An Educational Dynamic Model For Net Working Capital Management In A Trading Wholesale Firm

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Abstract

The purpose of this paper is to sketch a dynamic model which may be useful to improve net working capital (NWC) management. This subject is commonly studied through the use of *accounting models*, which are mainly based on General Ledger data.

In this respect, accounting models are mainly used in order to:
- evaluate the financial structure of the firm, through balance sheet analysis by ratios and flows of funds;
- support the budgeting process;
- monitor *accounts receivable*, *inventories* and *current debts* using variance analysis, thereby supporting also performance evaluation;
- understand how NWC behaviour may affect profits.

Such models face NWC management parcularly from a *financial perspective* and often (explicitely or implicitely) assume that a *linear relation* exists between *accounts receivable*, *inventories*, *current debts* and the other variables from which NWC takes origin.

On the contrary, the working hypothesis from which this paper stems is that *dynamic modeling* (which is mainly based on non-accounting data) may give a strong support to *corporate growth strategic control*, as it enhances a deeper and better comprehension of the feed-back loops which more closely may concern the NWC relating to current operations.

According to this perspective, it is easier to approach NWC management under an interfunctional point of view, taking into consideration not only financial, but also marketing, logistics, procurement and (in industrial firms) manufacturing policies, from which the value of inventories, accounts receivable and current debts derive.

Such approach takes also into consideration the way how "internal" variables (i.e.: *sales prices*, *extensions*, *customer service levels*) may affect (and may be affected by) "external-market" variables, relating to *customer preferences* and *competitors policies*.

Moreover, dynamic models assume that a *non-linear* relation may exist between the variables that give rise to NWC.

This implies that the "modeller" must elicit from the entrepreneur and/or managers - particularly through the exploitation of their experience and intuition - not only the *structure* of the system to be handled and the different *levers* on which it is possible to act in order to affect NWC, but also the *way how they perceive each variable may differently affect others* according to various working hypotheses.

Consequently, such approach makes *mental models* more explicit and may lead to a common shared view of the system to be managed. It follows that through organizational learning it is possible to enhance a better understanding of the trade-offs on which NWC management lays.

In this paper, the above said working hypotheses will be tested through the development of a *Powersim* educational dynamic software model for NWC management in a trading wholesale firm.

1. Net Working Capital Management and Strategic Growth Control in Small and Big Companies.

Environmental complexity and discontinuity often assume a different shape in big companies in comparison with smaller ones, i.e. in those contexts where there is, or not, a *technostructure* and where strategic/tactical decisions are taken by management or by an entrepreneur/equity-owner on the basis of his/her own experience and intuition, without any management accounting information support.

In a *big company* complexity and discontinuity are, usually, in fact, a product of the firm dynamic interaction with a *large number* of variables relating to a wide range of stakeholders (e.g.: Governments, foreing investors, research institutions, environmentalists, media, consumer advocates, customers, competitors, suppliers, ...) (Coda 1988, 11-21; Freeman 1984) that particularly impact on *medium-long term* business decisions and performance, given a "well-defined" set of variables in the short term.

On the contrary, *small companies* usually face more *simple* environments, owing to niche strategies they often pursue and/or the bounded range of their business activities; however, they generally suffer environmental shitfs much more than big companies, because of their *limited relative weight* on the market and *lack of internal and external information* (Brusa 1986, Marchini, 1986).

The *higher unpredictability* that commonly depicts small business on-going management implies that a more blurred distinction exists between *short* and *long term* and so between operating and strategic decisions, than in big companies. This means that in such contexts strategic control *time horizon* cannot be realistically extended over a long period and that it almost overlaps management control.

According to this view, in small firms strategic management (and control) is a matter of current decisions that are to be taken only after that one has tried to figure out the most possible effects not only in the short term, but also on a longer perspective.

Net Working Capital (NWC) management is a typical problem which overlaps short and long term, current and strategic decisions, that consequently may generate a significant strategic impact particularly in small companies.

