of the total amount of equipment in the state of North Carolina (rental and sold equipment). These numbers come from International Truck Association, ITA. Gross profit is calculated by a percentage of sales.

Market

TABLE **I**

HISTORICAL ITA ORDERS FOR "NORTH CAROLINA"

ITA ORDERS	Class									
Year	1	2	3	4	5	Total	1, 2, 3	4 & 5	1, 2, 3	4 & 5
2016	523	181	631	547	788	2670	1335	1335	50%	50%
2017	702	199	954	870	751	3476	1855	1621	53%	47%
2018	595	246	810	1043	1059	3753	1651	2102	44%	56%
2019	482	195	937	567	782	2963	1614	1349	54%	46%
2020	645	174	925	587	784	3115	1744	1371	56%	44%
2021	1052	263	1215	695	1155	4380	2530	1850	58%	42%
Avg 2016-21	667	210	912	718	887	3393				
%	20%	6%	27%	21%	26%	100%				

Class 1-3: Electric Trucks
Class 4-5: IC (internal combustion)

Shown in this model is all the total truck orders placed by customers for new equipment or by dealers for rental trucks. The orders go from year 2016 to year 2021 as well as the average from year 2016 through year 2021. The figure also shows the total orders for Class 1-3 which represents all the electric truck order amount as well as total orders for Class 4-5 which represents all the IC truck order amount.

Table 1 shows the industry average for the state of North Carolina and the total amount of orders (including customer orders and equipment dealer orders for rental fleets). This is background data to understand how to predict the number of customer-ordered and rental-ordered trucks Wesley Worldwide should expect in the region considering all the dealers.

The current ITA of the region is 3393[1]. However, in the calculations, this number will be rounded to 3,400 trucks. This is an annual report given by the International Truck Association. Each equipment dealer's orders from customers are reported to the manufacturers. All manufacturers report to the international association. This proceeds to mean that every truck that has been bought by a customer within all the regions of North Carolina within the last year is 3,400. So, if Wesley Worldwide was able to buy have customers buy 3,400 trucks, the company would basically have 100% of the market share.

Sales

This section addresses the revenue associated with sales which includes new equipment, used equipment, rental, parts, and service. The biggest revenue in sales based off of the previous year's revenue is product support which includes parts and service. The second largest sales revenue is new machines. However, for this expansion, the gross profit will be assumed to be significantly lower than most years because of lowering the price of new equipment to gain more market share. The lowest revenue out of all sales categories is usually used machines.

New

New equipment sales are calculated by multiplying the count of new trucks by $35,000 which is the average price of a new forklift truck. For the upper level, the starting goal market share for year 1 is 7.35% (with 41 new customer trucks) 18.09% in year 10, For the middle level, the starting goal market share for year 1 is 7.1, and years 2 through year 10 are shown in Table II.

TABLE II

UPPER-LEVEL GOAL MARKET SHARE

ITA Estimate	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	
Market Share	**7.4%**	**9.6%**	**10.6%**	**12.1%**	**13.2%**	**14.12%**	**15.88%**	**16.62%**	**17.35%**	**18.09%**	
	Base	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**	**Total**
Customer	50	225	280	330	370	400	460	485	510	535	3645

Shown in this model is all the total truck orders placed by customers, the goal market share for Wesley Worldwide, and how many new trucks is needed to hit goal market share for middle level.

For the upper level, the starting goal market share for year 1 is 7.4%. For year 2 to year 10 is showing below table with new customer truck count below.

TABLE III

MIDDLE LEVEL GOAL MARKET SHARE

ITA Estimate	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	
Market Share	**7.1%**	**8.5%**	**9.7%**	**11.2%**	**12.4%**	**13.24%**	**13.82%**	**14.12%**	**14.26%**	**14.56%**	
	Base	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**	**Total**
Customer	41	200	260	310	350	380	400	410	415	425	3191

Shown in this model is all the total truck orders placed by customers, the goal market share for Wesley Worldwide, and how many new trucks is needed to hit goal market share for middle level.

For the middle level, the starting goal market share for year 1 is 7.1%. For year 2 to year 10 is showing below table with new customer truck count below.

TABLE IV

LOWER-LEVEL GOAL MARKET SHARE

ITA Estimate	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	
Market Share	**7.4%**	**7.9%**	**8.4%**	**9.1%**	**9.9%**	**10.59%**	**11.32%**	**12.06%**	**12.35%**	**12.65%**	
	Base	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**	**Total**
Customer	50	190	225	250	275	300	325	350	360	370	2695

Shown in this model is all the total truck orders placed by customers, the goal market share for Wesley Worldwide, and how many new trucks is needed to hit goal market share for lower level.

For the lower level, the starting goal market share for year 1 is 7.4% which has the higher market share percentage as upper level, however, it tapers off and by year 5 to year 10 it is the

lowers percentage out of the 3 options. For year 2 to year 10 is showing below table with new customer truck count below.

