WORKING CAPITAL MANAGEMENT

Samithambe Senthilnathan
PhD (Business/Finance), MSc (Mgmt.), CMA (Aus.)
Academic Consultant, ITI, Papua New Guinea

Abstract: *This paper provides contextual explanations on the related aspects of Working Capital (WC) management. The objective of the paper is to illustrate related variables and cash management models in the WC management, especially from an accounting learning point of view. Initially, WC has been defined; and subsequently, WC policy and determination, some useful related ratios, liquidity management in relation to operating cycle and cash conversion cycle of a business, and optimal cash balance and cash management models are explained. All these contextual explanations are supported with some specific examples as exhibits at the end of this paper, especially with the determination of the WC requirement on a cash-cost basis as an operational approach. Further, the use of simple economic order quantity (EOQ) model for determining the required outflow of cash to buy initial production material in a continuous production process has also been explained.*

Keywords: working capital, policy, optimal cash balance, Baumol's model, Miller-Orr's model, cash-cost basis

JEL code: M00, M40, M41, M42, M49

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1. INTRODUCTION

WC is the current or short-term net assets of a firm resulting from short term assets (such as cash, bank balance, receivables, closing, marketable securities, etc.) minus short term liabilities (such as creditors, payables, bank overdraft, etc.). WC can also be referred as circulating capital for day-to-day operations of a firm and thus, executives of the firm should pay considerable attention to manage the WC.

WC is, by definition, a part of the firm's capital that is required for managing the financing requirements on both expenses (like payables and payments to creditors) and short-term (current) assets such as cash, marketable securities, debtors and inventories. Indicatively, the investment in current assets revolve fast and sooner liquefiable into cash and can again possibly be used or invested in other purpose/current assets. In other term, WC is the short-term capital reservation for immediate use. WC is therefore known as Revolving (or Circulating) Capital or Short-term Capital.

In application, firms attempt to manage two requirements: liquidity (WC) and profitability of the business. The efficiency of WC management depends on how a firm manages its WC requirements (without deficiency) while increasing the firm's profitability, since liquidity and profitability have negative relationship, i.e., higher the liquidity, lower the profitability and higher the profitability, lower the liquidity. Many studies have addressed this problem to fine a tradeoff between the liquidity and profitability (e.g., Garcia-Teruel and Martinez-Solano, 2007; Chakraborty, 2008; Singh and Pandey, 2008).

As Chakraborty and Bandopadhyay (2007) indicate that WC management is important for survival of a firm in the industry, this paper attempts to provide explanations on management of WC as a contextual note. In this context, the rest of this paper is organized with exhibits as: WC policy and relative measures, liquidity management, optimal cash balance and management models, and concluding remarks, together with some related exhibits at the end of this paper.

2. WORKING CAPITAL POLICY AND RELATIVE MEASURES

WC management implies implementation of WC policies with the control of day-to-day cash requirements, inventories, receivables, accrued expenses, and account receivables. To have efficient WC policies, it is important to know about determination of the level of WC and how the WC can be financed. For calculation of WC, amounts of current assets and current liabilities are in consideration. Therefore,

Gross WC = Total Current Assets (TCA)

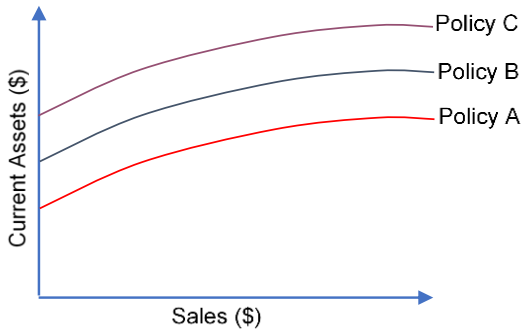
Net WC = TCA – Total Current Liability (TCL)

Net Operating WC = Operating CA – Operating CL

= (Cash + Inventory + Account Receivables) – (Short Term Liabilities)

There are basically three (3) different policy approaches in WC management with respect to sales: Aggressive, Moderate/Matching, and Conservative Approaches (see Figure 1).

Figure 1: Basic Working Capital management Policies



Policy C: Conservative (Liberal) Approach

Policy B: Moderate Approach

Policy A: Aggressive Approach

Policy A – Aggressive Approach

In this policy, a firm will maintain its WC at a minimum level even below the WC requirement. This can be a result of possible non-collection form debtors and delayed payment to creditors. On the other hand, available funds might have been invested in long-term assets. This sometimes make the firm to suffer from deficit of WC and the WC requirement can be met by selling out long-term/fixed assets. This is on hand a high risk to the firm to lose its profitable assets for the urgent requirement of WC.

Though this policy can lead to an advantage of less current assets and WC requirement, this policy make the firm to earn more return on investment (ROI) as the result of facing high risk. As this policy endorses high risk to high return, it is called as aggressive WC policy.

Policy B – Moderate/Matching Approach

Most firms apply this approach, since WC is managed as per the requirements. As per the revenue of the firm, the excess current assets will be converted into profitable assets and those assets can be liquidated, if there is a WC requirement. This approach has moderate risk to the business. In this approach, credit limits to the customers and creditors are pre-set in order to manage the WC requirement. The firms will act in meeting the deadlines to receive payments from debtors and to pay to creditors. In this policy, a firm must maintain its current assets to match with the current liabilities with low amount of cash in hand. This approach enables the firm to act defensively to face the WC requirement as necessary.

Policy C – Conservative Approach

This approach refers to lowest risk of managing the WC. This policy cannot ensure optimum use of funds in assets. This policy facilitates a firm to perform targeted revenue after analysing possible uncertain events, especially the fluctuations in sales. This policy helps a firm to have a smooth functioning of the operating cycle. As this policy facilitate the firm to operate at a reasonable earning with higher investment in current assets (this can cause higher interest cost and reducing the profitability), the firm may enjoy lower return on investment; and therefore, this can be a major disadvantage of this policy.

