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Design & implementation of a personal Cash flow program using Microsoft Excel®

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Abstract

A program that keeps record of personal financial details and also mines the data for insightful analysis is definitely a good day-to-day companion. In this generation, such tool is inevitable in the financial dealings of any individual or company. In this study, we developed an easy but highly intuitive method of tracking financial dealings, budgeting and forecasting personal financial expenditure using Microsoft Excel®. Among others, this program can aid in implementing financial strategies designed to meet specific goals based on percentages in specific categories. From such data, mathematical models were also developed and prediction was made. With little or no modification, the Cash flow program presented in this study could be adopted for use in any type of the organisation where money or any article of business comes in and goes out in a particular cycle (typical of which is monthly). Results and method presented here proved to be effective.

Keywords: Cash flow, Microsoft Excel, budget, forecast.

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1. Introduction

A lot of people do not keep track of their spending neither to they come up with any form of budget, for personal nor company use. Spending has become instinctively just like thirst or hunger and just like most people do; it just gets satisfied with whatever is available at the time without any proper consideration for planning and analysis before and after spending. The danger here is that this deficiency in basic accounting are transferred from personal life to the cooperate world or organizations. The result of such financial or accounting incompetency is miss-management of resources.

To curb financial miss-management, among others, one needs to track his/her spending. Once a system is in place for tracking money spent, two certainties will transpire. First, you will spend less money than you would have compared to the absence of the tracking expenses. Second, you will be developing the discipline necessary to accumulate true wealth.

Do not be deceived, no one makes it overnight, and those who do usually fail. Why? Because they have never been trained to manage success, invest wisely and spend sensibly by making budget first. If one does not effectively budget resources, the resources he/she have created will not meet the demands of the person's life or that of an organization.

To effectively manage one's personal finance, start an expense journal with section(s) for budget and actual expenditure. Write down every naira you spend over the next 30 days on the actual section using one of the budgets as a cue. Categorize your expenditure in thematic fashion, e.g., household expenses, medical expenses, car maintenance expenses, etc.

Part of the process of accounting in business is the recording of financial transactions. This is called Bookkeeping. There are several standard methods of bookkeeping, such as the single-entry bookkeeping system and the double-entry bookkeeping system, but, while they may be thought of as 'real' bookkeeping, any process that involves the recording of financial transactions is a bookkeeping process.

The origin of book-keeping is lost in obscurity, but recent researches would appear to show that some method of keeping accounts has existed from the remotest times. Babylonian records have been found dating back as far as 2600 B.C., written with a stylus on small slabs of clay.

In the normal course of any business, a document is produced each time a transaction occurs. Sales and purchases usually have invoices or receipts. Deposit slips are produced when lodgments (deposits) are made to a bank account. Cheques are written to pay money out of the account. Bookkeeping first involves recording the details of all of these *source documents* into multi-column *journals*. After a certain period, typically a month, each column in each journal is totalled to give a summary for that period. After other accounting processes, the journal is used to prepare the financial statements. Finally, financial statements are drawn from, which may include:

- *profit* and *loss account*, or P & L;
- the balance sheet, also known as the *statement of financial position;*
- the cash flow statement;
- the *statement of total recognized gains and losses.*

The nature of a business or it dynamics will determine how the bookkeeping is done. This simply means that at a point, one could just be interested in ascertaining the profit he/she is making.

2. Profit and loss (P & L)

Profit and Loss (P & L) statement measures a company's sales and expenses during a specified period of time. The function of a P & L statement is to total all sources of revenue and subtract all

expenses related to the revenue. Basically, this is the same as Cash flow analysis. It shows a company's financial progress during the time period being examined.

There are two reasons for preparing a P & L statement. One reason is the P & L statement answers the question, 'Am I making any money?' It will amaze you that most business owners cannot answer such question. If they try to, they cannot come up with a figure to ascribe as profit (or even loss) at a point in time. The P & L statement also allows outsiders to evaluate your ability to manage and use your company's resources.

