A Model of Goal Dynamics in Organizations: a case study

Francesco Ceresia
Department of European Studies and International Integration
University of Palermo, Italy
fceresia@libero.it

ABSTRACT

The purpose of the present work is to build a suitable system dynamics model for goal dynamics in organizations, as proposed by Barlas & Yasarcan (2008). The proposed model does not bear any ambition of being exhaustive: the main objective of this paper is to propose a model of goal dynamics in which Goal Setting, Management by Objectives and Training are viewed as human resource practices able to enhance workers' goal commitment, and therefore, improve organizational performance. In the first part of this paper, an analysis of the Goal Setting Theory and the role of goal setting practices, in bettering worker's performance, are stressed. In the second part, a case-study, the causal loop and a quantitative model of goal dynamics in organizations are described. In the third part, behaviour reproduction testing, optimization analysis for parameter estimation and scenario analysis are presented. Limitations of the present research and conclusions are finally discussed.

KEYWORDS

Goal Setting, Goal Commitment, Strategic Human Resource Management, Management by Objectives, Organizational Dynamics, Behavior Reproduction Testing, Optimization Analysis, Parameter Estimation

1. Introduction

Goal Setting is one of the most investigated and empirically validated practices in human resource management (Locke & Latham, 2002). A great deal of literature shows that goal setting plays a crucial role in the improvement of decision making processes, by increasing workers' motivation (Barlas & Yasarcan 2008; Bivona & Ceresia 2008; Ceresia 2008, 2009; Forrester 1975; Senge 1990; Sterman 2000; Warren 2008).
In the use of the system dynamics approach, Warren (2008) underlines the importance of setting appropriate goals for the achievement of organizational objectives. Managers may sometimes underestimate or overestimate the obtainable performance thus consequently companies can respectively lose big chances for growth or waste time and precious resources, trying to achieve some ideal but unrealistic goals.
Barlas & Yasarcan (2008) propose a comprehensive model of goal dynamics in organizations, adopting a system dynamics perspective. These authors underline the limitations of the simple goal seeking structure as a reliable model of goal dynamics in complex social systems, as organizations (see fig. 1). In simple structures, as illustrated below, the *state* is modified, approaching and reaching the goal, within a pure negative

exponential behaviour (for more details, see Barlas & Yasarcan 2008), recording an *improvement* of actions defined by the following equation:

(1) Improvement = (Goal – State)/State adjustment Time

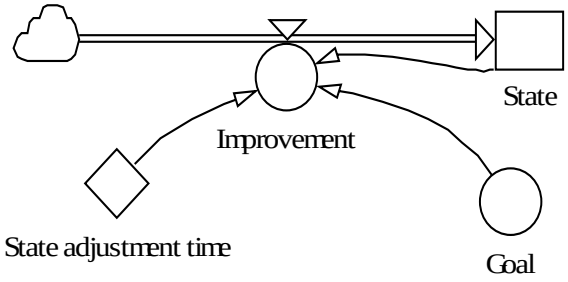

Figure 1. Simple goal seeking structure (stock-flow diagram).

Besides, Barlas & Yasarcan (2008) underline the role of intangible and "soft" variables involved in goal dynamics within organizations. One of their main efforts is to build a SD model in which intangible factors, such as motivation and frustration effects on performance, are included.

Following the suggestions of Barlas & Yasarcan (2008), this paper is a further effort in the pursuit of a suitable system dynamics model for goal dynamics in organizations. More specifically, the main objective of the present paper is to propose a model of goal dynamics in which Goal Setting, Management by Objectives (MbO) and Training are viewed as human resources practices able to enhance workers' goal commitment, and therefore, the organizational performance. The ample literature on goal setting, goal commitment, management by objectives (MbO) and training allow us to draw up a system dynamics model which includes the empirical results, supplied by forty years of research in the field.

One of the main purposes of the present work is to demonstrate the strength of a SD model, in which processes underlying the goal setting practices are integrated with processes underlying other business functions, such as commercial, financial and organizational ones. This study ultimately aims at:

- ✓ explaining how the application of the 'goal setting theory' in a company constitutes a vital directional lever in the growth of motivational standards;
- ✓ showing the opportunity of an efficient integration between the goal setting process sub-system and other business sub-systems;
- ✓ demonstrating how products sales dynamics are influenced by workforce goal commitment (motivation) and, indirectly, by the ways goal setting processes are managed;
- ✓ underlining that system dynamics constitutes an effective methodology in the elaboration and validation of models in goal dynamics in organizations.

The present resume is the result of a research project conducted with a firm operating in the Household Electrical Appliances industry. The company has its registered office in Sicily, but operates in all of the Italian regions[1].

In the first part of this paper, an analysis of the Goal Setting Theory and the role of goal setting practices in enhancing workers' performance are put into evidence. In the second part, the case-study, the evolution of the business and feedback analysis of applied

[1] For more details about the present case study, please see Ceresia (2008).

management growth policies are discussed. In the third part, the behaviour reproduction testing, an optimization analysis for parameter estimation and the scenario analysis are presented. Finally, limitations of the present research and conclusions are discussed.

2. Goal Setting and Managing by Objectives

2.1 Goal Setting

The Goal Setting Theory is considered one of the powerful motivational theories (Locke & Latham, 2002). The theory is based on the assumption that setting challenging goals, hard to reach (goal difficulty), yet well described (goal specificity), contributes to a general improvement in working performances (Latham & Baldes, 1975). A meta-analysis conducted by Tubbs (1986) confirms the hypothesis that setting challenging goals for workers, after a clear and detailed explanation of the objectives, positively influences their performance (see Tab 1).

2.2 Managing by Objectives

The goal setting theory underlines the importance of goal difficulty and specification in the improvement of workers' performance as well as the Management by Objectives approach (MbO) defines the entire process, which the goal setting procedure is part of.
The MbO theory, proposed by Drucker (1954), describes a procedure that takes into account the following 5 main steps or phases:

- Revision of Organizational Objectives: the manager explains to the workers the overall organization objectives.
- Setting Workers Objectives: the manager and the workers meet to agree on workers' objectives to be reached within a specific data.
- Monitoring the Progress: the manager meets with the workers at regular time intervals to monitor the workers' activities and goals already met.
- Evaluation of Performance: at the end of the operational period, the manager evaluates the workers' performance.
- Rewarding: the workers receive rewards, proportioned to the results achieved in relation to the objectives.

Megginson et al. (1992) highlight that the success of MbO as managerial practice results from a simple idea: the workers prefer to be evaluated following some criteria which they too consider realistic and reachable. The more organizational activities are designed taking into account these premises, the more workers' motivation increases, the more organizational goals are met.
Therefore, a model of goal dynamics in organizations should clearly state the causal relationship between goal setting and managing by objectives practices, workers' motivation and organizational performance.

3. Goal Commitment in Organizational Dynamics

Many scholars have stressed the importance of participation in the decision making process and acceptance of defined goals (goal commitment) for the determination of high performance standards. In accordance to these studies, a high level of goal commitment helps workers intensify their dedication and persistence to work and better their performance (Hollenbeck & Klein, 1987; Locke & Latham, 1990).

Scholars suggest that the management of goal setting procedures contributes to the enhancement of goal commitment levels in a participative set-up. Besides, high levels of workers' goal commitment accelerate the processes of skill acquisition, which is fundamental in carrying out particular tasks (Seijts & Latham, 2001).
Hollenbeck & Klein (1987) present a model of factors that may enhance the commitment to difficult goals. Commitment factors have been catalogued according to the attraction or expectation elicited in the attainment of a goal, and furthermore declined according to their personal or situational nature (see fig. 2).

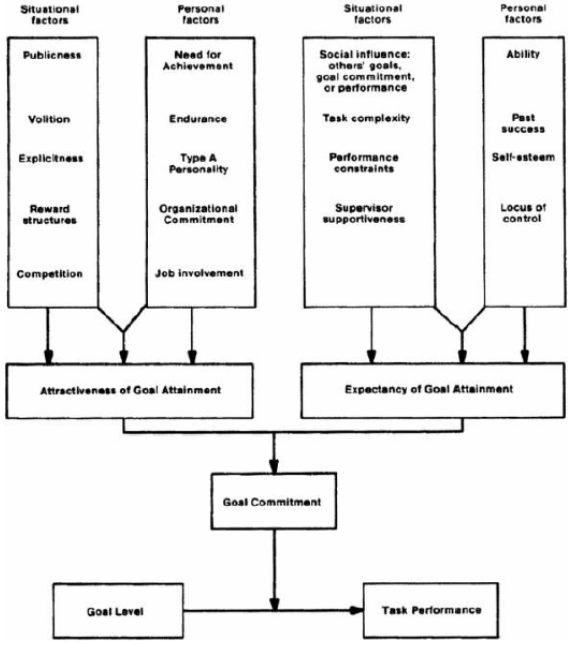

Figure 2. Expectancy theory model of antecedent factors and consequences of goal commitment (in Hollenbeck & Klein, 1987)

In the Expectancy Theory Model the level of goal commitment affects the causal relationship between goal and performance. More in details, goal specificity and stated difficulty resulted in a better performance if, and only if, the workers' goal commitment is high. In the opposite case: in the presence of a low level of goal commitment among the workers, the goal setting practice may even produce negative effects on performance.
The described hypothesis is confirmed by a meta-analysis conducted by Tubbs (1986), through which he shows that the effect size of the goal setting variables, acting on the performance, range between negative and positive values (for example, effect size for goal difficulty range between -.58 and .1.95) (see Tab 1).

Table 1. Overall Tests of Hypotheses - Direct Goal Measurement (in Tubbs, 1986)

Overall Tests of Hypotheses—Direct Goal Measurement

Hypothesis	*M*	*k*	*n*	*SD*	% s.e.	Range	95% C.I.
Goal difficulty	.816	56	4732	.409	26.6	−.58 1.95	.01 1.62
Goal specificity	.502	48	4960	.255	42.3	−.14 2.12	.00 1.00
Feedback	.564	3	176	.000	100.0	.31 .76	.56 .56
Participation	.002	17	890	.400	36.9	−.68 .99	−.78 .79

Note. Statistics reported in this table are those obtained after correcting for sampling error and unreliability. When the amount of observed variation in effect sizes was less than or equal to that which could be expected to be due to sampling error, a standard deviation of .000 is reported. *k* = number of results averaged; *n* = toal sample size across studies; % s.e. = percent of observed variance attributable to sampling error; 95% C.I. = 95% credibility interval.