Used

Used equipment sales equate to a certain percentage of new equipment sales. For all 10 years, the used equipment sales are calculated by multiplying new equipment sales by 12% for the upper level, 10% for the middle level, and 8% for the lower level.

Rental

For rental, all of the numbers for year 1 for upper, middle, and lower level are the same. However, for year 2 through year 10, the utilization changes. For year 1, there is a pre-set amount of rental equipment to buy for class 1, 2, 3, 4, & 5 with a preset amount of utilization percentage of 75% for upper level, 65% for middle level, and 55% for lower level. After year 2, the expected rental sales growth for upper level is 40% increase into year 3, for middle level is 30% in year 3, and for lower level is 20% in year 3. This yearly percentage growth continues to decrease until finally reaching 1% from year 9 to year 10.

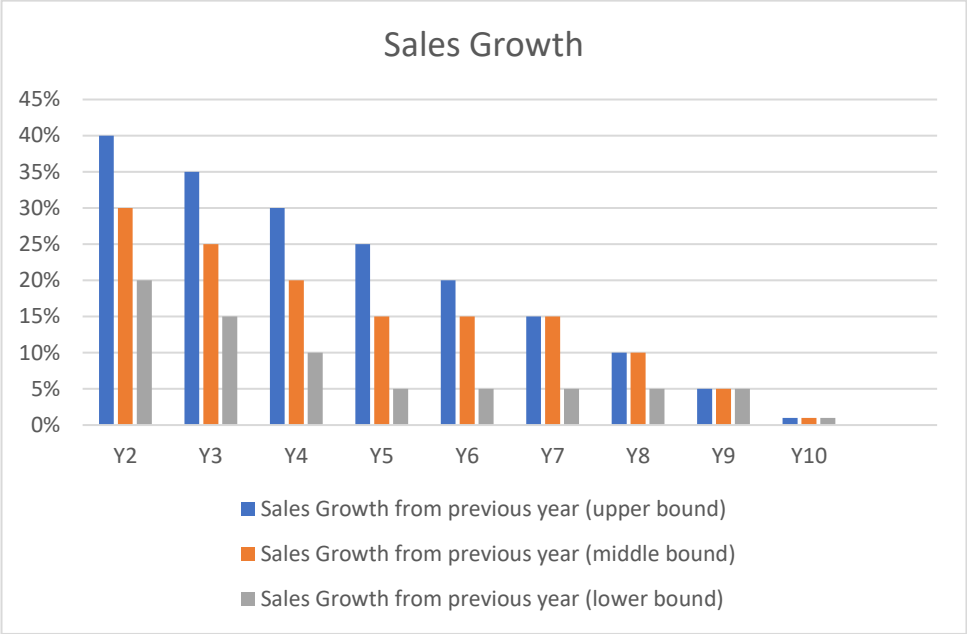

Fig. 2 Change in Sales Growth Percentage from Year 1 to Year 9 for upper, middle, and lower level

Product Support

The product support sales are calculated by taking the total gross profit of product support and dividing it by gross profit percentage. Going into year 2, the gross profit percentage for higher level begins at 50% in year 2 and increases .5% each year until 53.5% in year 10. For the medium level, the gross profit percentage begins at 48% in year 2 and increases .5% each year until 52% in year 10. For lower level, the gross profit percentage begins at 46% in year 2 and increases .5% each year until 50.5% in year 10. The gross profit percentage for product support are illustrated in Figure 3.

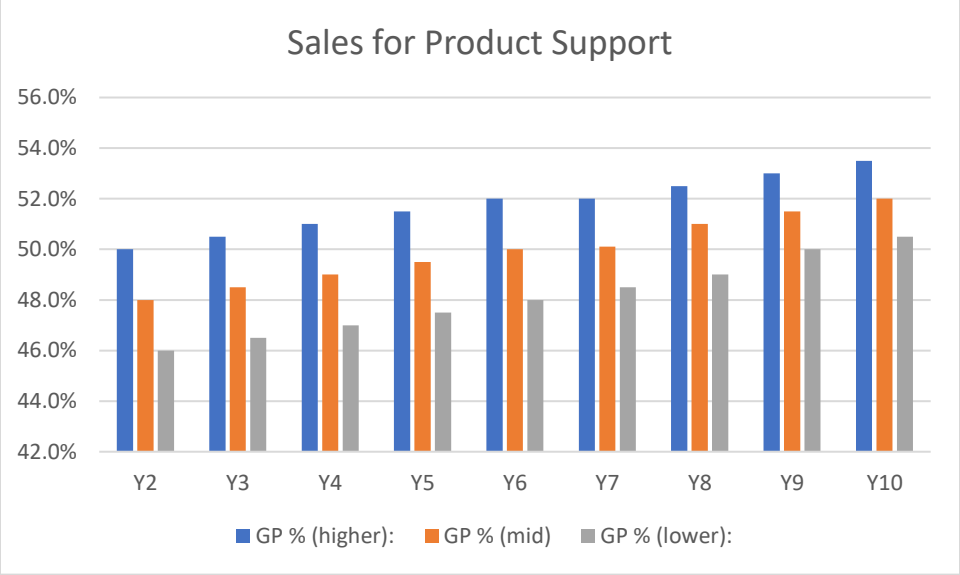

Fig. 3 Change in Sales Growth Percentage for Product Support from Year 1 to Year 9 for upper, middle, and lower level.