It is notable that there are three types of finances in a firm, namely: Short-term fluctuating finance (say X, represented by fluctuating current assets), Short-term continuously evolving finance (say Y, represented by permanent current assets), and Long term finance (equity and debt – say Z, represented by fixed assets). Also, based on the approaches, the financial managers can also be categorised: Moderate Practitioner (for Policy B), Aggressive Practitioner (for Policy A) and Conservative Practitioner for Policy (C). In this context, the moderate practitioner manages the WC by mostly using the fluctuating finance (X); the aggressive practitioner manages the WC by mostly utilising both the fluctuating finance and short-term continuously evolving finance (X + Y); and the conservative practitioner manages WC with all three types of finances (X + Y + Z).

Considering the above (3) policies, the decision on an approach of WC management depends on various factors, which includes: Nature of business, Size of a company, Storage time or processing period, Company financing and other policies (especially, policy on credit period), Seasonal requirement of inventories, Potential growth perspective of a business and level of competition in the

industry, Dividend policy, Limitations and access to money market, Working capital cycle (length of WC), Operating efficiency, Government policies and legislation, Terms of trade, Overall economic condition, Risk attitude of managers, and Customer database of the company.[1]

Though the above factors determine which WC approach a firm needs to follow, some of the factors become duplicative in determining the WC requirement of a business. There are various factors to be considered as the determinants of WC requirements, including the factors determining the approach/ strategy for WC management.[2]

The WC policy of a firm will be reflected in its current ratio, quick ratio, cash turnover, inventory turnover, debt collection period, credit payment period, etc. These are known as the measures in WC management. Some of the important measures are given below with brief explanations.

- **Current Ratio**: It is a measure of liquidity ratio to reflect a firm's short-term ability of current assets to meet its current liabilities (including payables) in its financial period balance sheet. Current ratio is measured as a portion of current assets amount to current liability amount as a unit. Generally, current ratio is expected to be 2:1 and the current ratio with less than 1 is an indicator that the firm has no sufficient current assets to meet its short-term current debt/obligations.

  Current Ratio = $\boldsymbol{Current\ Assets : Current\ Liablities}$

- **Quick/Acid Ratio**: It is another liquidity ratio to reflect a firm's short-term ability of quick liquefiable assets (cash in hand, marketable shares, bonds and securities, receivables, etc., except closing stock and prepaid expenses) to meet its current liabilities (including payables) in its financial period balance sheet. Quick ratio is measured as a portion of quick liquefiable current assets amount to current liability amount as a unit and this ratio is expected to be 1:1 in a firm.

  Quick Ratio = $\boldsymbol{Current\ Assets\ without\ Stock\ and\ prepaid\ expenses : Current\ Liablities}$

[1] Refer to https://accountlearning.blogspot.com/2011/07/factors-affecting-working-capital-or.html for certain factors listed in.

[2] ***Nature of business*** (for manufacturing business, more WC is required; for trading business, little WC is enough; for service business, almost, WC is nil - no investment in stock), ***Scale of operations*** (large scale, more WC; and small scale, less WC), ***Business Cycle*** (business boom period, more WC; business depression period, less WC), ***Seasonal factors*** (to meet seasonal demand, more WC is required), ***Production cycle*** (longer period of production needs more WC), ***Credit allowed to customers*** (lower the credit limit $/time, lower WC needed), ***Credit purchase limit*** (longer the credit $/time, less WC needed), ***Operating Efficiency*** (Completing various business operations in time with low cost), ***Converting raw material into finished products***, ***Sale of finished products***, ***Receiving payments from customers*** (less time period, low WC is needed), ***Availability of raw material*** (quick availability, low WC is needed), ***Growth prospectus/Access to other markets*** (high growth prospects need high WC), ***Level of competition*** (high competition needs more WC), ***Inflation*** (high inflation needs high WC), ***Change in technology***, ***Firm's dividend policy***, ***Attitude towards risk***, etc. (source: Lamberson, 1995; Deloof, 2003; Juan García-Teruel and Martínez-Solano, 2005; Chiou and Cheng, 2006).

- **Cash Turnover Ratio**: This is a ratio to reflect how many times a firm has restored its average cash requirements from the sales revenue. Indicatively, the sales revenue includes credit sales too; and thus, the customers may delay the payments to the firm. Cash Turnover Ratio (***CTR***) therefore becomes important, as it reflects how many times the sales revenue facilitates to meet the requirements of average cash in hand throughout the fiscal period. Higher the CTR represents higher the possibilities of cash replenishment in the fiscal year.

  Cash Turnover Ratio (CTR) $= \frac{\boldsymbol{Sales\ Revenue}}{\boldsymbol{Average\ Cash\ and\ Cash\ Equivalentent}}$
  (where averages are calculated from their respective opening and closing balances)

- **Inventory Turnover Ratio**: This refers to the number of times of stocks sold and replaced in a fiscal year with respect to average stock of the year. The inventory turnover ratio (ITR) shows how a business effectively manages its inventory by comparing its cost of goods sold with respect to the average inventory for a period (see Exhibit 1 for illustrations).[3] Indicatively, total turnover depends on three main measures of business performance:

  (a) Purchasing of stock – if larger the value of inventory is purchased during the fiscal period, the company would have sold greater value, thus improving its turnover. In case, the business fails to sell this greater value of inventory, the business may face increased cost for the period, especially with storage costs and stock-holding costs.

  (b) Sales of stock – if the business fails to match its sales to inventory purchased, the moments of stocks would be held in warehouse and this will increase the storage cost for the waiting stock in it.

  (c) Average stock – While comparing the stock purchased and sold, it is important to maintain and ensure a reasonable stock in hand to reflect the increased turn over. This will help to have better warehouse management in place in relation to the moments of stock sold.

  Inventory Turnover (ITO) $\frac{\boldsymbol{Cost\ of\ Goods\ Sold}}{\boldsymbol{Average\ Stock\ of\ the\ year}}$
  (where average stock of the year = average of opening and closing stocks)

  In this context, following durations are important in managing the WC in relation to the management of inventory turnover and liquidity management.