Locke & Latham (2002) suggest that a high-performance cycle model characterizes the goal setting theory (see fig. 3). Specificity and difficulty of set goals positively affect the workers' performance, and this enhances the workers' satisfaction with performance and rewards. The more the workers' satisfaction increases, the more the will to commit to new challenging goals increases, and the more *goal commitment* and other moderator variables effect the causal relationship between goal setting processes and performance.

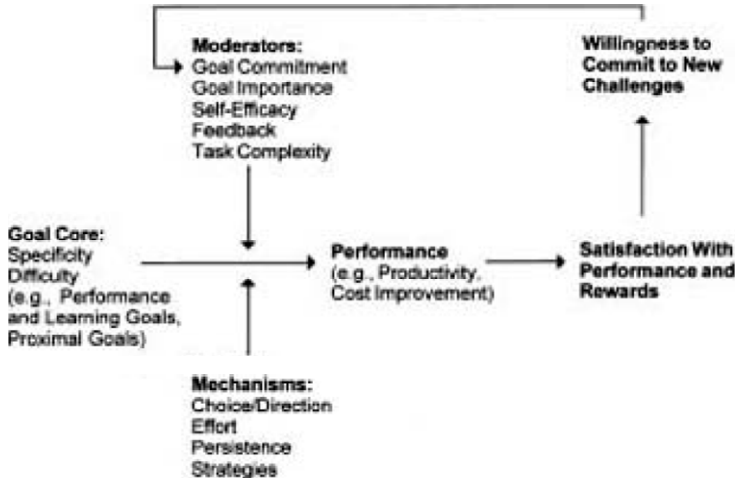

Figure 3. Essential Elements of Goal-Setting Theory and the High-Performance Cycle (in Locke & Latham, 2002).

As is evident, this model shows a feedback structure that is fully coherent with the system dynamics approach. That means that system dynamics may represent a powerful methodology in testing complex hypothesis in the goal setting field, until now empirically analyzed by sophisticated correlation methods, like structural equation models (Jöreskog & Sorbom, 1979).
In short, the empirical studies show that:

- goal commitment works as a moderator variable between goal setting and performance (Hollenbeck & Klein, 1987; Klein et al., 1999; Locke & Latham, 2002);
- goal commitment is a key-variable in a high-performance feedback (Locke & Latham, 2002).

Furthermore, Bass (1985) underlines that if the management adopts a transformational leadership approach, this can enhance the workers' motivation and produce a "performance beyond expectations" phenomenon, well-known in managerial literature (Bass, 1985). That is, if managers consciously use human resource management practices, they can reach goals and levels stretching far beyond their own expectations.

4. Training and Workers' Ability

Training is one of the most well-known and powerful tool among the human resource management practices. Managers take this practice into account to develop workers' skills and competencies. Then, it is possible to hypothesize that workers' ability, as well as personal anticipation of goal attainment, increases if management adopts effective training policies.

5. MbO Practices and Situational Antecedents of Expectancy of Goal Attainment

According to the Expectancy theory model of the antecedents of goal commitment, it is possible to show how MbO positively affects the situational antecedents of attractiveness and expectancy of goal attainment, as now described:

- Social influence: many studies have shown that knowing how others have performed on similar tasks influences self-set goal difficulty. A worker's commitment to difficult goals will be higher when those around him have similar goals, as opposed to when those around him have easier goals (Earley & Kanfer 1985, Rakestraw & Weiss, 1981). During the second phase of MbO, in which the manager and the worker meet to agree on goals to reach, the manager can give to the latter some information about his colleagues' past performances and goals. By doing so, the worker is more confident that the goals, assigned to him/her, are reachable and realistic.
- Task complexity: in difficult or complex tasks, the relationship between endeavour and performance will not be as strong as on simple tasks, and this may cause a reduction of workers' goal commitment (Earley, 1985). The second phases of MbO can restrain this risk by assigning a task coherent to the worker's resources, while during the third one, the manager can give effective support to the worker, helping him/her to solve the work difficulties.
- Performance constraints: some researches outline the influence of situational constraints on work outcomes, such as company performance and profitability. The presence of such performance constraints diminishes the expectancy of goal attainment (Peters & O'Connor, 1980). In relation to MbO practices, when a manager sets the workers' goals, he/she has to be sure that the failure to achieve the goals cannot be readily attributed to factors beyond the workers' control.
- Supervisor supportiveness: it is important for a worker to be confident that his/her boss is willing to listen to his/her opinions. Difficult goals assigned by such supervisors will probably be perceived as more realistic, causing a higher level of goal commitment (Latham & Saari, 1979). Referring to MbO practices, during the third phase a manager should pay attention to the worker's opinion and ideas, helping him/her approach the difficulties in a more confident way.

6. Beta s.r.l. Household Electrical Appliances Division: The Case Study

Beta s.r.l. is a small company of young business men, dealing with computers and mobile phones since 1991. After a slow but sure growth, the company expanded its business into a new line of products: household electrical appliances.

Beta s.r.l. created a division within the company for the purpose of commercializing the new products. The division resulted from the acquisition of another firm: Alpha s.r.l., which had been working in the distribution of electrical appliances. At the time of the acquisition, Alpha s.r.l. was buying from a sole supplying company, which, due to its international impact and high quality products, kept a strong contractual capacity against Alpha s.r.l.. On the other hand, Alpha s.r.l. was the exclusive distributor throughout the nation. In this venture the board of administration for the new division

was represented by members of Beta s.r.l. and also, minority quota, by members of Alpha s.r.l.

6.1 Beta s.r.l. Household Electrical Appliances Division: business firm

Beta s.r.l.'s business is to buy goods from the suppliers and to sell them through a network of sales agents throughout the national territory. The merchandise is kept in two large stock houses, property of a different company which is also engaged in shipping the goods to retailers.

The company keeps a general price list, indicative of cost, used to determine selling prices by adding a percentage standard mark-up. The selling prices are determined on a nationwide basis. The variables concurring in the determination of the mark-up percentage are cost and marketing strategies (business status is more important than business bulk). The final selling price may vary from 5 to 7 points of percentage, in relation to business swings during the year.

The goods distributed are generally of medium obsolescence rate and vary in cost prices and consequent selling prices. Beta s.r.l. holds a distribution agreement of exclusiveness with the manufacturer, for Alpha s.r.l. merchandise.

6.2 The dynamics of some system key-variables

After a dynamic analysis of revenue and sales data (see figure 4 and 5), it appears that these figures are definitely influenced by factors attaining to two major areas:

a. general market movements for the products commercialized by Beta s.r.l.
b. changes introduced in Beta s.r.l., following the acquisition of Alpha s.r.l., which have increased its market quota.

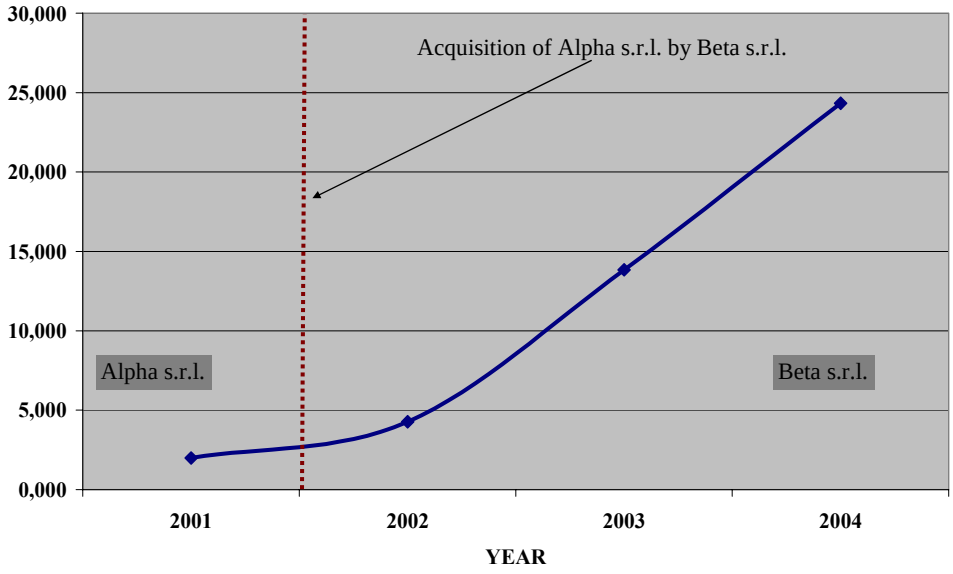

Figure 4. Total number of goods sold in every operational year. Data referring to the year 2001 results from activity prior to the acquisition of Alpha s.r.l.

As shown in figure 6, Beta s.r.l. registered a general demand increase of its commercialized goods, which cannot alone be responsible for the home sales increase registered in the period 2001-2004 in Italy. It is hypothesized that this performance is a result of specific choices in commercial and financial management for the purpose of becoming more competitive, made by the management of Beta s.r.l.

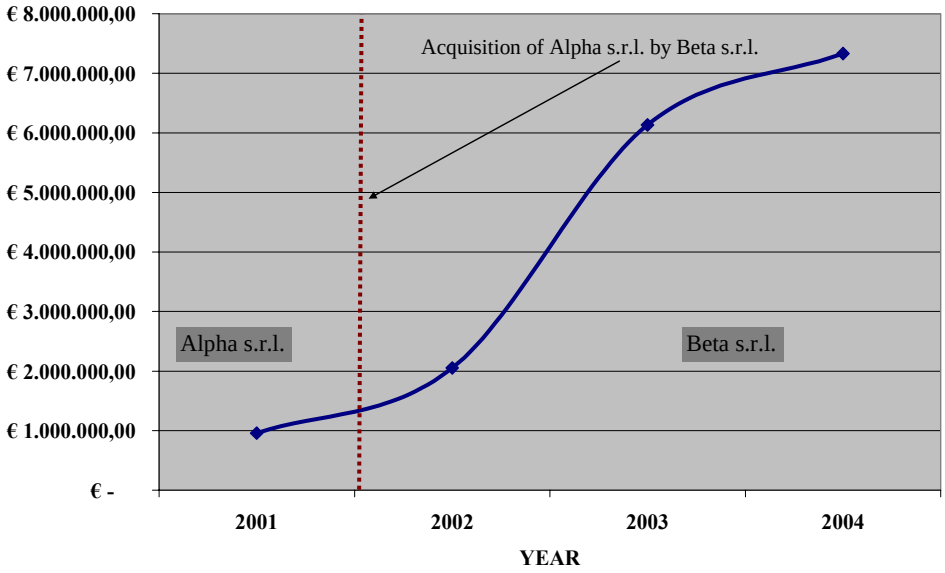

Figure 5. Yearly income. Data referring to the year 2001 results from activity prior to the acquisition of Alpha s.r.l.