Gross profit

New Equipment

New equipment gross profit equates to new equipment sales multiplied by a certain gross profit percentage. For the upper level, the gross profit percentage equals 1% in year 2 increasing to 8% in year 10. For the middle level, it equals 0% in year 2 increasing to 6.5% in year 10. For the lower level, it equals 0% in year 2 increasing to 5% in year 10.

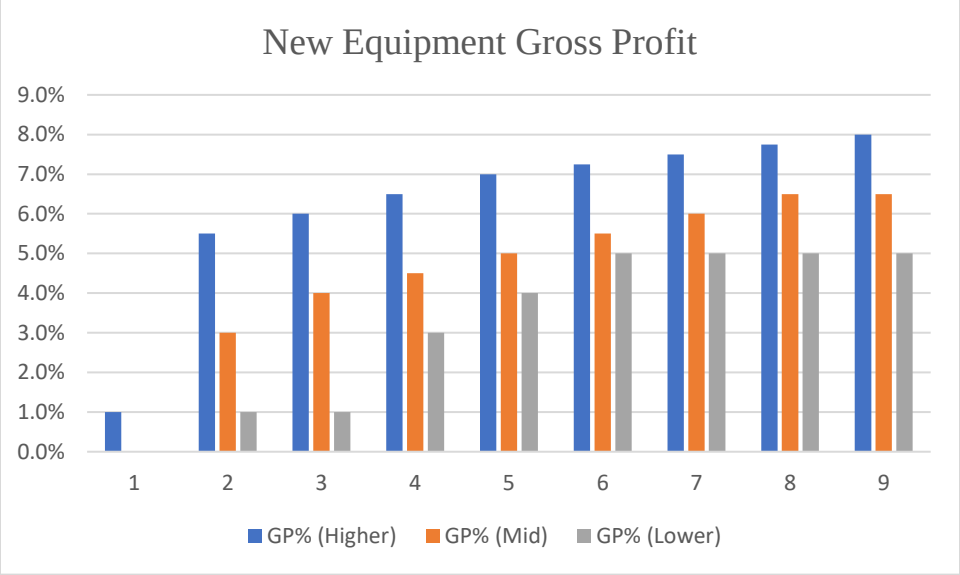

Fig. 4 Change in Gross Profit Percentage for New Equipment from Year 1 to Year 9 for upper, middle, and lower level.

Used Equipment

Used equipment gross profit equals the used equipment sales number multiplied by gross profit percentage expected for used equipment. The used equipment gross profit percentage equates to 34% in year 2 increasing by 0.5% to 1.0% each year to 40.5% in year 10 for upper level. For middle level, it equates to 29% in year 2 increasing by 0.5% to 1.0% each year to 34.5% in year 10. For lower level, it equates to 24% in year 2 increasing by 0.5% to 1.0% each year to 29.5% in year 10.

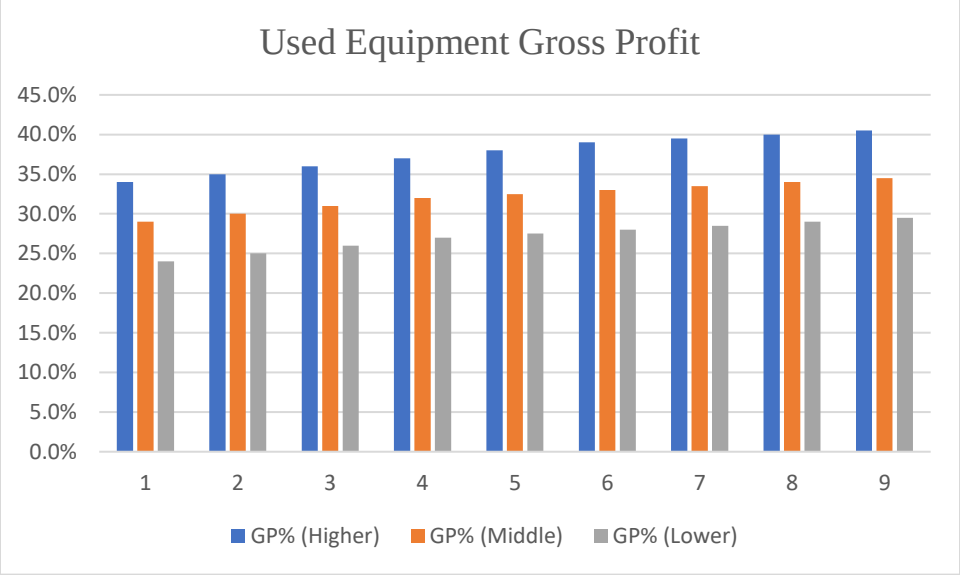

Fig. 5 Change in Gross Profit Percentage for Used Equipment from Year 1 to Year 9 for upper, middle, and lower level.

