Long over short term
the example of ecological management

Markus Schwaninger

Abstract
Managers and organizations are learning that dealing with ecological issues seriously is part of their responsibility. In this article, the inherent rationality of an ecologically oriented approach to management is highlighted. For this purpose, a conceptual framework for a comprehensive fitness of organizations is presented. Based on this framework and on case studies in small businesses a simulation model has been developed. The structure of this model is outlined. Then, on the basis of simulation experiments, several aspects of ecological management are discussed. The focus is on the role of pre-control, which substantiates the primacy of the long-term perspective. In this context, the trade-offs between short- and longer-term decisions, as well as the vulnerability of one-sided strategies are discussed.

Keywords
Long term
ecological management
environmental responsibility
sustainability management
Model of Systemic Control
pre-control
management simulation
strategy

1. Purpose and scope of this paper
One of the great challenges to the management of firms today is achieving a balance between the economic, social and ecological dimensions. The purpose of this paper is to highlight the role of the ecological dimension in the context of a management for the long term. Even though arguments for the 'triple bottom line' (performance in all three dimensions - economic, social and ecological) have become vigorous, firms are exposed to arguments, which tend to be unbalanced, as far as the ecological dimension is concerned. Either the importance of the ecological aspects is underestimated, or they are considered the one and only panacea. Both of these extreme views are non-systemic. The former one is reductionistic, following a one-dimensional logic, often expressed as 'The business of business is business.'[1] It forgets that economic activity ultimately hinges on ecological (and social) sustainability. The latter one is simplistic as well, because it forgets that ecological and economic viability are two sides of the same coin. It is not accidental that recently many prestigious firms have made serious efforts to balance their economic, ecological and social goals.

Even though such a balanced view is rapidly becoming accepted in the corporate domain, there is still a lack of understanding and of conceptual tools to deal with the complexity faced by organizations. The Systems Approach provides a powerful methodology to make progress towards a systemic management, which copes with the challenge of dynamic complexity. Already these days, any small firm can take advantage of modeling and simulation to improve decisions. Most important, managers can face the short term serenely, avoiding much of the proverbial stress, if they take their current actions with a long-term view.

In the following sections, a conceptual framework for ecologically responsible management will be presented (Section 2) and then operationalized in a System Dynamics model (Section 3). Also, the game version of the model (Section 4) as well as model validation (Section 5) will be addressed briefly. In

1 Based on a recent study about large firms' habits in environmental and social reporting, the *Financial Times* concludes that 'nerds seem to have the upper hand' (Maitland 2002).

the longest part of the paper, the dynamics of the model will be analyzed (Section 6). A brief outlook will conclude the paper (Section 7).

2. A conceptual framework for ecologically responsible management

There is still a large gap in the business world concerning the knowledge and awareness about the interrelationships between the factors that govern ecological matters. One of the deficits, which have curbed ecological progress in the past, has been the lack of an appropriate language for dealing with the environment. Of course, many managers have started to change their minds; they have become ecologically more sensitive. But many are still unaware or ill-prepared to deal with the pertinent challenges (Maitland 2002). In general, managers need better theories and also better instruments to deal with the environmental issues effectively. In terms of semantics, a new 'language' is required, because 'we read unconsciously into the world the structure of the language' (Korzybski 1958), and the meaning of the constructs we use. The power of orientation furnished by established theories of management is only strong with respect to the short-term horizon; until recently they had only little solid to say concerning the long run.

Systemic thinking offers new possibilities to solve the conflict between the two domains of interest. A management-cybernetic theory of pre-control in corporate management has been developed, which shows the path leading beyond intuitive claims for an 'ecologically responsible management' (Schwaninger 1997, 1990).

Due to the theoretical progress made, an ecological approach to management need no longer be doomed as irrational or romantic. On the contrary, what becomes evident is the inherent rationality of an ecologically oriented thinking, which transcends the boundaries of the traditional 'business way of looking at things'. I shall outline this briefly by means of the following framework for a comprehensive organizational fitness, which has also been called 'Framework for Systemic Control' (Figure 1).

This conceptual framework has been expounded elsewhere in detail (Schwaninger 2000). It has been implemented in real firms. Also, empirical studies have shown that it is highly effective as a tool to support conversations (a) among managers, and (b) between managers and other stakeholders, namely in strategy-making (Schwaninger 1989, 1997).

This scheme represents three different logical levels of management (operative, strategic and normative) with the respective goals and control variables relevant at each one of them.[2] Beyond the traditional orientors, profit and liquidity, insights into categories, which operate in larger horizons of time and complexity, have been gained such as value potentials (or earnings potentials), viability and development.

These are more than just new words but they represent categories, which we have the means to calculate, to foresee their patterns of behavior and to influence ('control') them. On the one hand the three logical levels shown in the diagram represent different perspectives, none of which can be set aside for a company to prosper.[3] The subject of ecological management has different meanings on each one of these levels; all of which must be taken into consideration, simultaneously:

2 A detailed specification of these concepts would reach beyond the scope of the present paper. A minute derivation and exposition of this framework and the notions contained therein were undertaken earlier (Schwaninger 1989: 169-215 in particular; see also Schwaninger 1984, 1993).

3 The Framework for Systemic Control also applies to other organizational levels, such as divisions, business units within divisions, etc. in a recursive mode. For example, an efficiency issue at one level of recursion may become an effectiveness issue at the next recursion level down. Most importantly, in order to be viable, an organizational unit at any level of recursion (company, division, etc.) needs to dispose of the management functions of all three levels - operative, strategic and normative (Beer 1985).

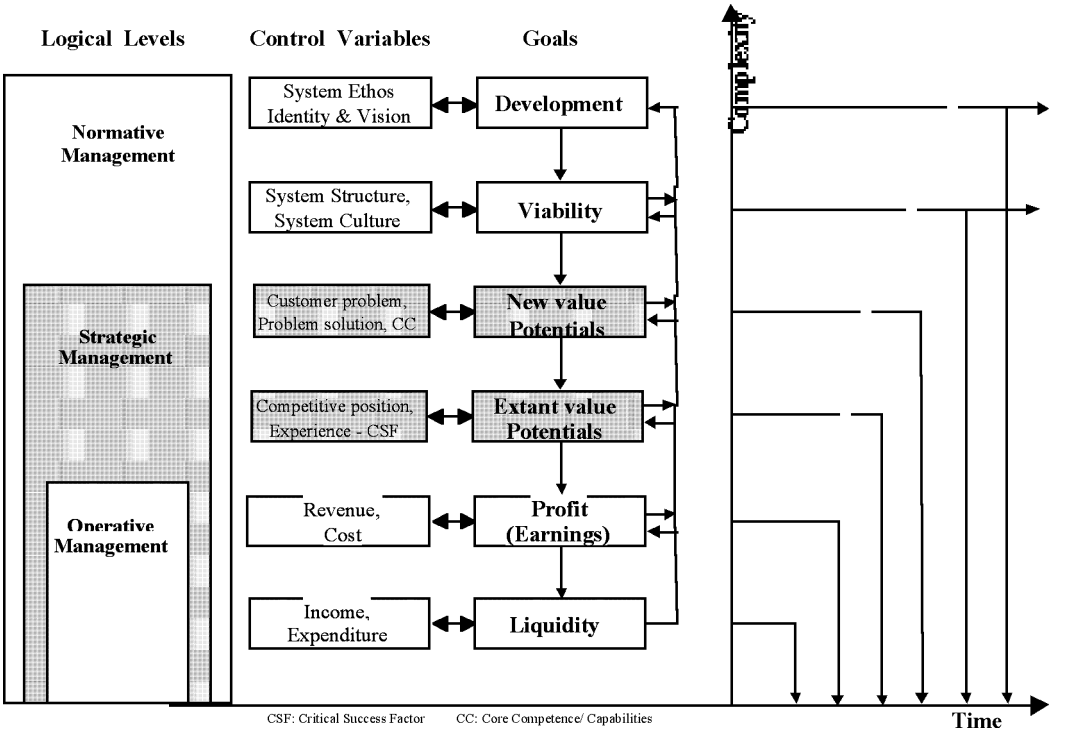


Figure 1: Framework for Systemic Control: reference variables at three logical levels of management