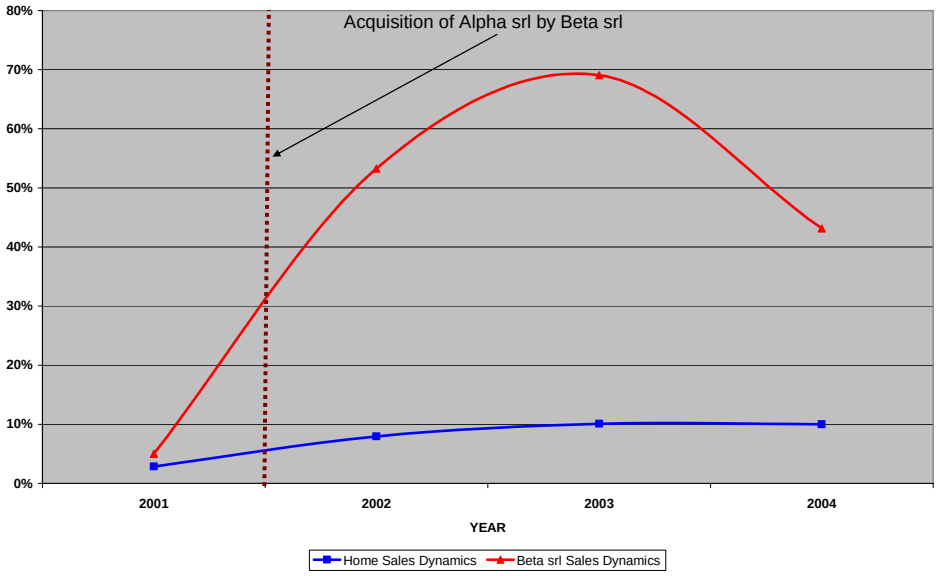

Figure 6. Sales increase expressed in percentage, compared to the precedent year, relative to products commercialized nationwide and those commercialized by Beta s.r.l.. Data referring to the year 2001 results from activity prior to the acquisition of Alpha s.r.l..

Analyses and monitoring of the main company business processes have allowed researchers to assess the importance of the goal setting practices adopted by the company management in generating the higher level of organizational performance during the last three operational periods (2002 – 2004). Managers of Beta s.r.l. have concretely supported a deep interaction between goal setting practices and the general business of the company. The next paragraph will specifically illustrate the cause-and-effect relation between structural key-variables in the firm, responsible for the final results in products sales dynamics. The feedback that underlies the business dynamics

will be highlighted and the connections between tangible and intangible variables will be traced, for the construction of an integrated model of goal dynamics in organizations.

7. The Causal Loop Diagram of a Model of Goal Dynamics in Organizations

In this section, the causal loop diagram of the cause-and-effect relationship between the key-variables of the considered social system is outlined.
In order to facilitate the explanation of the system dynamics model of goal dynamics in organizations, a structure that represents the commercial activities of a firm has been built. The stock generically called "state" in the Barlas & Yasarcan (2008) model, here is called *products sales*. As a consequence, the stock inflow called "improvement" now is called *shipment*. In a few words, this model attempts to represent - without any pretension of being exhaustive – the behaviour of a hypothetic Commercial Department of a firm that wants to reach its organizational goals through Goal Setting, MbO and Training policies. The model structure shows ten main feedback loops (see fig. 7), that will be described in the following subsections.
It is necessary to clarify that this model includes only the expectancy of goal attainment as antecedent variable of goal commitment. This choice has been made to simplify the presentation of the model, considering that the aim of this paper is not to build a full model of goal dynamics in organizations, but just to underline the role of goal setting, management by objectives and training on goal setting and then on company performance.

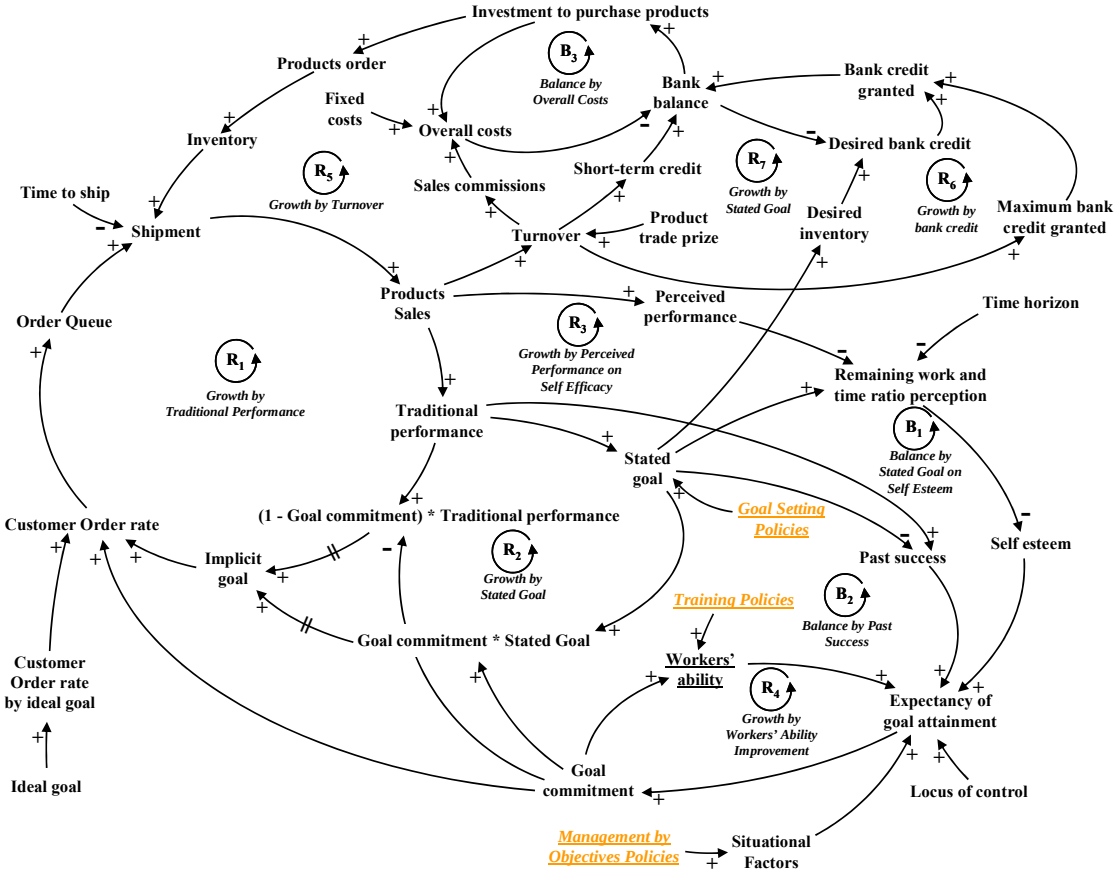

Figure 7. The Causal Loop Diagram of the Model of Goal Dynamics in Organizations.

7.1 R_1: Growth through Traditional Performance

Traditional performance plays an important role in effecting workers' performance. Since traditional performance refers to the workers' confidence on their past performance, it is hypothesized that this confidence influences the workers' perception about the possibility of reaching goals that are more difficult than past ones (Barlas & Yasarcan 2008, Forrester 1975, Senge, 1990, Sterman 2000). Besides, the hypothesis that confidence influences individuals' perception is confirmed by the Personal Construct Theory (Kelly, 1955).

Since *traditional performance* has been interpreted as workers' beliefs about their past performance, to model this variable we have to understand how the workers form these beliefs. From this point of view, workers need (a) an information system that allows them to recover the organizational data, which can foster beliefs, and (b) an adequate time span to develop some beliefs about past performance.

In the proposed model we assume that the workers analyze the data about the state of the system (*products sales*) every two weeks, when the company sends them the products sales report. Therefore, the last issue is to set an adequate time span during which the workers need to build these beliefs once they can read the real data, which we can estimate to be of two weeks. So, we may assert that workers need one month to build their *traditional performance belief*: the same solution that Barlas & Yasarcan (2008) propose, when they talk about a "tradition formation time" of 30 days.

But to correctly approach this issue, it is necessary to focus on the following aspects:

- a worker can built a belief even in a very short time, especially if the observed data is powerful, not ambiguous or doubtful, as seems to be in our case;
- once a worker has built a belief, it is unlikely that he changes it frequently. A belief is a mental structure that – in some circumstances – even resists obverse events; for example, the alibi that sometimes a worker builds to justify his/her behavior is one of the most common and interesting organizational phenomenon explored by many managerial theories;

As a consequence of these two aspects, it seems problematic to imagine that *traditional performance* could change as a delay function of *products sales*. The *products sales* stock changes every timestep, but it is difficult to imagine that a worker may change his belief every week or month, in accordance with the timestep adopted by the modeler.

Moreover, a delay function of *products sales* adopted to define *traditional performance* may force the model to change workers' belief even when it would not be changed by workers themselves.

An exemplification can help us to better understand the problem. Let us suppose that workers analyze the data about company *products sales* quantities every week, when the company sends them the products sales report. Now, let us imagine that the report of the first week of the calendar year shows that the *products sales* quantities are 50% more than the expected value. Adopting the delay function, we should observe a change of the *traditional performance* variable that starts at the end of the first week and increases in accordance with the delay function adopted by the modeler. But the workers could assume that the gap between the observed and expected data has a marginal meaning (for example, it may seem a consequence of a context variable), not sufficient at all to change their belief about the *traditional performance* trend. So they could decide to wait until the end of the year to be sure that the change of their belief is fully motivated.

As figure 8 shows, the delay function in traditional performance produces, in the first two months of every operational period, a behavior that is really unacceptable. The deep gap between *traditional performance* (the workers' belief) and *products sales* (the real data) during these two months is exclusively the consequence of the delay function effect. Neither a deep gap between past state (*traditional performance*) and actual state (*products sales*) could make broadly realistic a prompt change of traditional performance. In fact, if a gap between past state (*traditional performance*) and actual state (*products sales*) should occur, the change is guaranteed by an *implicit goal* variable, that changes towards *stated goal* or *traditional performance* because of workers' *goal commitment*, as will be shown in the next subsection. Yet this effect takes its time. From a conceptual (non-mathematical) point of view, the effect of *products sales* on *traditional performance* is delayed by two balancing feedbacks (B_1, B_2) and three reinforcing feedbacks (R_2, R_3, R_4), because workers will want to take their time to better understand the work situation before changing their beliefs.

