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Research Article

Development of Computer Aided Model for Wire and Cable Industry Cash Flow Analysis

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Abstract: This project investigates the Cash Flow Analysis of Manufacturing Industry which is now used to develop a Cash Flow Software Model that is capable of solving various cash flow problems. Denki Wire and Cable Nigeria Limited, Akure, Ondo State, Nigeria was used as a case study for this project and Questionnaires were administered. A Computer Aided Software Model was constructed with the aid of PYTHON programming language, mathematical tools and the data collected from the company. The major models used are: Discounted Cash Flow Model, Present Value Model, Gordon's Growth Model, Product Cost and Net Cash Flow Model. The results obtained from the 12 months discounted cash flow projection shows that the company will experience a positive cash flow all through the year provided it is able to meet up with the loans collected from banks and other creditors, and ensuring high sales of products in order to make its cash inflow greater than cash outflow. It was concluded that the best way to represent a cash flow analysis for Manufacturing Industries is with the use of an electronic spread sheet medium. This will give room for easy analysis and processing of all the data obtained. In order to avoid negative cash flow, Manufacturing Industries should set aside part of the profit generated, for expansion and they should borrow money only when needed.
Keywords: Modeling, software development, cash flow analysis, manufacturing industry, PYTHON programming.

INTRODUCTION

This research aims at solving various cash flow problems facing Manufacturing Industries. A manufacturing industry is defined as a building or a location where the production of goods and materials that are necessary for living is being carried out using raw materials (Akinnuli, 2009, Akinnuli & Babalola, 2013) .The three major processes involved in virtually all manufacturing are assembly, extraction and alteration (Microsoft Encarta, 2009). A cash flow analysis is a document that shows the movement of cash (money) in and out of a business. The cash flow statement is a tool that helps to provide information about the liquidity and loan payment capacity of a business. Through this, a manufacturing company will be able to know and predict if it has enough money to pay its present and future bills (VBIS, 2010). This is a vital information as also mentioned by (Mohammed, Fawad & Mihray,2012) in their work concerning benefits of information. The computer software (program) is a series of step to step logical instructions that is written down, using a computer language, with the aim of solving particular or specific problems (Adejuyigbe, 2002; Azida & Sa`ad,2012; Oluwadare,2102). The software to be used in this research will be able to record the timing and size of the cash inflows and outflows that occur over a given accounting period, usually one year. The account period is broken down into smaller periods, usually months and then the Total Cash Inflow, Total Cash Outflow, and Net Cash Flow is taken for each month.

This research developed a cash flow analysis computer software, that is easily comprehensive and analytical enough to help manufacturing companies to improve their financial management skills and thereby sustaining the smooth operation of their company. This made the researcher to go into identifying the parameters required for cash flow analysis, mathematical models for cash flow analysis, development of an algorithm as well as its software, and carry out performance evaluation of the developed model and its software.

Once Manufacturing Industries become familiar with this cash flow analysis model, they will

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find out that it is a necessary reference and planning tool. This calls for the reason to design and develop a Computer Aided Model that can accomplish this objective. This Software Model will be able to provide valuable management information for Manufacturing Industries in form of an electronic spread sheet format. Research has shown that odd as it may seem, most manufacturing industries (both large and small scale) are making a profit when they go out of business. This is because they ran out cash to pay some of their crucial bills such as Rent, equipment, fuel and electricity, etc (which are collectively called factory overheads), and so they will fold up. Therefore, this cash flow analysis model will help manufacturing companies to overcome the complexity and time consuming factors of manually estimating their monthly/yearly turnover in form of profit and loss.

In addition to this, the cash flow model developed in this research will be able to display the product cost sheet which will contain the total cost of raw materials, cost of labour and packaging materials. This will help to estimate and determine the unit cost of a product to be sold.

