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Model Developed for Competing Accessory, Spare Parts and Miscellaneous Costs for Limited Available Budget under Machine Availability

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

In a developing company or industry where there is availability of machines to keep the industry running effectively, a need always arise to consider the accessories and the spare parts which will enhance the production planning and also affects the economic growth of the company positively. An optimum model is developed to control the limited available budget that will be optimally allotted to accessories, spare parts and miscellaneous costs. This study considered the strategic decisions for budgeting, developed mathematical models for accessories, spare parts and miscellaneous, with considering the machines cost since it is available for the year under consideration. The models were tested and their performance evaluations carried out. A decision maker/project manager optimally allotted the limited resources to the considered strategic decisions to know exactly the amount that will be required to keep the machines functioning efficiently and effectively so that revenue can be generated. In allotting the limited resources for procurement, this study considered three major strategic decisions: accessories, spare parts and miscellaneous costs.

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Model for each strategic decision was developed. This study made it known that the highest value in any of these strategic decisions will definitely have the highest inventory in company's stock for production. Information from the past procurement made by OLAM Cocoa Processing Industry (OCPI), Akure, Ondo State, Nigeria was used as case study to test the developed models for decisions making. Fifteen (15) years past record of equipment cost data was collected from this institute. A software was also developed for easy processing of this data using visual basic language because of its versatility and friendliness. Five million, five hundred thousand Naira (₦5,500,000) which is equivalent to more than Twenty – two thousand US dollar (US \$22,448.98) was made available for the procurement of accessories, spare parts and miscellaneous costs and the amount allotted are ₦2,190,826.18; ₦2,861,556.10; and ₦447,617.71 respectively. This model is a strong decision tool for allocating available budget especially during the period of financial scarcity where equipment procurement for production needs must be carried out. This model is highly recommended to any manufacturing company, where equipment procurement affects their production in developed and developing countries.

Keywords: Model developed; accessories cost; spare parts cost; available budget; machine availability.

1. INTRODUCTION

The impact of the production sector of a company on its economic growth cannot be over-emphasized. It is always known that the economic growth of various companies that deal with production in a country will not only affect the nation's economy positively but will also promote the nation to greener pasture. It will act as a buffer for boosting the economy of the company and the nation at large, the production sector itself must be operating functionally so that revenue can be generated [1]. Akinnuli [1] also stresses that generating revenue requires proper planning of production processes and every process planned depends majorly on the machines to be used in achieving this purpose. Obviously the machines require proper planning since every other production planning depends on them. Machinery planning includes procurement and ensuring that the machines operate in good condition at all time. This is done by making sure that the spare parts and accessories are randomly available as at when needed and replacing them when they fail with functional ones [2]. To achieve this, plan has to be made to ensure that these replacements are available that is, it must be in stock in the company's store. For proper planning, forecasting tools would be needed. Osmond [3], considered the case of budgeting, which is an important part of small business management that budgets serve to limit the amount of expenditures for various economic resources. Libby and Lindsay [4], states that many companies use their accounting or finance departments for planning, creating and developing budgetary procedures but smaller or home-based businesses may not have a detailed

budget process since less cash is involved in these operations. Two important budgets include inventory purchases and personnel decisions were identified by Robinson and Last [5]. They went further to say that inventory and personnel often represent the two largest expenses organizations have in the business environment.

But Floyd, et al. [6] established the fact that inventory is a large expense since companies usually have more on hand than they can sell. This ensures companies do not run out of inventory and face declining sales. Hiring employees is generally an expensive process since companies spend copious amounts of time interviewing and training individuals for various company positions. Jacobs [7], Premchand [8] also stressed that Inventory budgets help companies avoid inventory obsolescence and wasted capital from useless goods.

A budget is a quantitative expression of a plan for a defined period of time. It may include planned sales volumes and revenues, resource quantities, costs and expenses, assets, liabilities and cash flows. It expresses strategic plans of business units, organizations, activities or events in measurable terms [9].

Budgeting has always been part of the activities of any business organization of any size, but formal budgeting in its present form, using modern budgeting disciplines, emerged in the 1950s as the numerical underpinning of corporate planning [10]. Modern corporate planning owes much to operations research and systems theory [11].

Modern formal budgets not only limit expenditures; they also predict income, profits,

and returns on investment a year ahead. They have evolved into tools of control and are also used as a means of determining such rewards as profit-sharing and bonuses [12]. Unless the budgetary process is managed with extreme skill and care, the very virtues of budgeting can turn into negatives—and have, of late, emerged into a movement actively working to change this process [13].

