

APPLICATION OF DECISION TREE IN ENTREPRENEURIAL DEVELOPMENT

by

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Abstract

A panoramic view of the application of decision tree in making right decision among alternatives was investigated in this paper. The study was backed up with two research questions which were answered using the case of Mr. Obidi obtained through field survey at Akili Ozizor in Ogbaru L.G.A of Anambra state. This was achieved by drawing the decision tree and calculating the Expected Monetary Values (EMVs) so as to select the right decision among the five alternatives. The results showed that decision tree is an indispensable tool in entrepreneurial growth and national development as it helped to select the best act. Application of this tool helps to foster business by increasing productivity and expansion of financial base. It was obvious that many entrepreneurs and leaders do not apply this indispensable tool instead they embark on hiring experts in decision making who will end up giving the wrong choice. Since if entrepreneurs at all do well, it will not only curb unemployment but also boost Nigeria economy by increasing the Per capital income which will in turn affect the country's GDP positively, the researchers therefore recommend entrepreneurs and our Leaders to adopt and adapt to the use of decision tree for tremendous increase in their enterprise and economy growth and development.

Keywords: *Decision tree, Entrepreneurship Development, Decision-making, probability.*

Introduction

Background to the Study

The origin of decision tree can be traced back from the decision tree analysis created by Ross (1975) at the University of Sydney and presented in the book series of Machine Learning. The first algorithm for decision tree creation was called the Iterative Dichotomiser3 (ID3). It is a tool that uses a tree-like graph illustrating every possible outcome of a decision. Decision trees are commonly used in operations research, specifically indecision analysis, in order to reach the final goal through the application of probability.

The feature of decision trees was a common reason to gain popularity across many industries from insurance to retail sectors. Experience in typical real-world domains has shown that the conventional approach of extracting knowledge directly from human experts is associated with many problems and shortcomings. Interviews and decision makers are usually slow and inefficient in decision making without adopting the appropriate design and algorithms for reliable decision making (www.mindtools.com). This is particularly true in those application domains in which decisions made by experts are "intuitive" ones, guided by imprecise and imperfect knowledge. In such domains, different experts may make substantially different judgments, and even the same expert may not give the same solution when confronted with the same problem twice over a period of time (www.mindtools.com). These problems become more acute when dealing with large knowledge-based systems in which upgrading the knowledge base, fixing previous erroneous knowledge, and maintaining integrity are extremely challenging tasks. A promising approach to ease the knowledge-acquisition bottleneck is to employ some learning mechanism to extract the desired knowledge automatically or semi-automatically from actual cases or examples that have been previously handled by the domain experts (Connolly, 1993).

The application of decision tree automatically provides the entrepreneur with the best alternative cause of action with the use of electronic programmed system. This helps to clarify and find an answer to a complex problem by displaying the problem in a simple, easy-to-understand format that shows the relationship between different events or decisions. Using decision tree in entrepreneurial development helps an entrepreneur to understand the specific path where the desired outcome has the highest likelihood. However, one can also recognize the situation which may end up with undesired consequences. It is in line with the above background that the study seeks to ascertain the application of decision tree in entrepreneurial development and economic growth of our nation.

Statement of the Problem

It is said that failure to plan, plans to fail. Many entrepreneurs make decisions which are detrimental to their business and this leads to retardation in growth and development of such business, hence quitting becomes inevitable. Inability to make good decision during planning and execution stages in business has been the major reason why many business owners failed woefully and not insufficient capital to sustain the enterprise. The crucial part of making a decision occurs when a decision-maker (usually, a single individual) surveys a known and fixed set of alternatives, evaluates them statistically and mathematically, weighs the consequences and makes a choice. When trying to make an important decision, it is critical that entrepreneurs examine all their options carefully. One tool they can use to do so is a decision tree. This paper offers a pragmatic approach and panoramic view to the application of decision tree in entrepreneurial development of our nation.