Rental

The used equipment gross profit equals the sales profit of used equipment multiplied by gross profit percentage (GP%). The used gross profit percentage was calculated at 38% in year 2 increasing by 0.5% to 1.0% each year to 43% in year 10 for the upper level. The used gross profit percentage was 33% in year 2 increasing by 0.5% to 1.0% each year to 38.5% in year 10 for the middle level. It was 28% in year 2 increasing usually by 0.5% to 1.0% each year to 33% in year 10 for the lower level.

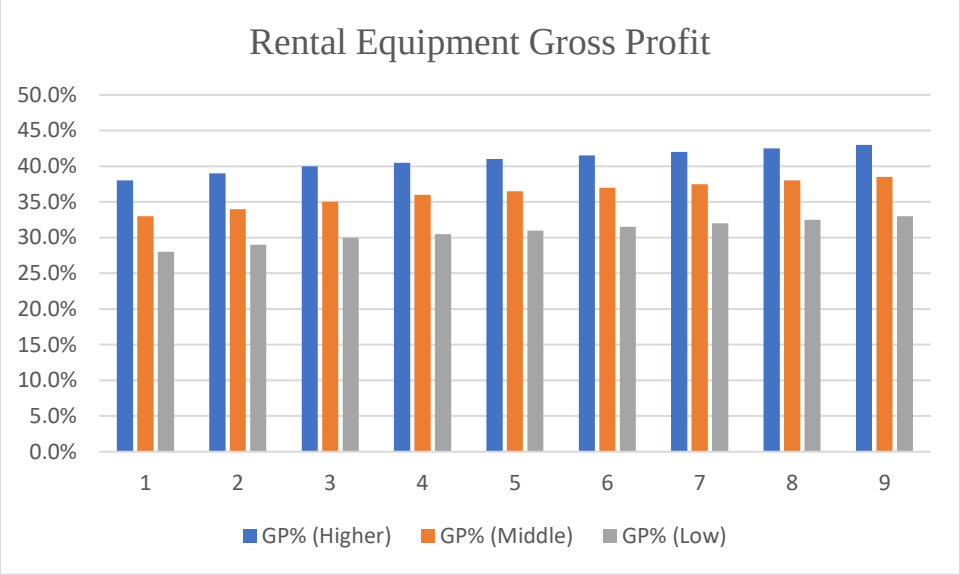

Fig. 6 Change in Gross Profit Percentage for Rental Equipment from Year 1 to Year 9 for upper, middle, and lower level.

Product Support

The product support is calculated by taking the average gross profit per technician by how many technicians there are currently hired. For the upper, middle, and lower levels, the predicted count of technicians hired between the levels are the same: 3 total hired technicians in year 1, 9 total hired technicians in year 2, 18 total hired technicians in year 3, and 27 total hired technicians in year 4. This predicted count continues the multiple of 9 until hitting 81 total hired technicians in year 10.

The gross profit per technician per year is show in the Fig. 7 showing that the gross profit at year 10 for the upper level is $175,000, for the middle level is $165,000, and for the lower level is $150,000.

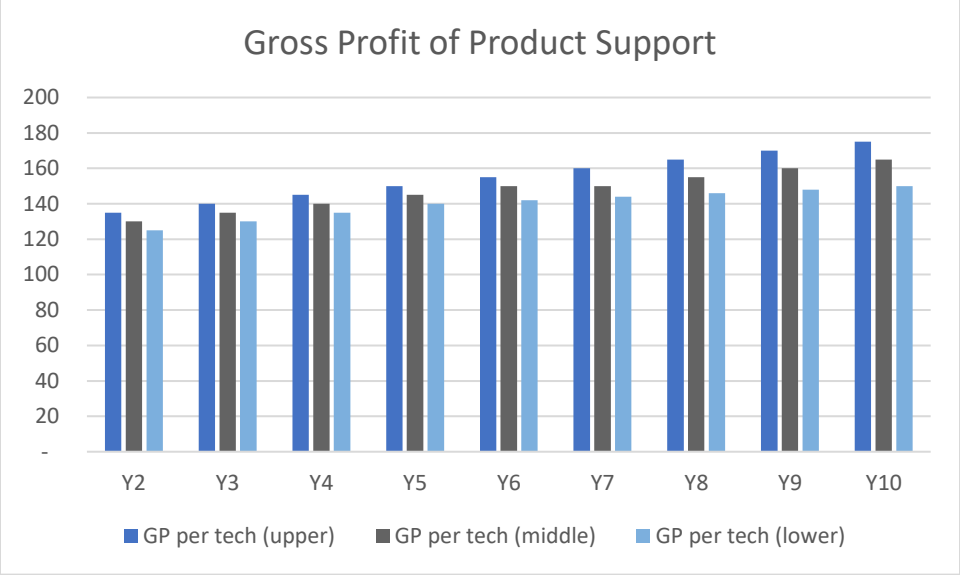

Fig. 7 Change in Gross Profit of Product Support for upper, middle, and lower level