In large corporations, budgeting is a collective process in which operating units prepare their plans in conformity with corporate goals published by top management. Each unit plan is intended to contribute to the achievement of the corporate goals. Unit managers prepare projections of sales, operating costs, overhead costs, and capital requirements. They calculate operating profits and returns on the investment they intend to use. The budget itself is the projection of these values for the next calendar of fiscal year [14]. Many small businesses try to operate without a formal budget. Even some businesses that have a budget seldom consult it, meaning they are not gaining the business advantages that they could be through budgeting. For start-up entrepreneurs, a budget is like a roadmap that can help them set goals and assess the validity of their business concept. For established small businesses, a budget can be used to take the pulse of the business, determining how the business is performing through the years, and helping identify possible future investments [15]. By regularly consulting a budget, business leaders can compare actual figures and catch potential business shortfalls or other problems early. Budgets can also be instrumental in winning over investors, convincing banks your business is a good loan risk, or bringing on new partners or customers. While budgets are developed bottom up, managers must strive to meet top-down business goals (e.g. “Annual growth in after-tax profits of 39 percent.”), [16].

According to Welch and Jack [17], because performance is measured based meeting or exceeding positive projections (of sales, returns, and profits) and meeting or coming in below negative projections (fixed and variable costs and capital expenditures) managers have strong incentives for projecting the lowest possible “positive” and the highest possible “negative” results.

Peterson [18], also stresses that, the more successful they are in understanding sales and profits and over estimating costs, the higher the

likelihood of “meeting the budget.” Top management’s incentives, by contrast, are to do the opposite. Therefore, the budgeting process is inherently marked by potential conflict. Such difficulties can be, and usually are, mitigated by rational policies, good will on both sides, and straight forward implementation.

Projections should be as realistic and quantifiable as possible. If projections are out of line with historical patterns, up or down, management must question the planning. Thus for instance, a sharply rising projection of costs must have some real-world justification. Overly, ambitious revenue projections must also be questioned. Conversely, managers must resist pressures sharply to raise revenue targets unless tangible changes in the market or compensating raises in sales expenditures are present [19].

Fraser and Hope [16], added that if the negotiating levels are honest and realistic, the right projections will result. Ideally, operating units should not be measured on activities over which they lack full control. An operation which does not operate its own debt collection, for example, should not be measured on how rapidly invoices are collected. Since budgets are often at least 50 percent guess-work, formal budgetary review at reasonable intervals and realistic adjustments based on actual events must be part of a well-functioning process. All too often, the spring budgeting event is rapidly forgotten.

In an industry where there is little or no accessories and spare parts in the stock that will aid the performance of machines to repair/replace the failed parts, a project manager must decide instantly to optimally allot the limited available budget on the strategic decisions in order to meet the customers’ needs, this research also serves as basis to proper planning and to avoid project failure, helps to avoid overbudget and underbudget and also running at lost. The nature of present business environment is such that no organization can boast of having sufficient resources as stated by [20].

Similarly the degree of competition in which the industry is involved signifies the need for achieving high productivity in order to retain its competitive strength. Based on these factors it becomes mandatory for an organization to ensure its limited resources are put into efficient use. One of the ways of achieving this objective is to determine the organizational financial obligation in advance. This is known as budget preparation [21]. This research guides and

assists decision makers of the industry in achieving their objectives by providing adequate service to customers when machines perform optimally. This outcome will also contribute to the performance of Industries particularly in equipment procurement. This study is limited to budgetary allocation for equipment procurement with limited available budget under machine availability.

2. METHODOLOGY

In order to forecast the required cost for the strategic decisions, 14 years of past procurement made by a case study, OLAM Cocoa Processing Industry (OCPI), Akure, Ondo State, Nigeria were collected for testing the models developed to find the ratio of contributions of each strategic decision in yearly budget using normalized ratio. This method makes the models simple and not burdensome.

2.1 Strategic Decisions for Model Development

In this research for proper budgeting, three strategic decisions were considered for their procurement. They are Accessories (Ca); Spare parts (Csp); and Miscellaneous (Cmis) Costs.

2.2.1 Strategic decisions and acronyms

The strategic decisions and their acronyms used in this study are:

- Accessories cost (Ca);
- Spare parts cost (Csp);
- Miscellaneous cost (Cmis); and
- Total yearly Budget (Bty)_i.

Where: $i = (1, 2, 3 \dots n)$ yr

These strategic decisions are being used in the model to know exactly the amount that will be allotted to each of them and the miscellaneous cost which is extra cost.