- On the level of *operative management,* the criterion of organizational fitness is efficiency, namely in terms of productivity, profitability and quality. There are many ecologically oriented measures that directly impinge on profit. Many of them are a gain on both sides. Energy savings, for example, relieve the environment and reduce costs at the same time. As the costs of insurance, waste disposal, etc. have risen dramatically, it is prudent to avoid them from the beginning. In these cases it is simply rational, in a financial and economic sense, to manage ecologically.
- On the level of *strategic management*, the criterion is effectiveness, which includes competitive and cooperative effectiveness (competition can spur cooperation, and vice versa). A strong market position in an ecologically sensitive market constitutes an excellent prerequisite for good earnings in the future. But sacrifices in the present such as investment in core competencies, for example via R&D and human resources development, which reduce profits (-) in the short term, are usually necessary to build up such value potentials (+). Beyond that, an ecological orientation is also apt to improve the competitive position in human resources markets.
- Again, another logic applies at the level of *normative management*, where the ultimate criterion of organizational fitness is legitimacy, i.e. the ability of a company to match the demands of all key stakeholders. Stakeholders include such groups as customers, staff, shareholders, allies, the State, the public and even future generations (represented by those who speak up for

them). It would be shortsighted to curtail the ecological aspects to the financial and the market rationalities only.

At the normative level, the logic of culture and of social, ethical and esthetical values applies. Here managers have the widest field to creatively shape the destiny of their company (and of its environment). One option often insufficiently considered is to refrain from ecologically detrimental programs (by the way, more companies have got into trouble or even gone for broke from *not* refraining than from refraining).

If legitimacy is to be attained, normative management has to reconcile internal and external demands as well as the economical and ecological imperatives.

An essential insight expressed in the framework presented is about the pre-control nature of the control variables of the logically higher levels with respect to those of the lower ones (Gaelweiler 1990): value potentials pre-control values delivered to stakeholders (e.g. customer benefit, returns delivered to shareholders); viability pre-controls value potentials, etc. A process controlled for profits (with revenues and costs) cannot be pre-controlled with these same levers. As outlined in the framework, other variables have to be used for that purpose. In sum, an integral model of management, which transcends the dominant logic of financial/economic steering, can be conceived rationally and accurately, not just in an intuitive, fuzzy mode.

In practice, the attainment of a comprehensive organizational fitness requires managing the control variables on all three logical levels - operative, strategic and normative management - simultaneously. Balance must be maintained, even if contradictions between the imperatives of the three levels occur.

This conceptual system of multilevel control variables gives substance to the vague concept of 'ecologically responsible management'. Simulation, eventually combined with optimization methods, is crucial not only for operationalizing the theoretical framework outlined here briefly. The pertinent tools can help managers enormously to hone their skills of balancing complex decisions - particularly between long- and short-term imperatives, both of which must be considered constantly (Bianchi 2000). To advance towards this purpose, the framework has been operationalized in a System Dynamics[4] model with approximately 60 variables. The model is the core of a business simulator ('microworld'), which can already be used for training purposes.

3. Outline of the System Dynamics model

The model draws on qualitative insights gained from case studies of small and medium-sized firms, in which the ecological dimension of management was studied. It was implemented, with the help of my research assistant Stephan Büttner, on the basis of the Stella/IThink software, and for the purpose of training (students and executives of small and medium-sized firms) as part of a case study called 'Impraeg AG'. It comprehends five modules (Figure 2): Marketing, Production & Technology, Human Resources, Ecological Management, and Finance. Due to the clear conceptual basis, it was possible to build a fairly comprehensive model, yet from a relatively small number of variables, altogether about 60.

This set of variables embraces aspects of all three logical levels of management - operative, strategic and normative. These aspects are distributed across

4 System Dynamics is an approach to the modeling and simulation of complex dynamical systems developed at MIT (Forrester 1961; Sterman 2000). By means of that methodology, the issues under study are modeled as closed-loop systems with temporal delays, and in continuous mode.

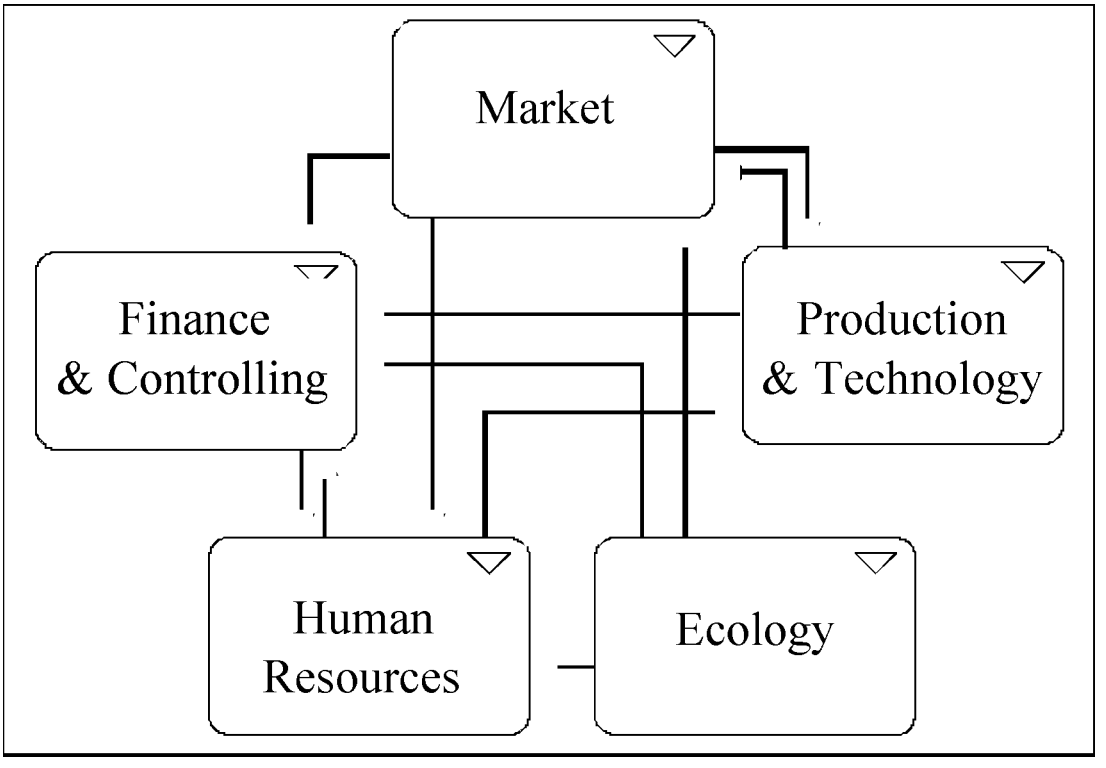


Figure 2: Modules of the model

the five functional modules of the model (Figure 2). In principle, each module has some significance with respect to each one of the logical levels.[5]

The stocks-and-flows-diagram is documented in the Appendix. In the following, the logic of the five modules will be outlined in a condensed way,[6] the names of model variables are typed in italics:

3.1. Market

Impraeg operates in a market described by the stock *Market Volume*, which grows as a function of a *Market Growth*, starting at 25% per annum, then approaching saturation and finally decline. The *Demand* for Impraeg's product is triggered by the *Relative Competitiveness* (which is a function of the product's *Quality* to *Price* ratio and *Ecological Image*) and Impraeg's *Marketing Effort*. *Sales* volume is the minimum between *Demand* and *Finished Products* in stock, *Market Share* the ratio of *Sales* to *Market Volume*. *Output* to be produced is set by the model users, hereafter called 'players'.

