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Access to credit as a limit to growth for SMEs

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ABSTRACT

Access to credit has been considered as one of the main problems that SMEs have to deal with in order to survive and keep growing. This document describes a system dynamics model based on the case of a medium-sized manufacturing firm, located in Colombia, where the author worked as operations manager, and subsequently as a consultant. The model integrates the operations and finance of the firm including variables associated with trade credit and banks credit. A sensitivity analysis is made in order to find high leverage variables. The results obtained indicate that operational or financial policies, when applied alone, are not sufficient to solve the firm stagnation problem. An appropriate combination of access to credit, credit conditions, and adequate financial and operational policies, is the only way to deal with the complex problem of SMEs survival and growth.

Introduction

Access to credit has been considered as one of the main obstacles that SMEs have to deal with in order to keep growing. Peel and Wilson (1996), mentioned the problems in obtaining long-term financing, that lead SMEs in UK to work through trade credit and late payment. Late payment as a working capital resource in transition economies has been described also by Pejic-Bach as a response to the restricted access to financial markets. Similar situations have been described by Chittenden and Bragg (1997) for SMEs in UK, Germany and France, Kotey (1999) and Peel et al (2000).

Although financial issues have a recognized effect on survival and growth of enterprises in general, and of SMEs in particular, there is little empirical research on this topic (Saint-Pierre, 2002). This appears to be particularly true for Latin America, as the author did not find any research concerning the influence of financial variables in Latin American SMEs performance. In fact, this document is based on the problems observed by the author as Operations Manager, and subsequently as a consultant, of a medium-sized organization in Colombia.

System Dynamics and Finance

Research on system dynamics (SD) applied to finance in enterprises, though not as copious as in other applications, has been growing during recent years. Examples of this trend are Thompson (1986) who applied SD to analysis and management of cash flow,

Kolay (1991) who described how SD can be successfully used to take appropriate decisions when an organization faces a shortage of working capital, Bianchi (2002) who integrated SD and accounting models into planning and control systems, and Pejic-Bach (2003) who explained the financial indiscipline problem in small businesses.

Objectives

The aim of this document is to serve to two main purposes

- To facilitate a discussion about the access to credit for Latin American SMEs, as a main factor for their survival and growth, that may promote future research on the subject.
- To contribute to the field of system dynamics applied to finance using a model that integrates the operations and finance of the firm. The model is based on the case of a medium-sized manufacturing firm in Colombia.

The Case

HiTech Tubes is a medium-sized firm, located in Colombia, that manufactures inner-tubes for tyres (in order to keep confidentiality the name of the firm has been changed and the values in the model have been normalized). The strategy of the firm is based on high performance products and its target market is the major tyre companies for whom HiTech produces inner-tubes with their trade marks, that are distributed in the Andean Community (Colombia, Venezuela, Ecuador and Peru). After several years in the market, inner-tubes from HiTech are widely recognized as high performance products, and their sales grew steadily until they occupied two thirds of the production capacity of the firm. Since then, and although customers continue to require higher volumes of product, HiTech has not been capable of satisfying this increasing demand, and one third of its production capacity remains unused.

The Model

Causal Loop Diagram

Figure 1 shows a causal diagram of the model. First, growth in sales is obtained through the quality perception of the product in the market (*Growth by Quality* loop). This growth implies a rise in the *Working Capital* that depletes the *Credit Available*, reducing *Payment to Suppliers*, *Raw Materials Income* and, thus, *Raw Materials Inventory* (*Credit as Limit* loop). This causes a decrease in *Production*, *Inventory* and *Shipments.* At this point, and after a delay, the *Expected Shipments Capability* falls and customers reduce or stabilize their orders and look for alternative sources in order to fill their needs.

In order to keep the causal diagram simple, *Credit Limit* is shown as an exogenous variable. In the simulation model, it is endogenous (affected by the operational cash flow history).