Cash Flow Diagram Development

A cash flow diagram is used basically to graphically depict the timing of the cash flows as well as the nature of the cash flow as either inflow or outflow. It also shows how the income comes in and how the expenditures are made in the cause of a project life. One the cash flow diagram, the arrows pointing upwards represent cash inflow, while arrows pointing downwards represent cash outflow. For example, assuming a Mathematical Industry is considering two control drill presses X and Y both with estimated usage life of 6 years. The data is as follows:

Table 1: Literature Review Table

S/N	AUTHOR	YEAR	CONTRIBUTION
1.	Stan	2008	Theory of interest
2.	Akinnuli	2009	Theory of Investment
3.	Koller and Copland	1994	Equity Valuation Model
4.	Damodaran	2001	Firm Valuation Estimate

The uniqueness of this research is that it combined the model of the above authors, and it also considered the development of the product cost model. This will enable Manufacturing Industry to be able to determine the cost of producing a unit of its product.

METHODOLOGY

The methodology carried out under this project involved; cash flow diagram development, model development, model formulation (Mathematical), logic model flow chart, software development and application of the developed software.

Table-2: Drill Press X and Y

Drill Press X	(₦)	Drill Press Y (₦)
Initial Investment (-)	280,000	370,000
Scrap/Salvage value (+)	40,000	70,000
Annual Operating cost (-)	120,000	80,000
Annual Maintenance cost (-)	30,000	50,000
Annual Benefits (+)	260,000	290,000

Key:
(+) means cash inflow
(-) means cash outflow
The above project can be represented on a cash flow diagram as shown below.
Cash inflow (+) ₦'000

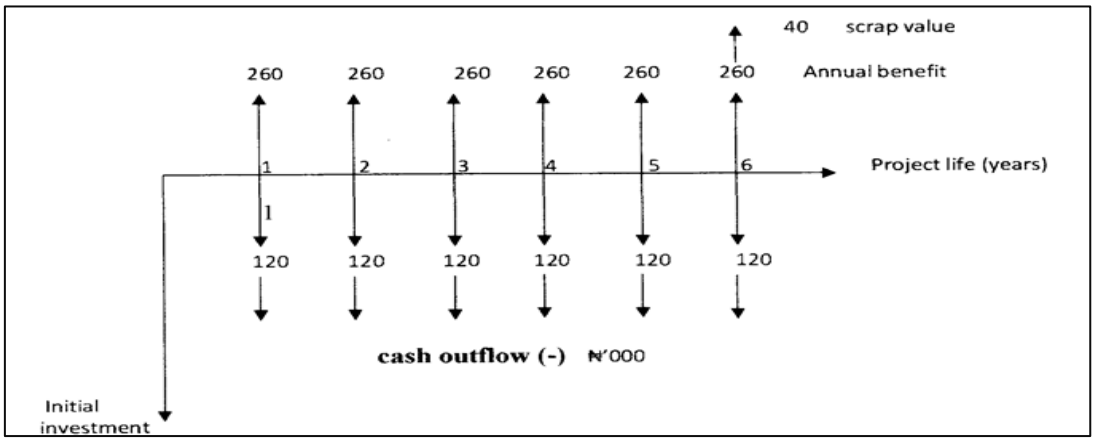


Fig.-2.1a: Cash flow diagram for press X

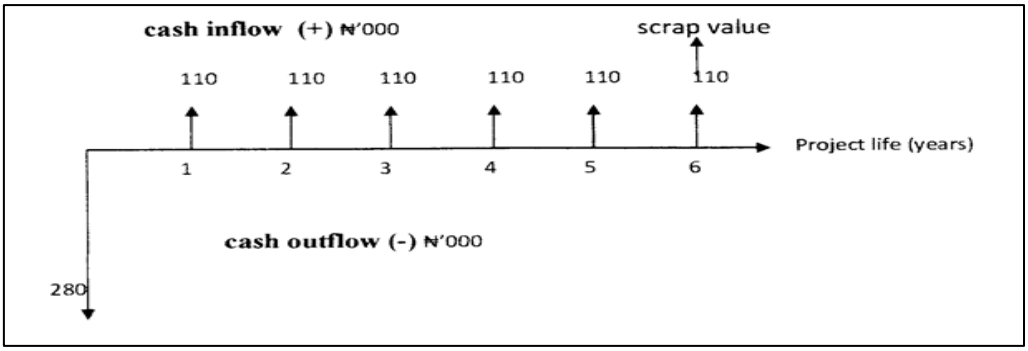


Fig. 2.1b: Cash flow diagram for project Y

In fig. b above, Net Cash Flow (NCF) is calculated as
NCF = Cash inflow – Cash flow
NCF = +260 + (-120) + (-30) = 110