We will prefer to use the word Cash flow to replace P & L statement in this study because we just want to track or keep good record of money, analyses it and make forecast for different categories of expenditure and finally, compute the different between money that came in as income and those that were spent. This last element of the Cash flow analysis is of paramount importance because we do not want to spend beyond what we have.

3. Cash flow

Cash flow is the net amount of cash and cash-equivalents being transferred into and out of a business or personal account. It is the money that is moving (flowing) in and out typically, in a monthly cycle. Although it does seem sometimes that Cash flow only goes one way—out of the business—it does flow both ways. Money going in and out of a business is fundamentally what Cash flow tries to address at any point in time. For us, the business is our home and in an attempt to keep record of money coming in and out as we run the home defines our Cash flow.

In this study, our goal is to keep record of personal income and expenditure and at the end of a monthly cycle, do certain analysis based on percentages. Finally, based on the realised percentages, come-up with a financial strategy. By the word strategies here, we mean, moving resource or increase spending in certain categories while ensuring that other(s) stay as low as possible to meet a set benchmark. With this idea in mine, a program was developed to record monthly earnings or income under a category (A) and expenditure in another category (B). Each of which has sub-categorised and a percentage computed based on the total sum in these major categories.

A lot of programs are available for bookkeeping and Cash flow analysis, examples, include Waveapps®, Manager®, Lessaccounting®, Fresh books®, Patriotsoftware®, Zipbooks®, Kashoo®, Nvoice®, Kashflow® and Clearbooks®. Such programs are limited to the fact that the end user cannot modify certain features of the program as he wants. One thing is for sure, different people will have different desires as it regards what they use (even when it comes to software). Hence, we present a simple yet intuitive program in MS Excel® for Cash flow analysis that can be easily modified to meet certain attributes of the end-user.

4. Cash flow in MS excel

The two main sections in our designed Cash flow program in MS Excel® program are;
- Money In (A);
- Money Out (B).

4.1. Money In (A)

This first part of the sheet Money In is depicted in Figure 1. Notice that, it is also tagged with a letter ('A') in front of the word Money. We expect money to be earned before we can spend it. Under this category, we have several sub-categories for different sources of income, these are as follows:

➢ Royalty (sales of books);
➢ Payment from seminars/workshops;
➢ Previous month's balance;
➢ Salary
➢ Credit card
➢ Others

The sample of the program developed for this study will only consider one source of income which is salary. This is due to the fact that previous month's balance appears every month, but it percentage compared to the salary is negligible. Also, money sometimes is gotten from credit card (borrowed), personal gifts and some special allowances from the office. Aside the fact that these sources of income are very low in percentage compared to salary, they are also not consistent. Other source of income was put to accommodate future needs or to suit those who will like to adopt this template without any major modification. Hence, salary is the only item on Money In section of our Cash flow program; thus, no analysis is done in this section based on the different sources of income.

Aside the listed sub-categories in 'A', after the *date* column, there are three other columns that follow in a respective manner. These are Budget I, Budget II and Actual. The first two budget columns permit two variants of budget for the month (a third can be added using *copy* and *insert column* appropriately). This is immediately followed by a column with the actual expenditure. One of the budgets will definitely serve as the *spending map* for the month and if things change (perhaps income increase), one could switch to using the other budget plan provided it captures this expected increment.