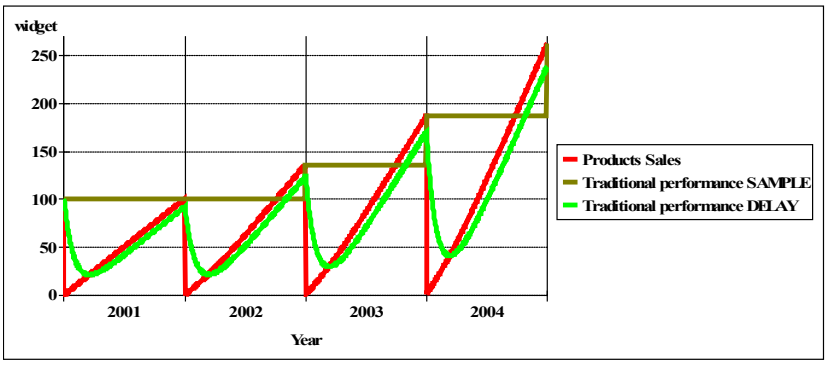

Figure 8. Traditional performance (sample and delay function) behaviours generated by the model when stated goal is increased of 50% during 2002, 2003 and 2004 operational periods.

In the proposed model *traditional performance* is interpreted as a fixed variable during the operational period. Its values do not change during the whole goal setting operation period. The following is the model equation[2] for *traditional performance*:

(2) Traditional performance = SAMPLE (('Products Sales'); STARTTIME + 1<<yr>>; 1<<yr>>; 'Products Sales')

Barlas & Yasarcan (2008) suggest the consideration of an intangible variable called "implicit goal", which refers to an undeclared goal that the workers seek, despite the stated goal that has been expressly assigned to them. Since this model represents the commercial activities of a company, *implicit goal* effects positively *customer order rate*. The more the *customer order rate* increases, the more the *order queue* rises and as a consequence, hence more products are shipped (obviously, if the *maximum shipment capacity* variable do not act as a constraint), increasing the value of the *products sales* stock. The following are the model equations for *implicit goal, customer order rate, order queue, shipment and products sales*:

(3) Implicit goal = DELAYINF((('Goal commitment' * 'Stated goal') + (1 - 'Goal commitment') * 'Traditional performance'); 2<<wk>>; 3)

[2] The "sample" function and the others functions presented in this paper are coherent with Powersim Studio 7 language.

(4) Customer order rate = MIN ('Customer Order rate by ideal goal'; IF ('Goal commitment' > 0,5; ('Implicit goal' + ('Implicit goal' * 'Goal commitment'^10))/'Time to order'; ('Implicit goal' - ('Implicit goal' * (1-'Goal commitment') ^10)/ 'Time to order'))

(5) Order queue = Order queue (t – dt) + (Customer order rate – shipment) * dt

(6) Shipment = MIN ('Orders queue'/'Minimun time to ship'; 'Maximum shipment capacity')

(7) Products sales = Products sales (t – dt) + (Shipment - Restart product sales) * dt

It is now necessary to make some considerations about the model equations for *implicit goal*, *customer order rate* and *products sales* variables.
Regarding *implicit goal*, in accordance with the Barlas & Yasarcan (2008) model, a third-order delay function has been introduced that represents the time workers need to form the new *implicit goal*, when *traditional performance* or *stated goal* change. However, the strength of *traditional performance* or *stated goal*, in determining the final value of *implicit goal*, is not influenced by workers' short term and accomplishment motivation variable, as proposed in the Barlas & Yasarcan (2008) model, but by workers' *goal commitment*, in accordance with the results of empirical psychosocial researches (Locke & Latham, 2002).
Regarding *customer order rate*, it is possible to note that the value of this variable is the minimum value between *Customer order rate by ideal goal* and an IF function that will be explained further in the paper. *Customer Order rate by ideal goal* is merely the value of *ideal goal* divided by the model operational period (1 year). It represents the normal *Customer order rate* the system could show if the best goal for the system were achieved: defined as the best goal which a company may hope for, when all of its resources are exploited at the top level.
Namely, *ideal goal* is a variable counterbalanced on one hand by the organizational capacities, on the other by the environmental constraints (competitors, market specificity, etc.). In accordance with the perspective adopted in the present paper, *ideal goal* does not influence *stated goal* because the model has to replicate, if required, the "performance beyond expectations": a well-known phenomenon in managerial literature (Bass, 1985). Obviously, managers take into account the ideal goals in setting their objectives but (a) they do not often have a clear idea about the size of ideal goals, and (b) the model has to allow the managers, underestimating or overestimating the firm's improvement capacity (that is, the workers' motivation and competence), to set goals that the system (the company) will overcome or fail. The IF function in the *customer order rate* equation, allows the system to perform better (or worse) than the workers' expectations and managers' goals (respectively, *implicit goal* and *stated goal*). In fact, it is assumed that when the *goal commitment* value is equal to or greater than 0,5 the *customer order rate* increases, due to a multiplying effect (implicit goal * goal commitment). The system will show the opposite behavior, when the *goal commitment* value is lower than 0,5. This multiplying effect is mitigated by an exponential function (see equation 4).
Regarding *products sales* stock, we can note an outflow called *restart products sales* that, at the end of every operational period (1 year), repositions the stock value to level zero. The simulation period started on 30/12/2000 and ended on 30/12/2004, with 4 operational periods of 1 year each. Figure 9 highlights the effects of the *restart products sales* outflow variable on *products sales* stock.

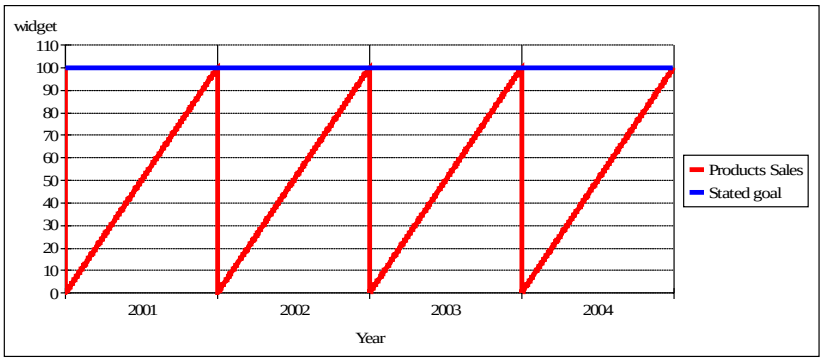

Figure 9. Goal seeking behaviour generated by the model where the effect of restart products sales outflow variable on products sales stock is shown.

7.2 R_2: Growth through Stated Goal

Stated goal variable is interpreted as a fixed variable during the operational period. Accordingly with MbO theory, managers set the goals (*stated goals*) before starting the operational period, and they do not change them during its course . Sometimes it may occur that, due to unpredictable events that can affect organizational performance, the management decides to reassign new goals to workers, but not more than once a year and, anyway, this is more an exception rather than a rule. So, *stated goal* variable is interpreted as a fixed variable during the operational period, and its value changes only under the effects of the management goal setting policies. Since, in this model, the operational period coincides with the calendar year (as happens very frequently in a company), at the beginning of the year *traditional performance* changed once, in coherence with *product sales* value, while *stated goal* changed once, as a function of traditional performance, aside from an increment defined by goal setting policies adopted by company management. The following is the model equation for *stated goal*:

(8) Stated goal = SAMPLE ('Traditional performance' + ('Traditional performance' * 'Goal Setting'); STARTTIME; 1<<yr>>; 'Traditional performance' + ('Traditional performance' * 'Goal Setting'))

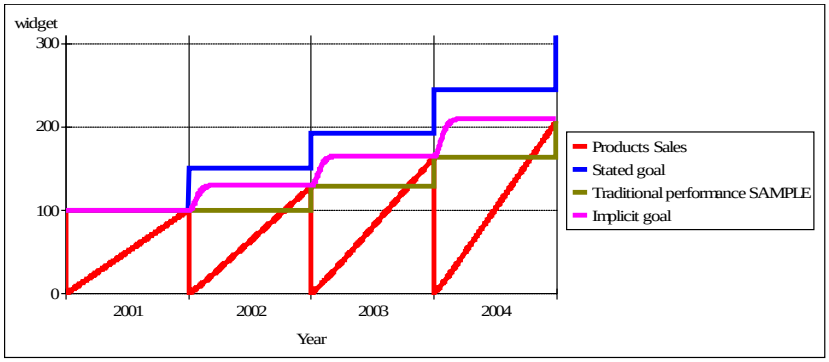

Figure 10. Goal seeking behaviour generated by the model when stated goal is increased of 50% during 2002, 2003 and 2004 operational periods.

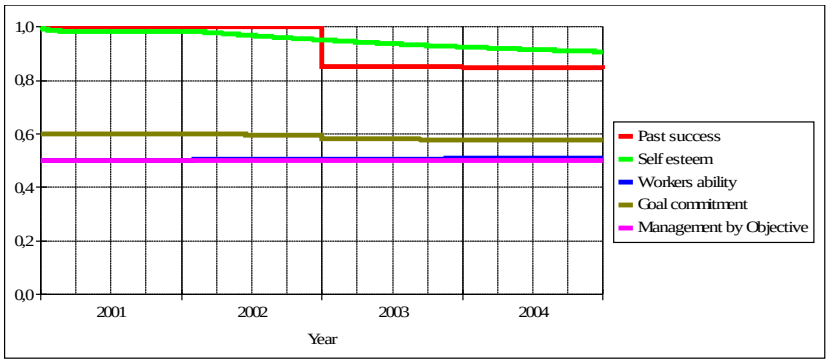

Figure 11. The dynamics of intangible variables in the model generated by the model when stated goal is increased of 50% during 2002, 2003 and 2004 operational periods.

Figures 10 and 11 show the movements of *stated goal, products sales, traditional performance and implicit goal,* and other intangible variables in the model, when *stated goal* is increased, in relation to the previous year, of 50% during 2002, 2003 and 2004 operational periods, as a consequence of a goal setting policy adopted by the company management.
The above described behavior represents a typical goal erosion phenomenon, caused by the low value of *goal commitment* which levels the value of *implicit goal* on *traditional performance* rather than on *stated goal*.