  (i) Average Inventory Period (AIP) $= \boldsymbol{365 / ITO}$ (where 365 = number of days in a year)

  (ii) Average Collection Period (ACP) for Debtors OR Average Receivable Period (ARP)
  $= Average\ (Monthly)\ Account\ Receivables\ \div Average\ (Daily)\ Credit\ Sales$
  $= \left(\frac{Total\ Account\ Receivables}{12}\right) \div \left(\frac{Total\ Credit\ Sales\ for\ the\ year}{365}\right)$
  where 12 = months and 365 = days, in a year

[3] Note: Exhibits are given at the end of this paper.

Alternatively, (a) ACP = ARP = $365 * \left(\frac{Average\ (Monthly)\ Credit\ Receivables}{Total\ Credit\ Sales\ for\ the\ period}\right)$

(b) ACP = ARP = $\left(\frac{365}{Credit\ Sales\ Turnover}\right)$

(iii) Average Payment or Payable Period (APP) for Creditors

$= Average\ (Monthly) Account\ Payables\ \div Average\ (Daily)\ Credit\ Purchase$

$= \left(\frac{Total\ Account\ Payables}{12}\right) \div \left(\frac{Total\ Credit\ Purchase\ for\ the\ year}{365}\right)$

Alternatively, (a) APP = $365 * \left(\frac{Average\ (Monthly)\ Credit\ Payables}{Total\ Credit\ Purchase\ for\ the\ year}\right)$

(b) APP = $\left(\frac{365}{Credit\ Purchase\ Turnover}\right)$

WC Management Policies of a firm have a great effect on its ***profitability***, ***liquidity*** and ***structural health***. It is important in WC management to ensure enough cash in hand to meet urgent transactions, strategic functions (Michael Porter's 5 Forces Model), precautions, etc.[4]

Liquidity and ***profitability*** are two opposing nature of a business, thus managing the WC at an optimal level is important as an optimal balanced (trade-off) approach between liquidity and profitability to maintain the ***structural health*** of a business. There is a negative relationship between liquidity and profitability of a business, i.e., higher the liquidity leads to lower the profitability; OR higher the profitability leads lower the liquidity.[5] As this paper intends to explain about managing the WC (in liquidity form), the explanation on profitability has a limitation here.

Just having the cash in hand cannot be an earning asset to have additions. Hence, rather than having cash barely in hand (known as "Safety Stock of money"), it is advisable to transform them into immediately liquefiable safety shares, securities and other assets at a minimum conversion cost to gain earnings for the business. It will also be helpful to meet short-term WC requirement, if needed. Specifically, total investment should be shared between short-term liquefiable assets and long-term profitability assets, and the emphasis on WC management urges at this point.

[4] The 5 forces model is first established by Porter (1979). The model is to analyse attractiveness and possible profitability of an industry/sector. It is one of the most popular and highly regarded business strategy tools that gives an analytical view about what other factors could impact the business environment. Porter (1979) has identified and explained five forces that set up the competitive environment to determine an organisation's business activities, cash management, strategy development, profitability, etc. These are: ***Competitive Rivalry*** (competitors of a business), ***Supplier Power*** (suppliers' controlling capability), ***Buyers' Power*** (buyers' controlling capability), ***Threat of Substitution*** (substitution to the products of the firm) and ***Threat of New Entrants*** (potential newcomers into the industry).

[5] If a firm wants to have more liquidity, its investment over the long-term profitable assets would be less, thus having less profitability; on the other hand, if it aims to have more profitability and investing in long-term profitable assets, the firm may suffer from liquidity problem, due to the investments made in long-term profitable assets. This is called as the trade-off nature between liquidity and profitability.

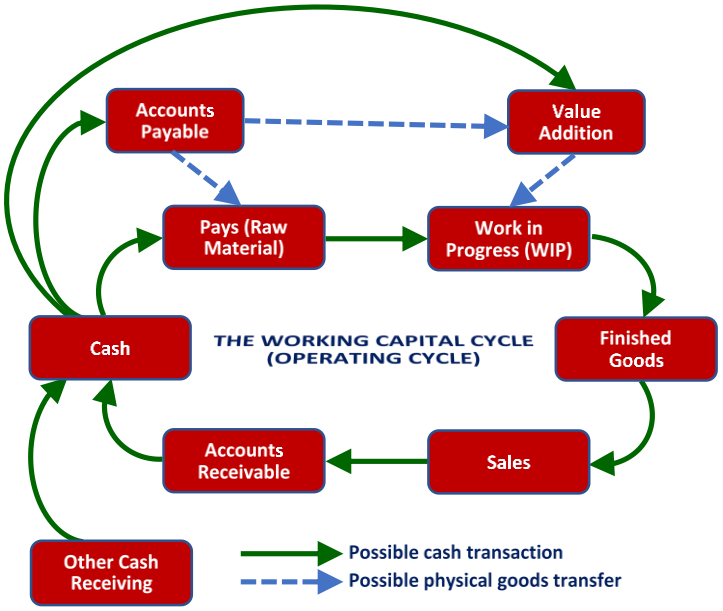
To facilitate the investment in liquefiable assets, the firm should potentially follow certain things as:

- Insisting customers to transfer money online as immediately accessible by the firm
- Synchronizing the outflow and inflow of the cash transactions through banks
- Negotiating online credits to overcome the short-term problem of liquefying the assets and this may help reducing the safety stock of cash
- Using forecasts of sales, purchase, expenses, cash inflows and outflow, ending cash balances, loan requirements, etc. and this may facilitate timely to make use of additional money on possible profitable fixed/temporary investments

3. LIQUIDITY MANAGEMENT - OPERATING CYCLE (OC) AND CASH CONVERSION CYCLE (CCC)

Liquidity management refers to a set of current strategies and processes in place to ensure the ability of a business to access the required cash in time to meet the short-term ongoing requirements. As the liquidity management is a continuous process and becomes a part of WC management, it is useful to know how cash transactions takes place. Though it is hard to incorporate all ways of showing the cash transactions, it is possible to illustrate with a model how those cash transactions can take place (see Figure 2).

