Predicting Behaviour O Working Capital Variables Through Decision Support Model

Dr. Rajib K. Mohapatra & Prof. K. Vizaya Kumar

***Abstract*: Working capital management involves management of current assets, individual current liabilities and all interrelationships that link current assets together with the current liabilities and other balance sheet accounts. Working capital management includes planning and controlling the flow of value between various working capital and other balance sheet accounts so as to ensure adequate liquidity for the company and optimizing levels of current assets so as to enhance the profitability of the organization. Reducing inventories may affect production volume and hence affect account receivables, changing in the level of account receivables will affect the cash holdings, short-term debt, inventories etc. So working capital of the organization cannot be considered in isolation from other financing decisions and the approach to working capital management should be a "Total systems Approach"**

I. INTRODUCTION

Working capital cycle involves conversions and rotation of various constituents/ components of the working capital. Initially 'cash' is converted into raw materials. Subsequently, with the usage of fixed assets resulting in value additions, the raw materials get converted into work in process and then into finished goods. When sold on credit, the finished goods assume the form of debtors who give the business cash on due date. Thus 'cash' assumes its original form again at the end of one such working capital cycle but in the course it passes through various other forms of current assets too. This is how various components of current assets keep on changing their forms due to value addition. Some of the important determinants of working capital includes " Nature of business, Terms of sales and purchases, Manufacturing cycle, Rapidity of turnover, Changes in technology, Seasonal variation, Market conditions, Seasonality of operation, Dividend policy, Working capital cycle" etc.

II. MODELING OF WORKING CAPITAL MANAGEMENT USING SYSTEM DYNAMICS

Some research work addressing financial problems using system dynamics can be traced back to 1975. Lyneis (1975, 1980) has discussed financial and corporate planning with the aid of system dynamics methodology. Forrester (1976) has used a system dynamics approach to judge the influence of capital investment on market growth. Kolay (1991) has analyzed industrial sickness qualitatively using system dynamics influence diagram as aid to better understanding. However there is very little/ negligible literature available on system dynamics application on working capital management. Kolay (1991) has used influence diagram for qualitative policy analysis for management of working capital crises. This chapter deals with developing a model for effective working capital management with the aid of system dynamics modeling and simulation This is an effort to develop a system dynamics model that depicts key relationships within a manufacturing organization affecting working capital is presented. The model is intended primarily to demonstrate the relationships between key elements affecting the working capital structure and cash flow of a Ferro alloys manufacturing firm and to generate the behavior of different variables. The model was developed and simulated using the system dynamics software Stella. A period of one day was taken between successive runs and the total length of the simulation run was taken equal to 120 days (four months) operation. The model consists of following important and critical sub systems of the organization affecting working capital management.

1.Production, Despatch, Inventory And Account Receivables Sub System. 2.Raw Material Sub System, 3. Account Payables Sub System 4. Profitability Sub System, 5.Cash Sub System And 6.

A Model Integrating All The Sub System The Details Of The Important Parameters Of The Above Sub Systems Of The Model Are Listed Below. Production, Despatch, Inventory And Account Receivables Sub System

1. Finished goods input rate- Rate at which finished product (Ferro Alloy) handed over finished goods storage shed. (Production finish Rate x Yield)
2. Productions finish Rate- Rate at which the finished product is produced from the furnace.
3. Yield – Ratio of the rate at which the finished product is produced from the furnace and the rate at which finished

   product (Ferro Alloy) handed over finished goods storage shed after handling

1. Finished goods despatch rate- Rate at which the finished product being dispatched to customer.
2. Order Backlog-Quantity of product to be dispatched for which order has been booked and despatch committed.
3. Rupee value of sale- This is the sale value of despatch of finished goods to customer.
4. FG Price- Price of the finished goods based on the chromium content
5. Chromium Percent – Chromium content in the alloy
6. Collection Rate- Rate at which the sale value of despatch is collected from the customer. It is collected in two stages.