7.3 R_2: Growth through Perceived Performance on Self Esteem

In this feedback loop we can observe that *perceived performance* is a function of *products sales*. The following is the model equation for *perceived performance*:

(9) Perceived performance = MAX (0<<widget>>; NORMAL ('Products Sales'; 'Products Sales'/20))

We can note that both perceived performance and traditional performance are psychological variables, that is, they are in the mind of workers: while the former is considered as a random (normal) function of *products sales*, the latter is interpreted as a fixed variable of each operational period. Furthermore: why do these two different variables not influence one another in the model?
Even if both variables are psychological ones, perceived performance is an immediate psychological perception of products sales quantities changing over time, yet the described perception cannot correspond to the real data which the perception refers to, due to the lack of products sales quantities company reports at each timestep. Traditional performance, as already explained in the previous subsection, is not merely a perception. It is a belief, and the rules that govern the change of a belief in an individual are quite different in comparison to the ones governing the change of perception in an individual.
As the equation (9) shows, in this model the perceived performance is not a delay function of products sales. Usually, system dynamics modelers utilize this useful function to represent human perception of some real data. A delay function returns the nth-order exponential information delay of input, using an exponential averaging time equal to delay time and a given delay order. However that may be, this function can

produce two main different behaviours: (a) if the delay time is not high and the input variable does not change its value in a consistent way, after some time the value of the output variable (perception) will reach the value of the input value; (b) if the delay time is high or the input variable changes its value substantially, the output variable can register an oscillatory behaviour.
But in this case, the issue is that the workers build a representation (perception) of the real data that can be affected by individual, group or organizational attitude. For example, a specific work team can show a proclivity to overestimate (or underestimate) the value of a performance variable. It is difficult to imagine that all workers - in the absence of the real data, provided by a reliable report – will build a representation which changes by simply trying to fill the gap between perception and real data.
In this model, *perceived performance* is modeled as a random function of *products sales*, with *products sales* as mean and *products sales* divided by the number 20 as standard deviation. That means that workers overestimate or underestimate in a casual way and with a small variance due to the frequent availability of products sales reports.

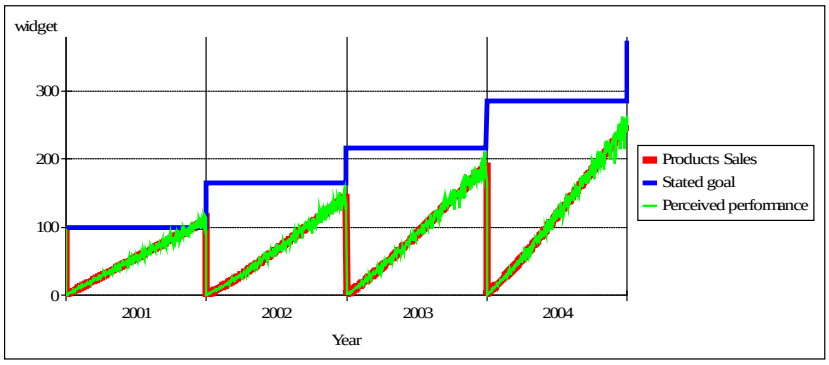

Figure 12. *Perceived performance* (normal function) behaviour generated by the model when *stated goal* is increased of 50% during 2002, 2003 and 2004 operational periods.

Figure 12 shows the effect of random function (normal function) on *perceived performance*. This behaviour was generated by the model when stated goal was increased of 50% during 2002, 2003 and 2004 operational periods.
Instead, figure 13 shows the effect of delay function (delay = 4 wk; order delay = 3) on *perceived performance*. This behaviour was generated by the model when stated goal was increased of 50% during 2002, 2003 and 2004 operational periods. As it is possible to observe in this second case, in the first months of every operational period the behaviour of *perceive performance* shows the same pattern of *traditional performance*.

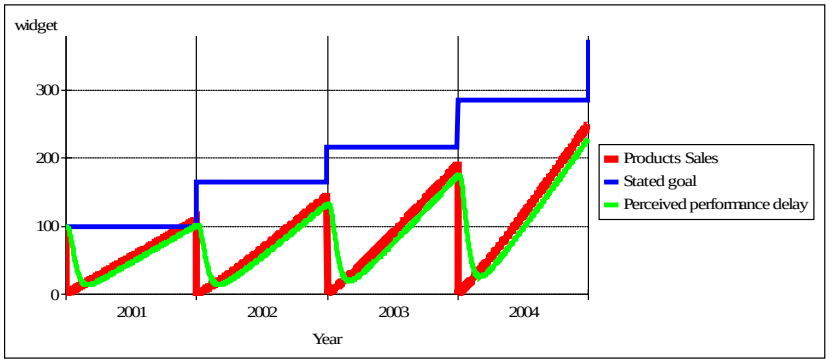

Figure 13. *Perceived performance* (delay function) behaviour generated by the model when *stated goal* was increased of 50% during 2002, 2003 and 2004 operational periods.

As already discussed about traditional performance, the deep gap between *perceived performance* (the workers' representation) and *products sales* (the real data) during the first two months of the operational period is exclusively due to the delay function effect. As figure 14 shows, the effect of *perceived performance* on *remaining work and time ratio perception* deeply changes if the modeller adopts the random or delay function to define *perceived performance*.

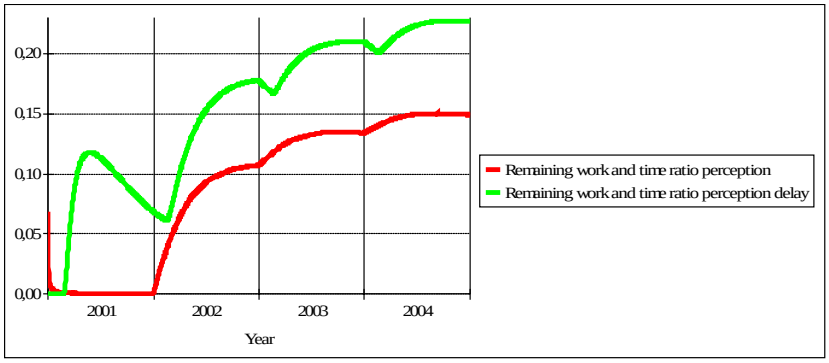

Figure 14. *Remaining work and time ratio perception* behaviour affected by *perceived performance* (random or delay function) and generated by the model when *stated goal* was increased of 50% during 2002, 2003 and 2004 operational periods.

Turning to the feedback loop, *perceived performance* negatively affects *remaining work and time ratio perception* that, in turn, negatively affects workers' *self-esteem*. In accordance with the Expectancy Theory of the antecedents of goal commitment (Hollenbeck & Klein, 1987), *self-esteem* is positively related to *expectancy of goal attainment* and therefore, with *goal commitment*. In turn g*oal commitment* affects *customer order rate*, as already explained.
The following are the model equations for *remaining work and time ratio perception*:

(10) Remaining work and time ratio perception = RUNAVERAGE (MAX (0; 1-(('Perceived performance'/'Time Horizon')/ ('Stated goal of the current year'/360))))

whereby

(10.1) Stated goal of the last year = SAMPLE ('Stated goal'; STARTTIME + 1<<da>>; 1<<yr>>;'Traditional performance')

(10.2) Time horizon = Time horizon (t – dt) + (Time horizon filling rate - Time horizon depletion rate) * dt

whereby

(10.2.1) Time horizon filling rate = 1/1<<da>>

(10.2.2) Time horizon filling rate = 'Time restart' * IF (MONTH_=12 AND DAY_=30;1;0)

(10.2.3) Time restart = 360<<1/da>>

Remaining work and time ratio perception is a normalized ratio estimate of how many days would be necessary to breech the gap between the *perceived state* and the *stated goal*. As the reader can note, the *stated goal of the last year* variable is merely the *stated*

goal variable without the influence of the increasing (or decreasing) effect of the goal commitment policies, adopted by management at the end of each operational period.
The following are the model equations for *self-esteem, expectancy of goal attainment and goal commitment*:

(11) Self-esteem = RUNAVERAGE(IF('Stated goal'>='Ideal goal'; 1; (1-'Remaining work and time ratio perception')))

(12) Expectancy of goal attainment = Ability*'Ability PAR'+ 'Locus of control'*'Locus of control PAR'+ 'Past success'*'Past success PAR'+ 'Self esteem'*'Self esteem PAR'+ 'social influence others performance and goals'*'Situational Factor PAR'+ 'Task Complexity'*'Situational Factor PAR'+ 'Performance Constraints'*'Situational Factor PAR'+ 'Supervisor Supportiveness'*'Situational Factor PAR'

(13) Goal commitment = 'Expectancy of goal attainment'

Self-esteem is a specific function of *Remaining work and time ratio perception* that returns the complementary accumulated average of *remaining work and time ratio perception,* valued after each operational period run. This function has been selected to moderate the variability of *self-esteem* over time. Being a personal perception, it is unlikely for an individual to change his/her *self-esteem* perception each month. Besides, the IF function has been included to prevent the value of *self-esteem* from decreasing whenever the management sets goals that are impossible to reach: equal to or greater than the ideal goal.
Expectancy of goal attainment is a function of the situational and personal antecedents described in previous sections. A parameter has been associated to each antecedent, in order to specify the impact every antecedents plays on the *expectancy of goal attainment* variance. These parameters have been identified through empirical studies that explore the quantitative relationships between *expectancy of goal attainment* and the mentioned antecedents.
Finally, more specifically, *goal commitment* is merely a function of *expectancy of goal attainment*, rather than a balancing function between *expectancy of goal attainment* and *attractiveness of goal attainment.*

7.4 R_4: Growth through Workers' Ability Improvement

Some scholars underline that goal commitment speeds up the ability acquisition process of workers (Seijts & Latham, 2001). A high level of goal commitment accelerates the processes of acquisition of the specific skills, fundamental for the accomplishment of particular tasks. Since, *goal commitment* is positively linked to *workers' ability*, which positively affects *expectancy of goal attainment.*
The following is the model equation for *workers' ability*:

(14) Workers' ability = Workers' ability (t – dt) + (Workers' ability improvement rate) *dt

whereby

(14.1) Workers' ability improvement rate = ('Ability MAX' - 'Workers' ability') *' Goal commitment'^10/ 'Time to improve Ability by Goal Commitment' * Training

As the reader can observe in the workers' ability equation, no outflow is represented to express a normal workers' ability depletion rate. The reason is that this variable simply represents the change of stock level due to the effect of *goal commitment*. Then, it is assumed that the hypothetical inflow and outflow that we could call, respectively "normal workers ability improvement rate" and "normal workers ability depletion rate", cancel each other out. Besides, the amplification effect due to *goal commitment* in equation 14.1 is mitigated by an exponential function, so that the *goal commitment* effect on *workers' ability* becomes greater with an exponential trend.