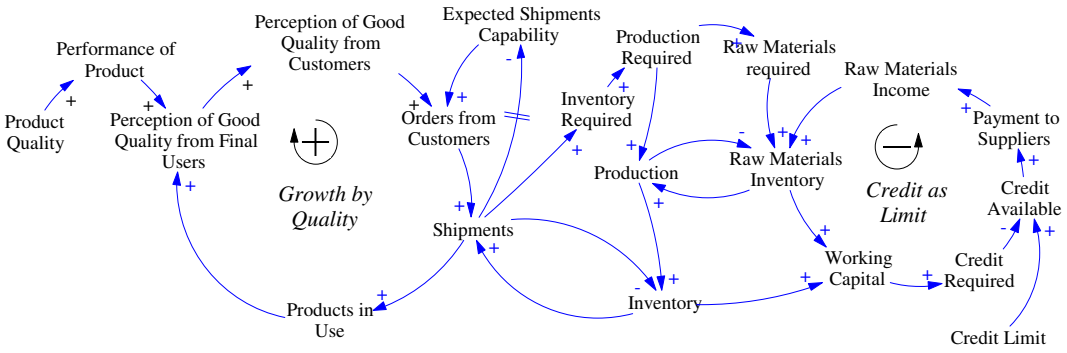

Figure 1. Causal loop diagram of the model

Demand and Operations

The Operations view of the model is shown in Figure 2. There are two level variables, *Finished Product Inventory*, increased by *Production* and depleted by *Shipments*, and *Raw Materials Inventory*, increased by *Raw Materials Income* and depleted by *Production*. *Shipments* are determined by *Customer Orders* and *Inventory* available; partial fulfilment of customer orders is allowed. *Customer Orders* are a function of *Customer Needs* of inner-tubes, that rise from 12000 to 18000 units/week in week 5, multiplied by a factor, expressed as a lookup function, whose input is the shipment capability perceived by the customer (exponential smoothing).

Desired inventories (product and raw materials) are based on *Expected Customer Orders*; the adjustment to these inventories (production orders and raw materials orders) are the differences between current and desired inventories. *Production Orders* are limited by *Production Capacity* (18000 units/week). An important percentage of the raw materials is imported, so, as an average, raw materials arrive six weeks after orders have been placed (*Raw Mat Income Delay*). *Raw Materials Income* is affected by the *Raw Material Delivery Factor*, that is a ratio between the accumulated payment made to suppliers and the accumulated payment due to suppliers; this is the link between operations and finance in the model, on the supply side.

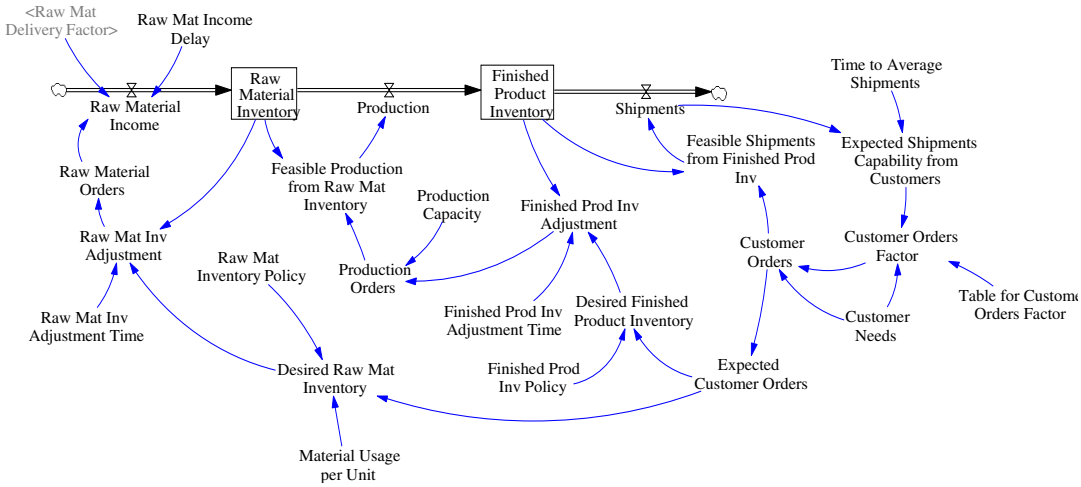

Figure 2. *Operations* view of the model

Finance

The financial structure of the model (Figure 3) is based on four level variables.
Accounts Receivable is increased by *Sales* revenues and depleted by *Payment from Customers* (accounts receivable collected) that depends on the current *Accounts Receivable* and the payment terms granted to customers (*Credit to Customers Policy*). *Sale Price* has been set to 10. Sales is the link between operations and finance in the model on the demand side.