Model Formulation (Mathematical Models)

The mathematical models used in developing the cash flow model are stated and explained below:

Discounted Cash Flow Model (DCF)

Today the discounted cash flow (DCF) model is the most commonly used tool among financial analysts when valuing a firm. The DCF model consists of a series of periodic cash flows, which are discounted to the present time (time 0) using a discount rate. Thus, the two important things that determine the net present value (NPV) of an investment in the discounted cash flow model are the series of cash flows used and the discount rate (Keck *et. al.,* 1998).

The discount rate can be defined as the required rate of return by the investor. The important things to have in mind about the discounted cash flow model are:

- All periodic cash flows that are used in the discounted cash flow model have to refer to periods of the same length (annual, semi – annual, quarterly, monthly).
- All cash flows that are used in the discounted cash flow model refer to the future.
- The discount rate used must represent the discount rate that corresponds to the length of period in which the cash flows refer to. For example, if quarterly cash flows are used then a quarterly discount rate needs to be used.

The formula for the discounted cash flow model for the calculation of Net Present Value (NPV) which takes into account investment costs (Cash Outlays) at time 0, is given as:

$$NPV = \frac{CF_0 + CF_1}{(1+d)} + \frac{CF_2}{(1+d)^2} + ...\frac{CF_n}{(1+d)^n}$$

Where: CF is the cash flow of each period within the investment analysis horizon; d is the discount rate and n the last period of the investment horizon.
The first cash flow CF_0 represents the initial cash outlay or investment cost.

The last cash flow CF_n includes any income expected to be received during the last period of the investment horizon plus the market value or sales price of the product at that point in time.

In addition, d is the periodic discount rate that corresponds to the length of period that cash flows refer to. For example, if cash flows are quarterly then the quarterly discount rate needs to be entered in the formula. Caution is needed here because discount rates are usually quoted in annual terms, and one might be tricked to use an annual discount rate with quarterly cash flows, in which case a very incorrect result will be obtained. The correct formula for deriving the quarterly discount rate (d_q) from the annual discount rate (d_a) is:

$$d_q = (1+d_a)^{1/4} - 1 \qquad (2.2a)$$

The correct formulas for deriving the monthly discount rate (dm) and the semiannual discount rate (ds) from the annual discount rate (da) are:

$$d_m = (1+d_a)^{1/12} - 1 \qquad (2.2b)$$

$$d_s = (1+d_a)^{1/2} - 1 \qquad (2.2c)$$

(Keck *et. al.,* 1998)

Net Present Value (Model)

Net Present Value (NPV) is a standard method for the financial appraisal of long term projects. Used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value (PV) terms, once financing charges are met. By definition, NPV = Present value of net cash flows. Obviously, net present value (NPV) value obtained using variable discount rates with the years of the investment duration is more reflecting to the real situation than the calculated from a constant discount rate for the entire investment duration.

Formula

Each cash inflow/outflow is discounted back to its PV. Then they are summed.

Therefore

$$NPV = \sum_{t=1}^{n} C_t \Big/ (1+r)_t - C_0 \qquad (2.3a)$$

Where: t is time of the cash flow; n is total time of the project; r is discount rate; C_t is the net cash flow (the amount of cash) at time t; and C_0 is the capital outlay at the beginning of the investment time (t = 0). (Rubak, 1995).

Gordon Growth Model

There are several ways to estimate a terminal value of cash flows, but one well known method is to value the company as a perpetuity using the Gordon growth model. The model uses this formula:

Terminal Value = Final projected year cash flow / (Discount rate – Long term cash flow growth rate)

This formula rests on the big assumption that the cash flow of the last projected year will stabilize and continue at the same rate forever.

$$TV = \frac{(FCF_n)}{(k-g)} \qquad (2.4)$$

Where: TV is terminal value; FCF_n is free cash flow generated by the firm in year n; n is last year of the projection; g is constant rate of increase in perpetual free cash flows and k is discount rate (Thavamani, 2007).