Figure 1. Excel sheet showing the Money In section

Under any sub-category, a total sum and percentage is computed. As such, there might be just a few rows for different entries in this sub-category. In the event, that all the rows are filled and there arises the need to add another item, we simple go to the last row or somewhere in-between and *insert row* above an existing one. This way, we retain formulas already established at the end of the sub-category. This eliminates the hurdle of having to re-writing the same formula anytime a new entry comes whenever the rows are exhausted in a sub-category. Hence, a sub-category can be expanded to an indefinite number. The benefits of such technique of row addition in a sub-category can be summarized as follows:

➢ retain and extend the formula computing the total sum in that category;
➢ retain and extend the formula computing the percentage for that category;
➢ extend the plot, without distorting it. Excel will automatically create a gap in the plot and add the item in between. This saves one the need to re-plot anytime a new item is added in the category.
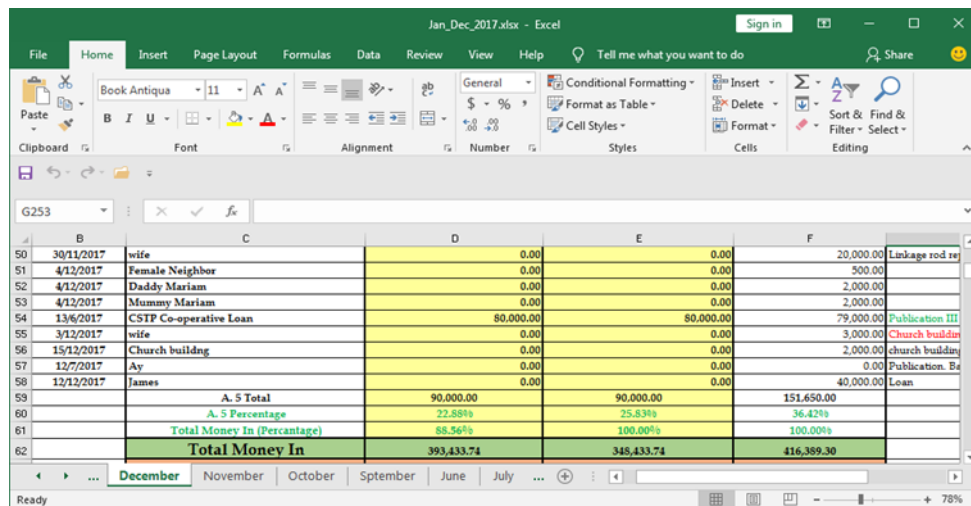
**Figure 2. Excel sheet showing the summed total and percentages of a
sub-category in Section A of the program.**

The last cell in this 'A' category is titled *Total Money In*. In this cell, all the sources of income under different sub-categories are summed together as shown in Figure 2 and the next row after it is the sum of all the individual sub-category percentages. Once this accrues to 100%, we are certain that all computations in this section are correct and we can safely move to the Money Out section which is also referred to as 'B' and will be addressed as such in the rest of this paper.

4.2. Money Out (B)

The second section (B) of the program is very similar to the first one (A). It has a column for date (for each entry being recorded) on the far left-hand-side and comment or notes column on the far right-hand-side of the worksheet. It comes with 22 sub-categories, namely, as follows:

➢ Bank loan;
➢ God (tithe, offering and gift);
➢ Parents;
➢ Beverages;
➢ Children education (Edu_c);
➢ Snacks;
➢ Family medication (FM);
➢ Food stuff;
➢ Children Clothing;
➢ Personal (Per)
➢ Household maintenance;
➢ Car maintenance (M_c);
➢ Generator maintenance (G_c);
➢ Investment (Invst);
➢ Life Insurance;
➢ Phone recharge;
➢ Savings;
➢ Fuelling car (F_c);
➢ Fuelling generator (F_g);

- Nuts;
- Fruits, vegetables and Nuts (FVN);
- Oils.