Cash is increased by accounts receivable collected (*Payment from Customers)* and depleted by production cost, general expenses and debt servicing. Production cost has been divided into payment to suppliers *(Feasible Payment to Suppliers from Cash*) and production cost without including raw materials (*Production Cost wo Raw Mat*), in order to model the payment policy of the firm; the cash assigned to pay to suppliers (*Cash Assignment to Raw Mat*) is what remains after subtracting *Production Cost wo Raw Mat*, *General Expenses* and *Debt Service*, from current *Cash*. As can be seen, this is a form of the "late payment" policy described by several research documents (Chittenden and Bragg, 1997; Peel et al, 2000; Pejic-Bach,2003).

Accounts Payable Suppliers is increased by raw material purchases (*Raw Mat Purchases*) and depleted by payment to suppliers (*Feasible Payment to Suppliers from Cash*). The payment terms switch from *Normal Payment Terms*, initially set to 6 weeks, to *Minimum Payment Terms*, set to 1 week, when accounts payable exceed the maximum trade credit available (*Credit from Suppliers Limit*); in other words, when the trade credit limit is exceeded, suppliers require cash payment. The ratio between the accumulated payment made to suppliers and the accumulated payment due to suppliers is the *Raw Mat Delivery Factor*, which determines what fraction of the *Raw Material Orders* is finally shipped to the producer.

Banks Credit is increased by *Loans* and depleted by *Repayment*. The firm asks for a loan when the current cash is lower than the cash that covers the firm's working capital needs (*Desired Cash*). The maximum credit given by the bank depends on the expected operational cash flow of the firm (exponential smoothing). *Repayment* is calculated from current *Banks Credit* and *Average Debt Maturity*, and Interest depends on current *Banks Credit* and *Interest Rate*.

Taxes have not been included in the model in order to avoid the complexity that the inclusion of the associated accounting variables would bring, and considering that the relevant patterns of performance could be noticed without the inclusion of this variable, specifically for the case under study.

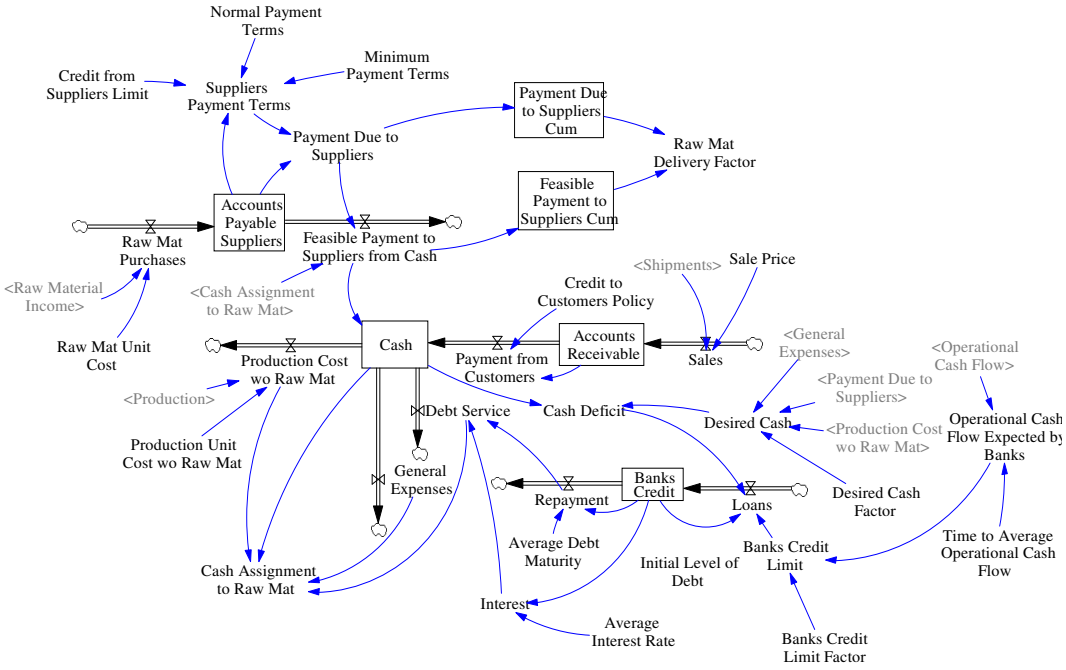

Figure 3. Financial structure of the model.