Product Cost Model

A major aspect of cash expenses in the cash flow statement spread sheet is the cost of procuring raw materials and production overhead (both of which are in form of Direct Cost). Therefore the product cost model helps to estimate the unit cost of producing a unit of a product. This will allow the factory to be able to determine the direct cash outflow from the business and also determine the selling price of their products. The formula is given by:

$$K = Q \Big/ N \qquad (2.5a)$$

$$Q = A + B + C \qquad (2.5b)$$

Where K is the unit cost of production; Q is total cost of production; N is number of units produced; A is total cost of raw materials; B is total labor cost and C is packaging and other production costs.

Development of Software Model

The software used in this project was developed by using a PYTHON programming language. This programming language is used because of its simplicity in coding the interface and its analytical properties. The software is able to do the following operations:

- Display the factory product cost sheet, and estimate the unit cost of manufacturing a product by using the Product Cost model.
- Display a 12 month projected Cash Flow statement in form of an electronic spread sheet, whereby the variables can be edited and re – edited to give the desired result.
- Calculate the Net Cash Flow, Gross Profit and Net Profit/loss per month.
- Project the present value of a future amount by using the NPV model.
- Estimate the cash balance at the end of each month.

Software Requirement

In order to run the software efficiently on a computer system, the following requirements must be filled:
Operating System: Windows XP Professional/Higher versions of Windows
Processor Speed: At least 720 MHz to 2.2GHz
RAM Capacity: At least 572MB
Hard Disk Capacity: at least 2GB
Hard Ware based disk accelerator

Software Algorithm

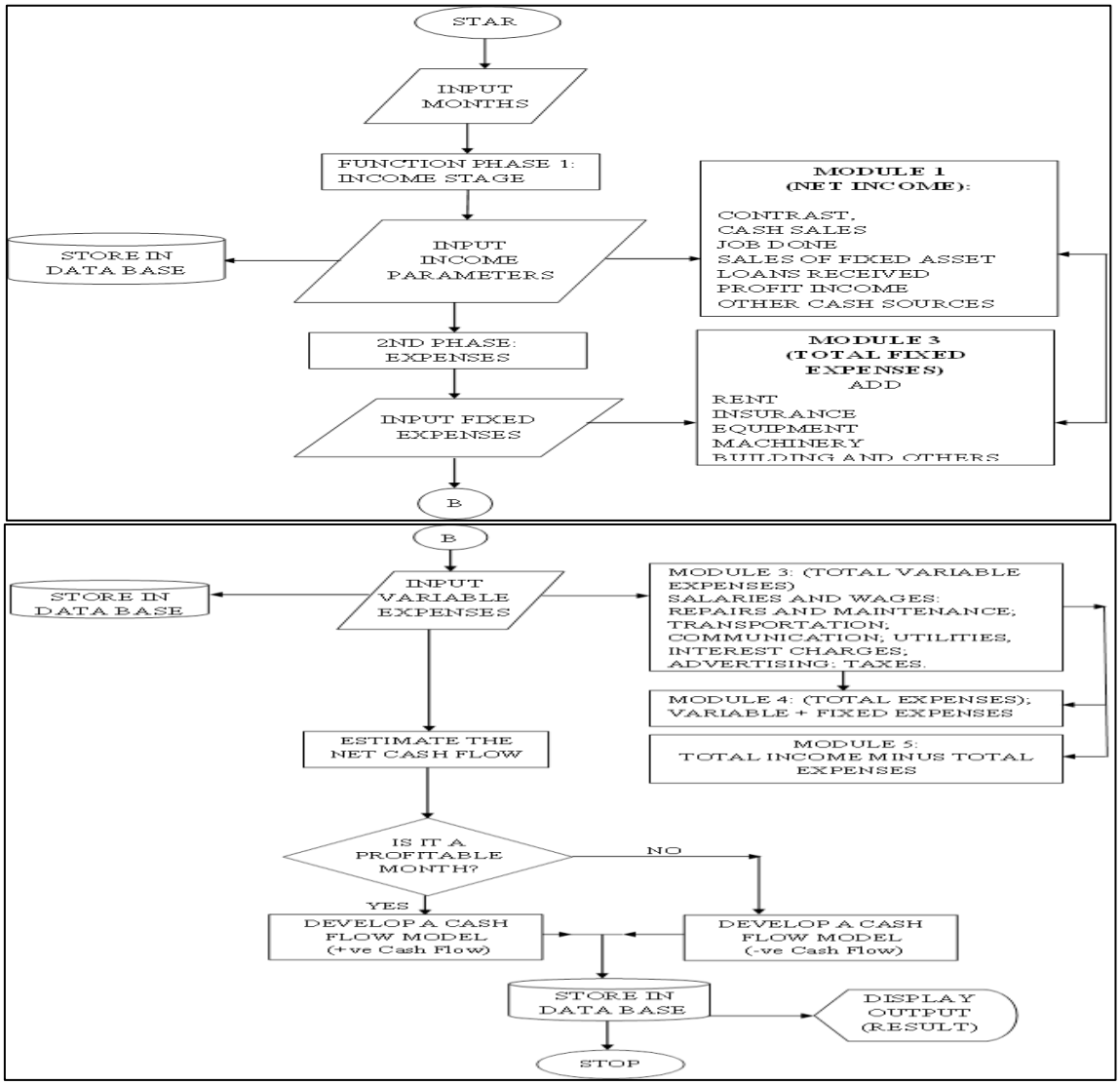
Algorithm is defined as an unambiguous set of instructions or actions that must be taken to solve a particular problem. The algorithm for the Cash Flow Analysis is shown below:
ENTER: Cash inflow variables
SUM/: Cash inflow variables
ELSE/:
ENTER: Cash inflow variables
READ: Fixed expenses
READ: Variable expenses
Outflow = fixed expenses + variable expenses
WRITE: Outflow
Cash flow = cash inflow – cash outflow
IF/: cash inflow > cash outflow
THEN/:
WRITE: Positive cash flow
ELSE/:
WRITE/: negative cash flow
END PROGRAM