Managing NWC relating to current operations is an important problem concerning *strategic corporate growth control*. In fact, pursuing a too high growth rate may give rise to NWC increases (particularly in inventories and in accounts receivable) that could be higher than operating gross margin. This means that supporting a product/SBA growth could lead to negative cash flows and to *liquitity crises* that - on a *medium term* perspective - could also give rise to higher financial costs and to lower profits, even though economic results are positive in the *short term* (Coda, 1984).

Very often, particularly in small companies, entrepreneurs are prone to support rapid current sales and market share increases without making any prior shrewd assessment of the growth policies consequences on cash flows.

Such behaviour may be caused both by the inclination of some small entrepreneurs to magnify marketing or production management problems, to the prejudice of financial ones, and by the unavailability of management accounting information that may improve a better understanding of effects on company liquidity caused by current decisions concerning price, extensions, customer service, etc..

In such contests, the only information available to the entrepreneur is generally provided with balance sheet/income statement and transaction systems (e.g.: logistics, personnel, customers, suppliers, ...).

When the company operates in a simple and highly stable environment, such information may be sufficient to support decision makers, but the more complex and discontinuous the environment becomes, the more it is necessary to apply to powerful information and control systems.

Failing to consider such information needs may be, particularly in small firms, a primary cause of a *too high growth rate* pursuing, which may give rise to *liquidity crises*, that often become a serious threat to business long-term survival, even though company operating profitability is strong.

2. Accounting and Dynamic Models in Net Working Capital Management. The particular relevance of System Thinking and Dynamics in the Small Firms context.

Accounting models are a typical response that small entrepreneurs give to this lack of information as soon as they realize the need to overcome it. Accounting models mainly draw data from transaction systems and General Ledger (particularly from balance-sheet and income statement).

Some examples of accounting models concerning NWC management are as follows:

- *balance sheet analyses by ratios and flows of funds*, which may be useful in order to assess whether a financial structure is balanced, according to a given set of variables relating to a well specified period time;
- *management/responsibility accounting*, which implies that costs, revenues and even NWC data are debited to several *centers*, that are considered as a primary basis for goal setting (budgeting) and performance evaluation;
- *variance analysis*, which supports performance evaluation through the comparison of actual versus standard (or budgeted) NWC data and the splitting of total variances into several groups, according to which different partial causal variances will be detected (Brunetti 1986, 38-48; Brunetti-Olivotto 1992, 43-59; Gallinger-Ifflander 1986);
- *detailed gross contribution margin assessments*, by customer or customer groups;
- *detailed inventory consumptions analyses*, by code/stock group;
- *"ABC" inventory analyses*, supporting selective logistical policies;
- *customer service reporting*, by warehouse/inventory code;
- *concise budgets* to be submitted to outside institutions (e.g.: banks), which are generally drawn on the basis of past balance-sheet and income statement data, often assuming that in the future the "rules of the game" will be the same as in the past and a linear relation exists between relevant variables (Vergara 1984);
- *linear spreadsheat internal simulations*, which are generally mainly based on balance-sheet and income statement data and, only partially, on external non-accounting information.

Accounting models are characterized by some common features that, if we particularly refer to small firms, can be summarized as follows:

- they are characterized by a *micro*, rather than *macro*, perspective. In fact, they are focused on single, stand-alone, problems and they often disregard the higher level interactions between *all* relevant variables;
- they are immediately *focused on financial information*, per se, rather than on a trade-off perspective, from which it could be possible to manage NWC and sales dynamics on an interfunctional point of view. Such a different perspective could allow, on the contrary, to assess

marketing, logistics, procurement and manufacturing implications of policies concerning, for example: mark-ups, extensions, customer lead times;
- they are *not flexible*, as most of them do not allow simulations; only traditional or even multidimensional "spredsheat" accounting models may be used for these purposes, but they are often quite mechanistic, owing to both the linear hypotheses to which they refer and the limited possibility to take into account time lags between variables;
- they are *not concise*, as they feed a structured reporting system, usually according to specific schedules, instead of "ad hoc" and selective information;
- most of them may be *too expensive for small firms as they do not fit with their organization structures and processes*. In fact, management/responsibility accounting implies that managerial activities are delegated from top to middle management and information needs are considerably different in several functions of the firm. However, many small firms do not have a *technostructure* and managerial activities are centralized by the entrepreneur; this implies, moreover, a limited differentiation between functional information needs.