Performance Measures

Accumulated sales (*Sales Cum*), *Cash Flow, Accumulated Cash Flow*, and *Operational Cash Flow*, have been included in a separate view named *Performance Measures* (Figure 4).

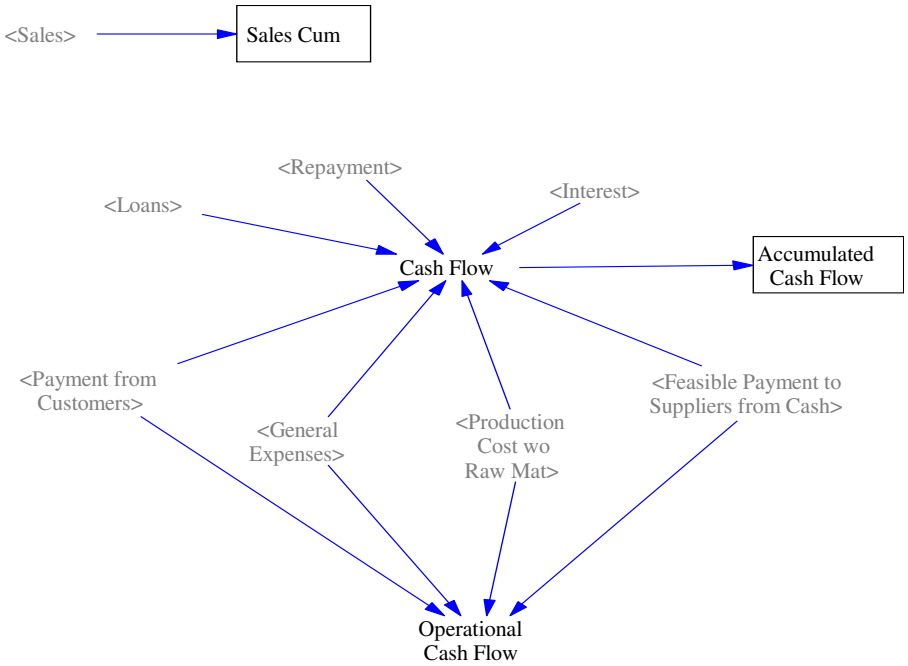

Figure 4. Performance measures of the model.

Simulation and Analysis

Simulation results for *Shipments*, *Customer Orders*, *Inventory* and *Production*, are shown in Figure 5. As was mentioned above, *Customer Needs* rise from 12000 to 18000 units/week in week 5, originating shortages in *Production*, *Finished Product Inventory* and *Shipments*, and, as a consequence, *Customer Orders* oscillates between 12000 and 13800 units/week.

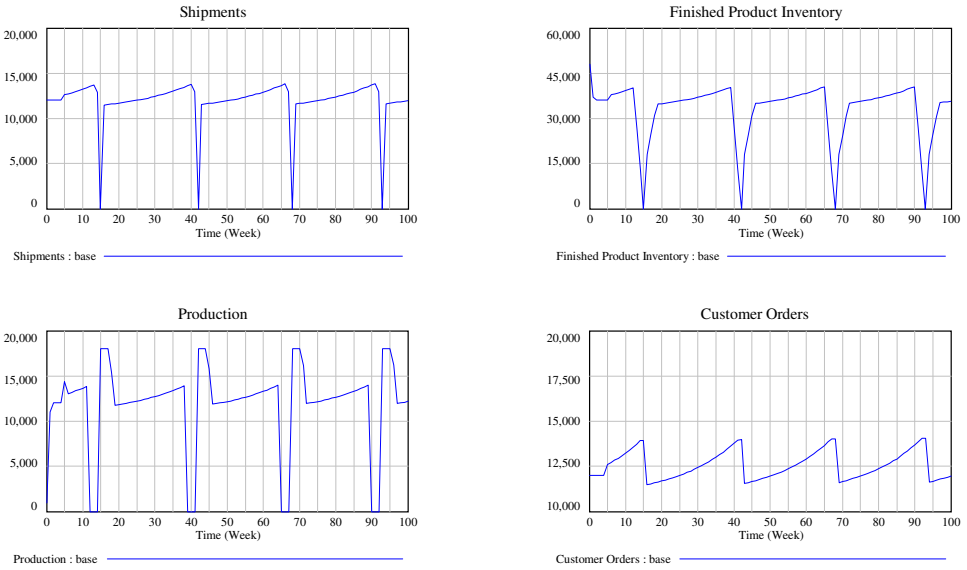

Figure 5. Simulation Results for *Shipments, Finished Product Inventory*, *Production* and *Customer Orders*.