Raw material sub system

1. Raw material ordering rate- Rate at which the material
2. Re order stock in days- No of day's stock to be maintained during reordering period.
3. Inventory discrepancy- Difference in inventory between desired inventory and actual
4. Inventory adjustment time- Time required adjusting the inventory discrepancy.

5. Raw material specific consumption- Raw material consumption (Rs per MT)
6. Raw material consumption rate- Raw material consumption per day
7. Desired inventory- Desired Inventory to be maintained at any moment of time
8. No. of day's invitatory- No of days the existing inventory will last.

Account Payables Sub System

1. Account Payable increasing rate – Rate at which account payable is increasing on day- to-day basis
2. Account Payable- Total Account payable at any moment of time
3. Account Payable Payment rate- Rate at which account payable is being paid on day-to- day basis. This is calculated by the ratio of Account Payable to Time to Pay Account Payables
4. Time to Pay Account Payables- Period within which the Account Payable to be paid to creditor.

Profitability sub system

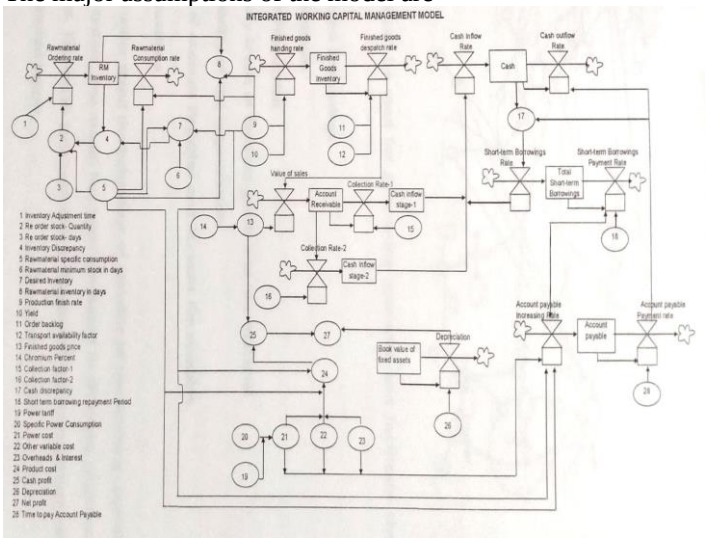
1. The variable cost of the Ferro alloy consists of the following elements as mentioned below.
2. Raw material - Reductant, Paste, Flux, Ore
3. Power -For furnace use (smelting purpose) and auxiliary Consumption
4. Other variable cost.-Stores consumables, Expenses for material handling, breaking, packing and loading, Maintenance expenses etc.

The difference of sales realization and variable cost forms the contribution of the organization. Overheads, Interest are deducted from the contribution to derive at the cash profit of the organization. Depreciation and taxed are deducted from the cash profit to derive the net profit (profit after tax) of the organization.

Cash sub system

Cash is increased by cash inflows, i.e., collection from debtors, debt borrowings. Cash inflow is made in two stages stage-1 and stage –2. In case of stage –1 some percentage of the realization (debt) has been received immediately on despatch of finished goods to customers and the balance amount is being received within next 10days on suitable delivery of material at the customer's site. On the other hand cash is decreased by cash outflows such as creditor's payment, interest, investment expenditure, etc. If the cash position does not permit to meet the account payables, a cash discrepancy (difference between cash availability and is account payable amount) generated which activate the short-term borrowings. Short-term borrowings are made to meet the account payables.
Integration and Assumptions of the Model

The above-described sub-systems are integrated to form a performance-monitoring model. The integrated model combining all the sub system has been developed using Stella simulation software. The integrated model layout and causal loop has been presented in figure 5.8 and 5.9 respectively. The major assumptions of the model are



Rate variables are assumed continuous, while in the real system this may not be the case.
Rates of Tax, Interest etc are assumed constant.
Declining balance method is assumed for depreciation accounting.
It has been assumed that the causal relationships will remain valid.
Deterministic situation is assumed in the model.
It has been assumed that the operational capacity will remain at the present level.