But, more particularly, accounting models are of a poor help in understanding problems *structure* and dynamics of *current management processes* impacting on *medium-long term* performance. They have, rather, a *normative* and sometimes also a *predictive* orientation.

If such approach has an advantage in immediate highlighting some managerial focal points and in order to get precise and analytical information, it may have a serious drawback in poor decision and learning process support, particularly when the firm operates in a complex and/or unpredictible environment.

When environment complexity or unpredictability are particularly significant it is better to apply also (and particularly) to *dynamic models*, which are mainly based on non-accounting data and may particularly enable to:
- *improve learning* of the system (as a whole), as they enhance a deeper and better comprehension of the feed-back loops which more closely may concern NWC relating to current operations;
- *improve effective communication among key-actors*. In fact, one of the most relevant roles of the "modeller" is to elicit, through "maieutics", *mental models*, i.e.: the way how each actor perceives to what extent a variable may differently affect other ones, according to various working hypotheses. Making mental models explicit may substantially help in achieving a management problems common shared view (Morecroft 1994; Senge 1990);
- *improve key-actors continual experimentation*, as they make possible to assess in advance - and consequently in a "protected" context - the different possible outcomes relating to a given set of changes in the value of particular "input variables" relating to internal *levers* and/or to *"external market"* constraint-variables. Moreover, they also allow to assess working hypotheses congruence, through an "ex post" comparison between supposed and actual system "behaviour".
- *implement a strategic corporate growth control sub-system*, drawing more on mental models, personal experience and intuition of the entrepreneur and of other key-actors than on accounting data. This makes possible their successful implementation also - and particularly - in *small firms*, where often relevant accounting data is not available;
- *improve an interfunctional approach* to NWC management, taking into consideration not only the financial value of information, *per se*, but particularly *trade-offs* between financial and marketing, logistics, procurement, manufacturing policies affecting inventories, accounts receivable and current debts;
- *point out different levers* on which it is possible to act in order to affect NWC and *evaluate* the different *effects* they may produce in the short and in the long term;

- *assess how "internal" levers* (i.e.: prices, extensions, customer lead times) *may affect - and may be affected by - "external-market" variables* relating, for example, to customers preferences and competitors policies.

System thinking and dynamic models may allow key-actors to better discern new action alternatives or, even, to detect the poor soundness of previously taken decisions, on the basis of a more superficial analysis (Lyneis 1980, 256-321).

Differently than accounting models, dynamic models are *descriptive*, rather than normative, as information they gather are mainly oriented to make system dynamics explicit, according to a set of hypotheses and conditions and to a given period of time.

This implies that the *single* peaces of information *accuracy level* in dynamic models may be also lower than in accounting ones. However, this does not mean a lower model reliability, as decision support is strictly related to the model capability to depict *key variables behaviour* and to the "modeller" ability to elicit key-actors mental models.

It is possible, however, to maintain that - particularly in those companies which already have an *accounting* control system - an interactive periodical information exchange between accounting and dynamic models is likely to be more supportive to decision makers. In fact, while NWC dynamic simulations may allow a wider insight in budgeting and responsibility accounting, on the other hand variance analysis (between budgeted and actual NWC data) may be useful in NWC dynamic modeling in order to better understand the real system structure and processes and so to support an on-going model building.

3. An Educational Dynamic Model to support Net Working Capital management and Corporate Growth Strategic Control in a small trading wholesale company.

In the following pages of the paper, an educational dynamic *Powersim* software model for NWC management in a trading wholesale small company will be shown.

Fig. 1 summarizes the model "structure". Our hypothesized firm operates in two main markets: *small* and *big* retail companies ("B" and "A" markets). Different customers may be ranked, for example, according to their total average purchases budget or to their current retail sales. Moreover, if we consider - from the company's point of view - geographic customer locations, we may distinguish, within each market, three different niches: *local*, *regional* and *national*. The three customer ranks may be defined according to the km/s (or miles) distance from the only company warehouse to the client. For example, *local* customers could be those who are located in Sicily; *regional* customers those who are located in Centre/Southern Italy (Sicily not included); *national* customers those who are located in Northern Italy.