Expense

There are four different types of expenses being calculated which are direct expenses, TC's GSOC Alliance, Store Expense, and Allocations. The direct expenses include items such as salary, bonus, commission, health, depreciation of work vehicles, travel/meals, mobile phone, allowed time off, etc. This expense grows significantly each year as more employees continue to join the team.

Direct

With each branch, there are a few different categories of jobs needed to be fulfilled such as technicians, parts or administration, operations managers, rental specialist, sales, and general manager. For Parts and/or administration personnel, for year 1, there is a plan to hire 1 personnel and keeps rising until year 10 to be at 4 personnel. For operations manager, for year 1, there is a plan to hire 1 personnel and by end of year 10 to be at 4 personnel. For rental specialist, there is a plan to hire 1 personnel in year 1 and a second by year 10. For sales personnel, there is a plan to hire 1 person in year 1 and a total of 13 people by year 10. For general management, there is a

plan to hire 1 person the entire 10 years. For lower level, there are the same number of technicians, parts and administrative, rental specialist, and general manger from year 1 to year 10; however, operations manager only increases to 3 personnel in year 10.

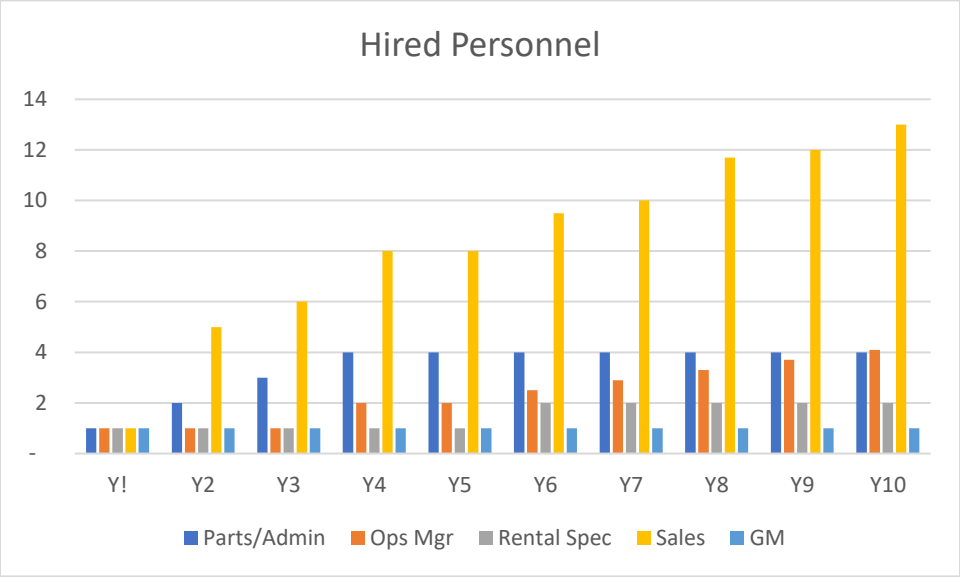

Fig. 8 Change in Parts or Administrative, Operation Managers (Ops Mgr), Rental Specialist, Sales, and General Manager personnel from Year 1 to Year 10 for upper and middle level.

The other expenses include technical communicator and Global Service Operations Center (combined as TC GSOC) allocation, store expense, and overhead allocation. TC GSOC allocation equals the multiplication of product support sales by 1.8% each year. The store allocation expense represents rent expense for one building in year 1, two buildings in year 2, and three building in year 3 through year 10. For allocations, this expense equals the multiplication of the sum of all sales by 10%. The overhead cost is the corporate expense.

Net profit

After each calculation, the net profit equation will be shown. Before calculating the net profit equation, gross profit and total expenses is calculated. The gross profit total equates to the

sum of the gross profit of new equipment, used equipment, rental equipment, and product support. The net profit equals the subtraction of all the expenses from the total gross profit.

Predictions show that the first positive net profit occurs at year 4 for upper level, year 7 for middle level, and year 9 for lower level. The payback period finishes in year 5 for upper level, year 8 for middle level, and year 10 for lower level.