3.2. Production & Technology

This module is about Research & Development and the Production process. Players can change three parameters:

* *Quality Management* effort, which impinges on *Output per employee* (a measure of productivity), *Product Quality* and the cost of *Defects*.

5 Let us take the market module as an example to illustrate this: The achieved *Sales* (in combination with indicators from the Finance module) are variables of operative performance. These are pre-controlled by strategy parameters such as *Relative Product Quality, Quality-to-Price* and *EcoImage* - the determinants of *Relative Competitiveness*. Those again are pre-controlled by parameters of the normative level, e.g. *Ecological Consciousness*.

6 Elaborating all the details of the model would reach beyond the scope of this paper.

- *Salary per hour* for production employees, which influences *Cost of Labor per Unit* produced.
- *Cost* for *Research & Development* (*R&D*) which triggers *R&D intensity* and the level of *Process Maturity*.

Output per employee is determined by three values, those of the Quality Management parameter, and the variables *Process Maturity* as well as *Performance level*. The latter comes from the Human Resources module. *Process Maturity* is also a function of the *Experience* curve (In line with empirical evidence (Ghemawat 1985; Henderson 1974) a gradient of -0.25 is assumed, i.e. unit cost is reduced by 25% with each doubling of cumulated output).

3.3. Human Resources

This module is mainly about human factors influencing the performance of employees. The *Performance level* is a function of *Motivation* and *Qualification level*. The latter accumulates or degrades depending on the level of *Training expenses* (a parameter set by players). *Motivation* is also a stock, fed, on the one hand - via a feedback loop - by *Performance level*. This corresponds to the need for achievement, emphasized by motivation theory. On the other hand, the *Salary* level and Impraeg's *Attractiveness as Employer* impinge on *Motivation* (Herzberg 1987), the latter being calculated as a weighted average of *Quality of Workplace, Intensity of Training, Profit level* and the firm's *Ecological Image with Staff* as well as its general *Ecological Image* (i.e. its image in the marketplace).

3.4. Ecological Management

In this building block, players can adjust three parameters:

- The cost spent on *Environmental Protection*, which influences the level of environmental protection, and thereby both Impraeg's general *Ecological Image*, and its *Ecological Image with Staff*.
- The cost spent on *Promoting Ecological Consciousness of Staff*. This impinges on the *Level of Environmental Protection*, via changes in *Environmental Consciousness of Staff*.
- The cost spent on *Ecological PR* (Public Relations), i.e. on efforts to make the endeavors of environmental management known. PR does not change *Ecological Image* on its own, but only in conjunction with the actual *Level of Environmental Protection*.

3.5. Finance & Controlling

In this module, all the decisions and processes coming from the other modules are modeled as to their financial consequences, resulting in the values which constitute profit and loss statement and balance sheet.

Profit and Loss values: All the cost components are aggregated in the variable *Costs*. *Sales* and *Costs* result in *Earnings before Interest and Taxes*. Based on the respective values, different levels of *Profit - before taxes*, and *after taxes* - are calculated.

Balance Sheet values: *Current Assets* are the sum of *Goods in Stock, Debtors & Liquid Assets. Fixed Assets* are calculated as a fixed initial value plus a variable component which depends on the level of *Output*. Debt is the difference of total assets minus *Equity*. The initial value of *Equity* is over time changed by

Profit after taxes, which (a) is reinvested (inflow), in case it is positive, and (b) diminishes *Equity* (outflow), whenever it is negative.

Finally, a number of indices are calculated, the most important of which also appear on the overview in the cockpit: *Debt Ratio*, *Return on Sales, Return on Capital*, and *Return on Equity* (Figure 3).

4. The game version of the model

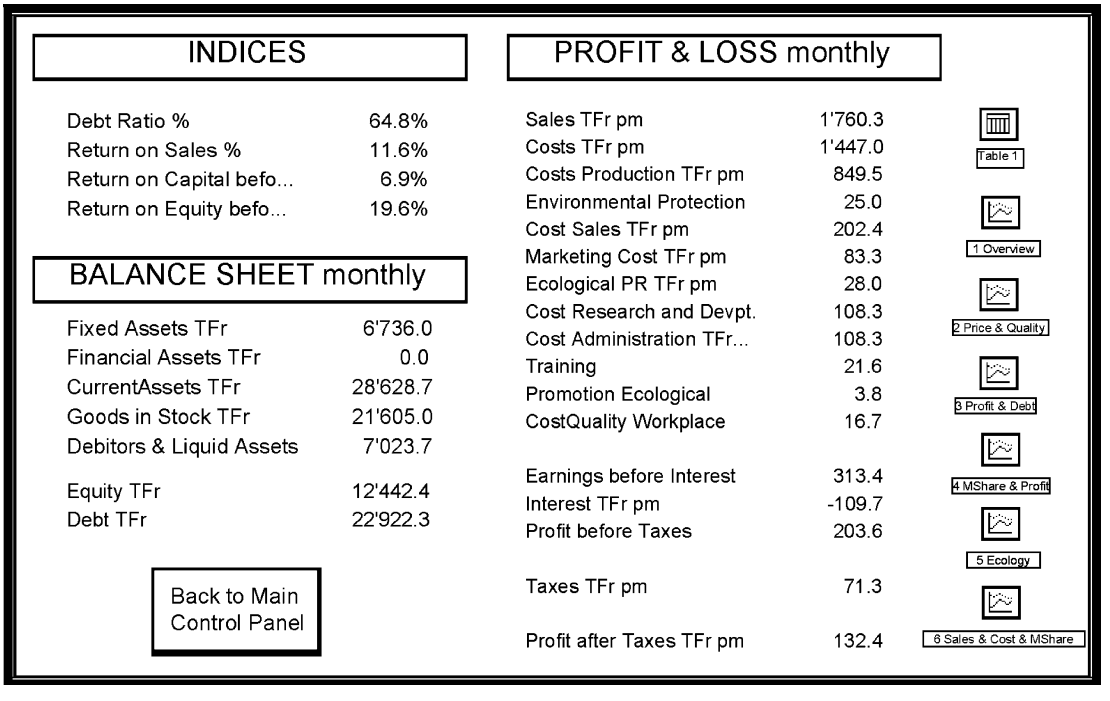
We designed a case study, around the model, that relates to a producer of chemical products and allows players to take decisions affecting any one of the modules over a number of rounds (representing quarters of business years).

One component of the model is a 'cockpit', i.e. an interface providing users with overviews of indicators and decision variables by means of graphs and tables. Besides the usual 'cockpit' - in this case with five decision levers for production and marketing, three for human resources and three more for ecology, as well as key financial indicators (capitalization and profitability indices), profit and loss (P&L) statement and balance sheet (Figures 3 and 4), the layout for the simulation game provides alerts. For example, whenever a decision leads to an equity/capital ratio lower than a defined threshold, the player is alerted to the imminent danger. Furthermore, graphs showing the evolution of stock variables, e.g. equity, over time, form part of the standard layout. These devices have allowed for increasing the scope and number of potential decision levers, in order to help players enhancing their skills for coping with complexity.[7]

The model runs in monthly periods, the default version being set at quarterly decision intervals. In other words, the model runs each time for three

7 Some experts of the simulations and games community have pleaded for limiting the number of decision variables to five or six.