Each "size/location" cross defines different "rules of the game" for competition. For example, "small/local" customers could be particularly attracted by low prices and longer extensions; "big/national" customers could be more attracted by shorter lead times, and so on.

The six market combinations that it is possible to define are so depicted in fig. 1 as concentric circles, whose diameters are proportional to potential sales values.

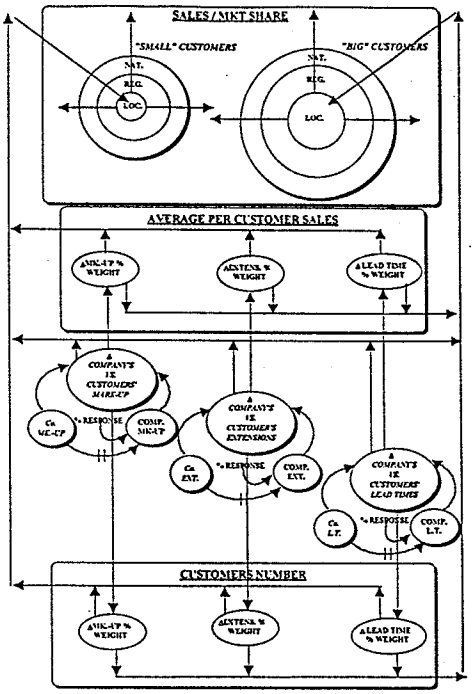
In order to grow (i.e.: to improve its sales and market share) our company has to increase each own customers *average sales* and/or the number of (new) *customers*.

To do that it can lever *mark-up* (i.e. price), *extensions*, and *lead times*. The three levers have a different relevance not only according to the particular "size/location" class to which customers belong, but also whether the goal is to increase the number of our customers or of average customer sales, within a given market segment.

Moreover, the model not only implies a customers' responses analysis, but also a *competitors behaviour* definition; this means, first of all, that competitors are to be (even geographically) located and that their policies concerning the three above said levers are to be at least supposed.

Competitors are so grouped in two main classes, according to the different main markets (i.e.: "A" and "B")

FIGURE 1:



In relation to *mark-ups*, *extensions* and *lead times*, it is necessary to define their initial values, corresponding to *standard* conditions.

Given that price-lists of purchased goods are the same both for the company and for competitors, the entrepreneur could be asked by the modeller to answer questions like the following: *if we increase of "x" points our average mark-up in "small customers" market, how competitors could probably react? When will they realize we have changed our prices? Will they react, changing their mark-ups? To what extent will they react?* (their reaction could be equal, but could be also less or more than proportional to the company original increase). For example, some customer groups could not be able to decrease mark-up under a given level because of their higher operating leverage (i.e.: higher fixed costs incidence). Competitors reactions will so affect customers' reactions and, consequently, company sales and market share. A same way of reasoning may be applied also to the other two levers.

The model, however, helps decision makers to understand also that *sales* and *market share* are not the only *key-variables* to be monitored in order to pursue a balanced growth rate. In fact, not always a sales or market share increase is a synonymous of a higher profitability over time. *Short-term* profitability may also be achieved through sharp growth rates which may be, however, attained to the prejudice of the company's *liquidity* and, so, of *medium-term* profitability.

Figure 2, particularly highlights this concept and shows the main feed-back loops between relevant model variables.