Figure 2: A model of possible cash transaction in liquidity management



Cash in hand can be used to buy direct and indirect (value addition) raw material, and to pay accounts payable (as an outflow). Further, wage and overhead expense payments can incur to have work in progress, have final products and have placed the final product for sales operations to reach the customers (again cash outflow as related expenses to incur). Customers can make payment, once they are satisfied with the sales process; and the business receives cash from customers and other related sources (cash inflows take place).

Liquidity management initially involves how receipt of cash (inflows) can be utilised to meet the expense cycle (cash outflows). In this context, a business must first determine its operating cycle (***OC***), which refers to a total period from ***purchase of raw materials on credit*** to ***make the payment to creditors***, in consideration of average inventory period (AIP), and accounts receivable period (ARP).[6] Secondly, the cash conversion cycle (***CCC***) should be determined by subtracting average payment period (APP) from operating cycle. In brief, three basic periods are important in order to determine: (a) Operating Cycle (OC) and (b) Cash Conversion Cycle (CCC). They are (as given in above explanation):

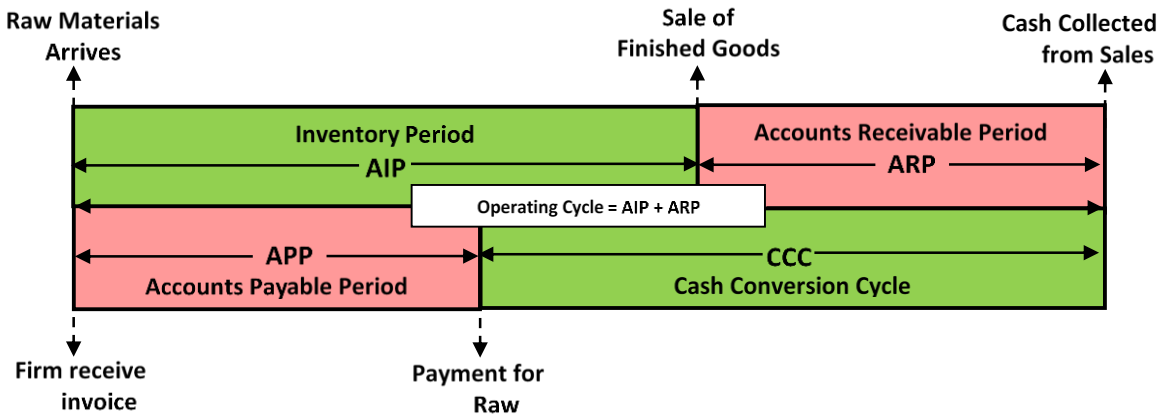
- Average Inventory Period (AIP) = $\left(\frac{Days\ in\ a\ year\ (365)}{Inventory\ Turnover\ (ITO)}\right) = \frac{365}{ITO}$
- Average Receivable (Collection) Period (ARP or ACP) = $\left(\frac{365}{Credit\ Sales\ Turnover}\right) = \frac{365}{CST}$
- Average Payment Perion (APP) = $\left(\frac{365}{Credit\ Purchase\ Turnover}\right) = \frac{365}{CPT}$

Accordingly, Operating Cycle (OC) and Cash Conversion Cycle (CCC) can be determined as:

- Operating Cycle (OC) = Average Inventory Period (AIP) + Average Receivable Period (ARP)
- Cash Conversion Cycle (CCC) = OC – Average Payment Period (APP)

The period of Operating Cycle and the determination of Cash Conversion Cycle with respect to AIP, ARP and APP are illustrated in Figure 3 below (also see Exhibit 1 for numerical illustrations).

Figure 3: Operating Cycle and Cash Conversion Cycle with respect to AIP, ARP and APP

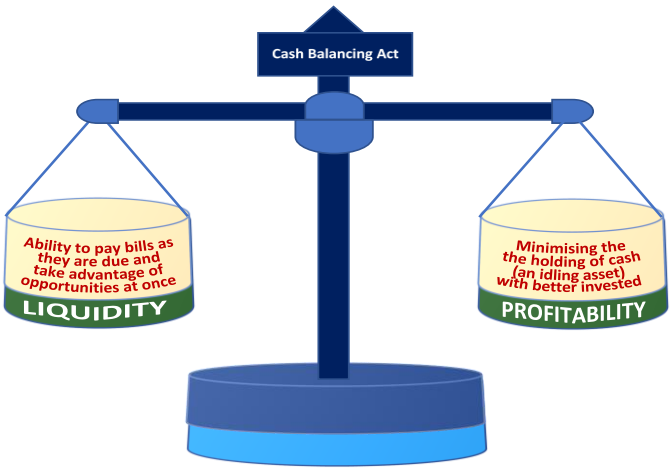


[6] Operating cycle includes paying for the raw materials needed, labour and overhead costs, holding the finished products in inventory until they are sold, and waiting for the customers' cash payments to be collected.

4. OPTIMAL CASH BALANCE AND CASH MANAGEMENT MODELS

Optimum cash balance is major part of WC management and simply refers to a balancing process between the liquidity and profitability. When a business runs with excess cash balance, it can leads to loss of interest and low earnings; and similarly, if the business maintains minimum cash balance, it can imply weaker liquidity status and make the suppliers and investors to suffer from meeting the shot-term financial requirements. Hence, maintaining optimum cash level in a business is an essential requirement as a cash balancing act in the WC management (see Figure 4).

Figure 4: Cash Balancing Act as a Tool for Optimal Cash Balance



Though there are many models for maintaining optimum cash balance, following two well-known models are considered and illustrated here.