7.5 B_1: Balance between Stated Goal on Self Esteem

In this feedback loop the *stated goal* positively effects the *remaining work and time ratio perception*. Then the more the *remaining work and time ratio perception* increases, the more *self esteem* decreases. Some researches underline that a high self-confidence, characteristic of a high self-esteem in workers, is associated with a high confidence in the probabilities of reaching difficult goals. In an empirical research, Hall & Foster, (1977) showed that a high self-esteem is associated with the choice of high goal levels. In accordance with these evidence, the more *self esteem* increases, the more *expectancy of goal attainment* rises. All the variables of this feedback have been described in the previous subsections.

7.6 B_2: Balance through Past Success

Future goals are apt to be higher following success rather than after failure. This premise well explains the meaning of this feedback. *Past success* is affected positively by *traditional performance* and negatively by *stated goal*. The more *past success* increases, the more *expectancy of goal attainment* rises. The following is the model equations for *past success*:

(15) Past success = IF('Stated goal'>='Ideal goal';1; SAMPLE ((MIN(1;'Traditional performance'/ 'Stated goal of the current year'));STARTTIME + 1<<yr>>; 1<<yr>>; MIN(1;'Traditional performance'/ 'Stated goal of the current year')))

where the MIN function is delimited to the value of 1 year of *past success*, in case the *traditional performance* value should overcome *stated goal of the current year* value. The SAMPLE function is adopted because the evaluation of the results of the past performance is made when the operational period has been completed. Finally, the IF function is meant to prevent a decrease of the value of *past success* whenever the management sets goals that are impossible to reach: equal to or greater than the *ideal goal*.

7.7 R_5: Growth through Turnover

The more the company sells its products, the more the turnover grows and, as a consequence, the more the *short-term credit* increases. The customer delay of payment policy adopted by the company effects the short-term credit collection rate and, hence, the *bank balance*. If *bank balance* increases, the company can invest more money in

purchasing new products from its suppliers. The more the investment in purchasing products grows, the more the orders of products increase and, consequently, warehouses bulk and shipments as well as products sales rise. The following are the model equations for *turnover, short-term credit, bank balance, investment to purchase products, products order and inventory*:

(16) Turnover = 'Products Sales'*'Average product trade prize'

(17) Short-term credit = Short-term credit (t – dt) + (Short-term credit rate - Credit collection) * ds

whereby

(17.1) Short-term credit rate = Shipment*'Average product trade prize'

(17.2) Credit collection = 'Short-term credit'/'Customer delay of payment'

(18) Bank balance = Bank balance (t – dt) + (Bank credit granted + Credit collection – Interest expenses rate - Interest bank credit granted rate - Investment to purchase products rate - Other payments) * dt

(19) Investment to purchase products = Investment to purchase products (t – dt) + (Investment to purchase products rate - Restart investment to purchase products) * dt

whereby

(19.1) Restart investment to purchase products = 'Investment to purchase products' * IF (MONTH_=1 AND DAY_=2;1;0)

(20) Products order = PULSE('Purchasable products'; STARTTIME + 2<<da>>; 1 <<yr>>)

whereby

(20.1) 'Purchasable products' = 'Investment to purchase products'/'Average product wholesale prize'

(21) Inventory = Inventory (t – dt) + (Products order rate – Shipment) * dt

7.8 R_6: Growth through Bank Credit

Turnover affects the maximum credit granted by banks, and this causes the improvement of bank credit granted to the company. The more the bank grants financial credits to the company, the more the bank balance increases, with the consequence that the company can purchase more products. The rest of the feedback has been already explained in the previous subsections. The following are the model equations for *Maximum bank credit granted* and *Bank credit granted:*

(22) Maximum bank credit granted = Turnover * '% Bank credit granted on turnover'

whereby

(22.1) '% Bank credit granted on turnover' = 30%

7.9 R_6: Growth through Stated Goal

The more the management sets high levels of stated goals the more the desired inventory increases, as well as the value of the desired bank credit. The rest of the feedback has been already explained in the previous subsections.
The following is the model equation for *desired inventory:*

(23) Desired inventory = SAMPLE ('Stated goal' – Inventory + 'Safety inventory'; STARTTIME; 1<<yr>>)

7.10 B_3: Balance of Overall Costs

The reinforcing feedback loops that effect the bank balance dynamics are balanced by the overall costs of the company's operational management, obviously.
The sum of the funds that are necessary in order to purchase the products, to pay the fixed cost and the sales commission for the agents, represent the overall cost variable that negatively effects the bank balance stock. Therefore, the lowering of the bank balance causes the reduction of the investment to purchase products that the company needs to satisfy the customer's demand. The following is the model equations for *overall costs:*

(24) Overall Costs = Investment to purchase products rate + Fixed costs + Sales commissions

8. The Company Management of Directional Levers

Table 2 shows the value set to the three main directional levers, as they were managed by the company during the four operational periods.

Table 2. Value of directional levers as managed by company

	30/12/2000	30/12/2001	30/12/2002	30/12/2003
Goal Setting	0 %	150 %	200 %	60 %
MbO[3]	0,4	0,8	1	1
Training[4]	1	3	3	1

8.1 Goal setting policy

Concerning goal setting policy, before the acquisition of Alpha by Beta, the management company decided to set the goal for the first operational period (2001) at the same level as the previous period (2000). That's means that the value of goal setting variable was 0 %, there was no increment between the goal set in 2000 and the goal set in 2001. The acquisition of Alpha by Beta produced a relevant change in company goal

[3] *MbO variable is modelled as a constant that can vary between 0 (very poor management of MbO) and 1 (really good management of MbO).*

[4] *Training variable is modelled as a constant that can vary between 1 (no training activities) and 5 (very effective training activities).*

setting policy. In fact, the management set the goal for the second operational period (2002) at 150% increase, that is, two times and a half higher than the previous operational period. It is necessary to underline that the new goal setting policy adopted by company management was supported by a significant increase of investment in purchasing products, as a consequence of higher bank credit granted, due to the higher turnover of Beta compared to that of Alpha. During the third operational period (2003), the company management set the goal setting on 200% increase, which is three times higher than the previous operational period. For the last operational period (2004), the management decided to set the goal setting at 60% increase.

8.2 Management through Objective policy

As underlined in the 6.2 subsection, the company management of Beta adopted a management by objective policy to improve the efficiency of their commercial network. As table 2 shows, before the acquisition by Beta, the management by objective practice was developed by Alpha in a weak way (MbO = 0,4). In fact, Alpha's managers adopted the "do your best" practice on behalf of its agents, giving them a sales commission at the end of each operational period.

Instead, Beta's managers adopted a strong and rigorous Management by Objective policy from the beginning of the operational activities, obviously with a development pattern which permitted the achievement of higher values in MbO practice (0,8) in the second operational period (2002), and the maximum value in MbO practice (1) in the last two operational periods (2003 - 2004).

8.3 Training policy

Before being acquired by Beta, Alpha did not adopt any training policy for its agents. Instead, Beta decided to invest in training activities for its agents, in order to develop personnel's skills and ability. During the last operational period (2004) the training activities were stopped because the managers did not register a deep gap between effective competencies and required competences.

9. Model Validation: The Behavior Reproduction Test

A first step model validation has been made comparing two series: products sales quantity real data and products sales quantity provided by the SD model[5]. As shown in figure 15, the products sales quantity provided by the model overlap the products sales quantity related to reference data in a quite satisfactory way. As table 3 shows in details, the gap between real data and current data is really shallow during the first two operational periods and a little deeper during the last two operational periods.

The value of the coefficient of determination (R^2), which measures the fraction of the variance in the data explained by the model, is high (R^2 = 0,9737). This measure conformity tells us that the model replicates, in a satisfactory way, the real (or actual) series. However, as some researchers underline, R^2 can not reveal (and reflects) the presence of an absolute error that affects two series (Sterman 2000; Georgantzas 2003).

[5] This model does not take into account the periodicity of product sales dynamics. In fact, in this department the majority of the sales are made during summertime.

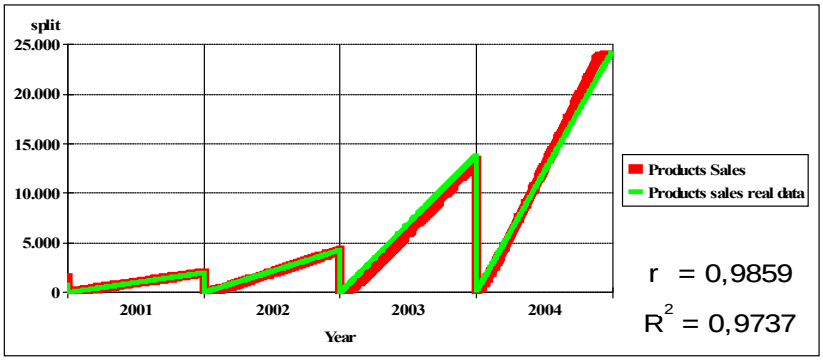

Figure 15. Overlapping between Products sales (current data) and Products sales real data with the value of r and R^2

Table 3. Comparison between Products sales current data and Products sales real data

	30/12/2001	30/12/2002	30/12/2003	30/12/2004
Real Data (Rd)	2.000	4.280	13.840	24.332
Current Data (Cd)	2.003	4.257	13.314	23.093
DELTA (Rd – Cd)	***- 3***	***+ 23***	***+ 526***	***+ 239***

For this reason the Theil's (1966) inequality statistic (TIS) has also been calculated. It provides a split analysis of the error, dividing the mean square error (MSE) into three components: bias (U^M), unequal variation (U^S) and unequal covariation (U^C) (Sterman, 2000). The Bias component generates when the model output and data have different means. Unequal variation component indicates that the variances of the two series differ. Unequal covariation component means the model and data are imperfectly correlated (Sterman, 2000). As underlined by Sterman (2000), errors due to a large bias are potentially dangerous and are usually due to systematic errors, like errors in parameters estimations. Errors due to a large unequal variation can occur if the model and the data match on average and are highly correlated but the variation in the two series around their common means differ. Finally, errors due to a large unequal covariation indicates that the model represents the means and the trend in the data coherently, differing from the real data only point by point. If U^C is large, according to Sterman: the "majority of errors are unsystematic, and so the model should not be faulted for failure of matching the random component of the data" (Sterman, 2000).