2.2 Model Development

Contribution of each strategic decision to yearly budget for any year i is as shown in equations 1 – 3.

$$\text{Accessories cost} = \frac{(Ca)_i}{(Bty)_i} \tag{1}$$

$$\text{Spare parts cost} = \frac{(Csp)_i}{(Bty)_i} \tag{2}$$

$$\text{Miscellaneous cost} = \frac{(Cmis)_i}{(Bty)_i} \tag{3}$$

2.3 Developed Models Application Sample for Allotting Ratio for Yearly Available Budget

2.3.1 Manual computation for year 2000, the first year (year 1)

Ratio of Accessories contribution to budget of year 2000

$$(R_A)_i = \frac{(Ca)_i}{(Bty)_i}$$

Where $i =$ year 1, (2000)

$$(R_A)_1 = \frac{(Ca)_1}{(Bty)_1} = \frac{4,100,000}{11,430,000} = 0.3587$$

Ratio of Spare parts contribution to budget of year 2000

$$(R_{sp})_i = \frac{(Csp)_i}{(Bty)_i}$$

$$(R_{sp})_1 = \frac{(Csp)_1}{(Bty)_1} = \frac{6,200,000}{11,430,000} = 0.5424$$

Ratio of Miscellaneous as extra cost of year 2000

$$(R_{mis})_i = \frac{(Cmis)_i}{(Bty)_i}$$

$$(R_{mis})_1 = \frac{(Cmis)_1}{(Bty)_1} = \frac{1,130,000}{11,430,000} = 0.0989$$

2.3.2 Manual computation for year 2001, the second year (year 2)

Ratio of Accessories contribution to budget of year 2001

$$(R_A)_i = \frac{(Ca)_i}{(Bty)_i}$$

Where $i =$ year 2, (2001)

$$(R_A)_2 = \frac{(Ca)_2}{(Bty)_2} = \frac{5,200,000}{13,800,000} = 0.3768$$

Ratio of Spare parts contribution to budget of year 2001

$$(R_{sp})_i = \frac{(Csp)_i}{(Bty)_i}$$

$$(R_{sp})_2 = \frac{(Csp)_2}{(Bty)_2} = \frac{7,300,000}{13,800,000} = 0.5290$$

Ratio of Miscellaneous as extra cost of year 2001

$$(R_{mis})_i = \frac{(C_{mis})_i}{(B_{ty})_i}$$

$$(R_{mis})_2 = \frac{(C_{mis})_2}{(B_{ty})_2} = \frac{1,300,000}{13,800,000} = 0.0942$$

This computation was carried out for each year from year 2000 to 2014, the summary of this computation results is as shown in Table 2 under results.

These average ratios were used in allotting the available budget for these strategic decisions (accessories, spare parts and miscellaneous costs). Summation of them will stand as the denominator. On yearly basis, the ratio will be recomputed due to new information received. Assuming ₦5,500,000 was given as the available budget for the execution of the plan for the year 2015. Therefore:

$$\Sigma(5.9751, 7.8044, 1.2208) = 15.0003$$

Table 1. Available data from OCPI: Year (2000 – 2014)

Year	C_a	C_{sp}	C_{mis}	Total
2000	4,100,000	6,200,000	1,130,000	11,430,000
2001	5,200,000	7,300,000	1,300,000	13,800,000
2002	5,800,000	7,900,000	1,400,000	15,100,000
2003	6,200,000	8,300,000	1,460,000	15,960,000
2004	6,500,000	8,900,000	1,610,000	17,010,000
2005	7,000,000	9,400,000	1,620,000	18,020,000
2006	7,500,000	9,900,000	1,630,000	19,030,000
2007	8,000,000	10,400,000	1,640,000	20,040,000
2008	8,500,000	10,900,000	1,650,000	21,050,000
2009	9,000,000	11,400,000	1,660,000	22,060,000
2010	9,500,000	11,900,000	1,670,000	23,070,000
2011	10,000,000	12,400,000	1,680,000	24,080,000
2012	10,500,000	12,900,000	1,690,000	25,090,000
2013	11,000,000	13,400,000	1,700,000	26,100,000
2014	11,500,000	13,900,000	1,710,000	27,110,000
Total	120,300,000	155,100,000	23,550,000	298,950,000

Source: OCPI, 2014

Table 2. Results summary for models application from year 2000 to 2014 for allotting ratio

S/NO	Year	Accessories ratio (R_A)	Spare parts ratio (R_{sp})	Miscellaneous ratio (R_{mis})
1	2000	0.3587	0.5424	0.0989
2	2001	0.3768	0.5290	0.0942
3	2002	0.3841	0.5232	0.0927
4	2003	0.3885	0.5201	0.0915
5	2004	0.3821	0.5232	0.0947
6	2005	0.3885	0.5216	0.0899
7	2006	0.3941	0.5202	0.0857
8	2007	0.3992	0.5190	0.0818
9	2008	0.4038	0.5178	0.0784
10	2009	0.4080	0.5168	0.0752
11	2010	0.4118	0.5159	0.0724
12	2011	0.4153	0.5150	0.0698
13	2012	0.4185	0.5141	0.0674
14	2013	0.4215	0.5134	0.0651
15	2014	0.4242	0.5127	0.0631
	Total	5.9751	7.8044	1.2208
	Average Ratio	0.3983	0.5203	0.0814