(a) Baumol Cash Management Model (b) Miller-Orr Model

Baumol's Cash Management (economic order quantity type - deterministic) Model

This model is known as "Inventory Model" and considers determination of required cash balances like a determining model of Economic Order Quantity (EOQ). As in EOQ, the model attempts to find the trade-off between cost of borrowing (transaction cost and/or sale of securities cost) and opportunity cost of holding the cash. The model also indicates that higher the interest leads to lower the cash in the current assets. In this context, the point where the total cost becomes minimum is known as the optimal cash balance to be maintained with the safety cash level (if any).

Assumptions:

- Use of cash is steadily predictable
- Cash inflows are identically known with regular flows
- The transaction cost is known and remains stable
- The opportunity cost of holding cash is known and it remains stable over time
- Daily cash needs are funded from bank current A/C
- Safety stock (buffer) cash is made in short-term investments

Baumol calculates the cash needed (Q) for either "injecting into the current A/C" or "transferring into short-term investments" at a time (see Figure 5 for graphical illustration and Exhibit 2 for numerical determination).

$$Q = \sqrt{\frac{2DC_O}{C_H}}$$

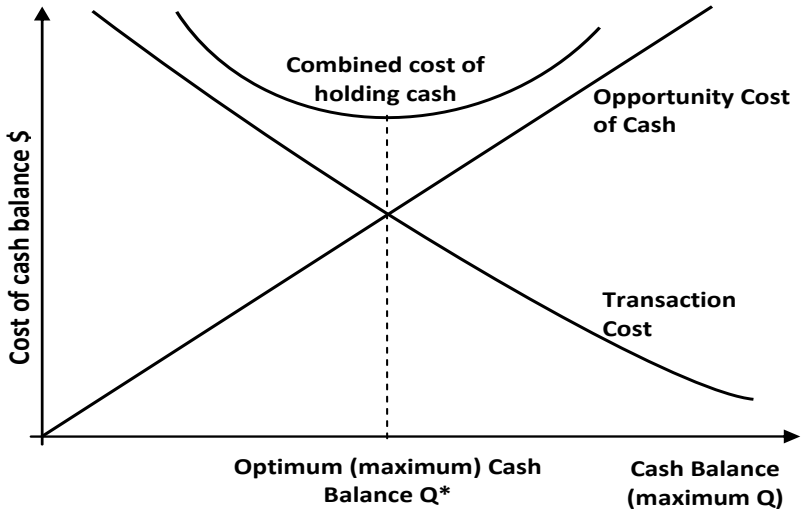
where,

D = Excess/Demand for cash for the period

C_o = Cost of Transaction (like commission and broker fee)

C_H = Cost of holding cash (opportunity cost - expected interest rate to earn from its investment)

Figure 5: Baumol's Cash Management Deterministic Model



Critics spell that the Baumol's model has a major limitation, since it is built on with unrealistic assumptions. They are:

(i) In real term, it is very difficult to predict the required amounts with certain for the future periods.

(ii) The model satisfies a firm, if it uses the cash at a steady rate. However, the model fails, when there are fluctuations in cash rates, especially with larger inflows and outflows of cash over time.

(iii) It is also not certain in predicting future interest rate with certainty.

Because of the criticism of the Baumol's cash management model, Miller's Cash Management Statistical Model has gained credits over the Baumol's cash management model.

Miller-Orr's Cash Management Model

This model determines the time and size of transfers between cash and investment accounts. The Miller-Orr model is useful for the businesses with uncertain cash inflows and outflows. This model consists of ***lower and upper limits*** of cash balance for determining the return point (targeted cash balance).

This approach is also known as statistical model that is devised with the following assumptions.

(a) The inflows and outflows of cash are subject to stochastic process, i.e., everyday cash payments and cash receipts my not be equal, can possibly be different.

(b) The daily cash balance occurs at random and forms normal distribution.

(c) Idle cash can possibly be invested in marketable short-term securities.

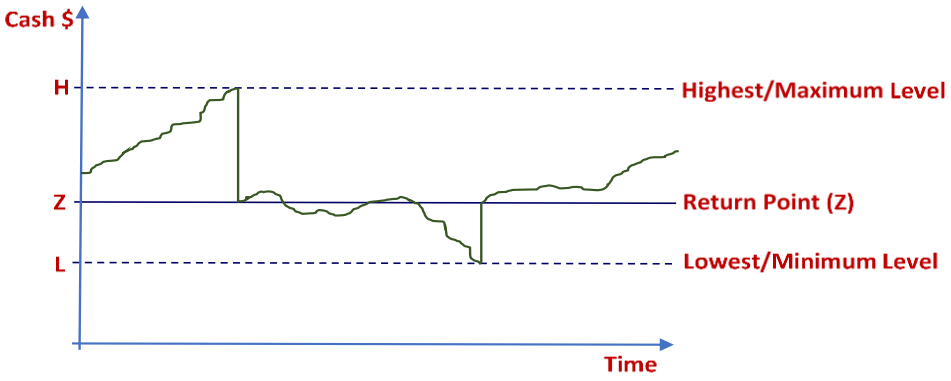
(d) Transaction cost applies while buying and selling those marketable securities.

(e) There is a safety/buffer cash level as the lower limit of cash in hand.

With the above assumptions, the following can result in as a process (see Figure 6 and Exhibit 3).

- The model establishes control limits (high/maximum level as "H", and low/minimum level as "L") and a return point (Z)
- When cash balance reaches to maximum "H", the difference (H-Z) above the return point will be invested in marketable/liquefiable securities, thus bringing the cash balance immediately to the level of return point "Z".
- When cash balance reaches to minimum "L", the difference (Z-L) below the return point will be recovered from the investment(s) made in marketable/liquefiable securities.
- The difference/range between the upper and lower limits is known as "Spread = S", where upper limit "H" will be determined based on the calculated spread "S" by using (a) unit transaction cost of securities, (b) variance/standard deviation of the daily cashflows and (c) daily interest rate.
- Spread $S = 3.\left(\frac{3.Unit\ Transaction\ Cost(UTC).Variance\ of\ daily\ CF\ (VDCF)}{4.Daily\ Interest\ Rate(DIR)}\right)^{\frac{1}{3}} = 3.\left(\frac{3.UTC\ .\ VDCF}{4.DIR}\right)^{\frac{1}{3}}$
- Upper limit H = (Lower Limit + Spread) = (L + S)
- Return Point Z = (Lower Limit + One-third of Spread) = (L + S/3)

Figure 6: Miller-Orr's Cash Management Model - Illustration



Other Few Aspects to be considered in Working Capital (and Cash) Management

Apart from the above, there are certain important aspects are necessary for a business in its WC management. In this context, credit policy variables, credit terms and inventory management are a few of the important aspects that the business pay attention for managing the WC.