Assumption made in Developing the Software Model

- The Cash Flow Model is based on projected future cash flow analysis which is based on historical data.
- The discount rate employed by the model depends on a risk free interest rate and cost of capital.

- In calculating for NCF, the annual income of the factory is assumed to be of almost equal value.
- The projected cash flow that is used in the software model is assumed to be free cash flow.

The Flow Chart showing Cash Flow Analysis (Logic)



Software Model Application

Denki Wire and Cable Manufacturing Industry is chosen as a case study for the Cash Flow Model developed in this research. The company is a medium scale manufacturing industry with the production capacity of about 1000 kg (wire and cable) per day. The software model can be applied to solve various cash flow problem of the factory.

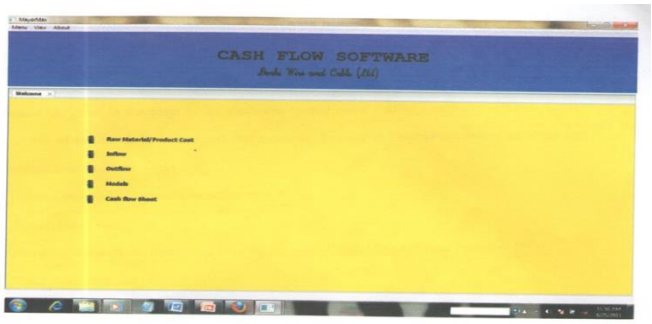


Fig.-2.2: Python Cash Flow Home Page

Fig. 2.2 shows the Cash Flow Software Home Page. This is the welcome page that is first displayed

once the software is lunched. It displayed the following information: Raw material/product cost; cash inflow; cash outflow; net cash flow; cash flow sheet and cash flow models.

RESULTS

The cash flow analysis software model developed in this study is able to display the results obtained in the form of an electronic spread sheet that will include: columns for the number of months to be considered (for example; January to December) and other which are: Inflow (sales, jobs, contracts, benefits, etc); total inflow; fixed expenses (rent, insurance, loan repayment, capital expenditure, permits); total fixed expenses; variable expenses (salaries, fees, supplies, food, equipments repair, staff welfare, etc); total variable expenses; net total expenses/outflow; net cash flow; gross profit and software models applied.