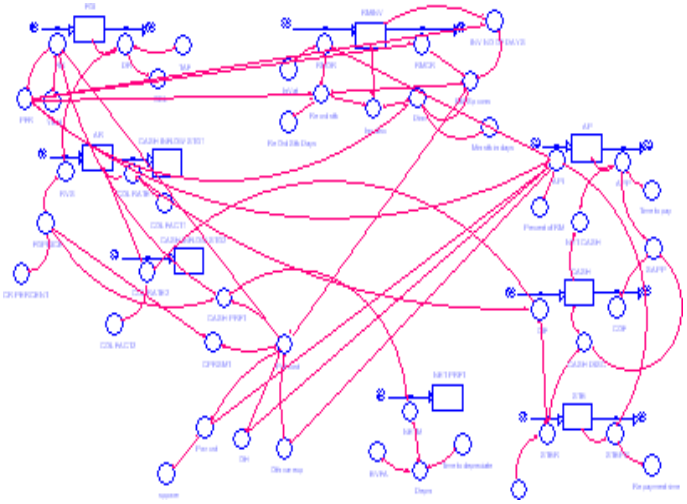
The model can be used for generating scenarios and facilitate the decisions on

1. Short term borrowings
2. Cash positions
3. Cost of Production
4. Inventory levels of finished goods and raw material
5. Profitability of the organization.
6. Status of Account Payables and Account Receivables

Integrated System dynamics model
In order to understand the behaviour of variable of the working capital management system, the model has been simulated in different situation of the business. Production and consumption levels of any metallurgical plant vary to certain extent as the major input is from natural resources (ore) and many operating parameters are involved in the process. The situations are broadly dividend in to two major categories (a) Normal Production Level and (b) Deviated Production Level. Each major category is further subdivided in to two sub category i.e (a) Normal consumption Level and (b) Deviated consumption Level in order to form four business situations. Further depending upon the level of raw material inventory policy, such as: 7 days, 15 days and 30 days, there are12- (twelve) simulation situations arouse. These situations are as mentioned below.

Production	Consumption	Inventory (No of Days)			Situation
Normal	Normal	7	15	30	Situation-1-2-3
Normal	Deviated	7	15	30	Situation-4-5-6
Deviated	Normal	7	15	30	Situation-7-8-9
Deviated	Deviated	7	15	30	Situation-10-11-12

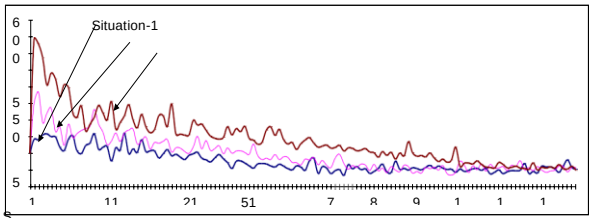
As Account Receivables, Account Payables, Shot-term Borrowings and Finished goods inventory are major components of working capital; we are interested to understand their behavior over a period of 4-months time. For this purpose the integrated model was simulated on these situations for the specified period. The behavior of different variables in different situations is analyzed and compare with each other in order to have a meaningful conclusion.



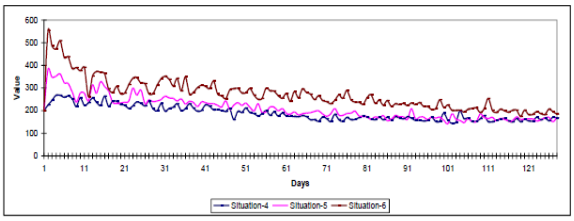
III. BEHAVIOUR OF ACCOUNT PAYABLES IN DIFFERENT OPERATING SITUATIONS:

The behaviour of the account payables in different operating condition in terms of production volume, raw material consumption levels and at different level of inventory policy for raw material. Based on the outcome of the simulation model, the organization can adopt a policy best suitable for the organization. Scenarios of different situations are presented below. It is clear from the output of the model that with increase in the no.days (7, 15 and 30 days) raw-material inventory in normal operating conditions, there is an increase in the volume account payables in the initial period up to 10 days. There after it declined gradually and gets normalized for all the situations by the end of fourth month. Moreover, it is evident from the figure that the demand for account payables in situation-3 (30- days inventory) is more than double as compared with that of the situation-1(7-days inventory) at the beginning and this gap reduced over a period of time and get equalized with other situations at the end of the period of study. Similar scenarios has been generated for all the situations