Credit Policy is a set of clearly written guidelines that consists of:

(a) Customer qualification criteria and credit terms,

(b) The terms and conditions for supplying goods on credit,

(c) Procedures for making collections, and

(d) Steps to be taken in case of customer negligence of paying the money.

It is also known as the debt called collection policy and the related concepts and factors are known as credit policy variables (e.g., eligibility for discount).

Credit terms are standard and negotiated terms between a seller and a buyer to facilitate the business to control its: (1) monthly and total credit amount, (2) maximum time allowed for repayment, (3) discount for cash or early payment, (4) the amount or rate of penalty for late payment, etc.

Other aspect is inventory management, especially with EOQ models and some of its related warehousing techniques for WC management. It is important for business to devise a mechanism for timely buying and selling products and to make payments and receive from debtors, accordingly.

5. CONCLUDING REMARKS

This paper provides contextual explanations about related aspects of WC management. The objective of the paper is to provide descriptions about related variables and cash management models in the WC management, especially from an accounting learning point of view. In this context, while defining WC, WC policy and determination, some useful related ratios, liquidity management in relation to operating cycle and cash conversion cycle of a business, and optimal cash balance and cash management models are explained.

All in consideration, these contextual explanations are supported with some specific examples as shown in Exhibits 4 and 5 at the end of this paper, especially with the determination of the WC requirement on cash-cost basis as an operational approach. Additionally, use of simple economic order quantity (EOQ) model for determining initial outflow of cash to buy initial production material in a continuous production process has also been explained (see Exhibit 6).

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Exhibit 1: Operating Cycle, Cash Conversion Cycle and related measures

Using the following information extracted from the records of SENA & Co, you are required to determine the (a) Average inventory period, (b) Accounts receivable period, (c) Account payable period, (d) Operating cycle, and (e) Cash conversion cycle. It is noted that all sales and purchases are made through credit transactions.

Description	Beginning of 2014 (in $ m)	End of 2014 (in $ m)
Sales		800
Cost of goods sold		720
Inventory	96	102
Accounts Receivables	86	90
Accounts Payables	56	60

Solution:

Credit Sales Turnover (CST) = Credit Sales/Average Debtors

$$= \frac{\mathbf{800}}{\left(\frac{\mathbf{86+90}}{\mathbf{2}}\right)} = \mathbf{9.091}$$

Credit Purchase Turnover (CPT) = Credit Purchase/Average Creditors

As per the information available,

Credit Purchase = Cost of goods sold + Closing stock – Opening stock = 720 + 102 – 96 = 726

And Average creditors = (56 + 60)/2 = 58

$$\text{Therefore,} \quad \text{CPT} = \frac{\mathbf{726}}{\mathbf{58}} = \mathbf{12.517}$$

Inventory Turnover (ITO) = Cost of Goods Sold/Average Inventory

As the average inventory or stock = (96 + 102)/2 = 99

$$\text{Therefore,} \quad \text{ITO} = \frac{\mathbf{720}}{\mathbf{99}} = \mathbf{7.273}$$

Accordingly,

Accounts Receivable (Collection) Period (ARP) = 365/Credit Sales Turnover = $\left(\frac{365}{9.091}\right) = 40.15$

Accounts Payable Period (APP) = 365/Credit Purchase Turnover = $\left(\frac{365}{12.517}\right) = 29.16$

Average Inventory Period (AIP) = 365/ITO = $\left(\frac{365}{7.273}\right) = 50.19$

Operating Cycle (OC) = AIP + ARP = **50.19 + 40.15 = 90.34**

Cash Conversion Cycle = OC – APP = **90.34 – 29.16 = 61.18**

Exhibit 2: Baumol's Cash Management (inventory type - deterministic) Model

MFCL identifies $ 1,440,000 excess cash that is the sum of equally accumulated every month for the year 2015 and intends to invest it in short-term bonds that can be liquefiable quickly. It expects to earn 4% interest per annum on the investment. The transaction cost is constant at $ 50 irrespective of the number of investments made.

You are required to determine:

1. Optimum cash to invest in every transaction
2. Number of transactions to be made in the year
3. Total Transaction Cost (TTC) per annum
4. Total Holding Cost (THC) per annum

Solution:

(1).

$$Q = \sqrt{\frac{2DC_O}{C_H}}$$

where,
D = \$ 1,440,000 (Excess cash for the period)
C_o = \$ 50 (Cost of Transaction)
C_H = 4% = 0.04 (Cost of holding cash, i.e., Opportunity cost)

$$Q = \sqrt{\frac{2 \,.\, 1440000 \,.\, 50}{0.04}} = \$\,60000$$

(2). Annual number of transactions = 1440000/60000 = 24
(3). Total transaction cost for the year = \$ 50 (1440000/60000) = \$ 1200
(4). Total holding (opportunity) cost for the year = 0.04 (60000/2) = \$ 1200

Exhibit 3: Miller-Orr's Cash Management Model

MFCL predicts the minimum cash required is \$ 36,000. It pays \$ 27 for a money transfer from and to its bank account. It is observed that daily cash flows are with a standard deviation of \$ 3,000 and daily interest rate is 0.0128%.

