Sales Company Working Capital Adjustment on bases of Fuzzy Logic Model

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***Abstract*—fuzzy logic model for management of working capital has been designed. The model is based on minimizing of working capital immobilization as well as its derivatives with the use of the arithmetic of interval numbers. The model could be used by distributor companies using different types of distribution strategy.**

***Index Terms*—working capital immobilization, sales channel, fuzzy logics, Big Data Analytics**

I. Introduction

High competitive sales markets force companies to search for more effective solutions to raise efficiency of sales and distribution activities. Working capital quantity and quality is a major parameter for business of Distributor Company. Providing Company with an analytic tool for adjustment of Working Capital movement and immobilization we give it a competitive priority and opportunity to succeed. Big Data Analytics (BDA) [1] could help us to analyze unstructured and semi-structured data as well to get some new advantage and make analytic tool more flexible and effective [2].

II. Business environment

Modern ERP systems give great advantages for vendors to reduce cost of manufacture and success in completion. As for business processes related with sales there is no universal tool to support sales managers in its everyday activity. The reason is that sales processes are sensitive to human factor, regional mentality, company work flow, working capital structure and many random factors, related with business activity in the region. So evidently there is a need in flexible tool making deal with sales and purchase company activity.

Most sales processes has distribution component which is tightly connected with working capital structure, investments and turnover ratio. A distributor should have tight relations with wholesales company and manage sales channels to meet customer needs (Fig. 1).

Analyzing Russian market, there are three types of distribution companies could be classified.

The first type companies focus on growth of standard pitch or consignment. To succeed they should cover as much as possible retail outlets in the region. It could be named as quantitative approach (Table I).

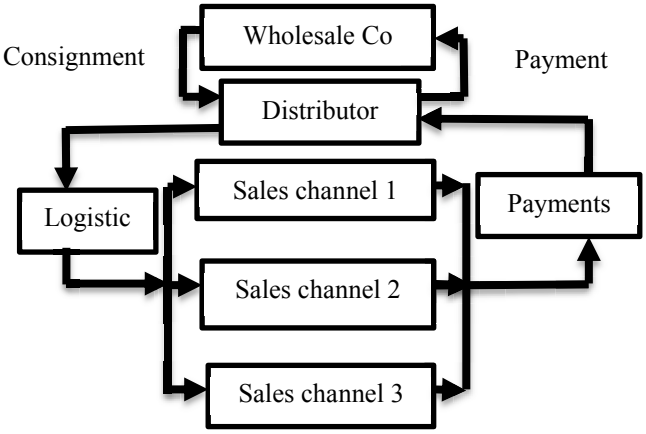

Fig.1 Distributor main business processes

Other distributors focus on the end customer needs and try to expand the range of goods to correspond customer expectations. They should monitor availability of the entire assortment in each outlet to satisfy customer. It is qualitative or 'full shelf' approach.

TABLE I. Distribution strategy

Distributer Type	Strategy	Focus
1	Quantitative	Wholesale Co
2	Qualitative	Customer
3	Integrated	Whole Sale Co and Customer

The third type companies try to find balance between the quantitative and qualitative strategy. They try to find the optimal pith to please wholesale company and get good price.

Same time they try to meet end customer needs and force the customer to buy several items and come back again and again. Such approach could be named as integrated.

It is not possible to clarify the best approach due to distribution company profit depends on marketing strategy, competition level, company effectiveness and efficiency.

On the other hand random factor impact could force the company to change strategy and use other approach in any time, which encourage interest from distribution companies for market investigation and predictive analytics research in business and customer environment.

Such investigations potentially should cover lots of freedom degrees, use sales statistics, several years' depth archives, and be quick enough to correspond with every day sales manager activity. To increase precision of prediction it would be logical to implement Big Data methods in the research and encourage distribution companies to provide data from social networking, customer feedback and insider information [3].

III. Accounting standards

Today accounting software could give us static operational indicators related with report periods (month, quarter or year).

Number of turnovers of working capital is estimated as quotient of division sales income floating assets by floating assets average and by turnover period:

$$v = \frac{S}{s \cdot T}, \qquad \text{where} \tag{1}$$

v – working capital turnovers,
S – sales income floating assets,
s – average floating assets amount,
T – turnover period estimated in days.

Inverse value gives us turnover duration, estimated in days:

$$d = \frac{1}{v} = \frac{s \cdot T}{S} \tag{2}$$

These indicators give us just integrated picture and could not be used for detailed analyses of working capital turnover. They could not estimate impact for working capital turnover taken by different types and pitches of goods, sales channels, turnover cycling features, etc.

Same time relationship S/T could be interpreted as working capital turnover velocity $g(t)$, that is a new term in accounting:

$$g(t) = \frac{dS}{dt} \approx \frac{\Delta S}{\Delta t} \tag{3}$$

IV. Suggested approach

Going further we could decompose formulas indicators [4].

Assuming that we have k pitches and l sales channels

We could estimate working capital turnover for one pitch as

$$d_j = \frac{\sum_{j=1}^{k} s(t_j) \cdot t_j}{\sum_{i=1}^{l} s(t_i)}. \tag{4}$$

Working capital velocity for the pitch differ in time and could be estimated as

$$g(t_j) = \frac{s(t_j)}{t_j}. \tag{5}$$

Now we could monitor working capital flow in time and clarify key factors affected on its immobilization. Due to variety of influencing factors, including customer behavior, seasons and competitors' activity semi-structured and non-structured data analysis should in involved. The thorough investigation of the issue is in the process and detiled result will be presented later on. We use R environment and Hadoop infrastructure to simulate the issue. Preliminary questionnaire of SME in Yekaterinburg city, Russia show potential interest for the investigation results and readiness to present initial data for the analysis.