Purpose of the Study

The purpose of the study is to ascertain the application of decision tree in entrepreneurial development using real-life business problems. Specifically, the objectives are to:

- Apply decision tree in small scale business for profit maximization.
- Find out how decision trees can be used for making right decision in an unprecedented business.

Research Questions

This study is geared towards tackling the following questions namely:

- How can decision tree be applied in small scale business for profit maximization?
- How can decision trees be used for making right decision in an unprecedented business?

Significance of the Study

The study when completed will be of immense benefit to all and sundry.

The benefactors of the study are:

➤ Entrepreneurs and prospecting entrepreneurs:

Decision tree being an analysis diagram, which can aid decision makers, when deciding between different options, will serve as a tool for projecting possible outcomes, hence fostering productivity. It will help prospecting entrepreneurs to have an overview of the multiple stages that will follow each possible decision. The Decision Tree Model blog have highlighted several benefits to using this technique, including that decision trees are easy to understand and interpret, small details that may have been missed are taken into consideration, it helps save time because once the decision is taken, the path to success is easy to follow.

➤ **Government:**

The findings from this paper will help in job creation and curbing of unemployment rate and boosting the country's GDP.

Review of Related Literature

Conceptual Framework

The concept of Decision making and Decision tree

Naturalistic decision-making

Conventional decision-making research, being quite formal, considers decision-making as a discrete, isolated decision event. It means that the crucial part of making a decision occurs when a decision-maker (usually, a single individual) surveys a known and fixed set of alternatives, evaluates them statistically, weighs the consequences and makes a choice (Gary, 2008). The evaluation criteria would include goals, purposes and values that are stable over time, and are clearly known to the decision-maker. Besides, all the necessary information is available, and the decision-maker is capable to process it according to the specified rules (Orasanu & Connolly, 1993).

Brooks (2014) explained that when trying to make an important decision, it is critical that business leaders examine all their options carefully. One tool they can use to do so is a decision tree. Decision trees are flowchart graphs or diagrams that help explore all the decision alternatives and their possible outcomes. Each "branch" of the tree represents one of the possible options that are available when making a decision. The branches can be extended when one alternative outcome leads to another decision that must be made. Added into each branch are the costs associated with each choice and the probability that each is likely to occur. With these numbers, leaders can calculate the value of each set of branches to determine the best choice.

The current study sees decision tree as a powerful mental tool to make smart decisions designed for focusing on discussion in a situation where a group must make decision by laying out the possible outcomes and paths in a tree-like form with branches. It will help entrepreneurs to visualize the big picture of the current business situation and know the best act to adopt. Also, leaders will be relieved of the burden of consulting decision makers for right decisions through the application of this mathematical tool.

Branches of Decision Theory: Normative and Descriptive Decision Theory.

Normative decision theory is concerned with identification of optimal decisions where optimality is often determined by considering an ideal decision maker who is able to compute with perfect accuracy and is in some sense fully rational. The practical application of this prescriptive approach (how people ought to make decisions) is called decision analysis and is aimed at finding tools, methodologies and software (decision support systems) to help people make better decisions. In contrast, descriptive decision theory is concerned with describing observed behaviors often under the assumption that the decision-making agents are behaving under some consistent rules. (Retrieved on July 3, 2019 from https://en.m.wikipedia.org/wiki/Decision_theory). This current study is in line with normative branch of decision theory.

Theoretical Framework

The Rational Theory propounded by George Homans (1961) and reviewed by Ashley. C (2007):

Rational choice theory, also known as choice theory or rational action theory is a framework for understanding and often formally modeling social and economic behavior. The basic

premise of rational choice theory is that aggregate social behavior results from the behavior of individual actors, each of whom is making their individual decisions. The theory also focuses on the determinants of the individual choices (methodological individualism). Rational choice theory then assumes that an individual has preferences among the available choice alternatives that allow them to state which option they prefer. These preferences are assumed to be complete (the person can always say which of two alternatives they consider preferable or that neither is preferred to the other) and transitive (if option A is preferred over option B and option B is preferred over option C, then A is preferred over C). The rational agent is assumed to take account of available information, probabilities of events, and potential costs and benefits in determining preferences, and to act consistently in choosing the self-determined best choice of action.