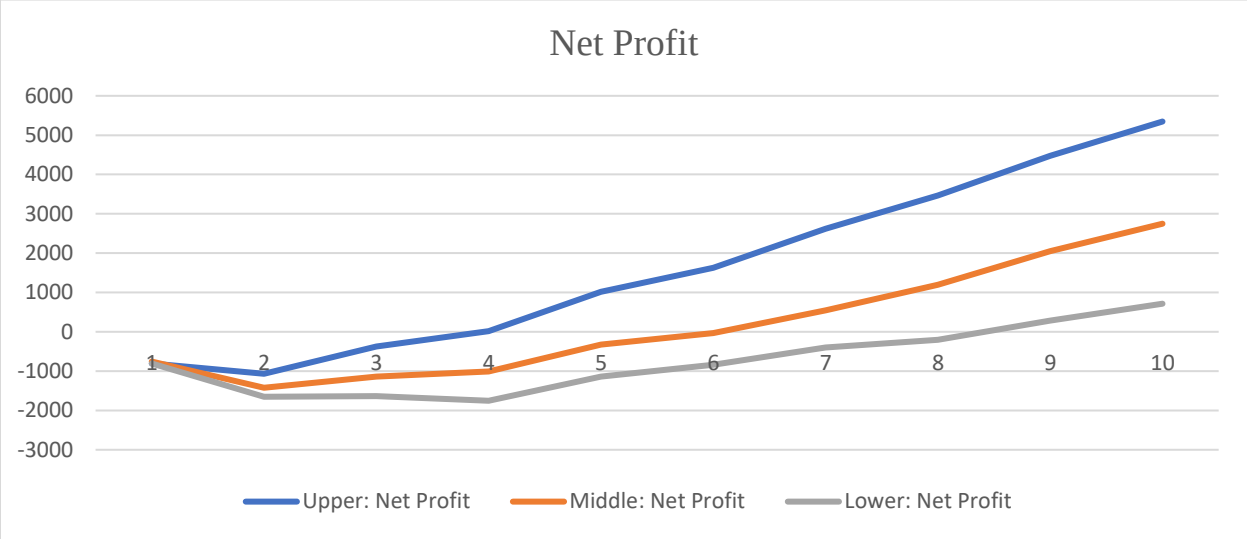

Fig. 9 Change in Net Profit from Year 1 to Year 10 for upper, middle, and lower level

Decision Making Calculations

One of the methods being used in this research is a decision tree analysis. This is used for decision making especially when only vague information is being provided. A decision problem can be provided with more structure and details by creating a decision tree which involves variables and probabilities [2].

In the next figure, the first decision tree is being presented. The initial node is a decision node. The decision is to choose whether to acquire new territory in order to grow Wesley Worldwide or whether to expand within already attained territory. After making this decision, the next node is the uncertainty node or the event node of whether the 5-year return rate will be a

high, middle, or low return. The middle and lower level have a negative 5-year return whereas the 5-year upper level has a positive return. The percentage chance of the return being close to the upper level is 65%, the middle level is 30%, and the lower level is 5%. Before the expected value is calculated, the calculations of the numerical will be shown. The value, if chosen to acquire new territory, of upper return is $1,017,000, medium return is $-322,000, and for lower level return is $-1,136,000.

At the initial node, the second decision node is to choose to expand within the current territory instead of acquiring new territory. There is one uncertainty node or event nodes after choosing to expand and not acquire which is a 5-year profit of 100% chance with $500,000.

To summarize, based on this initial analysis from the decision tree, the recommendation is for Wesley to acquire the new territory with an expected return value of $507,650 in 5 years. We will use 5-year return for decision tree because these values are more reliable. However, in the discussion, we will show what the expected return value of upper, middle, and lower level are for 10 years. All of these quantities are illustrated in Fig. 11.