Two out of the 22 sub-categories in Section B is captured in Figure 3 for perusal, scrolling down the worksheet will unveil the others. Notice that section B also comes with three main columns similar to that in section A, these are Budget I, Budget II and Actual.
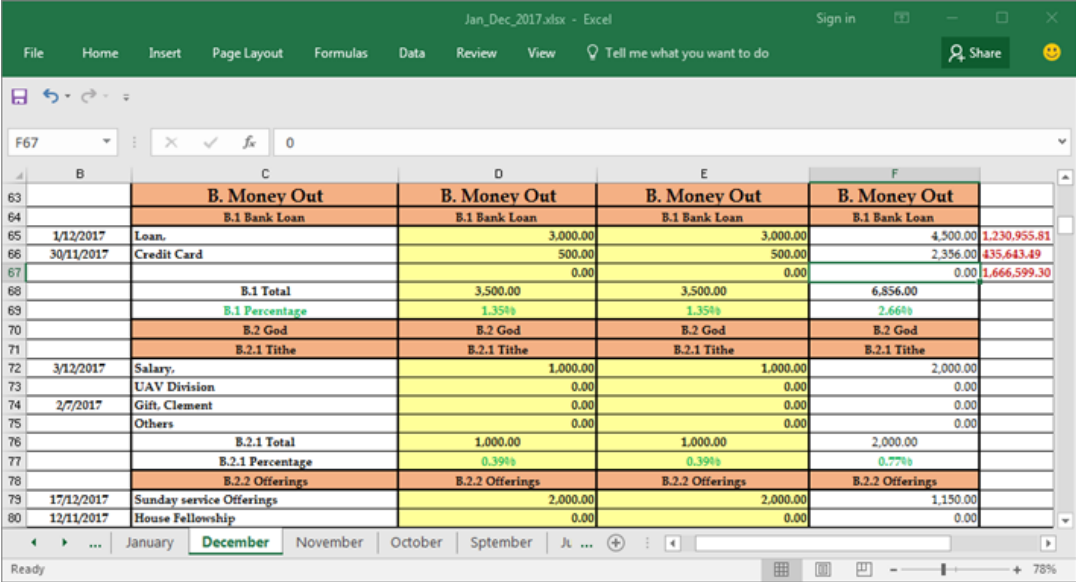

Figure 3. Excel sheet showing the Money Out section (Section B)

On a monthly basis, each sub-category can be measured graphically with respect to these three columns. For example, in November 2017, the actual expenditure for the previous month (Octobers 2017) was used as one of the budget entries (Budget I or Budget II) for November 2017. As such, we got a very close correlation graphically between the actual expenditure and Budget I for the month of November 2017 as depicted in Figure 4.
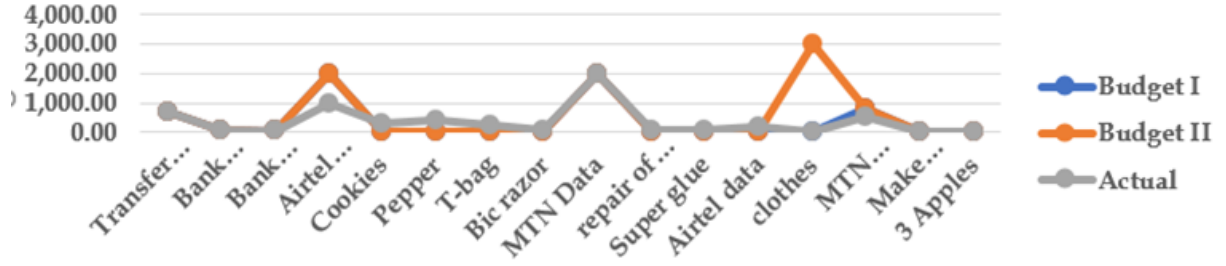

Figure 4. Budget I, II and actual personal expenses in November 2017

To ensure that, the whole entry for this section is added correctly, percentages are also computed for each sub-category and summed. As seen in Figure 5, the total percentage accrued to 83%. This simply means that 17% of the income is yet to be used.