From the figure, it is possible to realize how *NWC* provided with current operations is affected by:

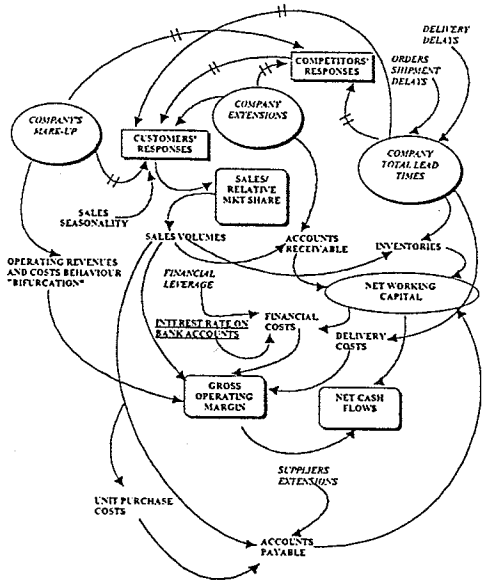
- *company extensions to customers*, that influence accounts receivable;
- *irrecoverable credits percentages*;

- *orders shipment delays*, that influence inventories and, together with delivery delays, *total lead times*;
- *suppliers extensions*, that influence accounts payable.

On the other hand, *gross operating margin* (GOM) is not only influenced by the combination sales volumes/unit prices, but also - and even in the short term - by *delivery costs*, which may substantially increase owing to a too short delivery delay.

When monthly NWC variance is positive and higher than GOM, the company generates a negative cash flow. Prolonging negative cash flows even over a few months - if equity is not increased - gives rise to accellerating bank accounts increases and to higher *financial costs*. The final effect of this *reinforcing feed-back process* is *gross operating margin reduction* and, often, the achievement of operating losses.

FIGURE 2:



Forgetting to consider the impact that both NWC increases, on a side, and maximum potential market sales and competitors' responses, on another, may generate on gross operating margin can be a serious and dangerous drawback for a company's growth policy. Particularly in small companies, quite often entrepreneurs focus their attention only on the central block of fig. 3, that is of immediate empirical evidence. In fact, after a price or a lead time reduction has been decided, customers' responses usually give rise to sales and gross operating margin increases (*positive loop*). When market share or gross operating margin start to drop (*balancing loop*), many entrepreneurs do not immediately realize that the cause of such problem is to be found *within* the same system to which they belong, whose boundaries are, however, larger than those they usually frame. Consequently, they often react trying to lever again on mark-ups, extensions, lead times or (in a still worse hypothesis), in order to give an immediate answer to sudden liquidity reductions, they may sharply or randomly change one or more of the three levers; however, attained results are often poor. This is because of a *short term* and *non-systemic* management approach.

The model allows to simulate up to 24 monthly periods. Four different simulations have been done. The *first simulation* concerns standard input values. From table 1 it is possible to observe that, at the end of the 24th month, GOM and cash flow are negative; more particularly, fig. 4 shows how GOM performance progressively deteriorates during the second simulation year. This is because of a poor lever mix setting. In fact, table 1 (particularly income statement) remarks how inventory, liquidity and credits management, may be considered as the main areas that

generate a higher negative impact on the firm's profitability. Inventory dynamics is depicted in fig 4.

FIGURE 3:

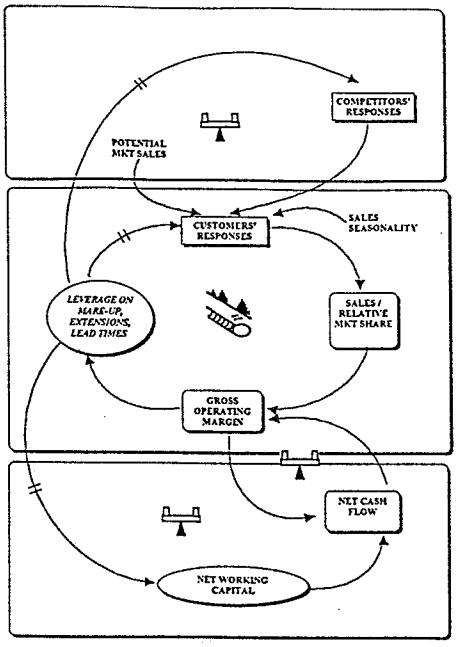


TABLE 1:

FUNDAMENTAL BALANCE SHEET DATA (BEGINNING MONTH)