V. Summary

So as to provide the planning and control of the working capital circulation the whole set of occurring business processes in distribution channel is considered as a kind of dynamic system where the working capital circulation is presented as a flow of working capital carriers (WCC) and a sequence of events of working capital transformation from one form of carrier into another simultaneously existing in different forms (material and monetary). The proposed fuzzy model for distribution channel velocity control allows on-going monitoring of the stock, accounts receivable and financial resources available at this using terms and concepts customary for economists and financiers what is achieved through the wise choice of economic-mathematical term framework for description of the phenomenon or process under review. In our model as an integral indicator of business process management efficiency we take the function of working capital immobilization which is defined as a multiplication of the sum of immobilized capital by the time of its immobilization.

The function of immobilization is formalized and is a complex non-linear function of a number of indicators of the processes' dynamics (the time of item supply, item sales rate at the retail outlets), wholesale and retail prices, the sum of cash flow and others, and its value depends on the volumes of the purchased items.

Mathematically, the fulfillment of the task of balanced management of working capital is limited to the task of minimizing the function of working capital immobilization as well as its derivatives with the use of the arithmetic of interval numbers.

VI. Case study

Investigate storage battery sales company from Yekaterinburg, Russia with $45.000 income. Company use to have $30.000 working capital at its disposal and runs four retail outlets.

In a wholesale market the enterprise can buy 12 different types of batteries at different wholesale prices in the range of $10 to $21. Retail prices differs from $12 to $42. itself for every battery and are the same for the each retail outlet. Profitability of sales varies across items from 1,1 to 2,3. The sales rate for every item in different retail outlets is estimated and specified in advance, and accounts to 3 – 7 items a day. It is known as well that the time of a pitch supply to every retail outlet ranges from 1 to 7 days.

It is required to distribute the available working capital for the purchase of the pitches of different items to be sold in different retail outlets in order to complete one of the following tasks in the given period of time:

- to minimize the working capital immobilization;
- to maximize the profit;
- to maximize the sales.

Having applied specially created fuzzy models to accomplish this task the optimal sizes of the pitches of different items for the sale in different retail outlets were found out.

The analysis of how optimal the solutions are was held in the following way. Two pitches out of 48 pitches of items (selected by chance) were chosen at random (at this, the optimal sizes of the pitches is known). After that, to build a graphic-analytical model without changing the sum of the working capital we varied the sizes of the pitches around the optimal value, i.e. we increased the size of one pitch and decreased the size of another, then, vice versa.

Thus, we managed to formalize the obtained model in the Cartesian coordinate system and gain a visual image representing the function of working capital immobilization as a result of plane section. Fig.2 presents the typical image of the curves of changing function of immobilization and efficiency of working capital when the size of the selected batch varies around the optimal value.

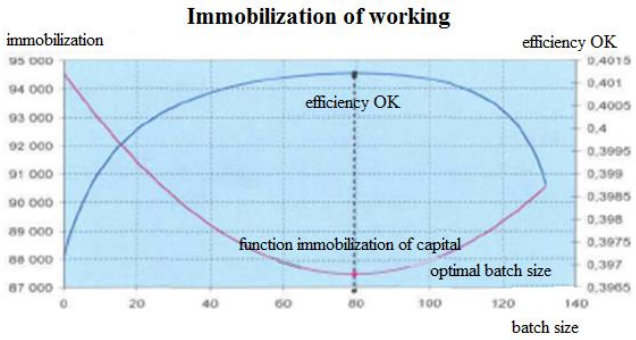

Fig.2. The curve of the function of immobilization and efficiency of working capital

Fig. 3 demonstrates similarly built curves of changing sales and profit volumes for the variant of calculation according to the criteria of getting the maximum profit.

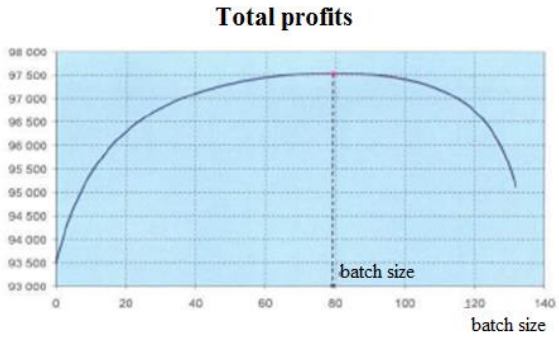

Fig. 3. The curve of changing profit when the pitch size is varied around the optimal value.

The given graphic dependences visually represent the possibility of building economic-mathematical model which would enable taking wise decisions to achieve the efficiency of working capital use in a business entity.

VII. Conclusion

Hence, suggested dynamic model of business processes has acceptable for business degree of inaccuracy and allows monitor and optimize working capital making deal with such options as:

to perform multi-option optimization of the working capital usage for purchase and realization of heterogeneous items allowing for the company specifics;

to minimize the working capital immobilization in the process of realization and circulation;

to maintain online control of the actual velocity of WCC;

to model and forecast the process of realization in various conditions and at different objects, calculating the need for working capital to be borrowed as a result of financial-economic activities for any period given.

As the next step, we could complicate the model with Big Data analytics module to use preliminary periods massive data and calculate Sales Channel velocity KPI.

Presented model is helpful for distribution companies. It could optimize sales orders, sales channels and working capital turnover. Bid Data module helps us to use non standards parameters for analytics and increase business productivity.

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