Figure 5. Excel sheet showing the summed total of percentages of each sub-categories of Section B of the program

The fourth to the last row in Figure 5 is titled *Total Money Out*. Here, all the sub-categories in B section are summed. This is followed by a Total Money Out (*Nominal Percentage*) row, here we sum all percentages of the sub-category of expenditures with intention to extract *true tithe* on income for that month. Note, the previous month's balance in a new month is not a *tithe-able* income. The second to the last row disregards the tithe thing and just add percentages with the goal of achieve a 100% (accounting for all money spent). Finally, a row title Cash flow does the subtraction of *Total Money Out* from *Total Money In* (A–B). At all times, we need to ascertain that the net balance in the bank and wallet is the same with what the program indicates as Cash flow. This we refer to as our *book balance.*

5. Book balance

Under section B, we created a sub-category that includes all bank accounts with the money in them. Also, we included wallet/purse as an item in this same sub-category. Hence, to ensure that, we have all expenditure accounted for, at a point in time in a month, we include what is in the bank (especially amount that cannot be withdrawn at the ATM) and wallet/purse. Ideally, the net or Cash flow should be zero. But, most times, it is not. We get to see in the most case, the exact amount of money we cannot account for. Anything less than 3,000 naira (8.3 US dollars, using 360 naira to one US dollar as the exchange rate) that cannot be accounted, we ignore for that month. But, if the error is greater than 3,000 naira (8.3 US dollars), a thorough investigation is launched until such error is corrected. This aspect of financial discipline we dread and dislike so much. Most times, it is due to the carelessness for not recording certain expenditure(s). Sparingly, it is the error due to typing in a wrong digit (for example 2,000 instead of 200) for a particular item, either under section A or B (most times in B, because the number of sub-categories are much).

The last day of the month or the very day salary for the new month is paid, prompts the end of using an existing worksheet and beginning of a new one. Hence, both worksheets need to be connected.

6. Connecting worksheets

Connecting one worksheet with another is inevitable in this type of automated bookkeeping program. Here, the Cash flow at the end of a particular month need to be the opening balance in the new month. To link 2 months in this manner, for example, if the Cash flow (A–B) row in November worksheet needs to be the opening balance in December worksheet, simply type '=' in the desired cell

and then navigate to the cell with the November Cash flow and click it, then hit enter. This could also be done by typing the following directly in December worksheet exactly at the cell that needs to capture November Cash flow:

$$=November!F348$$

The above code tells me that in November worksheet, cell F348 contains the information I need to transfer or mirror in a designated cell in December worksheet. This means of connecting worksheets was used all through from February to December.

In a similar manner, all monthly worksheets were connected on one single worksheet for summarisation. The result of such summarization is depicted graphically as shown in Figure 6.
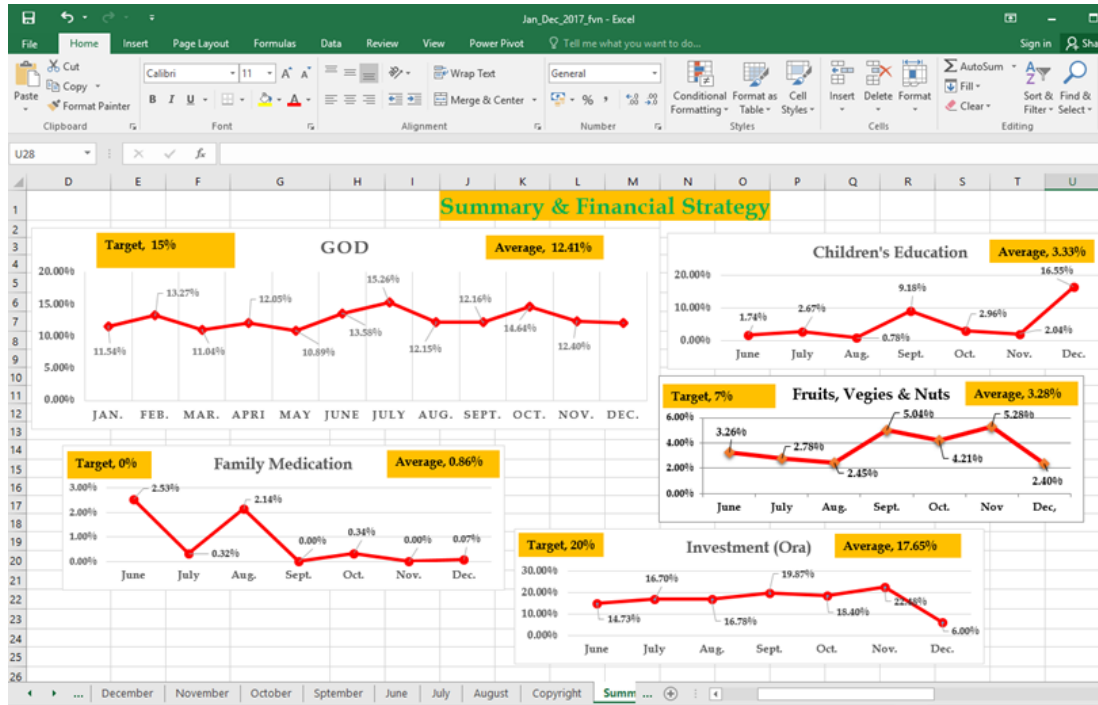