There are also shortages of *Raw Materials* and *the Raw Mat Delivery Factor* falls to values between 0.85 and 0.92 from week 21. *Sales* follow the same stagnant path of *Shipments*; average sales at week 100 are $119600/week, almost the same value before the increase of demand ($120000/week). *Accumulated Cash Flow* at week 100 is $1.6M. See Figure 6.

Sensitivity Analysis

A univariate analysis was carried out, looking for the variables that have significant influence on sales and on accumulated cash. A previous qualitative analysis, made using the SyntheSim tool of Vensim, indicated as significant variables *Finished Product Inventory Policy*, *Raw Mat Inventory Policy*, *Credit from Suppliers Limit*, *Average Debt Maturity* and *Banks Credit Limit Factor*.
Although some of them show an improvement in accumulated sales, none of them gave robust results regarding accumulated cash flow. Figures 7 and 8 illustrate this, for *Finished Prod Inventory Policy* and for *Credit from Suppliers Limit* .

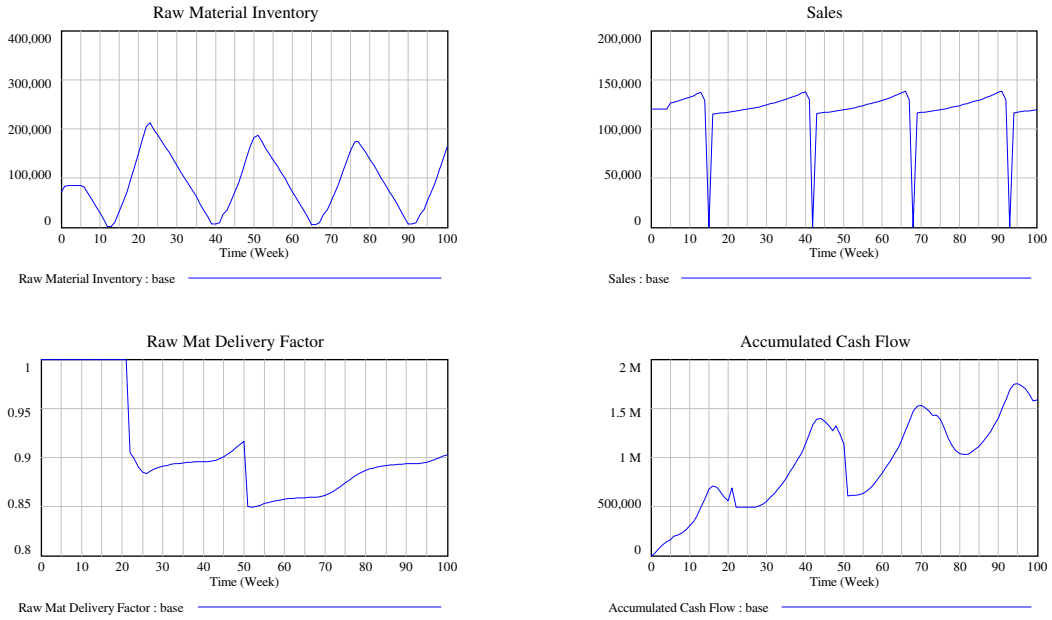

Figure 6. Simulation results for *Raw Material Inventory*, *Sales*, *Raw Material Delivery Factor*, and *Accumulated Cash Flow*.