You are required to determine:

- The Spread of the cash just above the lower limit
- The upper/maximum limit
- The return point of cash

Solution:

Information available from the above,

Lower or Minimum (buffer) level	L = \$ 36000
Unit Transaction Cost of securities	UTC = \$ 27
Variance of Daily Cashflow	VDCF = $SD^2 = 3000^2$ = \$ 9,000,000
Daily Interest Rate	DIR = 0.0128% = 0.000128

Therefore,

(1). Spread S = $3.\left(\frac{3.UTC\,.\,VDCF}{4.DIR}\right)^{\frac{1}{3}} = 3.\left(\frac{3.(27).(9{,}000{,}000)}{4.(0.000128)}\right)^{\frac{1}{3}}$ = \$ 33,750

(2). Upper limit **H = (L + S) = 36000 + 33750 = \$ 69,750**

(3). Return Point **Z = (L + S/3) = 36000 + (33750/3) = 36000 + 11250 = \$ 47,250**

Exhibit 4: Determining Working capital requirement on cash-cost basis

Max Ltd sells goods at a profit margin of 25% on sales, and accounts depreciation as a part of the cost of manufacture. Its annual figures in million $ for a particular financial period are as follow.

- Sales (2 months credit is allowed) 240
- Raw Material Cost (3 months credit is given) 72
- Wages (paid with one month arrears) 48
- Manufacturing O/H expenses outstanding at the end of the year (cash expenses are paid 1 month in arrears) 3
- Administrative and sales expenses (paid as incurred) 30

Max Ltd keeps 2 months stock of raw materials and 1-month stock of finished goods and it wants to maintain a cash balance of $ 5 million.

You are required to estimate the requirement of working capital on cash-cost basis, assuming 15% safety margin (ignore work-in-progress).

Solution – Process 1:

Primary workings	Description		Amount (m$)
	Sales		240
	(-) Gross profit margin (25%)		60
(1) Total Manufacturing Cost			180
	(-) Wages	48	
	Raw Material	72	120
(2) Manufacturing O/H Expenses	= (1) – [wages + Raw Materials]		60
(3) Manufacturing O/H to be paid by cash	Monthly 3 million for 12 months		36
(4) Depreciation	= (2) – (3) → (60 – 36)		24
(5) Cash manufacturing Cost	= (1) – (4) → (180 – 24)		156
	(+) Admin.& Sales Expenses		30
(6) Total Cash Cost	= (5) + [Admin. & Sales Exp.]		186

Note: Cash manufacturing cost can also be determined as:

Raw Material	72	= $ 156 m.
Wages	48	
Cash Manufacturing O/H	36	

Solution – Process 2:

A. Current Assets	= Debt Receivables + Stocks + Advances + Cash	Amount (m$)
(a) Debtors (2-month arear)	$\frac{\textit{Total Cash Cost}}{12}(2) = \frac{186(2)}{12}$	31.00
(b) Stock - Finished (1-month arear)	$\frac{\textit{Cash Manufacturing Cost}}{12}(1) = \frac{156(1)}{12}$	13.00
- Raw material (2-month arear)	$\frac{\textit{Material Cost}}{12}(2) = \frac{156(2)}{12}$	12.00
(c) Cash Balance		5.00
	Total Current Assets	61.00
B. Current Liabilities	**= Credit Payables + Other outstanding**	
(a) Creditors (3-month arear)	$\frac{\textit{Material Cost}}{12}(3) = \frac{72(3)}{12}$	18.00
(b) Wages Outstanding	1-month arrear	4.00
(c) Manufac. O/H Outstand.	1-month arrear	3.00
	Total Current Liabilities	25.00
C. Working Capital Required	**= A – B + Safety Margin**	
	A. Current Assets	61.00
	(-) B. Current Liabilities	25.00
	Working Capital required (no Safety Margin)	36.00
	(+) Safety Margin	3.60
	Working Capital Required	39.60

Exhibit 5: Determining Working capital requirement on cash-cost basis

XYZ Company has following annual figures in million $ for a particular financial period.

- Sales (2 months credit is allowed) 3600
- Raw Material Cost (2 months credit is given) 900
- Wages paid (1 month arrear) 720
- Manufacturing O/H expenses outstanding at the end of the year (cash expenses are paid 1 month in arrear) 80
- Total Administrative and sales expenses (paid as above O/H) 240
- Sales Promotion expense, paid quarterly in advance 120

Company sells products at a gross profit of 25% on sales, and accounts depreciation as a part of the cost of production.

Company keeps 1-month stocks each of raw materials and finished goods and it wants to maintain a cash balance of $ 100 million.

You are required to estimate the requirement of working capital on cash-cost basis, assuming 20% safety margin (ignore work-in-progress).

Solution – Process 1:

Primary workings	Description		Amount (m$)
	Sales		3600
	(-) Gross profit margin (25%)		900
(1) Total Manufacturing Cost			2700
	(-) Raw Material	900	
	Wages	720	1620
(2) Manufacturing O/H Expenses	= (1) – [wages + Raw Materials]		1080
(3) Manufacturing O/H to be paid by cash	Monthly $80 m. for 12 months		960
(4) Depreciation	= (2) – (3) → (1080 – 960)		120
(5) Cash manufacturing Cost	= (1) – (4) → (2700 – 120)		2580
	(+) Admin.& Sales Expenses		240
	Sales Promotion		120
(6) Total Cash Cost	= (5) + [Admin. & Sales Exp.]		2940

Note: Cash manufacturing cost can also be determined as:

Raw Material (900) + Wages (720) + Cash Manufac. O/H (960) = $ 2580 m.