Figure 6. Summary worksheet for subcategories of each month

From the information in Figure 6, mathematical models were added for prediction and analysis of sub-categories of interest. The objective, here, is to forecast how much one might spend in the next month or two under a particular sub-category. Also, to come-up with a strategy for either increasing or decreasing expenditure with a particular benchmark in mind. Of the 22 sub-categories, only three will be discussed and analysed here for obvious reason of space and time. The fact remains, the analysis carried out here can be extended to all other sub-categories.

6.1. Family medication (FM)

People cannot change what they do not understand, especially when it comes to money. But, once we understand the pattern of our spending, we can formulate a game plan about how to effect those patterns. The average under FM sub-category is 0.86%. This is close to 1% of the monthly income. The strategy here is to drive it to 0.43% in the next year.

Figure 7. Family medication

Mathematical model for FM as depicted by the trend in Figure 7 is

$$y_{FM} = 0.0218 - 0.0035x \tag{1}$$

where *x* is the number of month in consideration. To predict how much will be spent on FM in January 2018, we will need to assign *x* as 13.

To obtain Eq. (1) in MS Excel, click on the *chart element* bar, select *trendlines* and then further select *Linear*. This automatically fits your data with a linear curve. Once this is done, click on chart *element* again and select *trendlines* and then click more *options*. Under *more options*, check the box to *display equation on chart* and also check the box to *display R-square values on chart*. The *R*-square value of 0.49 is associated with Eq. (1) meaning that the fit explains 49% of the total variation in the data about the average.

6.2. Fruits, vegetables and nuts

Under FVN, and the trend is as depicted in Figure 8 and the average is 3.28%. The intention, here, is to double this percentage to 6.56% by the end of 2018. This I believe will help achieve the target percentage of 0.43% in FM sub-category.

Figure 8. Fruits, vegetables and nuts (FVN)

The trend in Figure 8 can be represented as given by Eq. (2). Notice that the *R*-square 7.1% is very low compared to that of Eq. (1). This means Eq. (2) might not be very useful for prediction. It mathematical equation is