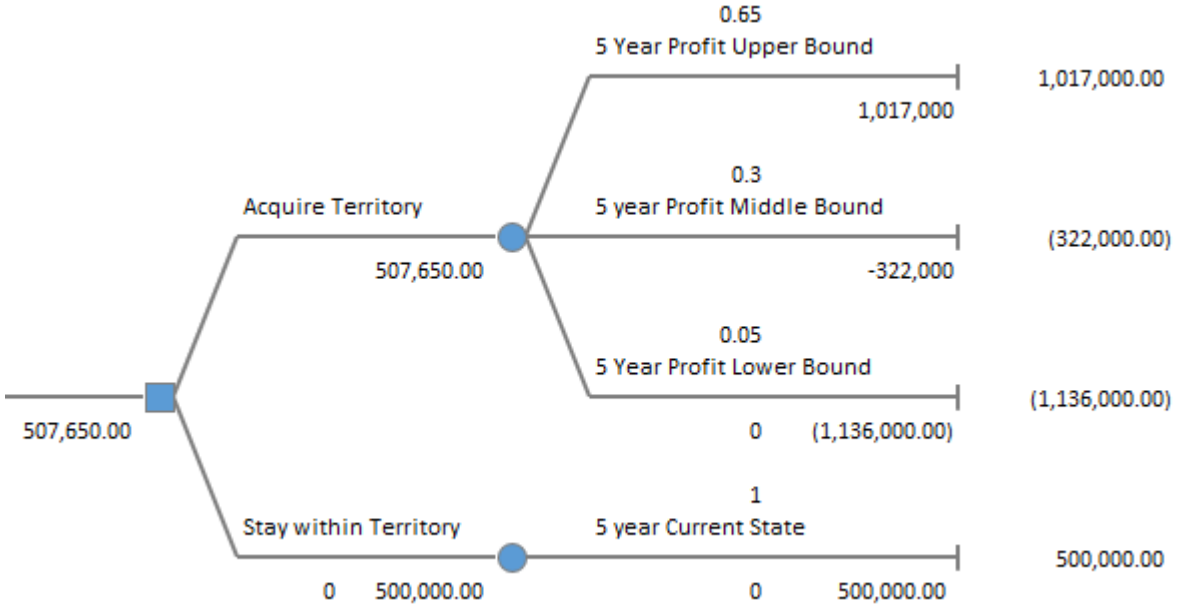

Fig. 10 The decision tree of a business expansion.

Another decision mechanism to use in order to see how much consulting advice would be worth for this decision would be the perfect information decision tree. Another tree that is adapted to include information not on hand but making some assumptions is that for the value of imperfect information. Usually, data analysts would like the information from the company analysts to be perfect, however it is accepted that this rarely occurs. In theory, if the expected value of perfect information (EVPI) is able to be determined, Wesley Worldwide will able to come to the conclusion of finding the upper value of the value of that information. To mathematically represent perfect information, Wesley Worldwide will take the numbers of net profit from upper, medium, and lower level and show these calculations in the next figure.

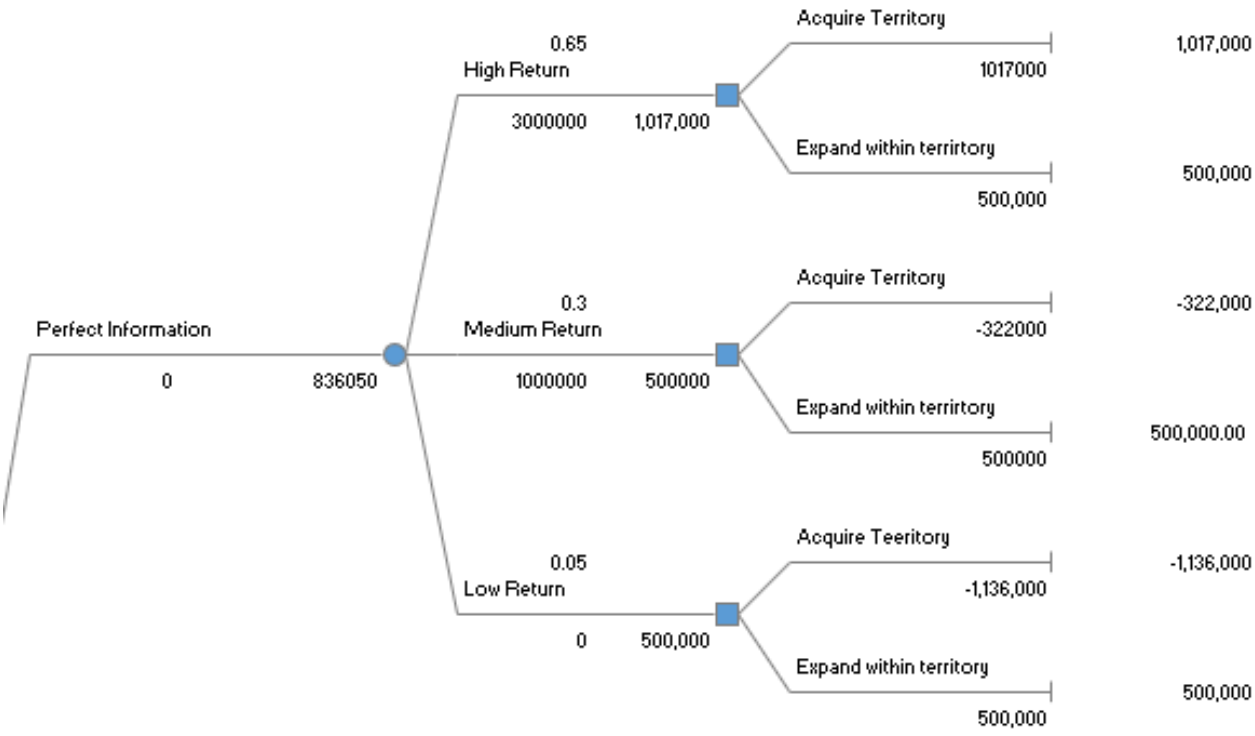

Fig. 11. The perfect information decision tree of a business expansion.