The table -3.1 above shows the cash inflow interface of the Cash Flow Software. The variables displayed are: Balance Brought Forward, Bank Loans Received, Cash Sales and Other Sources of Cash. The addition of all these variables is shown as the total inflow. The balance brought forward talk about the available cash in hand from the previous month. The other sources of cash might be through services rendered, contributions from sponsors, family, and friends, etc.

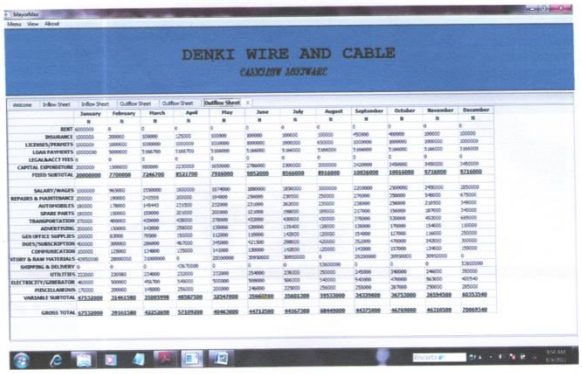


Fig.-3.2: Cash Outflow Sheet

Fig.-3.2 shows the interface for the cash outflow taken from January to December. The cash outflow entries are divided into fixed expenses (upper half of the sheet) and variable expenses (lower half of the sheet). Under the fixed expenses entry. Rent will be paid in the first month of the fiscal year (6 million naira), and this covers the remaining part of the fiscal year. Insurance company will be paid 1 million naira for a start. This is to insure the company's assets and cargo importation of some raw materials that are not available locally.

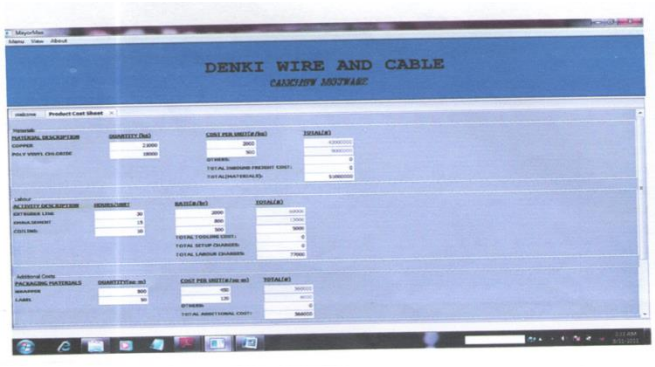


Fig.-3.3a: Product Cost Sheet

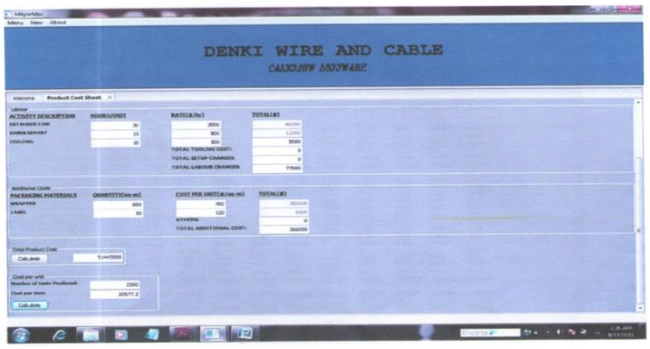


Fig.-3.3b: Product Cost per Unit

Fig.-3.3a and 3.3b above display the interface for the product cost estimation. The results generated in fig. 3.3a are used to generate the cost per unit of product in Fig. 3.3b. The three major entries considered for estimating the product cost are: Total cost of raw materials used for production; total cost of labor and total cost of packaging.

The addition of all these entries displayed the Total Cost of Production. In order to determine the unit cost per product, the Total Cost of Production is divided by the number of units produced as shown in Fig. 3.3b.