$$y_{FVN} = 0.0015x + 0.0303, \tag{2}$$

6.3. God

This sub-category comprises of three other sub-categories, namely, tithe, offering and charity. The primary objective, here, is to maintain 10% of all my income for tithe, 1% or more for offerings and 3% for charity outside church. Hence, church gets at least 11% of my income on a monthly basis. Bear in the mind that tithe is fixed to exactly 10%, but offering and gift can take any amount but not less the percentages ascribed earlier. As such, the trend for the year 2017 is depicted in Figure 9.
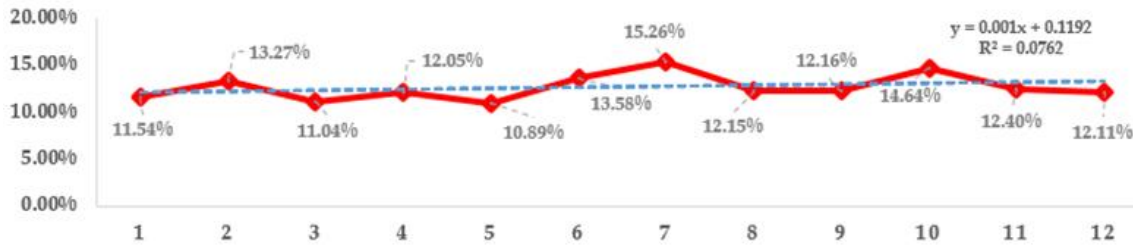
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Figure 9. God-tithe, offering and charity

Mathematical model for the trend in Figure 9 is as given in Eq. (3). Notice that the Eq. (3) has the highest *R*-square of 76.2% observe also that the number of data for this fit is 12 and are close to the fit line compared to that in Figure 8.

$$y_{God} = 0.001x + 0.1192 \tag{3}$$

Using Eq. (3), with *x* value as 15 (March 2018), we got 0.1342. This translates to 13.42%. The prediction from Eq. (3) compared to forecast value in Figure 10 gives a difference (13.42−13.35) of 0.07% error. It is clearly seen that both Eq. (3) and forecast in Figure 10 agree and can be used for prediction depending on which method best appeals to the user.

Figure 10. Graphical forecast for 15th month for sub-category God

It is informative to realise that in Figure 10, based on the past data, the lowest that could be realize as regard prediction for the 15th month is 10.69%. This value still meets the primary objective (above 10%).

To assess Eq. (3), we will need 2018 data for this same sub-category and juxtapose it with the predicted values as shown in Table 1.

Month	Actual (A_c,%)	Prediction (P_r,%)	($|A_c - P_r|$),%
January	14.12	13.22	0.90
February	11.21	13.42	2.21
March	14.88	13.42	1.46
April	13.29	13.52	0.23
May	11.14	13.63	2.49
June	16.03	13.72	2.31
July	13.25	13.82	0.57
August	12.02	13.92	1.90
September	11.82	14.02	2.20
October	13.84	14.12	0.28
November	11.67	14.22	2.55
December	14.12	13.32	0.80
Average	13.12	13.77	1.49

Out of 12 months' prediction in Table 1, five months (January, April, July, October and December) have an error of less than 1%, while five months (February, May, June, September and November) have errors above 2%. Only 2 months (March and August) have errors greater than 1% but less than 2%. The average error value of ($|A_c - P_r|$) column is ±1.49%. Under, A_c column, the average is 13.12% and that of P_r is 13.77%. The absolute difference between this two is 0.65%. Hence, to predict for 2019, we have the following options:

➢ Use Eq. (3) with a correcting term of ± 1.49% as

$$y_{God_1} = 0.01x + 0.1192 + 0.0149 \tag{4}$$

$$y_{God_1} = 0.001x + 0.1192 - 0.0149 \tag{5}$$

➢ Use Eq. (3) with a correcting factor of 0.65% as

$$y_{God_2} = 0.001x + 0.1192 + 0.065 \tag{6}$$

➢ Use data of both 2017 and 2018 to fit a line hence, get an equation from it;
➢ Use only the data from 2018 to fit a line and use the equation.

At the end of the year 2019, when we have the actual data, only then can we assess which of the prediction options outlined above is best.