Figure 3: Cockpit I - Results



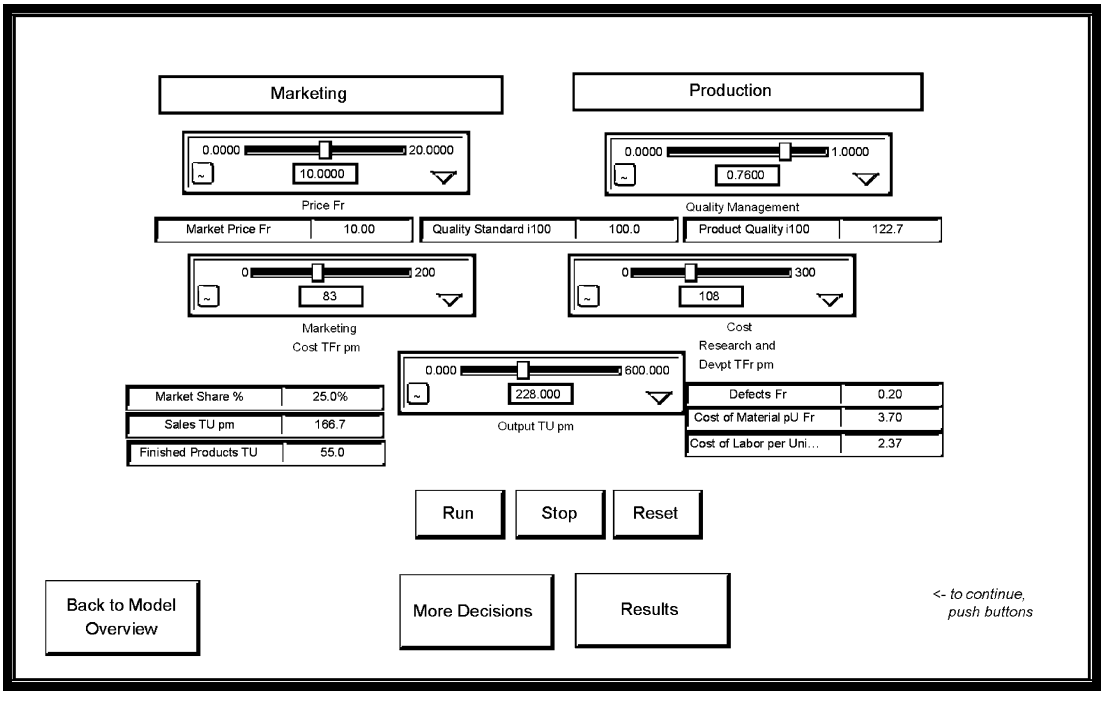


Figure 4: Cockpit II - Control Panel

months, then decisions can be made. The decision intervals can also be set differently, and they can also be eliminated altogether, e.g. for the purpose of scenario analysis.

5. Purpose and validation of the model

The model was inspired by numerous case studies realized on ecological management in small and medium-sized industrial firms, and by one business unit of a real firm in the chemical industry of Switzerland, which operated in a market with a handful of players. However, I cannot claim that this is a fully validated model.

The purpose of the model was twofold. First, to formulate a model which incorporated social and ecological aspects, besides the usually included aspects of market, product and finance. Even though this implied a necessity to use qualitative variables, which were difficult to measure and validate, it appeared to be necessary to start with a model that would make these aspects discussable and allow them to be improved consecutively.

Second, a model to highlight some aspects of management with students was desired, namely (a) trade-offs between short- and longer-term oriented decisions, and (b) the necessity of taken multidimensional decisions in complex settings.

The model was submitted to validation procedures involving a number of structural and behavioral tests.[8] The standard procedures are described in detail by Barlas (1996), whose terminology will be used in the following, and originally by Forrester/Senge (1980). The aim of these procedures is to build confidence into models gradually by means of both quantitative and qualitative

8 For details, see Barlas 1996, and literature indicated therein.

tests. Validity in this context means adequacy with respect to model purpose (Barlas 1996). This approach to validation precludes validation procedures being reduced to a small set of statistical tests. In the case of the model at hand the following tests were made:

5.1. Direct structural tests:

The most important aspect of validation at this stage was careful choice of the variables to be included and of their interrelationships, i.e. structure confirmation tests, parameter confirmation tests, direct extreme-condition tests and dimensional consistency tests. These relationships were defined on the grounds of cogent logical links, where accounting figures, financial indicators, market volume, product output and stocks were calculated. Furthermore, empirical studies were used to define relationships, where available, e.g. in the case of the experience curve in production and motivation theory in human resources management. Where such a basis was not available, ad hoc assumptions had to be made and tested for their plausibility individually.

5.2. Structure-oriented behavior tests:

Behavioral validation in the case at hand comprised standard tests of the model such as extreme-condition tests, behavior sensitivity tests, modified-behavior prediction tests and boundary adequacy tests, phase-relationship tests and qualitative features analysis.

Both kinds of tests were taken in a step-by-step mode, from inside out. In other words, tests were executed first for each equation, then for larger aggregates, i.e. subsets of variables and equations, and finally for the model as a whole. This approach from elements to subsystems to the whole model is a standard feature of validation in System Dynamics.

In order to gain higher validity, the model or successors thereof should also be submitted to a rigorous behavior reproduction test, in which actual data of the market and a concrete firm would be compared to data produced by the model.

6. The dynamics of the model

By means of a number of scenarios, several important lessons about the dynamics of the model have been learnt, a few of which shall be recapitulated here. All of the runs were realized without changes of the parameter values over the period under observation.

6.1 Base scenario

A base scenario run over 48 months shows the following development (Figure 5).

The firm will build equity, uninterrupted for three years (curve 5). Its premium strategy - high quality, high price apparently pays off. However, as changes of equity (*d Equity* variable, curve 4) and *Sales* have heralded early on, this process is reversed, leading to a loss of equity at a growing speed, starting in month 39. One could insert that the situation is not grave - after four years the equity and the debt ratio are about the same as at the beginning. An inquiry into the causal relationships as unveiled by Figure 6 suggests a different diagnosis.