ACCOUNTS RECEIVABLE	8.302,93	ACCOUNTS PAYABLE	6.027,54
OUTSTANDING ACCOUNTS RECEIV.	7.635,22	*BANK ACCOUNTS*	-11.800,00
INVENTORIES	0,00	*NET WORKING CAPITAL*	9.206,76

FUNDAMENTAL INCOME STATEMENT TOTAL DATA

SALES	20.005,80
PURCHASES (b)	19.713,46
INVENTORY INCREASE (-) OR DECREASE (+) (c)	-2.500,00
GROSS MARGIN (d) = (a) - (b) + (c)	292,33
CONSIGNMENT COSTS (e)	784,13
VARIABLE SELLING EXPENSES (SALESMEN COMMISSIONS) (f)	200,06
QUICK SUPPLY COSTS (g)	297,89
MONETARY WAREHOUSING COSTS (h)	495,00
IRRECOVERABLE CREDITS (i)	1.628,51
STOCKOUT COSTS (l)	6.103,55
OTHER GENERAL OPERATING COSTS (m)	55,00
ADDED VALUE PROVIDED WITH CURRENT OPERATIONS (n) = (d) - ... - (m)	-9.271,81
INTERESTS ON ACCOUNTS PAYABLE (o)	132,39
INTERESTS ON BANK ACCOUNTS (p)	1.314,92
THIRD MARGIN (q) = (n) - (o) - (p)	-10.719,12
STAFF SALARIES (r)	44,00
FIXED SELLING EXPENSES (SALESMEN SALARIES) (s)	220,00
GROSS OPERATING MARGIN (t) = (q) - (r) - (s)	-5.493,24
DEPRECIATION (u)	77,00
INCOME PROVIDED WITH CURRENT OPERATIONS (v) = (t) - (u)	-11.060,12

NET WORKING CAPITAL FLOWS PROVIDED WITH CURRENT OPERATIONS

(a) MONTHLY GROSS OPERATING MARGIN:		1.065,45
(b) MONTHLY FINANCIAL NEEDS:		9.631,22
ACCOUNTS RECEIVABLE INCREASE	2.899,83	
INVENTORY INCREASE	0,00	
ACCOUNTS PAYABLE DECREASE	6.027,54	
STOCKOUT COST DEBTS PAYMENT	703,85	
(c) MONTHLY FINANCIAL COVERINGS:		3.826,17
ACCOUNTS RECEIVABLE DECREASE	-211,78	
OUTSTANDING ACCOUNTS RECEIVABLE DECREASE	2.904,28	
IRRECOVERABLE CREDITS	213,73	
INVENTORY DECREASE	0,00	
ACCOUNTS PAYABLE INCREASE	0,00	
STOCKOUT COSTS DEBTS INCREASE	919,95	
NET CASH FLOW PROVIDED WITH CURRENT OPERATIONS (a) - (b) + (c)		-4.739,60

CASH FLOWS

SHORT COMPUTATION

BEGINNING BANK ACCOUNT (+)	-11.800,00
NET CASH FLOW PROVIDED WITH CURRENT OPERATIONS (+)	-4.739,60
END-OF-MONTH BANK ACCOUNT	-16.539,60

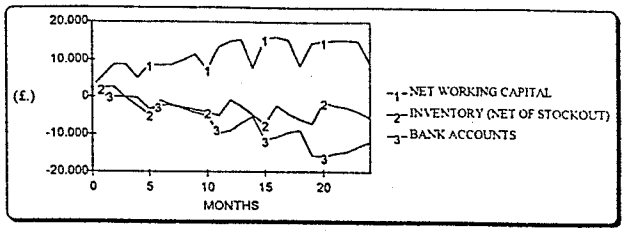
DETAILED COMPUTATION

BEGINNING BANK ACCOUNT (a)		-11.800,00
MONTHLY TAKINGS (b):		2.693,66
ACCOUNTS RECEIVABLE	-211,78	
OUTSTANDING ACCOUNTS RECEIVABLE	2.904,28	
CASH SALES	1,17	
MONTHLY PAYMENTS (c):		7.433,26
ACCOUNTS PAYABLE	6.027,54	
STAFF SALARIES	4,00	
SALESMEN SALARIES	20,00	
SALESMEN (VARIABLE) COMMISSIONS	29,01	
MONETARY WAREHOUSING COSTS	45,00	
CONSIGNMENT COSTS	71,79	
QUICK SUPPLY COSTS	0,00	
BANK INTERESTS	527,08	
OTHER GENERAL OPERATING COSTS	5,00	
END-OF-MONTH BANK ACCOUNTS (a) + (b) - (c)		-16.539,60