This study adopted the rational theory which pointed out the use of probabilities in determining the best action among alternatives. (Retrieved on July 3, from <https://www.thoughtco.com/rational-choice-theory>)

Review of Empirical Studies

According to (Adebayo, 2007), decision taken under conflict is a competitive decision situation. This environment occurs when two or more people are engaged in a competition in which the action taken by one person is dependent on the action taken by others in the competition. In a typical competitive situation the player in the competition evolve strategies to outwit one another. This could be by way of intense advertising and other promotional efforts, location of business, new product development, market research, recruitment of experienced executives and so on. An appropriate technique to use in solving problems involving conflicts is the Game Theory.

Game theory being a probabilistic theory is similar to what the current study is all about, in the sense that both emphasized on the application of probability and tree diagrams in decision making. Leaders under conflict with such situations should employ game theory to enhance their decisions in business and governance. The researchers would have provided more empirical reviews of local works but getting such works was a herculean task. Hence, this is one of the limitations to this study.

Research Methodology

Methodology

The method adopted involves drawing decision tree using available data from the problems so as to choose the best cause of action among alternatives. This would be achieved using the decision tree software known as E-draw. Also, the expected Monetary Value (EMV) would be calculated using the Expected Value Equation:

$$(A_i) = \sum_{i=1}^N V_i * P(V_i)$$

$$= V_1 * P(V_1) + V_2 * P(V_2) + \dots + V_N * P(V_N)$$

Where: (A_i) = Alternative *i*, N= Number of states of nature, V_i =Value of pay off, P(V_i)=Probability of pay off.

Research design

The design for the study is an opinion survey which requires in-depth interview of the responsible entrepreneur whose problem is under investigation. Also, the study involves

sourcing for available information from journal and review of related works from professional materials.

Data Presentation and Analysis

Data Presentation:

An annual stipend of ₦10,000 is usually given to Ogbaru local government indigenous farmers by an empowerment foundation founded by the senator representing Anambra north senatorial zone (Princess Stella Oduah) foundation. Akili community where the senator is residence usually benefit yearly from this empowerment program. The case of one of the beneficiaries interviewed during the field work, calls for the application of decision tree. Mr Obidi (not real name) a beneficiary of the 2019 empowerment program is still contemplating on what to do with the money. During the interview section with the beneficiary, it was gathered that the man wants to invest the money in either of these two: lend it out for interest or invest it into farming business. However, each of the alternatives has its own payoff and attached conditions. According to him, if he lends the money out, he would receive additional ₦10,000 from the borrower at the end of 12 months. According to him, the probability of the person paying back the money at the stipulated time is 0.7 while the probability of not paying back is 0.3. If he ventures into farming, he will either cultivate any of these four (4) crops viz: Potato, Pepper, Vegetable, or Seed yam popularly known as “Awana or Nkpuru ji” by Anambrarians. His fear of venturing into agriculture is due to the environmental condition of Ogbaru L.G.A where the beneficiary resides. The area is usually engulfed by flood. The threat normally starts in the month of June, but sometimes, earlier than that. From his estimates, cultivating either potato, pepper, vegetable or Seed yam would fetch him ₦3600, ₦70,000, ₦10,000, or ₦4000 if all things being equal. Although some crops are always ripe for harvest before the flood engulfs the land. If flood takes over the farmland months prior to the harvest proper, he may gain ₦3,000, ₦8,000, ₦15,000, and ₦8,000, respectively. The probability of flood damaging the crops before the harvest proper (Unsuccessful) are: 0.3, 0.1, 0.7, 0.35 and 0.8, respectively. Similar, the probability of flood not affecting the crops before harvest (Successful) are: 0.7, 0.9, 0.65 and 0.2, respectively.