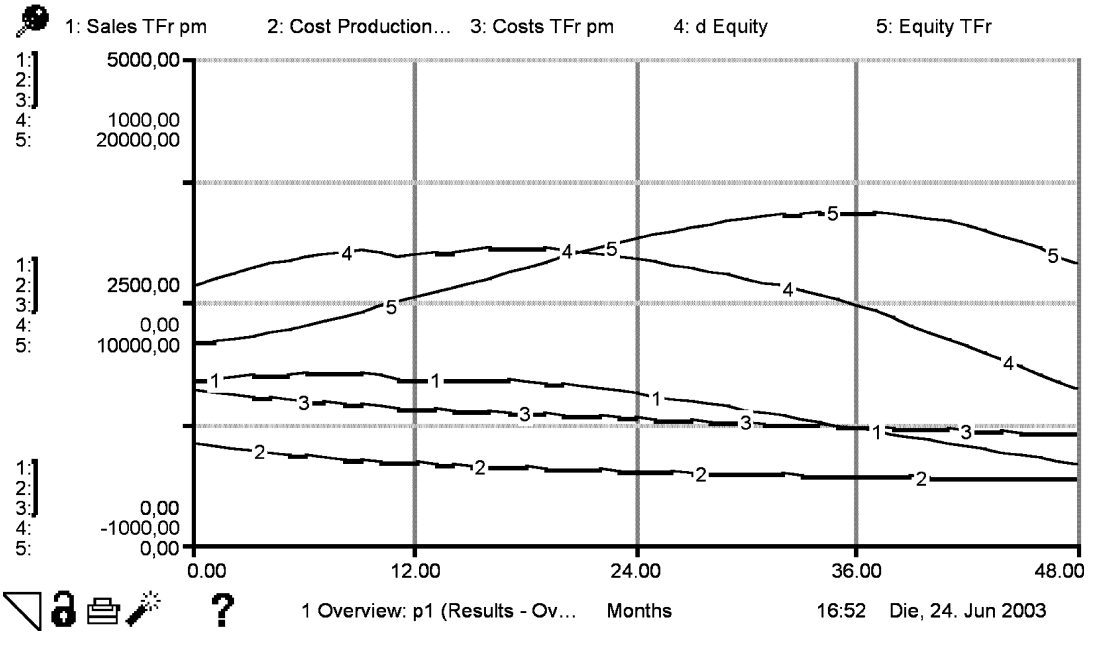


Figure 5: Results - overview (B)

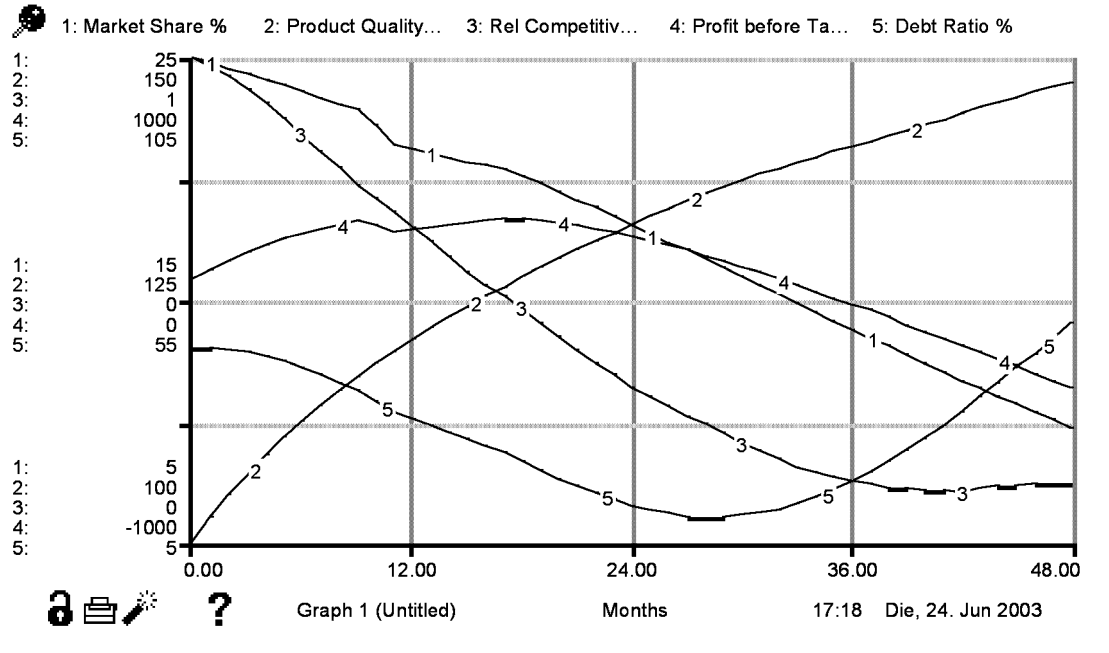


Figure 6: Overview (B)

This graph visualizes a continual loss of market share due to overpricing despite a gradual reduction of the market price level. Even though the level of product quality rises substantially, the relative competitive position is subject to erosion from the beginning. With a time lag of about one and a half years, this induces a sustained decay of profit and ultimately losses, with a consequent rise of the debt ratio. This evolution is exacerbated if the time horizon is extended: the company is inexorably bankrupt after 63 months.

This case in point clarifies the contradiction between the *short* and the *long* term addressed above: Profit is an inherently short-term variable of the operative level. The variables, which pre-control it - quality, competitiveness and the like – obey a different logic, which is linked to the different time constants involved.

In the following, different strategies will be examined: pricing, quality and ecology.

6.2 Pricing and quality scenarios

Given the problem of overpricing in the base scenario, in the following runs, the price level was changed. The behavior is highly nonlinear, but in sum all of these scenarios prove to be economically unsustainable sooner or later, i.e. bankruptcy occurs sooner or later (second column, Table 1).

Alternatively the variants of higher investments in Quality Management (QM level) were examined. This strategy proves to be much less vulnerable, yet it is still insufficient to provide unconditional viability (Table 2). Even though profit and equity are boosted for some time, in the long run, as the quality standard in the market rises, i.e. as competitors also succeed in raising their quality levels, while the average market price level slowly erodes, profitability shrinks and eventually turns negative.

Price	Months before going out of business	Remarks concerning price level
7	36	Minimum
8	68	
9	69	
10	66	Base Scenario
11	62	
12	59	
13	52	
14	46	
15	42	Maximum

Table 1. Variants of pricing strategy.

QM Level	Months before business loses money	Months before going out of business	Remarks concerning QM-level
0.5	36	66	Base Scenario
0.6	41	74	
0.7	47	83	
0.8	53	93	
0.9	60	105	
1.0	68	118	Maximum

Table 2. Variants of quality strategy.

6.3 Ecology as part of the strategy

The next question examined is whether an investment in ecological management can turn a strategy into being more robust. For this purpose, several of the scenarios examined up to this point were simulated. In all cases, the efforts on the ecological decision variables were doubled throughout.[9]

The enhanced effort in ecological management leads to the following results:

6.3.1 Variations of price

Table 3 shows that the life span can be extended significantly in the scenarios examined (except in the one with the very low price of 7), in comparison to the results exhibited in Table 1. In other words, the ecology strategy alone cannot solve the problem of economic viability.

6.3.2 Variations of quality

Table 4 shows that the life span can greatly be extended, in comparison to the results exhibited in Table 2, if efforts on ecology are increased. In other words, a strategy that combines quality and ecology is more promising than a quality strategy alone.

These results generated by the model are by and large corroborated by empirical studies (Meffert and Kirchgeorg 1992; Dyllick, Belz and Schneidewind 1997). Even so, the results summarized in Table 4 suggest that this strategy is not indefinitely sustainable economically, despite the promising picture conveyed for a shorter time horizon (Figure 8).

9 Cost of environmental protection (50,000 instead of 25,000 fr. per month), spending on promoting ecological consciousness of staff (9,000 instead of 4,500 fr. per month), ecological PR (34,000 instead of 17,000 fr. per month).

10 In the scenarios summarized in Table 3 the fact that the business-in-focus could survive at all with prices at roughly twice the market average (fr. 7.32) is explained by increased retreat to special segments with low price sensitivity.