The *second simulation* shows how indiscriminate mark-up reductions may not be convenient neither for the company nor for its competitors as they may give rise to unprofitable *price wars* (escalation archetype) which can only increase potential market, but do not affect the company's market share. From the figure 5 it is possible to realize the decreasing trend of GOM and,

particularly, of *total available bank credit* which, after the 15th month, sharply decreases to a value (nearly -15000) that is by far lower than the minimum allowed (-10000). Such dramatic decrease both in liquidity and in GOM is caused both by market "A" competitors sharp price reduction in response to the company's mark-up previous changes and by the coming of low sales season.

FIGURE 4:



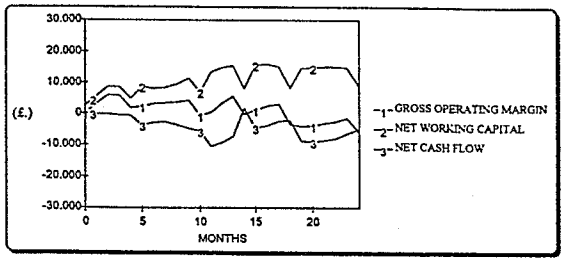
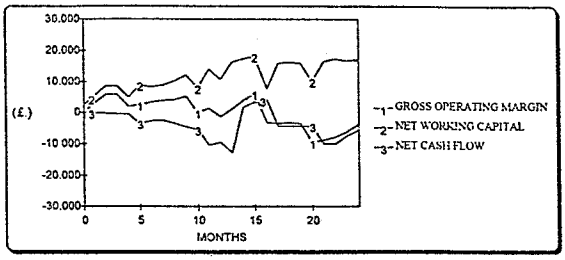
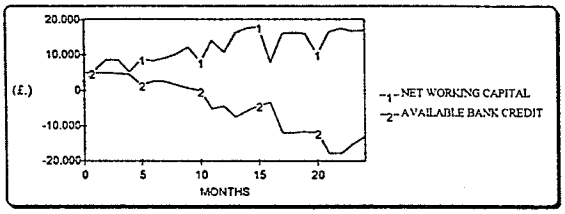
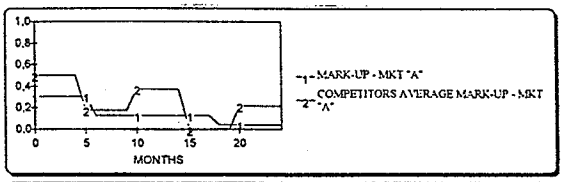
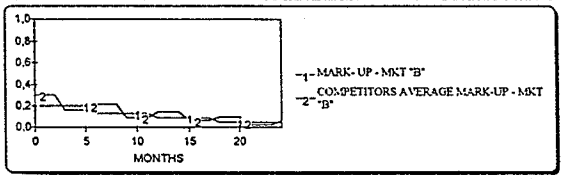


FIGURE 5:



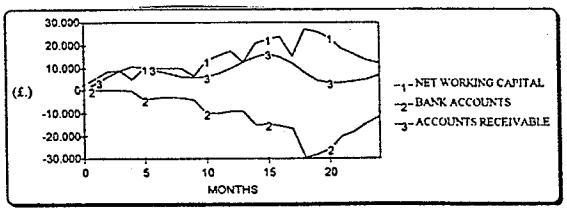


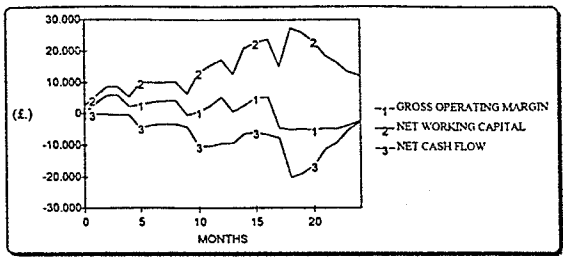


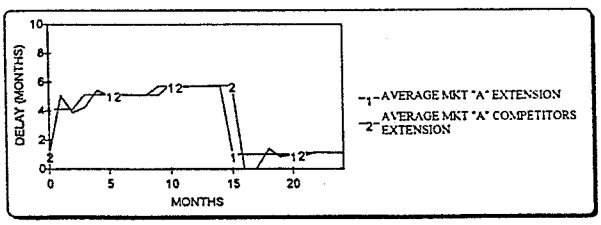


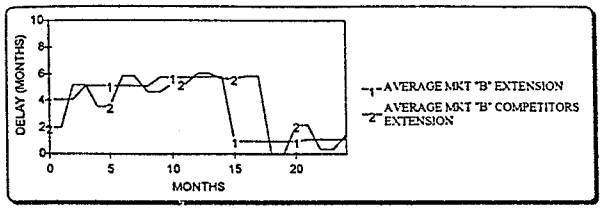
In the *third simulation* it has been tried to lever *only* on *customer extensions*. During the first year, the company progressively increases extentions in both markets.However, again in the 15th period it is forced to drastically riduce extensions, owing to the sharp reduction in bank accounts (which are by far less than the minimum allowed: -10000) and in GOM.

FIGURE 6:









Unfortunately, after extensions have been reduced, both bank accounts and GOM continue to decrease; this is because of the higher delays in credit collection (owing to the high rate of outstanding and irrecoverable bills) and of low season sales.

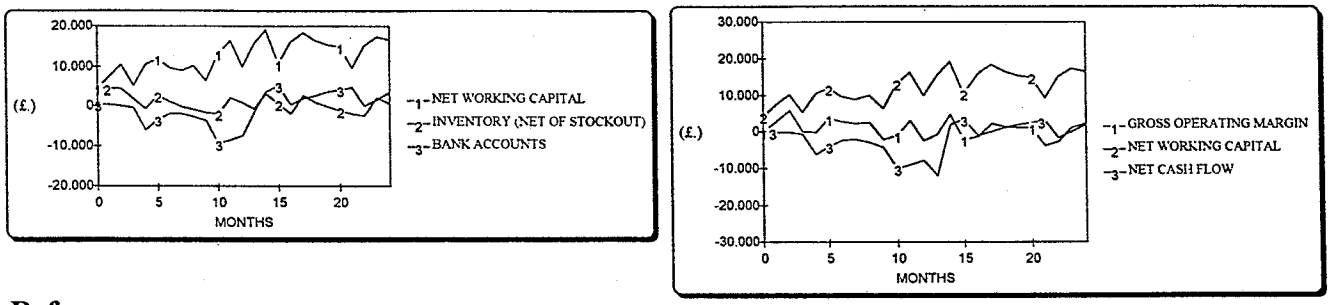
This example has shown again how most short-term emotional and non-systemic policies are bound to fail.

The forth simulation shows how effective may be to lever simultaniously on different sub-systems: for example, in this case, on inventories and bank accounts.

From the beginning of this simulation decision maker decides to reduce from 1 to zero months *mean time beween supply orders* (i.e.: inventory needs are now immediately converted into an order by warehouse information system), to ask suppliers to reduce their *lead time* from 2 to 1,3 months, to increase *initial inventories* from £ 2500 to £. 4326,92 and to increase also the value of *expected stocks monthly sent to customers*.These changes allow a drastic stock-out reduction.

However, such policy implies a gradual NWC increase, caused by the higher inventory levels, (fig. 7) and - given a steady GOM level - a *sharp net cash flow reduction*. Consequently, equity owners are forced to invest extra money, that is equal to £. 10000 (in the 12ve month) and to 3000 (in the 13th month). Such investments allow to face the second simulation year with strong liquidity position and so to achieve a steady and positive long-term profitability.

FIGURE 7:



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