To complete a personal financial analysis for the year 2018, a brief showing how money was spent in each category is very necessary. Remember in this program we have 22 categories under section B, here, we choose to depict them as shown in Figure 11.
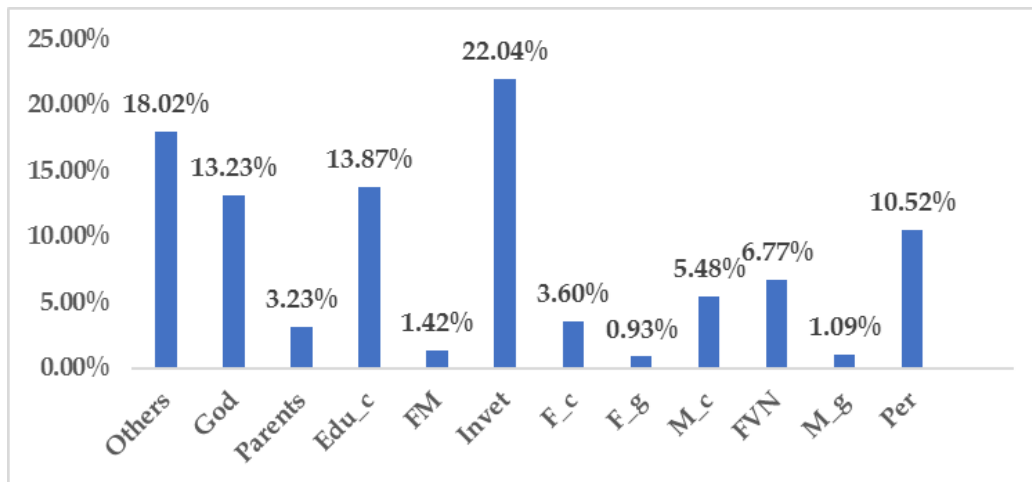

Figure 11. Personal financial brief for 2018

From Figure 11, it can be seen clearly that Investment is the highest with 22.04%. Ignoring the bar Others in Figure 11, the second highest sub-category is Children's Education with 13.87%. The sub-category God comes third with 13.23%. The pattern of spending in Figure 11 meets our financial strategy and we intend to have something similar in 2019. Though percentage values and ranking might change (the sub-categories God must be greater than 11% and Investment should be greater than or equals to 20%).

After detail analysis like this at the end of the year, the next task is to begin a new year in a new *workbook.* The Cash flow template of the last month in the previous year will then be the opening balance in the first month of the new year's *workbook.* This means two *workbooks* need to be connected.

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7. Connecting workbooks

Connecting two workbooks means one cell in the workbook serves as an input to another. For us, we began this automated bookkeeping in 2017 hence, by January 2018, we need to connect December 2017 Cash flow cell with January 2018 opening balance. Note, both workbooks need to be placed in the same directory and the following code was used:

$$= \big(\text{'D:\\2018\\Finanacial\\2018\\} \big[\text{Jan\_Dec\_2017.xlsx} \big] \text{ December'!F348} \big) + 2900$$

Alternatively, simply open both workbooks, type '=' in the appropriate cell on the 2018 workbook and in the appropriate worksheet (January). Go to the opened 2017 workbook and locate the December worksheet and the cell with the Cash flow entry. Select this cell by clicking once and hit 'enter.'

8. Conclusion

A program for personal bookkeeping was designed using Microsoft Excel®. This program does personal Cash flow analysis with graphical trends that summaries entries for a whole year. From the curves produced, mathematical models were also realized. These mathematical models were used effectively for forecast and results presented are reliable. Also, we were able to show that for prediction or forecast purpose, R-square is a powerful indicator. The higher the R-square and the more useful is the mathematical model for prediction. Prediction helps in accommodating future expenses and sacrificing non-mandatory spending in favour of necessary spending or a savings goal thus, aiding one to achieve personal/cooperate financial goals. We also, suggest the introduction of correcting terms from previous errors of forecast which will be compared with method of trend lines in future. This simple yet very intuitive method for bookkeeping could be extended and modified with easy based on individual desires. The beauty of this program is that the end user need not be too proficient in the use of Microsoft Excel®.

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