Source: Field survey 2019, Akili Ozizor in Ogbaru L.G.A of Anambra state:

Decision Analysis:

The three decisions identified in this problem are:

1. Lend out the money for interest.
2. Invest it into farming business.
3. Cultivate either: Potato, pepper, vegetable or Seed yam.

The Two States of Nature:

1. No flood experience before harvest.
2. Experience flood before harvest.

Moreover, the unprocessed pieces of information (Data) obtained is tabulated below for comprehensiveness.

Table 1: Field Survey 2019.

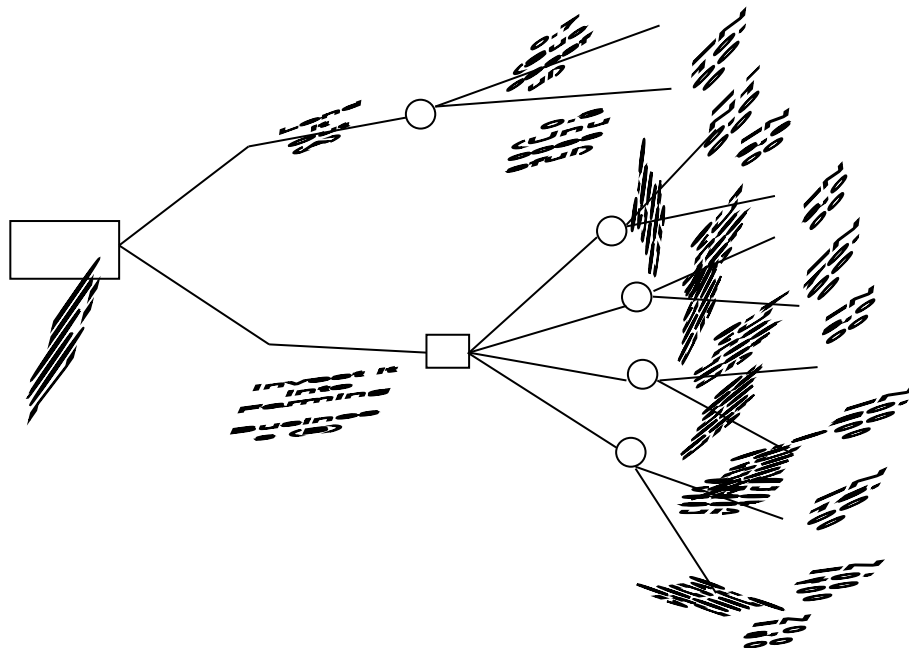
Decision	Cost	Probability of Being Successful	Profit	Probability of Being Unsuccessful	Profit
Lending	₦10,000	0.7	₦10,000	0.3	- ₦10,000
Farming Business	Potato	₦10,000	0.9	0.1	₦3,000
	Pepper	₦10,000	0.3	0.7	₦8,000
	Vegetable	₦10,000	0.65	0.35	₦15,000
	Seed Yam	₦10,000	0.2	0.8	₦8,000

Source: Researchers' computation from field survey 2019.

To proffer solution to the above problem, we start by following the steps below:

- a. First, present the problem in a diagrammatic form known as decision tree.
- b. The second step is to calculate the Expected Monetary Value (EMV).
- c. Finally, draw the decision tree with attached (EMVs) for each decision.

Fig1: First Decision Tree/Diagram of the above survey.