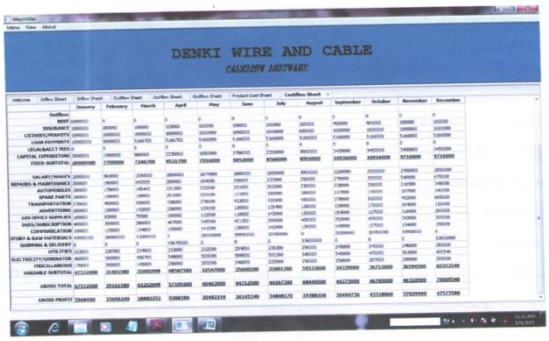


Fig. 3.4: Cash Flow Sheet

Fig.-3.4 shows the interface for the 12 months (January to December fiscal year) cash flow projection as obtainable from the case study (Denki Wire and Cable Company). The results are derived by combining the cash inflow and the cash outflow variables in the software together. The Net Cash Flow (which is

equivalent to the Gross Profit obtained in fig. 3.4) is calculated as total cash inflow minus total cash outflow.

DISCUSSION

Cash Inflow

The cash inflow consists of the sum total of all the income entering the company's account. This includes all the sources of cash such as: Balance brought forward, Loans, Sales, etc. In this software model, the entry for the bank loan will only be used or entered for the first month of the projection period which is January. This is because the bank loan that would be taken on January will cover the remaining months until December.

Cash Outflow

These are the means by which cash leaves the company's account. It includes the various types of expenses made within a period of time. In Fig. 3.2, the cash outflow is divided into two fields: Fixed expenses and the variable expenses. The fixed expenses describe those assets whose values do not easily change with time such as: Insurance, License/Permits, Loan Repayment, Rent, etc. The variable expenses are those expenses that do not have a fixed value over time. They include: Salaries/Wages of Workers, Maintenance and Repair, Automobiles, Transportation, Advertising, Office Supply, Utilities, Electricity Supply, and other miscellaneous spending.

In fig. 3.2; the Legal/Account Field is not displayed by the company, this might not be the case in other Manufacturing Industry. The capital expenditure talks about the expenses that are not earlier planned for but which must be meant so as not to hinder the production process. The entry for the Dues and Subscription had taken into consideration the Tax paid into the Ondo State Board of Internal Revenue.

Cash Flow Result Assumptions

The cash flow result displayed above is subjected to the following assumptions:

- The price of raw materials and finished goods will be steady throughout the projected period.
- The loan facility will be approved and disbursed by January 2011.
- The facility will be fully disbursed on Raw Materials and procurement will be through importation and local sources to ensure continuous production.
- The facility will be for 5 years revolving with an interest rate of 5% p.a.

Conclusion and Recommendations

CONCLUSION

This project has been able to identify the parameters and produce the algorithm required for the development of a cash flow analysis software model. The software model developed in this project gives room for the operator to be able to enter and re-edit necessary variables of the cash flow sheet and to have their result calculated immediately. It also helps to minimize listing of similar expenditures over and over again in the spread sheet. The Model is an effective cash flow analysis tool, which is able to perform several other functions related to cash flow as far as manufacturing industry operation is concerned.

It can be concluded that the results obtained from the 12 months discounted cash flow projection shows that the company will experience a positive cash flow all through the year provided it is able to meet up with the loans collected from banks and other creditors, and ensure high sales of products in order to make its cash inflow greater than cash outflow. It can also be concluded that the best way to represent a cash flow analysis for Manufacturing Industries is with the use of an electronic spread sheet medium. This will give room for easy analysis and processing of all the data obtained.

Other Areas of Application of the Model

The Cash Flow Model developed in this research can be used in the following areas:

- In manufacturing industries: to plan for what quantity and quality of products and services to produce for the incoming fiscal year in other not to run at loss.
- In institutional, investment property, and general factory business valuation.
- In Production Company: to monitor the actual cash flow of the company, identify potential problems and then plan for future projects.
- As a tool for technical feasibility study in manufacturing industries and other production companies.

Recommendation

In order for a Manufacturing Industries not to experience a Cash Flow Crunch (negative cash flow or loss), the following recommendations are made they should avoid employing unnecessary staffs and workers; burrow money only when needed in order to avoid unnecessary debts, not expand too rapidly because the increase in sales might not be enough to cover up for increased inventory, overheads and labour cost; keep a tight inventory control that is well monitored so as not to spend unnecessary cash on inventory control in addition to these, extending credits to customers must be under a close supervision and solid agreement; quarterly or monthly budget analysis should always be performed and money should be set aside for expansion of the factory and other opportunities.

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