Price	Previous number of months before going out of business	Later number of months before going out of business	Months of change of life span	Percentage change
7	36	27	-9	-25
8	68	88	20	29
9	69	89	20	29
10	66	82	16	24
11	62	76	14	23
12	59	69	10	17
13	52	64	12	23
14	46	60	14	30
15	42	53	11	26

Table 3: Variants of pricing strategy with enhanced efforts on ecology[10]

QM Level	Previous number of months before going out of business	Later number of months before going out of business	Months of change of life span	Percentage change
0.5	66	82	16	24
0.6	74	98	24	32
0.7	83	117	34	41
0.8	93	142	49	53
0.9	105	178	73	70
1.0	118	227	109	92

Table 4: Variants of quality strategy with enhanced efforts on ecology (comparisons in third and fourth columns refer to Table 2)

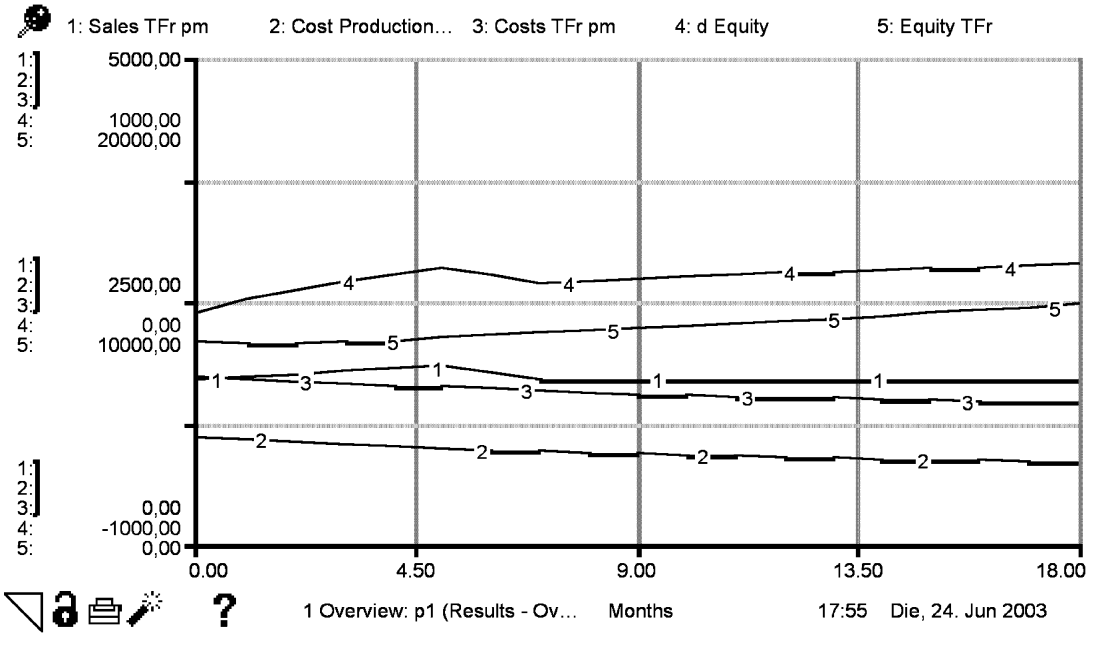


Figure 7: Short-term results for base scenario with increased efforts in ecology

Finally, exploratory scenarios with various decision levers have shown that the economic viability can be greatly extended. For example, by increasing spending on R&D, Marketing and Training of Staff in a balanced way, in addition to the adjustment of quality and price, our firm can reach a dominant market position, and hold it for a long time, without changing the strategy.

6.4 One-sided strategies versus multidimensional strategies

The analysis up to this point illustrates that advances towards sustainable strategies require a combined activation of different decision levers, which are complementary. Pursuing this logic further, in the following a combination of three aspects of strategy will be tested - price, quality and ecology. A number of scenarios were examined. For all of them, the ecology parameters were doubled in relation to the values of the base scenario (values were given in footnote 7), while the values for price and quality were varied. Figure 12 summarizes the values for equity generated in each scenario over t=72 months.

In those cases, which show an equity of zero, bankruptcy was the case at t=72 or earlier.[11] This applies for low levels of quality effort with high prices, despite the ecological commitment. At price levels that are too low bankruptcy follows early on, even if high-quality efforts are made; e.g. at a price of 7 bankruptcy follows somewhere between 21 months (for quality = 1.0) and 27 months (for quality = 0.5).[12] The graph also shows that, provided ecological commitment, a high-price strategy can be maintained if adequate quality efforts support it. These have their limitations, not only in the price sensitivity of the market, but also in the limited size of price-insensitive segments. The superiority of these multidimensional strategies is visible alone from the fact

11 For Quality=0.5 and for Price={12, 13, 14, 15} at t={69, 63, 62, 65}. For Quality=0.6 and for Price={14, 15} at t={69, 62}. For Quality=0.7 and for Price=15 at t=72.

12 The scenarios for Price=7 are not pictured in the graph.

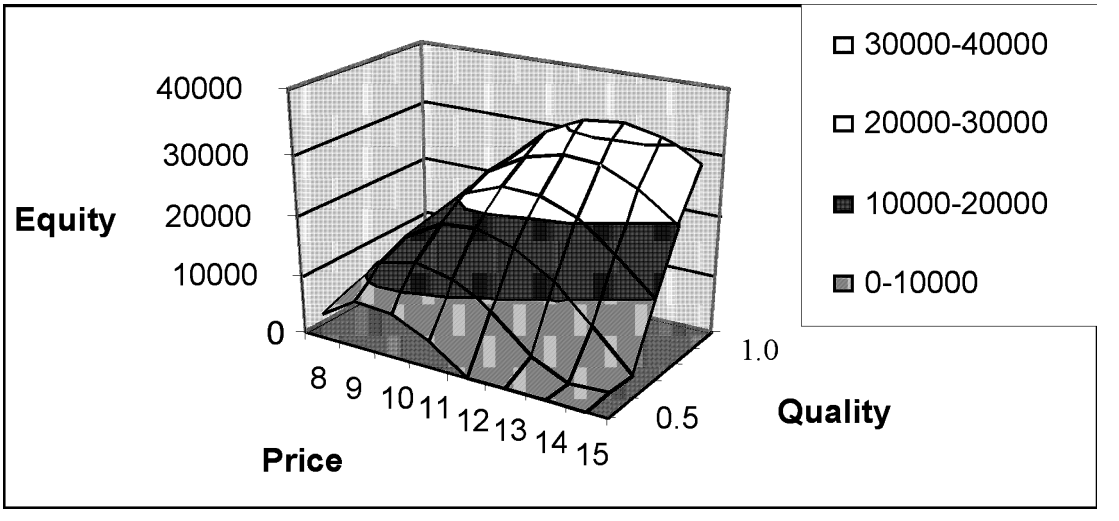


Figure 8: Results of scenarios for high ecological commitment with variations on price and quality effort

that the life span exceeded that of one-sided strategies (only price: Table 1; or only quality: Table 2) in all cases.

6.5 Ecology as strategy

Up to this point, only three variables have been examined as components of ecological management - cost of environmental protection, promotion of ecological consciousness of staff, and ecological public relations. A strategy that would rely on these three or a similar set of variables only should not be called an 'ecological strategy'. Spending on environmental protection tends to account for 'end-of-pipe' measures, and spending on ecological public relations does not say anything about the substance of ecological activities of the firm. A genuine ecological orientation characteristically pervades all areas of an organization, and is not limited to the punctual manipulation of a few variables that wear the label 'ecological' (Schwaninger 1990).

In this vein, the ecological dimension is implicit in many variables of the model expounded here. For example, the concept of Product Quality immanent in the variable of that name is not confined to the conventional attributes of quality, but includes to a large extent aspects of ecological benefit for customers. Similarly, spending on R&D, e.g. for 'clean processes' or for products with environment-friendly properties, training of staff etc., are manifestations of the quest for ecological progress, as also manifested in the organization under study. For this reason, in the model at hand, only the more conventional aspects of ecological management, that are easy to be separated, are expressed in a small number of variables and clustered in a separate module. Overall however, the model conceives of the ecological dimension as an integral part of the business process and its management.