Source: Researchers' computation:

- b. The second step is by calculating the Expected Monetary Values (EMVs).
Working from right to left, we consider each alternative and treat it as an entity:
Lending (A): $(0.7 \times ₦10,000) + [0.3 \times (-₦10,000)] = ₦4,000$

Invest it in Farming Business (B):

$$\begin{aligned}
 B_1 &= (0.9 \times \text{₦}3,600) + (0.1 \times \text{₦}10,000) = \text{₦}3,540 \\
 B_2 &= (0.2 \times \text{₦}70,000) + (0.8 \times \text{₦}8,000) = \text{₦}18,000 \\
 B_3 &= (0.65 \times \text{₦}20,000) + (0.35 \times \text{₦}15,000) = \text{₦}18,250 \\
 B_4 &= (0.2 \times \text{₦}40,000) + (0.8 \times \text{₦}8,000) = \text{₦}14,400
 \end{aligned}$$

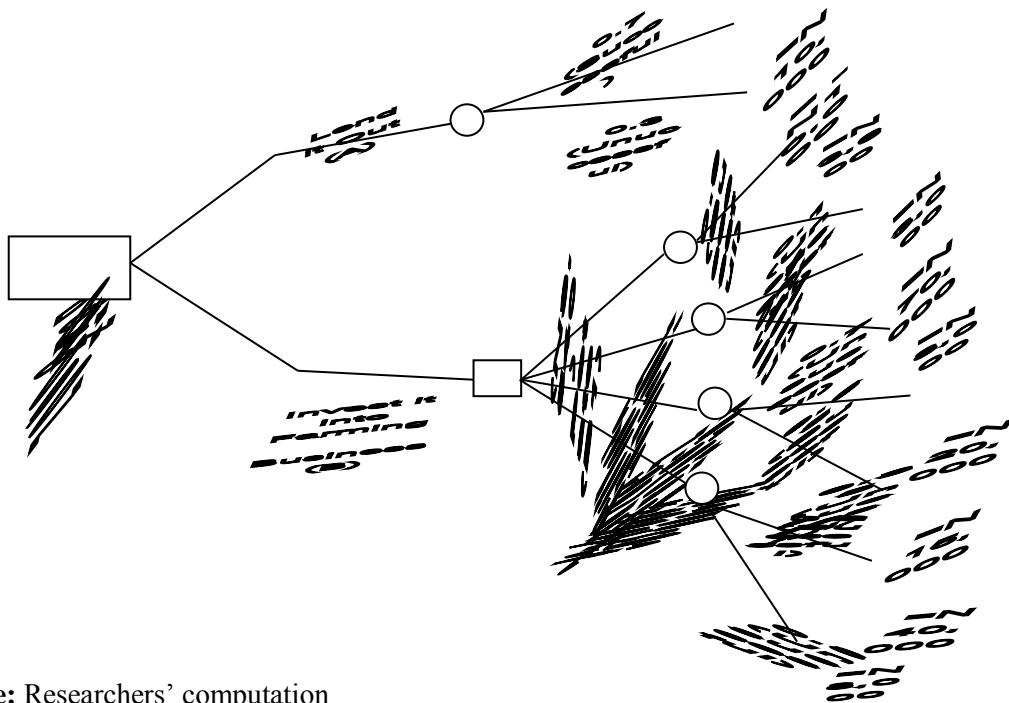
Therefore, the EMVs are:

- A = ₦4,000
- B₁ = ₦3,540
- B₂ = ₦18,000
- B₃ = ₦18,250
- B₄ = ₦14,400

Result Interpretation:

From the above calculations, the alternative that gave the highest Expected Monetary Value (EMV) is alternative B₃ under farming (B), which is cultivating of vegetable. This implies that the alternative with the maximum payoff/gain is alternative B₃.