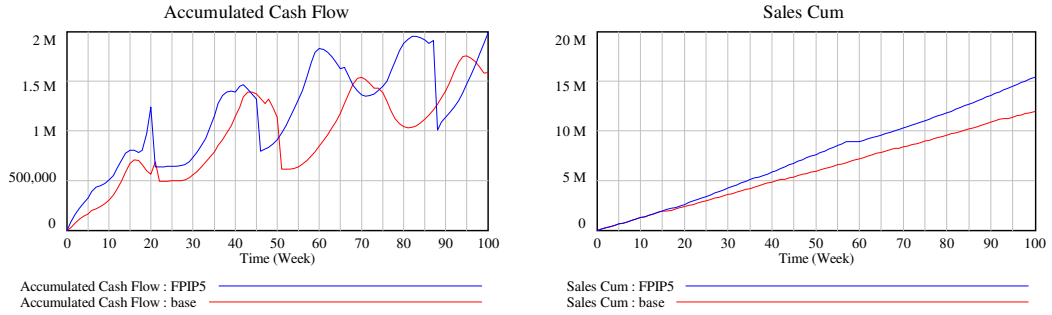

Figure 7. *Accumulated Sales* and *Cash Flow* for *Finished Product Inventory Policy values of 4 (red curve) and 5 (blue curve)*

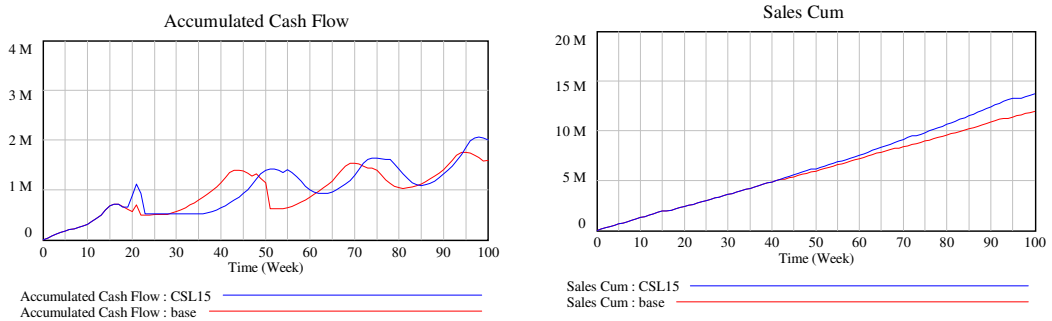

Figure 8. *Accumulated Sales* and *Cash Flow* from *Credit from Suppliers Limit* values of $1M (red curve) and $1.5M (blue curve)

The only way found to obtain a robust improvement of the Accumulated Cash Flow was by varying several variables, operational and financial, at the same time. The variables modified and their values, are summarized in Table 1. The results are shown in Figure 9.

Variable	***Base Value***	***Test Value***
Finished Prod Inventory Policy	4	6
Raw Mat Inventory Policy	6	8
Credit from Suppliers Limit	$1M	$2M
Normal Payment Terms	6	12
Average Debt Maturity	50	150
Average Interest Rate	0.005	0.002
Banks Credit Limit Factor	12	24

Table 1. Variables modified to obtain a robust improvement of the *Accumulated Cash Flow*.

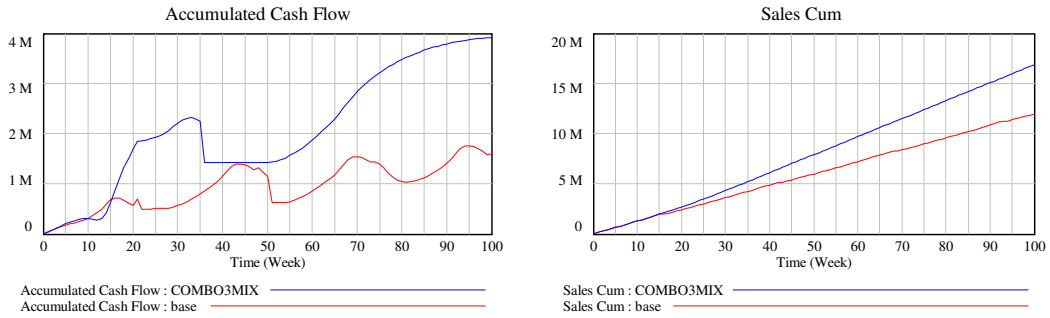

Figure 9. *Accumulated Sales* and *Cash Flow* for variables and values described in Table 1. Base Value (red curve), Test Value (blue curve).

Conclusions

- Models based on system dynamics are a helpful tool for managers of SMEs, that have to deal with decision making in complex systems, where solutions are a combination of several policies and actions rather than the finding of a single root cause.
- Access to trade and bank credit, and good credit conditions, are main factors for survival and growth of SMEs, but have to be complemented with good management policies. System dynamics models can generate insights that may help to obtain a powerful synergy between these elements.

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