Finally, it must be noted that the present model relates to a situation of five competitors, all of which - due to a new technology - have an ecologically high-performing product with similar features. For cases where additional differential value could be created by ecological product design (e.g. in certain

segments of the food market), the model would have to incorporate new features and the dynamics would change concomitantly.

7. Outlook

At the outset, a conceptual framework was presented to highlight the rationality of an ecological approach to management. The framework is based on a logical distinction between three levels of management. Each one of these levels shows different control variables, with a pre-control relationship between those of the higher in relation to those of the lower levels. In order to achieve a comprehensive organizational fitness, it is necessary to maintain the variables of all levels under control simultaneously in the longer run. For this purpose, a System Dynamics model can be of great help.

In this paper, a model has been presented that includes control variables of all three logical levels. Certainly, the operative level is represented in more detail and clarity than the other two levels. This is due to the fact that the modeling of the pertinent variables and relationships, which refer to liquidity and profit, can build on a long-established method. This is the method of double entry book-keeping (introduced by Fra Luca Pacioli, in 1494). The variables at the other two levels are less established, the pertinent methodologies less mature and 'softer'. Nevertheless, it is necessary to make efforts to incorporate them into the models. Several variables of the strategic level have been included. These relate mainly to extant value potential - competitive position and experience. Some aspects of new value potential, namely core competency, have been incorporated in the human resources module; others would require an enlargement of the model (e.g. new problem solutions or value propositions, and related processes of technological substitution). The aspect of normative management that is modeled is related to organizational ethos and culture, namely in the variables concerning environmental consciousness.

Many of these qualitative aspects have not yet been sufficiently developed for accurate representations. Yet to make progress towards valid models tentative modeling of this kind is necessary to make proposed variables, parameters and relationships at least discussable. Consequently, successors of this model may reach further stages of validation and higher levels of confidence. But even at this stage the model can convey to users some important clues about the trade-offs between short- and longer-term decisions, the importance of pre-control and the vulnerability of one-sided strategies. Most of all, it makes the conceptual primacy of the long- over the short-term perspective 'tangible', i.e. more concrete.

Acknowledgements:

The author expresses his thanks to Professor Roberto Moreno-Díaz, director of the Instituto Universitario de Ciencias y Tecnologías Cibernética at the Universidad de Las Palmas de Gran Canaria, Spain, where most of this paper was written. He is also grateful to Mr. Stephan Buettner, former research assistant at the University of St. Gallen, Switzerland, for his help in elaborating the model expounded here. Finally, he is especially indebted to Professor Aloys Gaelweiler for making him aware of the aspects of pre-control, many years ago.

References

Barlas, Y. (1996), 'Formal Aspects of Model Validity', *System Dynamics Review*, 12: 3, pp. 183-210.

Beer, S. (1985), *Diagnosing the System for Organizations*, Chichester: John Wiley.

Bianchi, C. (2000), *Processi di apprendimento nel governo dello sviluppo della piccola impresa*. Una prospettiva basata sull'integrazione tra modelli contabili e di system dynamics attraverso i micromondi. Milano: Giuffrè editore.

Dyllick, T., Belz, F. and Schneidewind, U. (1997), *Ökologie und Wettbewerbsfähigkeit*. München: Hanser.

Gälweiler, A. (1990), *Strategische Unternehmensführung*, ed. Schwaninger M., Frankfurt and New York: Campus.

Forrester, J.W. (1961), *Industrial Dynamics*, Cambridge, MA: MIT Press.

Forrester, J.W. and Senge, P. (1980), 'Tests for Building Confidence in System Dynamics Models', in Legasto Jr., A.A., Forrester, J.W. and Lyneis, J.M. (eds.), *System Dynamics*, New York, North-Holland, pp. 209-28.

Ghemawat, P. (1985), 'Building Strategy on the Experience Curve', *Harvard Business Review*, 63, March-April, pp. 143-49.

Henderson, B.D. (1984), *The Logic of Business Strategy*, Cambridge: Ballinger.

Herzberg, F. (1987), 'One More Time: How Do You Motivate Employees?', *Harvard Business Review*, September-October, pp. 109-20.

Korzybski, A. (1958), *Science and Sanity*, Clinton, MA: Colonial Press.

Maitland, A. (2002), 'Corporate Social Responsibility: Truants, Nerds and Supersonics', *Financial Times*, 18 November, p. 9.

Meffert, H. and Kirchgeorg, M. (1992), *Marktorientiertes Umweltmanagement*. Stuttgart: Poeschel.

Schwaninger, M. (1984), 'Zur Architektur integraler Planungssysteme', *Harvard Manager* (1st Quarter), pp. 102-10.

Schwaninger, M. (1989), *Integrale Unternehmungsplanung,* Frankfurt/New York: Campus.

Schwaninger, M. (1990), 'Umweltverantwortung: Manager sind herausgefordert', *Management Zeitschrift IO*, 59: 1, pp. 89-94.

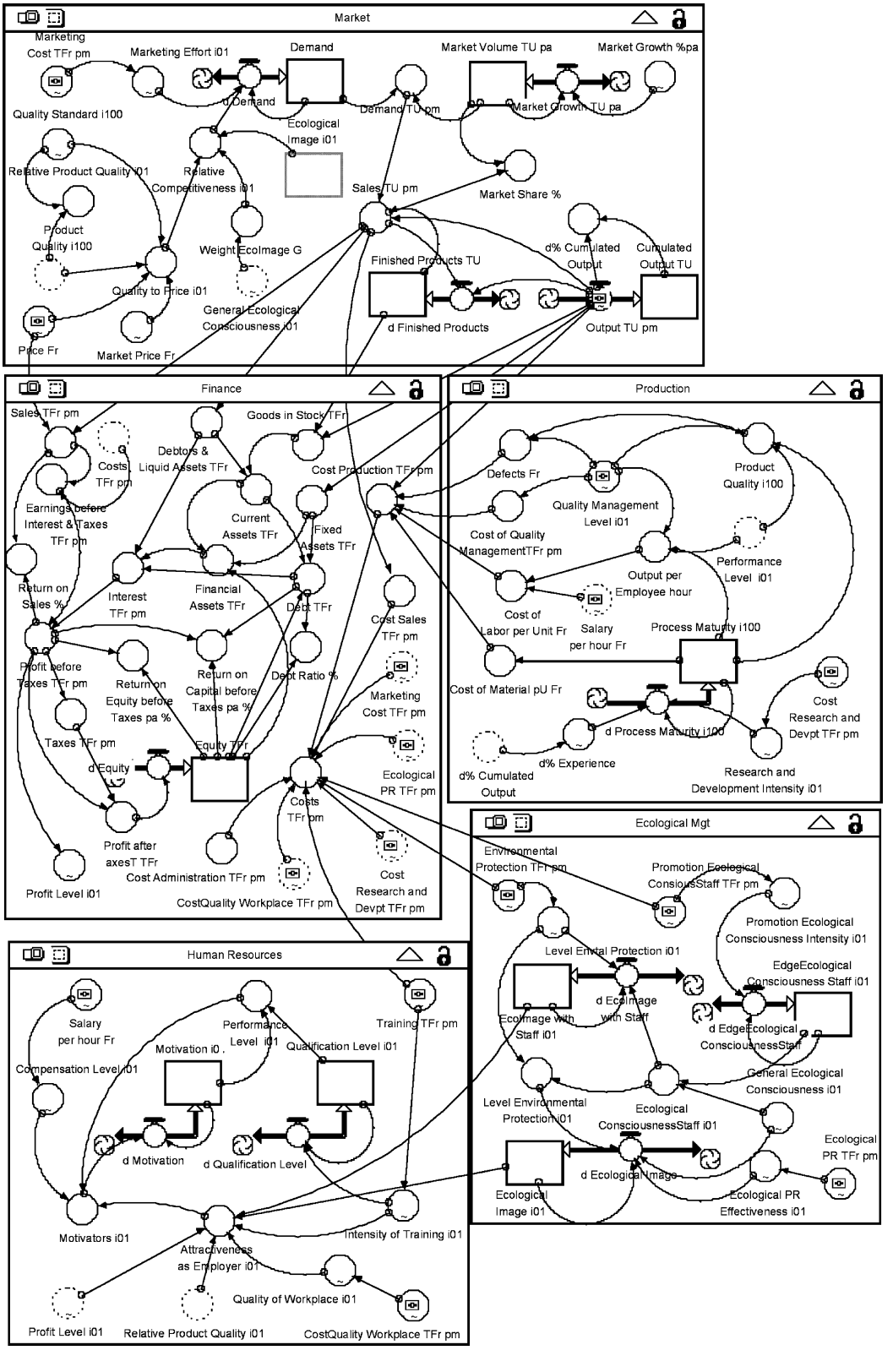
Schwaninger, M. (1993), 'A Concept of Organizational Fitness', in Espejo, R. and Schwaninger, M. (eds.), *Organizational Fitness - Corporate Effectiveness through Management Cybernetics,* Frankfurt/New York: Campus.