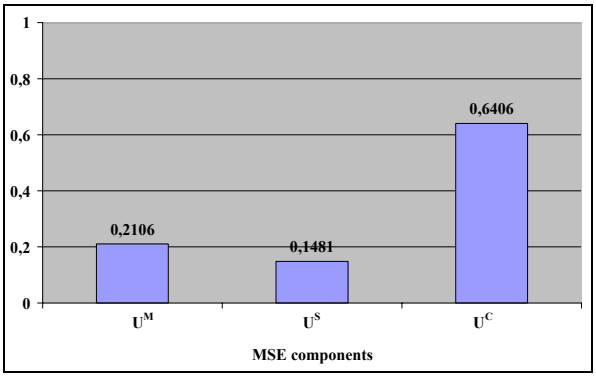

Figure 16. The values of the three mean square error (MSE) components.

As figure 16 shows, the majority of errors are unsystematic, whereby the errors are due to a large unequal covariation (U^C). That means that the model represents the means and

the trend in the data coherently. However, even if the majority of errors are unsystematic, the value of the other two components of mean square error (MSE) is relatively high (U^M= 0,21 and U^S = 0,14). That means that there should be a systematic error that affects the model behaviour, and it would be useful to spot out the cause.
As Sterman (2000) underlines, this cause can be found in some errors in parameter estimation. From this perspective, it is possible to hypothesize that the relatively high value of bias and unequal variation components of mean square error (MSE) can be caused by a wrong estimation of model parameters. More in details, the parameters that have been included in the model refer to the antecedent variables (personal and situational factors) of expectancy of goal attainment variable (see figure 2). As the equation 12 shows, the expectancy of goal attainment value is the result of the sum of a series of multiplication of each antecedent variable and its parameter. Obviously, the sum of these parameters must be equal to 1. As has been underlined in another paper (Ceresia, 2009), these parameters have been set in a quasi-arbitrary way.
In fact, while in psychological literature there are numerous empirical studies exploring the quantitative relationships between expectancy of goal attainment and these antecedents, unfortunately, there is a lack of inquiry, so all these antecedents are considered at the same time in the same research, to provide a more reliable result. It is possible to hypothesize that the relatively high value of bias and unequal variation components of MSE can be caused by a wrong estimation of these parameters.

10. Optimization Analysis as Estimation Method for Intangible Variables Parameters

In social science there are different statistical methods adopted to estimate the model parameters. The most widely reported method for parameter estimation is the *maximum likelihood* method, adopted for estimating the parameter in a structural equation model. The idea behind *maximum likelihood parameter estimation* is to determine the parameters that maximize the probability that the covariance matrix $\sum$ between the variables X and Y generated by the model is similar (from a statistical point of view) to the covariance matrix **S** observed in real data (Joreskog, 1967, 1973).
Now the question is the following: Is it possible to identify a method that allows parameter estimation in a system dynamics model, where the two data matrixes (reference and actual) change at every timestep? The evolutionary search algorithms (Hansen, 2005) used by Powersim Solver for optimization analysis, will be proposed as a parameter estimation method (Duggan, 2008).

Table 4. Values assumed by model parameters

		Optimization Analysis		
Parameter Name	***Fixed Value***	Minimun Value	Maximum Value	***Estimated Value***
Ability PAR	***0,2***	0,15	0,25	***0,15***
Locus of Control PAR	***0,1***	0,05	0,15	***0,1499***
Past Success PAR	***0,1***	0,05	0,15	***0,1499***
Self Esteem PAR	***0,1***	0,05	0,15	***0,1499***
Situational Factors PAR	***0,125***[6]	0,0	0,125	***0,1003***

[6] This value was set for each of the four parameters.

To activate the Optimization Analysis, some decisions need to be taken and objectives ought to be set. Specifically, the decision that all the model parameters should vary between a minimum and maximum value was made, setting values shown in table 4. Furthermore, the objectives were set, as described in the table below:

Table 5. Objectives of the optimization process

Variable Name	Value	Apply Time
ABS Residual[7]	0	Every 6 months after starting time
SUM PAR[8]	1	Start

As figures 17 and 18 show, while the optimization analysis does not produce any significant improvement between actual and real products sales quantities (the R^2 values are approximately the same), it is possible to appreciate a reduction of the bias component of MSE value (from 0,2106 to 0,1551) and an increment of the unequal covariation component of MSE value (from 0,6406 to 0,7049), while the unequal variation component of MSE does not vary in a significant way (from 0,1481 to 0,1392). These results can lead us toward a moderate positive evaluation of the usefulness of optimizations analysis as estimation method of intangible variables' parameters.

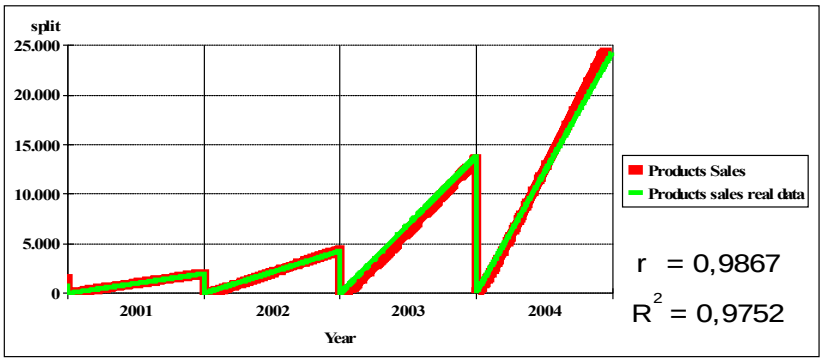

Figure 17. Comparison between Products sales (current data) and Products sales real data with the value of r and R^2 after Optimization Analysis.

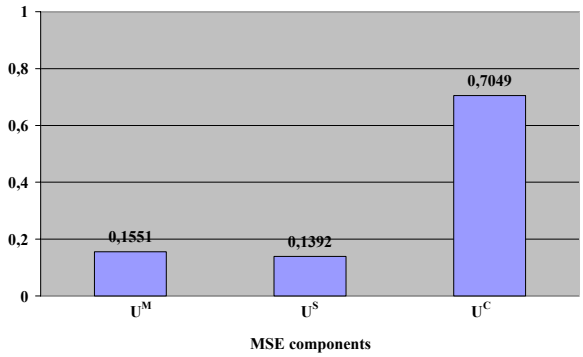

Figure 18. The values of the three mean square error (MSE) components after Optimization Analysis.

[7] ABS Residual is the absolute value of the difference between reference and actual products sales quantities.

[8] SUM PAR is the sum of the all model parameters considered in the optimization analysis, and it must be equal to 1.

Table 6 shows the Comparison between DELTA Values (Products sales real data - Products sales current data) before and after Optimization Analysis.

Table 6. Comparison between DELTA Values (Products sales real data - Products sales current data) before and after Optimization Analysis

DELTA (Rd – Cd)	30/12/2001	30/12/2002	30/12/2003	30/12/2004
Before Optimization	***- 3***	***+ 23***	***+ 526***	***+ 239***
After Optimization	***- 10***	***- 138***	***+ 259***	***0***

11. Scenario Analysis

The system dynamics model covers a period of four years (2001 – 2004) articulated in four different operational periods.

11.1 Scenario 1 (base run)

The first scenario (base run) is based on the management of the three main directional levers as described in section 8. The results of the goal seeking behaviour generated by the model are traced in figure 19.
As shown in figure 19, during the first two operational periods (2001 – 2002) the value of the products sales quantity corresponds to the value of the implicit goal, and both these values are lower than the stated goal value. During the third operational period (2003) the value of the products sales quantity overcomes the implicit goal value and reaches the stated goal value. Considering the last operational period (2004), it is possible to observe the "performance beyond expectations" phenomenon (Bass, 1985) already mentioned, where the value of the products sales quantity overcomes both implicit and stated goal values (Ceresia, 2009).
Figure 20 shows the dynamics of goal commitment and its antecedent variables. The management of the directional levers produces an increase of goal commitment that positively effects the agents' performance.

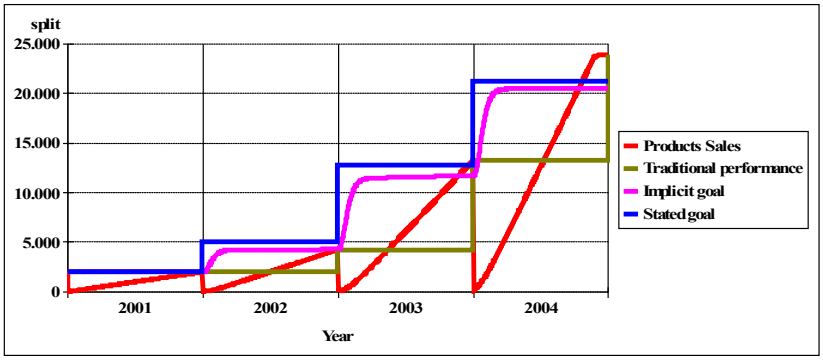

Figure 19. Goal seeking behavior generated by the model (scenario 1 - base run)

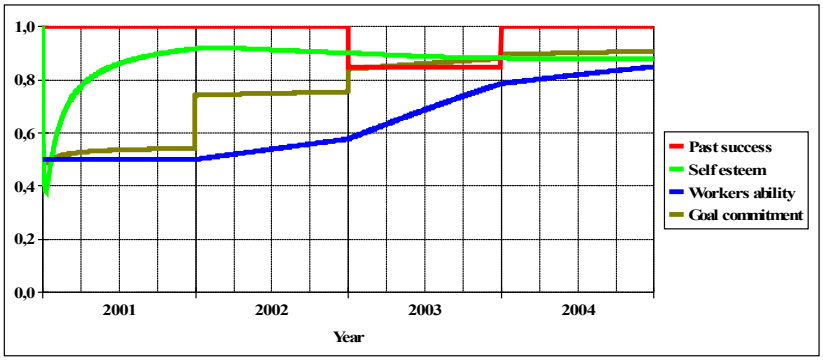

Figure 20. Goal commitment and its antecedent variables dynamics generated by the model (scenario 1 - base run)

11.2 Scenario 2

The second scenario (scenario 2) is based on the management of the three main directional levers as described in the section 8, with the exception of the higher maximum credit granted by the bank due the improvement of the company turnover as a consequence of the acquisition of Alpha srl by Beta srl. The results of the goal seeking behaviour generated by the model are traced in figure 21.