Source: OCPI, 2014

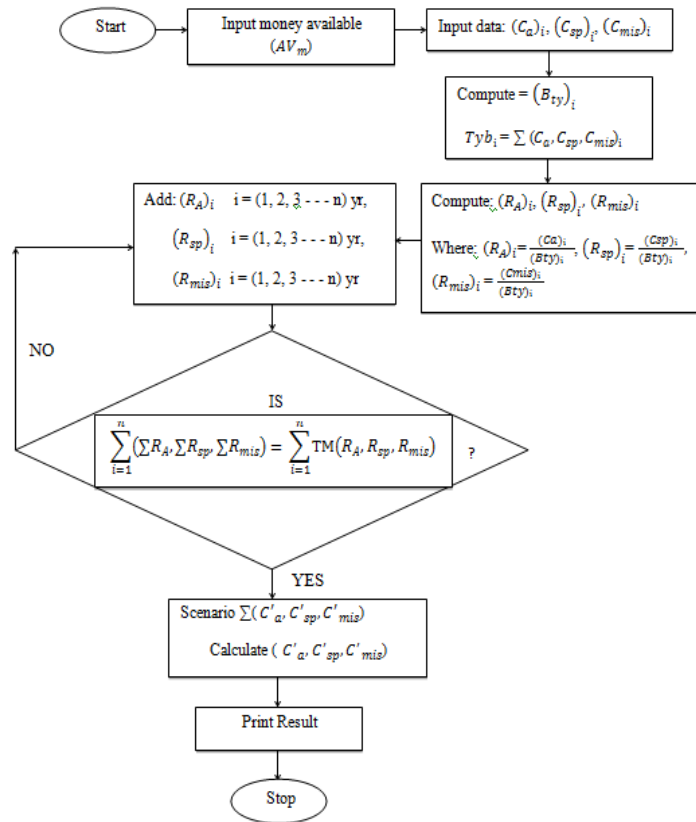


Fig. 2.1. Flow chart for models developed

Table 3. Result summary for allotting available ₦5,500,000 for year 2015 budget planning

S/N	Year	Computation	Result (₦)	US Dollar Equivalent (245/dollar)
1	2015	Compute: C'_a, C'_{sp} and C'_{mis}	$C'_a = 2,190,826.18$ $C'_{sp} = 2,861,556.10$ $C'_{mis} = 447,617.71$	$C'_a = 8,942.15$ $C'_{sp} = 11,679.82$ $C'_{mis} = 1,827.01$

Hence: The predicted costs for the three strategic decisions are calculated thus:

$$C'_a = \frac{5.9751}{15.0003} \times 5,500,000 = 2,190,826.18$$

$$C'_{sp} = \frac{7.8044}{15.0003} \times 5,500,000 = 2,861,556.10$$

$$C'_{mis} = \frac{1.2208}{15.0003} \times 5,500,000 = 447,617.71$$

From the computation above, it showed that the spare parts have the highest cost that would be spent in the year 2015 followed by the Accessories cost, the miscellaneous cost is only the cost that was not planned for but that could occur in budget planning. This proved that the

spare parts would have the highest inventory that would be stocked in the company store.

3. RESULTS AND DISCUSSION

In Olam Cocoa Processing Industry (OCPI), the available budget for running the institute workshop was ₦5,500,000 (US \$22,448.98). In this year (2015), the available budget was to cater for the accessories and spare parts, and miscellaneous, which serves as unexpected expenses to keep the machine functioning effectively. Therefore, the allotted ratios for accessories, spare parts and miscellaneous costs are ₦2,190,826.18; ₦2,861,556.10 and ₦447,617.71 respectively.

4. CONCLUSION AND RECOMMENDATION

4.1 Conclusion

This study introduced the budgeting system of Olam Cocoa Processing Industry, Akure, Nigeria as a case study using normalized ratio model. The results showed that (from the models developed) the spare parts have the highest amount allotted which would keep the available machines functioning effectively by replacing the failed parts, the accessories also have the second largest amount allotted to aid the performance of the machines in the workshop. The miscellaneous costs are the costs not planned for but can still be used by the project manager. In a situation whereby an industry faces financial scarcity and inability to plan for the necessity, a decision maker has to make reference to past records with the present events to prepare for the future events. This will help the industry to strengthen their competition with other viable companies and will prevent them from running at lost.

4.2 Recommendation

It is highly recommended that a project manager should set his priority with the limited available resources given to upgrade the performance of the machines. By doing so, it will affect the economic growth of the industry positively and meet the customer needs. It will also prevent the industry from running at lost by not having obsolete materials in stock.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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