Solution – Process 2:

A. Current Assets	= Debt Receivables + Stocks + Advances + Cash	Amount (m$)
(a) Debtors (2-month arear)	$\frac{Total\ Cash\ Cost}{12}(2) = \frac{2940(2)}{12}$	490
(b) Stock - Finished (1-month arear)	$\frac{Cash\ Manufacturing\ Cost}{12}(1) = \frac{2580(1)}{12}$	215
- Raw material (1-month arear)	$\frac{Material\ Cost}{12}(1) = \frac{900(1)}{12}$	75
(c) Sales Promotion Advance	(1 quarter)	30
(d) Cash Balance		100
	Total Current Assets	910

B. Current Liabilities	= Credit Payables + Other outstanding	
(a) Creditors (2-month arear)	$\frac{Material\ Cost}{12}(2) = \frac{900(2)}{12}$	150
(b) Wages Outstanding	1-month arrear	60
(c) Manufac. O/H Outstand.	1-month arrear	80
(d) Admin. Exp. Outstand.	1-month arrear	20
	Total Current Liabilities	310

C. Working Capital Required	= A – B + Safety Margin	
	A. Current Assets	910
	(-) B. Current Liabilities	310
	Working Capital required (no Safety Margin)	600
	(+) Safety Margin (20%)	120
	Working Capital Required	720

Exhibit 6: Economic Order Quantity (EOQ) and related measures

Simple EOG model has trade-off between Total Ordering Cost (TOC) and Total Handling Cost (THC) with respect to the minimising the total cost of them (see Figure 7). This model can be in practice with following certain assumptions.

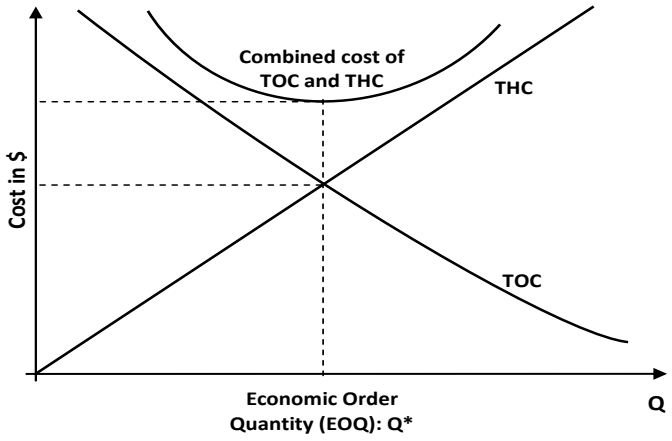
a) The EOQ will be determined for every product individually in a business.
b) Annual requirement (Demand) for product in units is known with certainty.
c) Ordering cost is known and constant throughout the year.
d) Inventory handling cost is known and constant throughout the year. Notably, if the handling cost of an item is given as the percentage of price of the item, the unit price of the item remains same throughout the year.
e) No cash or quantity discount is allowed.
f) The ordered quantity of the product is delivered at once as a single batch.
g) Immediate replenishment of ordered quantity on time (No delay and stock shortage).
h) Constant lead time is only allowed (no fluctuation is permitted).

Accordingly, the EOQ model can be given as:

$$\boldsymbol{EOQ} = \sqrt{\frac{2DC_O}{C_H}}$$

where,
D = Annual Demand of the product for the fiscal period
C_o = Cost per order placement of the product
C_H = Handling cost per unit of the product

Figure 7: Simple Economic Order Quantity (***EOQ***) Model



The following example of EOQ and its relative measure of optimum number of orders, length of inventory cycle, annual working days and reorder point for the product.

Example: Say Annual Demand (D) = 20000 tons for product X
Cost per order (C_o) = \$50
Handling cost per unit (C_H) = \$ 2

Determine the EOQ of the product X.

$$\boldsymbol{Q^* = EOQ} = \sqrt{\frac{2DC_o}{C_H}} = \sqrt{\frac{2.(20000).(50)}{2}} = \mathbf{1000}$$

The following are noticeable:

- **Optimum number of orders N*** = (D/Q*) = (20000/1000) = **20 orders per year**.
- **Length of inventory cycle (T)** for working days, if daily use (***d***) is of 100 units of tons:

  T* = (Q*/d) = (1000/100) = **10 days**.
- **Number of annual working days** = (N*).(T*) = 20 (10) = **200 days.**

As ordering quantity of a product is relatively important in managing the WC in relation to the payments of creditors, on-time order placements are important to set up the WC requirement in managing the creditors.[7]

To place an order for the product, its ***Reorder Point*** (Q_R)should be determined based on the daily usage (***d***) and lead time (say 'T_L') of the material/product, where $Q_R = d.\ T_L$).[8]

If product X is used 10 tons daily from warehouse (i.e., ***d*** = 100) and its lead time to meet the order placed is 7 days (i.e., T_L = 7 and this implies that it is needed to have daily stock in hand to meet the daily requirement of the product for these seven days).

Accordingly,

Reorder Point $Q_R = d.\ T_L$ = (**100**).(**7**) = **700 units**.

Note that where **Lead Time** (T_L = **7**) **< Inventory Cycle Time** (T^* = **10** days)

This implies that when $T_L \leq T^*$, only one (1) order can be placed before commencement of production/business; and the WC requirements must also be needed to place 1 order in advance.

In case, **Lead Time > Inventory Cycle Time** (i.e., $T_L < T^*$),

Then $Q_R = d.\ (TL - nT^*)$,
where ***n*** = how many inventory cycle-times (as a whole) exist in the T_L.

For example, now consider $T_L = 24$.

As $T^* = 10$ days, $d = 100$ units, and $n = 2$ (where $\frac{T_L}{T^*} = \frac{24}{10} = 2.4$)

$Q_R = d.\ (T_L - nT^*) = 100\ .[24 - 2(10)] = 400$.

This implies that 3 orders (= 1+n = 1+2, because $\frac{T_L}{T^*} = \frac{24}{10} = 2.4 > 2$) need to be placed before commencement of production/business for continuous operations; and the working capital requirements must also be needed to place 3 orders in advance.

[7] Note: The product considered here is a raw material in a production process and relatively creditors are considered for managing WC. If the product is a sellable product, relatively debtors must be considered for managing WC.

[8] Lead time is the amount of time permitted between the date of order placed and the date of receiving the product to meet the order placed.