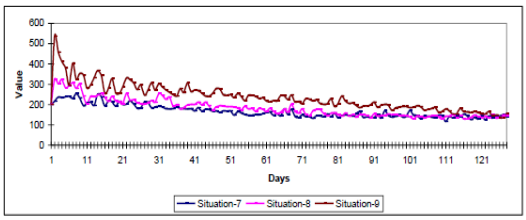
Behaviour of Account Payable in Situation 1, 2 and 3



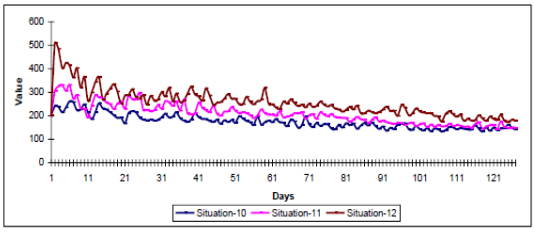
Behaviour of Account Payable in Situation 4, 5 and 6



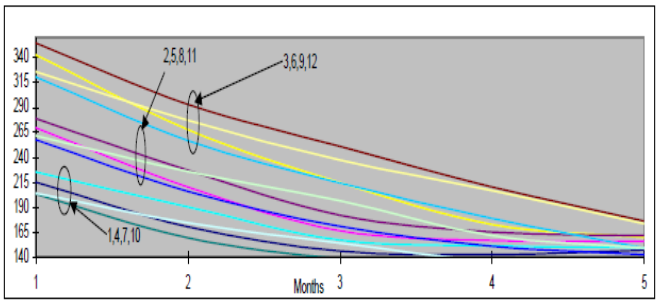
Behaviour of Account Payable in Situation 7, 8 and 9



Behaviour of Account Payable in 10, 11 and 12 situation



Summary of Behaviors of Account Payable: By combining all the twelve situations, we have presented a monthly average account payables trend . It is observed that the total scenarios of



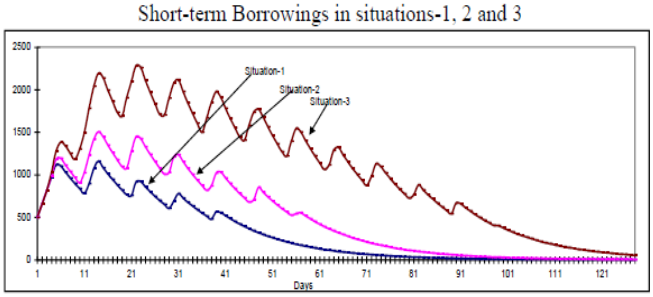
account payables are forming three major categories. The scenarios of account payables show a similar trend. Though there is an increase in demand for account payables at the beginning of the period, it gets stabilized over a period of time in all situations. It is also clear from the output that higher the inventory higher the volume of accounts payable at the initial period of the operation.

IV. BEHAVIOUR OF SHORT-TERM BORROWINGS IN DIFFERENT OPERATING SITUATIONS

This section of the study presents the behaviour of the short-term borrowing scenario of the organization in different operating conditions in terms of production volume, raw material consumption levels at different levels of raw

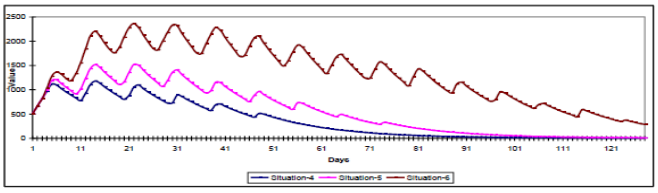
material inventory policy. Based on the outcome of the simulation model, the organization can visualize the quantum of short term borrowings required at different operational situations and can adopt the best policy suitable for the organization. Scenarios of different short-term borrowings situations are presented below