In Fig. 11, we see the value of the tree if we had perfect information. Compared to not having this information, this would be a very positive outcome; however, this would never occur unless in a perfect world with perfect data. More importantly, the difference between the value of the tree with the perfect information and the value of the tree without is useful. To calculate the value of perfect information, the final value of the tree with perfect information $836,050 is subtracted by the expected value from the tree in Fig. 10 ($507,650.00). This comes out to be $328,400. In this case, this would be what Wesley Worldwide would be willing to spend to get perfect information from, say, a consulting firm.

Discussion

Expanding at this current time is an incredible opportunity for this equipment dealership because of the current markets and expansive rental fleet. The numbers and values taken for the

upper level have been based off this equipment dealership's profit and loss statement from year 2021. Seeing the statements from year 2021 shows it being one of the greatest years for profit in the last fifteen years. The upper level is the largest reasonable income because the current markets are the highest that they have been in decades. For the industry, it is important to continue expanding while the market is good where potential can be seen.

Also, Wesley Worldwide provides an expansive rental fleet that is in huge need currently. Wesley Worldwide has an advantage of having an expansive rental fleet as compared to other companies. Rental is considered a great need as supply chain problems are causing long lead times for customers ordering new trucks. This gives this industrial equipment dealership an upper hand against other competitors even in new territories. North Carolina is such a unique opportunity to move to for this dealership. Since this equipment dealership sells forklifts which are mainly in distribution centers, North Carolina provides a great area to expand into for sales growth. The top 5 market segments in North Carolina are machinery and equipment, motor vehicles and equipment, steel works and blast furnaces, public warehousing and storage and fabricated structural metal products. As the market is growing rapidly, Wesley Worldwide will continue to expand into multiple cities in the state. Also, North Carolina is a very convenient place to expand into next because of the good location and closeness to other strong Wesley Worldwide branches. One of the closest branches is only around 30 minutes away and there are over 50 technicians within driving distance.

The model and calculations are necessary to understand the industrial equipment business, how acquisitions work in this field, and how to be a successful executive. While there are many variables, costs and risks, there are concrete statements to frame the model after to minimize errors in predictions. The main calculations after the completed model show that the total net profit over 10 years for the upper level is $5,347,000, for middle level is $2,748,000, and lower level is -$714,000. While the lower level is a decent net profit, most of the initial investments in an industrial equipment dealership are recoverable. Out of all the analysis that has been conducted in this paper, there were two possible options moving forward to grow the company's profit. After considering the expected value of all possible options, it is decided that the best option is indeed to acquire territory in North Carolina.

Risk

There are a few risks to consider when making this expansion plan including an economic downturn. An economic recession is a "significant decline in economic activity that is spread across the economy and that lasts more than a few months"[3]. Several of these percentages assumed in this model are based off historical averages. While the percentages do not show the market at an all-time high, wrong percentages can be detrimental to the future of the company if after making such a great investment in a new territory, that an economic downturn for the worst occurs. Recessions can have many possible causes such as "disruptions to the supply chain, a financial crisis, or a world event… or an inflationary period" [4] which can cause them to be very hard to predict.

Another risk that is possible is an unanticipated competition entering the marketplace. Usually, unanticipated competition is associated with a new startup that "offers cheap substitutes

to …products, capture new, low-end customers, and then gradually move upmarket to pick off higher-end customers"[5]. However, new competition is entering the market faster and with quicker development than ever before.

Another risk that is possible is unforeseen supply chain issues. While after the pandemic, "the pandemic left some global supply chains in shambles and others looking like the stars of the show"[6]. Currently, it is expected that there will be supply chain issues. While supply chain is still a huge risk, "best bet is to focus on shorter-term investments and on building flexibility and adaptability into your solutions"[6].

Conclusion

Considering all the data, results, and market evaluation, this investment is a very viable option for Wesley Worldwide to consider investing to expanding into new territories and markets. As seen by data, the biggest growth at Wesley Worldwide has occurred previously from acquisitions.

For all options of acquiring or investing, expanding into North Carolina is one of the greatest because of the already existing expansive rental fleet of Wesley Worldwide, the lookout for market growth in North Carolina, and the large amount of distribution centers, manufacturing plants, and automotive plants already located in North Carolina. While the lower level is not a great profit return to consider, the chances of the lower level occurring are quite slim because the last 3 years have resulted in the highest profits out of the last 15 years. While it is an option for supply chain issues to become worse which would cause delays in sales and profit, Wesley Worldwide has been able to buffer this previously with an expansive rental fleet.

In the future, further research will need to be conducted to perfect the percentages of upper level, middle level, and lower level results. While this model is based off previous expansion data and current market data, it will be important to continue research and improve the model as more data is collected. The data for these improvements could be collected over time as more expansions occur over the next several years for Wesley Worldwide. While in this research, decision trees and influence diagrams were used to make decision analysis material, more research could be done by calculating sensitivity analysis.

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