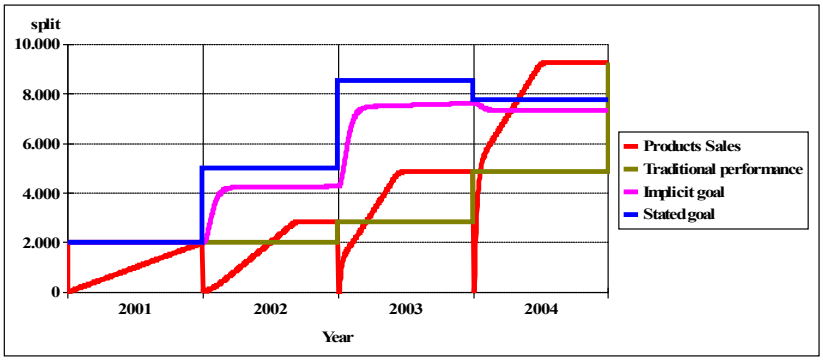

Figure 21. Goal seeking behavior generated by the model (scenario 2)

In figure 21 it is possible to observe that while in the first operational period (2001) the value of the products sales quantity corresponds to the value of implicit and stated goal, during the second and third operational period (2002 - 2003) the value of the products sales quantity is quite lower than the value of implicit and stated goal. This low company performance is the consequence of the limited financial possibility of the company to purchase products from the manufacturer.

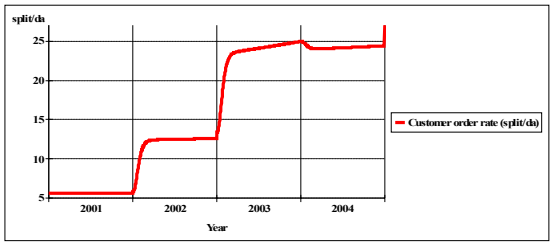

Figure 22. Customer's order rate dynamics generated by the model (scenario 2)

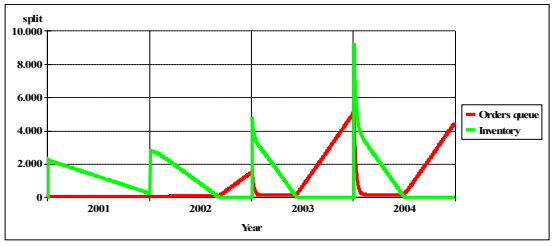

Figure 23. Order queue and inventory dynamics generated by the model (scenario 2)

In fact, while the company's commercial network performs in a satisfactory way, receiving a great quantity of orders (fig. 22), thus increasing the orders queue value (fig. 23), the limited financial possibility of the company to purchase products from the manufacturer does not allow the company to contrast the backlog phenomenon. In other words, this model behaviour is the consequence of the lack of the growth by bank credit reinforcing feedback loop effect. Figure 24 shows the increase of goal commitment, which is downsized by the drop of the past success variable from the third operational period till the end of the simulation.

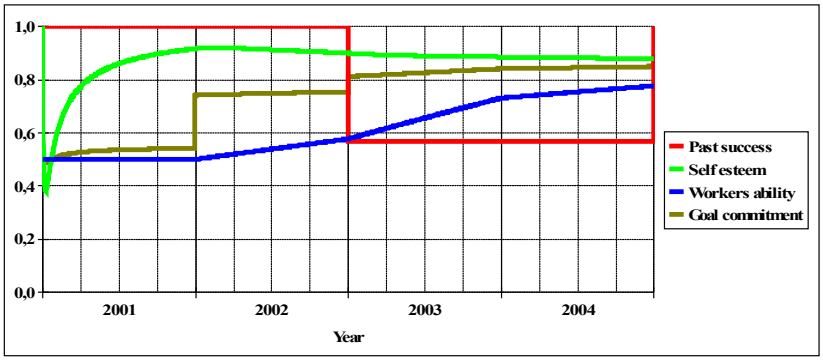

Figure 24. Goal commitment and its antecedent variables dynamics generated by the model (scenario 2)

11.3 Scenario 3

The third scenario (scenario 3) is based on the management of the goal setting directional lever as described in the section 8, without the support of the other two, MbO and Training policies. The results of the goal seeking behaviour generated by the model are traced in figure 25.

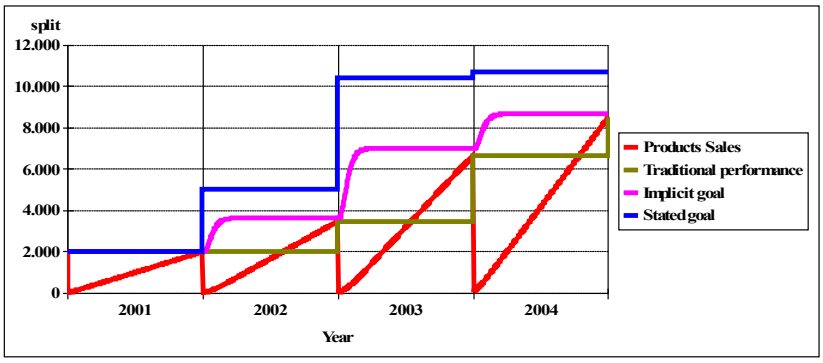

Figure 25. Goal seeking behavior generated by the model (scenario 3)

It possible to observe in figure 25 that while in the first operational period (2001) the value of the *products sales* quantity corresponds to the value of *implicit* and *stated goal*, during the other operational periods (2002 - 2004) the value of the *products sales* quantity is equal to the value of *implicit goal* but quite lower than the value of the stated goal. This low company performance is the consequence of the low level of agents' goal commitment due to the inefficient management of the MbO and Training policies.

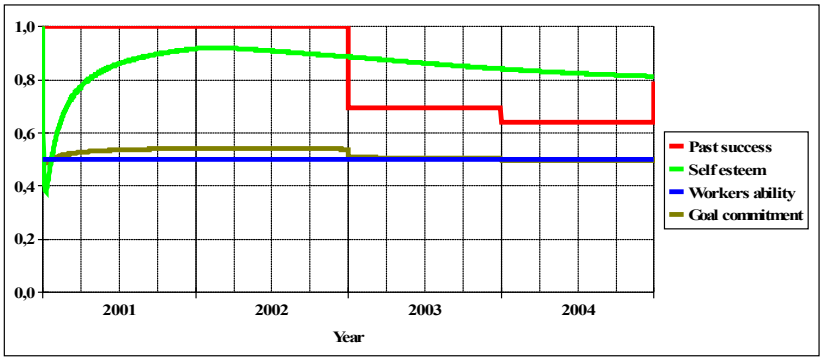

Figure 26. Goal commitment and its antecedent variables dynamics generated by the model (scenario 3)

In fact, Figure 26 shows the dynamics of *goal commitment*, maintaining a constant value around the mean value (0,5). As described in the equation (4), a value lower than 0,5 does not activate the positive and exponential effect of *goal commitment* on *customers' order rate* variable.

12. Limitations of the present Research and Conclusions

The present work constitutes a further effort in the development of a system dynamics model for goal dynamics in organizations. As already specified, this model is not meant to be exhaustive. First of all, goal commitment has been modelled without considering the "attractiveness of goal attainment" variable, which plays a relevant role in goal commitment dynamics. Secondly, in some model variables, like *workers ability improvement rate* and *customer order rate*, an exponential function has been added: of a degree evaluated as acceptable, but surely arbitrary.

The behaviours observed in the scenario 2 can raise some doubts. In fact, someone may question: 'How is it possible that the value of the workers' *goal commitment* is so high (see figure 24) even though the workers failed in achieving their *stated goals*.'

The explanation can be found in the fact that the proposed model of goal dynamics does not take into account the effect of workers' effort on their *negative psychological states* (like stress). The more the company management set difficult goals, the more the workers confronted themselves with hard work and greater implications. This work context facilitates the development of worker's *negative psychological states* (like stress), that effect workers' *self-efficacy* perception. As underlines by Bandura (1977), psychological states are one of the main key sources of individual's *self-efficacy* perception.

The balancing feedback loop drawn up in figure 27 (shown by dashed and bold arrows) shows the hypothesized effect of *negative psychological states* on *self efficacy* and, as a consequence, on the *expectancy of goal attainment*. This effect can produce a reduced *goal commitment* and a lower performance. If this sub-structure should be empirically confirmed, it would be responsible of a heavier decrement of *products sales* quantities, more than appears in the figure 21.

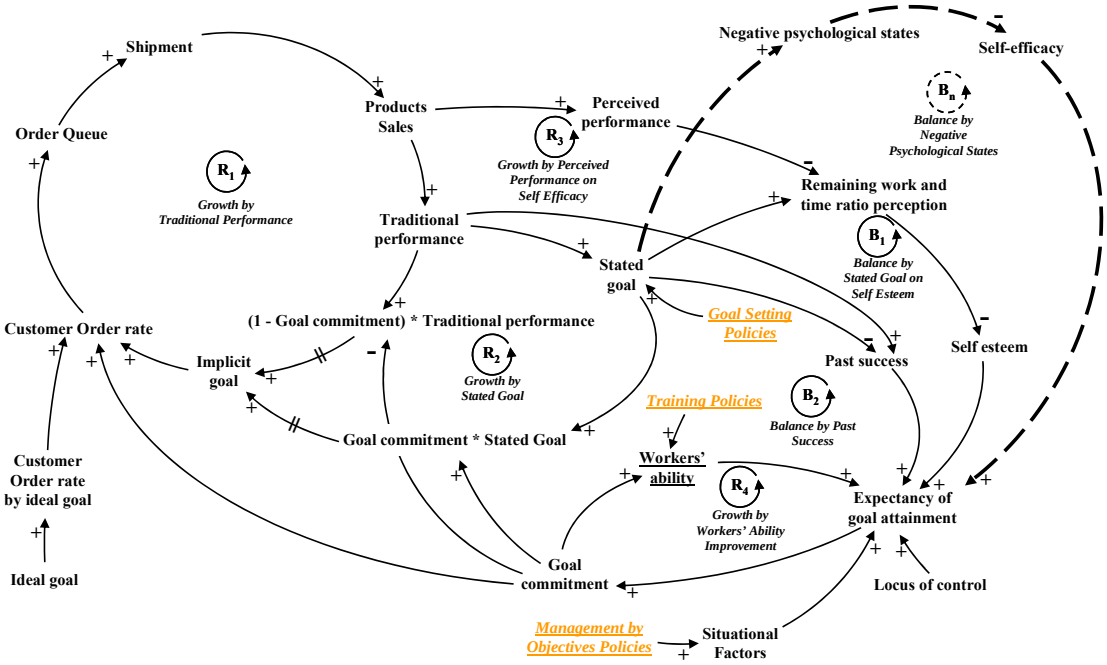

Figure 27 – The proposed balancing feedback loop "negative psychological states"

Although the present paper shows many limitations, its results may be of use in follow-up studies for a suitable SD model for goal dynamics in organizations, in which intangible variables are modelled in a proper way, trying to respect their inner and authentic complexity.

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