Short-term Borrowings in situations-1, 2 and 3

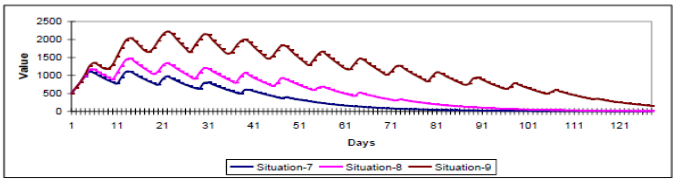


It is clear from the output of the model that with increase in the number of days inventory in a normal production and consumption level (in normal operating condition), there is an increase in demand for short-term borrowings in the initial period. In all situations we find a cycle of peak and buck is completed within 10 days of operation. In case of situation 1 and 2; the demand for short-term borrowings is in increasing trend till 15th day of operation where as incase of situation 3, it continue till 30th day. Demand for short-term borrowings in situation 3 (30-days inventory) is more than double the amount of situation 1(7-days inventory) during the initial period of forty-five days and reduces steadily thereafter. In case of situation 1 and 2, the demand for short-term borrowings become 'zero' at the end of 90- days of operation while in case of situation 3, it takes about 150 days to reach at same level.

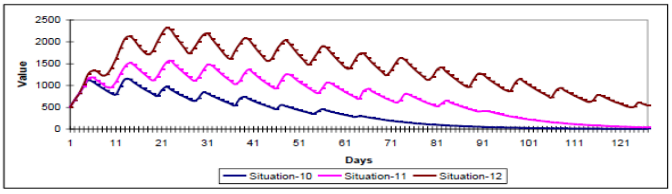
Short-term borrowings in situations-4, 5and 6



Short- term Borrowings in situations-7, 8and 9



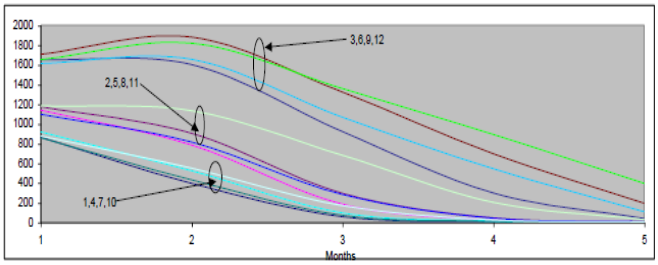
Short-term Borrowings in situations-10, 11 and 12



V. SUMMARY OF OBSERVATIONS OF SHORT-TERM BORROWINGS IN SITUATIONS

by combining all the twelve situations together, a trend of short-term borrowings on monthly average basis is presented in table 5.2. it is observed from the same that the total scenario of short-term borrowings comprises of three major categories.

Three Major Category of Short-term Borrowings



The scenario of short-term borrowings shows a similar trend in all the above situations. Though there is an increase in demand for the same at the beginning of the period, it gets stabilized and approaches to 'zero' over a period of time in all situations. It is also clear from the output that higher the inventory, higher the demand for short term borrowing and vice-versa at the initial period of the operation.

VI. OTHER APPLICATIONS OF THE MODEL

1. In addition to generating scenarios of the above parameters for a better decision-making, the model facilitates in generating scenarios of many policy decisions like:
2. Impact of sale on credit instead of advance
3. Impact of change in raw material credit terms
4. Impact of limitation in truck availability for dispatch of finished goods.
5. Plant profitability at different sales realization and change in chromium percentages

The model acts as a ready reference to simulate the business scenarios. It will be useful as a decision support tool and the manager can experiment with varied parameter values and policy alternatives to gain the knowledge of the behavior of the system under different situations.

REFERENCES:

[1]. Forreser J. (1976), Policies, Decisions and information Sources for Modeling, Modeling for learning organizations (edited by Morecroft J., Sterman J.) Portland Productivity Press.
[2]. Kolay, M.K. (1991) "Managing Working Capital Crisis: A System Dynamics Approach" Management Decision 29, 46-52.
[3]. Lyneis, J.M.(1980). Corporate Planning and Policy Designing: A System Dynamics Approach. Pugh-Roberts, Cambridge