Schwaninger, M. (1997), 'Organizational Intelligence: Managing for Environmental Responsibility', in Achterbergh, J., Espejo, R., Regtering, H. and Schwaninger, M. (eds.), *Organizational Cybernetics: Research Memorandum*, Nijmegen, the Netherlands: Nijmegen Business School/University of Nijmegen.

Schwaninger, M. (2000), 'Managing Complexity - The Path Toward Intelligent Organizations', *Systemic Practice and Action Research*, 13: 2, pp. 207-41.

Sterman, J.D. (2000), *Business Dynamics*, Boston, MA: Irwin/McGraw-Hill.

Appendix. Stock-and-Flow-Diagram


Market
Marketing Cost TFr pm
Marketing Effort i01
Demand
Market Volume TU pa
Market Growth %pa
Quality Standard i100
d Demand
Demand TU pm
Market Growth TU pa
Ecological Image i01
Relative Product Quality i01
Relative Competitiveness i01
Sales TU pm
Market Share %
Product Quality i100
Weight EcoImage G
Finished Products TU
d% Cumulated Output
Cumulated Output TU
Quality to Price i01
General Ecological Consciousness i01
d Finished Products
Output TU pm
Price Fr
Market Price Fr
Finance
Sales TFr pm
Goods in Stock TFr
Costs TFr pm
Debtors & Liquid Assets TFr
Cost Production TFr pm
Earnings before Interest & Taxes TFr pm
Current Assets TFr
Fixed Assets TFr
Return on Sales %
Interest TFr pm
Financial Assets TFr
Debt TFr
Cost Sales TFr pm
Profit before Taxes TFr pm
Return on Equity before Taxes pa %
Return on Capital before Taxes pa %
Debt Ratio %
Marketing Cost TFr pm
Taxes TFr pm
Equity TFr
d Equity
Ecological PR TFr pm
Costs TFr pm
Profit after axesT TFr
Cost Administration TFr pm
Cost Research and Devpt TFr pm
Profit Level i01
CostQuality Workplace TFr pm
Production
Defects Fr
Product Quality i100
Quality Management Level i01
Cost of Quality ManagementTFr pm
Performance Level i01
Output per Employee hour
Cost of Labor per Unit Fr
Salary per hour Fr
Process Maturity i100
Cost of Material pU Fr
Cost Research and Devpt TFr pm
d Process Maturity i100
d% Experience
d% Cumulated Output
Research and Development Intensity i01
Ecological Mgt
Environmental Protection TFr pm
Promotion Ecological ConsciousStaff TFr pm
Promotion Ecological Consciousness Intensity i01
Level Envtal Protection i01
EdgeEcological Consciousness Staff i01
d EcoImage with Staff
EcoImage with Staff i01
d EdgeEcological ConsciousnessStaff
General Ecological Consciousness i01
Level Environmental Protection i01
Ecological ConsciousnessStaff i01
Ecological PR TFr pm
d Ecological Image
Ecological Image i01
Ecological PR Effectiveness i01
Human Resources
Salary per hour Fr
Performance Level i01
Training TFr pm
Motivation i0
Qualification Level i01
Compensation Level i01
d Motivation
d Qualification Level
Motivators i01
Intensity of Training i01
Attractiveness as Employer i01
Quality of Workplace i01
Profit Level i01
Relative Product Quality i01
CostQuality Workplace TFr pm

intellectjournals2004

Cultural Studies

Portuguese Journal of Social Science



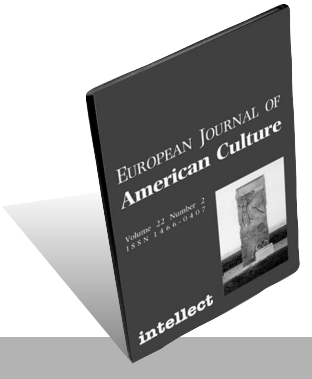
ISSN 1476-413X
3 nos/vol (Vol. 3, 2004)
Institutional **£130**
(print & full electronic access)

The *Portuguese Journal of Social Science* is an English-language, peer-reviewed scholarly journal, sponsored by the Instituto Superior de Ciencias do Trabalho e das Empresas (ISCTE), the state-funded university institute in Lisbon. Its purpose is to introduce an international readership to the best work currently being produced in the social sciences by Portuguese scholars.

The Journal makes available to scholars important work that formerly was often available only in Portuguese.

Cultural Studies

European Journal of American Culture



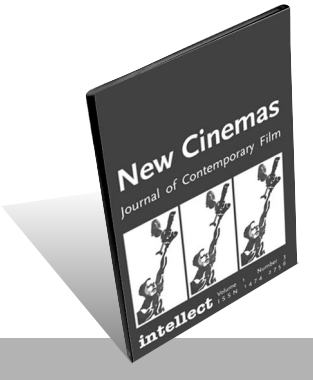
ISSN 1466-0407
3 nos/vol (Vol. 23, 2004)
Institutional **£130**
(print & full electronic access)

***European Journal of American Culture* includes long articles (6,000 to 8,000 words) on all aspects of American culture, both modern and historical, particularly in newer fields of academic inquiry such as film and media – as well as shorter comments and responses designed to foster academic debate. Also included are reviews of current scholarship in the field.**

The Journal is neither pro- nor anti-American in its editorial stance, but instead attempts to provide a contemporary European perspective on the world's most influential country.

Film Studies

New Cinemas: Journal of Contemporary Film



ISSN 1474-2756
3 nos/vol (Vol. 2, 2004)
Institutional **£130**
(print & full electronic access)

***New Cinemas* aims to challenge hegemonic value judgement about Cinema from around the world to explore approaches that posit the egalitarian value of Cinema, with a focus on what is happening now. The tendency to focus upon issues of 'otherness' and 'marginality' – ignoring the specificities of the films – is challenged head-on with a focus on the evaluation of the Cinema.**

The Journal breaks down barriers and places World Cinema on an equal footing with the 'mainstream' by creating a space where 'marginal' voices find a vehicle for expression.