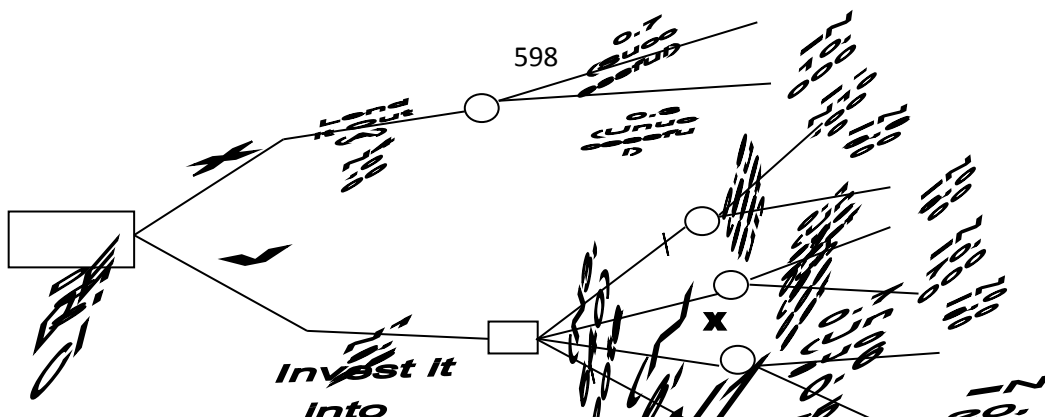
Fig.2: Second Decision Tree with Attached Calculated EMVs.



Source: Researchers' computation

Fig3: Last Decision Tree with The Best Act Selected.

Source: Researchers' computation:



Discussion from the Results:

Success cannot be taken away from right decision. Many people have made decisions that are detrimental to their lives and business. The failure of many entrepreneurs may not be attributed to insufficient capital to manage the business but the inability to make right decision that will propel the business. Some corps members are always stranded after their one year national service. Many of them had no savings at the end of their service year. Majority who made little savings sometimes misuse them due to lack of critical mathematical thinking like what has been displayed in this study. From Mr. Obidi's perspective he would have chosen alternative B_2 which is to cultivate pepper or any alternative other than alternative B_3 . This is in line with the Rational choice theory propounded by George Homans (1961). One thing is to invest in business whether trading or agriculture, another thing is to manage the business. This involves the application of critical mathematical thinking. One of the greatest impediments to economy growth of Nigeria is wrong decision making in governance which leads to mismanagement of funds and corruption. Nigeria is a country blessed with abundant mineral resources, but majority of Nigerians are still living in abject poverty not only because of the corruption ravaging the country but due to monopolistic decision making in governance. Some of our leaders do carry out actions without weighing mathematically other alternatives. This type of decision making is termed "monopolistic decision making". Despite the abundant mineral resources, the country has been dwindling in terms of economy growth. Though unemployment happens to people of all categories but its effect has bitten more sarcastically hard on the youth. This is the primary concentration of this paper. Unemployment is a global challenge, but worse in developing countries of the world, with attendant social, economic, political, and psychological consequences. In recent times, the situation of Nigeria has been compounded by the increasing unemployment of professionals such as accountants, engineers, among others which create more congestion in the already congested labor market (Njoku & Ihugba, 2011).

Today, the economy of Taiwan that imports common gravel for construction from China is far better than that of Nigeria. Taiwan's economy initially, was largely agriculturally oriented. Taiwan grew sugar cane but the harvested cane was exported for processing into sugar elsewhere, such as in Japan. Taiwan then built sugar mills and began to export sugar rather than sugar cane (https://en.m.wikipedia.org/wiki/Economic_history_of_taiwan). This could be attributed to the use of mathematical thinking in making right decisions as was clearly depicted in this paper. If entrepreneurs in all ramifications are doing well, it will not only reduce unemployment but also boost Nigeria economy by increasing the per capital income which will in turn affect the GDP positively.

Recommendations:

Having x-rayed mathematics as a tool for nation building and economy growths, the researchers therefore recommend entrepreneurs and leaders at all level to employ this unquestionable and reliable tool (decision tree) in decision making so as to curb the losses often experienced due to wrong decisions and reduce the rate of unemployment in Nigeria. No doubt that this tool if well utilized by the government, will help to foster economy growth of our nation.

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